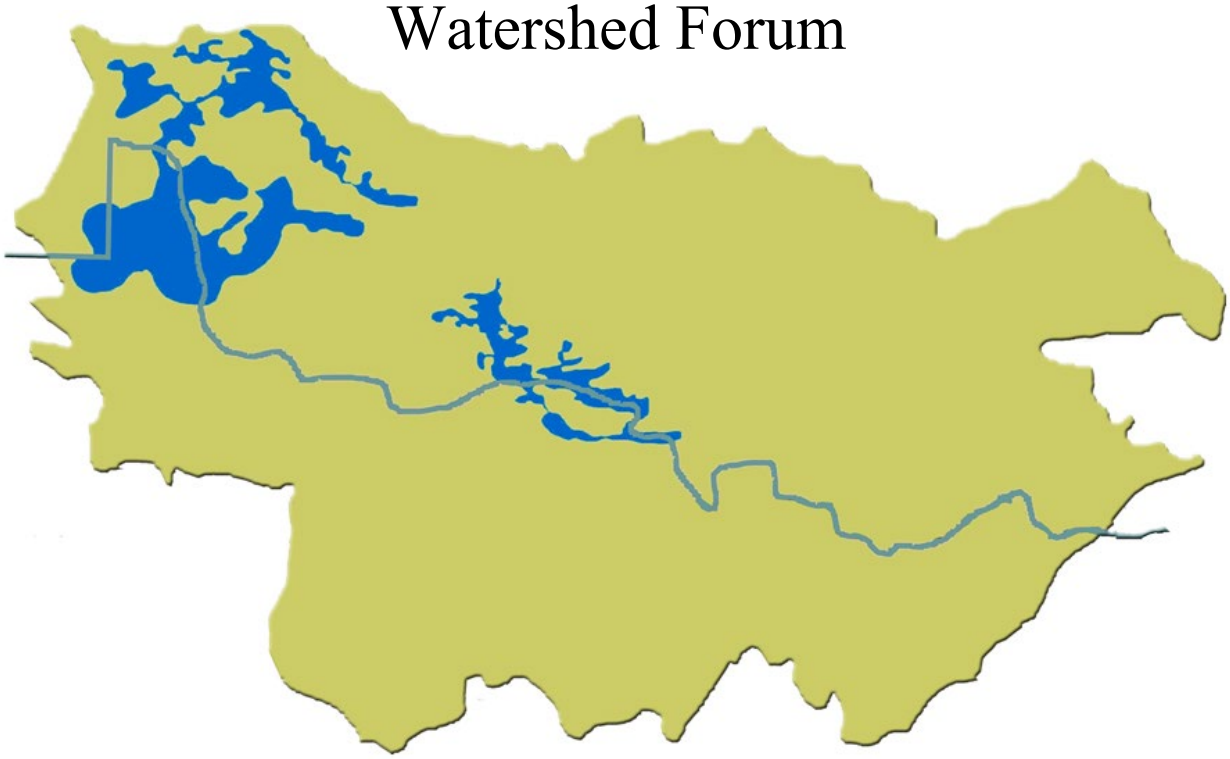
RAINY-LAKE OF THE WOODS WATERSHED 2023 FORUM

Proceedings of the 20th Annual International Rainy-Lake of the Woods Watershed Forum



March 8 - 9, 2023

Minnesota North College, Rainy River Campus

501 U. S. Hwy 71, International Falls, MN

Forum Partners – Sponsors

The organizing committee thanks our 2023 sponsors for assisting with the 20th annual International Rainy-Lake of the Woods Watershed Forum. This event would not be possible without them:

- Lake of the Woods Water Sustainability Foundation
- Grand Council Treaty #3
- St. Cloud State University
- Jefferson National Parks Association in cooperation with Voyageurs National Park
- International Joint Commission
- Consulate General of Canada - Minneapolis, Global Affairs Canada
- Minnesota Pollution Control Agency
- Lake of the Woods District Stewardship Association
- Rainy River Community College
- Minnesota North College - Rainy River campus
- Dorset Environment Sciences Centre
- Rainy Lake Conservancy
- Rainy Lake Property Owners Association

The information contained in this Proceedings report was compiled by the Lake of the Woods Water Sustainability Foundation from summaries of presentations and from presentation abstracts as supplied by the presenting authors.

We are grateful to the International Joint Commission for financial support to prepare this report.

The content herein does not necessarily reflect the official views of the International Joint Commission or other Forum partners / sponsors

Todd Sellers,
Executive Director
Lake of the Woods Water Sustainability Foundation

Table of Contents

Executive Summary

Crowd at the Forum attends to a presentation by Dr. Catherine Eimers of Trent University, on lessons learned from multi-year studies of nutrients in the Canadian tributaries flowing into the Rainy River and Lake of the Woods

A spirit of joyful reunion marked the 2023 International Rainy-Lake of the Woods Watershed Forum as we celebrated the event's 20th anniversary and welcomed the return to an in-person symposium after two years of online delivery. Once again, Minnesota North College – Rainy River, in International Falls, Minnesota was the venue for researchers, resource managers, policy makers and members of the public for the two-day symposium March 8-9.

Elder Priscilla Simard of Coochiching First Nation and the Women's Council of Grand Council Treaty #3 helped open the Forum with a prayer and ceremony honouring *Nibi* (water) and the work to be done together to respect and protect it. Binational greetings followed from US Consul Bryan Koontz and Canadian Consul Colin McLeod. Ontario MPP Dave Smith (Peterborough-Kawartha), Parliamentary Assistant to Minister of Indigenous Affairs and Minister of Northern Development, Greg Rickford (Kenora), provided remarks to open day two of the Forum.

Elder Pricilla Simard helped open the Forum in a good way with a prayer and ceremony honouring Nibi (water)

This year's 132 participants reflected a broad range of interests and involvement in the watershed, representing 61 organizations, including local governments, soil and water conservation districts, provincial and state governments, federal governments, U.S. Tribes, Canadian First Nations and Métis peoples, the International Joint Commission, industry, non-governmental organizations, universities, undergraduate and graduate students, and citizens interested in the future health of our watershed. A list of organizations attending the Forum is included as Appendix A.

For the past 20 years, the Forum has continued to be the only professional symposium for scientists and resource managers working on research and management activities related to the multinational Rainy-Lake of the Woods watershed. With a long-standing ecosystem focus, the Forum is a venue for presentations from all disciplines relevant to water quality and aquatic ecology in the watershed. In recent years, researchers, policy makers and citizens who live and work in the basin have increasingly sought to bridge scientific inquiry with public policy development and community engagement. This year, the Forum

included a session on planning and governance, hosting several talks by social scientists working to support robust governance, decision-making and citizen engagement in ensuring watershed health.

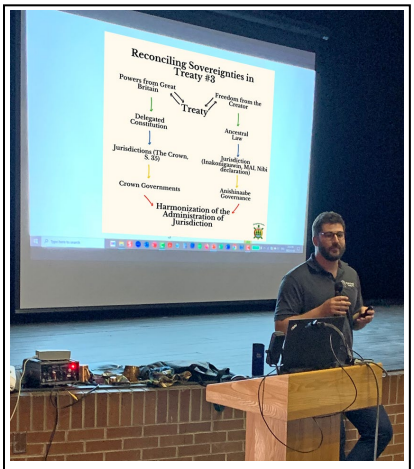
This year's Forum had a total of 24 presentations, plus an evening reception and banquet featuring guest speaker David Malaher. Many of the presentations this year focused on knowledge and tools that will inform management actions. Featured was a moderated panel discussion on "getting to shared water quality objectives". Five other themed sessions covered a wide range of disciplines including updates on water quality management and monitoring; multinational watershed management and governance studies; nutrients, cyanobacteria and toxins; emergent technologies for remote sensing and monitoring; and watershed ecology and biodiversity. In addition to this proceedings report, recordings of the Forum presentations are available online for replay at: https://lowwsf.com/forum-presentations-2023.

It was clear from this Forum that much has been achieved scientifically that positions us to move from pure research to management solutions. It was also clear from presenters and participants' questions that there continues to be the spirit and desire for all jurisdictions to move forward together.

Session 1: Getting to Objectives (Fireside Chat)

Moderator Mike Kennedy set the context for this special presentation and discussion session, noting that persistent algal blooms in Lake of the Woods have been a long-standing concern for the public, water mangers and governments. Minnesota designated the US part of the lake impaired for not meeting the state's eutrophication standards and it has developed a TMDL plan to reduce loads. Environment and Climate Change Canada has completed intensive study as well and points towards similar load reductions. For many years there has been calls for, and much work undertaken, towards an international approach to address nutrients and to have shared, common objectives. With this body of work behind us, now is a good time to look at examples from other basins and how they achieved new or updated shared nutrient objectives, to provide lessons learned and guidance for getting to shared objectives for Rainy River and Lake of the Woods. This context set the stage for this year's opening discussion at the 2023 Forum: how do we go about setting a shared international water quality objective for phosphorus for Rainy – Lake of the Woods, and what will it take for us to achieve it?

Questions and discussion followed presentations by Nicole Armstrong, Director of Water Science and Watershed Management for Manitoba Environment Climate Change and Parks, and Lucas King, Director of the Territorial Planning Unit of Grand Council Treaty #3. Nicole reviewed lessons learned from case studies of how new international nutrient objectives were achieved for the Red River and inter-provincial objectives were updated for the Canadian prairie provinces. Nicole noted that setting science-based water quality objectives is a complex diplomatic process that happens best when parties agree to follow a few crucial guiding principles, have a clear process documented from the outset, focus on consensus, and pragmatically remember that "perfect is the enemy of being done".



Lucas King presents an approach to reconciling sovereignties and governance systems to work together for shared objectives.

Lucas King provided insights and discussion with the audience on how Indigenous perspectives on shared water governance will contribute to protecting our waters in Treaty 3 territory. Lucas pointed out that we are really starting to do good work to harmonize and work in the space between two systems — the western legal framework and Indigenous governance processes — with the Forum itself serving as an excellent example of an event that brings us together to build relationships and learn with and from each other, using both systems' governance protocols to host the event.

Governance within the Rainy – Lake of the Woods Basin is complex, with federal, state, provincial, municipal, and Indigenous governments holding jurisdiction over different aspects of water management. Ensuring all these governance partners work cooperatively in contributing to shared water quality goals requires building trust and reinforcing understanding of and respect for one another's different approaches, protocols, and values.

Session 2: Watershed Updates: Research to Action

This session examined progress to date toward existing phosphorus reduction and water quality remediation efforts in the Rainy River – Lake of the Woods system.

The first presentation walked us through local watershed planning across eight Minnesota watershed subbasins within the Rainy – Lake of the Woods system. Next, we heard an update on the status and forthcoming plans for Environment and Climate Change Canada's science program for Rainy-Lake of the Woods and hope for forthcoming progress on setting targets for Lake of the Woods. Michael Goffin, co-chair of the International Rainy Lake of the Woods Watershed Board shared an overview of the regional IJC board's current work in the basin, followed by a presentation by Bev Clark that recommended an approach to tackling the next phase of work in support of the IJC recommending a shared phosphorus water quality objective and supporting core monitoring program.

Finally, the session was rounded out with an interactive demonstration of the powerful data visualization tools available through the Treaty 3 Geoportal.

Session 3: Planning and Governance

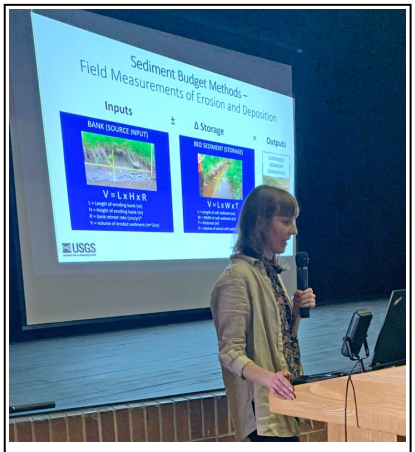
Becca Reiss, North St. Louis SWCD described moving from data to decisions in the Rainy Headwaters – Vermilion Watershed

The second day of the Forum kicked off with four talks that explored various aspects of how we govern ourselves and develop management plans across the watershed. We heard about contrasts and alignment between settler and Indigenous visions for watershed governance, watershed planning and implementation of protection and restoration strategies as part of Minnesota's One Watershed One Plan process, and approaches to climate adaptation planning to build basin-wide resilience. This latter presentation provided an overview of climate change impacts specific to the Rainy-Lake of the Woods region, and the IJC and its Rainy-Lake of the Woods Watershed Board's approach to developing and implementing climate change adaptation measures using the IJC Climate Change Guidance Framework.

This session concluded with a guided tour of the new Treaty 3 Nibi Portal, a web-based encyclopedic resource dedicated to understanding Nibi (water) from perspectives of the Anishinaabe nation in Treaty 3.

Session 4: Nutrients

A series of four presentations explored sediment dynamics in various parts of the watershed, from stream sedimentation in the Little Fork River, to proposed investigations of phosphorus-bound sediments and internal nutrient loading in the Rainy River. We learned about a wide array of stream studies looking at nutrient dynamics on the Canadian side of the Rainy River and Lake of the Woods tributaries, and we heard about cutting-edge student research that is exploring the role that algal nitrogen-fixation may play in contributing to cyanotoxin production during toxic algae bloom events.



Anna Baker, USGS, presents sediment budget research to identify main sources of sediment-bound phosphorus from the Little Fork River

Session 5: Emerging Issues & Technologies

This year, we got an excellent glimpse at some of the latest and most sophisticated tools that researchers are using to better understand our watershed. We explored tools for remotely monitoring water quality at high frequency, and for measuring water chemistry. Researchers shared satellite and terrestrial tools used for visualizing climate data and algae productivity, and we heard about efforts to map waters that are vulnerable to mining impacts throughout the watershed.

Session 6: Ecology and Biodiversity

The final session of this year's Forum took us on a journey through some of the ecological research focused on the region's waters. We learned about extensive community-led environmental and water monitoring happening throughout Treaty 3. We also heard from student researchers studying the relationship between spiny water flea infestations and walleye's propensity to bioaccumulate mercury, as well as different prospective management techniques to control invasive hybrid cattails through fire and flooding.

Ben Wood, MSc. candidate, Lakehead University, research on the impacts of spiny waterflea on mercury accumulations in walleye

Foundation Reception & Kallemeyn Award

This year, the Foundation's reception, held the evening of March 8, took place at Thunderbird Lodge on Rainy Lake. In the casual and friendly atmosphere of this historic lodge overlooking Rainy Lake, Forum participants had an opportunity to mingle, discuss the day's presentations, and in many cases, reconnect with long-time project partners, inter-agency colleagues and friends after two years of interruption to in-person international gatherings.

Guest speaker David Malaher provided an historian's perspective of the 100-year process of establishing the international boundary through our watershed and a cautionary note to not let getting an agreement on water quality take so long!

The evening wrapped up with the presentation of the **Kallemeyn Award** for the first time since 2020. This year's recipient was Mike Hirst, a resource conservationist with the Lake of the Woods Soil and Water Conservation District, in recognition of his outstanding professional achievements and contribution to research, resource management, and support of collaborative approaches in the Rainy-Lake of the Woods basin.

2023 Kallemeyn Award recipient Mike Hirst (left) with Todd Sellers, Lake of the Woods Water Sustainability Foundation (right)

Mike works tirelessly behind the scenes in just about every aspect of planning for the future of the Rainy-Lake of the Woods Basin, remaining a humble, thoughtful and calm voice of reason that guides and keeps our collective path moving forward collaboratively. Mike's contributions to our watershed are many, including:

- Serving as a member of the IJC watershed board and co-chair of its aquatic ecosystem health committee
- Coordinating invasive species efforts with the international collective of agencies known as the IMA
- Editorial contributions to the Rainy-Lake of the Woods State of the Basin Reports
- Participating in Minnesota's Lake of the Woods phosphorus studies and plan to cut phosphorus.

In 2012, Mike led a coalition of stakeholder groups to launch the **Keep it Clean Campaign** for Lake of the Woods, recently highlighted in an engaging video by Minnesota outdoors media celebrity Ron Schara (see https://keepitcleanmn.org/). This initiative combats the growing problem of garbage and human waste left on the ice from ice fishers using the large "residential" communities of ice fishing houses off the south shore of the lake. In the ensuing years, the Keep it Clean Campaign has spread across the State. Fittingly, on the day that Mike received the Kallemeyn Award, a bill to make it State Law was introduced in the Minnesota Legislature.

The Kallemeyn award is named in honor of Larry Kallemeyn, USGS (retired). Larry was the consummate professional and his collaborative and cooperative approach contributed significantly to cross border collaboration, public engagement and scientific understanding for this international lake and its watershed. The selection committee consists of researchers and resource managers from Canada and the United States. Congratulations and thanks to Mike for all his work for our watershed!

Meetings of Other Groups at the Forum

The Forum has become the "hub" for all groups working to ensure the future ecological integrity of the waters of the Rainy-Lake of the Woods Basin. Appendix B presents meetings on the margins of the Forum program, including:

- The **International Multi-Agency Arrangement (IMA)** held its annual joint meeting of its Technical Advisory Committee (TAC) and its managerial Work Group. Attended by 31 participants, this was an opportunity to review progress toward delivering on the IMA's multi-year work plan and set priorities for the coming year. The IMA's major focus in 2023 will be engaging with the IJC's International Rainy Lake of the Woods Watershed Board in ongoing efforts to recommend international phosphorus objectives and alert levels and identify elements necessary for a core monitoring program to support progress assessment and adaptive management.
- The **IMA Core Monitoring subcommittee** held a meeting during which nine technical experts contributed comments and ideas supporting the IMA's engagement on the work to complete a technical scoping exercise for a long-term, sustainable core monitoring program in support of prospective water quality objective(s) and alert levels for Rainy – Lake of the Woods. The IMA's three subcommittees (Core Monitoring, Water Quality and Aquatic Invasive Species) typically meet several times per year to implement the IMA and IMA-TAC's priorities and work plan.
- The **Industry Advisory Group (IAG)** of the International Rainy-Lake of the Woods Watershed Board held its annual face-to-face meeting, with updates from IJC advisors on the status of IJC Commissioners and IJC activities, an introduction and overview to the 2023 International Watershed Coordination program through the Lake of the Woods Water Sustainability Foundation and IJC, and update on the activities of the Board's Adaptive Management Committee. IAG member Chris Bazinet of H2O Power delivered a presentation on the history and workings of the regional hydroelectric generating stations maintained and operated on the Canadian side of the watershed by H2O Power.
- The **Community Advisory Group (CAG)** of the International Rainy-Lake of the Woods Watershed Board held an informal in-person meeting with its members who were present at the Forum. The CAG meets several times annually, typically by video conference, so this was a valuable opportunity to review committee priorities and in a face-to-face setting.
- The **International Rainy-Lake of the Woods Watershed Board met with its CAG and IAG**, providing an opportunity for advisory group members to receive updates on board activities, including water levels, aquatic ecosystem health and public engagement activities and to voice any issues, concerns or topics of interest to the Board.
- The **International Rainy-Lake of the Woods Watershed Board** held its spring meeting at the Forum, providing a face-to-face opportunity to discuss board matters, receive updates from its committees, plan for forthcoming projects, and make preparations for its spring appearance before the IJC Commissioners in Washington, D.C. in late April, as well as its annual Basin Week meetings that happen each August.
- The **Water Levels Committee** of the International Rainy-Lake of the Woods Watershed Board met with regional hydroelectric dam operators and also hosted a public information session in the theater at Minnesota North College the evening prior to the Forum. Attended by a few dozen residents and water levels experts, this was an opportunity for the WLC to share with the public information from the draft 2022 Post Flood Report. The WLC reviewed the conditions that led to the high-water event in 2022, a summary of WLC actions, and provided answers to questions raised by the public, including analysis on what would have happened if the High Flood Risk Rule Curve had been employed starting March 10, 2022.
- The **Engagement Committee** of the International Rainy-Lake of the Woods Watershed Board met in person to develop plans and priorities for communications and public engagement activities in support of the Board's workplan for 2023.

Final Thoughts

The 20th International Rainy-Lake of the Woods Watershed Forum was a tremendous success, with a welcome return to pre-pandemic attendance levels, and with tremendous “value-add” of meeting in person, which was obvious to all.

The strong participation in the symposium sessions and side-meetings of groups underscores the value of this event supporting the collaborations that exists among research and resource management professionals, policy makers and the public in the Rainy-Lake of the Woods watershed. The Forum continues to be an important meeting place, catalyst and incubator for research, resource management and international collaboration in our watershed.

The 20th year of the Forum is somewhat of a milestone and a point for reflection on both the past and the future. At the 10th Forum a decade ago, eutrophication, aquatic invasive species and impacts of the multiple stressors of climate change and climatic extremes were identified as our major concerns for the future. Subsequent experience has proven that right and although we’ve learned much, these are still major concerns in our basin. Also, ten years ago, one participant commented that when science begins to converge on policy, we’re on the right track. We’ve seen substantial progress in this respect since that time, with the establishment of an IJC watershed board, and completion of significant research in both the United States and Canada to inform plans, such as the Minnesota Lake of the Woods TMDL, to move from research to action, which was evident at the Forum this year.

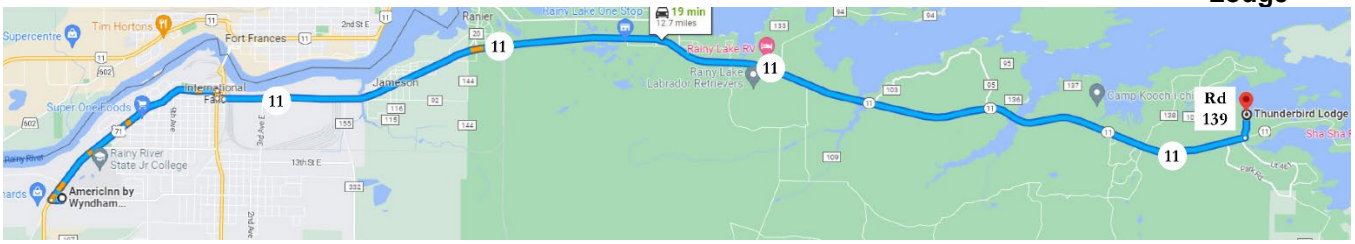
Finally, many thanks are due to the strong collective of sponsors that make this Forum happen each year – it could not happen without their financial and in-kind support. As with every year, special thanks are due to the Organizing Committee who have helped organize and run the Forum year after year.

Program At A Glance

DAY 1 – MARCH 8

Start	Mins	Symposium Sessions March 8
11:45	1:15	**Lunch**
1:00	0:40	**Traditional Protocols** Elder Priscilla Simard, Coochiching First Nation and Women's Council of Grand Council Treaty #3 **Greetings** U.S. Consul Bryan Koontz; Canadian Consul Colin McLeod
		Session 1 - Getting to Objectives (Fireside Chat Session)
1:40	0:10	Panelist Introductions and Instructions Moderator Mike Kennedy
1:50	0:20	New water quality objectives for the International Red River: A case study Nicole Armstrong, Manitoba Environment, Climate and Parks
2:10	0:20	Grand Council Treaty #3 perspectives on getting to objectives Lucas King, Territorial Planning Unit, Grand Council Treaty #3
2:30	0:30	Moderated Panel Discussion All participants
3:00	0:30	**Break**
		Session 2 - Watershed Updates: Research to Action (Moderator Todd Sellers)
3:30	0:10	Moving to action and understanding on the US Side: Implementation and further research in the Rainy Basin. Mike Kennedy, Amy Mustonen, Lindsey Krumrie, MPCA Duluth
3:40	0:20	Environment and Climate Change Canada Lake of the Woods Nutrients update Daniel Rokitnicki-Wojcik, ECCC
4:00	0:20	International Rainy-Lake of the Woods Watershed Board update Michael Goffin (ECCC), Col. Eric R. Swenson (US Army Corps)
4:20	0:10	IJC Objectives and Alerts project Bev Clark, Consultant
4:30	0:20	GCT3 Geoportal Raeshawn Parsons, TPU GCT3
4:50		**DAY 1 END** **<u>6 pm</u> Dinner Reception at Thunderbird Lodge on Rainy Lake** • **Guest Speaker, David Malaher**: "*An historian's comparison of the Lake of the Woods Water Sustainability Foundation work in 2023 with problems in surveying the Canada-US boundary on Lake of the Woods and Rainy River in 1823*" • **Kallemeyn Award presentation**

AmericInn &College → 12 miles / 20 minutes → **Thunderbird Lodge**



DAY 2 – MARCH 9

Start	Mins	Symposium Sessions March 9
8:00	0:30	**Coffee available in cafeteria**
8:30	0:10	Day 2 Welcome and Introductions
		Session 3 - Planning and Governance (Moderator Lucas King)
8:40	0:20	Centering Treaty in governing the Rainy-Lake of the Woods watershed Johann Strube, Carleton University
9:00	0:20	International Rainy-Lake of the Woods Watershed Board Adaptive Management Committee's climate change adaptation activities Teika Newton, IRLWWB Adaptive Management Committee
9:20	0:20	Moving from data to decisions: How the Rainy Headwaters-Vermilion Watershed planning effort is utilizing extensive monitoring & research data to prioritize, target, & measure for implementation Becca Reiss, North St. Louis Soil and Water Conservation District
9:40	0:20	Nibi portal and curriculum Grand Council Treaty #3 Women's Council
10:00	0:30	**Break**
		Session 4 – Nutrients (Moderator Brian Kotak)
10:30	0:20	A stream corridor sediment budget for the Little Fork River Anna Baker, USGS
10:50	0:20	Planned study of Rainy River sediment-bound phosphorus as a potential driver of Lake of the Woods algal blooms Anna Baker, USGS
11:10	0:20	Lessons learned from a multi-year nutrient research program in the Canadian tributaries Catherine Eimers, Trent University
11:30	0:20	Nitrogen fixation may offset nitrogen demands in Lake of the Woods cHABs, and molecular techniques reveal species responsible for toxin production Kaela E. Natwora, University of Minnesota Duluth
11:50	1:20	**Lunch in the cafeteria**
		Session 5 - Emerging Issues & Technologies (Moderator Andrew Paterson)
13:10	0:20	Using satellite-derived water quality data from an automated high-performance computing environment to identify lakes prone to cyanobacteria blooms in the Rainy-Lake of the Woods watershed Leif Olmanson, Remote Sensing & Geospatial Analysis Lab, University of Minnesota
13:30	0:20	Adaptive monitoring on the lower Winnipeg River, Manitoba Madeline Stanley, International Institute for Sustainable Development
13:50	0:20	Assessing vulnerability of waters to mining in the Rainy–Lake of the Woods watershed Victoria G. Christensen, USGS Upper Midwest Water Science Center
14:10	0:20	Using a novel photoelectrochemical oxygen demand (peCOD) analyser to augment monitoring of greenhouse gas impacts on the dissolved carbon in boreal lakes Blake Cooney, IISD Experimental Lakes Area and U. Manitoba
14:30	0:20	Hydrologic mapping tool for Rainy Lake, Namakan Reservoir, and Rainy River to support adaptive management of lake levels & USGS Web Informatics & Mapping Team web application capabilities Julia Prokopec, USGS Upper Midwest Water Science Center
14:50	0:30	**Break**
		Session 6 - Ecology and Biodiversity (Moderator Ryan Maki)
15:20	0:20	Impacts of invasive spiny water flea (Bythotrephes cederstroemi) on mercury accumulation in Northern Ontario walleye James B. Wood, Lakehead U. Community Ecology and Energetics Lab
15:40	0:20	Community-based monitoring and Grand Council Treaty #3 led monitoring Michaela Novak, Chris Herc, Grand Council Treaty #3
16:00	0:20	Whose track is that? Interpreting animal sign in Voyageurs National Park to determine semi-aquatic mammal presence Catherine Berrick, Voyageurs National Park
16:20	0:20	The effect of prescribed fire and flooding on hybrid cattail at Voyageurs National Park Erika Meints, Northern Michigan University and Voyageurs National Park
16:40	0:05	**Closing Remarks – Todd Sellers, LOWWSF**

Organizing Committee

Todd Sellers
Executive Director
Lake of the Woods Water Sustainability Foundation
P.O. Box 112
Kenora, ON P9N 3X1
Toll free 866-370-8891
tsellers@lowwsf.com

Andrew Paterson
Research Scientist
Ontario Ministry of Environment, Conservation and Parks
1026 Bellwood Acres Rd., PO Box 39
Dorset, ON POA 1EO
705-766-2951
andrew.paterson@ontario.ca

Jesse Anderson
Minnesota Pollution Control Agency
525 Lake Avenue South Suite 400
Duluth, MN 55802
218-529-6218
jesse.anderson@state.mn.us

Mike Kennedy
Minnesota Pollution Control Agency
525 Lake Avenue South Suite 400
Duluth, MN 55802
mike.kennedy@state.mn.us

Kelly Sjerven
Biology Instructor
Minnesota North College – Rainy River
1501 Hwy 71, International Falls, MN
218-285-2218
kelly.sjerven@minnesotanorth.edu

Lucas King
Territorial Planning Unit,
Grand Council Treaty 3
807-548-4214 ext.203
water@treaty3.ca

Kayla Bowe
Water Resources Program
15761 High School Drive
P.O. Box 279
Red Lake, MN 56671
218-679-1607
kayla.bowe@redlakenation.org

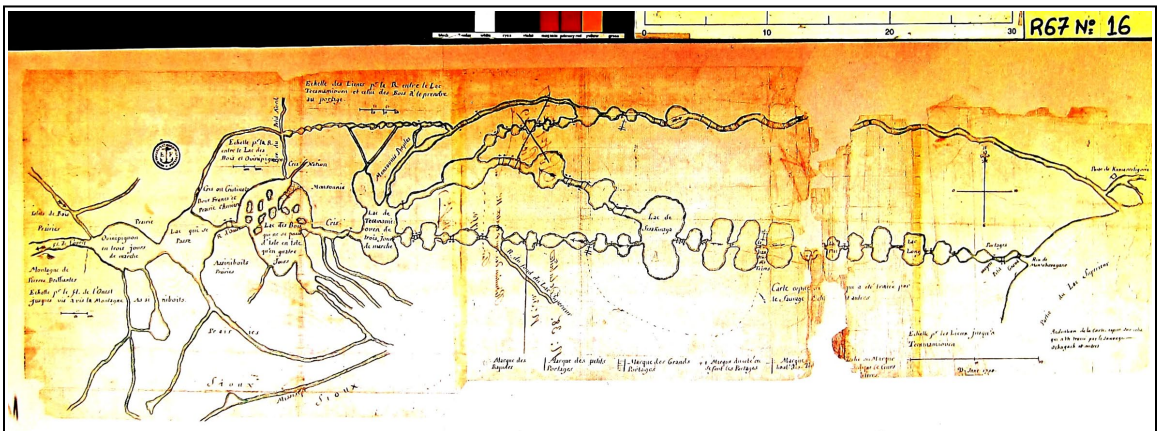
Ryan Maki
Aquatic Ecologist
Voyageurs National Park
360 Highway 11 East, International Falls, MN 56649
763-783-3112
ryan_maki@nps.gov

Diana Fred
Environmental Scientist
Environment and Climate Change Canada
150 Main Street, Winnipeg, MB R3C 4W2
204-983-1944
diana.fred@ec.gc.ca

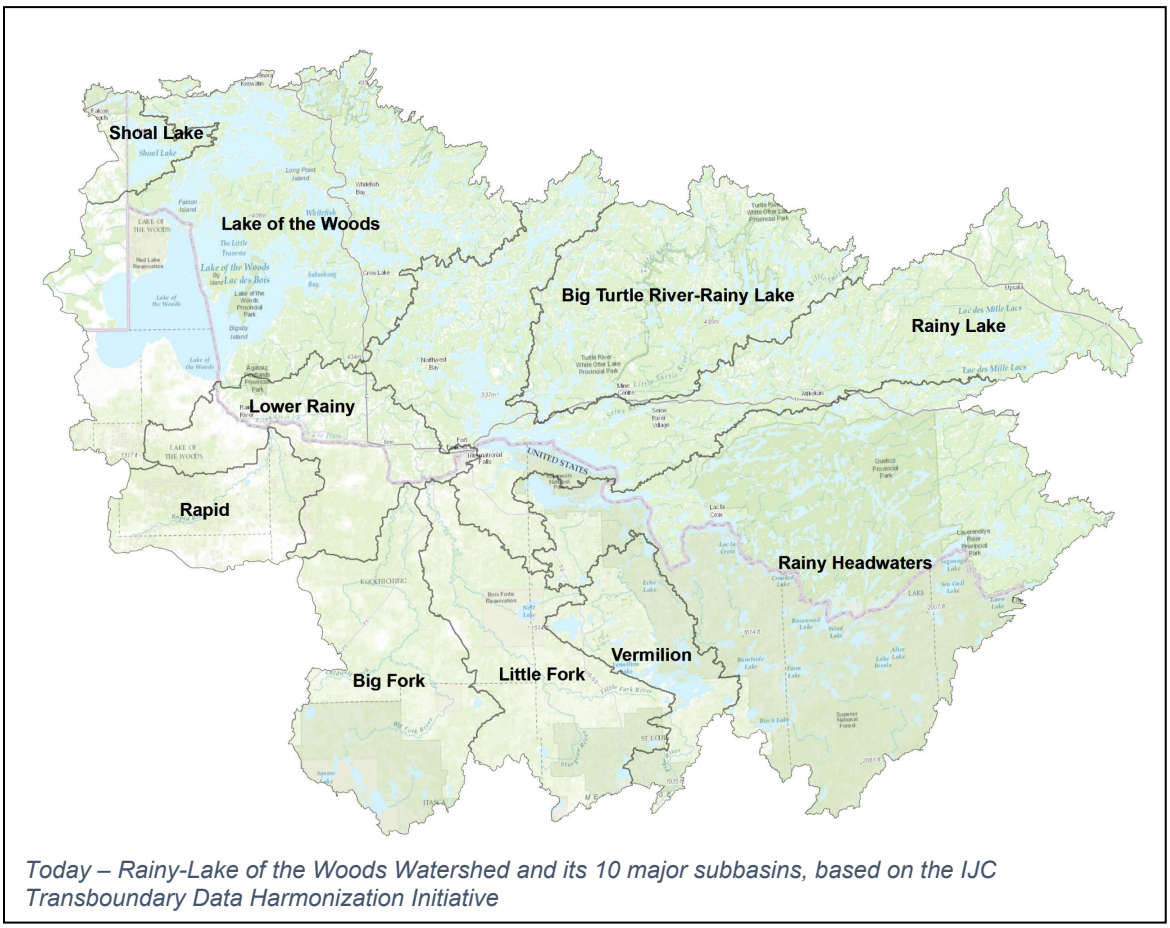
Matthew Julius
St. Cloud State University
Department of Biological Sciences
WSB-225, 720 Fourth Avenue South
St. Cloud, MN 56301-4498
320-308-6684
mljulius@stcloudstate.edu

Teika Newton
International Watershed Coordinator
Lake of the Woods Water Sustainability Foundation
P.O. Box 112
Kenora, ON P9N 3X1
teikanewton@lowwsf.com

The Rainy-Lake of the Woods Watershed – Our View Though the Ages



1729 – Auchagah's map for LaVerendrye (per David Malaher, from Archives of France)



Today – Rainy-Lake of the Woods Watershed and its 10 major subbasins, based on the IJC Transboundary Data Harmonization Initiative

Day 1 – March 8, 2023

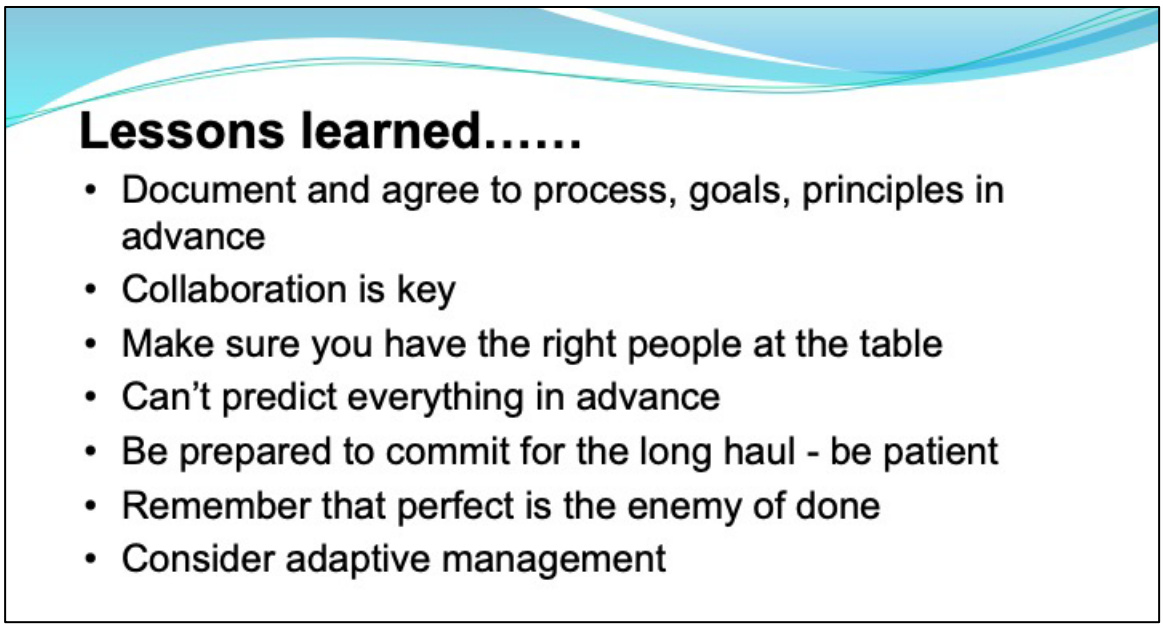
Session 1 – Getting to Objectives (Fireside Chat)

Presentations

Water quality objectives for the International Red River: A case study

Nicole Armstrong

Manitoba Environment, Climate and Parks



Overview

In November 2022 the governments of Canada and the United States approved four new water quality objectives for the Red River to continue improving water quality in the Red River basin, including downstream Lake Winnipeg. These water quality objectives are for the nutrients phosphorus and nitrogen and will be monitored by the International Red River Watershed Board to identify changes in water quality trends over time and provide key information to support efforts to improve water quality and reduce the occurrence of harmful algal blooms in the basin. The process for "getting to objectives" on the Red River will be presented as a case study, including lessons learned. Also examined will be the initiative through the Prairie Provinces Water Board, that led to 2021 updated water quality objectives the multi-jurisdictional setting within Canada.

Brief Bio

Nicole Armstrong is the Director of Water Science and Watershed Management Branch of Manitoba Environment Climate Change and Parks. She represents the Province of Manitoba on the Board of Directors of the Red River Basin Commission and as a member of the Prairie Provinces Water Board. Nicole is a former Canadian Co-Chair of IJC International Souris River Board and a Member of the IJC International Red River Watershed Board.

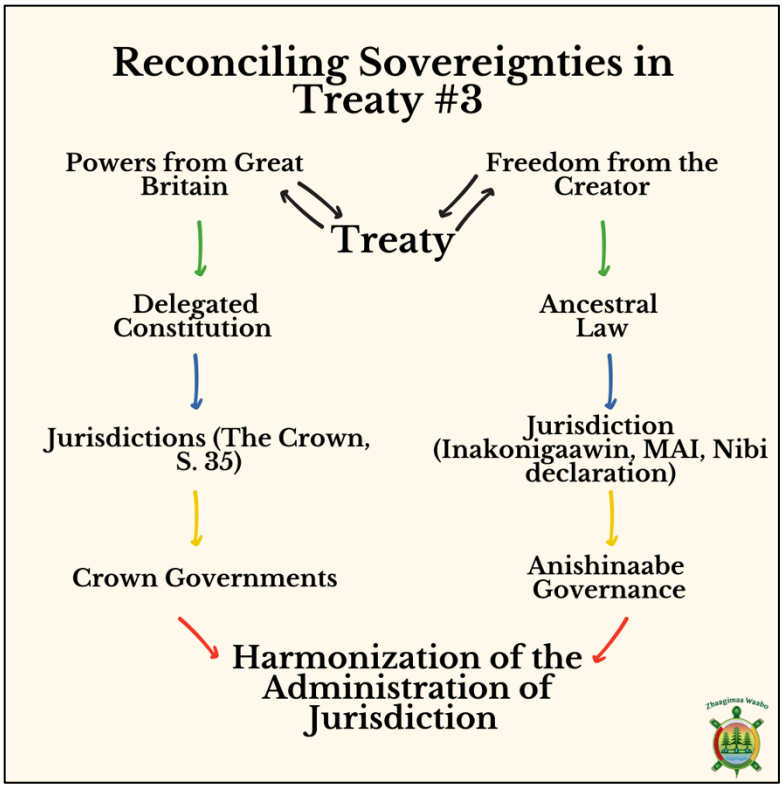
Grand Council Treaty #3 perspective on shared water governance

Lucas King

Grand Council Treaty #3, Territorial Planning Unit

Overview

The Canadian portion of the Rainy-Lake of the Woods Basin is entirely encompassed within the territory of the Anishinaabe Nation of Treaty #3. Perspectives will be presented on shared water governance within Treaty 3 territory which spans over 142,450 km^2, from west of Thunder Bay to north of Sioux Lookout, along the international border and into Manitoba. Treaty 3 is comprised of 28 First Nations with an estimated population of 25,000.



Brief Bio

Lucas King is the Director of the Territorial Planning Unit at Grand Council Treaty #3. He recently graduated from the Masters of Water Resources Engineering program at the University of Manitoba, where his research focused on modelling of best management practices in the Red River basin to improve water quality and shared governance. Lucas was recently appointed as a public member to the IJC International Rainy – Lake of the Woods Watershed Board. He has co – authored a number of reports and articles in relation to Indigenous Governance and water and land protection.

Moderated "Fireside Chat" Discussion Session – All Participants

---

Session Synopsis

Nicole Armstrong launched this session, explaining the complex diplomatic task of setting science-based water quality objectives - standards to which all governments agree and for which coordinated responses are established. Nicole noted that the work goes most smoothly when parties agree to follow a few crucial guiding principles and have a clear process documented from the outset.

For all parties involved to support the water quality objective, it is crucial that the approaches used are well coordinated, cooperative, transparent and integrated. Best outcomes result from working through consensus and striving to build understanding and trust among partners, including through early, frequent and ongoing public and community engagement. Working with

both Western science and Indigenous knowledge systems that reflect whole watershed perspectives will yield the most well-informed outcomes for watershed protection and restoration. At the same time, it is also equally important to recognize and leverage the jurisdictional independence of different parties. For example, federal, provincial, state, municipal and Indigenous governments each have unique roles to play in water governance, and each has its own regulatory framework, plans and approaches. The best results emerge when each jurisdiction works to understand the others' methods and potential contributions, and partners agree to pool contributions toward creating a collaborative management regime that no one party could achieve on its own.

Setting and achieving water quality objectives is a long-term undertaking, and building relationships and partnerships to sustain this work is, itself, a slow and methodical practice. Nicole reminded all of us of the tremendous value of being patient, working with integrity, and pragmatically remembering that "perfect is the enemy of done".

Lucas King followed Nicole with a discussion comparing and contrasting Indigenous and non-Indigenous approaches to water governance and reminded us that in our basin, we can expand outside of Boundary Waters Treaty and embrace the numerous treaties and governance systems that exist in this watershed. While many of the historic watershed governance processes have only followed the western legal tradition via a legal Duty to Consult framework, Indigenous governance processes have not been given equal, parallel investment.

In our watershed, Lucas pointed out that we are really starting to do good work to harmonize and work in the space between two systems - the western legal framework and Indigenous governance processes - with the Forum itself serving as an excellent example of an event that brings us together to build relationships and learn with and from each other, using both systems' governance protocols to host the event.

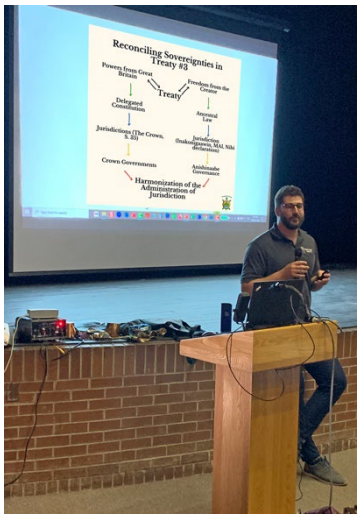
In the discussion that followed, audience members applauded efforts to establish water quality objectives, noting that good water quality is fundamental to the success of regional economies, especially fisheries and agriculture, and that by establishing multijurisdictional objectives, we are all better able to minimize the adverse impacts of our economic activities on water quality. People were excited to learn about Indigenous governance models and to explore opportunities to apply these decision-making processes to watershed management.

In response to a participant question about practical implementation of water quality objectives, Nicole explained how jurisdictional independence works in the Red River system. Here, if a particular water quality objective (e.g., a load or concentration objective) is set for some downstream segment of a watershed that is within one government's jurisdiction, upstream jurisdictions' governments use their own tools to contribute to achieving the objective. In the case of a load target, loads may be divided up among the various riversheds, monitoring sites established to gather data over the implementation period, and progress then measured against an integrated watershed management plan. Different regions will offer different regulatory functions, responsibilities, or priorities, such as a focus on agricultural runoff in one area versus water treatment plant regulation in another area. Nicole discussed the value of incentive-based programs, education (such as how to maintain your septic field), and other tools jurisdictions can use to cooperatively contribute toward achieving shared water quality objectives.

Climate change, one participant observed, throws dynamic flux into the system and amplifies the complexity of ecosystem interactions that affect water quality, resulting in material impacts on resource managers' abilities to adequately assess what water quality objectives and alert levels should be. Given that natural ecosystems will continue to be in constant flux, both Nicole and Lucas argued that we must aim for the best objectives given the information we have on hand, adapt them as we go, and welcome information from people who live in the watershed in close association and relationship with the lands and waters, as these are experts who will be able to tell us how the system is changing and responding to our efforts. As Lucas pointed out,

“Knowledge is biggest ally in decision making. Speaking to local people and knowledge keepers is vital to understand climate impacts on land and water. Having an adaptive framework is crucial to be able to accommodate changes over time.”

Finally, several people raised concerns about how to sustain the work of setting, striving for, and adapting water quality objectives over time. These are often long-term processes that may take decades and span multiple practitioners’ careers. Securing long-term financing to support monitoring, implementation and adaptive management processes is critically important and notoriously challenging. Some ways that local managers can plan for success over the long-term is by having human resources succession plans, including mentorship programs to train students, youth and community members as the next generation of technicians, and to maintain ongoing, robust dialogue and relationship-building with all governments, departments and agencies involved in the watershed to ensure public funding is always accessible from different sources at different times.

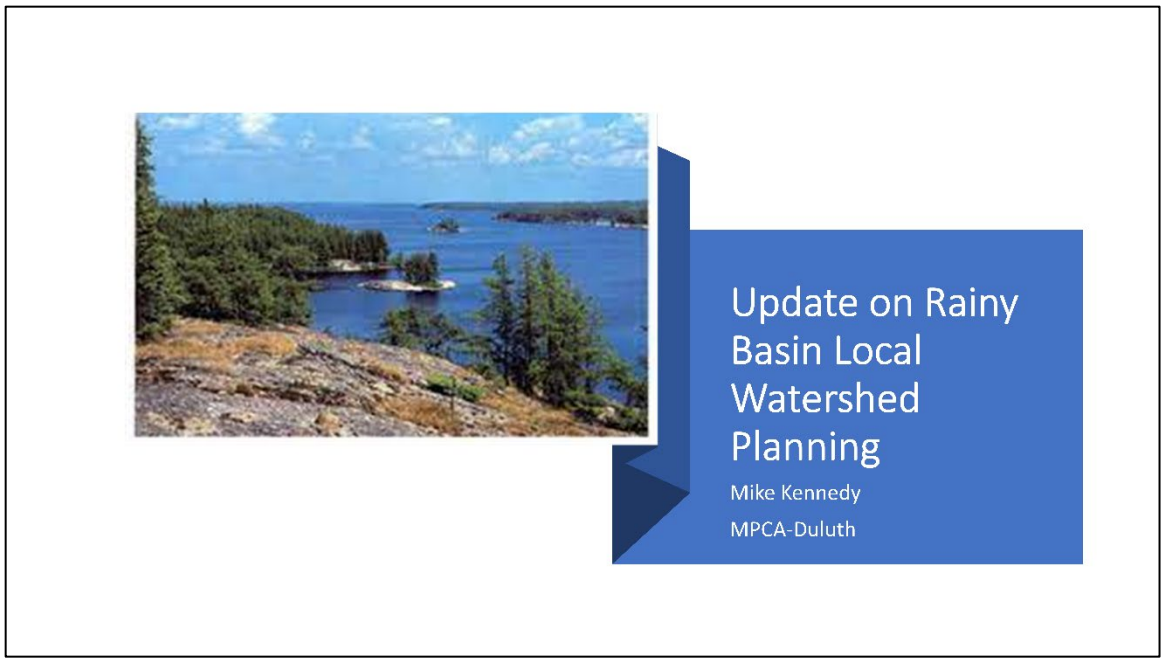


Session 2 – Watershed Updates: Research to Action

Moving to action and understanding on the US Side: Implementation and further research in the Rainy Basin

Mike Kennedy, Amy Mustonen, Lindsey Krumrie

MPCA-Duluth



Abstract

A brief update on the local watershed planning and other activities on US side of the Rainy Basin. We will highlight current research, the status of the One Watershed, One Plan (the local watershed planning effort post WRAPS and TMDL), and other activities.

Brief Bio

Mike, Amy, and Lindsey are Project Managers out of the Duluth MPCA Office and assist local partners in the Rainy Basin with water quality technical assistance.

Location of Study

U.S. portion of the Rainy-Lake of the Woods basin

Environment and Climate Change Canada Lake of the Woods Nutrients Update

Daniel Rokitnicki-Wojcik and Marie-Claire Doyle

Environment and Climate Change Canada, 867 Lakeshore Rd Burlington, ON L7S 1A1
Daniel.Rokitnickiwojcik@ec.gc.ca

Abstract

Environment and Climate Change Canada has implemented a science-based program in the Lake of the Woods since 2016. This has included research, modelling and monitoring to advance the understanding of the causes and consequences of harmful algal blooms in Lake of the Woods, as well as engagement on the development of ecosystem objectives and phosphorus reduction scenarios. This presentation will provide an update on the program, including key research, and communication and engagement activities that have occurred over the past year.

Brief Bio

Daniel Rokitnicki-Wojcik is a Program Coordinator, Strategic Policy Branch – Ontario Region, Environment and Climate Change Canada. He coordinates ECCC policy activities related to water quality and the management of nutrient loadings for the Rainy River-Lake of the Woods Basin and is a former Canadian secretary to the IJC's International Rainy-Lake of the Woods Watershed Board.

Location of Study

Canadian portion of the Rainy-Lake of the Woods Basin.

International Rainy-Lake of the Woods Watershed Board update

IRLWWB Co-Chairs: Michael Goffin[1], Col. Eric R. Swenson[2]

[1]Environment and Climate Change Canada; [2]U.S. Army Corps of Engineers

Abstract

The presentation reviews the International Joint Commission's International Rainy-Lake of the Woods Watershed Board mandate and provides updates on the Board's activities from April 2022 to date. The role and activities of the Water Levels Committee will be discussed, with particular focus on flooding throughout the basin in 2022. This presentation will cover the Board's aquatic ecosystem health endeavors, with a special focus on working with the International Joint Commission and Governments to reduce phosphorus and address toxic algae. Current International Watershed Initiative projects such as the Objectives and Alerts Project and Core Monitoring Program, the Aquatic Invasive Species Coarse Scale Risk Assessment Project and the adaptive management of the Rainy – Namakan boundary waters will be discussed.

Brief Bio

In 2020, Michael Goffin took on a special assignment as Director General Canada Water Agency Project within Environment and Climate Change Canada. Prior to taking this assignment, Mr. Goffin was the Regional Director General for Ontario, responsible for leading Canada's efforts to restore and protect the water quality and ecosystem health of the Great Lakes.

In 2012 he was lead negotiator for Canada responsible for the negotiation of the Canada-United States Great Lakes Water Quality Agreement. Mr. Goffin has been a long serving member of the International Joint Commission's Great Lakes Water Quality Board, and also currently serves as Canadian Co-chair of the International Joint Commission's International Rainy Lake of the Woods Watershed Board. Over the course of his more than thirty-year career in the Public Service of Canada, Mr. Goffin has been engaged in policy develop and program delivery in areas which include environmental protection, wildlife management, meteorology, water and ecosystem management, intergovernmental affairs and community outreach and engagement.

Colonel Eric R. Swenson is the Commander and District Engineer, U.S. Army Corps of Engineers – St. Paul District. He serves as the U.S. Co-chair for the International Rainy-Lake of the Woods Watershed Board, the Water Levels Committee, the International Lake of the Woods Control Board, and the International Red River Watershed Board. He is also a member of the International Souris River Board.

Location of Study

The Board's geographic mandate includes the entire Rainy-Lake of the Woods Watershed.

IJC Objectives and Alerts study

Bev Clark

Consultant

Abstract

An update on the IJC Objectives and Alerts project is presented. Phase one has been completed and provides recommendations for developing international objectives for phosphorus for Lake of the Woods and Rainy River and alert levels for other concerns. Phase 2 is being planned to get underway and a 50,000 ft overview of what might be considered is presented.

Brief Bio

Bev Clark is a consultant who has been involved in Lake of the Woods monitoring and research since the 1980s. He has been involved extensively in the State of the Basin Reports, as well as Phase I of the IJC Objectives and Alerts Study.

Location of Study

International Rainy-Lake of the Woods Watershed.

GCT3 Geoportal

Raeshawn Parsons

Territorial Planning Unit, Grand Council Treaty #3

Abstract

The Geoportal is an interactive tool for data storage and sharing across the Anishinaabe Nation in Treaty #3. The Geoportal allows Treaty #3 communities and organizations a secure location to store and share data, alongside public information acting as a comprehensive solution for all data needs. Through the portal the Anishinaabe Nation in Treaty #3 and Treaty #3 communities can view and share information across the 55 000 square miles of the Territory to understand ongoing resource activities, economic opportunities, identify gaps, share knowledge and teachings and protect sacred sites throughout the Territory that will support decision making as a Nation through Manito Aki Inakonigaawin (Treaty #3 Great Earth Law).

The purpose of the Geoportal is to support the Anishinaabe Nation in Treaty #3 and communities to access, protect, and share public and private spatial and non-spatial data. Communities can upload and save projects and documents as well have access to online mapping tools with diverse collections of Treaty #3 specific data layers. The Geoportal provides the ability to have singular community access, access shared between multiple communities, and as a Nation for each piece of data saved. Documents like impact assessments, forest management plans, land use studies, mineral surveys, emergency plans, housing developments and project outlines can all be connected with spatial GIS layers to make custom maps or share with project teams.

Brief Bio

Hello, my name is Rae (they/them) and I'm the Grand Council Treaty #3 GIS Specialist. I am from southwestern Ontario and have been with GCT3 since June of 2021. I have a background in Nature Conservations, GIS, and Horticulture. Basically, my job as a GIS Specialist is to make the maps everyone uses in monitoring, planning, researching, and spatial analysis.

Location of Study

Entire Treaty #3 Territory

Day 2 – March 9, 2023

Session 3 – Planning & Governance

Centering Treaty in governing the Rainy-Lake of the Woods watershed

Johann Strube

Carleton University, School of Public Policy and Administration

Abstract

The coexistence of Indigenous Peoples, Settlers, and more-than-human kin in the Rainy-Lake of the Woods Watershed is based on mutual responsibilities agreed upon in treaties. It is through Treaty 3 and the 1854 and 1866 treaties that First Nations, Tribes, Canada, and the United States recognized each other's sovereignty. In addition, the Anishinaabe closed treaties with non-human nations that prescribe a sustainable life of mutual respect and care. Finally, the 1909 Boundary Waters Treaty coordinates the governance of waters shared by the United States and Canada. The Boundary Water Treaty undergirds the local system of water governance in the Rainy-Lake of the Woods Watershed, but the other treaties have received little recognition. In this presentation, I review the different treaties in the watershed, reflect on their pertinence to water governance in the Rainy-Lake of the Woods Watershed, and suggests ways in which the current water governance system could be reformed to honor our mutual treaty responsibilities.

Brief Bio

Johann Strube is a sociologist with a focus on food, environmental governance and justice. He earned his PhD in Rural Sociology from the Pennsylvania State University studying the impacts of water level governance on wild rice and Indigenous Nations on Rainy Lake. Besides his ongoing work in Rainy Lake of the Woods Watershed, Dr. Strube is involved in research on Indigenous fisheries in the Arctic, the decolonization of rural sociology, and sustainable agriculture. In March, Dr. Strube will begin in a new position as Policy Analyst with the Grand Council of Treaty #3.

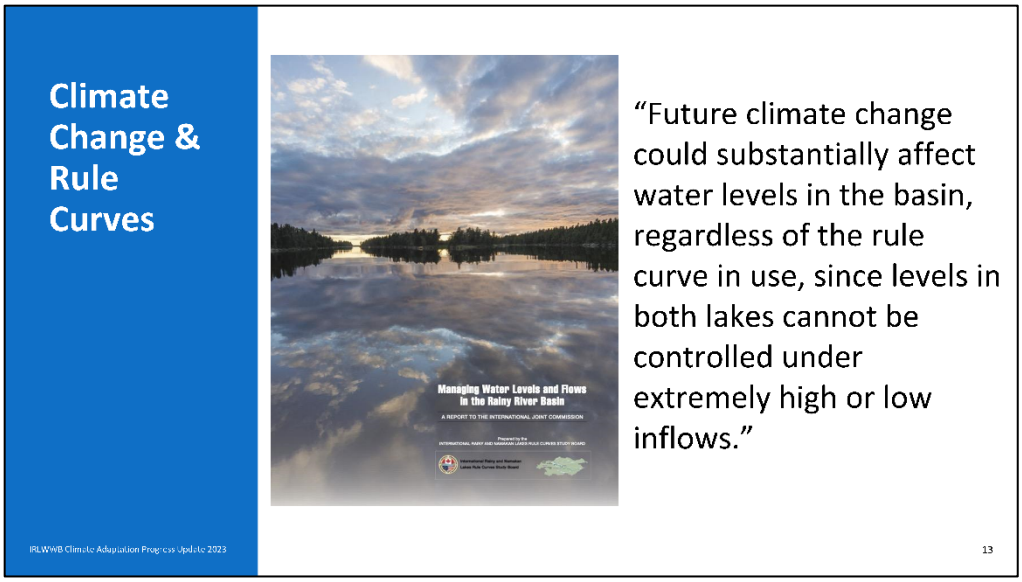
Location of Study

International Rainy-Lake of the Woods Watershed

International Rainy - Lake of the Woods Watershed Board Adaptive Management Committee's climate change adaptation activities

Teika Newton

Adaptive Management Committee, International Rainy-Lake of the Woods Watershed Board



Abstract

The Adaptive Management Committee (AMC) is one of four core committees of the International Rainy - Lake of the Woods Watershed Board. The AMC was established in 2020 with a primary function to monitor whether the latest rule curves perform as expected. In addition, the AMC is also responsible for overseeing the Board's implementation of the International Joint Commission's climate change adaptation guidance framework, an adaptive management protocol for Boards to assess and respond to known and anticipated climate change impacts. In this presentation, we provide an update on the AMC's activities since 2020 to support this watershed's adaptation to climate change and discuss upcoming work for 2023 and beyond.

Brief Bio

Teika Newton is the Canadian Co-Chair of the Adaptive Management Committee of the International Rainy-Lake of the Woods Watershed board. She is also the International Watershed Coordinator with the Lake of the Woods Water Sustainability Foundation. Teika is a long-time participant in regional watershed science, policy, and governance activities. She has served as a board member for the International Joint Commission's International Rainy–Lake of the Woods Watershed Board, and co-chaired the Board's Community Advisory Group, Engagement Committee, and currently the Adaptive Management Committee. Teika also has been helping to guide the IJC Board's work on climate adaptation since 2016. Teika joined LOWWSF in January 2023, after several years at Climate Action Network - Réseau action climat Canada, where she helped grow the network to 150 civil society member organizations and cultivate a powerful team of diplomats and climate policy experts under her leadership as Managing Director. At the local level, Teika continues to contribute as a member of the City of Kenora's Sustainability Advisory Committee.

Location of Study

International Rainy-Lake of the Woods Watershed

Moving from data to decisions: How the Rainy Headwaters-Vermilion Watershed planning effort is utilizing extensive monitoring and research data to prioritize, target, and measure for implementation.

Becca Reiss[1], Phil Norvitch[1], Tara Solem[2], Kari Hedin[2], Ilena Hansel[3], Erin Loeffler[4], Moriya Rufer[5]

[1]North St. Louis SWCD; [2]Lake County SWCD; [3]Cook County SWCD; [4]MN Board of Water and Soil Resources; [5]Houston Engineering

Abstract

The One Watershed, One Plan (1W1P) Process is underway in the Rainy Headwaters-Vermilion River Watershed. 1W1P is a Minnesota Board of Water and Soil Resources program facilitating development of a science-based comprehensive watershed plan that aligns state strategies with local priorities. Acknowledging we can't do everything, everywhere, the planning process integrates Minnesota Pollution Control Agency and citizen monitoring data, Department of Natural Resources data analyses, and research from other sources in order to prioritize which issues and resources will be addressed in the 10-year plan. Using this data along with local knowledge helped the team prioritize lakes and streams that will be the focus of restoration, enhancement, and protection activities. These results will be shared.

Brief Bio

Becca Reiss is the Community Conservationist for the North St. Louis Soil & Water Conservation District (SWCD) and is helping steer the planning effort for the Rainy Headwaters-Vermilion River Watershed along with Lake and Cook SWCDs and Counties, Houston Engineering, and the Minnesota Board of Water and Soil Resources.

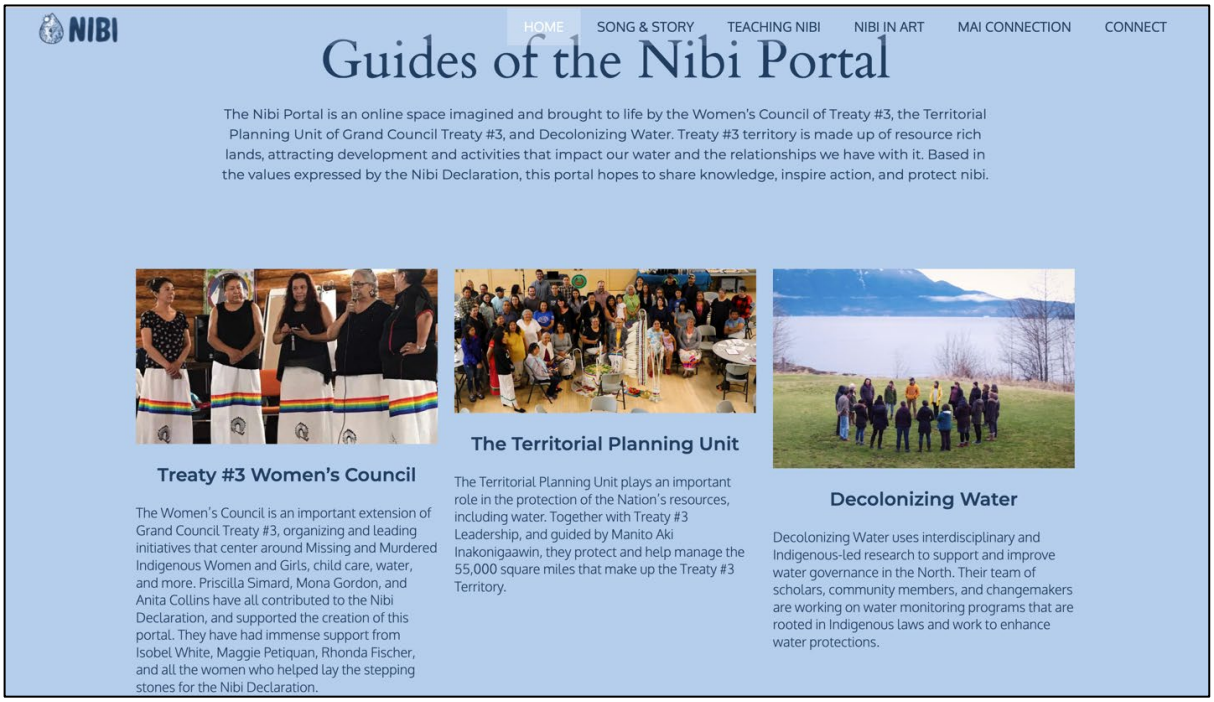
Location of Study

Rainy Headwaters-Vermilion River Watershed

Nibi portal and curriculum

Elder Priscilla Simard

Grand Council Treaty #3 Women's Council



Abstract

Through guidance from the Treaty #3 Women's council, knowledge keepers and technicians this online space was created in order to share teachings, experiences and responsibilities in relation to Nibi. Based on the values of the Nibi Declaration, the Nibi Portal is a continuation of the work that we must strive to do to preserve, protect and respect all Nibi. The space will be ever evolving with additions of videos, teachings, and support for the Nibi Declaration that can continue to guide decision making and our relationships to Nibi.

Brief Bio

Priscilla Simard is an elder from Coochiching First Nation and a member of the Women's Council of Grand Council Treaty #3. She was instrumental in helping to develop the Nibi Declaration and Nibi Portal, which is the subject of her talk today.

Location of Study

Treaty #3 Territory

Session 4 - Nutrients

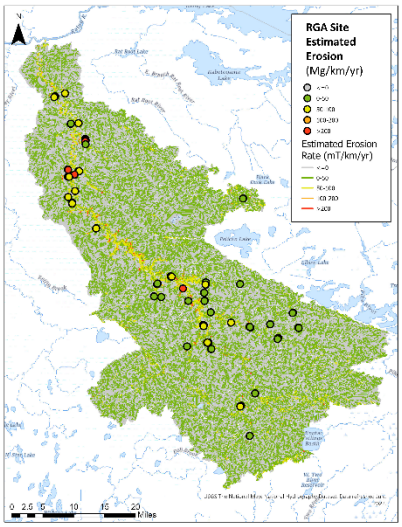
A stream corridor sediment budget for the Little Fork River

Faith Fitzpatrick[1], Shelby Sterner[1], Anna Baker[1]*, Sam Soderman[2], Mike Kennedy[3], Phil Norvitch[4], Andy Kasun[5], Karen Gran[5], Jesse Anderson[3], Matt Gutzmann[6]

[1]U.S. Geological Survey Upper Midwest Water Science Center abaker@usgs.gov , [2]Koochiching County Soil and Water Conservation District, [3]Minnesota Pollution Control Agency, [4]North St. Louis Soil and Water Conservation District, [5]University of Minnesota – Duluth, [6]Itasca Soil and Water Conservation District

Preliminary River Corridor Sediment Budget Results for Bank/Bluff Erosion

Stream Order	Cumulative stream length (km)	Total Erosion Mg /year	Fine (<63 um) Sediment Erosion Mg /year	% of Erosion <63 um
1	15,732	42,167	10,096	24
2	7,784	15,965	3,644	23
3	3,797	6,078	1,932	32
4	1,720	15,274	6,455	42
5	773	9,615	3,588	37
6	464	12,359	3,185	26
7	333	8,506	3,345	39
8	50	1,929	482	25
9	196	22,250	5,935	27
Total	**30,849**	**134,143**	**38,662**	**29**



USGS science for a changing world

Average annual TSS loads at Little Fork at town of Littlefork, Minnesota = **55,728** Mg

Preliminary Information – Subject to Revision. Not for Citation or Distribution.

Abstract

The Little Fork River has been identified as a disproportionate source of sediment to downstream waters. The Minnesota Pollution Control Agency (MPCA) has identified large sections of the Little Fork with sediment related impairments and has developed Total Maximum Daily Load regulations to address these impairments. However, the MPCA is in need of more detailed information describing sediment sources in the basin to help guide management for reduction of sediment loads. In collaboration with MPCA, the Soil and Water Conservation Districts of Koochiching, North St. Louis, and Itasca Counties, and the University of Minnesota, the USGS has been working to delineate sediment sources throughout this 4,850 square kilometer river basin, using sediment budget and sediment fingerprinting techniques. This presentation will share the results of a recently completed sediment budget constructed for the Little Fork stream corridor.

The development of the stream corridor sediment budget was supported by the collection of field-based reach-scale Rapid Geomorphic Assessment (RGA) data describing the channel morphology and major geomorphic processes, with specific measurements of eroding banks and valley sides, soft sediment deposition, and areal distribution of bars for a full range of channel sizes and geomorphic settings. Field data collected during the 2021 field season were applied to a stream network delineated for this project using a 10-meter digital elevation model and a small (0.02 km^2) basin threshold for stream delineation. Importantly, this newly delineated network included ravines with ephemeral channels, which are potentially important sources of sediment to the mainstem of the river and are not included in the perennial stream-based Minnesota Department of Natural Resources stream layer or USGS National Hydrologic Dataset. The more

detailed network was broken into 60-meter segments and then categorized by stream order, channel slope, and proximity of steep valley sides, and riparian vegetation. Field measurements of stream corridor erosion and soft sediment deposition from the RGAs were extrapolated along the network of segments, resulting in a delineation of areas anticipated to be important contributors to sediment load, and estimates of erosion and soft sediment deposition along the stream corridors. Preliminary results indicate 130,000 Mg/yr of corridor erosion and 840,000 Mg of soft sediment stored in channels. These estimates will be used to compliment the geochemical fingerprinting apportionments of both upland and corridor sources of sediment and sediment-bound phosphorus.

Brief Bio

Anna Baker is a hydrologist with the USGS Upper Midwest Water Science Center, and has been working in Minnesota since 2017. She obtained her masters in Water Resources Science at the University of Minnesota in 2018.

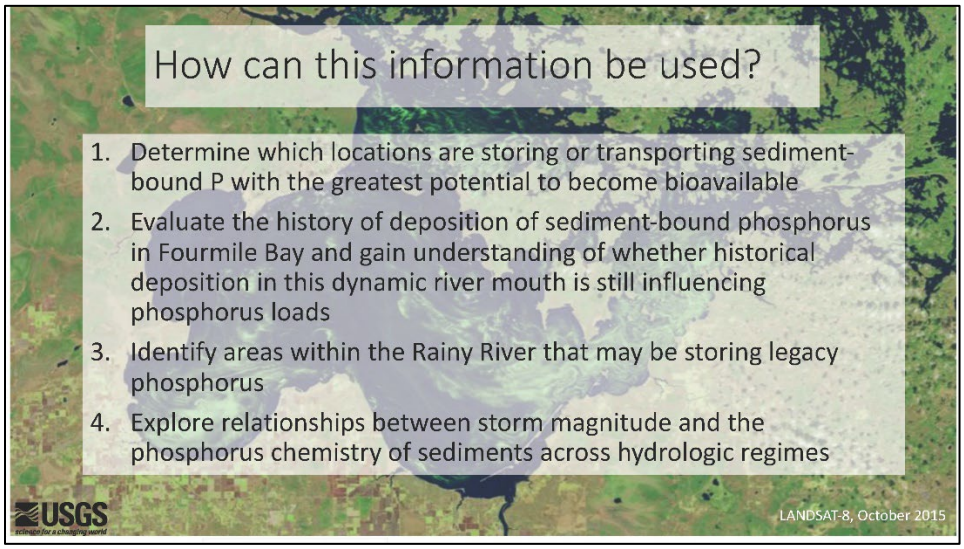
Location of Study

Little Fork River Basin

Planned study of Rainy River sediment-bound phosphorus as a potential driver of Lake-of-the-Woods algal blooms

Anna Baker[1*], Faith Fitzpatrick[1], Paul Reneau[1], Adam Heathcote[2], Mark Edlund[2], Sam Soderman[3], Mike Hirst[4], Joe Vrtacnik[4], Mike Kennedy[5], Jesse Anderson[5], Kevin Stroom[5], Phil Norvitch[6], Shelby Sterner[1], James Blount[1]

[1]U.S. Geological Survey Upper Midwest Water Science Center, [2]St. Croix Watershed Research Station, Science Museum of Minnesota, [3]Koochiching County Soil and Water Conservation District, [4]Lake of the Woods Soil and Water Conservation District, [5]Minnesota Pollution Control Agency, [6]North St. Louis Soil and Water Conservation District



Abstract

Lake of the Woods (LoW) is a vital ecosystem impacted by recurring harmful algal blooms. The Rainy River basin comprises 80% of the total drainage area to LoW and contributes 45-75% of the total phosphorus (TP). Despite major reductions in total phosphorus concentrations in the Rainy River, blooms persist in downstream Lake of the Woods. Previous investigations have explored the inputs of phosphorus from the Rainy to LoW, but none to date have explored the detailed phosphorus chemistry of sediments in storage and in transport in this large river network. As a result, we lack understanding of how sediment-bound phosphorus, which may accumulate in the river network over time and be slowly remobilized and transported, may serve to fuel blooms downstream now and into the future.

This year, a research team will begin work on addressing this gap by delineating areas of sediment-bound phosphorus deposition within the Rainy River and Fourmile Bay, and by exploring the detailed phosphorus chemistry of sediment in storage and in transport. The study will use geophysical tools to examine fine sediment deposit extent and thickness and will analyze how phosphorus is bound to sediment in the stream bed and in suspension throughout the Rainy River and in three key tributaries on the U.S. side of the river. Long-sediment cores will be collected in Fourmile Bay to link the results of this investigation of sediment-bound phosphorus storage to the longer-term history of sediment deposition in this dynamic river mouth, and in the lake itself. The results of this study will provide critical information for resource managers, identifying hotspots of phosphorus introduction and of legacy phosphorus storage within the network. This study will identify the in-stream source areas with greatest potential to contribute to the bioavailable pool of phosphorus downstream and to fuel algal blooms into the future.

Brief Bio

Anna Baker is a hydrologist with the USGS Upper Midwest Water Science Center, and has been working in Minnesota since 2017. She obtained her masters in Water Resources Science at the University of Minnesota in 2018.

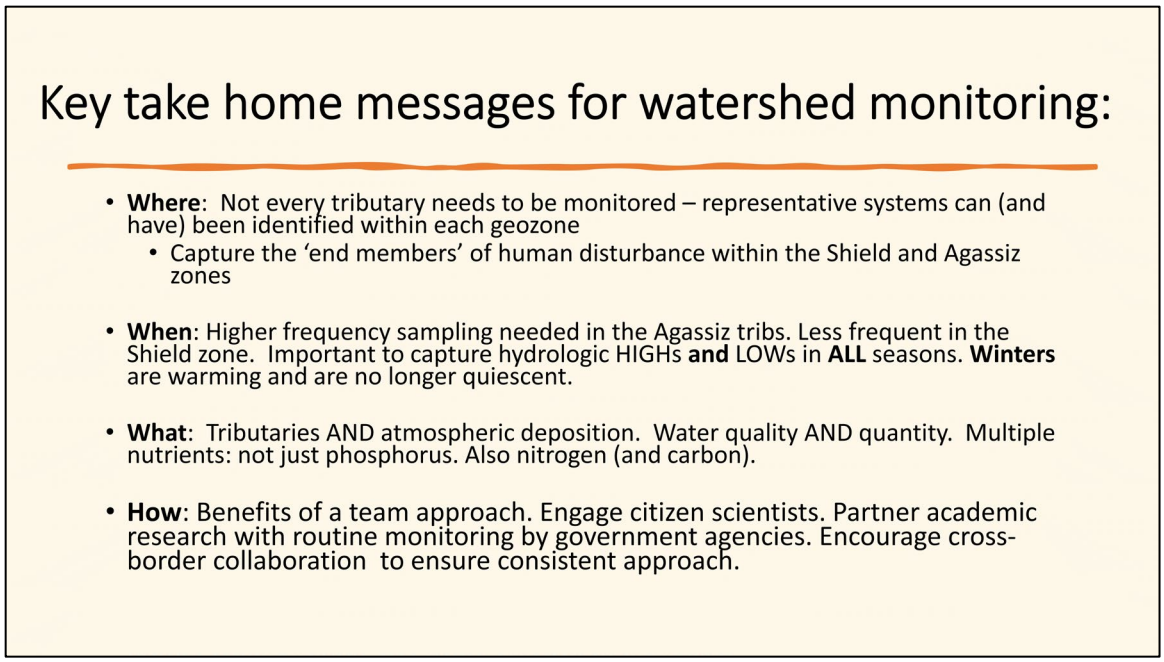
Location of Study

Lower Rainy River, Fourmile Bay

Lessons learned from a multi-year nutrient research program in the Canadian tributaries

*[1]Catherine Eimers, [1,2]Wes Greenwood, [1,3]Andrew Williams, [3]Andrew Paterson

[1]Trent School of the Environment*, Trent University, Peterborough, Ontario, Canada K9L 0G2
ceimers@trentu.ca ; 705-748-1011;
[2]Alberta Ministry of Environment and Protected Areas;
[3]Ontario Ministry of Environment, Conservation and Parks.



Abstract

In this talk we describe the primary 'take home messages' from an ongoing research and monitoring program in the Canadian portion of the Lake of the Woods watershed. Two plus years of temporally intensive and spatially extensive measurements of water quality and quantity indicate the importance of both high and low flow events for phosphorus and nitrogen concentrations and budgets. Comparison of river discharge patterns across sites demonstrated the critical need for site-specific flow monitoring and the high sensitivity of nutrient export to variation in climate. Nutrient loads in atmospheric deposition were surprisingly high, and deposition may account for a larger proportion of lake nutrient budgets than previously estimated. Nitrogen levels as nitrate are variable across the basin but are rising in agricultural rivers that feed the Rainy River. Expansions of tile-drainage and corn and soybean production in the Rainy River sub-basin affect both nutrient levels and stream flow and should be monitored into the future. While phosphorus has been the sole nutrient targeted for management historically, the dynamic nature of nitrogen loading as well as recent research on the influence of nutrient stoichiometry suggest a multi-nutrient approach to eutrophication management may be prudent.

Brief Bio

Catherine Eimers is a professor at Trent University. She has been involved in a tributary and deposition loading study within the Canadian portion of the LoW basin since 2018.

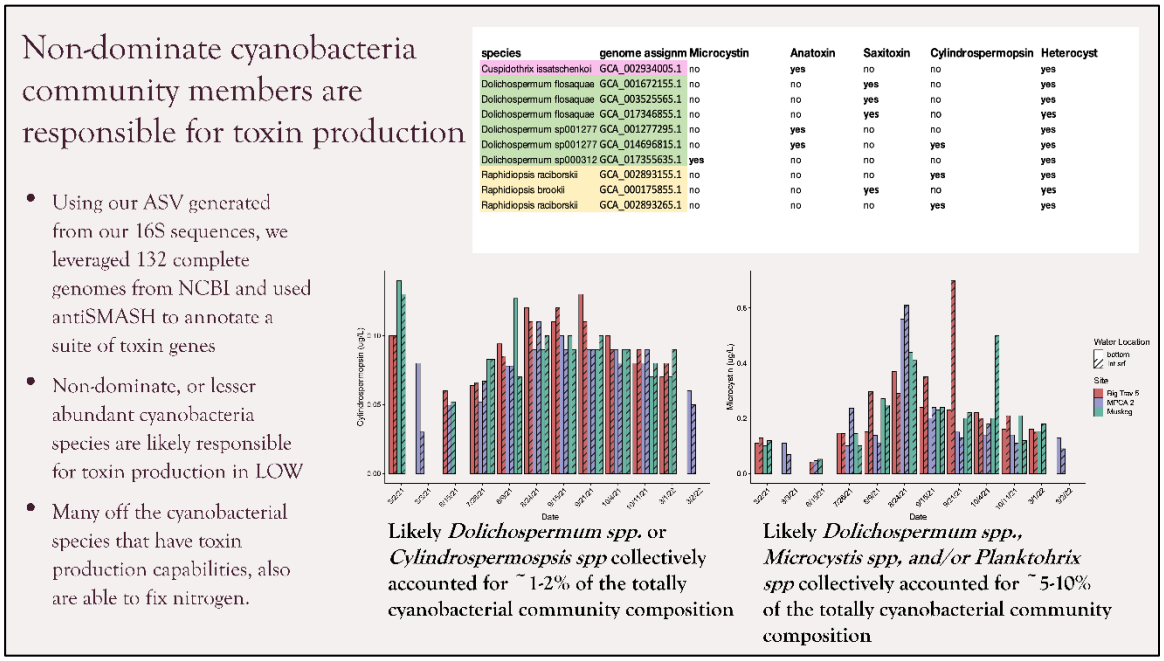
Location of Study

Canadian tributaries to the Rainy River and Lake of the Woods

Nitrogen fixation may offset nitrogen demands in Lake of the Woods cHABs, and molecular techniques reveal species responsible for toxin production

Kaela E. Natwora, Cody S. Sheik, Adam Heathcote, and Mark Edlund

University of Minnesota Duluth, Large Lake Observatory, 2205 E 5th St, Duluth, MN 55812
natwo001@umn.edu



Abstract

Cyanobacterial harmful algal blooms (cHABs) continue to threaten the ecosystem services supported by the waters of Lake of the Woods (LOW). LOW cHABs are increasing in frequency and toxicity despite phosphorous mitigation practices. One heavily supported trigger of cHABs is dual nutrient control of both phosphorus (P) and nitrogen (N). It has traditionally been assumed that freshwater systems are limited by P. However, not all systems are equal, and a “P-only Paradigm” has shifted to include the potential of co-nutrient limitation when understanding drivers of HABs, specifically N and P. LOW consistently becomes N-limited prior to the peak of the blooms, suggesting nitrogen availability is likely a strong driver of bloom extent and productivity. Thus, we sought to quantify how internal cycling of nitrogen through nitrogen fixation could help with the proliferation of cHABs in LOW. Nitrogen fixation is a microbial mediated process in which inaccessible, atmospheric nitrogen (N_2) is fixed to ammonia (NH_3), which is then available to be incorporated into biomass. Interestingly, the cyanobacteria *Aphanizomenon* and *Dolichospermum* that populate LOW cHABs, can fix nitrogen and in some species produce cyanotoxins. We found that nitrogen fixation rates increase exponentially as the bloom increases in intensity throughout the growing season. Using 16S rRNA gene sequencing, we saw significant shifts in the microbial community composition throughout the bloom season. A concomitant increase in the cyanotoxin toxin, microcystin, was also seen during our sampling. To determine the potential cyanobacterial culprits producing microcystin, we used a genome-based survey of the genera present at LOW. Using the secondary metabolite prediction program ANTISMASH, we were able to determine toxigenic cyanobacteria species and the diversity of associated toxins produced by them. Interestingly, at LOW cyanobacteria that were in low abundance like *Lyngba, Microcystis, Planktothrix and Raphidiopsis* are likely responsible, and contribute to toxin production. These findings are in line with the stoichiometry of LOW and suggests that N-limitation is likely suppressing toxin production, as microcystin has high nitrogen content per molecule. Together, our finding suggest that nitrogen fixation may alleviate N-demand during N-limitation ultimately

supporting cHAB growth, and that low abundant cyanobacteria may contribute to toxin production in LOW. Given that it is likely the nitrogen environment in LOW is structuring the microbial community composition and influencing toxin production, further monitoring of inorganic N will be important for management implications.

Brief Bio

Kaela Natwora is a Ph.D. student at the University of Minnesota-Duluth studying nitrogen dynamics and microbial community structure associated with harmful algal blooms. Kaela works in Dr. Cody Sheik's aquatic microbiology lab at the Large Lake Observatory. In summer of 2021, Kaela collaborated with Drs. Heathcote and Edlund integrating nitrogen fixation quantifications and molecular techniques into their existing monitoring efforts on Lake of the Woods in hopes of telling the nitrogen story and revealing the toxigenic cyanobacteria species in LOW.

Location of Study

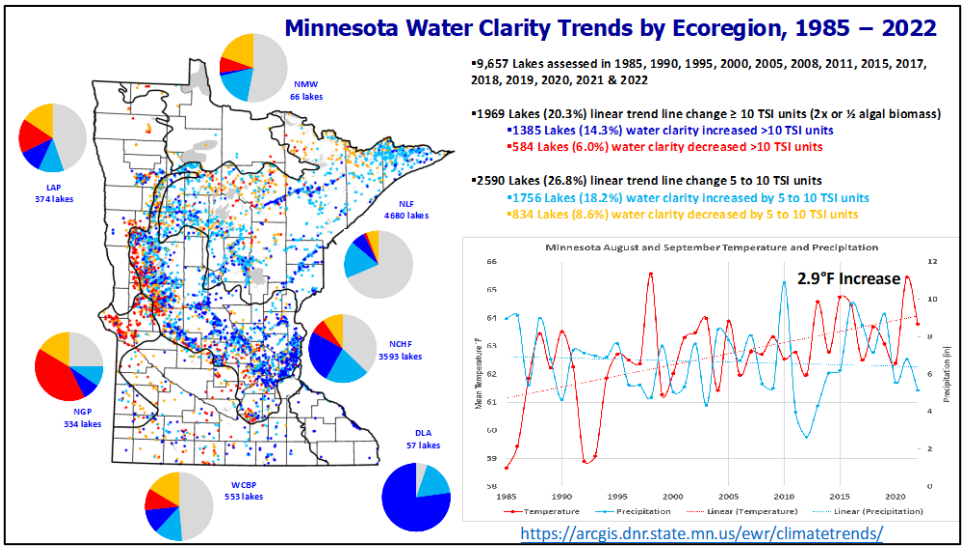
Southern Basin of Lake of the Woods (Muskeg Bay, Big Traverse and MPCA2)

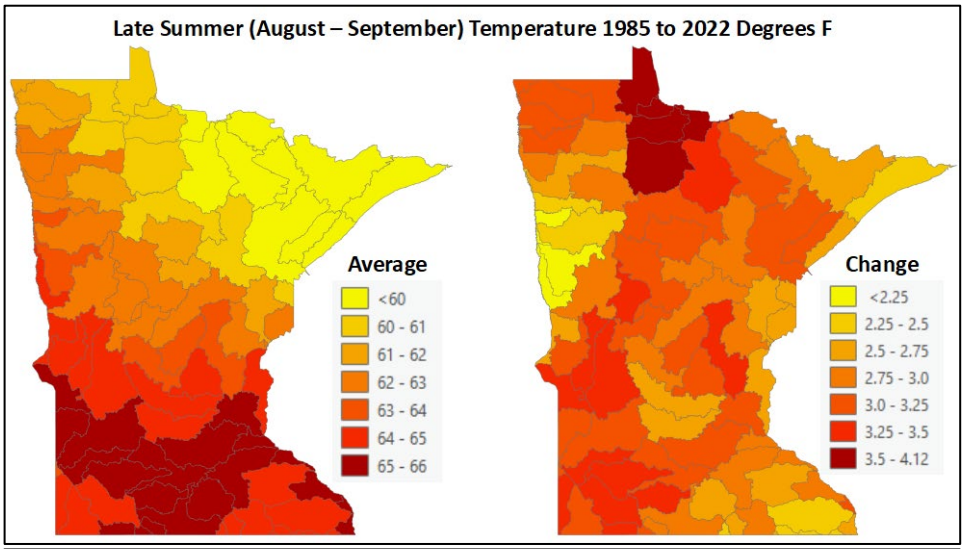
Session 5 – Emerging Issues and Technologies

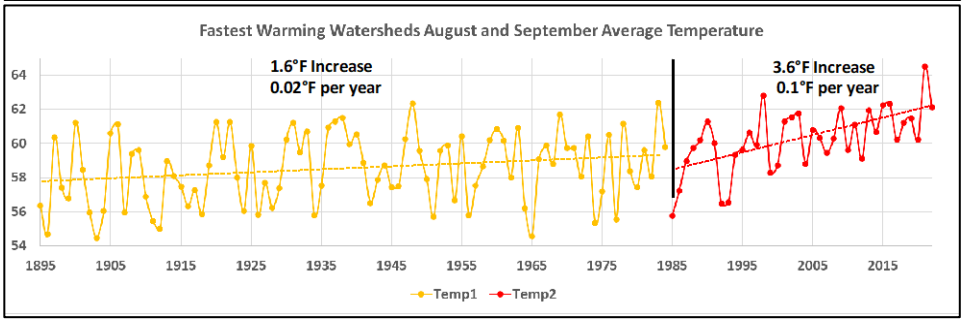
Using satellite-derived water quality Data from an automated high-performance computing environment to identify lakes prone to cyanobacteria blooms in the Rainy-Lake of the Woods watershed

Leif Olmanson[1], David Porter[2]

[1]Remote Sensing and Geospatial Analysis Laboratory, University of Minnesota, MN, USA
[2]Minnesota Supercomputing Institute, University of Minnesota, MN, USA







Abstract

The Rainy-Lake of the Woods Watershed is one of the fastest-warming areas in the continental USA. With warming temperatures, longer open water seasons, and more intense storms delivering more nutrients to our lakes, the occurrence of harmful algal blooms (HABs) and threats to fish habitats are increasing. Water temperature is one of the most important physical characteristics of aquatic systems, regulating many chemical and biological processes. Increasing water temperatures limit the fish habitat and increase the competitive advantage for cyanobacteria blooms. Lakes warm slower than air temperatures and the rate of warming depends on water clarity, lake depth, and size characteristics. Small shallow turbid lakes warm faster than large deep clear lakes. While water temperature measurements are relatively scarce, they are essential for determining lakes where high temperatures and associated low oxygen threaten fish habitats and where HABs are likely to occur.

Using Landsat imagery, we have been assessing lake water clarity in Minnesota, USA, and ~10,000 lakes in the Rainy-Lake of the Woods Watershed for over 25 years. We used empirical methods and in situ Secchi calibration data for early assessments. Recent advances in satellite technology (improved spatial, spectral, radiometric, and temporal resolution) and atmospheric correction, along with cloud and supercomputing capabilities, have enabled the development of automated regional-scale measurements of water quality and temperature. These new capabilities provide opportunities to improve lake and fisheries management and identification of lakes prone to HABs by measuring more variables (chlorophyll, colored dissolved organic matter (CDOM), and total suspended matter, the main determinants of water clarity) and temperature more frequently. Lakes prone to cyanobacteria blooms can be identified using historical water quality data along with lake temperature since the lakes that bloom tend to do so in a predictable manner due to climatic conditions and nutrient levels. Near real-time water quality and temperature data and modeling can be used to forecast HAB probability.

Brief Bio

Leif Olmanson is a Researcher at the University of Minnesota with over 20 years' experience developing remote sensing applications to create temporally and spatially rigorous datasets of water and land resources for large area ecosystem characterization. He is particularly interested in developing field validated image processing methods implemented in automated geospatial analysis systems such as Google's Earth Engine and Minnesota Supercomputing Institutes super computers to gain a better understanding of the natural environment. He currently leads a team of researchers and computer scientists to build a near real-time water quality monitoring system for Minnesota's >10,000 lakes using satellite imagery to providing critical water quality information for lake management.

Location of Study

US portion of the Rainy-Lake of the Woods Watershed

Adaptive monitoring on the lower Winnipeg River, Manitoba

Madeline Stanley[1]*, Thomas Saleh[2], Jeff Simpson[3], Steven Simpson[3], Connor Riach[3], Joey Simoes[1], Pauline Gerrard[2]

[1]International Institute for Sustainable Development. 325-111 Lombard Avenue, Winnipeg, MB, R3B 0T4
[2]International Institute for Sustainable Development Experimental Lakes Area. 325-111 Lombard Avenue, Winnipeg, MB, R3B 0T4
[3]Aquatic Life Ltd. Pinawa, 1 Vanier Avenue, Pinawa, MB, R0E 1L0

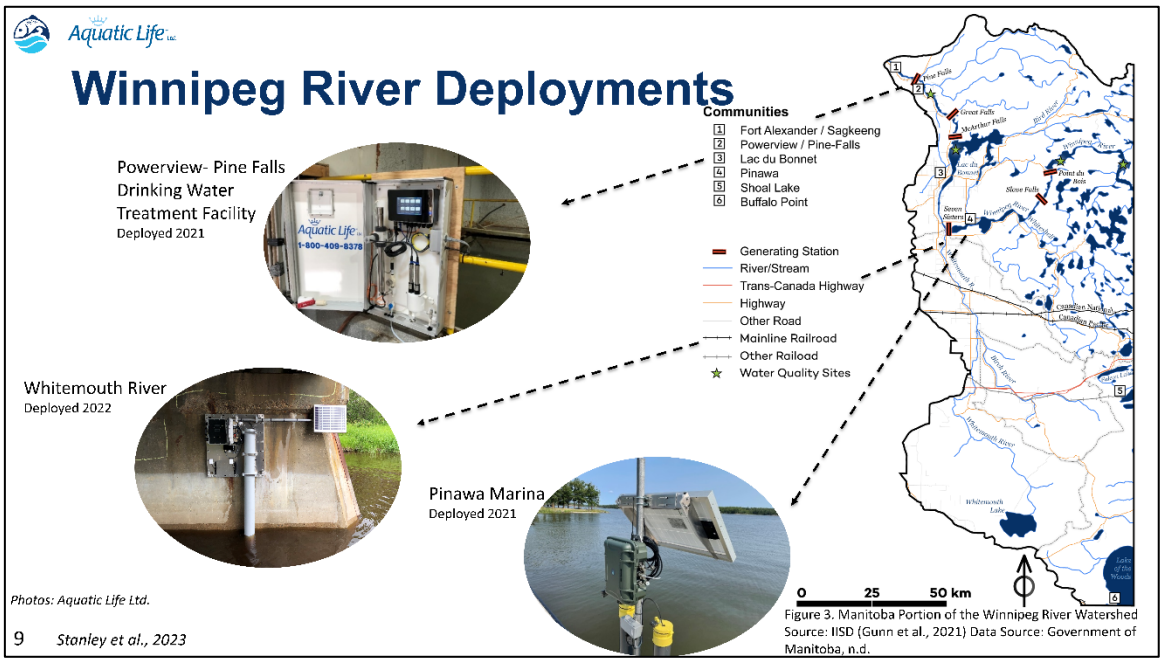


Figure 3. Manitoba Portion of the Winnipeg River Watershed Source: IISD (Gunn et al., 2021) Data Source: Government of Manitoba, n.d.

Abstract

The Winnipeg River is a region of cultural, spiritual, ecological, and socioeconomic significance, and yet it is difficult to assess its integrity and quality due to data limitations. Monitoring along the Winnipeg River, and in many watersheds in Canada, are led by various Federal, Provincial, or Community-based programs that are limited by space, time, and finances. Each have their own goals and priorities, and thus, each program may act independently. This limits our ability to compare sites, to fully understand the integrity of aquatic ecosystems, and ultimately, to make effective decisions. To address this gap, IISD-ELA and Aquatic Life Ltd have partnered to explore Adaptive Monitoring through the deployment of higher frequency, near real-time water quality sensors to better understand changes in the river to inform decision makers. Our project aims to explore how an adaptive monitoring program can improve the shared understanding of the river, develop surrogate models and near-term forecasting, and use spectral fingerprints to isolate phosphorus and nitrogen. To date, we have deployed three sensors along the Winnipeg River that collect and transmit ≤ hourly data on a variety of water quality parameters to test these questions.

Brief Bio

Madeline is a Policy Advisor with IISD's Water Program with a background in ecology and is also a PhD Candidate at the University of Manitoba, studying the use of engineered floating wetlands to remediate oil spills.

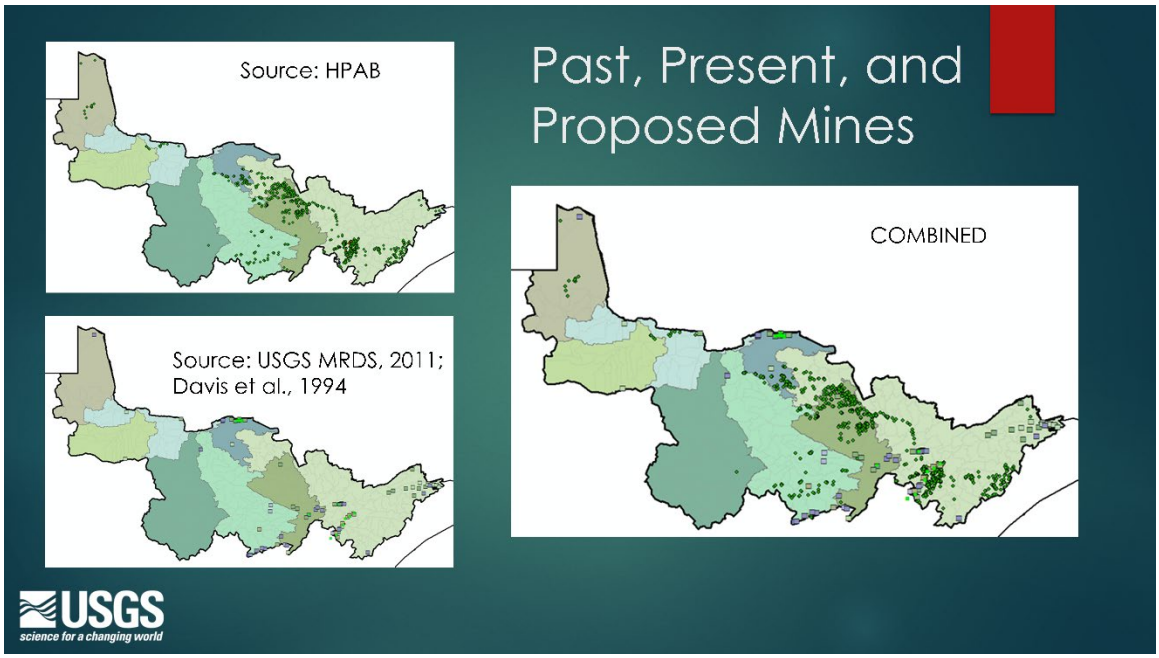
Location of Study

Lower Winnipeg River Basin, Manitoba

Assessing vulnerability of waters to mining in the Rainy—Lake of the Woods watershed

Victoria G. Christensen[1], Aliesha Krall[1], Eric Boisvert[2], and Hazen Russell[2]

[1]USGS Upper Midwest Water Science Center vglenn@usgs.gov ;
[2]Geological Survey of Canada



Abstract

The impacts of mining—past, present, and potential—have been of concern within the Rainy Lake of the Woods basin for many years. In 2020, the Health Professionals Advisory Board (HPAB) completed work on a preliminary map of mining activity that can affect common waters of Canada and the United States. However, the data sets supporting this effort had various purposes and thus data for some drainage basins affected by mines were not readily found and information on proposed mines was limited. The HPAB collaborated with the International Rainy—Lake of the Woods Watershed Board to support a case study for binational map harmonization of Rainy—Lake of the Woods watershed. This complex issue will require a multi-year, phased approach.

The U.S. Geological Survey and Geological Survey of Canada were selected to compile data and participate in a data gap analysis associated with the cumulative effect of mining on this transboundary basin. Erosion of soils is a concern, along with metals, sulfate, acidity, and other constituents or contaminants associated with particular mineral deposits. Key static and temporal environmental datasets include earth materials, terrestrial and aquatic biological systems, and water. Other available datasets may include human occupation and activities within the watershed, for example old mine sites.

Issues pertaining to the impact of mining fall under the jurisdiction of multiple federal, state/province, and Indigenous groups on both sides of the border. Data has been collected over many decades, by multiple individuals and agencies, operating with different sampling and analytical protocols.

An attempt will be made to provide some context on the extent of data integration. A discussion of how to maintain harvested datasets, continuous updates, and potential storage and retrieval options of data will be reviewed. Local agencies and Indigenous communities will be contacted,

as they may collect local water and aquatic indicators that are not widely published or accessible online.

In summary, the agencies will provide an update of the data obtained from a variety of reports, publications, and agency files and a preliminary analysis of what is known, what is not known, and the gaps of information that are required to fully assess the vulnerability of the Rainy—Lake of the Woods watershed to mining.

Brief Bio

Dr. Victoria Glenn Christensen is a research hydrologist with the Upper Midwest Water Science Centre of the USGS, who studies HABs, algal toxins, and cyanobacteria. She is a member of the Environmental Health Program's Algal Toxin Team and serves as the acting Communications Coordinator for the Water Mission Area.

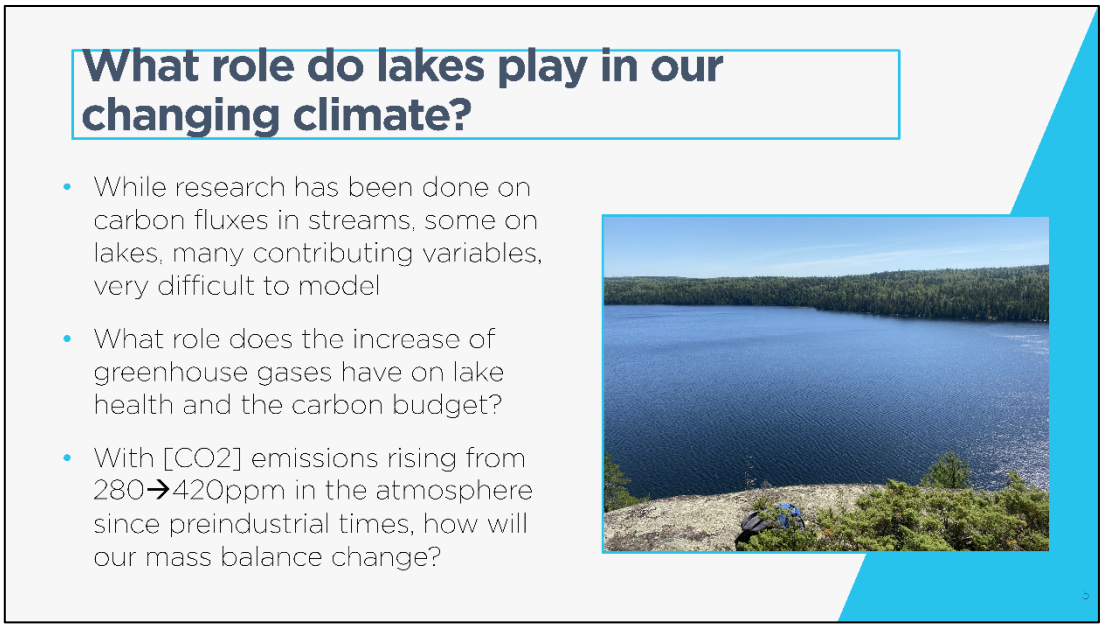
Location of Study

International Rainy – Lake of the Woods Watershed

Using a novel photoelectrochemical oxygen demand (peCOD) analyser to augment monitoring of greenhouse gas impacts on the dissolved carbon in boreal lakes

Blake Cooney[1,2], Robert Menegotto[3], Mark Hanson[2], Vince Palace[1]

[1]IISD Experimental Lakes Area;
[2]University of Manitoba; [3]MANTECH Inc



Abstract

Anthropogenic carbon outputs are an important consideration in limnology. As atmospheric monitoring of greenhouse gases continues, the impact of the changing atmosphere on freshwater is an important parameter to study. Questions surrounding the carbon budget of boreal lakes are complex and continued monitoring as environmental modelling improves is necessary. At the IISD-Experimental Lakes Area in Northwestern Ontario, we are implementing photoelectrochemical oxygen demand (peCOD) analysis into routine carbon monitoring. PeCOD analysis has shown a strong correlation with dissolved organic carbon (DOC) in several boreal lakes with varying DOC compositions and concentrations. The understanding of the transfer of terrestrial DOC to aquatic systems is evolving and peCOD analysis may offer a useful insight into the nature of carbon being transferred. Furthermore, peCOD analysis is a convenient tool for rapid analysis of organic carbon and delivers a more nuanced interpretation of the health of aquatic ecosystems in the boreal region. While we already use peCOD analysis to inform experiments involving organic contaminants, we are expanding its use to target long-term ecological effects on boreal lakes from increased carbon in the atmosphere.

Brief Bio

I am a chemist at the IISD Experimental Lakes Area, currently pursuing an M.Sc. through IISD-ELA Head Scientist Vince Palace, co-supervised by Mark Hanson at the University of Manitoba. I am going on my 6th year at IISD-ELA, starting as a student in 2018. While all limnology is certainly of interest, most of my research has been geared towards integrating environmental analytical chemistry with long-term monitoring and short-term contaminant detection in boreal lakes, with remediation of affected areas a constant consideration. I am an avid outdoorsman and enjoyer of our wonderful region!

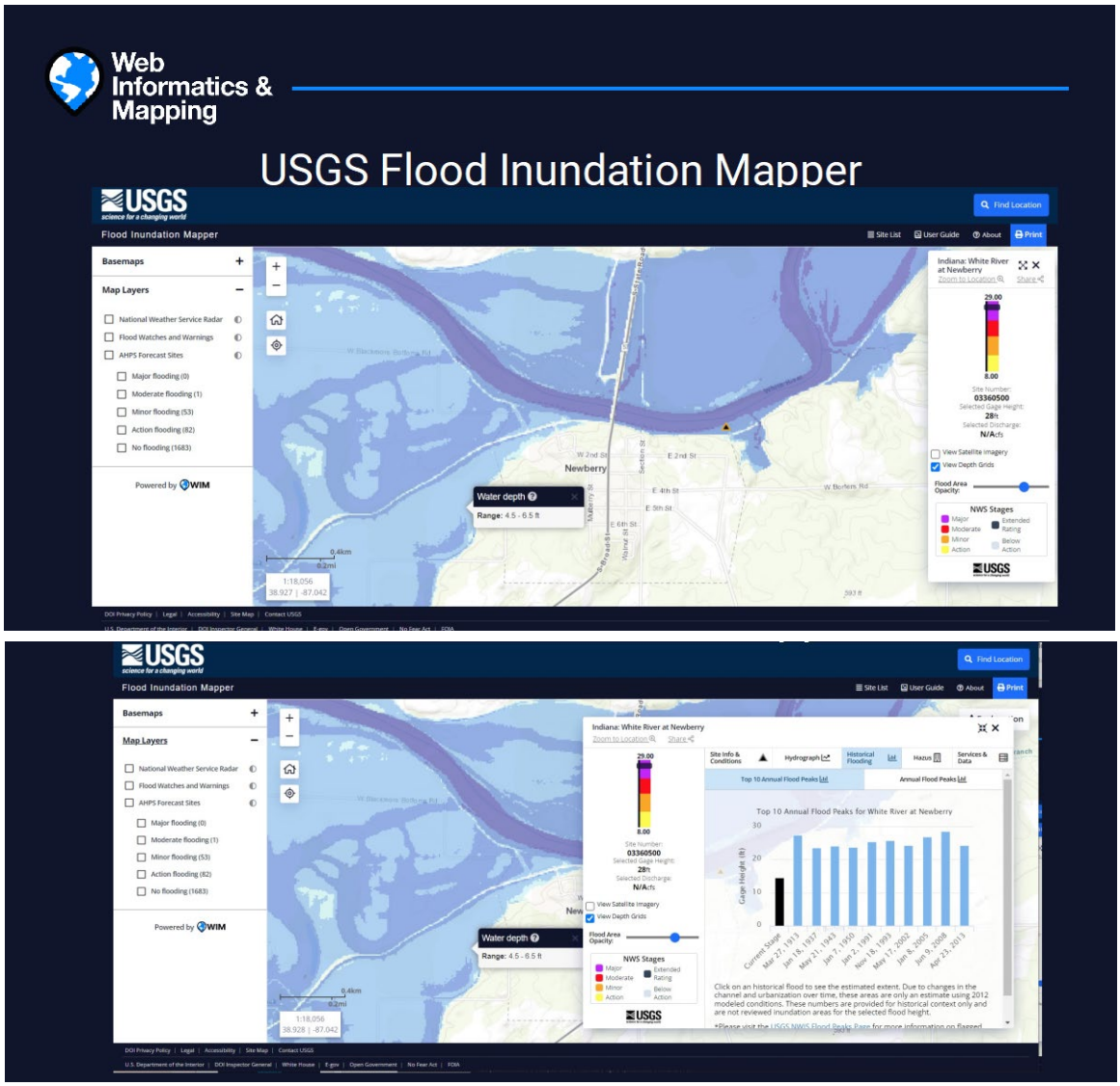
Location of Study

Across the IISD-Experimental Lakes Area on several lakes

Hydrologic mapping tool for Rainy Lake, Namakan Reservoir, and Rainy River to support adaptive management of lake levels and USGS Web Informatics & Mapping Team web application capabilities

Julia Prokopec[1] and Nick Estes[1]

[1]USGS Upper Midwest Water Science Center (UMid) Web Informatics & Mapping (WIM), 2280 Woodale Dr, Mounds View, MN 55112 Jprokopec@usgs.gov



Abstract

The US Geological Survey (USGS) Web Informatics and Mapping Team (WIM) in cooperation with the International Joint Commission (IJC) is tasked to create a Hydrologic Visualization Tool web application for Rainy Lake, Namakan Reservoir, and Rainy River in support of adaptive management of lake levels. This effort will provide a tool to assist the IRLWWB and its committees in assessing lake level management scenario modeling output showing performance of existing and alternate rule curves. The tool will built off of the hydrologic response models and digital elevation models completed for Rainy Lake, Namakan Reservoir, and Rainy River as part of the Plan of Study for the Evaluation of the International Joint Commission (IJC) 2000 Order for Rainy and Namakan Lakes and Rainy River (Kallemeyn et al., 2009). This project will also enhance and add benefit to a flooding and ice damage project completed through that plan of

study and the associated performance indicator that was used in the review of the 2000 Rule Curves.

Web Informatics and Mapping (WIM) develops web-based tools that support USGS science and other federal science initiatives. Our projects range from full-featured database applications to limited-scope data visualizations. WIM team members combine collective expertise in cartography, science, and web technology to create custom products that are practical, intuitive, and focused on our cooperators' needs. Our work includes digital cartography, data visualization, data management, data analysis, and decision support. All of our applications are created with the latest web technology, including Angular and ArcGIS. You can view the code for our public projects on our GitHub at **github.com/USGS-WIM.**

Brief Bio

Julia Prokopec is a hydrologist, project manager, and USGS Water Mission Area liaison for WIM. She received her B.S. in Environmental Studies with an emphasis in Geohydrology from Bemidji State. Julia has worked on projects studying groundwater and surface water interaction, persistence of pesticides in groundwater and surface water, and water quality monitoring. Her focus is hydraulic modeling and flood-inundation mapping where she has led studies to be used by communities for hazard mitigation.

Location of Study

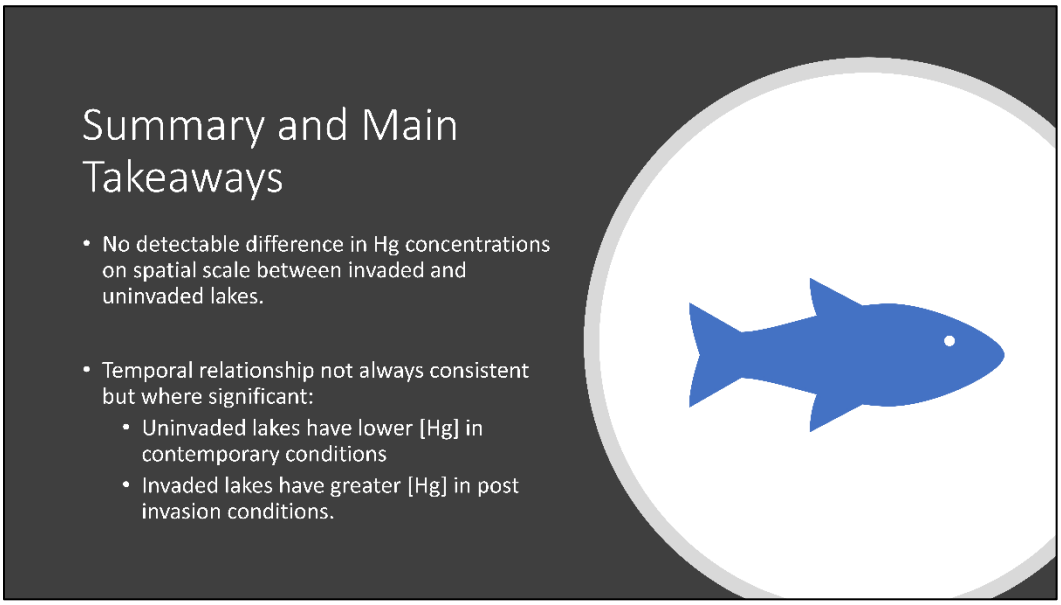
Rainy Lake, Namakan Reservoir, and Rainy River

Session 6 – Ecology & Biodiversity

Impacts of invasive spiny water flea (*Bythotrephes cederstroemi*) on mercury accumulation in Northern Ontario walleye

James B. Wood[1*] and Michael Rennie[1]

[1]Lakehead University (jbwood@lakeheadu.ca)



Abstract

Invasive species pose significant threats to aquatic biodiversity. The spiny water flea (*Bythotrephes cederstroemi*) has been investigated for its role in damaging zooplankton communities and its potential impact on contaminant accumulation in sportfish. This study aims to assess the impacts of *Bythotrephes* on the size-mercury (Hg) relationship in walleye by (a) comparing the size-Hg relationship of walleye in lakes invaded by *Bythotrephes* against lakes that are uninvaded for the same time, and (b) comparing the size-Hg relationship of walleye in lakes with sufficient data both before and after *Bythotrephes* invasions. Preliminary findings indicate no significant differentiation in the size-Hg relationship between invaded and uninvaded lakes, but significant differences between pre and post invasion size-Hg relationships in walleye. The greatest differences observed before and after *Bythotrephes* invasion were in Pickerel Lake and Namakan Lake, which were among the most data rich ecosystems available for evaluation. By contrast, no significant difference in the size-Hg relationship over time was detected in uninvaded lakes, indicating that in the absence of *Bythotrephes* invasion, the size-Hg relationship in Walleye regionally should be relatively stable. These preliminary results suggest that there is some effect of *Bythotrephes* invasions on the accumulation of mercury in walleye on a temporal scale, but that between-lake differences are large enough to obscure any potential differences between invaded and non-invaded lakes. Further examination of this potential effect includes conducting temporal analysis on additional lakes and refining the spatial comparison to account for more individual waterbody variation. Additional planned analyses that may inform the cause of this relationship include: The examination of biomagnification slopes that might reveal broader ecosystem changes related to the accumulation of contaminants, and the inclusion of a bioenergetics/mercury-mass-balance model that will show if walleye bioenergetics are significantly impacted by the presence of *Bythotrephes*.

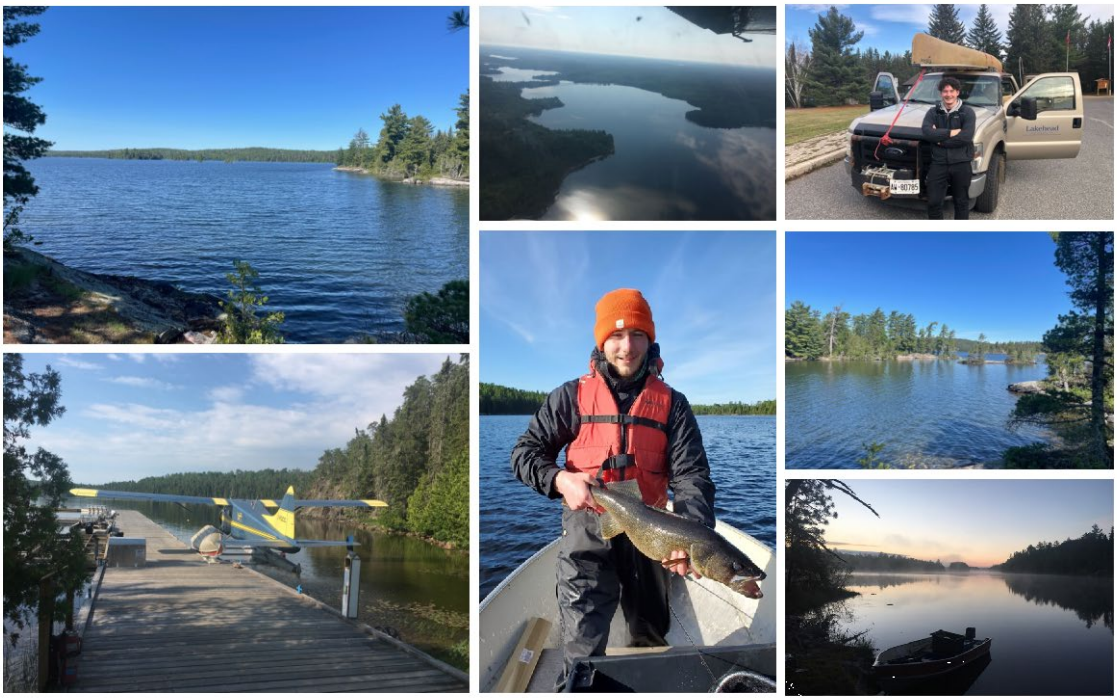
Brief Bio

James (Ben) Wood is a master's candidate currently writing his thesis at Lakehead University and is a current member of the Community Ecology and Energetics Lab (CEELab). His research is

primarily focused on Quetico Provincial Park where he has been collecting data for the last two summers. Before starting his master's, he had worked several seasons with the MNRF: Upper Great Lakes Management Unit. Ben graduated from Dalhousie University in 2021 with a bachelor's degree in Marine Biology and Environmental Science.

Location of Study

Quetico Provincial Park and Rainy River watershed



Community-based monitoring and Grand Council Treaty #3 led monitoring

Michaela Novak and Chris Herc

Grand Council Treaty #3, Box 1720, Kenora ON, P9N 3X7. Michaela.Novak@treaty3.ca, Chris.Herc@treaty3.ca

Abstract

Grand Council Treaty #3 helps protect the traditional waters of the Anishinaabe peoples through environmental monitoring and a Community-Based Monitoring (CBM) program. Grand Council Treaty #3-led environmental monitoring occurs across the territory, where water chemistry and invasive species (including zebra mussel veligers, purple loosestrife, and phragmites) data are collected. The CBM program has been operational since 2018 to collect baseline data, develop monitoring across the territory, and prioritize youth engagement. The program has expanded in capacity-building and participating communities. Overall, the 2022 year for the CBM program and Grand Council-led monitoring has been considered a success, strengthening the objective to protect the traditional waters of the Anishinaabe peoples.

Brief Bio

Michaela Novak has recently earned a B.Sc. in Biology and Certificate in Indigenous Studies from Dalhousie University, where she focused her education on aquatic life and conservation through a holistic perspective. Currently, she is the environmental monitoring coordinator for Grand Council Treaty #3, completing community-based monitoring across Treaty #3 Territory.

Chris Herc is an Environmental Specialist with Territorial Planning Unit, Grand Council Treaty #3.

Location of Study

Caviar Lake, Dogpaw Lake, Eagle Lake, Island Lake, Kenora ON, Lake of the Woods, Lake Winnipeg, Laurenson's Creek, Rainy Lake, Rainy River, Wabigoon River, Winnipeg River.

Whose track is that? Interpreting animal sign in Voyageurs National Park to determine semi-aquatic mammal presence

Catherine Berrick[1], Steve Windels[1], Adam Ahlers[2]

[1]Voyageurs National Park, Voyageurs National Park, 360 Hwy 11 E, International Falls, MN 56649
catherine_berrick@nps.gov
[2]Kansas State University

Abstract

Invasive hybrid cattails (*Typha x. glauca*) dominate wetland vegetation communities throughout many lacustrine wetlands in Voyageurs National Park (VNP). Once established, hybrid cattail can form dense, monoculture stands which degrade habitat quality for many wetland plant and animal species. In 2016, VNP initiated the Voyageurs Wetland Restoration Project to restore wetlands and establish a monitoring program focused on several key indicator groups. As part of our restoration efforts, we are studying the relationship between hybrid cattail occurrence and habitat use by four semi-aquatic mammals. Track board and walking surveys each offer a non-invasive method to determine species-specific presence at sites. These surveys allow investigators to record observations of animal sign such as tracks, trails, scat, feeding piles, huts, and lodges. From 2016 to 2022, 39-71 wetland sites within VNP were surveyed for the presence of muskrat, mink, otter, and beaver each year. We present preliminary results documenting changes in semi-aquatic mammal use in response to restoration efforts.

Brief Bio

Cat is a Wildlife Technician at Voyageurs National Park. She previously worked as a wildlife and fisheries technician in Nebraska, Utah, Idaho, Washington, and Minnesota. She graduated from the University of Nebraska in 2019 with a BS in Fisheries and Wildlife and a BA in Spanish. She enjoys foraging, crafting, and exploring the woods in her free time.

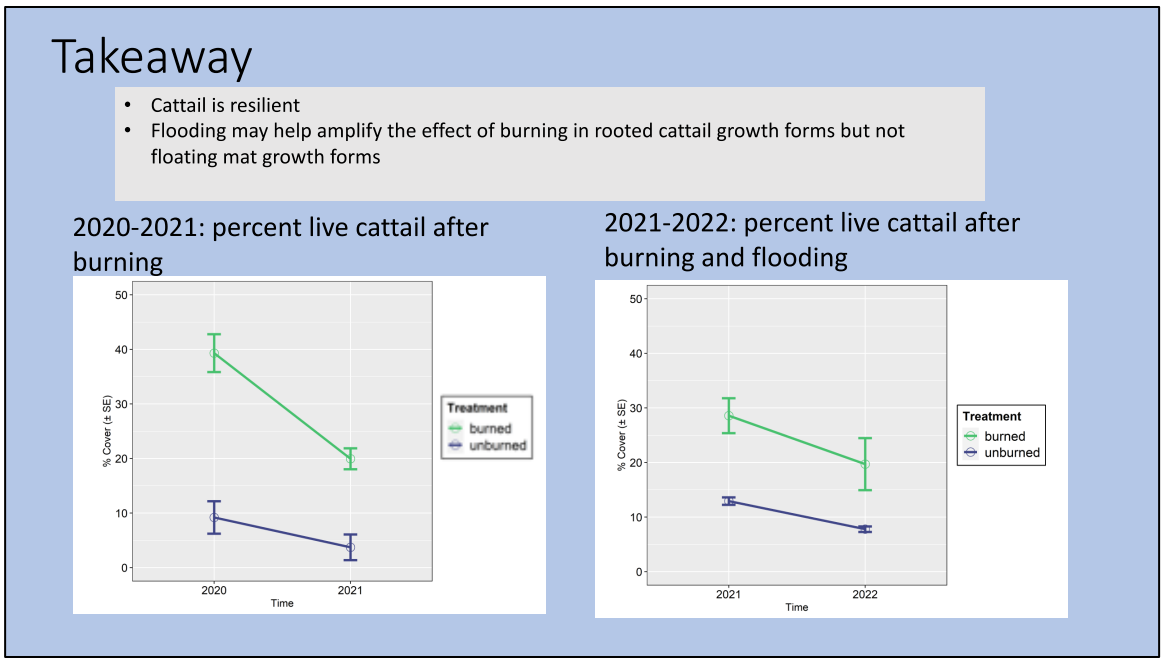
Location of Study

Voyageurs National Park (Rainy Lake, Kabetogama Lake)

The effect of prescribed fire and flooding on hybrid cattail at Voyageurs National Park

Erika Meints

Northern Michigan University and Voyageurs National Park



Abstract

Hybrid cattail is one of the most invasive plants in North America. The plant exhibits hybrid vigor and displaces native flora by rapidly forming dense monotypic stands that can break free from the substrate and form floating mats when established. The current, most successful management techniques use multiple methods to control the growth of hybrid cattail. Current research focuses mainly on populations of rooted hybrid cattail in shallow wetlands and there is little information on prescribed fire and flooding treatments impacts on floating mats. We looked at the effect of prescribed burning, flooding, and flooding following burning in rooted and floating cattail mats in Rainy and Kabetogama Lakes in Voyageurs National Park in northern Minnesota. We surveyed four wetlands that were burned in late winter of 2020-21, and six that were not burned. Pre-burn data was also collected for all ten wetlands. Pre-flooding data from other wetlands within The Park were used to compare and highlight the impacts of the historic flood of 2022 on hybrid cattail.

Brief Bio

Erika Meints is a M.S. candidate in the Biology Department at Northern Michigan University in Marquette, Michigan. She has worked as a Biological Science Technician for Voyageurs National Park for the past three summers. Erika's masters research is looking at the impact of prescribed fire and flooding on hybrid cattail in The Park.

Location of Study

Rainy and Kabetogama Lakes, Voyageurs National Park, Minnesota

Appendix A: Organizations Represented at the Forum

Anishinaabeg of Naongashiing

Bear River, Lake of the Woods

Bemidji State University

Citizens (unaffiliated)

Community Advisory Group IRLWWB

Cook County Coalition of Lake Associations

Consulate General of Canada in Minneapolis

Couchiching First Nation

Environment & Climate Change Canada

Global Affairs Canada

Grand Council Treaty #3

Holy Trinity Episcopal Church

Houston Engineering, Inc

IJC US Section

Independent Researcher

International Institute for Sustainable Development

International Institute for Sustainable Development - Experimental Lakes Area

International Rainy-Lake of the Woods Watershed Board

Itasca SWCD

Koochiching Soil and Water Conservation District

Lake of the Woods Control Board

Lake of the Woods County

Lake of the Woods District Stewardship Association

Lake of the Woods Soil and Water Conservation District

Lake of the Woods Water Sustainability Foundation

Lake Superior Watershed Conservancy

Lakehead University

Manitoba Environment Climate and Parks

Métis Nation of Ontario

Miette Environmental

Ontario Ministry of Natural Resources & Forestry

Minnesota Department of Natural Resources

Minnesota Department of Natural Resources - Fisheries

Minnesota North College - Rainy River campus

Minnesota Pollution Control Agency

National Parks Conservation Association

Nature Conservancy of Canada

North St. Louis Soil and Water Conservation District

Northern Michigan University

Office of MPP Dave Smithn (Peterborough–Kawartha)

Office of MPP Greg Rickford

Ontario Ministry of the Environment, Conservation and Parks

Packaging Corporation of America

Rainy Lake Conservancy

Red Lake Nation

RLB, Inc.

St. Cloud State University

St. Croix Watershed Research Station

State of Minnesota Board of Water and Soil Resources (BWSR)

Student - Thief River Falls

Trent University

U.S. Army Corps of Engineers

U.S. Consulate Winnipeg

U.S. Geological Survey

University of Minnesota

University of Minnesota Duluth

US EPA

Vermilion Lake Association

Voyageurs Conservancy

Voyageurs National Park

Wetlands Action Group

Appendix B: Meetings of Other Groups Co-located Around the Forum program

The following invitational meetings of collaborative groups occurred around the Forum program.

	Tuesday March 7	Room #	Wednesday March 8	Room #	Thursday March 9	Room #
8:00 AM	CLICK TO FIND REGIONAL ZOOM PHONE NUMBERS					
8:30 AM			IMA WG & IMA TAC meeting (8:30 - 10:30)	H118	FORUM SYMPOSIUM SESSIONS See separate daily 8:30 am - 4:45 pm Lunch: 11:50 am - 1:10 pm	Theater
9:00 AM	IMA TAC Core Monitoring (9:00 - 10:00)	H119				
9:30 AM						
10:00 AM	IAG meeting (10:00-11:30)	H118				
10:30 AM			Engagement Committee meeting (10:30-12:00)			
11:00 AM						
11:30 AM	CAG informal meeting (11:30 - 12:30)	H119				
12:00 PM			FORUM SYMPOSIUM SESSIONS See separate daily Schedules Lunch: 11:45am - 1 pm Talks: 1 pm - 4:40 pm	Theater		
12:30 PM	CAG/IAG/IRLWWB meeting (12:30 - 1:30)	S119				
1:00 PM						
1:30 PM	IRLWWB meeting (1:30 - 3:00)	S119				
2:00 PM						
2:30 PM						
3:00 PM						
3:30 PM						
4:00 PM	WLC & dam operators meeting (4:00 - 5:00)	H118				
4:30 PM						
5:00 PM			Travel to Thunderbird Lodge on Rainy Lake			
5:30 PM						
6:00 PM	IRLWWB Water Levels Committee public meeting (6:00 - 8:00)	Theater	Lake of the Woods Water Sustainability Foundation Reception & Dinner @ Thunderbird Lodge			
6:30 PM						
7:00 PM						
7:30 PM						
8:00 PM						
8:30 PM						
9:00 PM						
9:30 PM						

Acronyms

IJC	International Joint Commission
IRLWWB	IJC International Rainy-Lake of the Woods Watershed Board
CAG	Community Advisory Group to the IRLWWB
IAG	Industrial Advisory Group to the IRLWWB
WLC	Water Levels Committee of the IRLWWB
IMA WG	International Multi-Agency Arrangement Working Group (managers)
IMA TAC	International Multi-Agency Arrangement Technical Advisory Committee