27th Annual Idaho Water Quality Workshop

January 31–February 2, 2017
Boise, Idaho

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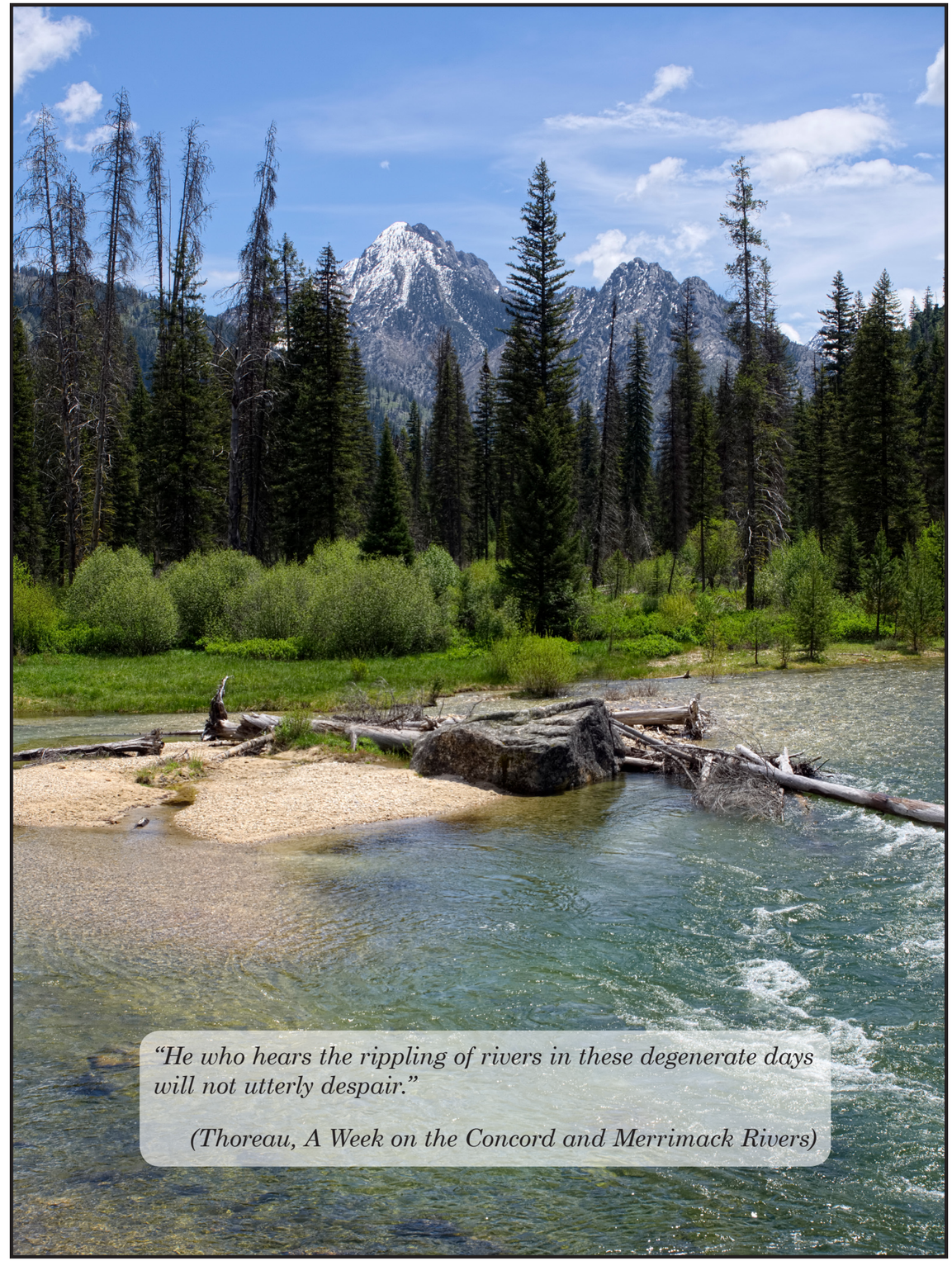
A special thank you to Idaho Power for the printing of this publication.

This conference is organized annually by the Idaho Department of Environmental Quality. It provides a forum for the dissemination and discussion of water quality monitoring results and techniques.

Cover photo: Selway River, Idaho (Dennis Behler)



Grandjean, Idaho

Poster Presentations

Tamsen Binggeli
Boise River Enhancement Network/Ecosystem Sciences
Riverside Hotel Green Stormwater Infrastructure Project and Boise River Enhancement Plan

Dan Isaak
Boise Aquatic Sciences Lab, Rocky Mountain Research Station, U.S. Forest Service
Big Biology Meets Microclimatology: Defining Thermal Niches of Aquatic Organisms at Landscape Scales for Conservation Planning

John and Charleen Keebaugh
Stitching Designs of Nature
Showing previously completed and framed cross stitchings of Idaho game fish. Artist(s) will be working on new projects during the conference, including the Westslope Cutthroat Trout Mill Creek.

Liz Berger, Joan Carlson, Pam Edwards, and **Christopher Carlson** with **Brenda L. Mitchell**
U. S. Forest Service
The Forest Service National Best Management Practices (BMP) Program

Heather Rice
The Aberdeen-Springfield Canal Company
Ground Water Recharge: A Water Quality Monitoring Plan that Makes Everyone Happy for the Hilton Recharge Site

Angelo Sanfilippo
Boise State University
The Effects of Dissolved Organic Carbon Quantity and Quality on Hyporheic Zone Microbial Respiration in a Second Order Headwater Stream

Dana Swift
Idaho Department of Environmental Quality
Interstate Technology and Regulatory Council (ITRC)

Joe Weirich
U. S. Bureau of Land Management, Vale District
Dark Canyon Stream Response to the Windy Ridge Complex Fire 2015

Clark Fork River, Idaho

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Agenda – Tuesday, January 31, 2017. 1:00 p.m. – 5:00 p.m.
Jordan Ballroom D

***Registration** opens at 12:00 p.m.*

1:00 p.m. – 1:05 p.m. **Hawk Stone**
Idaho Department of Environmental Quality
Welcome

1:05 p.m. – 1:10 p.m. **Ralph Myers**, moderator
Idaho Power Company

1:10 p.m. – 1:55 p.m. **Opening Address: Michelle Hladik**
U. S. Geological Survey
Changing Pesticide Use: Challenges for Water Quality Monitoring and Ecological Implications

1:55 p.m. – 2:15 p.m. **Curtis Cooper**
Idaho State Department of Agriculture
Idaho's Pesticides and Water Quality Program Update

2:15 p.m. – 2:40 p.m. **Kirsten Kapp**
Central Wyoming College
Assessing the Occurrence of Microplastics in the Snake River: a "Snapshot" View

2:40 p.m. – 3:05 p.m. **Monica Hubbard** and **Haley Robinson**
Boise State University, School of Public Service
Fate, Transport, and Policy Implications of Residential Pharmaceutical Drugs

***Break:** sponsored by Idaho Power Company*

3:30 p.m. – 3:50 p.m. **Brenda L. Mitchell**
Sawtooth National Forest
Water Quality Best Management Practices Monitoring on the Sawtooth National Forest

3:50 p.m. – 4:15 p.m. **Robert Tiedemann**
Clean Water Partners, LLC and Ecological Design Inc.
Expectations for the Future Ability of the Riparian Forest Growing Along Idaho Rivers to Ameliorate Ambient Water Temperatures

4:15 p.m. – 4:35 p.m. **Melissa Muradian** and **Rob Van Kirk**
Henry's Fork Foundation
Effect of Climate Change on Water Quality Below Island Park Reservoir

4:35 p.m. – 4:55 p.m. **Mark Shumar**
Idaho Department of Environmental Quality
Upper Salmon River Temperature TMDL Analysis

4:55 p.m. – 5:00 p.m. **Closing Remarks**

Perchlorate/Fireworks Contaminated Groundwater, Richardson Sawmill/Tribal Unit 45, Orofino, Idaho

Kevin Brackney
Groundwater Program Leader

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The Nez Perce Tribe Water Resources Division has been investigating groundwater contamination at a closed sawmill to assess the risks to human health and the environment. The Tribe is proposing to redevelop the property into a Tribal steelhead fishing resort on a high elevation gravel bar on the banks of the Clearwater River. The objective of the groundwater assessment is to develop a drinking water supply to support the resort. Seven "recognized environmental conditions" were identified in the Phase I Environmental Site Assessment. However, only perchlorate has been detected in nine of 14 monitoring wells drilled and sampled at the site. Three wells have intermittently exceeded the proposed drinking water standard of 15 µg/L with one well persistently exceeding the standard with maximum concentrations of 115 µg/L.

Concentrated detonation of fireworks on the mill site appears to be the likely source of the contamination. The geology consists of a "point bar" deposit of sand, gravel, and boulders and is interpreted to be particularly vulnerable to surficial contamination. The groundwater is likely to be characterized as "groundwater under the influence of surface water."

Multi-Tracer Evidence of Water Sources and Geochemical Processes in the Eastern Snake River Plain Aquifer, Idaho National Laboratory, Eastern Idaho

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A multi-tracer study of the eastern Snake River Plain (ESRP) aquifer at the U.S. Department of Energy's Idaho National Laboratory (INL) was performed by the U.S. Geological Survey to understand hydrologic processes in the aquifer. Tributary and regional groundwater, originating north and east of the INL respectively, flows through carbonate and silicate geologic terranes. These geologic source areas allow identification of groundwater provenance from concentrations of silica and lithium and the activity of carbon-14. Silica and lithium concentrations were larger in regional groundwater, relative to tributary groundwater, due to dissolution of rhyolite and basalt. Dissolution of Paleozoic and Mesozoic carbonate rocks in the mountains introduced "dead" carbon-14 into tributary groundwater; thus, for tributary and regional groundwater of the same age, carbon-14 activities are smaller in tributary groundwater than regional groundwater.

Sources of recharge were identified with hydrogen and oxygen stable isotope ratios, which were lighter in underflow of groundwater from tributary valleys, heavier in infiltration from the Big Lost River at the INL, and intermediate to heavy in underflow of regional groundwater. Helium concentrations and stable isotope ratios were used to identify recharge from surface water, old tributary or regional groundwater, and geothermal water. The isotope ratios of strontium and uranium were used to identify mixing of the various source waters at the INL and water-rock interaction with basalt.

Changing Pesticide Use: Challenges for Water Quality Monitoring and Ecological Implications

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Pesticide use is constantly changing due to pest resistance, regulations, type of crops planted, and the introduction of new chemicals. In the past few decades there have been changes in the types and amount of insecticides, fungicides and herbicides used in agricultural and urban areas.

In recent years, application techniques for agricultural use pesticides have also changed with an increase in seed coatings in addition to more traditional application methods such as foliar sprays. Most seeds coatings consist of one insecticide and up to five fungicides; many of these pesticides have not been used extensively prior to their inclusion on seed coatings.

A change in the pesticide active ingredient or application technique can impact the environmental fate and transport of these pesticides and their potential effects on non-target organisms. For example, a shift from more the hydrophobic pyrethroid insecticides to the more hydrophilic neonicotinoid insecticides requires new analytical methods, different environmental matrices (sediment vs. water) and different toxic effects (benthic vs. pelagic).

Idaho's Pesticides and Water Quality Program Update

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The Idaho State Department of Agriculture (ISDA) has been monitoring pesticide concentrations in the ground and surface waters of Idaho for nearly two decades. ISDA collaborates with the Idaho Ground Water Monitoring Technical Committee and works directly with other agencies to prioritize statewide sampling needs. Primarily referencing drinking water quality standards, ISDA typically does not develop Pesticide Management Plans (PMP) because of excess pesticide concentrations in ground water; however, a PMP was developed for Dacthal, in Owyhee County (2008) with on-going monitoring and use restrictions. There have been other measurable pesticide concentrations (such as atrazine) identified in the ground water, and typically, these measureable concentrations have been near the laboratory maximum detection limits of either 25 or 50 parts per trillion. There are some regional and site-specific differences throughout the State of Idaho most likely related to pesticide requirements, crops and geology. The ISDA surface water program has identified locations where concentrations exceed the Aquatic Life Benchmarks for Pesticides, such as chlorpyrifos insecticide in the Treasure Valley that lead to several impaired listings (i.e. Idaho's Integrated Report).

Currently, ISDA is changing its approach to water quality monitoring at ISDA. The goal is to better integrate the ground and surface water monitoring programs to capture their interconnection while maintaining the already established quality of work and serving as a first-line indicator of diminished water quality from pesticides.

Evaluating Background Concentrations of Selected Chemical and Radiochemical Constituents from the Eastern Snake River Plain Aquifer

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The U.S. Geological Survey and the Idaho Department of Environmental Quality's Idaho National Laboratory (INL) Oversight Program, in cooperation with the U.S. Department of Energy, determined background concentrations of selected chemical and radiochemical constituents in the eastern Snake River Plain aquifer to aid ongoing cleanup efforts at the INL. Samples collected from wells and springs at and near the INL that were not believed to be influenced by wastewater disposal were used to establish background concentrations. Selected chemical and radiochemical constituents included calcium, magnesium, sodium, potassium, silica, chloride, sulfate, fluoride, bicarbonate, chromium, nitrate, tritium, strontium-90, chlorine-36, iodine-129, plutonium-238, 239-240 (undivided), americium-241, technetium-99, uranium-234, uranium-235, and uranium-238. These constituents were selected for the background study because they were either not included in earlier studies completed in the 1970's and early 1990's or new data became available to give a more recent interpretation of background concentrations. Median concentrations were used to define background levels.

The eastern Snake River Plain aquifer at and near the INL was divided into two major water types (western tributary and eastern regional) based on concentrations of lithium less than and greater than 5 µg/L. Background concentrations for the chemical and radiochemical constituents will be presented and compared to past background levels for comparable constituents.

Ambient Water Quality in Aquifers Used for Drinking Water Supplies, Gem County, Southwestern Idaho, 2015

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The U.S. Geological Survey, in cooperation with Gem County and the Idaho Department of Environmental Quality, assessed the quality of groundwater from freshwater aquifers used for domestic supply in Gem County. A total of 47 domestic or municipal wells, 1 spring, and 2 surface-water sites on the Payette River were sampled during September 8–November 19, 2015.

To better understand analytical results, a conceptual hydrogeologic framework was developed in which three hydrogeologic units were described: Quaternary-Tertiary deposits (QTd), Tertiary Idaho Group rocks (Tig), and Tertiary-Cretaceous igneous rocks (TKi). Water levels were measured in 30 wells during sampling, and a groundwater-level altitude map was constructed for the QTd and Tig units showing groundwater flow toward the Emmett Valley and Payette River.

Analytical results indicate that groundwater in Gem County is generally of good quality. Samples collected from two wells contained water with fluoride concentrations greater than the U.S. Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) of 4 milligrams per liter (mg/L), six wells contained arsenic at concentrations greater than the EPA MCL of 10 micrograms per liter, and a sample from one well exceeded the MCL of 15 picocuries per liter for alpha particles. Although previous samples collected from some wells in Gem County contained nitrate concentrations greater than the MCL of 10 mg/L, the largest concentration detected in the current study was 5.2 mg/L.

Three volatile organic compounds (VOCs) were detected in samples collected from five wells, and herbicides were detected in samples from five wells. Methane was detected in samples from 36 wells, with the concentration in 1 well large enough to be considered an explosion hazard by U.S. Office of Surface Mining guidelines. Stable isotope signatures of methane in six samples suggest that naturally occurring methane in Gem County is probably of both thermogenic and biogenic origin.

Assessing the Occurrence of Microplastics in the Snake River: a "Snapshot" View

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Worldwide, microplastic pollution (plastic particles <5mm in size) is gaining attention from the scientific community. So much so that in 2015, the United Nations recognized microplastic pollution in waterways as one of the world's most important emerging environmental contaminants. These small plastic particles enter waterways where they pose harm to the environment. Recent studies demonstrate that once ingested, microplastics cause adverse health impacts to the organism. It has been shown that these particles adsorb potentially harmful toxins such as Persistent Organic Pollutants (POPs) and metals while leaching out additives (such as phthalates and bisphenol A). Once ingested, chemical additives in the plastic or chemicals adsorbed to their surface accumulate in the tissues of the organism, thus there is a plausible risk for bioaccumulation in the food chain. While microplastics are considered ubiquitous in the marine environment, less is known about the abundance and distribution of microplastics in freshwater systems, especially in large rivers.

This presentation will highlight the potential environmental impacts of microplastic pollution, review common sampling techniques, and share some preliminary results of a current and on-going study addressing microplastic pollution in the Snake River. Although there are many unanswered questions regarding the environmental consequences of microplastic particles, it is important to initiate and continue monitoring efforts addressing microplastic pollution in our waterways.

Fate, Transport, and Policy Implications of Residential Pharmaceutical Drugs

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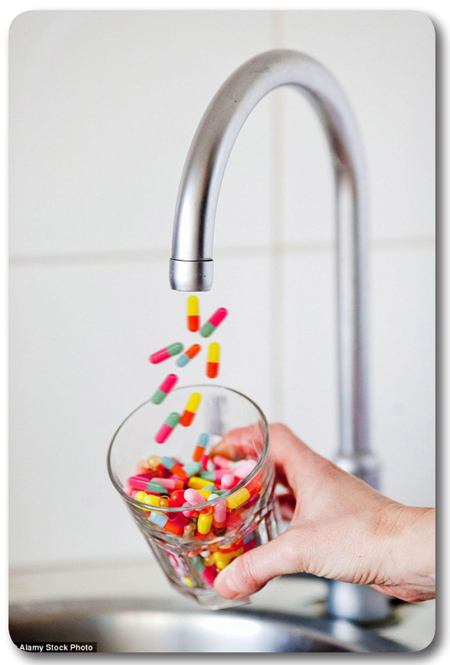
Throughout the United States the ecological and social problems associated with expired and unwanted pharmaceutical drugs and endocrine disrupting compounds (EDC) are becoming more prevalent. These include surface and groundwater contamination, effects on wildlife and aquatic species, unintentional poisoning of children and adults, and intentional drug misuse. It is estimated that three to twenty percent of residential pharmaceutical drugs are released into the environment in their active state. Whether disposed into solid waste or directly into the water supply, both routes result in water contamination.

This research reviews the fate and transport of unused residential pharmaceutical drugs; the social and environmental problems associated with their improper disposal; and the regulatory framework at play.



Water Quality Goals in Collision: CERCLA v CWA

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A primary environmental goal of remediation at the Bunker Hill CERCLA site is achievement of Idaho water quality standards (WQS) for trace metals (Pb, Cd, As, Zn) in the Coeur d'Alene River. CERCLA is the acronym for the Comprehensive Environmental Response, Compensation and Liability Act, also known as 'Superfund'. Meeting this goal is expected to result in increased bioproduction in Coeur d'Alene Lake and decreased hypolimnetic dissolved oxygen as zinc suppression of bioproductivity decreases. The result: achieving CERCLA goals and Idaho WQS in the river may release some or all of the 75 million tonnes of trace metals on the lakebed to the lake's waters, creating a violation of WQS in the lake.

The Recommended Water Quality Criterion for Selenium: What This Means for Idaho

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Among essential elements, selenium has a notably narrow range between dietary deficient and toxic levels. Waterbodies in parts of southeastern Idaho contain elevated selenium, largely associated with phosphate mining in the area. From 2001 to 2012, springtime selenium concentrations collected from the upper Blackfoot River and major tributaries ranged from 2 to 870 micrograms per liter (µg/L) within the water column (Mebane et al. 2014. Selenium in the Upper Blackfoot River Watershed, Southeastern Idaho, 2001-2012. US Geological Survey Scientific Investigations Report 2014-5203). Within the last year, the United States Environmental Protection Agency (EPA) released a recommended criterion for selenium to maintain aquatic health. In some streams in the Blackfoot River watershed, selenium concentrations exceed EPA's recommended criterion. All states, including Idaho, are currently assessing whether they will adopt this new criterion or identify an alternate criterion through rulemaking.

Water Quality Best Management Practices Monitoring on the Sawtooth National Forest

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The Clean Water Act (CWA) directs the Secretary of Agriculture "to establish and administer a program…of installing and maintaining measures incorporating best management practices to control nonpoint source pollution for improved water quality" [33 U.S.C. 1251]. The Code of Federal Regulations [40CFR130] and Forest Service policy [FSM 2532.03] further define this task, stating that Best Management Practices (BMPs) are the primary mechanism for preventing nonpoint source pollution toward attainment of State water quality standards and that monitoring BMP effectiveness is necessary to ensure that practices are properly designed, applied, maintained, and improved where necessary.

The purpose of the Forest Service National BMP Program is to provide a standard set of core BMPs and a consistent means to track and document the use and effectiveness of BMPs on National Forest System lands across the country. The National BMP Program has four components: a national core set of BMPs, a procedural guide for monitoring BMP implementation and effectiveness, a data management system, and corresponding national direction. The National Core BMP Technical Guide, published in 2012, includes an extensive list of BMPs covering the full range of forest management and ground disturbing activities that can affect water quality. Standardized monitoring protocols have been developed for ten land management activities (Aquatic Ecosystems Activities, Water Uses, Chemical Use Activities, Facilities, Fire, Minerals, Grazing, Recreation, Road, and Vegetation Management).

The Sawtooth National Forest has completed 21 monitoring sites since 2013 throughout the forest covering all ten of the protocol categories. Key questions addressed at each of these sites are:

- Are BMPs being implemented as planned?
- Are they effective meeting soil and water resource protection objectives?
- What are the causes of poor implementation or effectiveness?
- When do problems occur?
- Are corrective actions necessary?

Expectations for the Future Ability of the Riparian Forest Growing Along Idaho Regulated Rivers to Ameliorate Ambient Water Temperatures

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The Boise River is typical of those in the North American West that are regulated by dams, and their water diverted for irrigated agriculture. Ambient water temperatures in excess of those suitable for cold water biota have been documented in its lower reaches.

The braided nature of the Lower Boise River has been simplified by channel straightening and bank armoring (MacCoy and Blew 2005). As a result, the riparian forest growing along its floodplain has lesser ability to shade the understory. And its species composition, and therefore stature and height, has been changed by the reregulation of natural flows from upstream dams (Tiedemann 2015).

Engineered and biological solutions to this problem have been considered and include: (a) installation of "chillers" to cool effluents prior to their discharge to the river, (b) deepening and narrowing the river channel, and (c) fortifying the vegetated corridor and restoring the riparian forest to lessen exposure of the river to solar radiation.

The expense of real property and the costs of design, construction, and operation and maintenance are common and customary factors used to judge the practicability of project alternatives. Another factor, sometimes overlooked, is the additional public benefits that are secondary to a project purpose. Project alternatives that include restoration of the riparian forest are unique in this respect, because they offer wetland functions and services that include protection from flood flows, wildlife habitat, and open space for recreation. They also fortuitously sequester nutrients from our legacy of regional plumes of elevated nutrients in ground water.

This presentation will describe the present status of the riparian forest growing along the Lower Boise River, its potential trajectories of succession, and means and methods of intervening to maximize shading of the main channel of the river and its tributaries.

Mercury in the Hells Canyon Reservoir Complex: an Update on a Multi-Year Investigation

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The Hells Canyon Complex (HCC) is a hydroelectric project consisting of three dams located on the Snake River along the Oregon and Idaho border. Elevated concentrations of mercury and methylmercury in the water column, bottom sediments, and biota in this reach have resulted in two of the reservoirs, Brownlee and Hells Canyon, being listed as impaired for mercury by the state of Idaho. In 2014, the U. S. Geological Survey and Idaho Power Company initiated a collaborative investigation to determine key processes and factors controlling concentrations of mercury and methylmercury in the water column, sediment, and biota in the Hells Canyon reach of the Snake River.

Initial results indicate that methylmercury accumulates in the water column of the reservoirs during stratification, with concentrations peaking near the top and bottom of the hypolimnion. Methylmercury also accumulates in the top 10 cm of the reservoirs' bottom sediment as a product of decomposing organic matter; concentrations are negligible in bottom sediment deeper than 10 cm. Concentrations of methylmercury in zooplankton vary seasonally, annually, and with organism size. Fish tissue concentrations increase in a downstream direction through the complex of reservoirs and then decrease downstream of the reservoirs, indicating a possible difference between pelagic and benthic pathways for methylmercury bioaccumulation.

Contributors: Austin K Baldwin and Gregory M Clark, U.S. Geological Survey, Boise, Idaho; Jesse Naymik and Ralph Myers, Idaho Power Company, Boise, Idaho; David Krabbenhoft, U.S. Geological Survey, Middleton, Wisconsin; Collin Eagles-Smith, U.S. Geological Survey, Corvallis, Oregon; Mark Marvin Dipasquale, U.S. Geological Survey, Menlo Park, California; George Aiken, U.S. Geological Survey, Boulder, Colorado.

Agenda – Thursday, February 2, 2017. 8:30 a.m. – 12:00 p.m.
Jordan Ballroom D

Morning Refreshments: *sponsored by Clean Water Partners, LLC*

8:30 a.m. – 8:35 a.m. **Mark Shumar,** moderator
Idaho Department of Environmental Quality

8:35 a.m. – 9:00 a.m. **Austin Baldwin**
U. S. Geological Survey
Mercury in the Hells Canyon Reservoir Complex; an Update on a Multi-Year Investigation

9:00 a.m. – 9:25 a.m. **Stephanie Jenkins**
Idaho Department of Environmental Quality
The Recommended Water Quality Criterion for Selenium: What This Means for Idaho

9:25 a.m. – 9:50 a.m. **Mark Solomon**
Idaho Water Resources Research Institute
Water Quality Goals in Collision: CERCLA v CWA

Break: *sponsored by Idaho Department of Environmental Quality*

10:15 a.m. – 10:40 a.m. **Candice Hopkins** and **James R. Bartolino**
U. S. Geological Survey
Ambient Water Quality in Aquifers Used for Drinking Water Supplies, Gem County, Idaho

10:40 a.m. – 11:05 a.m. **Roy Bartholomay**
U. S. Geological Survey
Evaluating Background Concentrations of Selected Chemical and Radiochemical Constituents From the Eastern Snake River Plain Aquifer

11:05 a.m. – 11:30 a.m. **Gordon Rattray**
U. S. Geological Survey
Multi-Tracer Evidence of Water Sources and Geochemical Processes in the Eastern Snake River Plain Aquifer

11:30 a.m. – 11:55 a.m. **Kevin Brackney**
Nez Perce Tribe, Water Resources Division
Perchlorate/Fireworks Contaminated Groundwater, Richardson Sawmill/Tribal Unit 45, Orofino, Idaho

11:55 a.m. – 12:00 p.m. **Closing Remarks**

Effect of Climate Change on Water Quality Below Island Park Reservoir

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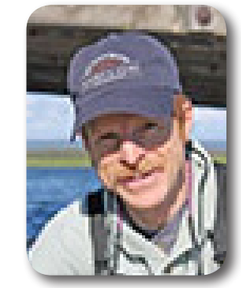

Through alteration of nutrient, sediment, and energy budgets and streamflow regimes, reservoirs greatly influence downstream water quality. Island Park Reservoir is an irrigation storage and delivery reservoir on the Henry's Fork of the Snake River that has capacity equal to one third of mean annual inflow and lies immediately upstream of the most popular reach among trout anglers. In 2016, above-average temperatures and below-average precipitation resulted in earlier springtime runoff, higher early-summer irrigation delivery, and higher early-summer reservoir water temperatures than long-term averages. Amidst these changes, anglers and fishing guides grew concerned about higher perceived turbidity below the reservoir during the historically prime fishing months.

To determine ecological impact, we first investigated factors influencing turbidity downstream of the reservoir and then investigated the relationship between turbidity and suspended sediment concentration (SSC). Using time-series modeling and three years of climatic and hydrological data, we found that after accounting for obvious seasonal effects, reservoir volume was the most significant driver of turbidity at the annual scale. Turbidity increased significantly as reservoir volume decreased. During the 2016 irrigation season alone, reservoir volume remained the most significant variable, but there was also statistical evidence for an outflow-elevation factor. Turbidity was slightly lower when at least a portion of outflow was delivered through the power plant, which has a 30-foot higher withdrawal depth than the dam's original outlet works. Additionally, turbidity is more variable below the dam than in unregulated stream reaches and is influenced by factors other than SSC, such as pigments from decay of cyanobacteria blooms in the reservoir. We predict that biochemical reactions that produce cyanobacteria blooms and other in-reservoir productivity will start earlier and last longer under warming climate conditions.

Upper Salmon River Temperature TMDL Analysis

Mark Shumar
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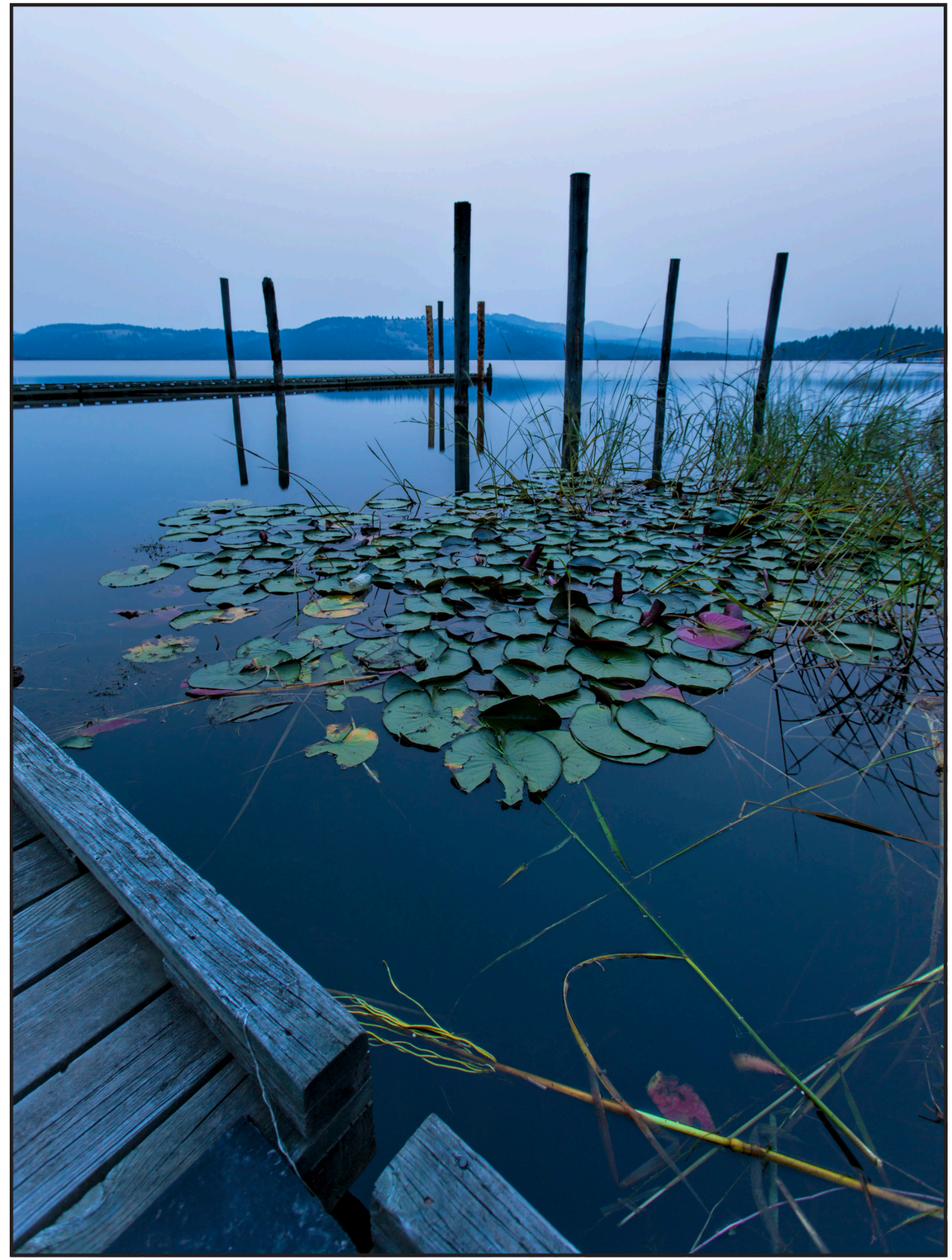
The Upper Salmon River subbasin (hydrologic unit code 17060201) is in central Idaho from the Sawtooth mountains to Challis, Idaho. Listed in Category 5 of the 2012 Integrated Report for temperature pollution were portions of the Salmon River from Redfish Lake Outlet to the confluence with the Yankee Fork and from Thompson Creek to Squaw Creek. To maintain a continuous examination, we have also included in the analysis that portion of the Salmon River from Yankee Fork to Thompson Creek and from Squaw Creek to Pahsimeroi River even though they were not listed in the Integrated Report.

Existing shade was determined from Heat Source modeling (shadealator only) that was partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance. Effective target shade levels were established for the river based on the concept that maximum shading under potential natural vegetation results in natural temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho.

The lack of shade in this region results primarily from the proximity of Highway 75 to the river and associated rock piles preventing vegetation development. The Salmon River below Squaw Creek did lack shade, especially in the cottonwood dominated valleys. However, due to the river's large width, excess load only amounted to 3% of the total solar load.



Chatcolet Lake, Idaho

Aquatic Biological Communities and Associated Habitats at Selected Sites in the Big Wood River Watershed, South-Central Idaho, 2014

Dorene MacCoy
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Blaine County's population has nearly quadrupled from about 5,700 to 22,000 people between 1970 and 2010. Residents and resource managers of the Wood River Valley of south-central Idaho are concerned about the potential effects that population growth and the expected increased demand for water might have on the quantity and quality of the valley's ground and surface waters. Increased water use has the potential to negatively impact streamflow, water quality, and the biological integrity in the Wood River and its tributaries.

In the face of current and future stresses on the water resources in the Wood River Valley, a comprehensive assessment of the current condition of the quantity, quality, and aquatic biology of the Wood River and its major tributaries was completed in September 2014 as a means for the establishment of a robust, objective baseline for a trend monitoring network. Sampling reaches were co-located with active USGS streamgages to allow evaluation of flow effects. Algae (periphyton), macroinvertebrate, and fish and associated habitats were sampled from seven representative reaches on the Big Wood River and major tributary locations and one site on Silver Creek in the Wood River basin. The baseline study objectives and a summary of data collected will be presented.

Owyhee River, Idaho-Oregon (Hawk Stone)

Agenda – Wednesday, February 1, 2017. 8:30 a.m. – 5:00 p.m.
Jordan Ballroom D

***Morning Refreshments** sponsored by Idaho Water Engineering*

8:30 a.m. – 8:35 a.m. **William Clark,** moderator
The College of Idaho

8:35 a.m. – 9:00 a.m. **Jesse Naymik**
Idaho Power Company
Long-Term Trends and Patterns in Southwest Snake River Nutrients and Chlorophyll-a Over the Past 15-22 Years

9:00 a.m. – 9:20 a.m. **Elliot Hohn**
The Freshwater Trust
Evaluating the Water Quality Benefits of Irrigation Upgrades in the Grand View Area

9:20 a.m. – 9:40 a.m. **Denine Schmitz**
U. S. Bureau of Land Management
BLM Nutrient Monitoring in the Powder Basin

9:40 a.m. – 10:00 a.m. **L. Flint Hall**
Idaho Department of Environmental Quality
Chemical and Isotopic Signatures for Nitrate Sources to Ground Water, Eastern Idaho

***Break:** sponsored by OTT Hydromet*

10:20 a.m. – 10:45 a.m. **Ralph Fisher**
U. S. Environmental Protection Agency
Tracking Migration of Nitrogen and Phosphorus Through the Soil Profile Using Post-Harvest Deep Soil Sampling (PHDSS)

10:45 a.m. – 11:05 a.m. **Daniel Wise**
U. S. Geological Survey
Estimating Phosphorus Delivery to Streams and Waterbodies in Idaho Using the USGS SPARROW Model

11:05 a.m. – 11:25 a.m. **Craig Cooper**
Idaho Department of Environmental Quality
Development of a Phosphorus Nutrient Inventory for the Coeur d'Alene Basin

11:25 a.m. – 11:45 a.m. **Jennifer Cornell**
Idaho Department of Environmental Quality
American Falls Reservoir 2001-2016: Tidbits of Wisdom Garnered From a Flood of Data

11:45 a.m. – 12:05 p.m. **Adam Van Patten**
Ada County Highway District
4,300 to 3: E. coli Source Elimination Success Story – Ada County Highway District's Dry Weather Outfall Screening Program

12:05 p.m. – 12:10 p.m. **Closing Remarks**

The Idaho Forest Practices Act – 2016 Audit Results

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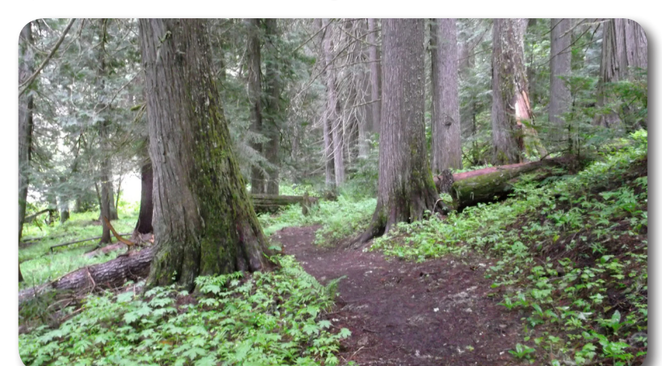
The ninth statewide Forest Practices Water Quality Audit was conducted between May and October 2016. The purpose of the audit was to assess compliance with the "Rules Pertaining to the Idaho Forest Practices Act" (IDAPA 20.02.01), under Idaho Code 38-13. The audit team included representatives from the Idaho Department of Environmental Quality (DEQ) and Idaho Department of Lands (IDL).

Overall, the audit team visited 62 timber sales, assessing 154 possible rules per site. We observed 2,717 instances where Idaho FPA rules were applicable, and of those, 2,620 instances where the rules were met or exceeded (96% compliance). In total, 56% of the sales were in perfect compliance with the rules. More than half of the total violations occurred on less than 10% of the sales. One particular sale, rated as 'unsatisfactory' by IDL, was responsible for 15% of the total violations.

The most common problem was the disposal of non-biodegradable and petrochemical waste. Burning grease tubes and oil buckets in slash piles is illegal under the Rules for the Control of Air Pollution in Idaho (IDAPA 58.01.01). The second most common problem was the failure to stabilize dirt and road materials.
The next largest source of violations was the rule forbidding the use of ground-equipment in the stream protection zone. Combined, these rules accounted for 44% of the total observed violations.



This presentation will discuss the audit findings and the ensuing policy recommendations.

Perennial/Non-Perennial Stream Identification Web Application

Kyle Blasch
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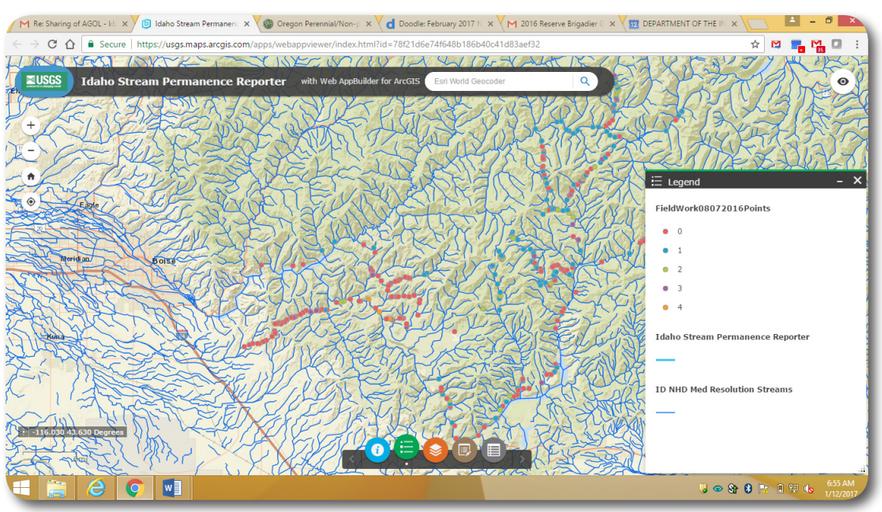
Headwater streams account for approximately 90 percent of the Idaho stream network and are integral to supporting downstream water quality, quantity, and ecosystem health. Despite the identified importance of headwater streams, accurate mapping, permanence classification, and flow rates are limited and are based on a small number of watersheds with short periods of observation. The best available national hydrography mapping tools, such as U.S. Geological Survey (USGS) topographic maps and high-resolution National Hydrography Datasets (NHD), are less than ideal (approximately 50 percent of headwater streams were misclassified) for identifying stream permanence designations and their boundaries. Many state, federal, tribal, university, and non-governmental agencies collect streamflow characteristics data each year for water quality, quantity, or biological studies. Therefore, the USGS Idaho Water Science Center has developed a communal stream identification web application that can be used by the Idaho water resources agencies to collate this information to the benefit of future water-quality studies and updates to NHD mapping. The application is simple to use, and the data will be publicly available.



12:10 p.m. – 1:30 p.m. **Keynote Luncheon:**
Jordan Ballroom A *co-sponsored by EcoAnalysts, HDR, and YSI*

Keynote Address: Michael Schwartz
National Genomics Center for Wildlife and Fish Conservation
Environmental DNA: New Technology for Monitoring Endangered and Invasive Species and Creating Biodiversity Inventories

1:40 p.m. – 1:45 p.m. **Walt Poole,** moderator
Jordan Ballroom D *Idaho Department of Fish and Game*

1:45 p.m. – 2:10 p.m. **Matthew Laramie**
U. S. Geological Survey
eDNA Monitoring of Bull Trout and Rainbow Trout Seasonal Distributions in the Bruneau-Jarbidge Rivers Wilderness

2:10 p.m. – 2:35 p.m **Dan Isaak**
U. S. Forest Service, Boise Aquatic Sciences Lab
The Aquatic eDNAtlas for the American West: All Species, All Streams Through Crowd-Sourcing and One Interagency Database

2:35 p.m. – 3:00 p.m. **Molly Wood**
U. S. Geological Survey
National Innovations in Sediment Monitoring

Break: *sponsored by Frontier Precision*

3:25 p.m. – 3:50 p.m. **Brad Alcorn**
Idaho Power Company
Use of Drones for Fall Chinook Redd Counts in the Snake River

3:50 p.m. – 4:15 p.m. **Kyle Blasch**
U. S. Geological Survey
Perennial / Non-Perennial Stream Identification Web Application

4:15 p.m. – 4:35 p.m. **Hawk Stone** and **Gary Hess**
Idaho Department of Environmental Quality and Idaho Department of Lands
The Idaho Forest Practices Act – 2016 Audit Results

4:35 p.m. – 4:55 p.m. **Dorene MacCoy**
U. S. Geological Survey
Aquatic Biological Communities and Associated Habitats at Selected Sites in the Big Wood River Watershed, South-Central Idaho, 2014

4:55 p.m. – 5:00 p.m. **Closing Remarks**

Long-Term Trends and Patterns in Southwest Snake River Nutrients and Chlorophyll-a Over the Past 15-22 Years

Jesse Naymik
Senior Biologist - Limnologist

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Idaho Power Company has monitored Snake River water quality at many locations over a long time frame that overlaps the development of multiple Total Maximum Daily Loads (TMDLs), implementation of those TMDLs, hydroelectric relicensing and various water year types (i.e., high and low water years). Trends and patterns in concentrations and loads of nutrients and chlorophyll-a at 3 sites; Celebration Park, Brownlee Reservoir inflow near Weiser, Idaho, and Hells Canyon Dam outflow were explored using Weighted Regressions on Time, Discharge and Season (WRTDS) and other methods available in a USGS developed software package for the R statistical program. The methods allow for estimates of concentrations and loads that are designed to remove the influence of year to year variations in flow allowing clearer visualization of underlying long term changes in water quality. Nonparametric Mann-Kendal statistical tests were also utilized to test for statistically significant trends over various time periods.

While there are few clear and consistent trends over the entire 22 year period, trends over shorter periods are evident. For example, phosphorus and chlorophyll-a have been declining since about 2002 at all three sites. However, the decline in both has slowed in recent years. In addition, seasonal trends can show different patterns. Nitrate concentrations show the opposite pattern than phosphorus with significant increasing concentrations and loads. Increasing nitrogen and decreasing phosphorus trends combine to show a clearly increasing trend in N:P ratios. These analyses are valuable in developing hypotheses relative to other water quality conditions such as harmful algae blooms (HABs) and dissolved oxygen conditions within Snake River reservoirs.

Use of Drones for Fall Chinook Redd Counts in the Snake River

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Fisheries Biologist

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Redd counts of Snake River fall Chinook salmon are used to aid resource managers in monitoring this ESA listed population of fish. Both shallow-water (aerial - helicopter) and deep-water (remote underwater video) survey methods are used to conduct redd searches within the main Snake River. To facilitate the safety of biologists, we developed a new method for conducting aerial redd surveys using small unmanned air systems (sUAS). The sUAS are small, lightweight, multi-rotor platforms that are able to be pre-programmed to fly specific sets of waypoints. In 2011 we tested the application of collecting video at 17 index sites within the Snake River to survey redds across the eight week spawning period. Each site was able to be surveyed once per week over an eight week period. Data from the video was used to calculate an estimate of total shallow water redds (1,922), and this compared favorably with what was reported by biologists using the traditional helicopter method (1,949). Continued development of this application led to a survey sampling method that estimates total shallow-redd counts from a sample of sites chosen proportionate to their size. This approach has been used since 2015 and has resulted in an effective method for surveying shallow-water redds in the main Snake River which is ultimately safer than traditional helicopter methods.

National Innovations in Sediment Monitoring

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National Sediment Specialist

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Elevated levels of fluvial sediment can reduce the biological productivity of aquatic systems, impair freshwater quality, decrease reservoir storage capacity, and decrease the capacity of hydraulic structures. The U.S. Environmental Protection Agency estimates that excessive sediment is one of the leading causes of water quality impairment in water bodies in the United States. Effectively tackling fluvial sediment issues often requires high-resolution sediment data and detailed information on sediment sizes and sources. Recent innovations have been made in U.S. Geological Survey sediment monitoring methods and assessments, including the use of acoustic surrogate technologies, digital image remote sensing, and sediment source fingerprinting, to assist in water resource management decisions. Some of these innovations have been successfully used to estimate sediment in Idaho rivers.

Evaluating the Water Quality Benefits of Irrigation Upgrades in the Grand View Area

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Since 2015, Idaho Power Company (IPC) has managed a stewardship program in the agricultural areas near the town of Grand View, Idaho focused on providing financial assistance to help area landowners upgrade from gravity-fed furrow irrigation to pressurized sprinkler irrigation systems. As part of the broader Snake River Stewardship Program, the irrigation upgrades aim to decrease sediment loading in the adjacent Snake River and maintain the functionality of downstream restoration projects, based on the hypothesis that sprinkler irrigation will cause significantly less soil erosion than furrow irrigation.

To support this effort, The Freshwater Trust (TFT) developed a process to estimate the potential reduction in irrigation-induced soil erosion on every agricultural field in the area. Each field can then be ranked based on the estimated environmental benefit per unit cost, allowing IPC to target program funding where it will achieve the greatest gains for the lowest cost. In addition, TFT developed a mobile application and monitoring protocol that allows IPC staff to track post-implementation outcomes across time using a smart phone or tablet.

In this presentation I will discuss the tools and datasets used to estimate and monitor the ecological benefits of irrigation upgrades in the Grand View area. I will summarize the results of these analyses in terms of overall program potential and benefits accrued to date.

BLM Nutrient Monitoring in the Powder Basin

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The Bureau of Land Management (BLM) monitored nutrients, bacteria, and field parameters at 20 locations in the Powder Basin (HUC3 170502) for long-term trending, standard compliance, and problem identification. BLM recognizes that our understanding of water quality is dependent on the quality of our assessments, our ability to detect changes, and the effectiveness with which we can make land management changes. Sites were monitored in 2003-04 and again in 2014-16, which bracketed grazing and recreation land management changes. A 10-year time step was a meaningful monitoring interval to determine effectiveness of management changes as well as to inform future actions (e.g. land use and restoration) that might affect aquatic and riparian habitat.

This effort supplemented the Oregon Department of Environmental Quality's monitoring program and supported Total Maximum Daily Load (TMDL) development for the basin, which is underway. This project produced data to support land management decisions, partnerships with private, state, and nonprofit organizations, and project experience for several budding professionals.

The Aquatic eDNAtlas for the American West: All Species, All Streams Through Crowd Sourcing and One Interagency Database

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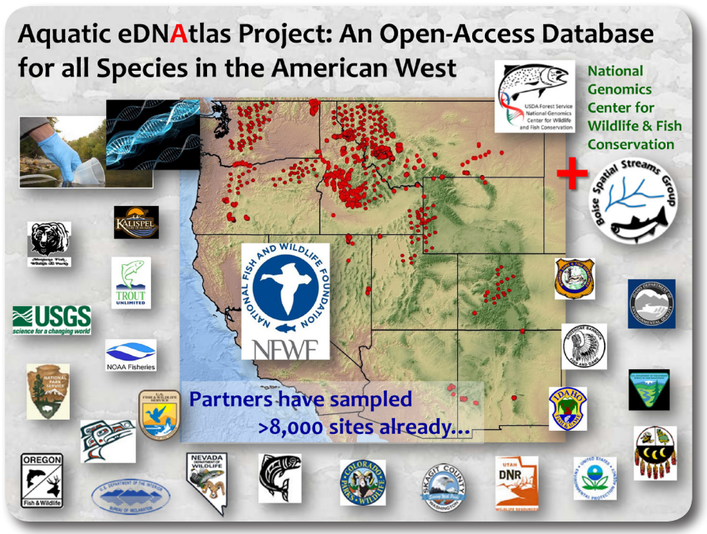
Aquatic environmental DNA (eDNA) sampling is rapidly transforming our ability to describe and monitor biological communities. Adoption of this sampling technology is occurring broadly across many natural resource organizations and now results in samples being collected at thousands of sites each year across the American West. To reduce redundancy and maximize data sharing among organizations, the Aquatic eDNAtlas project will develop an interagency database, sampling template maps, and a website to ensure standardization of data collections while providing access to samples collected in association with the National Genomics Center for Wildlife and Fisheries Conservation (http://www.fs.fed.us/research/genomics-center/).

Data will be provided in flexible digital formats that enable efficient use for many purposes including species distribution modeling, detection and tracking of nonnative species invasions, and assessments of habitat restoration efforts. The eDNAtlas project will encompass all species in the ~500,000 miles of perennial rivers and streams in 12 western states. The website and database will be launched in the latter half of 2017 and will be updated semi-annually with newly processed samples from those willing to share their data. The NGC database currently houses eDNA samples from ~8,000 stream sites, and >4,000 new sites are sampled each year so a wealth of data will become available to the aquatic community in future years.



eDNA Monitoring of Bull Trout and Rainbow Trout Seasonal Distributions in the Bruneau-Jarbidge Rivers Wilderness

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The Bruneau-Jarbidge Rivers Wilderness in Southwest Idaho provides essential habitat for native bull trout (*Salvelinus confluentus*) and redband rainbow trout (*Oncorhynchus mykiss*). The rugged landscape and steep canyons of the wilderness area preclude intensive visual or electro-fishing survey methods along the majority of the river corridor, limiting the current knowledge of fish distributions. The lower Bruneau River watershed has suitable habitat but may be seasonally limited for native trout by high water temperatures throughout much of the year. Bull trout and redband rainbow trout are considered among the outstanding resources in the wilderness area and understanding the distribution of these species is essential for their preservation.

An eDNA monitoring program was designed to document the seasonal distribution of both species throughout the watershed using environmental DNA (eDNA) detection methods. We established multiple monthly sample sites at suitable access points, as well as conducted several float sampling events bracketing the spring-runoff period to collect water samples for eDNA analysis. Preliminary data suggests that eDNA may offer some insight into season distributions of these native fishes. This project was a collaborative effort between the Bureau of Land Management, U.S. Geological Survey – Idaho Water Science Center and U.S. Geological Survey – Forest and Rangeland Ecosystem Science Center.

Chemical and Isotopic Signatures for Nitrate Sources to Ground Water, Eastern Idaho

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Nitrates are the most widespread and significant impact to ground water in Idaho. Under the Idaho Ground Water Quality Plan, Idaho DEQ partners with Idaho's Department of Water Resources and State Department of Agriculture to identify and prioritize areas of degraded ground water, and cooperatively develop strategies to improve water quality. To this end, DEQ conducts regional and local ground water monitoring designed to discern the chemical and isotopic signatures of recharge sources and anthropogenic nitrogen impacts. Results provide tools to assess the effectiveness of Best Management Practices (BMPs) and to direct ground water protection efforts.

Regional and local monitoring has provided insight to local recharge sources, potential signatures of land use practices and nitrate sources as well as possible signatures of nutrient management BMPs from analysis tools including major ion chemistry. I'll present some significant findings related to sources and possible tracers to aid in evaluating the effectiveness of current efforts to reduce nitrate impacts to ground water.

Tracking Migration of Nitrogen and Phosphorus Through the Soil Profile Using Post-Harvest Deep Soil Sampling (PHDSS)

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Numerous long term water quality studies show that nitrogen and phosphorus continue to adversely affect surface and ground waters in Idaho and nationally. It was intended that Nutrient Management Plans be written to balance nutrient application from agriculture sources with crop needs thus reducing or preventing the potential for off-site transport of those nutrients into Idaho's surface and ground waters. However, how well some of those plans have been applied over time and the resulting effects on water quality is a concern. Post-Harvest Deep Soil Sampling (PHDSS) can help producers determine how well they actually apply their nutrient management plan and when necessary provide the emphasis for improved management.

Soil samples are taken with a hydraulic probe to a depth of six feet in the fall following harvest and analyzed to determine plant available nitrogen and phosphorus. High concentrations of nitrogen and/or phosphorus can be indicators of nutrient applications that exceed crop requirements. If crops are irrigated, irrigation water management is a critical component. Nutrients found in high concentrations below the root zone are lost to the environment and not recoverable by subsequent crops. High concentrations of nutrients on the soil surface are potentially subject to runoff to nearby waterbodies.

PHDSS has been used successfully in the State of Washington in several Ground Water Management Areas and in the Yakama Nations. In Idaho, the Shoshone-Bannock Tribe has a PHDSS project which is in a designated Nitrate Priority Area and is in its 3rd year of sampling. In 2016, the Idaho Department of Environment Quality signed a contract with the Idaho Soil Conservation Commission to initiate a PHDSS in the Cassia/Minidoka and Twin Falls Nitrate Priority Areas.

Keynote Address

Environmental DNA: New Technology For Monitoring Endangered and Invasive Species and Creating Biodiversity Inventories

Michael K. Schwartz
Director

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At the broadest scale, many management and conservation issues revolve around shifts or changes in species' distributions. For endangered species there are often declines in historical distributions, whereas for invasive species the issue is the rapid spread and colonization of a species across new landscapes. Managers are often charged with halting or reversing the changing distribution of a particular species. Yet, to do so first requires accurate assessments of where species are currently located, and what factors influence this distribution. This becomes challenging when a species is hard to detect due to its rarity or life history. In the 1990s, non-invasive genetic sampling, where hair or scat was collected and identified to species via molecular genetic approaches, radically changed our ability to map uncommon species. However, it wasn't until the mid-2000s that non-invasive sampling was adapted to aquatic systems. Here filtered water is used to concentrate and detect DNA sloughed from a target organism. This approach has been called environmental DNA (eDNA) sampling.

The first generation of publications showed the efficacy of this approach for detecting both threatened and invasive species, and provided critical data used to optimize both field and laboratory protocols. The field is now entering a second phase where we are using this powerful new sampling approach for large-scale surveys to address both management and ecological questions.

In this talk I will describe several of our efforts to use eDNA to evaluate the range of endangered species at multiple scales and subsequently use these data to predict species distributions both now and under environmental change.

4,300 to 3: E. coli Source Elimination Success Story – Ada County Highway District's Dry Weather Outfall Screening Program

Adam Van Patten
Stormwater Quality Specialist

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Ada County Highway District (ACHD) holds permits by the Environmental Protection Agency to discharge stormwater from the right-of-way to surface waters. In accordance with the permits, ACHD actively seeks out dry weather illicit discharges through the Dry Weather Outfall Screening Program (DWOSP). The goal of the DWOSP is to locate potential illicit connections, trace the discharges to their source, and if necessary eliminate the source.

In the summer of 2016, ACHD pursued an elevated E.coli discharge to the Boise River from the storm drain system. The storm drain outfall in question services a complex network of pipes and structures throughout a large portion of the Boise Downtown core. With cooperation from various other public and private entities, ACHD staff was able to trace the offending discharge and eliminate the source. Follow-up sampling resulted in E.coli levels well below the water quality standard benchmark indicating that elimination efforts were successful.

Estimating Phosphorus Delivery to Streams and Waterbodies in Idaho Using the USGS SPARROW Model

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The USGS SPARROW model (Spatially Related Regressions on Watershed Attributes) was used to estimate the transport of phosphorus within watersheds throughout the Pacific Northwest (including most of Idaho). The model used data describing watershed attributes (phosphorus sources, landscape characteristics, and stream and waterbody properties) to explain the spatial variation in measured, mean annual phosphorus load. I will show how this SPARROW model can estimate the relative contribution of different sources (both natural and human) to the phosphorus load in streams and waterbodies located in Idaho and how it can predict water quality conditions in areas where no water quality data currently exists.

Development of a Phosphorus Nutrient Inventory for the Coeur d'Alene Basin

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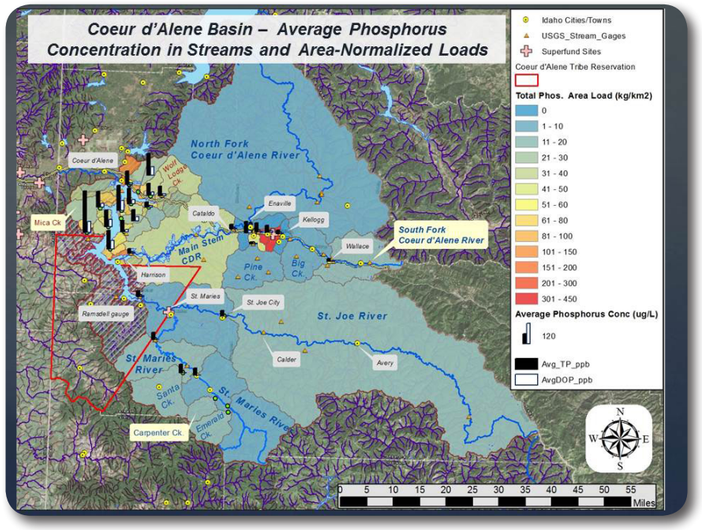
The Coeur d'Alene Lake Management Plan protects water quality in the Lake from toxic metals contamination from historic mining practices. Metals are sequestered within the sediments by maintaining high oxygen levels in the bottom waters. Oxygen levels are managed by limiting nutrient inputs from the surrounding basin, to sustain a low productivity, oligotrophic status. Trend analyses indicate that phosphorus and chlorophyll-a levels are rising in the northern Lake and that summer hypolimnetic oxygen levels may be declining in response. These findings have hastened the development of a nutrient inventory for the entire 3,741 square miles Coeur d'Alene Basin as a first step towards developing a comprehensive nutrient management plan.

The inventory must overcome data gaps and account for hydrologic variance along two major river basins and the smaller streams that flow directly into the Lake. The preliminary inventory, compiled from published studies and field data, shows that phosphorus loading can vary 5-fold between low-flow and high-flow years. For mid-flow years, ~200 tons of phosphorus enters the Lake with ~35% each from the Coeur d'Alene and St. Joe Rivers, ~25% from the sum of the smaller streams that flow into the Lake, and ~5% from other sources. The largest total loads dominantly come from large upstream watersheds that have low area-normalized loads. The highest area-normalized loads come from select reaches along the South Fork of the Coeur d'Alene River, the main stem of the Coeur d'Alene River, and some lakeshore regions.

Trend analyses suggest that phosphorus loading to the Lake has increased ~2-fold since the early 1990's and that phosphorus retention in the Lake has also increased. The relationship between total phosphorus concentration and streamflow has also changed. The next steps are to refine loading estimates from the Lake's smaller streams, finalize the inventory, and collaboratively develop and refine long-term action plans.



American Falls Reservoir 2001-2016: Tidbits of Wisdom Garnered From a Flood of Data

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TMDL monitoring has occurred on American Falls and its major tributaries, the Snake and Portneuf rivers, since approximately 2001. Data are collected to characterize nutrients, physico-chemical parameters (e.g., dissolved oxygen, pH and temperature) and associated phytoplankton community structure on an annual and seasonal basis. Here we describe trends over time using this long term data set.