St. Croix Watershed Research Station
Highlights of 2014 - 2015

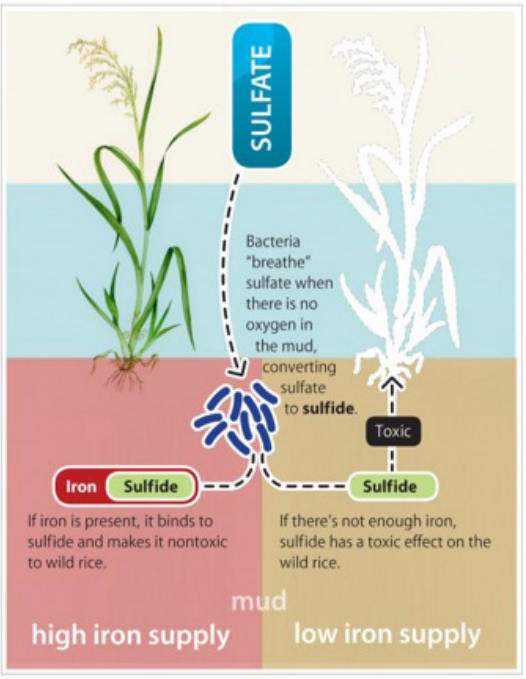
Science Museum of Minnesota

Bridging the St. Croix

Construction of bridge piers 9-12, August 2014 Photo courtesy MnDOT

Two Research Station scientists are studying potential impacts of the new St. Croix River bridge at Stillwater. A mitigation fund, established by the States of Minnesota and Wisconsin, provided $400,000 to the St. Croix Basin Team to investigate potential environmental consequences of bridge construction including accelerated growth and development along the corridor. Eight different projects will focus on soil and water modeling and monitoring and the development and implementation of phosphorus reduction strategies. As part of this effort staff scientist Sue Magdalene is assessing the current water quality conditions or "state" of Lake St. Croix. Sue and colleagues at the US Geological Survey are working to update records for inflows and outflows of Lake St. Croix; analyze current nutrient trends and assess progress toward the 20% phosphorus reduction goal for the River. Jim Almendinger, Research Station hydrologist, is expanding his watershed modeling work on the St. Croix, using the Soil and Water Assessment Tool (SWAT) to look at possible reductions in phosphorus through agricultural best-management practices. This computerized watershed model simulates the transport of eroded soil and nutrients from the land into the waterways. Jim will model possible scenarios and results from the use of practices such as no-till agriculture, vegetated filter strips, grassed waterways, reduction of soil-test phosphorus, and planting of fall cover crops. These projects, combined with the other mitigation efforts, will help ensure that the long-term health of the St. Croix River is not adversely affected by the new bridge crossing.

Wild Rice Redux



The Relationship of sulfate, sulfide and iron in surface water and sediment; courtesy MPCA

Back in the mid-1900s Dr. John Moyle, biologist with the Minnesota Department of Conservation (now DNR) made an incisive observation in his study of the distribution of aquatic plants in the state's lakes and rivers: "No large stands of [wild] rice occur in water having sulfate content greater than 10 ppm [parts per million], and rice generally is absent from water with more than 50 ppm". In 1973 Minnesota adopted the 10 ppm sulfate level as a formal standard to protect the state's waters "… used for production of wild rice… ", the only such water-quality standard in the country. Fast forward another 40 years to the recent completion of a comprehensive 3-year study to re-examine the validity of the state's sulfate standard. The standard had been challenged by the state's mining industry, a major emitter of sulfate. The study's results, which scientists at the St. Croix Research Station helped produce, both reaffirm Moyle's original observations and explain just how sulfate negatively affects wild rice – through the production of toxic hydrogen sulfide in the sediments where wild rice roots. The research also revealed the complexity of the chemical and biological interactions where other factors such as groundwater discharge and high dissolved iron may limit the toxic effects of sulfide in some waters. The Minnesota Pollution Control Agency is currently reviewing the study's conclusions and will issue a recommendation for retaining or revising the 10 ppm sulfate standard sometime in 2015.

A Journey Begins

Why – after spending billions of dollars to conserve soil, create habitat, and improve agricultural practices – do Minnesota rivers still run brown with silt, and lakes still turn green with algae? Are conservation "best management practices" measurably improving the water quality of our rivers and lakes? To answer this question, we need long-term data records – such as those hidden away in lake sediments.

This summer the Research Station began a new project informally titled "Sedimental Journey", using lake-sediment cores to document the impact of land use on water quality at the watershed scale and over long periods of time. Funding for the project was secured from the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative and Citizen Commission on Minnesota Resources. From lake-sediment cores, environmental histories will be constructed for five to ten lake watersheds. Soil erosion, fertilizer wash-off, and lake-algae growth determined from the cores will be linked to land use by computerized watershed simulations. The Center for Harmful Algal Research in Minnesota – the CHARM lab – will be established to identify noxious blue-green algae in the cores and lake water. How different are the lakes from their pristine conditions, and have conservation efforts made improvements? To find out, we have taken the first steps on our "Sedimental Journey."

Cedar Lake shows how excess nutrients can drive harmful blooms of blue-green algae

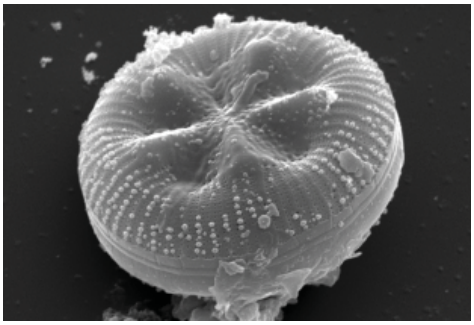
Working Locally...

Mark Edlund and Jeremy Williamson of Polk County (WI) Land & Water Resources retrieve a sediment core from Big Blake Lake

Several lake associations and watershed districts in Minnesota and Wisconsin are finding answers to questions about their area's environmental history through new studies by the Research Station. Mark Edlund is coordinating several projects to take sediment cores from area lakes and analyze them for signals of environmental stress. These results provide lake and watershed managers with recommendations for protection and improvement of their valuable aquatic resources. This summer two lake associations in Polk County, Wisconsin initiated projects on Big Blake and Bone lakes. The Riley Purgatory Bluff Creek Watershed District in the southwest metro area has begun a similar investigation on Rice Marsh Lake, and work which began in 2012 for the Spring Lake-Prior Lake Watershed District is continuing. All of these projects rely on the scientific strengths and unique resources of the Research Station – analyzing sediment cores for geochemical and biological signals of environmental change, including radioisotopic dating, nutrients, and remains of diatom algae that tell the story of how each lake has changed over the past several hundred years.

...and Internationally

In September, station scientist Mark Edlund traveled to Nanjing, China, to attend the 23rd International Diatom Symposium, a gathering of over 150 scientists from 18 countries who presented and discussed their research on diatoms (a diverse and ecologically critical group of microscopic algae). Edlund was invited to give a plenary presentation, "What the diatoms have taught us about large lakes," in which he synthesized past and ongoing studies at the Research Station on the Laurentian Great Lakes, Lake of the Woods, Lake Baikal, and Mongolia's large lakes. Mark was further recognized at the meeting as the new President-elect of the International Society for Diatom Research. The ISDR is home to over 350 diatom specialists from 66 countries.



A new diatom species discovered in Mongolia

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