<u>**MN Lake Superior Watershed Stream Science Symposium**</u>
<u>**January 7-8, 2014**</u>

Presentation Abstracts
(alphabetically by presenter*)

The Status of Migratory Fish Populations in North Shore Streams

Josh Blankenheim*, Lake Superior Anadromous Specialist
MN Dept. of Natural Resources

The fish communities in the anadromous reaches of Minnesota's North Shore streams have changed considerably since the 1800s. Brook trout were historically the only salmonid present in North Shore streams, but development, overfishing, and introductions of other salmonids have resulted in vastly different fish communities today. North Shore tributaries currently support naturalized populations of coho, Chinook, and pink salmon, steelhead, and brown trout, as well as reduced populations of native brook trout. Management of the fish community has evolved through the decades and the current goal is focused on rehabilitation of self-sustaining wild and naturalized migratory fish populations with emphasis on steelhead and brook trout. Progress has been made as is evidenced by an increase in the abundance of steelhead and a shift in the size distribution of brook trout to larger fish. However, all salmonid species face limiting factors in Minnesota's North Shore streams including erratic flow regimes, warm water temperatures, lack of suitable spawning and nursery habitat, and reduced stream connectivity. Future management of salmonids in North Shore streams must include a strong emphasis on watershed management.

Managing Stream Connectivity on the Superior National Forest

Jason T. Butcher*, USDA Forest Service, Superior National Forest

Maintaining and increasing stream connectivity is one of the most important goals in managing aquatic ecosystems. Connectivity in streams has important implications to biological communities, in-stream and floodplain physical properties, water quality, natural disturbance regimes, and overall watershed health. Aquatic organism passage is a primary component of stream connectivity in areas where streams are crossed by roads, dams, or other infrastructure. The three million acre Superior National Forest (SNF), located in northeastern Minnesota, has approximately 3,400 miles of streams that are crossed over 1,600 times by roads. The SNF uses an interdisciplinary program to assess, prioritize, implement, and evaluate restoration activities that improve stream connectivity. Restoration activities include removing crossings and roads from floodplains, dam removals, and riparian enhancement projects. Crossing improvement projects on the forest

range in scale from small culverts to bridges and occur in a variety of aquatic settings from low gradient wetland streams to high gradient rivers. We present a review of the various aspects of the program, including project design rationale, for consideration in watershed management of Lake Superior tributaries.

Using Zonation, A Value-Based Model, To Prioritize Areas For Watershed Management

Kristen Calrson*, Minnesota Department of Natural Resources
Paul J. Radomski , Minnesota Department of Natural Resources

As threats to Minnesota's watersheds continue to mount, it is becoming increasingly important to identify and conserve high-priority areas to produce multiple benefits. Two of the most common approaches for conservation prioritization are system-based models and value-based models. Unfortunately, we often do not have system models that can accurately identify where in the watershed specific good management practices should be applied or that have the ability to simulate alternative land management actions and predict consequences at specific locations in the watershed for multiple benefits. Value-based models use a compilation of individual criteria of valuable landscape features (heterogeneous content) and aggregated criteria (context and connections) with an objective function to prioritize places within the landscape for conservation. Feature-specific weights used in these models should reflect social valuation. Collaborations with multiple watershed groups throughout the state have yielded watershed-wide land prioritizations that can guide local resource protection efforts. We present example values-based model prioritizations with feature-specific weights set using an analytic hierarchy process.

Reducing Sediment Loads and Restoring Streams When Nature Controls (Most) of the Cards

Travis A. Dahl*, USACE, Matthew A. McClerren, Calvin T. Creech, & James P. Selegean

Most of us have an idea in our mind of what a healthy stream looks like. Sometimes, though, this is not the same as the way the stream looked before significant landscape impacts by humans or the way it will look hundreds of years from now if it is left alone. Many of the watersheds around the western end of Lake Superior, in particular, are still evolving at a geologically rapid pace. In this talk, I will discuss the implications of this evolution and other processes that we can't control for the restoration of streams and watersheds, with an emphasis on sediment. Examples will be taken from four watersheds: the Ontonagon River (MI), the Nemadji River (MN/WI), the Knife River (MN), and Knowlton Creek (MN).

Economic Aspects of Stream Restoration

Henry Eichman*, USDA Forest Service, TEAMS Enterprise Unit

Overview of Forest Service (FS) approach to economic analysis of stream restoration. Includes economic impact analysis (projection of employment and income using Input- Output modeling), economic efficiency analysis and other considerations, such as public perceptions of restoration value. Economic Impact analysis, performed by the forest service, employs expenditure profiles specific to restoration activities across the nation. Economic efficiency analysis explores financial efficiency and consideration of non-market values. Public perception of stream restoration and potentially affected values are prescient. While assessing the efficacy of stream restoration activity is important, the FS explores impacts and efficiency associated with forest/riparian uses affected by stream restoration activities (recreation, grazing, ecosystem services, etc.).

Diagnostic Geomorphic Methods for Understanding Future Stream Behavior of Lake Superior Streams – What Have We Learned in Two Decades?

Faith A. Fitzpatrick*, U.S. Geological Survey, Wisconsin Water Science Center

Geomorphic studies of Lake Superior streams started in about 1993 from questions posed by fisheries biologists at the Wisconsin Department of Natural Resources to the U.S. Geological Survey: Are erosion and sedimentation rates in Bayfield Peninsula streams natural or human accelerated? If human accelerated, what can be done to alleviate the problems and improve habitat? Sedimentation problems noted in river mouth areas pointed to a need to look upstream for understanding the longitudinal connections between past and present watershed hydrological processes and present and future trajectories of channel behavior. A multi-disciplinary, diagnostic, geomorphic analysis approach was used that included the following: documenting historical and pre-Euro-American settlement channel changes, mapping glacial landforms and bedrock outcrops, constructing historical and modern sediment budgets, describing valley alluviation, and simulating historical land-use effects by testing watershed hydrological models. This led to the determination that erosion and sedimentation rates in Bayfield Peninsula streams were elevated above natural rates and helped guide managers on where to locate future rehabilitation and protection activities. This diagnostic approach has been used for informed prediction of future geomorphic responses to watershed hydrological disturbances and has been used for answering a variety of management questions related to stream rehabilitation and contaminant fate and transport.
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Geologic History of Western Lake Superior Streams

Karen Gran*, Associate Professor of Geological Sciences, University of Minnesota Duluth

Streams are constantly evolving. Although much attention focuses on human manipulations of streams and watersheds, stream response to anthropogenic drivers must be understood within the context of stream response to natural drivers. In western Lake Superior, stream geomorphology is controlled by both the geologic setting and the Quaternary glacial history of the area. This talk will review the geologic history of western Lake Superior, back to the time of emplacement of bedrock during the mid-continent rift 1.1 billion years ago up to the most recent glaciation. During the last glaciation, the Superior lob flowed northeast to southwest, scouring the basin now occupied by Lake Superior. The Rainy lobe flowed from the north, scouring the uplands. During times of glacial retreat, large proglacial lakes formed in front of the ice, filling the basin with water. Following the final retreat of glacial ice, isostatic rebound has uplifted the Superior basin. Ice depths were greater in the north, leading to higher rates of isostatic rebound to the north and east, resulting in a general tilting of the basin over time. This tilt continues through today, drowning river mouths in the east and south, while uplifting those on the North Shore.

Stream Restoration: An Evolving Practice

Karen Gran*, Associate Professor of Geological Sciences, University of Minnesota Duluth

Stream restoration is a booming industry in the United States, as movement shifts from engineering-focused management of streams to rehabilitation and restoration of impaired waterways. Much of the stream restoration movement follows the concept of Natural Channel Design, which is becoming standard practice in many states. The development and spread of the Rosgen-based NCD practice has inverted the traditional science-to-practice pathway and been opposed by many stream experts in academia, leading to a conflict in the stream restoration community dubbed the "Rosgen Wars". This talk will discuss the conflict and its development through time as well as the role of science in stream restoration. Woven throughout will be issues of predictability and uncertainty in fluvial systems, and the role of sediment transport and complex channel change in restoration practice.

Climate Change Vulnerability of Forest Ecosystems in Northern Minnesota

Stephen Handler*, Forest Service Northern Research Station and Northern Institute of Applied Climate Science.

Abstract: Forests in northern Minnesota will be impacted directly and indirectly by a changing climate over the next 100 years. NIACS has recently coordinated a climate change vulnerability assessment for forest ecosystems in northern Minnesota in order to describe these potential changes for forest managers and planners. Information on current forest conditions, observed climate trends, projected climate changes, and impacts to forest ecosystems was considered in combination with manager expertise in order to draw conclusions on climate change vulnerability. Wet forests, Forested Rich Peatlands, and Acid Peatlands were determined to be the most vulnerable Native Plant Communities, whereas Floodplain Forests, Fire-Dependent Forests, and Mesic Hardwood Forests were determined to be less vulnerable to projected changes in climate. Many partners assisted with this report, including federal, state, private, and tribal land managers; conservation organizations; and academic institutions. Stephen will share the results of this assessment on behalf of the author team, focusing in particular on possible implications for the Lake Superior watershed.

Cross River Channel Survey: Present Day Effects of Historical Logging Structures

Brad Hansen*, University of Minnesota
Karen Gran University of Duluth
John Nieber University of Minnesota

During the historical logging period between 1895 and 1905 the Cross River was used to transport logs to Lake Superior. It was one of the few successful attempts to drive logs down a North Shore stream. Because the river did not produce enough flow to easily drive logs, the Schroeder Lumber Company built a series of dams and other logging related structures designed to move logs down river to Lake Superior. Today six dams and a number of other logging related structures still exist in some form. The two main questions this research project addressed were:

1. Did the historical use of driving logs to Lake Superior cause any long lasting changes to the river channel?
2. What impact do the existing structures have on the river channel?

The three main components of the project were: LIDAR analysis of geomorphology, watershed modeling and a walking survey of the channel. The conclusions of the research were:

- The Cross River channel was not altered significantly by driving logs to Lake Superior
- Present day dams have a minor local influence on floodplain continuity.

Stream Temperatures: Are Our Trout Comfortably Cold?

Deserae Hendrickson*, Duluth Area Fisheries Supervisor, MN DNR

Temperatures in trout streams tributary to Lake Superior can be extremely variable, on a number of scales. This presentation looks at stream temperatures from the trout's perspective, in several watershed areas in the Duluth Management Area including the Nemadji watershed, Duluth urban streams and North Shore streams up to the Split Rock River. Factors influencing stream temperatures and their suitability to sustain trout will also be highlighted.

Assessing Cumulative Watershed Stressors: Using LIDAR to Assess the Amount of Open Lands and Young Forest Associated with In-Channel Erosion for North Shore Tributaries

Tom Hollenhorst*, U.S. Environmental Protection Agency, Office of Research and Development, Mid Continent Ecology Division, Duluth, MN
John Jereczek, MN DNR Lake Superior Habitat Coordinator, Division of Ecological and Water Resources, Two Harbors, MN

Hydrologist with the US Forest Service have demonstrated the cumulative impacts of land use change, particularly additional open lands and young forest (< 15 yrs) on bank full flows and in-channel erosion. Mapping these impacts has been difficult due to challenges associated with mapping forest age and the lack of detailed terrain data. Fortunately with available LIDAR data we now have the tools to map forest stand height as a proxy for age, proportion of mature canopy cover and high resolution terrain data to explicitly map these impacts. We used LIDAR return data, classed into low, medium and high forest canopy, to asses the percent canopy cover or mature forest, and inversely open lands (including developed lands and agricultural lands) and young forest lands effects on MN streams flowing to the north shore of Lake Superior. We used a LIDAR derived DEM to populate an ESRI ArcHydro data model. This was then used to create continuous accumulation grids of percent open lands, contributing area and slope. With simple rule sets, these grids were then used to identify stream locations likely to have increased peak flows that might then increase the likely hood of prolonged in-channel stream erosion and sedimentation.

GIS Landscape and Watershed Stressors

George Host*, NRRI

Lake Superior, headwaters to the largest freshwater system in the world, faces increasing risk from human activities along the coastline and from contributing watersheds. Human-induced stressors affecting Lake Superior are many, including impacts to water quality from point and non-point sources, changes in hydrologic and thermal regimes, and shifts in patterns of land use. Geospatial analysis can be used to quantify the spatial distribution of human stressors within watersheds at multiple spatial scales. When coupled with field assessments, this provides a means to identify relationships between watershed-scale factors and in-stream habitat and water quality variables. The resulting models can be used to identify 'hot spots' of environmental risk, as well as reference conditions to identify restoration endpoints. Results from studies of the Lake Superior's North Shore, the St. Louis River watershed, and the local watersheds feeding into the St. Louis River Estuary show predictable relationships with key water quality variables, including sediments, nitrogen, and chloride. However, the spatial scale of these relationships varies with flow regime, which alters the relative importance of local vs whole-watershed characterizations.

Historic Overview of Logging in the Cross River Watershed: 1895-1925

Lee Johnson*, Forest Archaeologist USDA Forest Service, Duluth MN

The industrial level harvesting of pine timber from the North Shore of Lake Superior began in the last quarter of the 19th century. Prior to the 1890's, small-scale harvesting of pine for local consumption centered around the newly organized cities of Duluth, Beaver Bay, and Port Arthur in Ontario. The Schroeder Lumber Company consolidated ownership of valuable stands of white and red pine in the upper Cross River watershed near Schroeder in the 1890's and commenced logging operation in 1902. In order to transport raw logs from the woods to the market, the Schroeder Lumber Company harnessed the power of the Cross River through construction of various splash dams, flumes, and water control mechanisms. The Cross River represents one of the few watersheds on Minnesota's North shore were industrial level log drives occurred during the historic logging period (ca. 1880-1925) . Schroeder Lumber Company's operations on the Cross River provide a context for the mechanics of log driving and watershed manipulation on Minnesota's North shore in the early 20th century.

Effects of Climate Change on Distribution of Cold Water Fish in North Shore Streams

Lucinda Johnson1*, William Herb2, Meijun Cai1
1 University of Minnesota Duluth, Natural Resources Research Institute
2 University of Minnesota, St Anthony Falls Laboratory

Water temperature is generally considered one of the primary physical habitat parameter determining the suitability of stream habitat for fish species, with effects on the mortality, metabolism, growth, behavior, and reproduction of individuals. In this study we assessed the potential threats of climate change on stream

temperatures and flow regimes in Lake Superior tributary streams in Minnesota. The study included deterministic models for stream flow and temperature of three study streams (Amity Creek, Baptism River, Knife River), and regional (empirical) models for specific flow and temperature parameters to give better spatial coverage of the region. Information on stream flow, stream temperature, and land cover was used to develop a brook trout presence/absence model to understand the current pattern of distribution of brook trout and predict future distributions under future climate.

Role of Non-Profits

John Lenczewski*, Minnesota Trout Unlimited
Kris Larson*, Minnesota Land Trust

Restoring and protecting trout streams requires a special combination of scientific information, professional expertise, willing landowners, political will and sufficient funding. Due to their unique ability to put these ingredients together, non profit organizations can play an important role in delivering on state and local goals for watershed protection in the Lake Superior basin. This presentation will explore a few of the strategies used by non-profits such as Minnesota Trout Unlimited and the Minnesota Land Trust to ensure the health of the Lake Superior streams and how scientific data can be helpful in determining priorities and delivering on real-world project implementation.

An Isotopic Approach to North Shore Lake Superior Watershed Management

Joe Magner* and Lu Zhang
Dept of Bioproducts & Biosystems Engineering
University of Minnesota
Lee Engel
Minnesota Pollution Control Agency

The stable isotopes of hydrogen and oxygen offer watershed managers a tool to better understand hydrologic storage and pathway movement. Isotope data was collected over several years from varying tributaries along the North Shore Lake Superior, selected arrowhead lakes and specifically in the Cross River watershed in 2012. Results offer hydrologic insight related to sources of runoff and hydraulic residence time. Data collected from tributaries discharging to Lake Superior suggest a general south to north pattern of isotopic signatures that are dynamic and change with season. Headwater lakes provide the most important storage of precipitation and sustain baseflow in most tributaries, including the Cross River. Subsurface storage is relatively small due to limited aquifer extent. Lake hydraulic residence time is directly influenced by location in the watershed, contributing drainage area and lake volume. The mega-storm of June 2012 illustrated a relatively small amount of storage in the Cross River. The new precipitation overwhelmed the watershed pre-event isotopic signature and shifted all measured sites toward the storm isotopic signature. These data point to the need for comprehensive intentional watershed management of North Shore Lake Superior streams and lakes.

Large Woody Habitat

Eric Merten*, Wartburg College

Abstract: Wood is critical to the ecology of lotic systems, and influences every ecological process that occurs there. Wood appears to be relatively sparse in north shore streams; possible reasons include reduced recruitment due to forest harvest, decreased retention due to relatively small piece size and flashy hydrology (both exacerbated by forest management), increased rates of breakage and decay, or intentional removal and chucking by humans. Wildfires may lead to reduced wood recruitment as well. I will discuss results from studies addressing several of these processes, with some implications for biota.

Effects of Climate Change on Watersheds of Grand Portage Indian Reservation, a Case Study in Climate Change Adaptation Planning

Seth Moore*, PhD, Director of Biology and Environment Grand Portage Band of Chippewa

The Grand Portage Indian Reservation is located in extreme north eastern Minnesota along the border of Ontario and on the shore of Lake Superior. Grand Portage Natural Resources Management Department has been researching the effects of climate change on waterbodies and watersheds on the reservation. Climate change effects on water temperatures and fisheries have been observed. Some observed effects of climate change include loss of coldwater obligate species like brook trout in inland lakes. The Grand Portage Band of Chippewa have developed a Climate Change Adaptation Plan to address projected impacts to the reservation lands and waters. Implementation of the plan has begun and results of some adaptation strategies will be discussed.

Effects of Forest Harvesting on Flows in the Cross River; a Look with the HMS Model

John L. Nieber*, Professor, Department of Bioproducts and Biosystems Engineering, University of Minnesota
Nick Grewe, LimnoTech Inc.

The harvesting of timber in the watersheds along the north shore of Lake Superior probably increase the magnitude of runoff generated for north shore streams. As a

case in point, an analysis of the generation of runoff for the Cross River and the potential effect of timber harvesting in that watershed in the early part of the last century was undertaken. This hydrologic analysis was conducted in concert with a geomorphic assessment of the Cross River channel to determine the possible effects of historical timber harvesting and log-drives down the river on the character of the river channel. For the hydrologic analysis the HEC-HMS model was applied to the Cross River watershed with a historical large rainfall event that occurred July 21, 1909. The rainfall event consisted of 5.2 inches of rain in 24 hours, a greater than 100-year storm for the area. During the time period of logging in the Cross River watershed approximately 39% of the area had been logged. Taking these conditions into account in the assignment of curve number parameters to the subwatersheds, the peak runoff generated from this storm event is predicted by the model to be increased 57% over the peak flow generated from either pre-timber or current (recovered) conditions.

A Review of Landscape and Riparian Disturbances to Stream Ecosystems

Gerald J. Niemi*, Department of Biology and Natural Resources Research Institute, University of Minnesota

Flowing water ecosystems in forested regions are greatly affected by their associated watersheds and riparian zones and these effects are cumulative as the water flows across the landscape. Riparian zones are important to stream water quality and quantity by reductions in erosion of stream banks, by restricting the flow of water across the land surface, serve as habitat for wildlife, plants, and other biota, and provide recreational opportunities for society. Forested riparian areas are affected by many disturbances from both natural (forest fire, wind, insects, and natural flooding) and human-induced sources (logging, residential or industrial development, and human-induced flooding). In the mid-1990's Minnesota developed voluntary guidelines for logging in riparian areas as a result of the Minnesota Forest Resources Act. These guidelines, recent research, and the continued development of best management practices in landscapes and riparian zones will be reviewed.

Hidden Watersheds: Understanding Seasonal Pools in a Landscape Context

Brian Palik*, Research Ecologist, USDA Forest Service, Grand Rapids MN

Small seasonal pools and ponds are abundant in many forest landscapes of the Great Lakes region, yet they remain poorly understood in terms of physical and biotic variation, the contributions they make to biodiversity and hydrologic function of watersheds, and their response to disturbance of the surrounding upland forest. The potential for interaction of ponds with the upland is large because of their small size, which increase the importance of functional connections with the surrounding forest, and their often seasonal hydroperiod, which renders them particularly susceptible to degradation during dry phases. My colleagues and I have studied seasonal ponds and pools in northern Minnesota for many years within the context of several interrelated descriptive and experimental studies. Our objectives have been to describe the hydrologic and biotic characteristics of seasonal ponds in a landscape context, to relate variation in these characteristics to multi-scale factors, and to examine the impact of forest disturbance within pond watersheds on hydrology and related biotic communities. Our applied goal of this work is to foster better conservation and sustainable management of these important wetland ecosystems.

Climate Trends and Climate Change in Our Own Backyard: A Review

Mark Seeley*, Professor of Meteorology and Climatology
University of Minnesota, Dept of Soil, Water, and Climate

In recent decades there has been increasing recognition by scientists that the climate is showing several distinct trends or changes quantity and in character. In our own Great Lakes Region there are measurable changes going on. Among these are: (1) warmer temperatures (with seasonal and diurnal disparity); (2) higher frequency of tropical-like dew points, especially in the summer months; (3) and an overall increase in variability of precipitation and other hydrologic features, as well as a change in the character of extremes. These climate trends are clearly linked to visible consequences in the landscape. In addition climate models, validated against three independent sets of climate measurements, suggest our climate will continue to change in the directions shown by these recent trends. There are both quantity and character changes in climate that are important for us to understand if we are to adapt effectively.

Role of Beaver in Riverine Management

Marty Rye*, Forest Hydrologist, Superior National Forest

Beaver are a natural and important component of the riverine environment. They provide an important energy source that alters the physical, biological, and chemical characteristics of a riverine corridor. Their activity is considered an important natural disturbance dynamic. Beaver population numbers, density, and presence vary greatly over time and space. Their activity can interfere with human service demands of a riverine system, especially when riverine systems are managed for service optimization. A truly sustainable or restored system must include beaver. Management of beaver has always occurred and will need to continue. It will need to come in the form of population control, mitigation of undesirable effects, modification of service expectations and accommodation of natural disturbance dynamics.

Prioritizing Lake Superior Watersheds Using Forest Disturbance and Landscape Metrics

Titus S. Seilheimer*, Wisconsin Sea Grant
Patrick L. Zimmerman, University of Minnesota
Kirk M. Stueve, Natural Resources Research Institute
Charles H. Perry, USDA Forest Service

The watershed of Lake Superior is a major source of phosphorus and sediment entering the nearshore environment, therefore, watershed characteristics can be used to prioritize watersheds for the protection of nearshore water quality. We used novel landscape information describing the forest cover change, along with forest census data and land cover data (e.g. agriculture and urban) to predict springtime total phosphorus and turbidity in Lake Superior streams. Models were developed to rank watersheds based on landscape conditions relative to the amount of phosphorus or turbidity produced. Phosphorus was modeled as a function of proportions of persisting forest, forest disturbed during 2000-2009, and agricultural land, and turbidity was modeled as a function of proportions of persisting forest, forest disturbed during 2000-2009, agricultural land, and urban land. We used the models to estimate water quality in watersheds without observed instream data and prioritized those areas for management. These relationships were used to identify areas for restoration in watersheds and catchments of Minnesota's Lake Superior basin. Prioritizing watersheds will aid effective management of the Great Lakes watershed and result in efficient use of restoration funds, which will lead to improved nearshore water quality.
Research funded by the Great Lakes Restoration Initiative.

Forest Restoration and Management in Changing Climate: Implications for Lake Superior Watersheds

Mark A. White* and Meredith Cornett, The Nature Conservancy in Minnesota, and North and South Dakota
Matthew Duveneck and Robert Scheller, Portland State University, Portland OR.

European settlement led to a more homogeneous forest across northern Minnesota where dominance shifted from long-lived conifers to early successional hardwood species. The range of natural variation (RNV) based on pre-settlement forest condition is commonly used as the basis for restoration objectives. Restoring species and structural diversity can maintain biodiversity and key forest functions including water quality and quantity. Objectives based on past climates and disturbance regimes may not be viable in a rapidly changing climate. We examined the interaction of climate change and forest management using a spatially dynamic forest model, LANDIS II. RNV based restoration may be effective under low greenhouse gas emission scenarios. High emissions scenarios indicated increased

forest homogenization, a steep decrease in boreal species biomass, and significant loss of forest cover. We examined climate adaptive management including: adaptive silviculture, planting climate tolerant tree species, and expanded forest reserves. Adaptive silviculture and climate tolerant planting may help maintain diversity and biomass under low and high emissions. Expanded forest reserves could maintain current composition under low emissions. Climate induced forest change will have significant impacts on North shore watersheds. A long term monitoring program to detect changes and inform adaptive management will be needed.

Symposium Planning Committee: Minnesota Department of Natural Resources, University of Minnesota Sea Grant, UMD Natural Resources Research Institute, Minnesota Pollution Control Agency, US Forest Service, US Environmental Protection Agency, Lake Superior Coldwater Coalition, Minnesota Trout Unlimited, and Laurentian Resource Conservation and Development Council

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