What's Bugging Our Creeks?

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Volunteers are sinking to new depths in their pursuit of healthy creek habitat as they study the link between an urban dam and the distribution of fine sediment and benthic macroinvertebrate assemblages.

A hatchet-shaped trochantin? A notch in the ventral edge of the mesonotum? When it comes to the world of magnified macroinvertebrates, or "bugs", volunteers often find the view through the microscope to be surprising and beautiful, and sometimes a bit scary. Predatory stonefly nymphs sport a welter of threatening mouthparts. Caddisfly larvae encase themselves in structures of amazing variety and intricacy – swirled cones of silk and algae fibers, pine needle cabins and sparkling sand capsules.

STONEFLY

Jim Carter and Steve Fend, US Geological Survey (USGS) stream ecologists, are very patient with explanations of bug bits and pieces. Each week a dedicated group of volunteers meet to identify collected Stevens Creek macroinvertebrates to the family level. Although we eventually get everything identified, those of us who are less experienced with the tweezers somehow end up with more bits and pieces than we started with. While entertaining, this exercise has a serious purpose. This fall marks the beginning of the third year of partnership between the USGS and SPCWC to study aquatic habitat quality in the four miles below Stevens Creek Dam. The study focuses on the link between the dam and the distribution of fine sediment and benthic macroinvertebrate assemblages.

CADDISFLY

Although this is a scientific study, interest and participation has spread far beyond the traditional scientific community. Teachers, students, engineers, biologists, fishermen, lawyers and legislative aides have all joined in the collection and identification of Stevens Creek benthic macroinvertebrates. Just what are benthic macroinvertebrates? They are the small animals without a backbone which dwell in the bottom of our creeks. Insects, worms, clams and snails are some of the more common macroinvertebrates found. They comprise an important part of the creek ecosystem as they break down dead leaves, control algae and serve as food for other animals.

The larvae from the insect orders Ephemeroptera, Plecoptera and Trichoptera, more commonly known as mayflies, stoneflies and caddisflies, are often known collectively as the "EPT", and are used extensively in stream biomonitoring because they are considered

sensitive to the impacts of fine sediment and other water pollutants. Biomonitoring of macroinvertebrates is a far more sensitive way of determining habitat quality than equipment which just measures pH, dissolved oxygen and so forth at a particular point in time. A macroinvertebrate assemblage will reflect the habitat quality of days, weeks or even years prior to the study.

COLLECTING MACROINVERTEBRATES

Stevens Creek, like streams throughout our area, has been altered from its historical condition first by agricultural practices and now by extensive urbanization. Myriad chemicals from commercial and residential activities make their way into the creek. Sediment, a natural component of an aquatic habitat, has greatly increased with the intensification of human activities. Additionally, water capture by the Stevens Creek Dam, management of that dam, storm water discharges, and surface and groundwater withdrawals have greatly changed the water-flow regime of the creek. This in turn affects a number of chemical factors as well as sediment transport and deposition – all of which are important to habitat quality. Not surprisingly, studies have determined Stevens Creek to now be biologically impaired.

Of particular concern is the four-mile stretch below the dam which has been designated as priority spawning and rearing habitat for the federally threatened Steelhead trout. Water runoff from storm events brings much sediment from the surrounding watershed into the creek. Under natural conditions, the flood-flows would flush this sediment down the creek and out into the bay. With the dam, however, this water is captured in the reservoir with the sediment settling to the bottom. Studies have shown that larger sediment particles, such as the gravel and cobbles needed for healthy Steelhead spawning habitat, are retained behind the dam.

Conversely, increased turbidity, or the suspension of fine sediment, is evident in the water below the dam. This has led to a concern that the tightly regulated flows from the bottom-release Stevens Creek Dam are resulting in an increased deposition of fine sediment on the substrate downstream. As the US Environmental Protection Agency regards fine sediment as the number one water pollutant, the probability is high that this has a significantly negative impact on creek health.

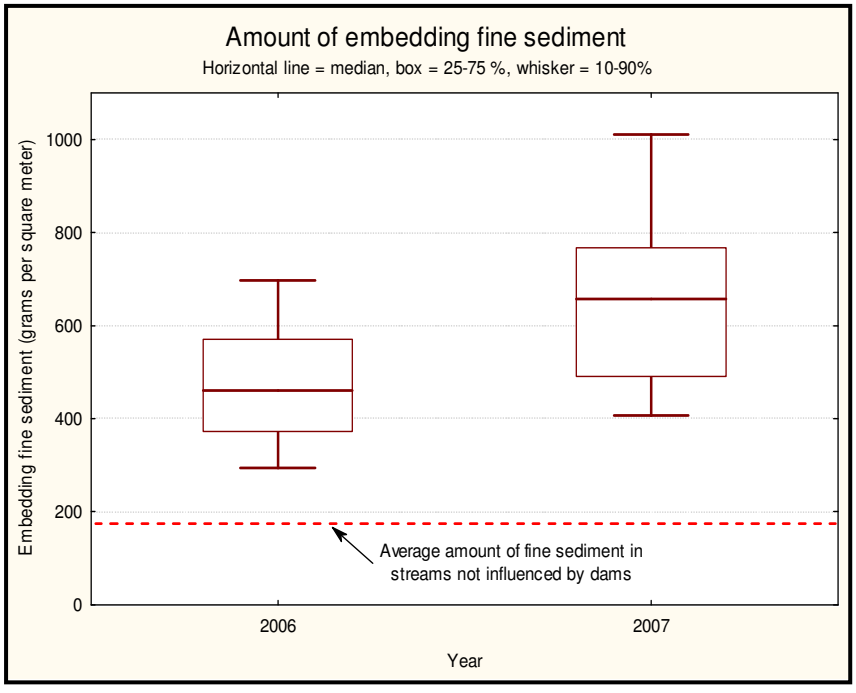
SORTING AND IDENTIFYING MACROINVERTEBRATES

In an effort to assess the effect the dam has on fine sediment deposition in the area downstream from the dam and the resulting alteration in habitat quality, the SPCWC/USGS study seeks to answer three questions: 1) Is the amount of embedding fine sediment below the dam

more than in streams that do not have dams? 2) Does the amount of fine sediment present on and within the creek substrate decrease with increasing distance from the dam? 3) Is the benthic macroinvertebrate assemblage correlated to the distribution of fine sediment?

This fall, as in the previous two, we spent a week wading in the waters of Stevens Creek to collect bug and fine sediment samples at eight riffle sites within the study area. Jim and Steve cobbled together a clever collecting device which allowed the simultaneous sampling of bugs and fine sediment. To aid in site evaluation we also measured slope, flow-rate, tree canopy cover, water chemistry and the size of streambed particles - grains of sand on up to boulders too large to be lifted. Our volunteers are the intrepid sort and none complained of wrinkly toes at the end of the week.

The data from the first two years provide a wealth of information on the distribution of fine sediment and macroinvertebrates, as well as the water chemistry and habitat of this segment of Stevens Creek. So far, over 160 samples of fine sediments have been collected and analyzed. A previous study of Santa Clara Valley streams found the average amount of fine sediment embedding the substrate of creeks without a dam to be 170 grams per square meter, while the amount found in streams influenced by dams was 440 grams per square meter. By contrast, our study found the average amount of fine sediment embedded in the substrate of the Stevens Creek study area to be approximately 570 grams per square meter, although it was variable between the two years and among the eight sites. The accompanying graph demonstrates the variance in embedded fine sediments.



Although samples were collected at the same time of the year, there were major differences between 2006 and 2007 in the amount of fine sediment deposited and the

macroinvertebrate distribution. The amount of fine sediment averaged 485 grams per square meter in 2006 and 665 grams per square meter in 2007. Also, in 2006 there was a general decrease in fine sediment from approximately 0.5 kilometers below the dam to the downstream end of the study area. By contrast, the longitudinal distribution of fine sediment in 2007 was more complex. A few other important parameters also differed between the two years, in particular, water flow, which at the time of sampling in 2007 was approximately one-half as high as it was in 2006.

Volunteers have identified over 40 families of macroinvertebrates during the past two years. Additionally, we determined the total number of individual organisms to be 1600 per cubic meter in 2006 as compared to 3600 per cubic meter in 2007. Interesting, as the number of organisms increased, the percentage of the EPT (pollution sensitive macroinvertebrates) decreased from 58% in 2006 to 42% in 2007. A number of statistical tests were used to determine the relationship between the fine sediments and the macroinvertebrates. Results indicate approximately 25% of the decrease in EPT among sites and between years could be explained by the increased amount of fine sediment embedding the substratum.

In a region where there are so very many environmental stressors, it is difficult to determine the major cause and effect relationships which lead to stream impairment. It is only through field studies such as this that we can begin to do so. More data, both from Stevens Creek and other creeks in the valley, will increase our confidence in and the validity of our interpretation of the results. The partnership of SPCWC and USGS is proving to be a successful way to involve the community in meaningful creek stewardship – we hope other watershed groups will expand this study into their creeks for the benefit of all.

More information on the study methods, results and analyses may be obtained by writing to programs@spcwc.org.