

Knowledge Exchange Workshop

# Management of Aquatic Systems in Forested Landscapes



## Agenda

Winnipeg, Manitoba  
March 20-21, 2007

Holiday Inn Airport West  
2520 Portage Avenue

# Agenda

Theme: Management approaches for integrating riparian (stand) and watershed (landscape) level strategies into policy and practice for multiple-value management of aquatic systems in forest landscapes.

## Workshop Objectives

1. To provide an overview of the latest in forest watershed and riparian science from some of Canada's leading researchers.
2. To promote dialogue and discussion with presenters and participants on the challenges of managing aquatic systems in the boreal forest.
3. To share examples of alternative management strategies and pilot projects implemented by industry, government and non-government sectors in Manitoba and other provinces.

Workshop sponsored by:

SUSTAINABLE **FOREST**  
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**Manitoba** 



Canadian Institute of Forestry  
Institut forestier du Canada

This workshop is eligible for continuing education credits from the Canadian Institute of Forestry.

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## Day 1: Tuesday, March 20

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0730-0830 0830-0900	Registration and Continental Breakfast Opening Remarks <ul style="list-style-type: none"><li>• <i>Margaret Donnelly, Sustainable Forest Management Network</i></li><li>• <i>Fred Meier, Assistant Deputy Minister, Conservation Programs, Manitoba Conservation</i></li></ul>
0900-1015	Forest Aquatic Systems: State of the Science PLENARY SESSION  <i>Scaleable indicators of disturbance.</i> <ul style="list-style-type: none"><li>• <i>Jim Buttle, Trent University</i></li></ul> <i>Landscape-level watershed management frameworks.</i> <ul style="list-style-type: none"><li>• <i>Kevin Devito, University of Alberta</i></li></ul>
1015-1045	Coffee Break
1045-1200	<i>Landscape-scale modelling of hydrologic controls on lakes.</i> <ul style="list-style-type: none"><li>• <i>Gabor Sass, University of Western Ontario</i></li></ul> <i>Riparian areas: challenges and opportunities for sustainable forest management.</i> <ul style="list-style-type: none"><li>• <i>Julienne Morissette, Ducks Unlimited Canada</i></li></ul>
1200-1300	Lunch
1300-1445	Systems Approaches to Aquatic Management PLENARY SESSION  <i>A systems approach for the management of aquatic systems.</i> <ul style="list-style-type: none"><li>• <i>Slobodan Simonovic, University of Western Ontario</i></li></ul> <i>A decision support system for riparian management and shoreline forests.</i> <ul style="list-style-type: none"><li>• <i>Paul Sibley, University of Guelph</i></li></ul> <i>Manitoba guidelines policy development.</i> <ul style="list-style-type: none"><li>• <i>Phil Keenan, Manitoba Conservation</i></li></ul>
1445-1515	Coffee Break
1515-1630	Policy and Regulatory Approaches to Aquatic Management PLENARY SESSION  <i>Watershed management from the water quality perspective: the integration of research into regulatory practice in Alberta.</i> <ul style="list-style-type: none"><li>• <i>Preston McEachern, Alberta Environment</i></li></ul> <i>Current developments in forest riparian policy in Ontario.</i> <ul style="list-style-type: none"><li>• <i>Rob Mackereth, Ontario Ministry of Natural Resources</i></li></ul>
1630 - 1800	Mix and mingle. Cash bar. Appetizers will be provided.

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## Day 2: Wednesday, March 21

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- 0730-0830  
0830-0835 Registration and Continental Breakfast  
Welcome
- 0835-1015 Aquatic Management: Implementation and Case Studies  
PLENARY SESSION
- Towards improved forest operations planning based on wet areas mapping: examples from Manitoba, Alberta and the Maritimes.*
- Paul Arp, University of New Brunswick with contributions from JD Irving.
- Hydrological risk mapping: a working example in the boreal forest.*
- Sean Smyth, Ducks Unlimited Canada with contributions from Alberta-Pacific Forest Industries Ltd.
- Management of riparian zones in Newfoundland: results of operational trials.*
- Eric Young, Newfoundland Department of Natural Resources
- 1015-1045 Coffee Break
- 1045-1200 *Exploring the 30% harvest rule: research and implementation in eastern Manitoba.*
- Brian Kotak, Manitoba Model Forest and Vince Keenan, Tembec Industries Inc.
- Riparian birds and the role of buffers and other silvicultural treatments.*
- Keith Hobson, Environment Canada
- 1200-1300 Lunch and Guest Speaker
- Lake Winnipeg – where to from here?*
- Allan Kristofferson, Lake Winnipeg Research Consortium
- 1300-1430 Presented Poster Sessions  
THREE 30 MINUTE SESSIONS
- 1430-1500 Coffee Break
- 1500-1600 Aquatic Management: Implementation and Case Studies  
PLENARY SESSION
- Effects of harvest and road development on surface flow pathways and sediment transport rates.*
- Darren McCormick, Ontario Ministry of Natural Resources
- Integrated forest-watershed planning tools: case studies using the Equivalent Clearcut Area model.*
- Uldis Silins, University of Alberta and Kevin Bladon, Silvacom Ltd.
- 1600-1615 Wrap-up and Closing Remarks

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## Presented Poster Sessions

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These sessions will be similar to musical chairs for posters. In each session there will be several posters. The poster presenters stay with their posters and the audience moves every 25 minutes. Each speaker presents their poster 3 times for 25 minutes including questions and discussion, each time to a different audience of 10-15 people.

Delegates choose which poster they wish to start with, emphasizing that there is a desire to have the audience numbers balanced to a certain degree. Delegates will have the opportunity to hear and discuss 3 presentations during the 90-minute session.

### Presented Posters:

- A. *Bird community change in boreal plain riparian habitats in a before-and-after harvesting experiment in Duck Mountain, Manitoba.*
  - Kevin Kardynal, University of Saskatchewan
- B. *Environmental effects of selection logging in riparian reserves of boreal shield streams.*
  - David Kreutzweiser, Natural Resources Canada and Laurentian University
- C. *A watershed-based Boreal Conservation Partnership: a strategic and innovative approach to conservation and sustainable forest management.*
  - Chris Smith, Ducks Unlimited Canada and Donna Grassia, Louisiana Pacific Ltd.
- D. *Beavers and riparian zones in Canada's western boreal forest.*
  - Kathryn Martell, University of Alberta
- E. *Making a natural disturbance approach work in riparian zones.*
  - Dave Andison, Foothills Model Forest
- F. *Partial harvesting in buffer strips: effects on cavity-nesting birds.*
  - Heather Clarke, University of Alberta
- G. *The influence of culverts on small stream fish communities in northwestern Ontario.*
  - Eric Berglund, Ontario Ministry of Natural Resources
- H. *Dynamic catchment area of perched boreal wetlands: a new hydrologic landscape unit?*
  - Joe Riddell, University of Alberta
- I. *High-resolution wet-areas mapping for large forest areas in Manitoba (Duck Mountain Provincial Park) and northern Alberta.*
  - Jae Ogilvie, University of New Brunswick

### Silent Poster:

- J. *Forest bird responses to selection logging in riparian buffer strips.*
  - Stephen Holmes, Ken McIlwrick, and David Kreutzweiser, Natural Resources Canada

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## Poster Abstracts

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### POSTER A

#### **Bird Community Change in Boreal Plain Riparian Habitats in a Before-and-After Harvesting Experiment in Duck Mountain, Manitoba**

K.J. Kardynal<sup>1</sup>, J.L. Morissette<sup>2</sup>, K.A. Hobson<sup>1,3</sup>, and S.L. VanWilgenburg<sup>1,3</sup>

<sup>1</sup> University of Saskatchewan

<sup>2</sup> Ducks Unlimited Canada

<sup>3</sup> Environment Canada

Due to biotic and abiotic interactions between surrounding landscape elements, riparian areas are among the most structurally heterogeneous and productive habitats on the boreal landscape. Approximately 40% of bird species breeding in the Boreal Plains ecozone primarily use riparian habitats for nesting. Provincial management guidelines mandate the retention of forested buffer strips along riparian zones under the perceived notion that buffers maintain water quality, serve as migration corridors, act as visual barriers and are habitat for game species. Numerous studies have investigated the responses of 'upland' birds to various buffer retention strategies; however, little is known about the responses of birds using the non-forested portion of the riparian zone to these management approaches. We surveyed bird communities along the riparian interface of small (2-30ha) boreal wetlands one year pre-harvest and two years post-harvest to determine the response of birds using riparian habitats (forested and non-forested) to four treatments: 1) 0m buffer (0-20% retention; n=16); 2) 10m buffer with variable retention in the next 30m (20-50% retention; n=14); 3) 50m buffer (50-100% retention; n=18), and; 4) unharvested reference sites (n=19). Overall species richness declined in all treatments post-harvest except in reference sites whereas richness of riparian associated species did not appear to be affected by treatment type. Decreasing buffer widths caused greater change in abundance than treatments with higher retention for forest-dwelling species; but this was not the case riparian associated species. We make recommendations for management of riparian buffers that best maintain pre-harvest bird communities and discuss the trade-offs between retaining forested buffer strips with creating smaller patches of old-growth forest.

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### POSTER B

#### **Environmental Effects of Selection Logging in Riparian Reserves of Boreal Shield Streams**

David Kreutzweiser<sup>1,2</sup>, Scott Capell<sup>1</sup>, Kevin Good<sup>1</sup>, and Stephen Holmes<sup>1</sup>

<sup>1</sup>Canadian Forest Service, Natural Resources Canada, Sault Ste Marie, Ontario

<sup>2</sup>Laurentian University, Sudbury, Ontario

An inter-disciplinary, multi-agency field study is underway on the Boreal Shield near White River, Ontario, to investigate the environmental impacts of selection logging in riparian reserves of boreal forest streams. The overall objective is to determine if selection-based logging in riparian reserves can be conducted to improve riparian stand quality, increase habitat complexity, and partially offset declining wood supplies without causing harmful alterations to riparian or in-stream biotic communities. This poster summarizes a component of the study that is examining effects of the logging on stream habitat and invertebrate communities. Biotic and

physical characteristics of six low-order streams, three within clearcut watersheds across a gradient of selection logging in riparian reserves and three within undisturbed watersheds, are being measured over a three-year pre-logging and three-year post-logging study period. The study sites were established in 2001, three years of baseline data were collected in 2002-2004, and the riparian and upland logging was completed in February 2005. The post-logging assessment phase will consist of the field seasons of 2005-2007. This phase will examine the impacts of selection logging in riparian reserves on stream temperature regimes and cooling potential, organic matter processing rates, sediment and fine particulate organic matter deposition, and aquatic macroinvertebrate communities on standardized leaf packs. An auxiliary study is comparing leaf pack decomposition rates and macroinvertebrate communities among 9 recently logged and 11 undisturbed low-order watersheds to determine the effectiveness of standardized leaf packs as a bioassessment tool for detecting logging impacts, and to assess the efficacy of current forest harvesting guidelines as applied to low-order boreal watersheds for protecting stream biotic communities and processes. Sampling, sample processing, and data analyses are ongoing.

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## POSTER C

### **A Watershed-based Boreal Conservation Partnership: a strategic and innovative approach to conservation and sustainable forest management**

C.E. Smith<sup>1</sup>, E.Butterworth<sup>1</sup>, M. Donnelly<sup>2</sup>, D. Grassia<sup>3</sup> and J. Morissette<sup>1</sup>

<sup>1</sup>Ducks Unlimited Canada, Western Boreal Program

<sup>2</sup>Donnelly Ecological Consulting Services Inc.

<sup>3</sup>LP Canada Swan Valley Forest Resource Division

In 2005, Ducks Unlimited Canada, Western Boreal Program and LP Canada - Swan Valley Forest Resources Division established a 5 year partnership to ensure effective watershed-based conservation for LP's Forest Management License (FML)Area #3 located in west-central Manitoba. This poster will provide an overview of the Conservation Partnership between DU and LP which is based on the recognition that the conservation of boreal wetland systems is an important component of sustainable forest management. This partnership identifies several priorities related to watershed based conservation including strategic planning, research to develop best management practices, monitoring and evaluation, and knowledge exchange. We will collaborate on the development and implementation of research, inventory and monitoring projects related to water and biodiversity at multiple scales including: wetlands, riparian areas and watersheds. We will share information and research results to develop Best Management Practices (BMPs) based on this and other boreal research. These BMPs will then be applied and evaluated in the context of a pilot project. Finally, LP and DUC will also work together to promote sustainable private land forestry that maintains long-term forest cover and protects the integrity of watersheds, riparian habitats, water and wetlands. Throughout the life of the partnership, effective communication of key components of work undertaken will be promoted to internal and external audiences. Of particular importance will be knowledge exchange and information transfer to governments, industry and academic institutions to enhance the development and implementation of watershed-based approaches to forest management.

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## POSTER D

### Beavers and Riparian Zones in Canada's Western Boreal Forest

A Lee Foote<sup>1</sup>, Kathryn A Martell, and Nadele J Flynn.

<sup>1</sup> Department of Renewable Resources, University of Alberta, Edmonton AB Canada

Alberta's boreal mixedwood forest has seen intensifying industrial activity in the past several decades, with increasing and over-lapping impacts from logging and petroleum exploration and extraction. At the same time, populations of North American beaver (*Castor canadensis*) have been recovering from past near-extirpation and may be a keystone species structuring riparian vegetation along low-order streams in the region. In this study, we conducted studies at two geographical levels (1) detailed field surveys of six beaver dam sites on low-order streams in northeastern Alberta, including examined a 50-year chronosequence of air photos at each site, to quantify beavers' effects on riparian forests; and (2) GIS analyses of beaver dam placement, riparian zones, and road crossings at 1024 sites. This study showed that beaver activity increased the width and diversity of riparian zones along first- and second-order streams. Over the 50-year air photo time sequence, the number of dams increased considerably and beaver activity converted narrow, entirely lentic habitats to a mix of lentic and lotic. Dam abandonment and draining widened the riparian area and generated patches of meadow, shrub, and early-successional forest along the stream corridor.

Current forestry operating ground rules in Alberta require 30 – 60 m unharvested buffer strips on permanent streams. Around dams, beaver felling removed most or all *Populus* trees within 30 – 40 m of the pond edge. The abundance of dams and their tendency to be built in chains altered vegetation structure over long stretches of riparian corridors. Beavers thus could be removing forest cover from entire buffer strips in direct conflict with forest management objectives; conversely, a natural disturbance model of forest management could involve emulating these non-forest riparian patches. We argue that beavers may be the primary disturbance agent structuring riparian zones on low-order streams in the study area, and present several alternative (and perhaps controversial) forest management options instead of the 30 m unharvested riparian forest buffer currently prescribed. Secondly, we show an emerging, and complex, relationship between roads with culverts bisecting stream crossings and beaver dam placement/persistence.

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## POSTER E

### Making a Natural Disturbance Approach Work in Riparian Zones

Dave Andison

Foothills Model Forest

On the surface, the strategy of using natural disturbance patterns to guide forest management decisions seems to fall apart in riparian zones. Riparian zones are historically disturbed as often as upland sites, but harvesting is not necessarily the answer. Perhaps the question in this case was too simple. What if we instead asked: "*What is it about natural disturbance in riparian zones that is so (biologically) important?*" In the foothills of Alberta, the one answer that stands out is large woody debris (LWD). So what if we shifted our strategy slightly to focus on managing levels, types, sizes, and persistence of LWD using historical patterns as a guide?



Towards this new goal, we have initiated 1) focused research, 2) discussions with others, and 3) design of the resulting decision-support tools.

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## POSTER F

### **Partial Harvesting in Buffer Strips: Effects on Cavity-Nesting Birds**

Heather Clarke and Susan Hannon

Department of Renewable Resources, University of Alberta

In response to increased boreal harvesting across western Canada, and greater concern over resulting ecological effects, many forest companies are following a natural disturbance model. In mixedwood riparian forests, this is often carried out through partial harvesting of riparian buffers. Riparian forests provide important habitat for many bird species, including cavity-nesters. Compared to upland forests, they generally contain higher numbers of large, dead or dying, deciduous trees, snags, and downed woody material – all features required by cavity-nesters to meet nesting and foraging demands. Landscape context may also influence the quality of riparian habitat to cavity-nesters. This research aims to determine the effect of partial-harvesting in buffers, and of surrounding landscape features, on cavity-nesting birds. Preliminary results from 2006 data suggest an influence of the amount of forest retention on both individual species and overall community composition. Most species show an affinity toward either open or closed buffers. Future analyses will reveal the influence of other local composition features, retention configuration, and habitat features across the broader landscape. Results will have direct implications for future management and conservation plans that strive to maintain the integrity of natural riparian cavity-nesting bird communities.

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## POSTER G

### **The Influence of Culverts on Small Stream Fish Communities in Northwestern Ontario**

Eric Berglund

Centre for Northern Forest Ecosystem Research,  
Ontario Ministry of Natural Resources and Lakehead University

There is currently limited information on habitat fragmentation and the cumulative effects that culverts may have at the local and landscape level on fish communities in northwestern Ontario. Forty-three culvert sites on coldwater streams were sampled in 2004 northeast of Thunder Bay, Ontario to: (1) determine the extent to which culverts block or impede the movement of fish; and (2) to evaluate the relationships among patterns and responses of fish assemblages and functional groups to environmental and culvert variables. Species richness, relative abundance, biomass and density were significantly higher below culverts compared to above ( $p < 0.05$ ). On average, there were fewer, but larger brook trout captured above culverts compared to below, suggesting that stronger swimming individuals were able to move through culverts. The differences in habitat characteristics above and below culverts were marginal and unlikely to account for the variation in fish communities above and below. This suggests that differences in community assemblage above and below were the result of impeded movement rather than habitat differences. None of the culvert characteristics explained large amounts of variation in fish community. Although marginal, perched culverts and culverts not on stream bottom were most closely associated with differences in fish community above and below

culverts. Upstream catchment area appeared to be the single most important environmental variable structuring fish communities across the study area. The results from my study support the hypothesis that culverts limit the movement of certain fish species. However, due to the combination of local and landscape environmental influences, it would be difficult to predict the long term impacts of culverts across multiple scales based on culvert characteristics alone.

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## POSTER H

### **Dynamic Catchment Area of Perched Boreal Wetlands: A New Hydrologic Landscape Unit?**

Joe Riddell<sup>1\*</sup>, Carl Mendoza<sup>1</sup>, and Kevin Devito<sup>2</sup>

<sup>1</sup>Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB, T6G 2E3

<sup>2</sup>Department of Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9  
Presenting Author (jridell@ualberta.ca)

The hydrological processes sustaining perched wetlands above a regional groundwater flow divide in Northern Alberta were studied to aid in the development of a framework to assess their susceptibility to impact and disturbance. We characterized the hydrology of two perched wetlands and intervening uplands, separated from the regional water table by a thick unsaturated zone in heterogeneous glacial deposits. Instrumented transects, from a shallow pond and a peatland to their adjacent hillslopes, were used to quantify groundwater/surface water interaction and soil moisture regimes adjacent to and beneath the wetlands. Field data, including groundwater/surface water levels, soil storage/ tension, and atmospheric fluxes were used to determine a water budget, flow paths, and evaluate the sustainability of perched wetland/upland complexes.

Results indicate climate drives perched systems above a laterally extensive, low-permeability confining layer. The temporal distribution of precipitation and spatial distribution of available storage control dynamic catchment characteristics such as catchment area, and atmospheric flux redistribution. Isolation of perched wetlands from large-scale flow systems highlights the role of storage, evapotranspiration, interception loss, and lateral saturated/unsaturated fluxes of perched groundwater at wetland/upland interfaces as crucial water budget components. This delicate balance of climate, storage, vegetation, and basin morphology sustains both aquatic and surrounding forest ecosystems. This reveals vastly different hydrologic response characteristics relative to those observed in humid regions, and important distinctions as compared to depression focused recharge. The newly developed conceptual model will aid in the development of hydrologic response unit characteristics for perched wetland environments improving landscape scale modeling results.

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## POSTER I

### **High-Resolution Wet-Areas Mapping for Large Forest Areas in Manitoba (Duck Mountain Provincial Park) and Northern Alberta (Map Sheet 83P)**

Jae Ogilvie, Mark Castonguay, Paul Murphy, Fan-Rui Meng and Paul A. Arp

Faculty of Forestry and Environmental Management, University of New Brunswick,  
Fredericton, N.B., Canada E3B 5A3

The purpose of this 4-part poster is to present an application of the GIS-based wet-areas mapping process for the Duck Mountain Provincial Park, Manitoba, and part of Alpac's Forest Management Area, north of Edmonton, Alberta. This process involves a high-resolution delineation of all pertinent flow channels, all associated wet areas, and related depth-to-water underneath the soil surface adjacent to all digitally recognized surface water features (see below). At the basis of this is a digital elevation map (DEM), and the geo-referenced locations and boundaries of all open water features of the area, i.e., streams, rivers, lakes, ponds, potholes and pools.

**Part 1 and 2:** Wet-areas map and details for Duck Mountain Provincial Park, Manitoba;  
**Part 3:** Wet-areas map and details for Alpac's Forest Management Area (Map Sheet 83P);  
**Part 4:** Wet-areas mapping, principles and further developments.

**Acknowledgements:** Elston Dzus, Alpac; Margaret Donnelly, Donna Grassia and Steven Hills, LP; Chris Smith, Al Richard and Eric Butterworth, Ducks Unlimited; Rolland Gagnon and Gaetan Pelletier, JD Irving; Barry White, ASRD; SFMN, Nexfor-Bowater Forest Watershed Research Center, UNB.

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## POSTER J

### **Forest Bird Responses to Selection Logging in Riparian Buffer Strips**

Stephen Holmes, Ken McIlwrick, and David Kreuzweiser

Natural Resources Canada, Canadian Forest Service, 1219 Queen St. E.,  
Sault Ste. Marie, ON, Canada, P6A 2E5

In most North American jurisdictions, uncut forest strips are left along permanent streams during forest harvesting operations to protect riparian habitats. In Ontario, Canada, 30-90 m no-harvest riparian reserves are currently designated in silvicultural guidelines, but the effectiveness of these buffer zones in terms of protecting environmental values has not been rigorously tested. In 2001, we initiated a project in the boreal mixedwood forest zone of Ontario to (i) evaluate the existing riparian management guidelines, and (ii) determine whether partial harvesting within riparian reserves could be conducted in a way that is compatible with the environmental protection objectives of the guidelines. As part of this project, we collected data on songbird use of riparian and adjacent upland habitats in 3 harvested and 3 control blocks, during the breeding season (point counts) and during spring (transect counts) and fall (constant-effort mist-netting) migration. Early results (2-3 years post-harvest) suggest that songbird community composition is significantly altered, both during the breeding season and during migration, as a result of habitat changes caused by forest harvesting. The pattern of these changes is different between upland and riparian habitats.