

# 2013

## GIS in Education Conference



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## Plenary Session

### Confronting Infectious Diseases in a Globalized World

9:15 – 10:00 AM

Globalization is transforming the landscape of infectious diseases in the world. Human population growth, urbanization, growing livestock production and consumption, and disruption of wildlife ecosystems are among factors that are driving the emergence of new human pathogens, while global climate change, mass gatherings, and global air travel are among factors that are leading to their dissemination and international spread. Knowledge of these global forces and their effects from a spatial and temporal perspective can offer valuable insights to help governments better anticipate infectious disease threats before they occur and consequently take steps to prevent or mitigate their health and economic impacts. This presentation will involve discussion of a scientific research project created in academia that ultimately evolved into a technological solution called BioDiaspora. The technology has helped support time sensitive public health decision-making around emerging infectious disease threats ranging from the 2010 outbreak of cholera in Haiti, planning for the 2012 London Olympic Games in London, to recent events around the Middle East Respiratory Syndrome in the Arabian Peninsula.

Dr. Kamran Khan  
St. Michael's Hospital / University of Toronto  
[Khank@smh.ca](mailto:Khank@smh.ca)

Dr. Kamran Khan is a practicing infectious disease physician and scientist at St. Michael's Hospital in Toronto, and an Associate Professor of Medicine at the University of Toronto. His research interests in globalization and emerging infectious disease threats were inspired by the 2003 Toronto SARS outbreak. Since then, Dr. Khan has led the development of a web-GIS application called BioDiaspora ([biodiaspora.com](http://biodiaspora.com)), which brings together global information on human demography, animal populations as reservoirs for infectious disease, insects that can transmit infectious diseases, infectious disease outbreaks, real-time worldwide climatic conditions, and the world's travel patterns through commercial flights. The application has been used by governments around the world to conduct rapid risk assessments of emerging global infectious disease threats and for public planning around mass gatherings such as the Olympic Games.

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## Web GIS App Development

10:15 – 11:45 AM

### 1. Scholars GeoPortal: Improving Geospatial Data Access for Ontario Researchers and Students

Scholars GeoPortal (<http://geo.scholarsportal.info>) is a geospatial data access platform created by the Ontario Council of University Libraries (OCUL) and available to students, staff and faculty at universities across Ontario. The GeoPortal's goal is to make it easier to discover, explore and download datasets from the geospatial data collections licensed by Ontario academic libraries. Scholars Geoportal offers sophisticated search tools, high-quality metadata and simple Web mapping abilities. Through these features, Scholars GeoPortal facilitates the integration of high-quality geospatial data sources into GIS academic work. This session will introduce attendees to Scholars GeoPortal's data content and features.

Leanne Trimble  
Data & Geospatial Librarian  
University of Toronto / Scholars Portal  
[leanne.trimble@utoronto.ca](mailto:leanne.trimble@utoronto.ca)

Leanne Trimble is Data & Geospatial Librarian at Scholars Portal (she's also acting Map & Data Librarian at the University of Toronto Map & Data Library for Fall 2013). At Scholars Portal, Leanne provides support for data services, including Scholars GeoPortal (<http://geo.scholarsportal.info>) and the social science portal ODESI (<http://odesi.ca>).

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### 2. Development of the GeoFoundation Exchange

The GeoFoundation Exchange (GFX) is a collaborative project that was created for the exchange and distribution of an authoritative Canadian basemap in a cloud-based secure platform where transactional data is contributed by municipal, provincial and federal participants. The benefits derived from the GFX system includes open data that is accurate, current and complete and is the definitive source in the creation of the Community Map of Canada. This presentation provides an overview of the project's challenges and the methods being developed to address them.

Dr. Michael Leahy  
Developer, Technology Strategy  
Esri Canada  
[mleahy@esri.ca](mailto:mleahy@esri.ca)

Michael Leahy graduated from the doctoral Geography program at Wilfrid Laurier University in 2012. His academic work focused on the development of Web-based geospatial applications for improving access to open data, and for facilitating public participation through real-time and asynchronous modes of group collaboration using VGI concepts. He currently works as a developer for Esri Canada and as a technical lead for the GFX project.

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### 3. Searching for Similar Schools: a Web Map Application for Principals

The goal of this project is to provide principals and vice principals within the Toronto District School Board the ability to access school level information, both geographic and statistical through a Web map. Data in the system include:

- Geographic data: the location of the school, its neighbourhood, ward, etc.
- School type characteristics: elementary, secondary, French immersion, grade ranges, etc.
- Student data: student achievement in key subject areas, absenteeism, etc.

Keeping in mind the various levels of familiarity with such tools in the audience, the site is designed to be as easy to use as possible, while still having options to allow more advanced users to carry out complicated queries. It includes the following functions:

- Search for schools by name
- Run one-click queries to find schools with similar characteristics to a given school
- Run advanced queries based on as many or as few variables as the user chooses
- Export maps to pdf from browser
- Provide charts for the majority of the school level data within the Web map

Cosmin Marmureanu  
Education Officer  
Ontario Ministry of Education  
[cosmin.marmureanu@hotmail.com](mailto:cosmin.marmureanu@hotmail.com)

Cosmin Marmureanu obtained a Masters of Spatial Analysis from Ryerson University in 2011. Since then, he has worked for the Toronto District School Board, Knowledge Network for Applied Education Research, Higher Education Quality Council of Ontario and Ontario Ministry of Education on a number of GIS projects.

## Spatial Analysis

10:15 – 11:45 AM

### 1. Land Use Regression Modelling

This talk will focus on land use regression (LUR) models for modelling air pollution concentrations. The general workflow for producing these models will be presented, including data generation, statistical modelling, and statistical assessment. Our Land Use Regression Tool Box will be introduced, which is being developed to reduce analyst time when producing LUR models.

A land-use regression model for sulfur dioxide air pollution concentrations in Hamilton, ON, which makes use of mobile air pollution monitoring data is presented. This research introduced the use of a simultaneous autoregressive model (SAR), specifically the spatial error model to alleviate spatial correlation in model residuals. We identified spatial correlation in the ordinary least squares regression residuals with Moran's I. The SAR model improved the model fit slightly, but more importantly removed spatial correlation among the model residuals. The observed SO<sub>2</sub> concentrations are regressed against a comprehensive set of land use and transportation variables.

Beyond demonstrating a superior modelling technique, we found that a location's relative direction to the pollution source and wind direction alignment is a strong predictor; and mobile monitoring data are applicable for land use regression. We suspect many LUR models using OLS regression violate the independence of errors assumption.

Matthew Adams  
PhD Candidate  
McMaster University  
[adamsm@mcmaster.ca](mailto:adamsm@mcmaster.ca)

Matthew Adams is a PhD candidate in the School of Geography and Earth Sciences at McMaster University and is currently the McMaster University Esri Development Centre Student of the Year. He is a member of the Centre for Spatial Analysis at McMaster. His research explores the assessment of air pollution exposure.

### 2. Comparing Interpolation Techniques for Predicting Rainfall in Tropical Climates

Environmentally-driven spatial models increasingly require detailed, large-scale climatic datasets. In the context of rainfall mapping, spatial interpolation techniques are therefore required to produce these inputs. In this paper, four spatial interpolation techniques were analyzed to test whether high-quality rainfall data for Sri Lanka could be produced for use in future environmentally-driven models. The interpolation techniques tested were inverse distance weighting, thin plate splines, ordinary kriging, and Bayesian kriging.

Rainfall data was interpolated for all of Sri Lanka from community-managed weather stations, and compared to a network of meteorological station readings and satellite-based rainfall estimates. The objectives of the research were threefold: investigate the potential for community-managed weather stations to produce quality estimates of rainfall when compared to independent meteorological station data, explore the use of a spatial analysis method for supplementing the assessment of interpolation pattern when compared to satellite-based rainfall measurements, and produce seamless monthly rainfall maps for all of Sri Lanka.

Several error metrics and the structural similarity index—an image comparison method—were used to assess which technique produced the best quality estimates. No particular interpolation method uniformly performed best, but thin plate smoothing splines predicted the most accurately in high rainfall conditions, while Bayesian kriging performed best with low rainfall.

Cameron Plouffe  
MSc Candidate / Higher Education Analyst  
Wilfrid Laurier University / Esri Canada  
[cplouffe@esri.ca](mailto:cplouffe@esri.ca)

Cameron Plouffe is a Higher Education Analyst at Esri Canada. He is in the latter stages of completing his MSc in Geomatics at Wilfrid Laurier University. His research interest involves developing environmentally-driven forecasting models to gain a better understanding of emerging infectious diseases.



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### 3. Monitoring Effects of Beach and Dune Protection & Restoration Efforts in Sauble Beach, ON

This paper documents the changes in the beach and dune complex at Sauble Beach following the implementation of beach and dune protection, and restoration efforts by the de-facto custodian of the area, Friends of Sauble Beach (FSB). Sauble Beach is heavily impacted by recreational use, has a finite sediment supply and is essentially closed during the winter season (Byrne and Dale, 2010).

Friends of Sauble Beach, a grassroots not-for-profit organization, advocates for the conservation of the area's beach and dunes. Some of the organization's conservation efforts included installing permanent signage, seasonal sand fencing and boardwalks to reduce natural and visitor impact on the beach sand and dunes.

For this study, eight GPS surveys were conducted between May 2003 and March 2010 and used to evaluate FSB's protection and restoration initiatives. Using ArcGIS 3D Analyst, triangulated irregular network (TIN) surfaces were created using the Inverse Distance Weighted method. The TINs were used to detect changes in beach and dune elevations.

During the study period, beach and dune surfaces exhibited increases and decreases in elevation. Generally, during winter, the beach area exhibits increases in the surface elevation. By the end of summer, most of the beach area exhibits decreases in elevation. Comparing the beach and dunes in March 2010, post-FSB initiatives, to these of May 2003, the beach and the dunes exhibit a net increase in elevation (between 6 cm to 80 cm). The dunes in the south exhibited a net decrease in elevation (up to -0.61 m). Future surveys are expected to delineate the effects of FSB's protection and restoration initiatives in 2007-2009.

Dr. Abdullah BaMasoud  
Instructor  
Wilfrid Laurier University  
[abdullah.bamasoud@gmail.com](mailto:abdullah.bamasoud@gmail.com)

Dr. Abdullah BaMasoud is a recent PhD graduate from the Department of Geography at Wilfrid Laurier University. His research focuses on using GIS/Remote Sensing applications in coastal geomorphology with publications in internationally recognized journals. He also completed an MSc in Physical Oceanography from University of Washington in 2005 and an MBA in Finance from McMaster University in 2010. Currently, he is a member of the contract academic staff in the Department of Geography at Wilfrid Laurier University.

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### GIS & Digital Learning (2 sessions)

#### *GIS & Digital Learning 1*

**10:15 – 11:45 AM**

##### **1. Project work using GIS in Junior High**

Daniel will speak about how GIS has helped students at Zion Heights to think critically and become more spatially aware. He will use examples from a number of projects that have utilized GIS in his grade 7 and 9 Geography courses. The projects span a variety of topics including, trees on their school property, tornadoes in the US and Ontario, and location analytics.

Daniel Nini  
Geography Teacher  
Zion Heights Junior High School  
[Danny.Nini@tdsb.on.ca](mailto:Danny.Nini@tdsb.on.ca)

Daniel has been teaching geography for the last 15 years and began using ArcGIS in 1997. He is also a student himself at Ryerson as he is presently working on his GIS certificate. He has been teaching ArcGIS for the last 5 years at Zion Heights Junior High School to students in grades 7 through 9. He sees how the introduction of GIS has helped students think critically and become much more spatially aware of patterns and trends which shape our daily lives and world. He has made GIS a vital component of his Geography programs which gives students an opportunity to develop a variety of different skills but more importantly the chance for theory and practical studies to be messed and tested within the subject of geography using GIS. It is one of few tools available in education that provides students with employable skills.

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### 2. GIS Flipped!

Other than access to technology, the biggest complaint from Geography teachers is that “We just don’t have time for GIS!” Mark Miller and Andrea Luksts, lead Geography teachers at David Suzuki Secondary School in Brampton, will demonstrate flipped classroom methods as a strategy to make time for GIS and inquiry-based learning, two key components of the new Canadian and World Studies Curriculum. A lesson on local suburban growth will be used to highlight how to incorporate flipped classroom learning, community connections and GIS-based inquiry.

Mark Miller  
Geography Teacher  
David Suzuki Secondary School  
[mark.miller@peelsb.com](mailto:mark.miller@peelsb.com)

In 2011, Mark Miller and Andrea Luksts, helped open the David Suzuki Secondary School in Brampton. Being a part of a dynamic team of geographic educators, they have helped to develop innovative lessons using technology and GIS.

### 3. Using ArcGIS in CGC1D

For the past two years, I have integrated the free version of ArcGIS Online with the CGC1D - Grade 9, Academic, Canadian Geography curriculum at St. Marys DCVI. I will demonstrate the various ways in which the ArcGIS platform was used including Esri Canada Lesson Packs, Esri map layers and an ongoing project in which students posted to a common online map. I will also discuss the positive impact ArcGIS Online, available through OSAPAC, will have on the use of ArcGIS with CGC1D Geography.

Peter McAsh  
Retired teacher  
Formerly St. Mary’s DCVI / Avon Maitland DSB  
[pmcash@gmail.com](mailto:pmcash@gmail.com)

Peter McAsh retired in June 2013 from his position of Subject Chair (Computer Studies, Business Studies and Interdisciplinary Studies) at St. Marys DCVI in St. Marys, Ontario. He remains active in education through consulting and conference presentations. In University, he majored in Geography with an emphasis on quantitative analysis which was the early days of GIS. After a career of teaching primarily Computer Studies, when presented with the challenge of teaching Grade 9 Geography, he integrated the use of ArcGIS into the course.

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### *GIS & Digital Learning 2*

12:45 – 2:15 PM

#### **1. Moving the Yardstick: Advancing Problem-Based Learning using GIS**

True Problem-Based Learning (PBL) is learner centered and requires educators to step back from being the sage on the stage to being a facilitator. For educators, this can be a problem: we like to share our knowledge, skills and abilities with students. However, we should be providing students with an active role in the acquisition and creation of knowledge, and the higher academic standards that come with students' engagement in learning.

This presentation will cover curricula, pedagogy and program development between and across curriculum, teachers and courses using a problem-based approach. This includes: problem orientation, project organization, integration of theory and practice, participant direction, team-based approach, collaboration, assessment and feedback.

Steven Hills  
GIS Instructor  
Assiniboine Community College  
[hillssc@assiniboine.net](mailto:hillssc@assiniboine.net)

Steven is a GIS Educator at Assiniboine Community College in Brandon, Manitoba. He has conducted dozens of workshops for educators and GeoMentors teachers, and coordinates the Regional Envirothon and provincial GIS Skills competition. Prior to academia, he spent nearly 20 years as a forester and GIS Analyst.

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### 2. Time, Place and Experience: Spatial Literacy Tools in the Undergraduate Class

A persistent issue faced by instructors of historic, prehistoric and place-specific undergraduate courses is the need to make their subject's spatial and temporal context concrete in student minds when, customarily, space and place remain abstract concepts. As part of the much larger Caravanserai Networks Project that focuses on the chronological, economic, political, religious and social aspects of transportation during the medieval period of South Asia, Candis Haak and Heather Miller have developed a Spatial Literacy Tool (SLT) that fulfills the instructional need of engaging students with place and space, while simultaneously fostering a deeper understanding of the subject at hand through the use of a geographic information program.

Modeled after a pilot study developed by Andrew Nicholson and Andrew Graham of University of Toronto Mississauga for Introductory Classical Civilization courses, the SLT incorporates ArcGIS or Google Earth as a framework to engage students in historical and archaeological studies, while also cataloguing, organizing and integrating visual and documentary sources in an interactive, temporal and spatial capacity. The emphasis is not on generating static maps of places, but on landscapes as experienced by travellers, past and present.

The SLT was also designed as a package for instructors that are easily tailored for areas outside of South Asia. The SLT has been tested in an upper level undergraduate course. The desired outcomes and the actual outcomes for student learning experiences, the methodology employed and the resources required for implementation will be presented.

Candis Haak  
Lab Manager and PhD Candidate  
University of Toronto  
[candis.haak@mail.utoronto.ca](mailto:candis.haak@mail.utoronto.ca)

Candis Haak is a PhD candidate in the Department of Anthropology at the University of Toronto, where she focuses on South Asian archaeology and interpretive uses of GIS for landscape analyses coupled with cognitive geography. Her Master's degree is from the School of Archaeology at the University College of Dublin, where she studied Irish Bronze Age landscapes and burials.

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### 3. Giving Students Choices about When and Where They Learn: Teaching GIS Both Online and In Person

Online tools and strategies for teaching can increase the flexibility of when and where students access course material, how they interact with the instructor and each other, and how they are assessed. However, these tools take time and effort to master and may provide mixed results. Teaching GIS presents its own set of challenges, particularly around software and data access, and providing student support for practical assignments where they are learning complex software.

Experiences will be shared about teaching introductory and intermediate undergraduate GIS courses using webinar, podcasting and virtualized software for teaching in synchronous and asynchronous modes, including simultaneous in-person and online participation, as well as the use of a learning management system for communication and assessment. These pedagogical tools require varying levels of instructor time, effort and technical expertise, which will be discussed in relation to student learning and their perceived value, and how and when students choose to engage in the course content. Evidence from surveys and course evaluations indicate that students appreciate these new strategies, and many state a preference for one mode over another.

Dr. Don Boyes  
Senior Lecturer  
University of Toronto  
[don.boyes@utoronto.ca](mailto:don.boyes@utoronto.ca)

Don is a Senior Lecturer at the University of Toronto, where he has specialized in teaching the theory and application of GIS to undergraduate and graduate students for the past 12 years. He currently teaches over 200 unique students each year from a variety of disciplines, spread over five different GIS courses. Don has a strong interest in the scholarship of teaching and learning, particularly with respect to teaching with technology.

## VGI & Open Data

12:45 – 2:15 PM

### 1. Establishing the Value of Open Data

Governments across Canada are taking measures to improve transparency and efficiency in their activities and services. A key component of this trend are new data distribution protocols, often called “open data” initiatives. Generally, open data must be downloadable by users free of charge, contain contents that can be viewed, edited and combined with other data, and be provided under a non-restrictive license.

The motivations for delivering open data from government to citizens fall into several categories, including the search for efficiencies in government operations, supporting a desire for increased transparency or achieving other democratic goals, and in creating economic value through the liberalization of government data (Johnson & Sieber, 2012a; 2012b). A research gap exists in understanding the value and impact of these open data initiatives. Current perspectives on the value of open data are often anecdotal, or reflect only the potential commercialization of software applications developed that use open data.

The objectives of this research are to;

- 1) measure the value of open data as reported by diverse user communities (government, non-profit, community organizations, private developers)
- 2) develop a set of quantitative metrics to guide the evaluation of open data strategies at all levels of government. Value is used as general term that encompasses both economic and non-economic value. Through these research objectives, this ongoing research will make a significant contribution to the emerging discourse on the use and value of open data.

Dr. Peter Johnson  
Assistant Professor  
University of Waterloo  
[peter.johnson@uwaterloo.ca](mailto:peter.johnson@uwaterloo.ca)

Peter Johnson is an Assistant Professor in the Department of Geography and Environmental Management at the University of Waterloo. His areas of research interest include open data, the geospatial Web, mobile devices and volunteered geographic information. He is currently the open data node leader for the SSHRC-funded Geothink.ca project.

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### 2. VGI-Based Citizen Science: A Field Report from the Frontlines of the RinkWatch Project

New technologies have enabled rapid development of citizen science tools through online mapping, user forums and mobile platforms. RinkWatch, a VGI citizen science project, was created to actively elicit VGI from people who maintained outdoor skating rinks. Users report skating conditions at local rinks, which can act as a spatially local surrogate indicator of temperature around freezing, providing possible insight into temperature changes over time. More importantly, RinkWatch connects climate change to a common Canadian pastime: outdoor skating. This paper will detail the successes and failures of the first year of the RinkWatch project, focusing on the factors and design leading to the strong launch and participation rates.

Haydn Lawrence  
MSc Geomatics Candidate  
Wilfrid Laurier University  
[lawr8480@mylaurier.ca](mailto:lawr8480@mylaurier.ca)

With a Computer Science degree from UNB in Fredericton, he later found his interests were more focused in GIS and spatial information, studying post-grad through COGS where he was chosen as valedictorian. He is now in his second year of Geomatics at Wilfrid Laurier University in Waterloo.



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### 3. Scale Effects in Geotagged Photographs

User-generated or volunteered geographic information (VGI) is transforming patterns of spatial data use and production, and also presents new opportunities for geographical research. In this presentation, we explore how a common form of VGI, namely geotagged photographs (GTPs), may be used to distill spatial expressions of place in an urban environment. We focus specifically on the effects that GTP aggregation unit size has on the dominant place descriptions present in photograph tags. To explore this notion of “tag-space”, a multi-scale approach based on different sizes of hexagonal lattices was used to examine geotagged photographs obtained from the Flickr API assembled for the City of Vancouver for the 2001-2012 period. Local log-odds ratios were used to examine how citizens’ place descriptions varied across localities relative to neighbouring areas. The results show significant interaction between tag-space descriptions and spatial aggregation, and suggest that scale effects should be considered explicitly when examining citizens’ sensing of urban environments.

Dr. Rob Feick  
Associate Professor  
University of Waterloo  
[rfeick@uwaterloo.ca](mailto:rfeick@uwaterloo.ca)

Dr. Colin Robertson  
Assistant Professor  
Wilfrid Laurier University  
[crobertson@wlu.ca](mailto:crobertson@wlu.ca)

Dr. Colin Robertson runs the Spatial Lab at Wilfrid Laurier University. His research interests center on the intersection of spatial epidemiology, global health and spatial ecology. Colin's interests encompass a broad range of areas from developing and applying spatial and space-time models to better understand processes of disease emergence and spread, to the use of new forms of digital data (e.g., crowdsourced, participant-generated) in understanding geographic processes.

Dr. Rob Feick is an Associate Professor at the University of Waterloo in the Faculty of Environment's School of Planning. His research focuses broadly on the application of spatial information technology to assist decision-making and public participation in land management and planning. His current research centres on spatial Web 2.0 tools that facilitate citizen involvement in planning through spatially referenced forms of community dialogue, volunteered geographic information (VGI), spatial decision aiding methods such as GIS-based multi-criteria analysis, and Web-based spatial data visualization methods.

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### Evolving the K-12 Curriculum

12:45 – 2:15 PM

#### Past, Present and Future of GIS in the Ontario Curriculum

In this session, we will highlight the role of spatial technology in the Ontario Social Studies, Grades 1 to 6; History and Geography, Grades 7 and 8; and the secondary Canada and World Studies curriculum. We will also discuss resources available to support educators in implementing GIS into their teaching including training, activities and data. Access to the Ontario Ministry of Education software will also be covered.

Jennifer Farrell-Cordon

Ontario Ministry of Education

[Jennifer.Farrell-Cordon@ontario.ca](mailto:Jennifer.Farrell-Cordon@ontario.ca)

Mark Lowry

Toronto District School Board

[Mark.Lowry@tdsb.on.ca](mailto:Mark.Lowry@tdsb.on.ca)

Jennifer Farrell-Cordon is an intermediate teacher with the Toronto District School Board. She is currently an Education Officer, in the Curriculum and Assessment Policy Branch working on the revision of the Social Studies, Grades 1 - 6; History and Geography, Grades 7 and 8 and the Canadian and World Studies, Grades 9 - 12 curriculum policy documents. She has co-authored two Geography textbooks and has served on a variety of writing teams concerning the elementary curriculum through the Toronto District School Board and The Critical Thinking Consortium.

Mark Lowry is a world renowned Geography and Geotechnologies educator at both the national and international level. As a Geography consultant with the Toronto District School Board and Past President of the Ontario Association for Geographic and Environmental Education Mark has more than 20 years' experience infusing Geotechnologies and spatial literacy into Ontario's and other curricula worldwide.

## Lightning Talks (2 sessions)

### *Physical/Environmental focus*

2:25 – 3:40 PM

#### 1. Spatial Data Quality Management Framework for Telecommunication Enterprise

The evolution of modern spatial information technologies is continually changing the landscape of geospatial usage. However, although spatial data quality assessment has long been established as a cornerstone to support data management in Spatial Data Infrastructure, the exploration of implementing spatial data quality management in an enterprise context is still an on-going process. In this research, a framework is developed to specifically address the spatial data quality management challenges in telecommunication enterprise. A process-oriented approach, instead of the data-centric approach, is applied to examine spatial data quality assessment from a different perspective. By doing so, a new understanding of spatial data quality management in enterprises is identified in this research.

Yunwei Dong  
PhD Candidate  
University of Waterloo  
[y5dong@uwaterloo.ca](mailto:y5dong@uwaterloo.ca)

#### Biography:

- Jan. 2009 - Present, University of Waterloo, PhD Candidate, Geomatics, Geography Program, Faculty of Environment
  - Research interests: Spatial data quality management, Enterprise GIS, geo-semantic web
- Sept. 2006 – Dec. 2008, University of Waterloo, Master of Environment Studies, Geomatics, Geography Program
  - Thesis topic: Web-based GIS for watershed non-point source pollution management
- Sept. 2002 – Aug. 2006, Nankai University, China, Bachelor of Applied Science, Computer Science Program
  - Thesis topic: Geo-visualization design in location-based embed system

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### 2. Topography Toolbox: Creating a Toolset to Analyze Landslide Hazards in Hamilton, ON

Aside from slope, aspect and surface curvature, many common topographic indices found in the literature do not exist in the current versions of ArcGIS. To solve this issue, a Topographic Toolset was created using the Python scripting language and the ArcPy package. In this presentation, the toolset will be applied to study landslide potential in Hamilton, Ontario.

Michael Zablocki  
Recent Graduate  
McMaster University  
[zablockimichael@gmail.com](mailto:zablockimichael@gmail.com)

Michael Zablocki is a recent graduate from McMaster University's Biology and Environmental Science program. He received the 2012 EDC Student of the Year award for developing a Topographic Toolset, which he will be presenting at this year's conference. Mike is interested in the application of GIS to health and education.

### 3. Remote Sensing of Tall Grasslands: Estimating Vegetation Biochemical Contents at Multiple Spatial Scales

This thesis estimated vegetation biochemical properties at multiple spatial scales and investigate vegetation temporal dynamics under climate influences in a heterogeneous tallgrass ecosystem in Southern Ontario using remote sensing data. Ground hyperspectral and space multispectral remote sensing data derived Normalized Difference Vegetation Index (NDVI) and Simple Ratio (SR) were used to estimate biochemical properties at the species, canopy and landscape level. Both vegetation indices explained 32% to 56% of the variations in biochemical properties at the species level, 16% to 53% at the canopy level, and over 60% at the landscape level.

MODIS NDVI and climate data were also collected to investigate the vegetation-climate relationships during the growing season and the lag effects of climate factors on vegetation at the peak growing season. The findings indicate that temperature is the key climate factor that drives the annual cycle, and there is a time lag effect of climate factors on vegetation.

Kelly Wong  
Graduate Student  
University of Toronto  
[kellykaleiwong@gmail.com](mailto:kellykaleiwong@gmail.com)

Kelly is a Master graduate in Geography specializing in Remote Sensing at University of Toronto. Her master thesis was published in the Canadian Journal of Remote Sensing in August 2013. Currently, she works at Bell Mobility as a GIS Analysis Associate. Her goal is to become a professional GIS analyst.

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### 4. An Approach for the Early Detection of Emerald Ash Borer using Multi-Geospatial Data

As an invasive insect species, Emerald Ash Borer (EAB) attacks all species of ash trees (*Fraxinus* spp.) in Ontario. The ash trees attacked by EABs normally die within 3 to 5 years and show obvious decline within 2 years. Therefore, the early detection of EAB infestation is critical for the urban environment monitoring and management.

The purpose of our project is to establish a framework to improve species identification, health characterization and early EAB detection using multiple geospatial data sources, including airborne and terrestrial LiDAR, hyperspectral and high-spatial-resolution aerial imagery. The presentation mainly focuses on the first stage of the project, in which individual trees were delineated from aerial imagery and LiDAR, and ash trees were identified using spectral, textural and structural information derived from hyperspectral, high-spatial and LiDAR data. An initial investigation on the characterization of ash tree health based on the multiple geospatial data sources is also proposed. ArcGIS Online and ArcGIS for Desktop were used for the data processing and visualization in this project.

Dr. Jili Li  
Post-doctoral  
York University  
[jili.li@ymail.com](mailto:jili.li@ymail.com)

Dr. Jili Li obtained his PhD degree from the Department of Earth and Space Science and Engineering at York University in August 2013, with a focus on LiDAR remote sensing in forestry for tree species identifications. He is currently working as post-doctoral fellow at York University, for a NESRC Engage Project with Esri Canada to detect ash trees in the Greater Toronto Area and quantify their health conditions. His research interests include remote sensing and GIS in forestry, biology and ecology.

## GIS in Education Conference 2013

### *Human/Urban focus*

2:25 – 3:40 PM

#### **1. A Framework for Investigating Volunteered Geographic Information Relevance**

There is a growing interest in citizen-sourced data due to its heterogeneous, time-sensitive, geo-social nature. The term Volunteered Geographic information (VGI) was coined to describe the processes whereby non-professionals or “citizen scientists” participate directly in spatial data creation, editing and shared use. Members of the public can use VGI to comment on issues of personal or community concern. However, uncertainties associated with VGI include relevance, credibility, representativeness and quality of the geographic information. This talk investigates the opportunities and barriers to the use of VGI.

A framework and methodology for collaborative quality control through multi-criteria subjective relevance ratings of the VGI by its producers and users is put forward in this talk. The relevance rating framework for quality control of VGI is based on the use of relevance in information retrieval in information science to improve the relevance of search engine results. This concept is transferred to the quality control of VGI contributions to determine the best VGI contributions based on three criteria. A VGI Web application prototype, including the subjective relevance rating system, was created and a methodology and demonstration of its use is presented.

Terri Cowan

Geospatial Analysis Associate at Bell Professional Management Program

University of Waterloo

[terri.cowan09@gmail.com](mailto:terri.cowan09@gmail.com)

Terri is a recent graduate of the University of Waterloo with a Masters degree in Urban Planning. She also has an undergraduate degree in Geomatics from the University of the West Indies. She is currently an intern in the Geospatial Analysis department at Bell Mobility in the Professional Management Program.

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### 2. Children's Risk of Pedestrian Injury Walking to School

Child-pedestrian injuries are those injuries resulting from a collision between child-pedestrians and motor-vehicles, and are a leading cause of injury-related deaths for Canadian children aged 14 years and under. The goal of this paper is to study the association between attributes of the transportation environment and the risk of child-pedestrian injuries at a small geographic scale. We study this association using estimates of child pedestrian volume, which allows us to make local estimates of risk of child-pedestrian injuries as a function of both the features present in the transportation environment and the number of child-pedestrians at a given location.

Our objective is to determine what environmental attributes found at a small geographic scale put children at the greatest risk of collision with motor-vehicles, which can be used by policy makers to determine what modifications of the transportation environment are most pertinent for reducing the risk of child-pedestrian injuries. Challenges include estimating children's routes to school and identifying child-pedestrian injuries that occurred on the walk to or from school.

Scott Bennet  
PhD Candidate  
McMaster University  
[scottbennet@gmail.com](mailto:scottbennet@gmail.com)

Scott is a PhD candidate in the school of Geography and Earth Science at McMaster University. Scott also holds a Masters of GIS from the University of Calgary and has been involved in the GI Science field for 10 years.

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### 3. Characterizing Congestion Using INRIX Data

This research aims to augment measures of traffic congestion severity with a probabilistic measure of travel reliability to contribute towards a more robust understanding of traffic congestion in Canadian cities. The value of travel time reliability is largely ignored in transportation cost-benefit analysis, even though unreliable routes can incur more financial burden than the associated costs of congested delay. I will cover a condensed workflow of my statistical methods and modelling techniques, and introduce the struggles associated with “big data” and INRIX data in particular. Preliminary results and comparison of existing congestion indices will be presented.

A Gaussian mixture model is used to classify subpopulations of vehicle speeds (congested and un-congested) for every road link in the massive INRIX dataset. These subpopulations depict the probability of belonging to a congested or free-flow state. The metric, the Reliable Commuter Index (RCI), utilizes these probabilities to scale the severity of congestion to more accurately represent traffic congestion of a particular road link. The RCI is presented as:

$$RCI = (mC p(C))/(mF p(F))$$

Where:

- $m$  is the 5% median travel time under  $C$  (congested),
- $F$  (free-flow) conditions,
- $p$  is the probability of belonging to either the  $C$  or  $F$  state.

To ease initial computational costs due to data volume, and control the input sources, we first test the metric against simulated data. The index response is observed against a range of traffic conditions to demonstrate its superior response to other popular indices such as the Travel Time Index (TTI). The metric is then applied to 2011 GPS recorded speed data provided by INRIX and mapped to all of Canada during both the morning and afternoon peak periods.

Ryan Kelly  
Masters Candidate  
McMaster University  
[kellyrm@mcmaster.ca](mailto:kellyrm@mcmaster.ca)

Ryan Kelly is a Masters candidate in the School of Geography and Earth Sciences at McMaster University. His research is exploring the severity of traffic congestion within major Canadian cities using a dense collection of GPS recorded speed data and innovative techniques.



### 4. A Model-Based Approach to Selecting Case Sites for Walkability Audits

Walkability audits provide valuable information about pedestrian environments, but are time consuming and can be expensive to implement. In this paper, we propose a model-based approach to selecting sites for conducting walkability audits. The key idea is to estimate a model of travel behaviour at the meso-scale level, which can be examined to identify locations where the behaviour is under- and over-estimated. We conjecture that systematic under- and over-estimation can be caused by micro-level factors that influence the behaviour. The results can be used to identify sites for walkability audits.

The approach is demonstrated with a case study in Hamilton, Ontario. A model of walk shares forms the basis of the site selection procedure. After identifying areas with higher and lower shares than predicted by the model, we select a sample of neighbourhoods for audits.

Analysis of the results reveals elements of the local environment that associate with greater-than-expected walk shares. The case study demonstrates that the proposed model-based strategy can be used to better target limited resources and produce valuable insights into micro-level factors that affect travel behaviour.

Md Moniruzzaman  
PhD Candidate  
McMaster University  
[monirm@mcmaster.ca](mailto:monirm@mcmaster.ca)

Md Moniruzzaman (Monir) is a PhD candidate in the School of Geography and Earth Sciences in McMaster University. Before joining McMaster in 2009, he finished his bachelor degree in Urban and Regional Planning from the Bangladesh University of Engineering and Technology.

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### 5. Parametric City - An Exploration of Large-Scale 3D Planning Tools

With today's abundance of digital tools, there is an expectation of instantaneous and accurate results. Rapid ideas and questions deserve thoughtful, efficient outcomes and solutions. Designing mass-models at large city scales with these expectations continues to be a challenge. Our research focuses on implementing Esri's CityEngine software within a Canadian context by incorporating intuitive parametric modelling into a design scenario. Through data visualization, real-time reporting and analysis, and improved communication methods, the CityEngine platform can be utilized as a research tool and a practical application to assist in the transfer and creation of knowledge media between industry and the public realm.

Main research ideas include:

- Using 3D modelling software as a way to drive the creation of form through automatic or parametric means; using parametrics as a descriptive communication method in landscape knowledge; evaluating the usefulness of real-time reporting and interaction in the design process; and understanding the benefits and limitations of a parametrically-focused design approach
- Evaluating user interfaces for efficiency in communication and iterative design

David Kossowsky  
Master of Landscape Architecture Candidate  
University of Toronto  
[david.kossowsky@mail.utoronto.ca](mailto:david.kossowsky@mail.utoronto.ca)

David Kossowsky is a Master of Landscape Architecture student and a member of the collaborative program in Knowledge Media Design at the University of Toronto. He is also a Medical Geographer with the BioDiaspora project, where he assists in the development of systems and maps to track the spread of infectious diseases.

# GIS in Education Conference 2013

## Roundtable Discussion

3:45 – 5:00 PM

### Opportunities in GIS Education: meeting the needs of students

Members of the panel will address the following questions:

1. How do we identify student needs at each level of the education system, and how should these dovetail within and between systems?
2. What are the current student needs? (identify the top 5)
3. What are the greatest challenges that current face K-12 and higher education students (and how might these best be overcome in terms of improving spatial literacy through the use of GIS)?
4. What are the 5 most important opportunities in GIS education and how should these be best addressed?

*Chair:*

Pat DeLuca  
McMaster University  
[delucapf@mcmaster.ca](mailto:delucapf@mcmaster.ca)

*Panel Members:*

Dr. Don Boyes University of Toronto <a href="mailto:don.boyes@utoronto.ca">don.boyes@utoronto.ca</a>	Mark Lowry Toronto District School Board <a href="mailto:Mark.Lowry@tdsb.on.ca">Mark.Lowry@tdsb.on.ca</a>
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Dr. Bob Sharpe Wilfrid Laurier University <a href="mailto:bsharpe@wlu.ca">bsharpe@wlu.ca</a>	Kim Wallace Retired Curriculum lead, Ministry of Education (Ontario) <a href="mailto:kwallace@sympatico.ca">kwallace@sympatico.ca</a>
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James Boxall  
Dalhousie University  
[james.boxall@dal.ca](mailto:james.boxall@dal.ca)

# GIS in Education Conference 2013

## Technical Workshops

### How to Put ArcGIS Online to Work in the Classroom

**2:30 – 3:45 PM**

Learn how ArcGIS Online can provide you with everything you need to introduce your students to the use of spatial technology. In this hands-on workshop, you will learn how to access data, create your own Web maps, share content and integrate Web mapping into your teaching. You will also be introduced to a variety of ArcGIS Online resources that are available to achieve curricular outcomes and foster critical thinking and spatial skills among students.

Angela Alexander  
Esri Canada  
[aalexander@esri.ca](mailto:aalexander@esri.ca)

Ashleigh Harris  
Esri Canada  
[aharris@esri.ca](mailto:aharris@esri.ca)

### Telling Stories with ArcGIS Online

**3:45 – 5:00 PM**

Story Maps are Web maps that incorporate text, multimedia, and interactive functions to inform, educate, entertain, and inspire people about a wide variety of topics. Learn how you can use maps to tell a story in your teaching and educate your students on being more geographically aware. In this hands-on workshop you will create and configure different types of story maps and be introduced to additional resources available from Esri Canada.

Caroline Tiegs  
Esri Canada  
[ctiegs@esri.ca](mailto:ctiegs@esri.ca)

Cameron Plouffe  
Esri Canada  
[cplouffe@esri.ca](mailto:cplouffe@esri.ca)

### Developing Mobile Apps with ArcGIS Online

**3:45 – 5:00 PM**

Learn how to create mobile web apps using the ArcGIS JavaScript development tools. The application you will create will show how you how to query and update an ArcGIS Online Feature Service. Techniques for optimizing the app for mobile devices will be covered. No prior web development experience is required for this workshop.

Michael Luubert  
Esri Canada  
[mluubert@esri.ca](mailto:mluubert@esri.ca)

Dr. Michael Leahy  
Esri Canada  
[mleahy@esri.ca](mailto:mleahy@esri.ca)

# Notes

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# Notes

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# Notes

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