BODEGA LAND TRUST

BODEGA LAND TRUST REPORT:

What's Going on in Salmon Creek?

by Cleo Woelfle-Erskine

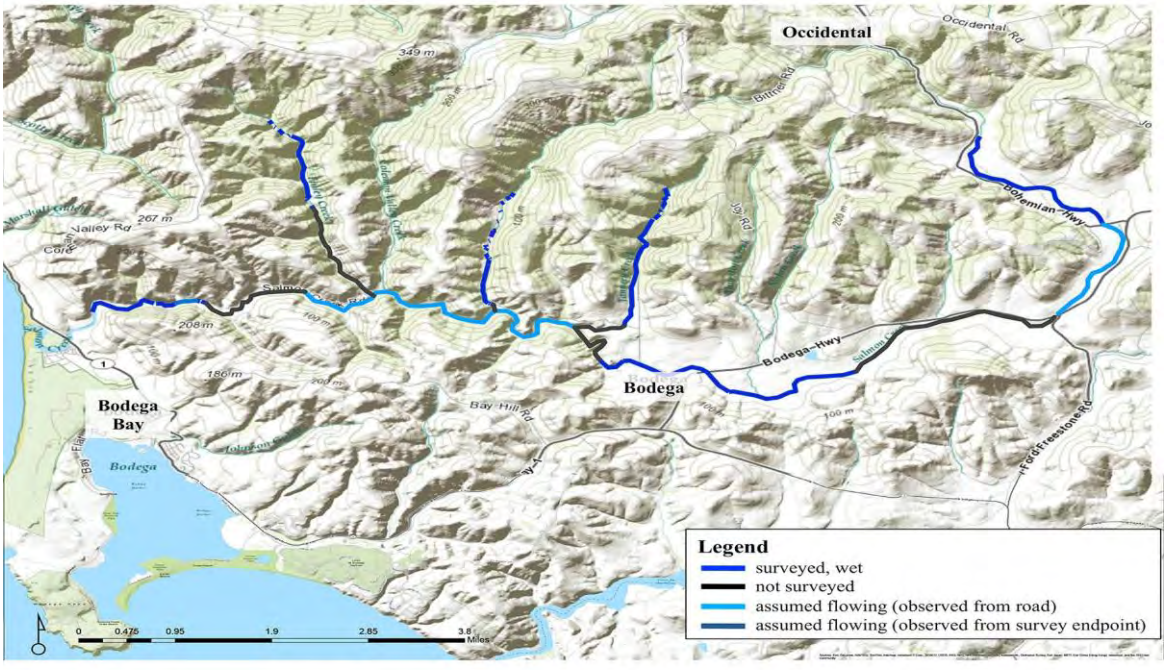
Collaborative Research on Salmon Recovery

Summer streamflow dynamics strongly influence salmonid survival and growth rates because streamflow drives aquatic insect drift, temperature, and dissolved oxygen levels. As Salmon Creek residents have all seen this fall, streams become disconnected or dry completely as flows drop over the summer and fall. Ecologists have found that salmonids that survive in disconnected pools on intermittent streams possess different traits than those that grow up in continuously flowing streams. These different traits increase the overall fitness of the population by making it more likely that some fish will survive in any given year.

In 2012, I began a 3-year hydro-ecological field research program on in the Salmon Creek watershed (Sonoma Co., CA) that investigates how streamflow affects over-summer survival of Coho and steelhead. I chose two tributaries, Fay and Tannery creeks, as my study sites because earlier studies found good quality habitat that dried into a series of intermittent pools in the late summer. I have two study reaches on each stream, all of which are located on land owned by Delia Moon, with a conservation easement on the Fay Creek riparian corridor held by the Bodega Land Trust. Both tributary reaches have gravel and cobble beds, with some large woody debris, and low levels of nitrate and phosphate.

Observations by residents and scientists suggest that Fay has lower summer flows than Tannery. My study is the first to measure streamflow and water quality for extended periods and to assess how Coho and steelhead survival changes as flows decrease and the stream becomes a series of disconnected pools.

- continued on page 11



A Year of Walks and Talks: 2013

Cont'd from pg. 1

On July 12, 2013, I convened a Salmon Creek Research Collaborative Workshop to bring together residents, agency scientists, restoration practitioners, and citizen scientists involved in salmonid restoration in the Salmon Creek watershed. Our project was to understand who is collecting data, what their different research and restoration goals are, what resources would advance these efforts, and what barriers hinder collaboration. I wanted to better understand adaptive management processes that are unfolding along Salmon Creek, where people are trying to adapt land and water management practices so that salmon and steelhead can recover, even as climate change and human interventions will likely further increase demand for dwindling flows. The twenty-seven people who attended the workshop had connections to institutions ranging from neighborhood groups to watershed councils to county, state, and national agencies, and brought different knowledge, experience, research methods, habits of thought, and ways of talking to bear on this topic.

Wet/Dry Mappers Robert Blasdell, Charon Vilnai & Hazel Flett
- photo by David Hines

The day-long workshop began with a panel discussion that included Kathleen Kraft (Salmon Creek Watershed Council and watershed resident), Sierra Cantor (Gold Ridge RCD biologist), Brian Cluer (NOAA-NMFS geomorphologist), Lauren Hammack (Prunuske-Chatham geomorphologist / designer and local resident), and me. Participants then broke into groups by interest area to talk about specific problems, and knowledge gaps. After lunch, everyone walked down to Salmon Creek. I asked people to share their field methods - what they look for when they are out surveying the creek, what kinds of equipment they use, and what specific observations they record. Not surprisingly, biologists paid attention to fish and in-stream habitat, while geomorphologists paid more attention to sediment, and how flow shaped the stream channel. Both groups considered how the available habitat changes at different flows. Local residents shared specific observations of salmon sightings and memories of high-water marks. Many participants remarked that they learned new ways of seeing the stream through the activity. At the end of the day, the group discussed concrete steps that individuals or collaborative groups can take to improve collective understanding and action in the watershed. Participants agreed to take action on three proposals:

Fay Creek, September 2013 - photo by Joe Mortenson

1. plan another Watershed Day to share information with the local community,

2. pursue partnerships with UC Berkeley faculty and students to analyze the large amount of data that agencies and the watershed council have collected, and

3. organize a citizen mapping effort to map which reaches of the stream remain wet during the driest time of year.

Wet / Dry Mapping

In September 2012, I organized a wet-dry mapping study in collaboration with local residents. Wet-Dry Mapping is a method developed by the Nature Conservancy on Arizona's San Pedro River, and has been used there for the last 12 years. Here's how it works: on one day during the driest time of year, citizen volunteers walk along the stream channel with GPS units and record where the channel is wet or dry. Landowners either grant access to citizen volunteers, or volunteer to walk the stream reaches on their own property. By comparing data across several years, researchers can tell which reaches always remain wet, which always go dry, and which fall in between. The Salmon Creek Wet-Dry Mapping group decided to spread the mapping over a week in late September. We chose this period because the main reason for collecting this data is to identify sanctuary reaches where salmonids can survive the late-summer dry period. Habitat enhancement projects could then target those reaches.

Wet / Dry Mapping continued

More than 20 landowners agreed to participate in the project, and 15 other residents signed up as volunteers. A surprise rainstorm on September 22 dropped about an inch of rain over the area on the first day of surveying on lower Fay Creek. However, the dry ground absorbed much of the rain, and flows had dropped back to previous levels a day later, when teams began surveying the upper Salmon Creek mainstem and Tannery Creek.

Wet-Dry mappers recorded the location of dry reaches on a GPS, and also noted sanctuary pools and the presence of salmonids. I aggregated the GPS data into a map (see map for detail of Fay and Tannery Creek sections). Based on the experience with the pilot survey in 2013, the mapping team is planning a larger effort this year--please contact me at waterunderground@gmail.com if you would like to walk the creek that day, or if you are a landowner willing to grant access to creek walkers.

Spring and well sampling

The final piece in the streamflow puzzle is understanding which aquifers are most important in supplying late-summer flow to streams. During the summer months, all water in the stream is groundwater, which discharges via springs in the stream banks or beneath the stream bed. One goal of my study is to determine whether increasing groundwater flow to the tributaries during the late summer will improve conditions for juvenile salmonids. Additional groundwater could improve survival by increasing the volume of sanctuary pools, or by maintaining flow over riffles, which adds oxygen to the water. Groundwater is low in dissolved oxygen, however, so increasing groundwater flow may not improve salmonid survival if low oxygen levels are responsible for salmonid mortality.

However, if people pump too much water from the stream or aquifer, these sanctuary reaches dry up completely, or shrink to small puddles that leave fish vulnerable to raccoon and avian predators. Once streamflow goes subsurface, dissolved oxygen levels drop because water no longer cascades over riffles (which add oxygen). My goal is to understand how long salmon can survive in disconnected pools and identify sanctuary reaches—perhaps fed by springs or tributaries—where large numbers of Coho and steelhead can seek refuge during dry spells. I then plan to identify which aquifers provide water to these reaches using natural tracers. With this data in hand, I would like to work with local landowners to develop aquifer protection and recharge strategies that can safeguard residential and agricultural water supplies while preserving minimum in-stream flows that salmonids require.

In December 2012, I collected samples from 12 wells and springs along Joy Road. These wells and springs tap aquifers that feed Fay and Tannery Creeks. Landowners granted access to their properties, approached their neighbors on my behalf, and helped me collect samples from their well heads. The procedure is fairly simple--we lower a thirty-foot-long 1/2" diameter tube directly into the well casing, then pump out a few ounces (40 mL, to be exact) using a peristaltic pump. If the well can't be accessed directly, we can sample from the pump, although this may introduce other carbon compounds into the sample.

Back at the lab, we use a fluorimeter and a dissolved organic carbon analyzer to identify which carbon compounds each sample contains. By comparing the well samples to one another statistically, we can determine which wells tap into the same aquifer. Comparing different well samples to samples collected from the streams allows us to calculate what percentage of streamflow originates from a given aquifer.

I plan to expand the well and spring sampling effort to include 50 wells and springs within or near the Fay and Tannery Creek watersheds. If you are interested in participating in the study, please contact me.

Concluding thoughts

As I prepare for my third and final field season in the Salmon Creek watershed, I am thinking about how lessons from this small watershed can inform salmon recovery efforts across coastal California and beyond.

Although the story of how streamflow influences summer salmonid survival is complex, researchers are slowly piecing it together. I have found that on Salmon Creek, as on most coastal streams, temperatures never get high enough to cause mortality. I have also found that Coho and steelhead can survive for several months in streams with dissolved oxygen levels below 4 parts per million--levels reported to be lethal in other streams. I have also been amazed by the detailed and specific records that local landowners keep about rainfall, spring and well levels, and bird and fish sightings. I look forward to bringing together all of these different kinds of knowledge in the future.

Fay Creek Spawners - Photo by Steve Killey