

Volunteers with the Lake Winnipeg Community-Based Monitoring Network. *Photo by Paul Mutch.*

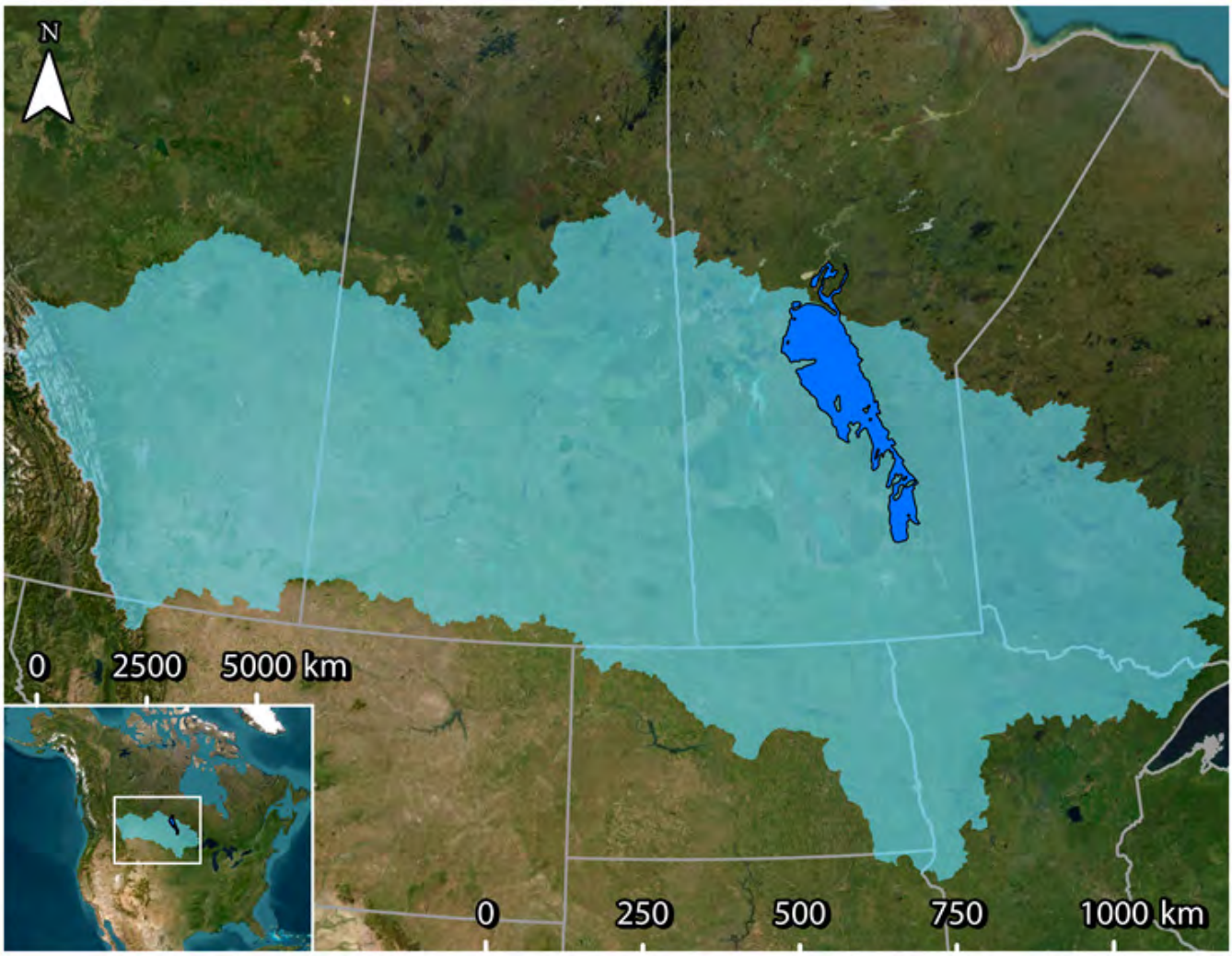
DATA FOR DECISION MAKING

The Lake Winnipeg Community-Based Monitoring Network

BY CHELSEA LOBSON

WHAT IF THE MOST POWERFUL data shaping water policy didn't come from satellites or sensors, but from people living in the watershed? In the Lake Winnipeg watershed, the Lake Winnipeg Community-Based Monitoring Network (LWCBMN) is a collaborative, long-term monitoring program designed to identify localized phosphorus hotspots across the Lake Winnipeg watershed. By partnering with watershed districts and community volunteers, LWCBMN generates high-resolution phosphorus data that complement and are interoperable with federal and provincial monitoring programs, strengthening the evidence base for water quality management and policy.

Over the past three decades, the interaction of climate change and land-use intensification has exacerbated algal blooms on Lake Winnipeg. Decades of whole-ecosystem research at the IISD Experimental Lakes Area have clearly demonstrated that to reduce algal blooms, we must first reduce the excess phosphorus entering the lake from its watershed.



Lake Winnipeg's watershed is one of the largest in the world, encompassing parts of four Canadian provinces and four U.S. states.

Lake Winnipeg's watershed (pictured above) is immense, stretching from the Rocky Mountains across the Prairies, into the Canadian Shield, and nearly to Thunder Bay, with portions extending into the Dakotas and Minnesota. Managing phosphorus runoff across such a vast and diverse landscape is complex, costly, and logistically challenging. To achieve meaningful water-quality improvements, phosphorus-reduction efforts must be strategic and evidence-based, prioritizing the largest sources of phosphorus and working systematically toward smaller contributors. Identifying and targeting phosphorus hotspots is therefore critical to improving Lake Winnipeg's health.

On the Prairies, spring snowmelt and increasingly severe summer storms account for a disproportionate share of annual phosphorus loading. If water samples are not collected responsively during these significant runoff events, phosphorus loads are typically underestimated. Accurately characterizing phosphorus loading requires frequent, spatially distributed, and responsive sampling. For a centrally located organization, mobilizing staff to sample more than 100 flow-metered sites across southern Manitoba immediately following storm events would be prohibitively resource intensive.

LWCBMN addresses this challenge through a community-based monitoring model that is inherently nimble and responsive. Volunteers and watershed partners live, work, or travel near sampling locations and can mobilize quickly during snowmelt, spring floods, and summer and fall storms—periods when runoff flushes phosphorus from the land into waterways (e.g., see hydrograph on following page). As a result, community-based monitoring is uniquely well-suited to identifying phosphorus hotspots within a large watershed and enabling targeted, cost-effective action.

Established in 2016, LWCBMN has now completed its 10th field season. The long-term continuity of the program captures interannual variability and provides the data needed to understand climate and land-use-driven changes in hydrology and phosphorus dynamics in the watershed.

With a decade of data now available, the network has identified persistent

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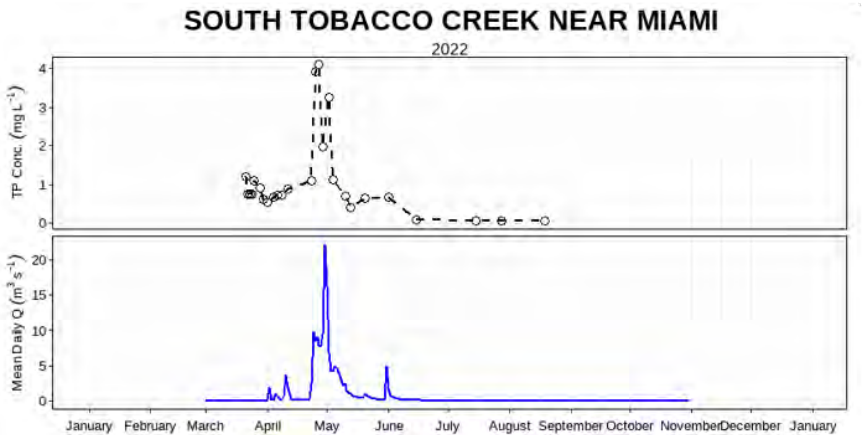
phosphorus hotspots—subwatersheds that consistently export higher amounts of phosphorus relative to others.

In wet years, elevated phosphorus concentrations combined with high flows result in greater phosphorus loads and exports. Phosphorus concentrations are also elevated during flood conditions, when water remains on surrounding landscapes for extended periods, allowing phosphorus bound in soils to dissolve into standing water. This process is especially pronounced in the flat landscapes of the Red River Valley, due south of Lake Winnipeg (see map at right).

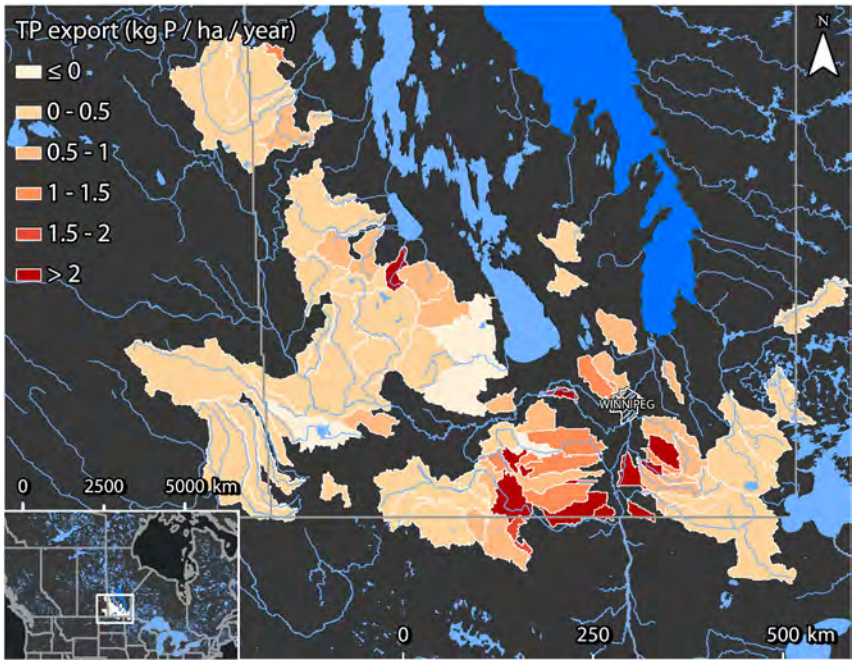
In contrast, dry years are characterized by low stream flows and correspondingly low phosphorus exports across most monitored regions. Some monitoring sites dry up entirely, resulting in substantially reduced phosphorus loading to Lake Winnipeg during those years.

LWCBMN was designed to generate data that inform management and policy decisions for Lake Winnipeg. Science advisors Mike Stainton (analytical chemist) and Greg McCullough (watershed hydrologist) recognized early on that phosphorus-reduction resources were often distributed broadly and inconsistently across the watershed. They identified the need for high-resolution empirical data to support a more targeted and effective approach.

As LWCBMN's dataset expanded, the network prioritized building trust with scientists, policy makers, and other stakeholders by demonstrating methodological rigor and transparency. All field and laboratory protocols are shared openly, the program participates in Proficiency Testing Canada's phosphorus program to ensure



Total phosphorus concentration and water flow (Q) at South Tobacco Creek near Miami, Manitoba, illustrating the flow-responsive sampling schedule.



Phosphorus export (kg/ha/y) from drainage areas sampled in 2022, LWCBMN's seventh field season.

analytical accuracy, and raw data are publicly accessible through Lake Winnipeg DataStream.

Today, LWCBMN data are being translated into action. Academic researchers, such as Darshani Kumaragamage (see sidebar), are using the data to guide studies of phosphorus runoff from agricultural landscapes, while watershed districts are leveraging the information to secure funding for targeted phosphorus-reduction projects. Most recently, the Canada Water Agency's Lake Winnipeg Freshwater Ecosystems Initiative combined LWCBMN data with federal SPARROW model outputs to identify priority areas for focused investment.

When stakeholders view phosphorus hotspot maps, the most common question is "What is driving the high phosphorus exports in these areas?" While LWCBMN data clearly identify where phosphorus is entering the system, they do not explain the underlying sources and mechanisms of phosphorus release. To address this gap, LWCBMN data are now being integrated with land-use data in a spatial correlation analysis aimed at identifying the drivers of elevated phosphorus exports.

Long-term monitoring programs are essential because they reveal patterns and trends that persist despite year-to-year variability. Within the Lake Winnipeg watershed, LWCBMN provides the empirical foundation for targeted phosphorus-reduction efforts, supporting both the prioritization of subwatersheds for intervention and the evaluation of management effectiveness over time.

This dataset exists because of the commitment of community volunteers and watershed partners who enable frequent and responsive sampling. As pressures from climate change and land-use continue to intensify, empowering people on the ground to generate trusted data will remain essential to protecting the health of Lake Winnipeg.

Chelsea Lobson is programs director at the Lake Winnipeg Foundation.



Installing snowmelt collection devices in farmers' fields. *Photo by Doug Goltz.*

Managing phosphorus for healthy soils and clear lakes

Phosphorus is a nutrient essential for crop production, but when excess phosphorus leaves the fields and reaches water bodies like Lake Winnipeg, it contributes to algal blooms and poor water quality. The main goal of our research is to reduce phosphorus loss from agricultural lands in the Red River Basin to protect Lake Winnipeg and other water bodies. This research is funded by the Canada Water Agency with partner contributions from the University of Winnipeg and the Lake Winnipeg Foundation and will be carried out in collaboration with Agriculture and Agri-Food Canada, University of Manitoba, the Lake Winnipeg Foundation, Environment and Climate Change Manitoba, and Seine Rat Roseau Watershed District.

In the Canadian Prairies, including the Red River Basin, most of the phosphorus runoff doesn't happen during rainfall, but during snowmelt. That's why our work specifically targets phosphorus loss in snowmelt runoff. Our previous research has shown that phosphorus loss from agricultural soils to snowmelt is highly variable across the region. We now aim to assess and map regions with excessive phosphorus loss via snowmelt in Manitoba's Red River Basin and facilitate more targeted management approaches to retain phosphorus in soil and reduce losses. For this research, we aim to collect 300–400 soil samples from fields with varying cropping and management histories over three years, focusing more on regions identified as phosphorus hotspots by the Lake Winnipeg Community-Based Monitoring Network. To date, we have contacted many farmers in the region who have shown strong support for the project by allowing us to take soil samples from their fields and letting us install snowmelt collection devices.

If we can reduce phosphorus loss from agricultural lands during snowmelt in the Red River Basin, we will keep more of the phosphorus on the land, where it is needed, and less amounts in the lakes, where it is not. That would be a win-win situation.

By Darshani Kumaragamage, University of Winnipeg, and Nelum Jayarathne and Inoka Amarakoon, University of Manitoba.