

# Prairie Water Problems.

Water is an important topic in Manitoba but to date it has been difficult to accurately predict how much water will occur in any one place at a given time. Historically, theoreticians in hydrology have mostly avoided dealing with flat regions such as the Prairies; when your first scientific principle is that water flows downhill, it is natural to discard mountain-free regions as simple exceptions to the rule. This then explains why most commercial hydrological models fail to provide accurate runoff predictions when applied to Manitoba, as they were designed to simulate water movement over sloping terrain. In the wake of water disasters such as the 2011 or 2014 Manitoba floods, public criticism was largely directed towards those responsible for predicting the onset of extreme river flows and managing

emergency situations. **Dr. Genevieve Ali** (Junior Chair, Watershed Systems Research Program, Department of Geological Sciences and the Centre for Earth Observation Science (CEOS)) however argues that most of the uncertainty associated with flood prediction and management comes from a lack understanding of Prairie hydrology. Putting it simply, the trivial question that hydrologists face is “*how do meltwater and rainwater move over Prairie landscapes?*” The present-day answer is “*we do not really know*”. In the meantime, the commercial models that Prairie hydrologists rely on do a poor job simulating not only water infiltration into frozen soil but also river ice jamming that leads to early spring flooding, water storage in wetland depressions, and subsurface runoff.

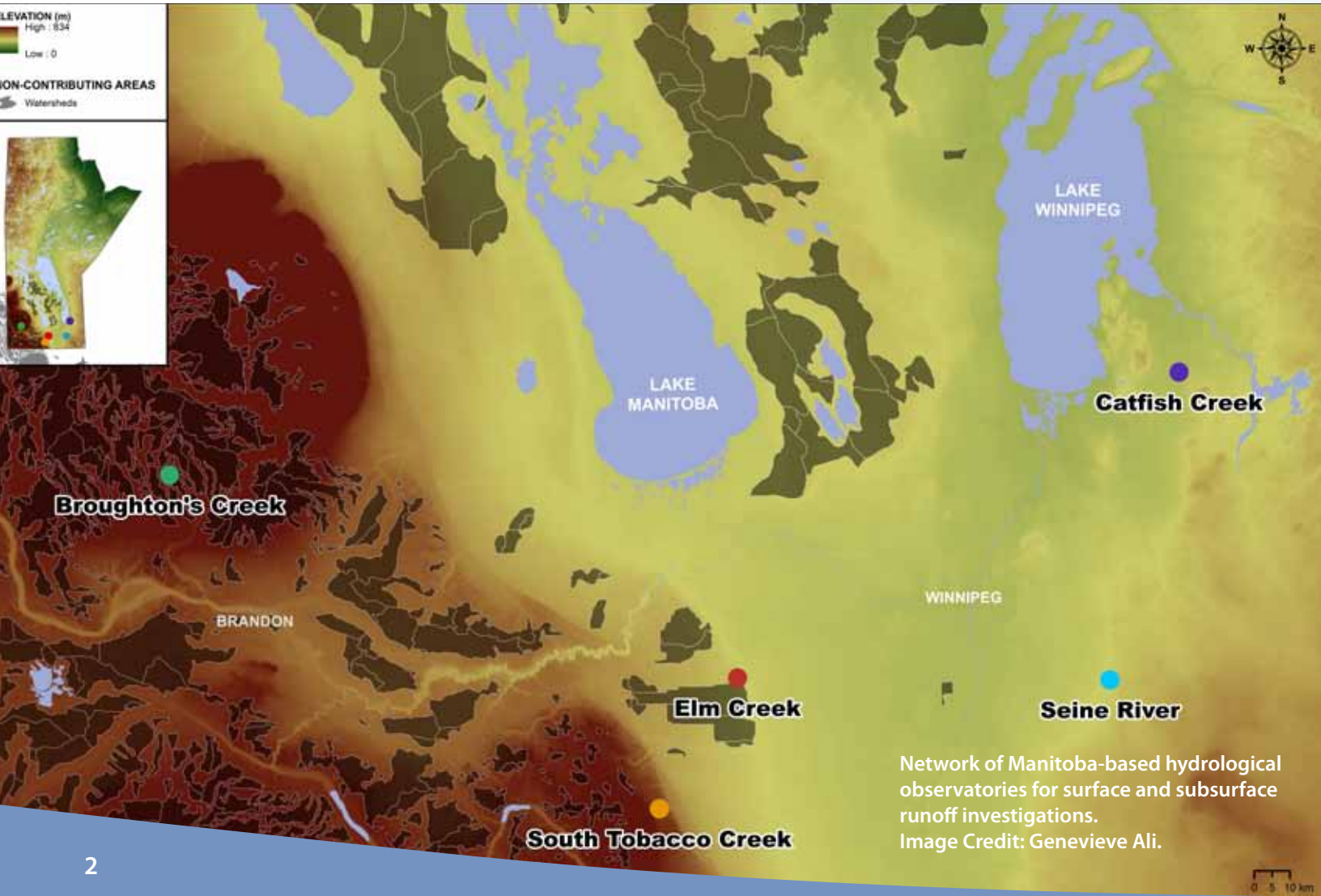


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One of the most challenging Prairie water problem is related to the prediction of water movement velocities depending on whether the landscape is subject to surface runoff, subsurface runoff, or both. Another equally challenging problem has to do with the connection, or lack thereof, between above- and below-ground processes. This is especially true in human-impacted systems where surface drains, tile drains, and retention ponds can promote the leakage of surface water - and its associated pollutants - into deep groundwater aquifers. To tackle those surface-subsurface runoff interactions, Manitoba's Watershed Systems Research Program (WSRP) has set up a network of hydrological observatories to deploy instrumentation in the Prairie Pothole Region, the steep Pembina escarpment, and the flatter Red River and Winnipeg River Valleys. For instance, research in Broughton's Creek Watershed focuses on how surface and subsurface pathways facilitate the exchange of water and nutrients between rivers and seemingly isolated pothole wetlands. In the South Tobacco Creek Watershed, the aim is to understand how subsurface

water flows through connected bedrock fractures before discharging into surface waterways, thereby increasing flood water volumes. As for sites in the Red and Winnipeg River valleys, they are used to compare the dynamics of subsurface runoff in clayey, sandy and peaty soils.

With such a variety of study sites, one goal of the WSRP is to identify which landscape characteristics are responsible for the spatial variability of surface and subsurface runoff, and subsequently revise the structure of runoff prediction models. Another goal is to figure out whether water and pollutants are flushed out of Prairie watersheds in a matter of hours, days, years, or decades. This information will be critical to inform managers on the delay between the time when nutrients responsible for eutrophication are applied on land, and the time when those nutrients are expected to emerge in Lake Winnipeg. This information, however, will only become available (and reliable) after solving the previously mentioned Prairie problems... one at a time.

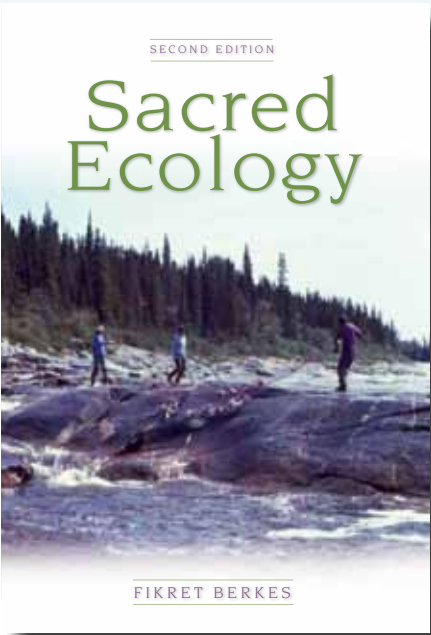


Network of Manitoba-based hydrological observatories for surface and subsurface runoff investigations. Image Credit: Genevieve Ali.

# Awards and Honours.

**Dr. Genevieve Ali** (Junior Chair in Watershed Systems Research, Department of Geological Sciences and the Centre for Earth Observation Science (CEOS)) is the recipient of the 2014 Canadian Geophysical Union (CGU) Young Scientist Award. This award recognizes outstanding research contributions from Canadian geoscientists within 10 years of obtaining their Ph.D. The award was presented at the CGU/CSSS (Canadian Society of Soil Science) annual meeting in Banff, Alberta on May 6th, 2014. While delivering the citation, Jeff McDonnell (Professor of Hydrology and Associate Director of the Global Institute for Water Security) noted: *"Genevieve is already a leader in the field—promoting a new science of connectivity and leading many initiatives in Manitoba and internationally. I see Genevieve developing further as a leader in Canada in the coming years. We need more role models like her, particularly for young women entering our science."*

Pictured from left to right: Dr. Brian Branfireun (CGU President) Dr. Genevieve Ali, and Dr. Jeff McDonnell; Photo Credit: CGU.



**Dr. Fikret Berkes** (Canada Research Chair in Community-Based Resource Management, Distinguished Professor, Natural Resources Institute (NRI)) is the recipient of the 2014 Sustainability Science Award from the Ecological Society of America for his book *"Sacred Ecology"* (Routledge, 2012). (cover image right.) *"The award is given to authors of a scholarly work that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social issues"*. In this book, Dr. Berkes *"explores the importance of local and Indigenous knowledge as a complement to scientific ecology and its cultural and political significance for Indigenous groups"*. Currently in its second edition, *"Sacred Ecology"* was originally published in 2008.



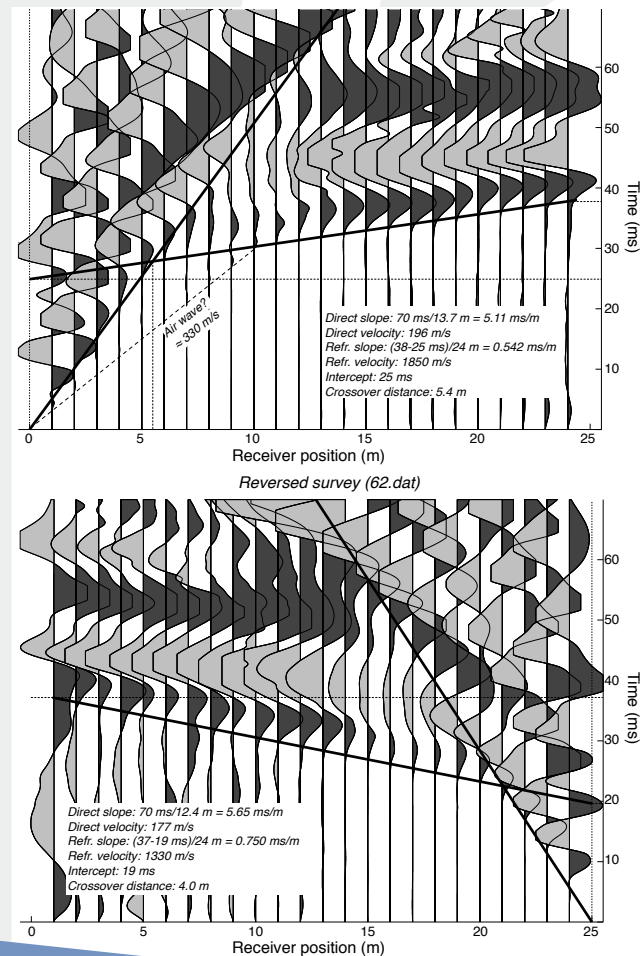
# New Geophysics Equipment.

Geophysics is an instrumentation-driven field, relying on measurements from sensitive equipment at the surface to determine physical properties of the subsurface. Direct experience with field data collection is a vital part of a geology or geophysics education, and may be applied in environmental, resource exploration, engineering, and archaeological/forensic settings. The geophysical teaching equipment we use in laboratory sessions, field courses, and undergraduate research was aging, with all pieces being of 1980s vintage or older. Funding from the Riddell Faculty Endowment Fund has enabled the purchase of three new instruments, all of which are already in active teaching use.

The new equipment consists of the following:

- **A Geometrics Geode 24-channel digital seismic system.** This replaced our previous 1960s-vintage single-channel analogue instrument. This system may be used for seismic refraction, reflection, and surface-wave studies, and is used annually in Lab 2 of GEOL 2060 Introductory Geophysics as well as in our biennial geophysics field courses (GEOL 4740 and GEOL 4260).
- **A GSSI EMP-400 electromagnetic profiler.** This is a shallow-sensing electromagnetic instrument useful in a number of near-surface applications; it has been used in both field courses, as well as in an archaeological project with Dr. Brooke Milne of the Department of Anthropology, and will potentially be useful for any near-surface study in which electrical conductivity (which is influenced by water content, salinity, and clay content) is a useful parameter to map.
- **A GEM Overhauser walking magnetometer/VLF system with GPS and base station.** This is an essential instrument for teaching exploration geophysics and is heavily used in our field schools; since its purchase, it has already been used for two technical-report projects as well.

Pictured top right, magnetic surveying during geophysics field school, 2013, in the vicinity of Selkirk. Pictured bottom right, Electromagnetic profiler taking conductivity measurements in horizontal mode at Birds Hill. Figure, bottom left, data from hammer seismic survey on the bank of the Red River, University of Manitoba campus. The data indicate that the base of the soil layer is at about 2 m depth, and dips gently towards the river. Photo Credits: Andrew Frederiksen.



# UCN Transfer Students.

Two recent graduates **Michel Leclaire** (B. Env. Sc. (Hons.) May 2013) and **Nick Kosmenko** (B. Env. Sc. (Hons.) May 2013) were the first students to have completed their degrees as part of a University College of the North (UCN) transfer agreement with the Riddell Faculty and the University of Manitoba. This initiative is open to graduates of the two Year Natural Resource Management Technology Diploma from University College of the North who may apply for admission into the Bachelor of Environmental Science program in the Clayton H. Riddell Faculty of Environment, Earth and Resources. Successful applicants will be granted 60 credit hours of transfer credit on admission towards the completion of the 120 credit hour Bachelor of Environmental Science degree.

Michel completed his NRMT diploma in 2010 focusing on water resources and fisheries conservation. Once at the University of Manitoba, he took part in three different research projects with Fisheries and Oceans. All three projects took him to northern Canada where he worked on population assessments of northern salmonids. These projects not only gave Michel a better understanding

of the unique challenges of northern fieldwork, but also showed him the full range of ecosystem complexities that surround environmental research. He is currently working on his Master of Science once again with Fisheries and Oceans at the University of Manitoba in which he is examining the cisco species complex to determine the subtle differences of these species found in Great Bear Lake.

Having completed his NRMT diploma, Nick Kosmenko worked for three summers as a resource officer for Manitoba Conservation in Snow Lake, Thompson, and Flin Flon. He subsequently took a position as a wildlife assistant once again for Manitoba Conservation in Dauphin and then worked for Tolko Industries in The Pas as a forest surveyor. While at the University of Manitoba, Nick was also a Bison athlete in the University's

cross country and track and field teams. Upon graduation, he enrolled in the Environmental Science M.Sc. program at the University of Windsor. Nick's research focuses on the ecological, morphometric, physiological, and behavioural traits of



fish and their rates of respiration and consumption. This will form the basis of a predictive model to estimate potential trophic impact of introduced species.

Pictured (inset): Nick Kosmenko, Photo credit Nick Kosmenko, (below): Michel Leclaire. Photo credit Michel Leclaire.



# Sustainable Tourism in Grenada.

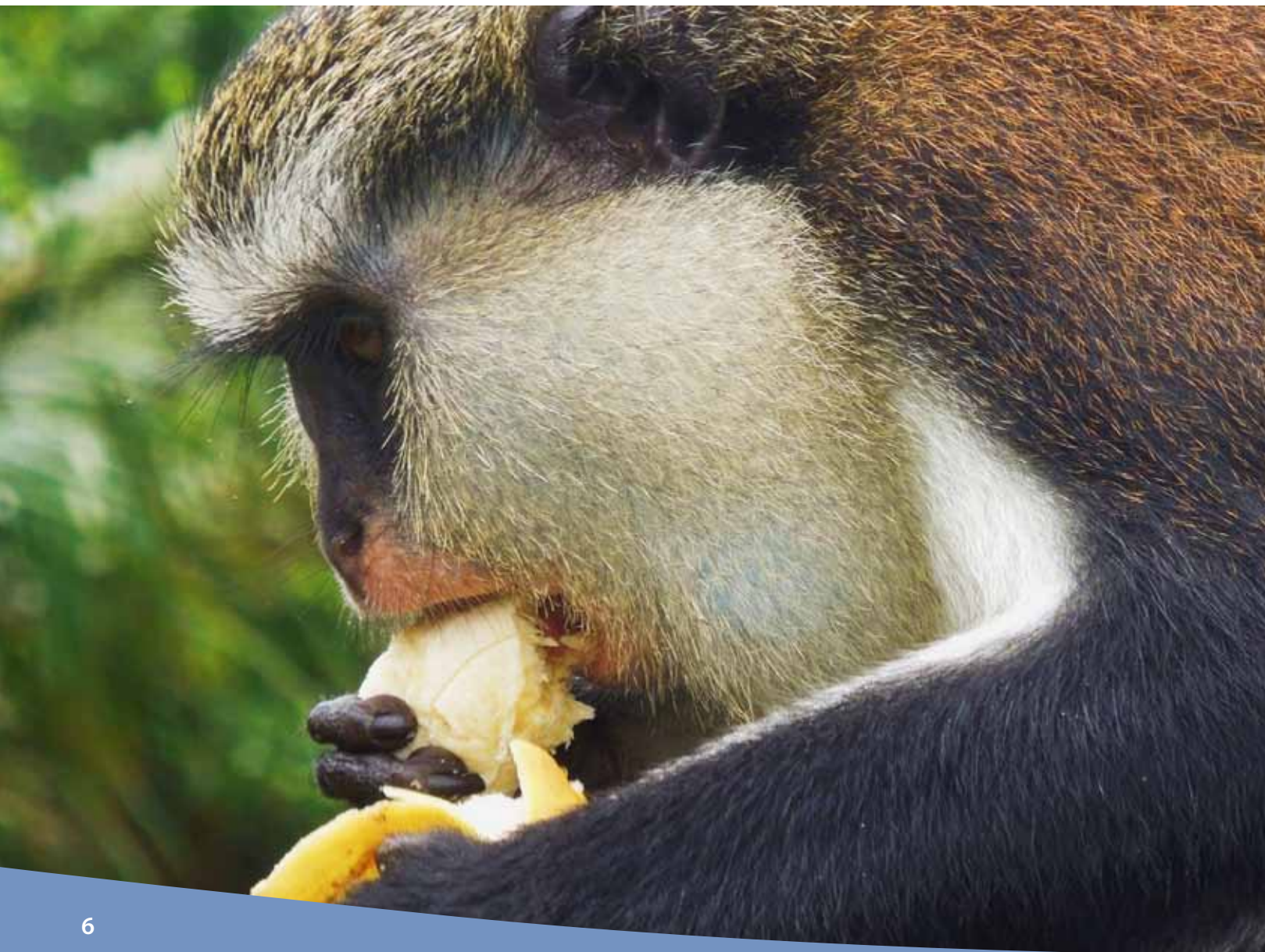
A new field course "*Conservation and Sustainable Tourism in Grenada*" was first offered in April 2014 and it was a great success. Offered by **Dr. Nicola Koper**, **Dr. Michael Campbell**, and **Dr. Iain Davidson-Hunt** (Natural Resources Institute (NRI)) the course focused on the complexities involved in developing ecologically, socially, and economically sustainable agricultural and tourism programs and businesses on the island. Eleven graduate students from the University of Manitoba took the course, and conducted independent projects on topics such as organic nutmeg production, the role of volunteers in sea turtle conservation, and the contribution of agroforestry to biodiversity conservation, gave presentations, and kept learning journals to record their reflections and to integrate them with theory.

Students participated in several background lectures prior to departure, and continued with presentations at St. George's University on Grenadian issues related to cultural, historical,

and ecological conservation, to lay the ground-work for the following two weeks. The course encompassed field trips on most days, including a biocultural island tour, snorkelling in marine protected areas, rainforest hikes, visits to St. George's and other markets, visits to national parks, observing nesting leatherback sea turtles, and several trips to the organic Belmont Estate. The Belmont Estate is a historic agri-tourism plantation that includes an organic farm, gardens, heritage museum, and cocoa processing facilities.

The two-week course will offered in either early January 2016 or 2017 for both graduate and undergraduate students. For further information about the course, students are advised to contact Dr. Nicola Koper by email at: **Nicola.Koper@ad.umanitoba.ca**.

Photo below: Mona monkeys were introduced to Grenada from West Africa in the 18th century. Photo Credit: Nicola Koper.



# New Faculty Profile: Bruce Erickson.

**Dr. Bruce Erickson** (Department of Environment and Geography) is an assistant professor of geography whose research focuses on the cultural and political dimensions of outdoor leisure, paying attention to how colonialism and nationalism in Canada impact our recreational use of space. His work also documents the impact of gender, race, and sexuality on our understandings of nature and space. His book, *Canoe Nation*, (cover image right.) argues that canoeing matters not because it necessarily shows us a better way of engaging with nature, or a path to a responsible connection to nature, as many proponents of the canoe suggest, but instead, canoeing matters because it illustrates how the colonial history of Canada has had a prominent place in shaping our environmental history as well, including current environmental protection campaigns. Remembering the complicated history of the canoe as a vehicle that was vital to the emergence of a particular white, urban Canadian aesthetic we can start to address how this bias shapes our responses to environmental problems.

His current research program examines the interaction between climate change, ecotourism, and market-based governance policies in Northern Canada. While much of the North is being scouted for its extractive resource potential there is also a slightly smaller push to protect areas and offer tourism opportunities. This research project, focused on Polar Bear tourism, will investigate the connections and conflicts between these two lines of northern trends, especially for how they similarly rely upon southern intervention into northern communities.

Dr. Erickson has a Ph.D. in Environmental Studies from York University, where he was also an assistant professor in Geography for three years before joining the University of Manitoba. He teaches in the area of culture and the environment, paying specific attention to the dynamic between our everyday lives and the larger patterns of the economic and political spheres.

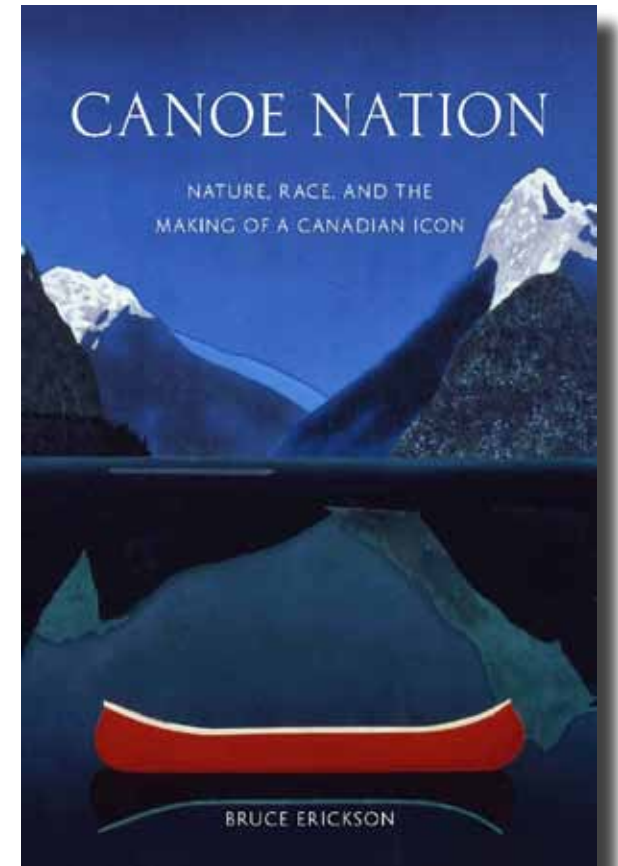
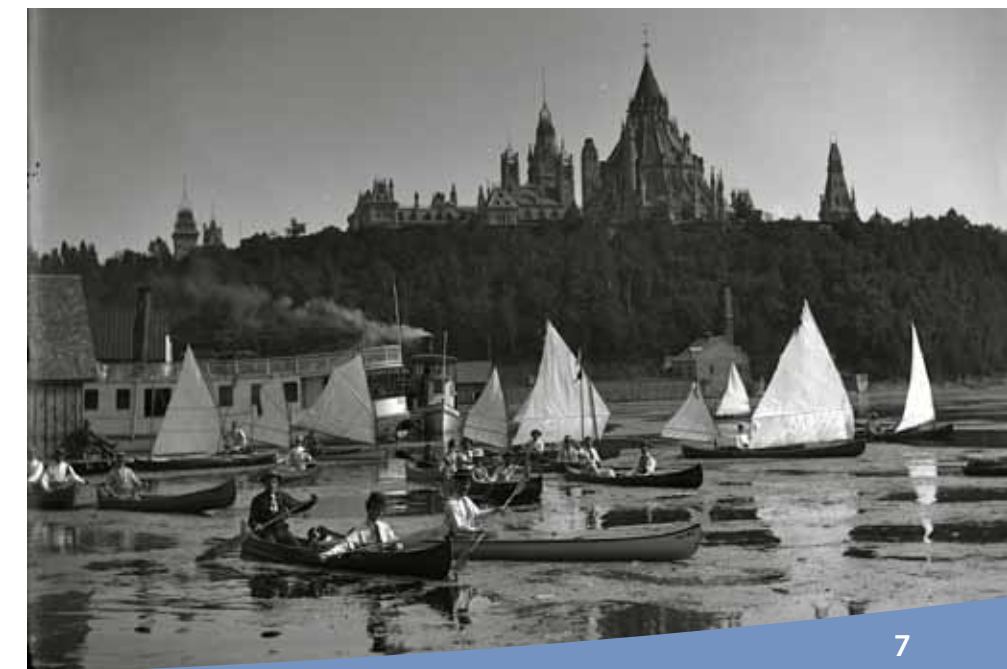


Photo below: Canoe Regatta on the Ottawa River, July 1899. Parliament Buildings in the background. Library and Archives Canada Photo Credit: LAC, 1936-270 NPC.





# China-Canada Dual Ph.D. Workshops.

From July 17 to 20, 2014 **Dr. Norman Halden** (Dean, Department of Geological Sciences) and **Dr. Feiyue Wang** (Department of Environment and Geography and Centre for Earth Observation Science (CEOS)) visited China as part of the Sino-Canada Workshop on Building Dual Ph.D. Degree Programs. They first visited the School of Earth and Space Sciences (ESS) of the University of Science and Technology of China (USTC), Hefei, one of China's top universities, known as the C9 League. The school offers leading training and research programs in atmospheric science, environmental science, geochemistry, solid-state geophysics, and space physics, four of which align very well with what we offer in the Riddell Faculty; their recently established Institute of Polar Environment shares many common interests with CEOS. Their meetings (Pictured below) with Dr.

Yumin Wang (Associate Dean of ESS) group leaders from each of the programs, and the Associate Dean of their Faculty of Graduate Studies were informative and productive. All agreed to form a partnership to explore the possibility of developing dual Ph.D. degree programs, and to facilitate faculty and student exchanges.

## The Harbin Principles

- The participants reaffirm the vital importance of increasing and deepening the research and educational ties between China and Canada. Major, complex problems of global importance are best solved by research teams from China and Canada working together.
- Post-secondary institutions, in particular the universities, play an essential role in the effort to define, analyze, and solve the complex and challenging problems faced by China, Canada, and the global community.
- Dual-degree doctoral agreements, developed in support of institutional strategic priorities, are an excellent means of establishing and maintaining a strong working relationship between our institutions.
- Dual-degree doctoral agreements should provide a significant component of professional development for the participating students to prepare them for all career opportunities, in recognition of the fact that most doctoral students will pursue non-academic careers.
- The intensive international and cross-cultural educational experience provided by a dual degree is perfect training for students who will be future leaders in every sector of society including the academic, industrial, business, and the public sectors.
- By training doctoral students at both universities, we provide a truly international educational experience for the young researchers, which is beneficial to China, Canada, and our universities.
- The conferral of a dual degree marks the commitment of the institutions to the success of the partnership.

Following, Dr. Halden and Dr. Wang traveled to the northern city of Harbin, along with delegates from 12 other Canadian and 21 Chinese universities. Dr. Jay Doering (Dean of Faculty of Graduate Studies of the University of Manitoba) also joined the meeting. Dual Ph.D. programs were seen as important opportunities to equip our students with research capabilities, international competencies, and transferrable skills. At the end of the workshop, the 7-point "**Harbin Principles**" were declared to reaffirm the commitment from participating universities (see the inset).



# The Wildlife Society's Annual Conference Winnipeg, Manitoba, October 2015.

The 22<sup>nd</sup> Annual Conference of The Wildlife Society (TWS) will be held in Winnipeg, Manitoba on October 17-22, 2015, at the Winnipeg Convention Centre. The Manitoba Chapter of TWS will be in charge of arrangements and the Canadian Section of TWS will assume responsibility for the program.

The Society was established in 1937, and is committed to a world where humans and wildlife co-exist. Members work to manage, conserve, and study wildlife populations and habitats.

The 22<sup>nd</sup> Annual Conference will begin on a Sunday with an opening reception and continues until the following Wednesday evening. There are the Opening Plenary and members forum, awards ceremony, concurrent technical contributed papers and poster sessions, symposia, working group meetings, affiliated meetings, a student quiz bowl, photography contest, trade show and exhibition, various sponsored receptions, mixers, leaders lunch, and committee meetings. Extensive opportunities are available for networking and for mentoring students and young professionals. Prior to and following the conference are associated field trips and workshops on selected topics.

The Annual Conference generally has about 1500 registered attendees. Over the years, the Annual Conference has been held only once in Canada (2004 in Calgary). Now the conference will come to Canada for a second time as Winnipeg won as the 2015 host.

For further information, contact Arrangements Committee Co-Chairs, Merlin Shoesmith ([109mejo@mymts.net](mailto:109mejo@mymts.net)) or Don Sexton ([sextonda@mymts.net](mailto:sextonda@mymts.net)).



Pictured: The Wildlife Society's Annual Conference that took place in Pittsburgh in October, 2014. Photo Credit: Erin McCance.



## Verna Kirkness Initiative.

For the second year in a row, the Verna J. Kirkness Science and Engineering Program once again saw curious high school students visit the Clayton H. Riddell Faculty of Environment, Earth, and Resources for a week of hands-on science. The Kirkness Program offers scholarships to grade 11 Aboriginal students so they can visit a Canadian university and interact with leading research scientists in their laboratories. This year three students from Norway House Cree Nation, Manitoba and one student from Carry the Kettle, Saskatchewan visited the Faculty. The students worked with **Drs. Norman Halden** (Dean, Geological Sciences), **Mark Hanson** (Environment and Geography), and **Feiyue Wang** (Environment and Geography and CEOS) on techniques to understand and mitigate pollution in water, soil, and biota.

In Dr. Hanson's Stress Ecology Lab, the students conducted experiments with graduate students Jonathan Challis (Ph.D. candidate) and Chelsea Lobson (M.Sc. student). The students brought soil samples from their home communities with which to apply techniques in the laboratories. They learned the value of aquatic insect identification and the link to water quality measurements, as well as how to use biological tools such as earthworm avoidance to assess toxicity. Chelsea Lobson noted: *"The Kirkness Program was hugely successful and enriching for both the students and volunteers like myself. It was especially rewarding to see how excited the students were to share what they learnt with their communities!"*

In Dr. Halden's laboratory the students analyzed fish otoliths or 'ear stones' for the presence of trace elements, providing unique insight into fish contamination over the course of the organisms' entire life spans. With Dr. Wang, his lab manager **Sarah Beattie**, (M.Sc. in Environment and Geography, June 2014), and Ph.D. candidate **Kang Wang** the students were immersed in the Ultra-Clean Trace Elements Laboratory (UCTEL) where they analyzed trace metals in tap water from their communities. Sarah Beattie reflected about the program: *"The highlight of the week was taking the students out on the land to the Red River to do some water sampling. The students were interested in comparing the quality of water in their communities to the Red River water, and excitedly shared observations about what might be impacting their community water sources."*

The Kirkness program provided these students with a unique exposure to world-class environmental research in the faculty. Jonathan Challis observed: *"This experience provides the students with a real, hands-on university experience at a perfect time in their education. Making academic research a tangible goal as they enter university is a fantastic idea!"*

Pictured: 2014 Student Participants with Verna J. Kirkness.



## Yukon Territories Visit.

Many people in the Yukon Territories are very passionate about natural resource management, resource development, fisheries, and wildlife. Where these intersect has as much potential for collaboration as for conflict. Dean **Norman Halden** traveled to Whitehorse over the summer to participate in a collaborative project to examine fish that were potentially impacted by the re-development of silver mines in the world famous Keno Hill district of the Yukon Territories. In this joint initiative involving researchers from the Department of Fisheries and Oceans, Access Consulting, Yukon College, and the Na Cho Nyak Dun First Nation, the first steps were taken to put in place an environmental monitoring program that would allow the on-going development of existing and new mines and to involve First Nations people directly in the monitoring program. Meetings were held (pictured below) with all stakeholders to explain the project.

Dean Halden has developed new microbeam analytical techniques and approaches to examine fish exposure to trace elements in the environment. Otoliths, which are "ear stones" located in an endolymphatic sack just behind the fishes brain

(where they serve a balancing and pressure sensing function not unlike the human inner ear) are made of the mineral aragonite. They grow throughout the life of the fish preserving an annular structure like tree rings. Analysis of trace elements in these rings at the part per billion level on the scale of a few microns can tell us about the past history of the fish through exposure to a variety of elements. The task at hand is to determine and distinguish natural from anthropogenic signals.





# Picturing the Planet.

As a regular feature "*Picturing the Planet*" bring inspiring and informative images taken by our students, staff, and faculty.

In April 2014, graduate students from the Riddell Faculty attended a field course on conservation and sustainable tourism in Grenada (see page 6 for the full story). While visiting an organic, fair-trade working plantation and agrotourism site, the hosts from Belmont Estates cooked a traditional oil-down curry stew over an open fire in the heart of the plantation. This beautiful view shows the nutmeg and cocoa fields interspersed with rainforest. (Photo credited: **Nicola Koper**).



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