



Ryan MacDonald, Ph.D., EP., A.Ag.
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Biography

Dr. MacDonald has been conducting research and working in the hydrological sciences for over eleven years. He is currently an independent consultant based in Cranbrook, B.C. and an Adjunct Assistant Professor at the University of Lethbridge. His work focuses on hydrological processes, modelling, and aquatic ecosystems. He has worked throughout western Canada and has an excellent understanding of key issues facing water resources in this region. He has conducted extensive work related to stream temperature in mountain environments and is interested in how thermal regimes affect aquatic organisms. He has been a lead modeller for multi-stakeholder collaborative modelling initiatives looking at large-scale water management in Alberta. Ryan has played a technical advisor role in the Columbia River Treaty Collaborative Modelling Work Group. He has also led several watershed-scale assessments looking at the interface between human land use, climate, and the natural environment, particularly focusing in British Columbia and Alberta. He led the Elk Valley Cumulative Effects Management Framework project for the ALCES Group, including the development of models and assessment of Valued Component response. His background in process-based hydrology, modelling, and interdisciplinary studies enables him to pursue research questions that can be applied in a practical management context.

Areas of Expertise

- Thorough knowledge of hydrological processes, particularly in mountain and foothill environments
- Development and implementation of hydrometric monitoring and field-based research programs
- Watershed Assessment, focusing on advanced techniques for quantifying hydrologic change
- Process-based hydrological modelling, including model development
- River system modelling, including reservoir operations, instream flows, economic, social, cultural, and environmental performance optimization
- Cumulative Effects Assessment, including the evaluation of environmental, social, and cultural values
- Multi-stakeholder engagement and collaborative modelling

Education

- Ph.D., Earth, Space, and Physical Science, University of Lethbridge, Lethbridge, AB - 2014
 - M.Sc., Geography, University of Lethbridge, Lethbridge, AB - 2009
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- B.Sc., Environmental Science, University of Lethbridge, Lethbridge, AB - 2005

Relevant Training and Recent Professional Development

- Articling Agrologist (A.Ag.) will obtain P.Ag. June 2018
- Environmental Professional (E.P., Water Specialization)
- WHIMIS (2016)
- ATV operator certificate (2016)
- WCB Occupational First Aid – Level 1/ Transportation Endorsement (2016)

Professional Experience and Service

- 2017 – present. Columbia Basin Trust Environmental Grants Committee, Cranbrook, BC
- 2014 – present. Adjunct Assistant Professor, University of Lethbridge, Lethbridge, AB
- 2013 – present. Hydrologist, MacDonald Hydrology Consultants Ltd., Cranbrook, BC
- 2012 – 2013. Sessional Instructor, University of Lethbridge, Lethbridge, AB
- 2006 – 2013. Graduate Student, University of Lethbridge, Lethbridge, AB
- 2001 – 2005. Hydrogeological Technician, Wiebe Environmental Services, Calgary, AB

Awards and Special Recognition

- University of Lethbridge Alumni Honors Society inductee (2016)
- Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarship (2011)
- Trout Unlimited Canada Coldwater Conservation Trust Fund recipient (2010)
- The Prairie Adaptive Research Collaborative (PARC) Graduate Scholarship (2009)
- The Queen Elizabeth II Graduate Scholarship (2009)
- The Alberta Profiling Award (2008)

Contributions to research and development

Articles published or submitted to refereed journals and books:

1. **MacDonald, R.J.**, Carlson, M., and Chernos, M. In prep. A multi-model approach for evaluating cumulative effects of land use and climate on streamflow indices in the Bow River Basin, Alberta, Canada. *Journal of Hydrology*.
2. Mirnasoudi, S., Byrne, J., **MacDonald, R.J.**, Johnson, D.J., Kroebel, R. Submitted. Climate change impacts on water supply and demand in an Okanagan-Similkameen Subwatershed, British Columbia, Canada. *Journal of Hydrology: Regional Studies*.
3. Mirnasoudi, S., Byrne, J., Johnson, D.J., Kroebel, R., **MacDonald, R.J.** Accepted. A novel time-effective model for daily distributed solar radiation estimates across variable terrain. *International Journal of Energy and Environmental Engineering*.

4. Chernos, M., **MacDonald, R.J.**, and Craig, J. 2017. Efficient semi-distributed hydrological modelling workflow for simulating streamflow and characterizing hydrologic processes. *Confluence: Journal of Watershed Science and Management*, Volume 1(3): doi: 10.22230/jwsm.2017v1n1a3.
5. Sauchyn, D.J., St-Jacques, J., Barrow, E., Nemeth, M., **MacDonald, R.J.**, Sheer, A.M., and Sheer, D.P. 2015. Adaptive Water Resource Planning in the South Saskatchewan River Basin: Use of Scenarios of Hydroclimatic Variability and Extremes. *Journal of the American Water Resources Association*. 1-19. DOI: 10.1111/1752-1688.12378
6. Byrne, J.M., Fagre, D., **MacDonald, R.J.**, and Muhlfeld, C. 2014. Climate Change and the Rocky Mountains. In: Grover V.I, Borsdorf A, Breuste J, Tiwari P.C, and Witkowski Frangetto F. (eds) *Impact of Global Change on Mountains: Responses and Adaptation*. CRC Press. 400 pp.
7. Wagner, M.J., Silins, U., Bladon, K.D., Williams, C.H.S., Boon, S., **MacDonald, R.J.**, Stone, M., Emelko, M.B., Martens, A.M., and Anderson, A. 2014. Catchment-scale stream temperature response to land disturbance by wildfire governed by surface-subsurface energy exchange and atmospheric controls. *Journal of Hydrology*. 519: 328-338.
8. **MacDonald, R.J.**, Boon, S., and Byrne, J.M. 2014. Process-based stream temperature modelling approach for mountain regions. *Journal of Hydrology*. 511: 920-931.
9. **MacDonald, R.J.**, Boon, S., Byrne, J.M, Robinson, M.R., and Rasmussen, J.B. 2014. Potential future climate effects on mountain hydrology, stream temperature, and native salmonid life history. *Canadian Journal of Fish and Aquatic Sciences*. DOI:10.1139/cjfas-2013-0221.
10. **MacDonald, R.J.**, Boon, S., Byrne, J.M, and Silins, U. 2014. A comparison of surface and subsurface controls on summer temperature in a headwater stream. *Hydrological Processes*. DOI:10.1002/hyp.9756
11. **MacDonald, R.J.**, Byrne, J.M., Boon, S., and Kienzle, S.W. 2012. Modelling the Potential Impacts of Climate Change on Snowpack in the North Saskatchewan River Watershed, Alberta. *Water Resources Management*. DOI: 10.1007/s11269-012-0016-2.
12. Kienzle, S.W., Nemeth, M.W., Byrne, J.M., and **MacDonald, R.J.** 2011. Simulating the hydrological impacts of climate change in the upper North Saskatchewan River basin, Alberta, Canada. *Journal of Hydrology*. DOI: 10.1016/j.jhydrol.2011.01.058.3
13. **MacDonald, R.J.**, Byrne, J.M., and Kienzle, S.W. 2010. The St. Mary's River. Chapter 14 In: Sauchyn, D.J., Diaz, H. and Kulsthrestha, S. (eds.) *The New Normal: The Canadian Prairies in a Changing Climate*. CPRC Press, Regina, SK. 7 pp.
14. **MacDonald, R.J.**, Byrne, J.M., Kienzle, S.W., and Larson, R. 2011. Assessing the potential impacts of climate change on snowpack in the St. Mary River watershed, Montana. *Journal of Hydrometeorology*. 12: 262-273.
15. **MacDonald, R.J.**, Byrne, J.M., and Kienzle, S.W. 2009. A physically based daily hydrometeorological model for complex mountain terrain. *Journal of Hydrometeorology*. 10: 1430-1446.

Selected non- refereed contributions:

1. **MacDonald, R.J.**, Chernos, M., and Cairns, D. 2018. Climate and hydrologic change assessment for the Fort Nelson Timber Supply Area. Prepared for: Canadian Forest Products Ltd. by MacDonald Hydrology Consultants Ltd. 39 pp.
2. Chernos, M., **MacDonald, R. J.**, and Marcotte, D. 2018. Victoria Creek Watershed Assessment. Prepared for Little Salmon Carmacks First Nation, by MacDonald Hydrology Consultants Ltd. 31 pp.
3. Chernos, M., Bonifacio, C., and **MacDonald, R.J.** 2017. Water Supply and Demand in Nansen and Victoria Creek, Yukon, Phase 1: Current Streamflow Regime and Range of Natural Variability. MacDonald Hydrology Consultants. Prepared for: Little Salmon Carmacks First Nation.
4. **MacDonald, R.J.**, Chernos, M., Cairns, D., and Marcotte, D. 2017. Hydrologic Assessment for Riparian Assessment Units (RAU). Prepared for: Canadian Forest Products Ltd. by MacDonald Hydrology Consultants Ltd. 26 pp.
5. **MacDonald, R.J.**, 2017. Luxor Watershed Assessment. Prepared for: Canadian Forest Products Ltd. by MacDonald Hydrology Consultants Ltd. 41 pp.
6. Alberta WaterSMART. 2017. ARB Initiative Interim Report 1. Produced by Alberta WaterSMART for Alberta Innovates, Calgary, Alberta, Canada. 146 pages. Available online at <http://www.albertawatersmart.com/>.
7. Alberta WaterSMART. 2017. Quantifying the effects of climate change and land use on streamflow and lake levels in the Lesser Slave Watershed. Produced by Alberta WaterSMART for the Lesser Slave Watershed Council. 36 pp.
8. Advice to Government on Water Management in the Bow River Basin. 2017. Prepared by Alberta WaterSMART. 226 pp.
9. Wilson, B., Straker, J., Carlson, M., and **MacDonald, R.J.** 2016. Adams River Watershed Cumulative Effects Scenario Assessment. Prepared for Adams Lake Indian Band.
10. **MacDonald, R.J.**, Chernos, M. 2016. Blaeberry Watershed Evaluation. Prepared for: Canadian Forest Products Ltd. by MacDonald Hydrology Consultants Ltd. 19 pp.
11. **MacDonald, R.J.**. 2016. Palliser Watershed Assessment. Prepared for Canadian Forest Products Ltd. 28 pp.
12. **MacDonald, R.J.**. and Cairns D. 2015. Phippen Watershed Assessment. Prepared for Canadian Forest Products Ltd. 14 pp.
13. St-Jacques, J.M., Sauchyn, D.J., Barrow, E., Nemeth, M.W., **MacDonald, R.J.**, Sheer, A.M., Sheer, D.P. 2015. Adaptive water resource planning in the South Saskatchewan River Basin: use of scenarios of hydroclimatic variability and extremes. 27th Pacific Climate Workshop, Pacific Grove, California.
14. Bow Basin Flood Mitigation and Watershed Management Project. 2014. Prepared by Alberta WaterSMART. 124 pp.
15. **MacDonald, R.J.**, and Robinson, M.D. 2014. Cabin Watershed Assessment. Prepared for Canadian Forest Products Ltd. 49 pp.

16. **MacDonald, R.J.**, and Robinson, M.D. 2014. Hogranch Watershed Assessment. Prepared for Canadian Forest Products Ltd. 40 pp.
17. **MacDonald, R.J.**, Anderson, A., Silins, U., and Craig, J. 2014. Applying physically representative watershed modelling to assess peak and low flow response to timber harvest: Application for watershed assessments. American Geophysical Fall Meeting, San Francisco, California, H51G-0690.
18. Barnes, C., Byrne, J., **MacDonald, R.J.**, Lewis, D. 2014. Elk River Watershed – Flood study. American Geophysical Fall Meeting, San Francisco, California, GC41B-0551.
19. Mirmasoudi, S., Byrne, J., **MacDonald, R.J.**, Lewis, D. 2014. High resolution modelling of crop response to climate change. American Geophysical Fall Meeting, San Francisco, California, GC41B-0553.
20. Byrne, J., **MacDonald, R.J.**, Cairns, D., Barnes, C., Mirmasoudi, S., and Lewis, D. 2014. Integrated resource management at a watershed scale (invited). American Geophysical Fall Meeting, San Francisco, California, H14B-05.
21. **MacDonald, R.J.**, Boon, S., Byrne, J.M., and Silins, U. 2013. Changes in snowmelt runoff timing: Potential implications for stream temperature and native salmonids. American Geophysical Fall Meeting, San Francisco, California, GC23C-0958.
22. **MacDonald, R. J.** and Robinson, M. D. 2013. Line Creek Stream Temperature and Dissolved Oxygen Assessment – Report. Prepared for Teck Coal Ltd. Prepared by Lotic Environmental Ltd.
23. Robinson, M.D., **MacDonald, R.J.**, Day, S., Swanson, J., and McPherson, S. 2013. Teck Coal Ltd – Calcite Monitoring Plan. Prepared for Teck Coal Ltd by Lotic Environmental Ltd, SRK Consulting Inc and Swanson Environmental Strategies Ltd.
24. Larson, R., **MacDonald, R.J.**, and Byrne, J.M. 2013. Historical Agreements and Future Climates: Water sharing challenges in the St. Mary/Milk Rivers. CWRA BC Branch Annual Conference, Vancouver, BC. March 5-7.
25. **MacDonald, R.J.**, Boon, S, and Byrne, J.M. 2013. Stream temperature response to environmental change. Western Division of the Canadian Association of Geographers. Annual Meeting. Lethbridge, Alberta. March 9.
26. **MacDonald, R.J.** 2013. Epistemic error and our understanding of stream temperature response to environmental change. Department of Geography invited seminar. Lethbridge, Alberta, January 18.
27. **MacDonald, R.J.**, Byrne, J.M., and Boon, S. 2012. Quantifying stream temperature response to environmental change in a groundwater-dominated catchment, Alberta. American Geophysical Fall Meeting, San Francisco, California, H53E-1578.
28. **MacDonald, R.J.**, Boon, S and Byrne, J.M. 2012. A comparison of surface and subsurface controls on summer stream temperature in a headwater drainage basin, Alberta. Canadian Geophysical Annual Meeting, Banff, Alberta, June 6.
29. **MacDonald, R.J.**, Boon, S and Byrne, J.M. 2012. A process perspective on stream temperature. Canadian Geophysical Hydrology Section Meeting, Saskatoon, Saskatchewan, April 10.

30. Robinson, M.D., and **MacDonald, R.J.** 2011. Elk River Fisheries Enhancement Program – October 2011 Enhancement Opportunities Report. Prepared for Teck Coal Ltd. and the Regional Fisheries Management Group. Prepared by Lotic Environmental Ltd.
31. **MacDonald, R.J.**, Boon, S, and Byrne, J.M. 2011. Using reach scale data to model stream temperature at the watershed scale. American Fisheries Society Annual Meeting. Seattle, Washington, September 7.
32. **MacDonald, R.J.**, Boon, S, and Byrne, J.M. 2010. Assessing stream temperature response to environmental change – modelling framework. GC51D-0787 AGU Fall meeting, San Francisco, California, Dec 13-17.
33. **MacDonald, R. J.**, Boon, S., and Byrne, J. M. 2010. Stream temperature response to environmental change: Field techniques and modelling concepts. MTCLIM biennial mountain climate conference, HJ Andrews Research Forest, Blue River, Oregon, June 1-10.
34. **MacDonald, R. J.**, Boon, S., and Byrne, J. M. 2010. Stream temperature response to environmental change: Background and methods. Canadian Geophysical Union, Hydrology section annual student meeting, Edmonton, Alberta, January 30.
35. **MacDonald, R. J.**, Townshend, I., and Byrne, J. M. 2010. Potential effects of climate change on the spatial characteristics of mountain hydrometeorology in the upper North Saskatchewan River watershed, Alberta. CWRA Alberta Branch Annual conference, Edmonton, Alberta, March 28-30.
36. Byrne, J. M., Booth, E., Dalla Vicenza, S., and **MacDonald, R. J.** 2010. Historical and future environmental change indices, Upper North Saskatchewan watershed, Alberta. CWRA Alberta Branch Annual conference, Edmonton March 28-30.
37. Nemeth, M. W., Kienzle, S. W., Byrne, J. M., and **MacDonald, R. J.** 2010. Verification of simulated hydrological processes using the ACRU Agro-hydrological modelling system in the Upper North Saskatchewan River watershed, Alberta. CWRA Alberta Branch Annual conference, Edmonton March 28-30.
38. Lapp, S., Sauchyn, D. J., Byrne, J. M., and **MacDonald, R. J.** 2010. Using a fine scale hydrometeorology model to develop paleoclimate, historical, and GCM based future scenarios of soil moisture indices. CWRA Alberta Branch Annual conference, Edmonton March 28-30.
39. **MacDonald, R.J.**, and Berzins, N. 2009. Upper Columbia River watershed hydrometric analysis – phase 1. Prepared for the Columbia Basin Trust. 72 pp.
40. Booth, E. J., Byrne, J. M., **MacDonald, R. J.**, and Kienzle, S. W. 2009. Analysis of historical changes in extreme temperature and precipitation in Western North America, *Eos Trans. AGU*, 90(52), Fall Meet. Suppl., Abstract GC21A- 0727.
41. **MacDonald, R. J.**, Byrne, J. M., and Kienzle, S. W. 2009. Testing the sensitivity of snowpack to climatic change in a large physiographically diverse watershed. Poster (international). *Eos Trans. AGU*, 90(52), Fall Meet. Suppl., Abstract GC21A-0733.
42. Byrne, J. M., **MacDonald, R. J.**, and Kienzle, S. W. 2009. Simulating hydrometeorological processes in large diverse watersheds. *Eos Trans. AGU*, 90(52), Fall Meet. Suppl., Abstract GC21A- 0732.

43. Byrne, J. M., **MacDonald, R. J.**, and Kienzle, S. W. 2008. The development of the GENESYS hydro meteorological model for mountain environments. *Eos Trans. AGU*, 89(53), Fall Meeting. Suppl., Abstract C21C-0567.
44. Byrne, J. M., Kienzle, S. W., and **MacDonald, R. J.** 2008. Modelling Detailed Hydrometeorological Surfaces and Runoff Response in Large Diverse Watersheds. CEATI, annual meeting, Montreal Quebec, October 8-9.
45. **MacDonald, R. J.**, Byrne, J. M., Kienzle, S. W., and Blair, D. 2008. Developing detailed hydroclimatic surfaces for the upper St. Mary watershed, Montana-Alberta., CIRMOUNT, MntClim annual meeting, Silverton Colorado, June 9-13.
46. **MacDonald, R. J.**, Byrne, J. M., and Kienzle, S. W. 2008. Assessing potential environmental change impacts in the St. Mary River watershed, Montana. *Eos Trans. AGU*, 89(53), Fall Meeting. Suppl., Abstract C21C-0569.
47. **MacDonald, R. J.**, Byrne, J. M., Kienzle, S.W., and Larson, R. 2007. Deriving high resolution historical and future climate databases for mountain environments. *Eos Trans. AGU*, 88(52), Fall Meeting. Suppl., Abstract GC31C-04.
48. Forbes, K., Larson, R., **MacDonald, R. J.**, Axelson, J., Kienzle, S. W., Byrne, J., and Sauchyn, D. 2006. Water resources risk assessment for Alberta watersheds under paleo, present, and future climate conditions: Four groundwork-laying projects.. Alberta Ingenuity Center for Water Research. Fall meeting, Edmonton Alberta, November 10-12.