

Session B2: Challenges in Defining Reference Conditions, Session 1

Room A106
1:30 – 3:00 pm

0064
B2-1

Establishing a National Network of Reference Watersheds and Monitoring Sites for Freshwater Streams in the United States

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A significant challenge faced by water resource scientists and managers is the need for reliable long-term data and information from watersheds that are minimally disturbed by human activities. Monitoring in areas with minimal human disturbance helps to provide (1) an understanding of natural patterns of variability necessary to differentiate changes from those due to land and water use from those changes associated with natural climatic cycles; and (2) reference information that can inform water management decisions such as those guiding the establishment of water-quality criteria and establishing appropriate expectations for watershed restoration. To address this need, the National Water Quality Monitoring Council is providing leadership in the development and design of a collaborative and multipurpose national network of reference watersheds and monitoring sites for freshwater streams. The network design will emphasize the chemical, physical, and biological aspects of water quality and water quantity for evaluating the influence of land use change, water use, atmospheric deposition, and climate change on freshwater ecosystems and will integrate, to the extent possible, with existing reference site networks. Membership in the network would be voluntary and open to individuals and institutions interested in participating in monitoring and (or) research in minimally disturbed and pristine watersheds. Outcomes and benefits would include: access to high-quality observations from pristine and minimally disturbed watersheds that can be used to establish background conditions for select hydrologic variables and water-quality measures; providing a benchmark for understanding environmental stressors on aquatic communities; internet access to real-time data and annual data summaries and syntheses that are responsive to current environmental issues; and increased efficiency of monitoring with improved coordination and collaboration. Increased collaboration among Federal, State, and non-governmental agencies is a key mechanism for the success and support of a national network of reference watersheds and monitoring sites that ultimately serve multiple agency needs and program goals.

0368
B2-2

Selecting Reference Sites for the US EPA's National Aquatic Resource Surveys

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One of the biggest challenges when conducting a continental-scale assessment of aquatic systems is setting appropriate expectations for the assessed sites. The challenge occurs for 2 reasons: 1) tremendous natural environmental heterogeneity exists within a continental landscape and 2) reference sites vary in quality both across and within major regions of the continent. Many of the assessment results from EPA's National Aquatic Resource Surveys (NARS) were based on a reference-site approach, in which least-disturbed sites in each region of the country were used to establish benchmarks for assessing ecological condition. Implementing a reference site approach for NARS required a process for selecting reference sites, a national classification scheme or typology of site types, and a way to adjust for varying reference site quality. In NARS, reference sites have been selected by both best professional judgment (BPJ) and a variety of field and office filtering methods. BPJ methods have been inefficient in the past. For the first stream assessment, reference-site macroinvertebrate data were used to help define 9 large ecoregions that minimized the naturally occurring assemblage variation associated with continental-wide differences in biogeography. These 9 ecoregions have been used to develop MIBI and O/E indices, report results and as classes for the probability survey design for streams, lakes and wetlands. Additional classification work that takes into account other factors besides ecoregion location is probably warranted for future reference site development. A least-disturbed definition of reference condition has been used nationally, but we suspect that the quality of the best extant sites in ecoregions, such as the Northern Plains and Temperate Plains, was lower than that of sites in other ecoregions. For the stream macroinvertebrate IBI assessment, we used a simple modeling approach to adjust scores in ecoregions where gradients in reference-site quality could be demonstrated conclusively. The NARS provide an unparalleled opportunity to push the limits of our conceptual and technical understanding of how to best apply a reference-condition approach to a real-world need. Our hope is that we have learned enough from this exercise to improve the technical quality of the next round of national assessments.

0552
B2-3

Reference Sites and Reference Condition for Biological Condition Gradient (BCG) Development in the Upper Midwest

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The US EPA and state and tribal entities in Minnesota, Michigan and Wisconsin have partnered to develop a common assessment system based on the Biological Condition Gradient (BCG) for fish and macroinvertebrate assemblages in cool and cold water streams of the region. The BCG requires empirical grounding in reference sites and a reference condition, but for BCG development, the reference sites are not assumed to be the highest or most pristine condition attainable. In addition to observations on least disturbed sites, BCG development also makes use of professional judgment to describe undisturbed conditions, and then to identify where sampled reference conditions fall on the biological condition gradient. The BCG for the states and tribes of the northern region of necessity had to make use of multiple levels of “least disturbed” among the states. We describe the calibration process and results for the region.

0336
B2-4

Historical and Current Assemblages of the Youghiogheny River Watershed: Implications for Determining Reference Conditions and Conducting Restoration

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Based on land use, habitat, and water quality conditions, the Youghiogheny River and many of its tributaries currently qualify as a high quality “reference” streams. However, the ecology of this river and many tributary streams was drastically altered in 1929 due to pervasive and severe acid coal mine drainage, leaving the river almost devoid of life for more than 40 years. Active and passive lime dosers were placed throughout the Youghiogheny watershed in the 1960s and 1970s and Maryland DNR has documented substantial water quality improvements as a result. However, a dam and waterfall have limited the potential for natural re-colonization of the river by native fishes. Reintroducing extirpated species may be possible if those species that once lived in the river can be definitively identified. But, there are few reliable records of fish species found in the Maryland portion of the Youghiogheny River and its tributaries prior to 1929. However, experts agree that many fewer species inhabit the river currently than likely did historically. There are dozens of fish species that have been mentioned by ichthyologists as potentially occurring historically in the Maryland portion of the river, but there is no agreement about what species have definitely become extirpated. We plan to use empirical models and the limited historical information that is available, along with input from regional ichthyologists, to develop a tentative list of fishes that most likely lived in the river historically. We hope to use the results to determine biological reference conditions and to plan potential ecological restoration. This effort illustrates the importance of considering legacy impacts when choosing ecological reference sites and the difficulty in reliably reconstructing historical assemblages.