Antone Creek Bio-Monitoring Project
Union/Baker WSEP Program, Powder Basin, Baker County

Master Watershed Stewards William Lovelace and Jackie Dougan, Class of 2003

Masters from Baker County worked together to collect water quality and aquatic habitat data for their watershed assessment. This project aimed to also demonstrate the value of and need for local bio-monitoring, while giving the community a more complete understanding of the Oregon Plan water quality assessment protocols.

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Background, Goals, and Objectives

Antone Creek is a tributary to the North Powder River in northeastern Oregon. Master Watershed Stewards Bill Lovelace and Jackie Dougan were the leaders of a group bio-monitoring project on Antone Creek. Their overall purpose was to contribute to the Powder Basin Watershed Council's North Powder/Wolf Creek assessment by collecting water quality and aquatic habitat data. They also aimed to demonstrate the value of and need for local bio-monitoring, while giving the community a more complete understanding of the Oregon Plan water quality assessment protocols.

Bill and Jackie collaborated with 5 other Master Watershed Stewards to carry out the project: **Jerry Franke**, Burnt River Irrigation District, and watershed council members **Vicki Wares**, **Ulee Yanok**, **Vicki Valenzuela** and **Mark Taylor**.

The group had help from Jackie, a fish biologist from the Bureau of Land Management (BLM), and was assisted by fisheries technician Zona Irby, the Burnt River Irrigation District, and the Department of Environmental Quality Bio-monitoring section.

To add to what they learned in their WSEP module on water quality monitoring, Bill and Jackie attended additional training in bio-monitoring and macroinvertebrate sampling techniques. The group comprised a reading list for themselves, which they could refer to over time (see end of article). Ongoing question and answer sessions about protocols and the equipment used were an important part of the project.

The Antone Creek bio-monitoring project group gathers to develop plans for the project.

With education, training, and reading under their belts, the group identified their main objectives:

1) Collect a late summer macroinvertebrate sample to provide baseline data, analyzed by a professional lab (National Aquatic Monitoring Center, aka "The Bug Lab").
2) Collect physical and chemical water quality measurements including: stream width, stream depth, substrate composition, vegetation type, canopy cover, flow, temperature, pH, dissolved oxygen, nitrates, phosphate, and turbidity.
3) Offer the bio-monitoring project as a demonstration and awareness building activity to the watershed council and general community.

Jackie and Bill sample macroinvertebrates in the creek.

Thanks to Jackie's access to tools and equipment from the BLM, they did not need to seek money to complete this project. They began by carrying out an extensive site description and land management history, which included research on such information as elevation, latitude/longitude, stream class, fish presence, irrigation diversions, land-use type, plant associations, topography, hydrology, soil type, and timber management history. Such information gave them a broader perspective and a better understanding of site variability for characterizing and interpreting what they were to find. Then after they discussed a field safety strategy, the group was ready for the fun part of field sampling! Following Oregon Plan protocols in the Water Quality Monitoring Technical Guidebook (see the reading list at the end of this article), they measured several variables. The following is a shortened summary of their data collection.

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Methods

All macroinvertebrate samples were collected with a Wards' Biology D-frame Kick Net with EPA approved 500 micrometer mesh net from "Research Nets." The lab sample consisted of eight square feet of stream bottom collected at four locations in the project reach. Before identifying the *taxa* (kingdom, phylum, class, order, family, genus, species), the group sorted out the macroinvertebrates into *functional feeding groups.* Macroinvertebrates are typically classified according to their "eating" habits: shredders, filterers, gatherers, scrapers, and predators. This classification system reflects the major source of stream resources (where the food comes from), either within the stream itself or from riparian or upland areas. The character of a stream can be determined by evaluating the relative proportions of functional feeding groups.

Substrate composition (boulders, cobbles, pebbles, sand, etc.) was estimated at sample sites. Vegetation canopy cover was measured using a Spherical densiometer. An estimate is made of the overstory density to estimate canopy cover of an area. This estimate is an average of four readings facing: North, South, East, and West at systematic locations along the stream.

A spherical densiometer provides an estimate of a stream's overstory vegetation density. The measurement is stated as an average of four readings facing north, south, east and west. This estimate is a measurement of "canopy cover".

Water quality data was monitored at the most upstream site of the project, and information was recorded twice during the project period. Variables such as pH, turbidity, dissolved oxygen, and others were compared to the State's standards and rated. The group measured dissolved oxygen, nitrates and phosphates, and pH by professional scientific measuring devices from Hach®.

Stream flow was measured with a flow meter, which measures the total flow of the stream in cubic feet per second (cfs), by taking several measurements in a transect across the stream channel where width and depth can be clearly defined.

Antone Creek's stream temperature was monitored every 60 minutes using an Onset StowAway TidbiT continuous temperature data logger. The device was placed in the stream for 79 days, when the warmest stream temperatures occur.

Lastly, a turbidimeter measured suspended sediment within the water column. Usually the sediment that covers the bottom substrate is the most concern for fisheries. Sediment can remove much of the oxygen from fish eggs in the gravel.

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Results

Results showed that the main type of macroinvertebrate found was the Gatherer (Figure 1). Gatherers feed on deposited fine particulate organic matter, and they are sensitive to deposited toxins. Since they are sensitive to toxins, it is a good sign that their abundance was as high as 50%.

The 7-day max/average temperature for Antone Creek was 60.5 degrees F, and there were zero days over 64 degrees F. The 64 degree mark indicates lethal temperatures for most fish species. Dissolved oxygen was rated as "fair." Dissolved oxygen above 10 mg/L is rated as ideal for optimum health of most fish species. The three readings were: 9.82, 9.75, and 9.78, just under the "ideal" rating. The average pH reading was within the limits of the ideal range, which for most fish species is 6.5-8.0. The three readings were 8.37, 7.5, and 7.5.

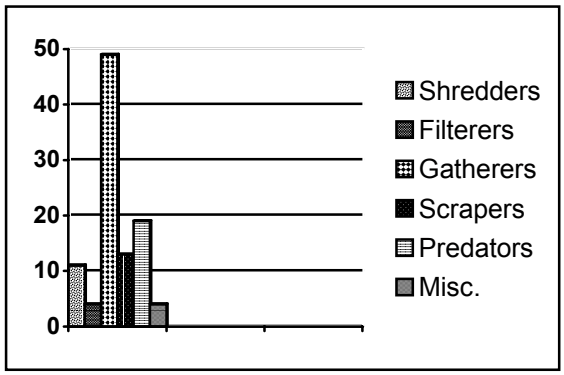

Figure 1. Macroinvertebrate functional feeding groups found in Antone Creek.

Nitrates were within the limits of the 1999 DEQ drinking water standard of 10 mg/L, although phosphates exceeded the standard of 0.10 mg/L. The two times the water quality was tested for phosphates the readings were 0.53 and 0.11 mg/L. The higher phosphates could be a background measurement from phosphate or calcium phosphate contained in the rock within this watershed. Clays, limestone, and other sedimentary rocks, which are conglomerates of many soil types, can produce these minerals.

In terms of riparian vegetation cover, the group found that average canopy cover ranged from 38-60% canopy cover over the stream in the area of study, although this was variable. When examining in-stream habitat components, Antone Creek's substrate was found to be a mixture of cobble and boulders, but the relative percentage of each changed in each area. Large wood and boulders were found to provide adequate pools.

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Conclusions

Overall, the Antone Creek monitoring group found that the creek is in "pretty good shape" for fish habitat. The outcomes and results from such a project are critical for making management decisions and setting priorities in the watershed and in the region. The information gained from this project will be incorporated into the Powder Basin Watershed Council's North Powder/Wolf Creek assessment and will be referenced for years to come.

Social Impacts

This project provided social interaction to a diverse group in the watershed. Landowners, scientists, environmental groups, and other volunteers worked together for watershed stewardship that is beneficial to the whole community. When local government agencies and water user groups collaborated for information and water quality testing equipment, new connections were made. Working together like this fosters cooperation, consensus, and positive future working relationships. Moreover, this project serves as a demonstration and awareness building activity to the community, region, and state, and proves that bio-monitoring is feasible for local individuals and groups.

Economic Impacts

As a woodland owner, Bill believes that bio-monitoring can be a cost effective tool for working with the Department of Forestry in developing forest management plans on properties that include riparian and stream habitat. Bio-monitoring can be done with equipment costing hundreds of dollars, not thousands of dollars. It is a relatively fast method of evaluating stream conditions and measuring the macroinvertebrate community that is a continuous living monitor of stream conditions. Bio-monitoring can also provide a shortcut for considering where in a watershed you may want to focus on more intensive chemical and physical long-term monitoring.

The methodology for carrying out bio-monitoring and collecting macroinvertebrate samples is simple enough that local watershed volunteers can easily do it, in comparison to the more complex and expensive methodology of physical and chemical testing. Chemical analysis of water samples is expensive at a "certified" laboratory. Laboratory results usually cost several hundred dollars per sample. It was therefore much cheaper for the group to collaborate with agencies such as the BLM, since they had equipment and expertise to donate.

> "We all learned a lot from completing this project and we had a lot of fun doing it. Every day in the field was a great day and we each walked away feeling satisfied in working together, enjoying the day and learning new information." – Jackie and Bill

For the full report, you may contact Vicki Wares, Powder Basin Watershed Council, in Baker City, at: 541-523-3621.

The Group's Required Reading List:

Guide to Pacific Northwest Aquatic Invertebrates, Aquatic Biology Series: Book 1. Rick Hafele and Steve Hinton. Oregon Trout, 1996.

The Stream Scene: Watersheds, Wildlife, and People, 2nd Edition. ODFW, 1999.

Water Quality Monitoring Technical Guide Book, Version 2.0. Oregon Plan for Salmon and Watersheds. July 1999. Available on-line at www.oregon-plan.org/cdrom/index.html, or by calling toll-free: 1-888-854-8377.

Watershed Stewardship: A Learning Guide, Section 3 Chapter 5 (Appendix C) and Section 3 Chapter 8. Oregon State University Extension Service, 2002.

-Tara Nierenberg