Dry Creek Watershed Background and History

Introduction

The Dry Creek watershed (Figure 1) is a 100 square mile, low gradient (0.5%) watershed northeast of Sacramento, spanning Placer and Sacramento counties. The watershed lies in the Central Valley and lower Sierra foothills, ranging in elevation from 50 - 900 feet (Figure 2). The watershed contains 4 sub-watersheds: Cirby/ Linda Creeks, Antelope Creek, of which Clover Valley Creek is a major tributary, Secret Ravine and Miners' Ravine Creeks. In the lower elevations of the watershed, temperature varies from an average of 40-55 ^{O}F (5-12 ^{O}C) in winter to 60 – 95 ^{O}F (15-34 ^{O}C) in the summertime. Temperatures in the higher elevations of the watershed are very similar, with the exception of wintertime lows, which average 38 ^{O}F (3 ^{O}C). Yearly average precipitation varies from 24" in the lower elevations to 37" in the uppermost portions of the watershed.

Land use history of watershed

Before the arrival of Europeans in the mid-1700's, there were more than 300,000 indigenous people resided in California. The Nisenan

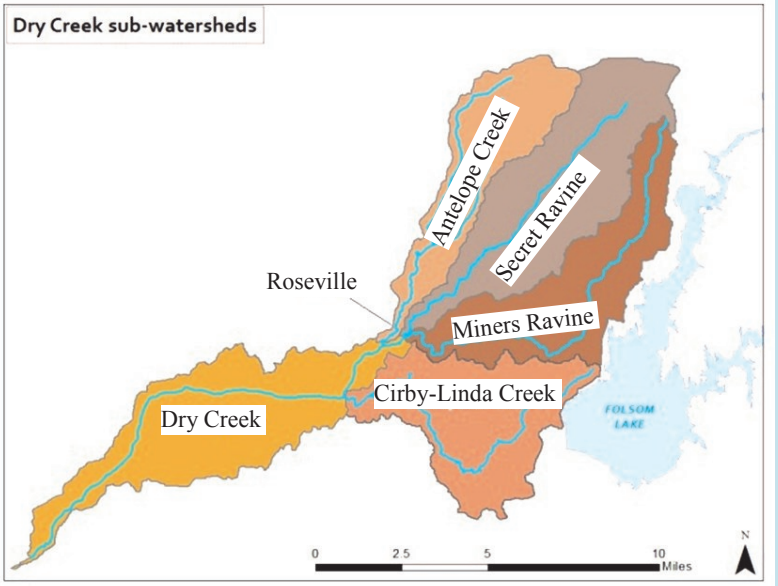

Figure 1. The sub-watersheds of Dry Creek.

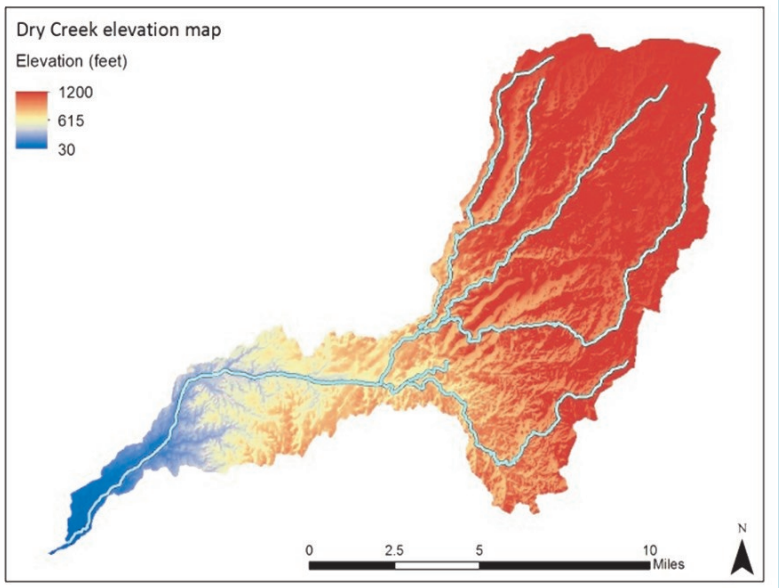

Figure 2. Elevation map of the watershed. The watershed's headwaters are just above Newcastle, CA at approximately 1250 ft. elevation. Dry Creek drains into the Natomas East Main Drain (not shown), at approximately 50 ft. elevation, a channel that was constructed to reroute Dry Creek as part of land reclamation projects many years ago.

people of Maidu tribe lived in the foothills (Ayres et al., 2003). In the 1850s, the Gold Rush drew people from around the world to Placer and Sacramento counties. Miners used hydraulic, drift, and dredge mining techniques to exploit gold deposits. Remnants of Dry Creek's mining history can still be seen today in the mounds of tailings that can be found in many reaches of the creeks. During this period, Dry Creek was dry in the summer because it received no summer snowmelt.

This circumstance changed following the Gold Rush period. Agriculture became a dominant activity within the watershed and along with it came small dams and canals, built to regulate and carry water for irrigation. Some canals had outlets into natural waterways that brought water from the Bear and Yuba Rivers to the creeks of the watershed during the summer (UCSB, 2003). From this point forward, Dry Creek was no longer dry during the summer.

During the 1940s, Dry Creek and surrounding watersheds became one of the nation's stone fruits capitols. During the season's peak, one thousand or more boxcars of peaches, pears, and other fruits were delivered to all points east by rail (J. Carlisle, pers. comm.). In addition, the land was used for raising a variety of livestock. As the area became increasingly more urban through the 20th century, resource use in the watershed shifted once again. The last fruit-packing warehouse in Loomis closed in 2002 and no large-scale livestock operations remain today (Ayres et al., 2002). Far from the intensive practices of the past, agricultural land use is now mostly non-commercial. The population of Placer County has grown exponentially over the past 60 years due to the surge in high technology industry and suburban development (Placer Co. Economic & Demographic Profile, 2011). The homes in the upper sub-watersheds (the upper reaches of Antelope Creek, Miner's Ravine and Secret Ravine) are characterized by mostly low-density and rural residential developments. In the middle reaches of Dry Creek, around Roseville and Rocklin and including the lower portions of Antelope, Miner's Ravine and Secret creeks as well as Cirby and Linda Creeks, suburban development predominates, characterized by expansive shopping malls and low and moderate density residential development. Some neighborhoods in these middle reaches are estate developments with large, manicured lawns. Recently, there have been attempts throughout the watershed to implement creek-friendly landscaping practices, such as the use of native vegetation that requires the use of fewer chemicals and less fertilizer than turf.

Many homes that border the creek (Figure 3) extends their backyard landscaping right to the edge of the waterway. Policies regarding landscaping within the stream corridor vary by jurisdiction. In some cases, homeowner initiatives have been organized to prevent disturbance within 100 feet of the creeks. While water from the Bear and Yuba Rivers continues to be delivered via the historic canal system to a small number of farms and ranchettes, wastewater treatment plants also contribute a significant amount of water that keeps the creeks flowing throughout the year.

Figure 3. Owners of property that backs onto the creeks have built patios, gazebos, and planted grass and invasive plants right up to the edge of the creek.

Geology of the Watershed

The Rocklin Pluton Formation is the primary geologic feature of the watershed. It is the solidified core of a magma chamber

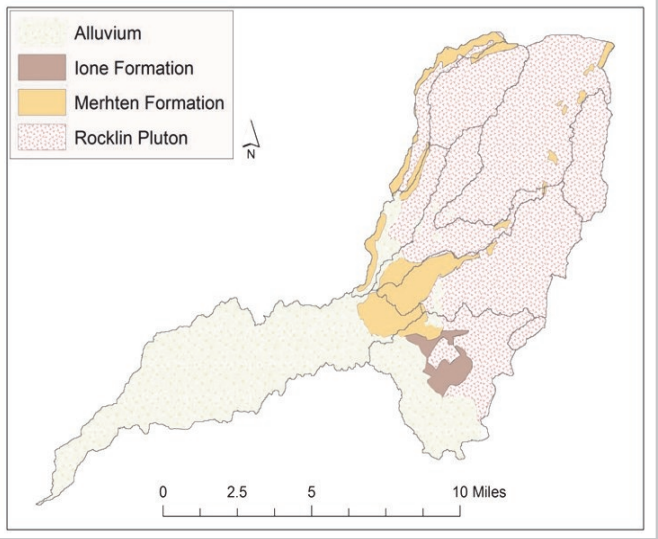

Figure 4. Geologic map of the watershed.
Data Source: The National Geologic Map Database, USGS, AASG. Dataset further digitized using georeferenced quadrangle from CA Department of Mines and Geology.

Figure 5. Evidence of high erodibility within the watershed. 5a: Diorite crystals easily scraped off an outcrop of the Rocklin Pluton demonstrating the highly erosive properties of this granitic rock. 5b: Sediment in the creek bed is composed of diorite along with finer grained sand, mud, and organic materials giving it a lighter color than the diorite alone.

from a Mesozoic volcano. This intrusive igneous rock is composed of diorite; a salt and peppery colored rock. The size of the crystals is larger than the grain sizes of most of the sedimentary rocks in the area, resulting in a zone of relatively low permeability. Outcroppings of the Rocklin Pluton formation are exposed throughout the upper portions of the watershed (Figure 4). The pluton is weathered in many areas producing significant amounts of decomposed gravel (Figure 5). Quaternary alluvium of the Turlock Lake and Modesto-Riverbank formations appear in the lower portions of the Dry Creek watershed. These highly permeable formations contain loose, unconsolidated rocks that are silt, sand and gravel.

Between the Rocklin Pluton and alluvium lay the Tertiary Mehrten and Ione Formations. The Mehrten is a combination of lava flow, sandstone, and breccia; angular bits of rock cemented together. Its coarse sediments provide good habitat for aquatic life but also make it susceptible to higher rates of erosion. These formations permit greater infiltration of rain and runoff. The Ione Formation is composed of a hard, white sandstone and clay and, like the Mehrten Formation, is also susceptible to higher rates of erosion. In general, this watershed naturally produces sizable amounts of sediment that works its way into the stream system. This makes the watershed particularly sensitive to disturbance.

Salmon in the Watershed

The Dry Creek watershed provides spawning habitat for fall-run chinook salmon. Chinook salmon are the most prominent anadromous fish in California, in terms of economic value and ecological importance (Yoshiyama et. al., 1998). Fall-run salmon numbers have decreased substantially in the Dry Creek watershed over the years (Figure 6). This phenomenon is not unique to this watershed; fish populations have declined throughout California, to the point where commercial salmon fishing

was halted in 2008 and 2009. This is thought to be due, in large part, to changing ocean conditions and reduced availability of food. However, freshwater aquatic habitat conditions that support spawning and rearing of young have also changed and negatively affect reproductive success. These conditions are the subject of this report.

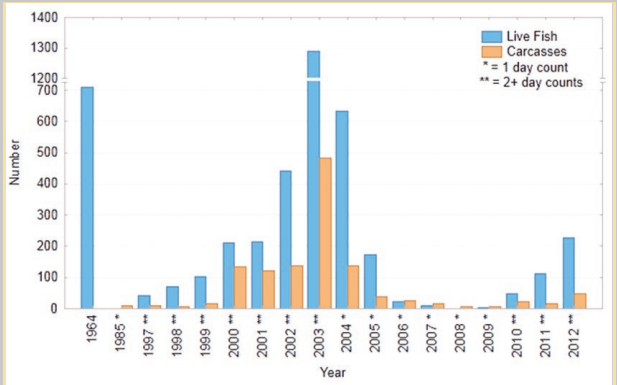

Figure 6. Fall-run Chinook salmon survey results. Data collected in 1964 & 1985 by Dept. Fish & Wildlife; 1997-2012 by the Dry Creek Conservancy (DCC).

Threats to watershed health

The main type of pollution in the Dry Creek watershed is non-point source pollution, primarily associated with stormwater. As water flows over the watershed and into the waterway, it collects fertilizers, pesticides, oil, sediment and numerous other contaminants that can harm aquatic life. Further changes in the hydrologic cycle resulting from increased impervious cover can impact the physical condition of waterways. Today, large areas of hardscape (impervious cover) cover what used to be farmland, rangeland, or natural areas (Figure 7). This has significantly altered the water cycle. Rain is now captured in storm drains and canals that quickly remove the water from residential and commercial neighborhoods and release it into the local waterways, the creeks of the Dry Creek watershed. The result of this large volume of water and associated pollutants (e.g. pesticides, fertilizers, metals, etc.) entering the creek system has been streambed and bank erosion and degradation of water quality.

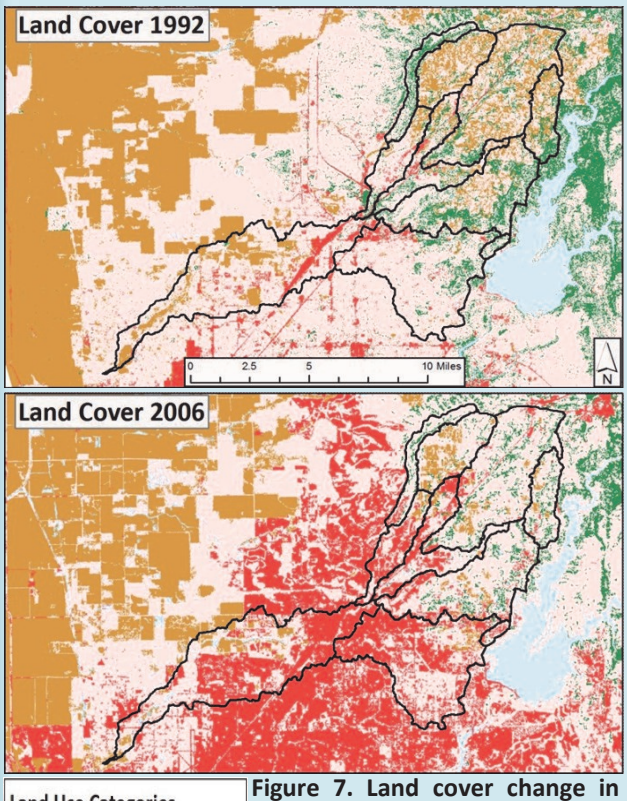

Figure 7. Land cover change in the Dry Creek watershed between 1992 and 2006. The shift from agricultural and rural land uses to more urban uses can easily be seen over the 25 years represented on these two maps.

In addition to non-point sources, there are also some notable point sources of pollution. Construction sites have historically been problematic. For example, sediment runoff from one site in Rocklin increased turbidity in Secret Ravine greater than 3000 NTUs (nephelometric turbidity units). This compares to a background level of less than five NTUs. In addition, the rail yard in Roseville and two golf courses lie directly adjacent to various Dry Creek tributaries. Runoff from these land uses has been linked to a variety of toxic chemicals, including polycyclic aromatic hydrocarbons, nutrients, and pesticides.

A final additional source of both chemical and physical changes is roads that run through the watershed, spanning the gamut from small, rural roads to Interstate 80. They have significant

impacts on the waterways in a number of different ways. At each crossing, the road is supported by culverts or bridges, both of which alter flows in the creeks and cause upstream and downstream erosion of the creek bed. Further, vehicle exhaust releases nitrogen, in the form of NO_x, which falls into the creeks and surrounding land via wet and dry deposition. In general, NO_x is a major source of excess nitrogen in waterways that contributes to algae blooms (M.C. Newman & W.H. Clements, 2008). Road runoff introduces metals and toxic organic contaminants into creeks as well. Due to the variety of ways in which roads adversely impact waterways, road density are often used as an indicator of disturbance in watershed report cards.

Watershed Stakeholders

The primary organization that is active in watershed stewardship efforts in the Dry Creek watershed is the American Basin Council of Watersheds (ABCW). The ABCW is composed of representatives of local, state, and federal government agencies, consultants, non-governmental organizations such as the Sierra Club, and watershed residents. The Dry Creek Conservancy (DCC) convenes the ABCW. Members meet monthly to discuss watershed issues and projects. They have hosted a Low Impact Development Conferences for many years that has drawn experts from the throughout the West Coast. The ABCW recently completed a significant restoration and barrier removal project along Secret Ravine with funds obtained from the Regional Water Authority, the local Integrated Regional Water Resource Management program. In addition, the Dry Creek Conservancy, Granite Bay Flycasters, and others conduct a yearly salmon count, coordinating creek cleanups, and organizing educational events related to environmental stewardship. Lastly, the DCC has conducted extensive water quality, habitat, and aquatic life monitoring throughout the watershed.

References

Ayres, E., Knapp, E., Lieberman, S., Love, J., Vodopals, K. 2003. Assessment of Stressors on Fall-Run Chinook Salmon in Secret Ravine (Placer County, CA). UC Santa Barbara. Donald Bren School of Environmental Science and Management.

East Loomis Basin Canal Efficiency Study Report. 2008. Placer County Water Agency. Auburn, CA.

History of Roseville. 2012. City of Roseville. Posted at: http://www.roseville.ca.us/visit_roseville/history_of_roseville/default.asp

Jim Carlisle pers. comm. Placer County Economic and Demographic Profile. 2011. Center for Strategic Economic Research.

Kahn, D. Oct 14, 2011. SALMON: Chinook numbers soar after Calif. shuts dam gates. *The Golden Gate Salmon Association.* Retrieved December 28 2012, from http://goldengatesalmonassociation.com/2011/10/14/salmon-chinook-numbers-soar-after-calif-shuts-dam-gates/

M.C. Newman & W.H. Clements. 2008. Effects of Global Atmospheric Stressors on Ecosystem Processes. In: Ecotoxicology: a comprehensive treatment. Taylor & Francis, pp. 771-809.

NPDES Stormwater Program. Information posted at: http://cfpub.epa.gov/npdes/stormwater/swbasicinfo.cfm

U.S. Bureau of the Census, Decennial Census data:

-for 1950-1990: http://www.census.gov/population/cencounts/ca190090.txt
-for 2000 and 2010: American Fact Finder 2010 Decennial census, Posted at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

Yoshiyama, R. M., F. W. Fisher, P. B. Moyle (1998). "Historical abundance and decline of Chinook salmon in the central valley region of California." North American Journal Fisheries Management 18: 487-521.