Managing cumulative effects in the Muskoka River Watershed: Monitoring, research and predictive modeling

Progress update
March 21st, 2013
CWN’s Consortium Approach

• Collectively address shared water management research priorities
• Focus on broad issues involving overlapping jurisdictions where no single agency or actor has the mandate, access to sufficient breadth of knowledge, or the ability to advance an issue individually.

• Includes:
  • Pathogens-in-Groundwater Research Consortium
  • Canadian Municipal Water Consortium
  • Secure Source Waters Consortium
  • Canadian Watershed Research Consortium
Goals of Canadian Watershed Research Consortium

(CWN’s perspective)

• To support each node to achieve and maintain a practical and implementable cumulative effects monitoring framework
  – Beyond the scope of simply implementing research projects
  – Beyond the timeline of the current CWN funding
Canadian Watershed Research Consortium

- Support for local efforts to design and use watershed-level frameworks for managing multiple stressors, and for assessing cumulative impacts

- Led by end users (i.e., including stakeholders and decision-makers within the watershed)
Canadian Watershed Research Consortium

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Muskoka River Watershed Consortium Node
• Stakeholders
  – Lead - District of Muskoka
  – Collaboration Partner - MOE Dorset Environmental Science Centre (DESC)
  – Others: University researchers, Lake associations, and Forestry interests (MNR/harvesting industries)
• End Users
  – Lake Associations – local stewardship programs
  – District of Muskoka – development planning
  – Consultants – development planning
  – DESC – Inland Lakes Research
priorities: initial stakeholder meeting

Median Ranking of Stressor Importance
(Rank of 1 = most important)

calcium
phosphorus
invasive species
climate change
acidification
development

Stressor

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Median</th>
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<td>25%-75%</td>
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Priorities: initial stakeholder meeting
Public Research Question

• Why, if phosphorus is declining, are we seeing more algae blooms and aquatic vegetation?
• What can I do to protect my lake from a decline in water quality?
The ‘Call for Proposals’ identified the need for:

- a monitoring program aimed at early detection of cumulative effects;

- (physical, chemical and biological) benchmarks against which lake and stream conditions can be assessed; and

- dynamic models that can be used to predict future impacts of multiple stressors

- improved integration of the science (research, monitoring) with watershed management (planning, development, stewardship and communication)
Our team (6 universities and 1 provincial agency)

Dr. Cathy Eimers (Trent University); Project Leader
Dr. Anurani Persaud (Trent University); Project Manager

Dr. Julian Aherne (Trent University)
Dr. John Bailey (Ont Min of the Env)
Dr. Peter Dillon (Trent University)
Dr. Joerg Grigull (York University)
Dr. John Gunn (Laurentian University)
Dr. Roland Hall (University of Waterloo)
Dr. April James (Nipissing University)
Chris Jones (Ont Min of the Env)
Dr. Andrew Paterson (Ont Min of the Env)
Dr. Murray Richardson (Carleton University)
Dr. Shaun Watmough (Trent University)
Dr. Jennifer Winter (Ont Min of the Env)
Dr. Norman Yan (York University)
Dr. Huaxia Yao (Ont Min of the Env)

4 Post-docs, 1 PhD, and 6 MSc students
Drivers and stressors
land-use change, resource extraction, acid deposition, climate change, ecosystem engineers (beavers, invasive species)

Physical regime
flow, ice cover, temperature, stratification, DO

Water quality
declining TP & Ca; increasing Cl

Effect on system
shifts in diversity, abundance, biomass, community composition, tolerant vs. sensitive species

Ecosystem services
Potable water; Public health
Recreation
Resource extraction
Cultural value; Intrinsic value
Flow regime
Our approach

Design of comprehensive monitoring program and conceptual model

Fill key knowledge gaps

Develop new tools for managing cumulative effects
Our approach

- Physical baselines of hydroclimatic assessment
- Drivers of declining P and rising DOC
- Interactive effects of stressors on ecotoxilogical thresholds
- Harvesting intensities to sustain critical Ca levels
- Long-term changes in lake nutrient stoichiometry
- Geographic template for cumulative effects assessment
- Assessing and modeling cumulative effects on biological communities

- 11 unique projects in 9 research areas
- employing 4 post-docs and 7 graduate students
- Predictive models of algal bloom occurrence
- Evaluation and application of dynamic hydrological and water quality models
Our approach

- Geographic template for cumulative effects assessment
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The Issue

• we don’t yet know what constitutes a “normal” benthic invertebrate or attached algae communities in lakes and rivers of different types in Muskoka

• we don’t know which indices should be used in our assessments, because we don’t know which indices are most sensitive to stressors of interest to DMM

* Thanks to Colin Yates and the U of W crew
• there are clear mechanisms for translating this new science into monitoring and management tools – e.g., Muskoka Watershed Report Card
Our progress

- December, 2011 – research team first notified of funding
- January, 2012 – advertised student/PDF positions
- April, 2012 – first funding instalment received
- Spring, 2012 – Initiated detailed GIS mapping of watershed, and created study design for biomonitoring projects
- Summer, 2012 – fieldwork for some projects
- September, 2012 – start date for three of the projects
- January, 2013 – presentation at CWN inter-node meeting in Saint John, NB
- April 22, 2013 - end user meeting
- May, 2013 - final project to begin
Communication is key

• regular meetings/discussions with consortium management committee and end-users
  – Dec. 21, 2011; Oct. 22, 2012; end-user meeting proposed for April, 2013

• updates to District of Muskoka Council

• targeted public presentations
  • e.g., A. Persaud’s presentation to the BLA AGM “Understanding Algal Blooms in Brandy Lake”. Port Carling Community Centre, August 25 2012

• annual (summer) public presentations in the watershed

• website – updated twice in the past 10 months
  http://www.muskokawaterweb.ca/lake-data/cwn/cwn-projects
Overview of Canada Water Network Project: Cumulative Effects, Muskoka River Watershed

Purpose:
1. Derive a conceptual model of multiple stressors and cumulative effects for the Muskoka River Watershed.
2. Evaluate physical, chemical, and biological stressors and response indicators, and characterize baseline conditions in the Muskoka River Watershed (underpinnings of a cumulative-effects monitoring program).
3. Model cumulative effects of multiple stressors.

Research Projects:
1. A systematic template for cumulative-effects assessment in the Muskoka River Watershed
   Richardson, Rachel Plowes (MSc student)
   - Classify lakes based on chemical and biological stressors to key stressors or indicators (Ca, P, DPC, IC)
   - Develop a lake typology system for the Muskoka River Watershed

Topics
- Canadian Water Network
  A collaborative monitoring program in the Muskoka River Watershed funded in part by the Canadian Water Network.
- CWN Research Team
  - Learn about the scientists carrying out the research.
- CWN Research Projects
  1. A systematic template for cumulative-effects assessment in the Muskoka River Watershed
  2. Assessing and modelling cumulative effects on biological communities
  3. Establishment of biological baselines in the Muskoka River Watershed and development of a diatom index for assessing lake and riverine health

http://www.muskokawaterweb.ca/lake-data/cwn/cwn-projects