

WORKSHOP PROCEEDINGS

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Aquatics Research: Knowledge Transfer Workshop

October 13, 2000
Boyle, Alberta

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**Aquatics Research: Knowledge Transfer Workshop
Boyle, AB
October 13, 2000**

organized by:
the Sustainable Forest Management Network

Workshop Proceedings

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Workshop Objectives

One of the main objectives of the workshop was to be a forum for knowledge transfer of recent aquatics research initiatives. The direct contact between foresters and some of Canada's premier water quality researchers provided an opportunity to discuss research results and proposed management solutions in light of current and future forest management frameworks and limitations.

Another objective of the workshop was to attempt to achieve some consensus on the key messages that can be drawn from recent research. For example, a discussion of the basis for water quality management in the boreal forest as well as potential indicators of water quality and management.

A third objective of the workshop was to set priorities for future research initiatives.

Several workshop participants discussed the objectives of the workshop from their own perspective. The results of this discussion can be summarized in the following few categories:

- ◆ Would like to work toward establishing tolerable limits of disturbance, defined based on predicted dose-response relationships of the % of the watershed harvested vs. key water quality variables.
- ◆ Interested in what is known in relation to riparian strategies, wildlife species diversity and water quality
- ◆ Would like to discuss what is known in terms of stand vs. landscape management in terms of water quality management.
- ◆ Would like to know the state of our knowledge of buffer strips and regulatory requirements
- ◆ Interested in lessons that can be learned for the development of large scale forest management experiments

Workshop Format

As well as presenting the key results to date, the workshop highlighted some of the water quality research planned for the future. Recent research results were presented in the morning. The afternoon was primarily spent discussing what we know and don't know about water quality and forestry in the boreal forest. The results of this discussion were a consensus of the key water quality variables that should be considered by forest managers and addressed in future research, and any other issues related to priorities for future research initiatives.

The basis for water quality management in the context of logging, buffer strips and natural disturbance

The workshop addressed several issues related to the basis of water quality management. This discussion focused on: 1) The development of indicators for water quality; 2) issues related to scale; 3) the potential for coarse filter, disturbance-based approaches to water quality management; 4) the state of our knowledge in relation to buffer strips.

Developing Indicators for surface water management

Workshop participants discussed how to develop water quality indicators, in the context of the forest management systems that industry currently uses. In establishing indicators in results based management systems, it is important to establish both the key water quality variables that should be assessed, and associated variables that could be indicators of the key water quality variables. The key water quality variables are primarily those that when above certain concentrations, result in changes to water quality that are of concern for one reason or another (e.g. concentrations of Mercury and the consumption of sport fish). Key water quality variables discussed by workshop participants included those on the following list.

Key Water Quality Variables

- ◆ Phosphorous
- ◆ Nitrogen
- ◆ Carbon
- ◆ Suspended sediments
- ◆ Runoff
- ◆ Flow
- ◆ Bio-indicators
- ◆ Contaminants
- ◆ Coloured Dissolved Organic Carbon
- ◆ Mercury
- ◆ Temperature

Of equal interest are the list of associated variables that hold some promise as indicators, or that should be directly assessed in future research. It was generally agreed that the choice and evaluation of these associated variables should ideally be such that they can be easily measured, and can be easily adopted by forest managers. Some of the associated variables that should be considered in efforts to design water quality management systems include:

- ◆ Watershed size
- ◆ % harvest by watershed area
- ◆ stream classification
- ◆ lake type/depth
- ◆ proportion of wetland and classification
- ◆ hydrological modifiers
- ◆ the presence/absence of buffers
- ◆ disturbance pulse frequency
- ◆ the amount of partial retention
- ◆ other factors related to spatial patterns
- ◆ species composition
- ◆ disturbance severity

Issues related to scale - Relative watershed size and the Percent harvest in the watershed

Watersheds are an important consideration for forest water quality management. The research from the east¹, and west² has suggested that the impacts of forest disturbance should be assessed based on the watershed. Because the rate of disturbance plays a major role in water quality changes, the % of a watershed that is harvested has emerged as a key indicator variable. It was suggested that, in the boreal shield of the east, 30% serves as tentative threshold for indicating when forest harvesting or forest fires will have a significant impact on water quality. Further, it was acknowledged that the effects of disturbance varies depending on the scale of the watershed. When taking into account the likelihood of 30% or greater rate of harvest, it is far more likely that there will be significant impacts in smaller watersheds than larger ones, as it is much more likely to have greater than 30% of a smaller watershed logged.

The potential for coarse filter, disturbance-based approaches to water quality management

An important product of the workshop discussion was the question as to whether we can use coarse-filter, disturbance based approaches to water quality. One framework for assessing this type of approach was suggested in light of conditions related to the characteristics of disturbance types, scale issues, and the realities of water resource use. Specifically, the use of a coarse-filter approach would be based on whether the following three conditions held:

- ◆ Impacts from natural disturbance = Impacts from logging (i.e. does all disturbance from logging come from areas that would otherwise burn – are they compensatory, or are their effects in part cumulative?)
- ◆ There are no other conflicting uses of water resources (e.g. recreation, other industrial activities, etc.)
- ◆ The two types of disturbances operate at the same scale

While there still remains some uncertainty when assessing the details of each of these three conditions, and there is some likelihood of significant regional differences, some consensus can be reached in the following areas:

1. There are some differential impacts between fire and logging, at least over the short term.
 - ◆ In the east: coloured dissolved organic carbon (CDOC); Mercury; NO₃, SO₄
 - ◆ Perhaps also nitrates, toxins

¹ e.g. SFM Network Publication: 2000-32. Comparative impacts of fire and forest harvesting on water quality in boreal shield lakes. Richard Carignan, Pierre D'Arcy, and Sébastien Lamontagne

² e.g. Prepas, E.E., B. Pinel-Alloul, D. Planas, G. Méthot, S. Paquet & S. Reedyk. In Press. Forest harvest impacts on water quality and aquatic biota on the Boreal Plain: introduction to the TROLS lake program. *Canadian Journal of Fisheries and Aquatic Sciences*. 40 pgs., 8 figs., 4 tabs.

2. Even under the most optimistic scenarios of fire suppression, logging will in part be additive (cumulative)'
3. Most of the boreal forest is increasingly subject to conflicting uses of water resources.

As a result of this discussion, the use of a coarse-filter, disturbance-based approach was generally seen to have significant limitations as a water quality management tool. Further, the fact that logging and fire are likely at least partly additive, suggests that we need to establish how they are different and attempt to minimize the differences between logging and fire.

The variables that should be considered in attempting to minimize the differences would be similar to those discussed above as key water quality variables. These variables were discussed in light of recent aquatics research involving the SFM Network. While it was acknowledged that there are likely to be difference between the variables of interest in the boreal shield and the boreal plains, the following variables were proposed as a starting point in attempts to understand and minimize differences between disturbance types:

- ◆ Runoff
- ◆ Nitrogen Species
- ◆ Phosphorous
- ◆ Carbon
- ◆ CDOC
- ◆ Mercury
- ◆ Suspended Sediments

The state of our knowledge in relation to buffer strips

There was considerable interest by workshop participants in evaluating the function of buffer strips in water quality management. There was general agreement, that linear strips such as buffer strips are not associated with natural disturbance. Buffer strips were acknowledged to provide constancy in an otherwise dynamic system. Further, it was generally recognized that buffer strips are unlikely to accomplish many of the water quality, flow and sedimentation expectations. It was suggested that buffers may provide some protection from sedimentation and potentially affect temperature both positively and negatively. Finally, despite the fact that buffers remain a pervasive component of water quality management, it was generally agreed that there is little evidence of the effects of buffer strips on water quality.

Priorities for Aquatics Research

The discussion in the workshop considered several aspects of aquatics research for the future. The general viewpoint of workshop participants was that better integration of aquatics research across disciplines and between researchers and forest managers is crucial to the development of effective water quality management tools. While recent research has contributed significantly to our knowledge of aquatics systems, more and different data are required to answer important questions about large and small lakes, riparian differences, wetlands, and stream management. More specific priority areas for future aquatics research included:

- ◆ Further establishing the differential impacts of burnt watersheds and logged watersheds in relation to reference (undisturbed) watersheds. It was also recognized that collaboration between forest managers and researchers is vital from the planning stages of major aquatic research initiatives.
- ◆ Research over the range of natural disturbance (e.g. 15%-30%, up to 90%) that was more fully integrated.
- ◆ Research on disturbance levels and water quality that is effectively integrated with hydrological modifiers (e.g. DBA/volume, landscape position, connectivity, substrate permeability).
- ◆ Recognition of the importance of establishing what role, if any, buffer strips play in water quality management
- ◆ Recognition of the need to assess the role of water quality management on terrestrial biota, and that aquatic attributes for water quality should be integrated with terrestrial requirements for biodiversity and harvesting.
- ◆ Research efforts directed toward understanding the role of wetlands in relation to water quality in the boreal forest
- ◆ The need to address pulsing frequency, partial retention, thinning, and species composition in relation to water quality management

What should happen in future aquatics workshops?

- ◆ The next workshop should include research result from western streams research, more detailed hydrological considerations and effects of water quality management on terrestrial biota.
- ◆ The next workshop should include the participation of Kevin DeVito.
- ◆ The next workshop should in part focus on moving from the state of our current knowledge to constructing an outline for future experimental design
- ◆ More provincial regulators and operations level foresters should be included in future workshops
- ◆ Future workshops should more involve more consultation between researchers and forest managers in order to allow for more communication and collaboration as to the workshop outcomes.

Participants

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Sustainable Forest Management Network and Other Publications

SFMN Working Papers

2000-8 (*Internal Publication)

Landscape variables influencing nutrients and phytoplankton communities in Boreal Plain lakes of northern Alberta: a comparison of wetland- and upland-dominated catchments

Ellie Prepas, Paul Dinsmore, Kirsten Wolfstein, Dolores Planas, Serge Paquet, Terry Prowse, John Gibson, Preston McEachern, Garry Scrimgeour, Bill Tonn, Cindy Paszkowski, Linda Halsey and Dale Vitt

1999-24 (* Internal Publication)

The forest fire induced impacts on phosphorus, nitrogen and chlorophyll a concentrations in boreal sub-arctic lakes of northern Alberta

P. McEachern, E.E. Prepas, John J. Gibson, and P. Dinsmore

SFMN Project Reports

2000-36 (*Internal Publication)

Impact of logging and natural fires on fish communities of Canadian Shield lakes

Pierre Magnan and Isabelle St-Onge

2000-32 (*Internal Publication)

Comparative impacts of fire and forest harvesting on water quality in boreal shield lakes

Richard Carignan, Pierre D'Arcy, and Sébastien Lamontagne

2000-29 (*Internal Publication)

Impacts of watershed disturbance on phytoplankton and periphyton communities

Dolores Planas, Serge Paquet and Mélanie Desrosiers

2000-23 (*Internal Publication)

Comparative impact of natural fires and forest logging on zooplankton communities of boreal lakes

Bernadette Pinel-Alloul and Alain Patoine

1999-38 (*Internal Publication)

Atténuation des impacts de la coupe forestière sur les lacs de la Haute-Mauricie

Richard Carignan, Bernadette Pinel-Alloul, Sébastien Lamontagne, Dolores Planas, Yves Prairie et Pierre Magnan

1999-37 (*Internal Publication)

Element export in runoff from eastern Canadian boreal shield drainage basins following forest harvesting and wildfires

Sébastien Lamontagne, Richard Carignan, Pierre D'Arcy, Yves T. Prairie, and David Paré

1999-36 (*Internal Publication)

Effects of wildlife and clear-cutting in the boreal forest on mercury in zooplankton and fish

Édenise Garcia and Richard Carignan

1999-35 (*Internal Publication)

Comparative impacts of fire and forest harvesting on water quality in boreal shield lakes

Richard Carignan, Pierre D'Arcy, and Sébastien Lamontagne

Journal Publications

Carignan, R. P. D'Arcy, and S. Lamontagne. 2000. Comparative impacts of fire and forest harvesting on water quality in Boreal Shield lakes *Canadian Journal of Fisheries and Aquatic Sciences*. Vol. 57 (S2): 105-117

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