

Measurement of Water Quality of High-Altitude Wilderness Streams: Cloud Peak Wilderness, Bighorn National Forest, Wyoming

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Abstract—The measurement of water quality and stream health in wilderness areas is made difficult by the need to use non-motorized modes of travel. In Wyoming, data on streams in the high-altitude Cloud Peak Wilderness are scarce. The monitoring of stream health of the Tongue, Powder and Big Horn Rivers at lower altitudes can be made more meaningful by the collection of baseline data on chemical and biological factors upstream in the tributary creeks of the Cloud Peak Wilderness.

Introduction

In the past 5 years, volunteers of the Cloud Peak Chapter of Wilderness Watch have sampled 21 streams within or just outside the Cloud Peak Wilderness. Methodology was supplied by employees of the Water Quality Division of the Wyoming Department of Environmental Quality (WYDEQ), and training was provided by WYDEQ volunteers. Cumulative assessment of habitat, water quality, benthic macroinvertebrate populations and general land use observations suggest that several of these wilderness streams should be candidate “reference sites,” while others are potential “reference sites” for stream health in Wyoming.

Methods

1. These chemical parameters of samples collected onsite were measured by a contract laboratory: turbidity, total suspended solids (TSS), total chloride, total sulfate, total phosphorus, alkalinity, hardness, total nitrate nitrogen.
2. These parameters were measured onsite: pH, conductivity, air and water temperature, dissolved oxygen, current velocity, discharge in cu ft/sec.
3. Samples of benthic macroinvertebrates (bugs) were collected in a Surber sampler and preserved in alcohol for identification by a contract laboratory.
4. Habitat assessment included responses to questions designed to illustrate the ability of the habitat to support fish

and other aquatic organisms, and the stability of the stream to erosion and other factors. The type of stream substrate (sandy, rocky, silted) was described quantitatively.

5. Photos and field notes documented the physical appearance of the area, and GPS positioning coordinates pinpointed the location for future resampling.

Results

As would be expected, these high-altitude streams showed none of the hallmarks of chemical pollution (chloride, sulfate, phosphorus, high nitrogen, high total suspended solids or turbidity). Fish were present, often in abundance; the pH ranged from 7.6 to 8.3 and dissolved oxygen was sufficient to support aquatic life. Even though some data were collected in the Wyoming drought years of 2000–2002, with correspondingly low discharge rates, these streams were generally healthy.

Benthic macroinvertebrates were identified from many expected taxa: Chironomidae (midges), Trichoptera (caddisflies), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tipulidae (crane flies), Coleoptera (riffle beetles), and Acari (worms).

Many of the 115 taxa that were identified are restricted to cold streams that are low in pollutants. The presence of these organisms is a good indicator of the absence of significant pollution. Also, there was very little occurrence of pollution-tolerant organisms (leeches and oligochaete worms). The studies of eleven creeks carried out from 2000–2002 have been published as a technical report by the Cloud Peak Chapter of Wilderness Watch, available to any interested group or agency by writing to Cloud Peak Wilderness Watch, P. O. Box 6773, Sheridan, WY 82834. Further data on ten creeks assessed in 2004–2005 will be published at a later date, after evaluation.

Discussion

Because of the increased need for scientific information about the National Forests and Wildernesses, and the decreased budgets of the agencies that administer these public lands, the volunteers of Cloud Peak Wilderness Watch have accepted a challenging role in collecting unique data. Volunteer teams transported field equipment by backpack and/or llama pack train into remote areas, conducted a series of assessments, and returned field samples for analysis by contract labs.

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The need for volunteers in protecting wilderness values cannot be underestimated. One way we can contribute is by filling the need for information otherwise not accessible by traditional agency methods and personnel. Our project can fulfill the need for “good science” to support the decisions of land managers who are charged with protecting our resources. It is also important for those who need wilderness to be “out there” in the field, enjoying the resource that we

work to protect, so that we are stimulated to advocate for wilderness values.

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