

2007 AES Report – Nels H. Troelstrup, Jr., P.I.

The objectives of our efforts are to (1) develop and maintain a comprehensive database of aquatic macroinvertebrates from prairie lakes and streams, (2) develop load-response relationships between water quality contaminants and invertebrate community characteristics and (3) develop demonstration and outreach programs to showcase linkages between biological integrity and water quality impairments.

A newly funded effort was initiated to develop a statewide voucher collection of aquatic macroinvertebrates and digital database. Nearly 6000 specimens have been submitted to initiate this collection and document the distribution of invertebrate species throughout the state. This collection will be documented on a SPECIFY database with digital images of voucher specimens, providing reference data against future changes resulting from natural and anthropogenic environmental changes.

Many of these invertebrate species occupy the 85,000 miles of headwater, intermittent streams in South Dakota. These streams interact closely with terrestrial management and contribute directly to downstream water quality and habitat conditions. We utilized the U.S. EPA Analytical Tools Interface for Landscape Assessment within a GIS framework to score watershed condition for intermittent stream watersheds in eastern South Dakota. Watershed scores were found to be highly correlated with on-site field validation data and principle land management practices in eastern South Dakota. Methodology developed through this effort is now being utilized by the State of South Dakota to define reference sites for stream monitoring across South Dakota.

High sediment loads result in loss of aquatic life uses which must be quantified and reduced under the Clean Water Act. Experimental sediment loads spanning the regional range (0, 250, 2500, 25000, 250000 kg/ha/yr) were administered in pulsed treatments to 10 macrophyte dominated and 10 rocky shoreline sites around the perimeter of Oak Lake, SD. Sediment treatments increased the percentage of fine substrate in treatment plots. Analyses suggest significant differences in invertebrate species composition and guild structure between these two dominant habitat types. High sediment treatments reduced generalist feeders 8% in macrophyte plots. Current efforts aim to model relationships between invertebrate community characteristics and regional loads to facilitate TMDL development and implementation efforts.

A new collaborative effort was initiated between SDSU, South Dakota School of Mines and Technology, West River Water Development District, RESPEC Consulting Firm and local landowners to investigate water quality, habitat and biological impairments to tributaries and mainstem sites of the Cheyenne River. Water quality, contaminant loads, physical habitat and invertebrate samples were collected from 43 sites within the Cheyenne basin during the 2007 growing season and will be sampled again in 2008. Results of this effort will be communicated to the water development district and private landowners to facilitate future implementation of best management practices within this watershed.

Outcomes/Impacts:

Newly initiated efforts to compile a statewide collection and database of aquatic invertebrates reveal high species and guild diversity and wide tolerance to environmental conditions. This collection will serve as both a physical and virtual repository of information for water resource managers and scientists. Knowledge of existing distributions will facilitate monitoring efforts designed to detect natural and anthropogenic environmental changes. Sediment loading is a leading non-point source of water quality impairment throughout the Northern Plains. Results of experimental efforts reveal little influence of regional sediment loads to depositional invertebrate communities but more significant shifts in community structure to erosional communities. Models describing relationships between invertebrate community characteristics and sediment loading will have direct application within the TMDL process by water resource managers. Some of the most sensitive aquatic habitats to human activity are those in headwater areas. Watershed condition scores throughout eastern South Dakota reveal regional patterns linked closely with natural landscape characteristics and predominant land management practices. ATtILA modeling has provided a means of selecting high quality reference sites in each of these regions to support future monitoring and development of region-specific management benchmarks. State water quality managers are now utilizing this ATtILA modeling approach for the selection of high quality reference sites in larger perennial streams throughout the state. The Cheyenne River basin is one of several large river systems flowing through South Dakota. Our large collaborative effort has revealed impairments to water quality, habitat and biological integrity in tributaries and mainstem sites. TMDL's produced from this effort will guide the West River Water Development District and state water quality managers toward implementation of best management practices designed to reduce contaminant loads and restore beneficial uses of water within the Cheyenne River basin.

Publications

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