Vineyard Property Storm Runoff Impact Assessment (Trso, 2011)

Introduction

We conducted a study to inform regulation of storm runoff increases from hillslope vineyard properties in the Napa River and/or Sonoma Creek watersheds. The study was focused on the following question:

At points of storm runoff discharge from hillside vineyards and roads is the discharge causing or contributing to significant local changes in sediment dynamics and/or channel habitat conditions?

We explored two lines of investigation:

1. Reviewed available information including: a) local sediment budgets; and b) case studies documenting geomorphic/hydrological responses to land uses common in both watersheds.

2. Conducted a field survey of eight hillside vineyard properties located over a wide range of physical settings to assess current conditions at the points of storm runoff discharge and to predict future changes.

Results of the Review of Available Information

Case studies reveal that there are three styles of response to storm runoff increases at points of discharge from vineyards and/or from storm runoff changes caused by roads. These very different responses are a function of the significant variability in soil and bedrock types found within both watersheds. Some hillslope vineyard properties are underlain by hard bedrock units and shallow soils, others properties are underlain by soft sedimentary rocks with deep soils, and still others are underlain by deep-seated landslides and pervasively sheared bedrock. To illustrate the different responses in each of these physical settings, our results are presented as three case studies below.

Case Study # 1, Hard Bedrock Units with Shallow Soils: Low natural sediment supply– small gullies and landslides may form at points of discharge – they matter because added sediment is enough to clog cobble/boulder habitat- reducing growth and survival of juvenile trout

In watersheds underlain by competent bedrock (e.g., lava flow units of the Sonoma Volcanic Formation), where natural sediment supply to channels is very low, storm runoff increases may cause small gullies and/or landslides to form at some points of discharge. Since these features are small, one might think they are not important. However, this is not correct because the extra sediment represents a significant contribution to a very low natural supply: a boost of 50%-or-more in the supply of sand and fine gravel delivered to channels (Water Board, 2009).

This alone would not matter, except it does not take much extra sand and fine gravel to fill most of the holes between cobbles and boulders in the streambed. This is the impact. Clean cobble and boulder substrate provides excellent summer and winter rearing habitat for steelhead. Even small increases in the amount of sand and fine gravel in the bed may cause significant decreases in the growth and survival of juvenile trout (Suttle and Power, 2004), and ultimately, greatly reduce the number of adult steelhead that return to spawn (Shapovalov and Taft, 1954).

Example watersheds: Milliken Creek, Suscol Creek, and Bell Canyon Creek.
Background literature: Suttle and Power, 2004; Shapovalov and Taft, 1954, and Water Board, 2009.

Case Study #2, Soft Sedimentary Rocks with Deep Soils: Low natural supply-very large gullies and landslides at points of discharge-substantial increase in supply to tributaries- and perhaps a driver for channel incision in fish-bearing reaches

In watersheds underlain by sedimentary rocks, where natural sediment supply to channels is very low, storm runoff increases may cause large gullies and landslides to form in some locations. These features cause dramatic increases in the total sediment supply to channels (Water Board, 2009), transforming naturally low supply channels into high supply channels. Storm runoff increases in this setting also may be an important driver or contributing factor to channel incision further downstream in the channel network in reaches that provide habitat for fish.

Example watersheds: Carneros Creek, Huichica Creek, and Redwood Creek.
Background Literature: Water Board, 2009.

Case Study #3, Deep-seated Landslides and Sheared Bedrock: Medium to high natural supply-very large gullies and landslides may form at points of discharge- fish habitat in these tributaries may not really become much worse-but the extra supply needs to be reduced in order to achieve the Napa River and Sonoma Creek sediment TMDLs.

In watersheds, with high natural supply (mélange terrain and other units with active deep-seated landslides), large gullies and/or landslides may form at points of discharge. However, when these sources are added up, they only cause a 15-to-30 percent increase above a very high natural background supply (Water Board, 2009). Therefore, it's not clear they cause tributary fish habitat to become much worse. Instead, the problem is, that the extra sand and fine gravel constitutes a significant proportion of the total supply of fine bed material discharged to the Napa River and/or Sonoma Creek. Therefore, these sources have to be controlled to attain suitable substrate conditions for fish (e.g. a prevalence of clean gravel patches) in the bed of Napa River and/or Sonoma Creek.

Example watersheds: Sulphur Creek and Bear Canyon Creek.
Background literature: Water Board, 2009.

Results of the Field Survey

The field survey was conducted at eight Napa Valley vineyard properties located across a wide range of physical settings. The surveyed properties were chosen to allow for timely property access and may represent better maintained (more compliant) sites where landowners were willing to participate in a field study sponsored by a regulatory agency. Seven of the eight were certified previously by the Fish Friendly Farming Program, all are permitted under the Napa County Conservation regulations, and many previously had implemented erosion control projects in partnership with the Napa RCD. At most vineyard drainage outlets, we observed no erosion or only a moderate amount of erosion (e.g., small gullies, small slide scar(s), or a pre-existing channel that had widened and/or deepened by a measureable amount while still maintaining its basic structure). All points of storm runoff discharge, where erosion was observed, were treated to control sediment delivery by armoring scars (where these occurred) or extending the point of discharge to a channel at grade[1]. Two of these properties had been previously surveyed in 2003-04 when we prepared the Napa River watershed sediment budget, at which time we documented several large active gullies and shallow landslides at points of storm runoff discharge from vineyard blocks and roads. Since 2004, all of the large sediment sources (e.g., active gullies and shallow landslides) were treated to control erosion. Based on this survey, at sites that have been certified under the Fish Friendly Farming Program (12,000 acres in the Napa River watershed)[2], we conclude that the proportion of land-use related sediment delivery to channels likely is much lower at present than documented in 2003-04 period. This finding is quite encouraging[3].

Based on review of available information and field survey, we also conclude that management practices to promote infiltration of rainfall into soils need to be implemented to a greater extent and level of effectiveness at many vineyard sites. Opportunities to increase infiltration within farmed areas should be conscientiously evaluated and implemented to the maximum extent practicable. Application of no till cover crops, composted mulch, controlled traffic, infiltration trenches, vegetated swales, constructed wetlands, and other conservation practices are effective both in attenuating land-use related increases in storm runoff and decreasing fine sediment delivery from cultivated areas, which would be a significant added benefit. Similarly, more work is needed to disperse storm runoff from roads through application of rolling dips, water bars, and/or out-sloping of the road surface, where these treatments are practicable.

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[1] At the time that we prepared the sediment budget for the Napa River watershed in 2003-04, this was not the case. In 2003-04, scars at points of discharge often were not treated to control erosion.

[2] Some BMPs implemented at these sites result from: a) permitting under the Napa County Conservation Regulations; and/or b) road erosion control and/or gully erosion control projects implemented in partnership with the Napa County RCD and/or the Napa County Office of the USDA Natural Resources Conservation Service.

[3] As a certifying agency, we have participated in farm plan reviews and site inspections for all of these properties (over 100) in the Napa River watershed. The intensive field survey complements the more general surveys we have performed and our observations support this conclusion."

References Cited

Shapovalov, L. and A.C. Taft 1954. The life histories of the steelhead rainbow trout (*Salmo gairdeneri gairdeneri)* and the silver salmon (*Onchorhynchus* kisutch) with special reference to Waddell Creek, California, and recommendations regarding their management. State of California, Department of Fish and game, Fish Bulletin 98: Sacramento, CA: p. 232, Table 79. http://escholarship.org/uc/item/2v45f61k.

Suttle, K.B., Power, M.E., Levine, J.M., and C. McNeely 2004. "How fine sediment in riverbeds impairs growth and survival of juvenile salmonids." *Ecological Applications* 14(4): 969-974. http://ib.berkeley.edu/labs/power/lab_people/blake_suttle/Publications%20in%20pdf/Suttle%20et%20al_04.pdf.

Water Board, 2009. Napa River sediment TMDL and habitat enhancement plan. September 16, 2009. Oakland, CA: pp. 155. http://www.swrcb.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/napasediment/C_NS_Staff_Report_09-09.pdf.