

Session D2: Challenges in Defining Reference Conditions, Session 2

Room A106
8:00 – 9:30 am

0185
D2-1

The US Geological Survey Hydrologic Benchmark Network: A Testing Ground for a National Network of Reference Watersheds and Monitoring Sites

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The Hydrologic Benchmark Network (HBN) was established in 1963 to provide long-term measurements of streamflow and water quality in undeveloped watersheds and set a benchmark against which developed watersheds could be compared. The original vision for HBN was for a 100 site network of reference watersheds that included measurements of flow, water quality, groundwater elevation and temperature, precipitation and other meteorological data, stream geomorphology, and air borne pollen as an indication of watershed vegetation. In addition to those periodic and seasonal measurements the watersheds were to be characterized for soil, geology, topography and vegetation. The full vision of HBN was never realized, the network grew to a maximum of 58 watersheds where flow and water quality were measured, and although a basic characterization of each watershed was completed there was no network-wide soil or biotic sampling.

Today the HBN network is being used to characterize trends in water quality at 17 watersheds across the contiguous United States. Collaboration among three US Geological Survey programs has allowed an expansion of the network for the first time in more than 2 decades. In addition, the number of water chemistry parameters has been expanded and soil sampling has begun on a 5-year rotational schedule at each HBN watershed. The goal of HBN soil sampling is to characterize the physical and chemical characteristics of HBN watershed soils and to track changes in soil chemistry through time. The most promising development for the future of reference watershed networks has been the recent effort to form a partnership of reference networks through the National Water Quality Monitoring Council. An initial activity of that effort was a collaboration between HBN and the USGS National Water Quality Assessment Program to sample aquatic biological communities at each HBN site during 2011. As the National Network of Reference Watersheds and Monitoring Sites develops we hope to expand these collaborative efforts to other Federal and State reference monitoring activities as well as non-governmental organizations.

0479
D2-2

Evaluation of Various Classification Schemes for Establishing Reference Conditions for Wisconsin's Stream Resources

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To develop reference conditions for various physical, chemical, and biological measures of stream quality, data from 339 "least-disturbed" stream sites were analyzed. Several methods were used to select candidate reference sites: best professional judgment (BPJ) of known sites, stream segments identified using a detailed watershed land use stressor model, and a combination of modeling and BPJ. None of the three methods appeared superior. Resulting chemical or biological data for some sites suggested significant degradation but to avoid circularity in reasoning and the possibility of excluding sites that may have natural limitations in fish or invertebrate populations, all candidate sites were left in the sample population. Our original intent was to set reference condition thresholds based on a set percentile (5th or 95th depending on the parameter of interest) of the entire statewide dataset. However, high variance in the reference data distributions were observed, and for some parameters, thresholds appeared too restrictive, while others too lax when compared with other stream sites data for certain geographic areas. In order to reduce variance we tried grouping the reference condition data using three different methods: 1) *a priori* classification using Omernik Level III Ecoregions, 2) using classification and regression trees (CART) to create unique geographic areas for each stream response variable, and 3) using multivariate regression trees (MRT) to create unique geographic areas for groups of correlated stream response variables. Resulting geographic area groupings from CART and MRT analyses showed a similar response of separating the heavily agriculturalized southeast region of Wisconsin from the rest of the state. In order to create geographic areas that are independent of human disturbance, and thereby creating minimally-disturbed reference condition thresholds, we are exploring the use of spatially adjusted regression tree analyses (SPARTA). SPARTA will help account for watershed land use impacts to the reference sites, allowing the regression tree classifications to be performed on explanatory variable values that are independent of human disturbance.

0517
D2-3

Development and Evaluation of Reference Criteria for California's Perennial Streams

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Over the last decade, the State of California has begun integrating biological integrity into its water quality regulatory programs for wadeable, perennial streams. To support effective and accurate use of its biological indicators, California has begun systematically developing a large pool of reference sites that represent the diverse array of environmental settings in the state. In anticipation of developing regulatory biological objectives, California developed the reference condition management program (RCMP) to standardize the way that reference sites are chosen and monitored throughout the state. The fundamental challenge in establishing a regional reference pool in an environmentally complex region like California is to balance two potentially conflicting needs: 1) that reference sites reflect minimally disturbed biological conditions, and 2) that reference sites adequately represent the diversity of stream types throughout the region with enough sites to support robust scoring tools. The California Water Board in partnership with the California Department of Fish and Game, implemented the RCMP by screening a set of nearly 1700 candidate sites assembled from around the state against a multitude of metrics that characterize both the natural characteristics and landscape and local anthropogenic stressors associated with each site. Over 600 sites met our selection criteria. Extensive analysis of performance criteria demonstrated that the final pool of reference sites adequately represents nearly all stream types in the state, with the exception of the Central Valley and portions of coastal southern California. We will discuss our development and evaluation process and discuss applications of our reference pool to biocriteria and other water quality applications.

0565
D2-4

Estimating Reference Condition for Large-Scale Surveys-Where Are We, and How Did We Get Here?

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Successful implementation of large-scale surveys, like the US EPA's National Aquatic Resource Surveys (NARS), depend on our ability to set expectations for all assessed indicators. Most commonly, expectations are based on estimates of Reference Condition, which is in turn (almost always) based on data from reference sites. This so-called "reference site approach" is appealing because it is quantitative and repeatable, but also presents some significant challenges. Among the challenges to be discussed in this presentation are: (1) Does the reference-site approach limit us to using a Least-Disturbed Condition definition of reference? (2) What are the implications of degraded reference condition in some, but not all, regions? (3) What approaches can we use to manage variable reference site quality within a region?