ES07: Professional Geoscience 2: From Natural Science to Regional Practices in Canada

Conveners: Roger T.J. Phillips[1], and Joanna Eyquem[2]

Co-chairs: Roger T.J. Phillips[1], and Joanna Eyquem[2]

[1] Geography Department, Western University, London, ON, N6A 5C2
Phone: 519-661-2111 ext. 80161 E-mail: roger.phillips@uwo.ca
[2] AECOM, Montreal, QC, H2X 3P4
Phone: 514-287-8500 ext. 8638 E-mail: joanna.eyquem@aecom.com

Session Description

Many natural sciences—including hydrology, geomorphology, and biogeoscience—are also active areas of applied environmental science, with practitioners working in a wide range of environmental settings across Canada. The purpose of this session is to draw together environmental scientists and geoscience practitioners working within different physiographic and economic regions to explore how natural science is translated into professional practice. Contributions are welcome from all aspects of environmental science and are encouraged to address key themes in applied practice, including Environmental Assessment, natural hazard assessment, and ecological habitat restoration/rehabilitation. Connections to engineering practices for hazard mitigation and/or habitat restoration may also be explored where the scientific foundations are well-defined to arrive at practical solutions. Under these key themes, the session aims to highlight common threads in professional geoscience practice, as well as potential regional differences. Exploring the translation between science and practice across a variety of landscapes is especially relevant to professional ethics given that scientific foundations can be weakened by oversimplification and practical limitations within interdisciplinary projects. This session will also provide an opportunity to discuss professional regulation of environmental geoscience in Canada—beyond its traditions in geology and relative to other disciplines such as engineering and biology.

Primary Affiliation: CGU Earth Surface Processes Section and the Canadian Geomorphology Research Group

---

NOTE: THIS DOCUMENT CONTAINS INFORMATION FOR ALL SESSION SUB-SECTIONS. PRESENTER ABSTRACTS ARE FOUND AT THE END OF THE DOCUMENT.

SCHEDULE MAY BE SUBJECT TO CHANGE.

ORAL SESSION ES07a

Chairs: R. Phillips and J. Eyquem **Room: GEOG 229**

Tuesday, May 30th

TIME	AUTHORS	TITLE
11:00	Sally-Beth Betts (Invited)	A Critical Review of the Application of Fluvial Geomorphology in Ontario's Conservation Authorities and Setting the Stage for a Path Forward
11:15	Paul V. Villard (Invited)	Degrees of Freedom, River Management, and Natural Channel Design
11:30	Brett Eaton, and Rob Millar	Predicting gravel bed river response to environmental change: the strengths and limitations of a regime-based approach
11:45	Sarah Davidson and Laurent Roberge	Incorporating river mechanics into geohazard management: a simple model for quantifying bank erosion
12:00	Erica Ellis, Amir Taleghani, and Chad Davey	Putting Sediment Mobility To The Test: Predicting Fish Habitat Impacts
12:15	Andre Zimmermann, Jamie Stirling, Tim Argast	Flood and Precipitation Warning Systems: Successes and Challenges

POSTER SESSION ES07

Chairs: R. Phillips and J. Eyquem **Room: ESB Atrium**

Tuesday, May 30th

Poster No.	AUTHORS	TITLE
P01-ES07	Peter Ashmore, Julia Howett, and Imran Khan	Meander Belt Width Procedures: Developing a Regional Model for Southern Ontario
P02-ES07	Roger T.J. Phillips	Defining Geoscience: Facing the challenges of professional regulation and environmental geoscience education
P03-ES07	Joanna Eyquem and Roger T.J. Phillips	Challenges for the regulation of increasingly diverse and mobile: Professional Geoscientists within and between the Canadian Provinces

---

SUBMITTED ABSTRACTS

ES07-01 A Critical Review of the Application of Fluvial Geomorphology in Ontario's Conservation Authorities and Setting the Stage for a Path Forward

Sally-Beth Betts[1] (Invited)

[1] Integrated Water Management Dept., Credit Valley Conservation, Mississauga, ON, L5N 6RN
Phone: 905-670-1615, E-mail: sbetts@creditvalleyca.ca

Abstract
Fluvial geomorphology is a natural science that draws from several disciplines and has a wide range of applications. Numerous geomorphic techniques exist, developed for different geographic and physiographic regions, to answer a range of different questions, by people with different specialties. It is widely recognized among the community that the established field of geomorphology was not able to keep up with the demand for the application of the science to address practical river management issues. Further, policy typically lags behind science. There is a need to catch up to today's cutting edge, and to allow for flexibility of implementation of future research and development. This presentation focuses on the application of fluvial geomorphology within southern Ontario's Conservation Authorities (CAs)* and proposes some improvements to the way the science is practiced. Drawing on the experience from numerous CAs, we consider how geomorphology is applied, specifically: what types of projects geomorphology is included in, what guidelines exist, what techniques and methods are employed and who is considered a qualified geomorphologist. We consider some of the consistencies, inconsistencies and complexities of governance. We then discuss how to better translate the science of geomorphology into applied geomorphology to ensure that our policies and guidelines are informed by innovative science. Rather than relying on simplified, traditional or ad hoc methodologies, we should be considering the fundamental root issues that are being addressed and selecting the tools or methods most appropriate to lead us to sustainable, process based, whole-system solutions. **CAs were created by an Act of Provincial Legislature in 1946 to conserve, restore and manage Ontario's water, land and natural habitats. Subsequent regulations empower CAs to regulate development activities in or adjacent to watercourses.*
[285 words]

Presentation type: Oral Presentation

ES07-02 Degrees of Freedom, River Management, and Natural Channel Design

Paul V. Villard[1] (Invited)

[1] GEO Morphix Ltd., Milton, ON, L9T 6P4
Phone: 416-920-0926, Email: paulv@geomorphix.com

Abstract
Degrees of freedom describe a channel's capacity for change by the number of physical attributes that can adjust. They include sediment load, sediment size, discharge and stream slope. This can be expanded to include gross morphological parameters associated with channel planform and cross-section, and even with groupings of geomorphic units (e.g., pools, riffles). Degrees of freedom define the system's ability to assimilate and recover from perturbations. As such, it is acknowledged that it is a critical component in effective watershed and river management. Particularly, where changes in hydrology or sediment regime are anticipated. Examples are provided to illustrate increased resilience provided through application of degrees of freedom concepts in large scale corridor restoration. These examples focus on sediment supply and potential for adjustment in channel cross-section and planform.

Presentation type: Oral Presentation

ES07-03 Predicting gravel bed river response to environmental change: the strengths and limitations of a regime-based approach

Brett Eaton[1], and Rob Millar[2]

[1] Geography Dept., University of British Columbia, Vancouver, BC, V6T 2P6
Phone: 604-822-2257 Fax: 604-822-6150, E-mail: brett.eaton@ubc.ca
[2] Golder and Associates, Vancouver, BC, V5M 4X3

Abstract
Rivers respond to environmental changes such as climate shifts, land use changes and the construction of hydro-power dams in a variety of ways. Often there are multiple potential responses to any given change. Traditionally, potential stream channel response has been assessed using simple, qualitative frameworks based largely on professional judgment and field experience, or using some form of regime theory. Regime theory represents an attempt to use a physically based approach to predict the configuration of stable channels that can transport the imposed sediment supply with the available discharge. We present a specific regime model that we have created as a stand-alone computer program, called the UBC Regime Model (UBCRM). UBCRM constrains its predictions using a bank stability criterion, as well as a pattern stability criterion; it can be used in a stochastic modelling mode that translates uncertainty in the input variables into uncertainty in the predicted channel characteristics. However, since regime models are fundamentally based on the concept of grade, there are circumstances in which the model does not perform well. We explore the strengths and weaknesses of the UBCRM in this paper, and we attempt to illustrate how the UBCRM can be used to augment the existing qualitative frameworks, and to help guide professionals in their assessments. [209 words]

Presentation type: Oral Presentation

ES07-04 Incorporating river mechanics into geohazard management: a simple model for quantifying bank erosion

Sarah Davidson[1] and Laurent Roberge[2]

[1] BGC Engineering, Vancouver, BC, V6Z 0C8
Phone: 778-886-7844, E-mail: SDavidson@bgcengineering.ca
[2] BGC Engineering, Vancouver, BC, V6Z 0C8

Abstract
Rivers are dynamic systems that may be subject to progressive migration across the floodplain as well as rapid, episodic channel change. These processes create and maintain complex, high quality habitat in many streams. Bank erosion, for example, introduces large wood to the river network, promoting pool formation. However, while these channel processes provide ecological benefits, they also pose a hazard to key infrastructure such as highways, pipelines, and urban centres. The need for sound geohazard management motivates the understanding and modeling of the stream mechanics responsible for channel migration. We outline a simple bank erosion model tailored to predict channel widening in gravel-bed streams, and present applications of the model. The physically based model assumes that channel stability is contingent on the stability of coarse grains on the bed surface, and that rapid bank undercutting and retreat occur with the exceedance of the entrainment threshold of the coarse tail of the grain size distribution (D90). In accordance with previous laboratory experiments, the channel is assumed to widen rapidly, during a single flood event. The increased channel capacity serves to maintain a shear stress at or near the pre-flood critical entrainment value. As widening progresses, the flow depth and shear stress decrease, allowing the coarse bed material to re-deposit. The model can be calibrated from observed channel change, and used to predict the potential erosion associated with a range of flood magnitudes. Examples from several wandering gravel-bed rivers show that the model is useful for predicting channel widening in gravel-bed streams. [250 words]

Presentation type: Oral Presentation

ES07-05 Putting Sediment Mobility To The Test: Predicting Fish Habitat Impacts

Erica Ellis[1], Amir Taleghani[2], and Chad Davey[2]

[1] Kerr Wood Leidal Associates Ltd., Burnaby BC, V5C 6G9
Phone: 604-294-2088 Fax: 604-294-2090, E-mail: eellis@kwl.ca
[2] Kerr Wood Leidal Associates Ltd., Burnaby BC, V5C 6G9

Abstract
Watershed managers are generally aware that geoscience (and engineering) practice includes predictions of sediment transport and sediment mobility. However, the questions that are typically posed by managers are not well aligned with the current focus of scientific research in this field. Typical management questions include: prediction of erosion and deposition volumes, locations and timing of erosion/deposition, and associated impacts to fish species. While research is exploring these questions, the tools typically accessible to practicing professionals largely fall short of providing definitive answers to managers' questions. Additionally, timelines associated with watershed management decision-making often require answers based on little field data, and on relatively short timelines. We present examples of applying sediment mobility theory to answer questions related to fish habitat impacts in three regulated river systems in BC (Cheakamus, Seton and Lower Bridge Rivers). The management questions in those systems are understandably complex: we will highlight our approach to providing useful answers using defensible methods ranging from field observations to predictive modeling. We will close by identifying gaps between current theory and what would be useful for practitioners/decision-makers. [178 words]

Presentation type: Oral Presentation

ES07-06 Flood and Precipitation Warning Systems: Successes and Challenges

Andre Zimmermann[1], Jamie Stirling[2], Tim Argast[2]

[1] Northwest Hydraulic Consultants (Address to be confirmed)
Phone: 604-980-6011 E-mail: azimmermann@nhcweb.com
[2] Northwest Hydraulic Consultants (Address/Affiliations to be confirmed)

Abstract
Over the last three years Northwest Hydraulic Consultants (NHC) has installed real-time warning systems on the Cowichan, Quamichan, Kingcome, Fitzsimmons, Lillooet, Athabasca and Clearwater Rivers to monitor water levels associated with potential landslide and glacier outburst floods, ice jams, rain on snow events, or rain events. In addition, we have installed a rain gauge for Fairmont Creek to provide alerts during high intensity rainfall events that have the potential for debris floods. The systems are configured such that the data loggers send email and text notifications directly to the end users for rapid response. In some cases, integrated webcams also send photos of the site to the end user. To date the warning systems have performed well and have sent out a number of notifications for both real and false-positive events that have met the pre-specified trigger conditions. Through this process, we have observed that the end users do not have the experience with rain or river level data to consistently make an educated interpretation of the data, particularly around false alarms. NHC has informally reviewed the data and helped the end users along the way as NHC staff are available; however, NHC does not provide guaranteed round-the-clock data interpretation as the costs associated with continuous service would make the stations financially infeasible. We hope to stimulate a discussion on how such support could be best managed, and the trade-offs of having no real-time data what so ever, and having data, but not being sure what it means. We will also discuss the challenges of choosing a return period for an initial notification to be sent out to end users.

Presentation type: Oral Presentation

P01-ES07 Meander Belt Width Procedures: Developing a Regional Model for Southern Ontario

Peter Ashmore[1], Julia Howett[2], and Imran Khan[3]

[1] Geography Dept., The University of Western Ontario, London, ON, N6A 5C2
Phone: 519-661-2111 ext. 85026 Fax: 519-661-3750, E-mail: pashmore@uwo.ca
[2] Geography Dept., The University of Western Ontario, London, ON, N6A 5C2
[3] Beacon Environmental Limited, Guelph, ON, N1H 3W4

Abstract

The delineation of a meander belt has been recognized in Ontario through land use planning policies as a primary tool for determining the extent a river or stream requires for natural meandering tendencies; thus, providing input to channel restoration projects, development constraints or limits, and regulated areas for species-at-risk. Current delineation procedures utilize site-specific historical migration assessments, or published empirical equations to predict meander belt width. In the case of altered, low order watercourses in southern Ontario, the meander belt width dimension is usually assessed by the application of empirical relations, as the available historic record often lacks the information necessary to conduct meander morphology and migration assessments. There is limited research concerned with the variables controlling meander belt development, and on the precision and reliability of the measurement of belt width. The watercourses from which most of these empirical equations are derived differ from geomorphic conditions and morphological types in southern Ontario. Drawing on a sample population of river reaches in the Credit River watershed, this research project evaluates the current standards of practice for meander belt delineation in southern Ontario, focusing on empirical equations to determine whether the width of the meander belt can be reliably predicted from hydro-geomorphic variables. Empirical models of meander belt prediction will be selected through regression analyses and a correlation matrix, providing a basis for model selection. Preliminary results suggest meander belt width is scaled to channel dimensions, primarily bankfull width, and drainage area. However, further investigation into hydrologic and physiographic influences may offer opportunity to produce sub-regional or categorized equations for meander belt prediction. The ultimate goal of the research is the improved management of watercourse erosion hazards in southern Ontario. [279 words]

Presentation type: Poster Presentation

P02-ES07 Defining Geoscience: Facing the challenges of professional regulation and environmental geoscience education

Roger T.J. Phillips[1, 2]

[1] Department of Geography, Western University, London, Ontario, N6A 5C2
Phone: 519-661-2111; E-mail: roger.phillips@uwo.ca
[2] Aquafor Beech Limited, Mississauga, Ontario, L4W 5B2

Abstract
The definition of "geoscience" is contested because the word evokes a broad sense of Earth science knowledge and practice, but its traditions are primarily geological. Given the existing ambiguity, future efforts to define the scope of geoscience practice are an important collective responsibility, particularly for advancing professional credibility outward into the public, legal, and political spheres. Current provincial legislation varies in defining the "practice of geoscience," leaving the scope of professional geoscience in Canada open to interpretation. Particularly under legal scrutiny, what constitutes geoscience practice can still (in some cases) require expert opinion. Many provincial geoscience regulations reference protection or preservation of the natural environment and water resources, both of which extend well beyond the field of geology. While knowledge requirements for professional geoscience accreditation in most provinces—under Geoscientists Canada guidelines—do reinforce its geological traditions, they also allow for a broader environmental geoscience education in Earth surface processes, including training in hydrology, geomorphology, and biogeochemistry (to name a few). This talk will explore the varying definitions of geoscience in relation to professional regulation and Earth and environmental science education in Canada. As an example from one province, a new geomorphology subcommittee within the Association of Professional Geoscientists of Ontario is now contributing to a broader vision of what professional geoscience practice is and can be. Addressing the definition of geoscience—particularly as it relates to environmental geoscience—is a collective responsibility to effectively regulate ethical practices in public and environmental protection, as well as to ensure that the appropriate educational pathways and professional accreditation opportunities are aligned for future geoscientists. [262 words]

Presentation type: Poster Presentation

P03-ES07 Challenges for the regulation of increasingly diverse and mobile: Professional Geoscientists within and between the Canadian Provinces

Joanna Eyquem[1] and Roger T.J. Phillips[2]

[1] AECOM, Montreal, QC, H2X 3P4
Phone: 514-287-8500 ext. 8638 E-mail: joanna.eyquem@aecom.com
[2] Department of Geography, Western University, London, Ontario, N6A 5C2

Abstract
Although largely under the umbrella of Geoscientists Canada, the current professional regulation of geoscience professionals is undertaken on a provincial basis. While there are significant differences in the environments, policies and accepted protocols between provinces across Canada, professionals themselves are increasingly mobile, often working within national and international organizations. The purpose of this discussion session is to highlight some of the advantages and disadvantages of the current approach to professional practice, and potential improvements that could be considered in the future, in particular in relation to:

- Differences in the scope of activities covered by professional accreditation bodies (e.g. inconsistency in the regulation of geomorphologists)
- Potential barriers to professional mobility, in particular for environmental geoscientists who, although professionally competent in their field, may have significantly different academic qualifications.
- General characteristics of a good geoscience professional (common to all provinces and professions) vs. aspects that need to be assessed provincially (e.g. knowledge of provincial legislation, policy and best practice protocols)
- Emphasis placed on academic qualifications vs. proven professional experience and judgment.

An interactive exchange will be encouraged through facilitated panel and audience discussion. [181 words]

Presentation type: Poster Presentation