

## Session E1: Applied Biological Assessments

Room A105

10:30 am – 12:00 pm

0129

E1-1

### Determining Sediment Impairment in New Mexico using Biologic and Geomorphic Sediment Thresholds

Lynette Guevara and James Hogan

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The New Mexico Environment Department (NMED) has revised its assessment protocol for determining impairment due to excessive sedimentation/siltation in perennial, wadeable streams. A sediment workgroup consisting of NMED, USEPA Region 6, USEPA ORD Corvallis, and Tetra Tech, Inc., worked collaboratively to develop sediment translators or thresholds for New Mexico's narrative sedimentation criteria. The goal of this characterization was to enable NMED to identify situations where sedimentation expectations are not met, using sediment indicators that show responsiveness to disturbance. Examining the relationships between biological measures and sediment indicators helped to identify where disturbance caused sediment imbalance (*e.g.*, excessive fine sediments given stream geomorphic characteristics) and biologically-relevant habitat degradation (*e.g.*, loss of benthic macroinvertebrate diversity). Multiple sediment indicators were analyzed for their responsiveness to site disturbance and effects on benthic macroinvertebrates using reference distributions, quantile regression, and change-point analysis. Sediment site classes were identified through a principal components analysis of environmental conditions and the bedded sediment indicators to distinguish sediment expectations across New Mexico. The results of these analyses led to quantitative sedimentation threshold recommendations by sediment site class used to revise New Mexico's sedimentation assessment protocols. The revised protocol utilizes a two level field survey and assessment per study reach. The first level considers the simpler indicator of biological impairment, and then refines the assessment with the second indicator of geomorphic impairment as needed when the first level threshold is exceeded. First, a simple substrate characterization is performed to determine the percent of bedded sediment less than 2.0 mm in diameter. If this percentage exceeds the sedimentation threshold for the associated site class, a modified geomorphic Environmental Monitoring and Assessment Program (EMAP) survey is then performed to determine the log of the relative bed stability of the reach (LRBS). The revised field methods and assessment protocol were used to develop New Mexico's draft 2012 CWA 303(d)/305(b) Integrated List and Report. The revised assessment protocol and associated streamlined field survey has increase efficiency and confidence in sedimentation assessments.

0532

E1-2

### Watershed-Wide Macroinvertebrate Monitoring in Johnson Creek

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The 52-square mile Johnson Creek Watershed is managed by five cities, two counties, multiple state and federal agencies and several nonprofits and neighborhood associations in the Portland, Oregon metro area. Since 1999, representatives from agencies within the watershed have worked together on an interjurisdictional committee focused on watershed issues (*e.g.*, collaboration on TMDL implementation and monitoring). In addition to sharing science, these organizations are investing millions to restore aquatic habitat and improve water quality in Johnson Creek and tributaries, which are impaired by both rural and urban influences. Analysis of data from a probabilistic watershed-wide macroinvertebrate survey was performed to assess the impact of different land-use conditions on the biological integrity of streams in the watershed. A variety of land use variables were assessed including percent impervious, percent canopy and road density, and determined at four spatial scales for each site: drainage, 10m-, 30m- and 100m-buffer widths. Sites were grouped according to the similarity of their macroinvertebrate assemblage using cluster analysis and Indicator Species Analysis (ISA). Indicator taxa identified in ISA, as well as a suite of biological metrics (*e.g.*, richness, functional feeding groups, sensitive/tolerant taxa, IBI), were used to identify major differences in the macroinvertebrate community composition among groups. Classification and regression tree (CART) models were developed to determine which metrics characterized groups, and how the groups differed with land-use. Land use variables at the drainage scale were consistently selected for the primary as well as competing splits in the model indicating that macroinvertebrate community composition in Johnson Creek is influenced more by land-use conditions in the upstream drainage area than in the near-stream buffer. Sites with the highest biological integrity as indicated by the macroinvertebrate community had the lowest percent impervious, highest percent canopy, and were characterized by relatively high abundances of shredders and sensitive taxa, particularly stoneflies. Our results support the findings of others indicating that degradation in urban watersheds can occur at low levels of imperviousness (< 10%). The implications for managers of urban systems

is that decreasing imperviousness and increasing vegetation throughout the watershed may be equally or more important than near-stream riparian enhancement projects.

**0571**  
**E1-3**

### **Monitoring Water Quality in Alaskan National Parks: Development of RIVPACS Empirical Models for Assessing Ecological Condition and Detecting Change in a Heterogeneous Landscape**

Trey Simmons<sup>1</sup> and Jeff Ostermiller<sup>2</sup>

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The Central Alaska Network, part of the National Park Service Inventory and Monitoring Program, is tasked with assessing status and trends in the condition of key natural resources in 3 large, remote Alaskan national parks. These parks, constituting 25% of all national parklands in the United States, comprise 22 million acres of mostly roadless wilderness spread over 100,000 mi<sup>2</sup>. Tens of thousands of miles of streams and rivers flow through this huge and highly diverse landscape. Our initial work on these mostly unstudied streams reveals that the diversity of the landscape is reflected in its lotic ecosystems, with remarkable variability in measures of chemical, physical and biological characteristics. For example, the beta diversity of benthic macroinvertebrates is very high, with 2/3 of taxa occurring at fewer than 10% of sites sampled. Accordingly, development of a robust stream monitoring program for the Network presents significant conceptual and logistical challenges. To evaluate the applicability of standard biological assessment methods to monitoring water quality in the Central Alaska Network, we used macroinvertebrate and environmental data from 66 streams in Denali National Park and Preserve and Wrangell-St. Elias National Park and Preserve to develop and test a preliminary RIVPACS model for these parks. Initial results have been promising, but reflect the challenge of predictive modeling in a highly heterogeneous landscape, with lower precision and higher bias than models of comparable size in less diverse landscapes. We will discuss the development of this model and its application as a tool for the contemporary biological assessment of water quality in streams and rivers in Alaskan national parks. We will also discuss the potential of using this approach to detect the ongoing effects of climate change in otherwise pristine streams and rivers.

**0235**  
**E1-4**

### **Interactions of Stressors in Virginia Streams**

Lawrence Willis and Jason Hill

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This research examined the combined effects of stressors on benthic invertebrate communities in Virginia streams. The streams locations were selected from Virginia DEQ's probabilistic monitoring program, ProbMon. Major stressors were identified and adjusted in a process similar to cumulative criteria units (CCUs). Because no criteria were available for many of the stressors, we used thresholds determined using a 90<sup>th</sup> quantile of stressor response curves to the Virginia Stream Condition Index (VSCI). The original list of stressors were then reduced using the Stepwise GLM procedure in SYSTAT. The primary stressors explaining variation in VSCI was reduced to dissolved oxygen, total nitrogen, sulphate, Sodium, Arsenic, Zinc, Physical Habitat Index and width to depth ratio. The overall model had an R<sup>2</sup> of 0.47, leaving 50 percent of the variability of VSCI unexplained. Possible reasons for the unexplained variability include other stressors (such as temperature and hydrology), natural variability and sample error (estimated at 10-20%). Principal components analysis of the entire stressor list clumped the stressors into two primary groups. Elements of one group were strong redox reactive parameters (DO, pH, Mn, Fe, Al, Phab Index and W:D). Inclusion of landscape parameters in the PCA grouped these redox reactive parameters with % wetlands and longitude possibly indicating a natural condition. CART analysis indicated heavy metals and Sodium were primary parameters separating streams with good biology and streams with poor biology. PCA grouped Sodium with chloride and impervious surfaces. Nutrients grouped with agricultural land use.