UNIVERSITY OF TORONTO SCARBOROUGH | PHYSICAL & ENVIRONMENTAL SCIENCES | PhD Environmental Science

6th Doctoral Environmental Science Colloquium
DESC VI
SEPT 29TH – 30TH, 2022

DESC IV Student Organizing Committee:

Aisha Javed
Akunne Okoli
Ratnajit Saha
Alice (Xia) Zhu

Departmental Assistance:

Prof. George Arhonditsis
Elizabeth (Liz) Pulickeel

DESC VI Cover Art Contest Winner:

Sayuri Sagisaka

DESC IV Presentation competition categories:

Applied Science and Technology
Environmental Social Sciences
Experimental and Theoretical Science

Many thanks to our keynote speakers, Dr. Grant Brown, Dr. Brian D. Fath, and Dr. David McLagan for giving their time to present at and attend the DESC VI colloquium and to the PhD students who participated in the Cover Art Competition.

DESC VI Schedule

Day 1: September 29th, 2022 (Thursday) from 8:00 AM – 5:00 PM
Location: EV151 (UTSC)

TIME (AM/PM)	SPECIFICATION	
08:00 – 09:00	**BREAKFAST**	
09:00 – 09:15	**Welcome Speech by Chair**	
09:15 – 10:15	**Keynote Speaker: Dr. Brian D. Fath**	
10:15 – 10:30	**BREAK**	
	APPLIED SCIENCE AND TECHNOLOGY	
	Chaired by Aisha Javed and Alice Zhu	
	Presenter	**Supervisor and Co-Supervisor**
10:30 – 10:45	Emily Chenery	Peter Molnar and Nicholas Mandrak
10:45 – 11:00	Yuening Li	Frank Wania
11:00 – 11:15	Vincent Moxley-Paquette	Andre Simpson
11:15 – 11:30	Ratnajit Saha	George Arhonditsis
11:30 – 11:35	**BREAK**	
11:35 – 11:50	Erik Dean	Nicholas Mandrak and Andrew Drake
11:50 – 12:05	Syed Bukhari	Nick Eyles
12:05 – 01:00	**LUNCH BREAK (Location: EV 140)**	
	APPLIED SCIENCE AND TECHNOLOGY	
	Chaired by Alice Zhu and Ratnajit Saha	
	Presenter	**Supervisor and Co-Supervisor**
01:00 – 01:15	Akunne Okoli	George Arhonditsis
01:15 – 01:30	Aisha Javed	George Arhonditsis
01:30 – 01:45	Mahendra Doraisami	Adam Martin
01:45 – 02:00	Beatriz Herrera	Kimberly Strong
02:00 – 02:15	**BREAK**	
	ENVIRONMENTAL SOCIAL SCIENCES	
	Chaired by Akunne Okoli and Aisha Javed	
	Presenter	**Supervisor and Co-Supervisor**
02:15 – 02:30	Noelle Gadfly Stratton	Nicole Klenk and Nicholas Mandrak
02:30 – 02:45	Raúl Salas Reyes	William Gough and Nicole Klenk
02:45 – 03:00	Ichha Ravinderpal Kaur Kohli	Laura Tozer
03:00 – 03:15	Fatima Ahmed	Len Tsuji
03:15 – 03:30	**BREAK**	
03:30 – 04:30	**Keynote Speaker: Prof. Grant Brown**	
04:30 - 04:45	**Day highlight and day 2 activities; Adjourn**	

Day 2: September 30th, 2022 (Friday) from 8:00 AM – 5:00 PM
Location: EV151 (UTSC)

TIME (AM/PM)	SPECIFICATION	
08:00 – 09:00	**BREAKFAST**	
09:00 – 10:00	**Keynote Speaker: Dr. David McLagan** **Presentation and Q&A session**	
10:00 – 10:15	**BREAK**	
	EXPERIMENTAL AND THEORETICAL SCIENCE	
	Chaired by Aisha Javed and Ratnajit Saha	
	Presenter	**Supervisor and Co-Supervisor**
10:15 – 10:30	Xia (Alice) Zhu	Chelsea Rochman
10:30 – 10:45	Erico Oliveira Pereira	Myrna Simpson
10:45 – 11:00	Huan (Phoebe) Tong	Myrna Simpson
11:00 – 11:15	Franklin Perez	Ruby Sullan
11:15 – 11:30	**BREAK**	
	EXPERIMENTAL AND THEORETICAL SCIENCE	
	Chaired by Ratnajit Saha and Aisha Javed	
	Presenter	**Supervisor and Co-Supervisor**
11:30 – 11:45	Sayuri Sagisaka	Carl Mitchell
11:45 – 12:00	Patricia Semcesen	Mathew Wells
12:00 – 12:15	Sarah Simon	Jennifer Murphy
12:15 – 12:30	Haiyong (Planck) Huang	Carl Mitchell
12:30 – 12:45	**BREAK**	
12:45 – 01:00	Cindy Yang*	George Arhonditsis
01:00 – 01:15	Patricia Miller	Roberta Fulthorpe
01:15 – 01:30	Xiaoqing Shao	Maria Dittrich
01:30 – 02:30	**LUNCH BREAK (Location: EV141)**	
02:30 – 03:30	**POSTER PRESENTATIONS (Applied Science and Technology; Experimental and Theoretical Science)** *Note: Posters will be set up for both days, but speakers will be judged during this time slot and must be present near their respective posters*	
	Presenter	**Supervisor and Co-Supervisor**
	Edina Illyes	Nicholas Mandrak
	Eden Hataley	Chelsea Rochman and Dimple Roy
	Jennifer R. Powell	Nicholas Mandrak
	Diwen Yang	Hui Peng
	Joe Kawalec	Peter Molnar
03:30 – 04:00	**BREAK (*Note: Presentation judging polls will close at 3:30 pm*)**	
04:00 – 04:30	**Presentation of awards and closing remarks**	
~ 4:45pm	**Social event at Olde Stone Cottage Pub** **(3750 Kingston Rd , Scarborough, ON M1J 3H5)**	

* Speaker is a part of the Environmental Social Sciences research category

Keynote Presentations

Dr. Brian D. Fath

Brian D. Fath is a Professor in the Department of Biological Sciences at Towson University (Maryland, USA) teaching courses on Ecosystem Ecology, Environmental Science, and Human Ecology. He is also a Senior Research Scholar at the International Institute for Applied Systems Analysis (Laxenburg, Austria) and since 2011, the Scientific Coordinator of IIASA' s Young Scientists Summer Program. He has published over 200 research papers, reports, and book chapters on environmental systems modeling, specifically in the areas of network analysis, urban metabolism, and sustainability. He co-authored, among others, the books A New Ecology: Systems Perspective (2020), Foundations for Sustainability: A Coherent Framework of Life–Environment Relations (2019), and Flourishing within Limits to Growth: Following Nature's Way (2015). He served as Editor for 6-volume Environmental Management Handbook (2020) and 4-volume Encyclopedia of Ecology (2019).

Dr. Fath is also Editor-in-Chief for the journals Current Research in Environmental Sustainability and Frontiers in Sustainable Resource Management. He was the 2016 recipient of the Prigogine Medal for outstanding work in systems ecology; twice a Fulbright Distinguished Chair (Parthenope University, Naples, Italy, in 2012 and Masaryk University, Czech Republic, in 2019), and twice University System of Maryland Regents awardee for outstanding scholarship.

Title of Talk:

Flourishing within Limits: Following Nature's Way

Abstract:

Decades of research and discussion have shown that an increase in human population and our consumption of natural resources cannot continue – there are limits to growth. Developments in systems ecology have discovered basic ecological principles that demonstrate how living systems are able to continue to increase in complexity, diversity, and information, in light of their given biophysical constraints. One goal is to learn from these insights to modify and revise our economic systems using nature as a model – a form of holistic ecomimcry. This presentation draws on systems ecology, network analysis, and recent projections of human world population to give hope about changes that may lead to win–win situations. In other words, we can learn from nature how to develop a society that can flourish within the limits to growth with better conditions for prosperity and well-being.

Dr. Fath's talk is scheduled for 9:15 am on September 29th.

Dr. Grant Brown

Grant Brown is a Professor of Biology at Concordia University in Montreal, Quebec. His research group focuses on the chemical, behavioural, and cognitive ecology within freshwater ecosystems. Using a combination of field and controlled laboratory experiments, Dr. Brown's research aims to shed light on the evolutionary arms race between predator and prey by exploring key questions relating to the ways in which prey assess and respond to variable predation threats and the techniques by which predators compete for food based on variable information. To date, Dr. Brown has published over a total of 180 highly cited (> 9000 citations) peer-reviewed publications in high-profile journals such as Fish and Fisheries, Proceedings of the Royal Society, and Ecological Monographs. He has given 43 invited talks and over 140 conference presentations. Dr. Brown obtained a Bachelor of Science from the University of Lethbridge (Comparative Psychology and Neuroscience) and a Ph.D. from Memorial University of Newfoundland (Biopsychology).

Title of Talk:

The cognitive ecology of predator-prey Interactions and why it matters.

Abstract:

Predation exerts an unforgiving and pervasive selection pressure on prey populations, forcing them to make behavioural trade-offs between the successful detection and avoidance of acute threats and a suite of fitness-related activities such as foraging, courtship, and/or territorial defence. Prey individuals rely on a suite of risk assessment cues to balance such trade-offs and make context-appropriate behavioural decisions. However, conditions of uncertain or unpredictable predation risks can dramatically increase the costs associated with behavioural decisions. Recently, our group has focussed on what biotic and abiotic factors contribute to increasing 'ecological uncertainty' among prey populations and how prey respond to increasingly uncertain conditions. Additionally, anthropogenic stressors such as elevated temperature, turbidity, or ambient pH are known to disrupt the availability of risk assessment information; further increasing 'ecological uncertainty'. My talk will describe some of our recent work, highlighting the sophistication of prey information assessment and decision-making and why predicting the impact of multiple (and interacting) anthropogenic stressors on the decision-making process among prey populations is a critically important question.

Dr. Brown's talk is scheduled for 3:30 pm on September 29th.

Dr. David McLagan

David McLagan was an outstanding graduate student of our DPES Ph.D. program. He is the recipient of the (highly prestigious) Governor General's Gold Medal and the initiator and founder of the DESC colloquium. Dr. McLagan's Ph.D. research, co-supervised by Professors Frank Wania and Carl Mitchel, focused on the development and rigorous testing of a highly novel, passive (non-electrical) sampler for mercury in the air. His research carried a relatively undeveloped idea into a fully functional product that is now being used across the world. Dr. McLagan has an impressive record of academic achievements with a much greater number of exceptional quality journal articles than is the norm for the discipline, a commercialization agreement with a private company for an invention developed in his thesis work, tangible impact on current global mercury pollution policy and numerous important contributions to graduate student life at the University of Toronto. Dr. McLagan was extremely productive throughout his graduate work, achieving a spot in a class of his own. In addition to over 45 conference presentations (25 as presenting author and several invited!), he has 20 peer-reviewed papers in top-tier journals. He was recently an NSERC Postdoctoral Fellow at the Technical University of Braunschweig (Braunschweig, Germany) and an Assistant Professor for graduate studies at the University of Toronto. Currently, Dr. McLagan is an Assistant Professor and works in the FEWA Lab – Fire, Earth, Water, and Air: Contaminant Biogeochemistry Lab at Queen's University.

Title of Talk:

A toxic legacy: Utilising polluted sites for mercury biogeochemical cycling assays.

Abstract:

Until Minamata disease, which caused >2000 deaths in the 1950s and 1960s (Minamata, Japan), was directly linked to mercury (Hg) pollution, use and emissions of Hg from production (mining and energy) and industrial processing were unregulated. Facilities such as these are commonplace around the world and Hg pollution from these sites has a lasting impact on human and environmental health. In 2019, I published a study that showed approximately 80 – 150 $kg \cdot yr^{-1}$ is emitted into the atmosphere alone from a former Hg mine in central Italy. While assessments of environmental emissions of Hg from legacy polluted sites and the effects of these emissions on local populations and ecosystems are of critical importance, these sites also provide the opportunity to study intricate details of the Hg biogeochemical cycle without constraints of analytical detection limits that can affect studies in background regions. Hg stable isotopes are a powerful analytical tool that provides unparalleled degree of detail on Hg sources and processes that control the transport, exchange, and fate of Hg in the environment. However, they are once such analytical system that becomes increasingly challenging as Hg concentrations in target matrices decrease. I will use this seminar to describe how I have been able to apply a multi-analysis approach led by Hg stable isotopes to improve our understanding of Hg biogeochemical cycling across environmental compartments in and around Hg polluted sites. This work involves studies tracking Hg emissions from

industrial sources and then tracking its transport, transformation, and fate in coupled soil-groundwater systems, streams, atmosphere, and trees as well as exchanges between these systems. Ultimately, this work has direct applicability to the Minamata Convention on Mercury that highlights the importance of understanding "*the environmental cycle … of mercury and mercury compounds in a range of ecosystems*".

Dr. David McLagan's talk is scheduled for 9:00 am on September 30th.

PhD Presentations

Day 1 Oral Presentations:

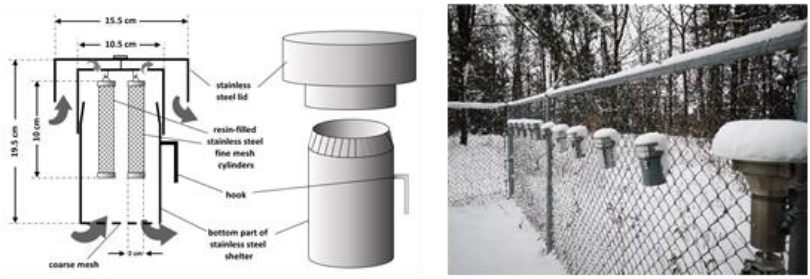
Par-tick-ular times and places: estimating the risk of host-parasite interaction in a dynamic boreal ungulate community
Emily Chenery, Peter Molnar, Nicholas Mandrak

Parasite transmission between hosts is rarely observed and particularly challenging to study in the field, where sampling live hosts is often both invasive and logistically infeasible. We sought to assess the relative risk of environmental transmission of the juvenile life stage of the winter tick, Dermacentor albipictus, to four species of ungulate hosts in Yukon and to determine the likely contribution of new host species to regional winter tick dynamics. Data from 70 wildlife trail cameras were analyzed to estimate intensity of habitat use by a resident cultural keystone species, moose (Alces americanus), introduced elk (Cervus canadensis), feral horse (Equus ferus caballus), and newly colonizing mule deer (Odocoileus hemionus). Cameras were sited at locations with known larval winter tick activity and the resulting data analyzed across key periods of winter tick transmission to, and detachment from, hosts. During the tick transmission period (Oct-Dec), tick-present areas did not appear to have a negative effect on the expected number of use events per week by elk, horses, and deer, indicating that these potential hosts are at higher risk of collecting larval ticks due to inherent habitat preferences. Moose were not detected during the tick transmission period and only infrequently during the tick detachment period (Mar-May) across the study region. Our results suggest that the winter tick-host system in this area of Yukon is most likely

maintained by just one or two introduced host species (elk, horse), whose relative risk of infection is greatest given their use of tick-infested habitat over time.

Year: 6th +
Research Category: Applied Science and Technology

Field Calibration of the XAD-based Passive Air Samplers for Legacy and Emerging Organic Contaminants
Yuening Li, *Frank Wania*



Schematic of the short XAD-PAS (left) and the photograph of the sampling site in Toronto, Ontario.

The use of passive air samplers (PAS) for atmospheric semi-volatile organic compounds (SVOCs) has expanded over the past decades. Confident use of a PAS requires knowledge of its uptake kinetics in their dependence on meteorological conditions and chemical properties and of the limits of linear uptake of more volatile SVOCs. Such knowledge is gained through calibration studies involving the side-by-side deployment of active and passive air sampling techniques. Here we describe a calibration of the XAD-PAS, which uses styrene-divinylbenzene-copolymeric (XAD) resin as a sorbent. 24 XAD-PASs were deployed on the campus of the University of Toronto Scarborough on June 17th, 2020, and duplicates were retrieved at monthly intervals until May 19th, 2021. During the entire passive air sampling period, 48 consecutive week-long active samples were taken with a mid-volume pump. The gas and particle phases were collected on PUF-XAD resin sandwiches and glass fibre filters, respectively. One duplicate of each pair of PASs, all blank samples and the PUF-XAD-PUF sandwiches have been extracted, concentrated, and analyzed for over 350 target chemicals. Sampling rates (*SR*) can be derived using the slopes of the linear regressions through the curves of effective sampling volumes over the deployment period. *SR*s have been successfully determined for 93 compounds including 75 first ever reported *SR*s. It is hoped that this "gold standard" calibration experiment will succeed in greatly expanding the knowledge base on *SR*s and lengths of the linear uptake period for a great variety of legacy and emerging SVOCs in the XAD-PAS.

Year: 4th

Research Category: Applied Science and Technology

A Comparison of Methods for Producing Low-Magnetic Susceptibility Micro-coils
Vincent Moxley-Paquette, *Andre Simpson*

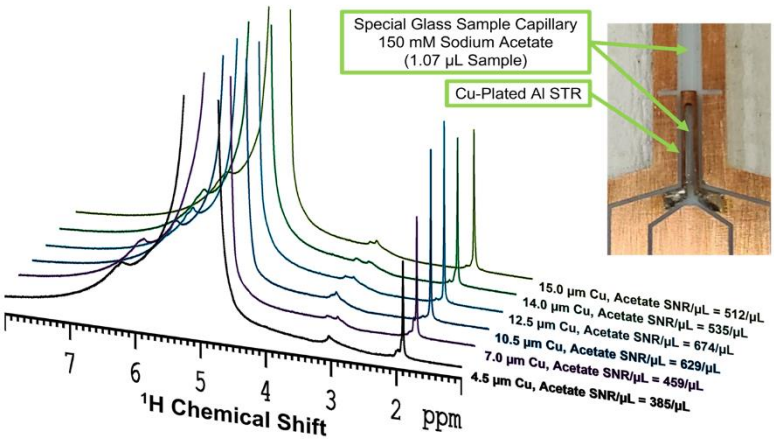


Figure 1. A Cu-plated Al STR with a 500 µm O.D. special glass sample capillary (10 µm thick walls) between the two strips (top, right). The thickness of the Al layer within the STR is 291 µm. A series of ^{1}H NMR experiment were performed on 150 mM Sodium Acetate (in H_2O) at Cu thicknesses to determine the optimal Cu thickness (bottom, left). The Cu layer thickness and SNR per µL of sample is also shown.

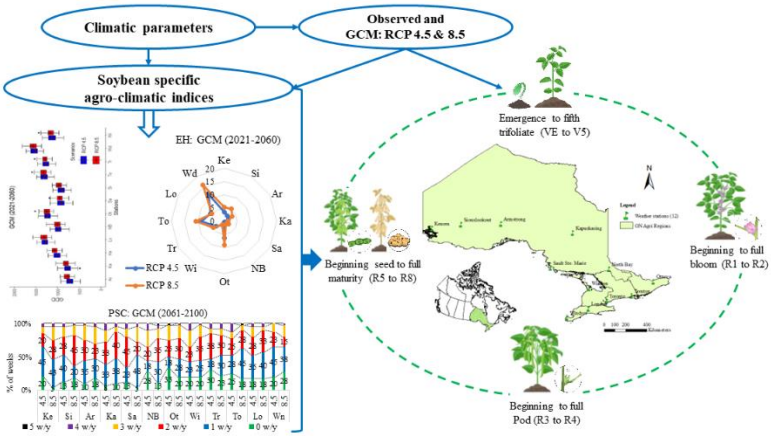
There is great interest in enhancing the mass-sensitivity of Nuclear Magnetic Resonance (NMR) Spectroscopy through the utilization of micro-coil technology. Previously, 5-axis CNC micro-milling was shown to be a viable alternative to traditional micro-coil production methods and was used to create a prototype Slotted-Tube Resonator (STR). Although an excellent Limit of Detection was shown, the lineshape was reduced due to the magnetic susceptibility of the Copper resonator. This was evident by the improvement in lineshape when a capillary with a diameter 8X smaller than the I.D. of the STR was used.

However, moving the sample further away from copper resonators to improve lineshape limits the sizes of samples that could be used and is not a viable long-term solution. Therefore, a more universal alternative is to use materials that have near-zero magnetic susceptibility such as the “zero-susceptibility wire” (a copper wire with an aluminum core), which showed improved lineshape and sensitivity compared to those wound from copper wire.

Here, a similar concept was applied to eliminate the distorted lineshape by creating an STR with near zero magnetic susceptibility. To do this, Aluminum STRs were produced using a MiRA6 5-axis CNC milling machine and electroplated with various thicknesses of copper (each metal having an opposing magnetic susceptibility) ranging from 4.5 µm to 15 µm. Lineshape improved as the Copper thickness reached 12.5 µm before deteriorating. In this presentation, multiple methods will be employed to reduce the impact of magnetic susceptibility on lineshape, including the use of both Alloys and electroplating.

Year: 6th +
Research Category: Applied Science and Technology

Examination of the effect of climate change on soybean-specific agro-climatic indices and phenological changes in Ontario
Ratnajit Saha, *George Arhonditsis*



Climate variability and timing of occurrence of extreme weather events in the crop growing season have a profound impact on crop phenological development stages. The study aims to examine the effect of climate change on soybean-specific agro-climatic indices and phenological changes in Ontario, Canada. Important factors were considered such as climatic parameters, observed and GCM RCP 4.5 & 8.5 scenarios, four-time frames, seeding dates, agro-climatic indices, group of indicators, major and cluster of development stages and agricultural regions in Ontario. Selected GCM MRI-CGCM3 model datasets were found good to predict and project the status of agro-climatic indices. Growing degree days and non-growing degree days showed increasing and decreasing trends across Ontario for all datasets in all-time frames. Heat stress (warm nights and extreme heat) influences reproductive stages, and southern, central, and eastern Ontario experienced high-frequency heat stress, and that could increase in

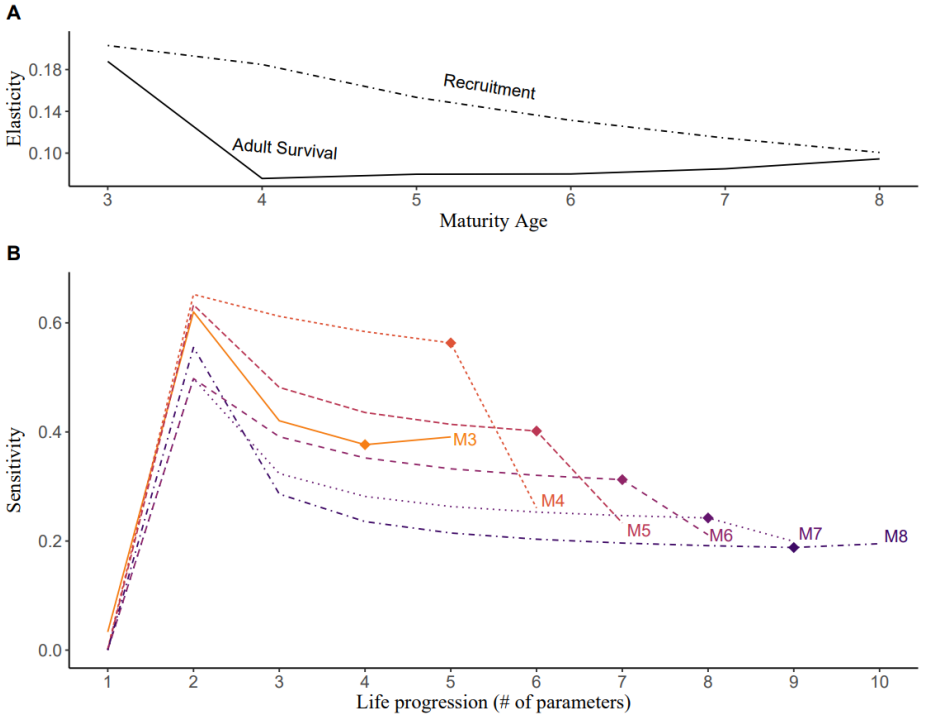
the future. Cold stress impacts vegetative and reproductive stages, and a higher occurrence of cool night and spring-killing frost were observed in northern Ontario. Excessive wetness influences vegetative and early reproductive stages, where 1-2 weeks/year for poor seedling condition and 1 week/year for early flooding were found to be the commonest across Ontario. Considering the trend of increasing, decreasing, and remaining the same for all agro-climatic indices, early seeding for soybeans could be suitable across Ontario in the recent (2021-2060) and distant (2061-2100) future for both RCP 4.5 and 8.5 scenarios. The findings could contribute to appropriate adaptation strategies for soybean cultivation to optimize production in future.

Year: 3rd
Research Category: Applied Science and Technology

BREAK

Cold and Old or Young and Hot: Performance and Maturation of Bighead Carp in Different Climates

Erik Dean, Nicholas Mandrak, Andrew Drake



The invasive Bighead Carp (Hypophthalmichthys nobilis) currently threatens to invade the Laurentian Great Lakes of North America. They have caused significant ecological and economic impacts where they have established in the United States, but it is uncertain how they will perform in colder conditions as they expand northward. However, rates of growth and maturation in Bighead Carp can be seen to vary across climates when comparing populations around the world. These differences between populations suggest what the potential outcomes could be for populations in warmer or colder conditions. Bighead Carp grow more slowly and mature later in life in colder, northern latitudes compared to those in warmer regions, which grow faster and mature at younger ages. Given that growth typically decreases after maturation, a potential consequence of this is that fish in colder climates could reach larger adult sizes — generally associated with greater survival and reproductive ability. Early maturation, alternatively, allows for faster reproduction and shorter generation times, which are known to increase population growth. Accordingly, a trade-off between growth and maturation could arise across climatic conditions. Using published data for Bighead Carp worldwide, I parameterized a matrix population model to simulate populations under various rates of growth, reproduction, and survival corresponding to different maturation schedules and environmental conditions, and earlier maturity was found to be advantageous up to an extent. While anticipated warming appears to enable greater population growth in some circumstances, other environmental factors could also result in reduced performance for Bighead Carp.

Year: 5th
Research Category: Applied Science and Technology

Drone-based LiDAR mapping at Saskatchewan Glacier

Syed Bukhari, Nick Eyles

The thinning and retreat of modern glaciers in a warming world, offers unparalleled opportunities for glacial geologists to study modern subglacial processes, landforms, and sediments especially till. New technology such as drone-based LiDAR, now allows high resolution mapping of exposed glacier beds in remote areas, yielding insights into the origins of hitherto poorly understood landforms. Saskatchewan Glacier which drains the Columbia Icefields in Banff National Park, Alberta, Canada is rapidly retreating exposing tree stumps dated at c. 4000 years before present (ybp) that record ice-free conditions throughout the Rocky Mountains. Trees were overrun by glacier ice when the Columbia Icefield reformed during the subsequent Neoglacial after 3,800 ybp and Little Ice Age (c. 1300-1900 AD). The glacier reached its maximum extent in 1853 and has since retreated upvalley some 7 km. The entire valley floor was mapped in ultra-

high resolution using a DJI Matrice 300 drone system paired with a Zenmuse L1 LiDAR sensor. Provisional data processing reveals prominent glacial flutes and striations on the former bed, offering insights into till forming processes. This project comes at a time of heightened interest in the search for critical minerals within older tills and landforms left by Pleistocene continental ice sheets such as once covered Canada several times during the last 2.5 million years, underscoring the need for better understanding of glacial processes. This project is jointly supported by NSERC, the Geological Survey of Canada, and the Geological Survey of Finland.

Year: 1st
Research Category: Applied Science and Technology

LUNCH BREAK (Location: EV 140)

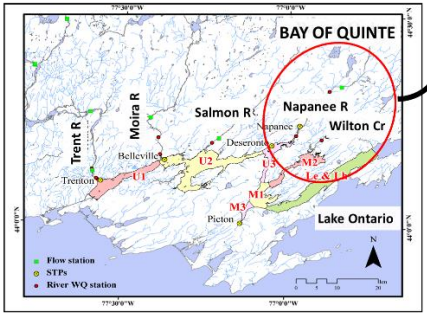
Evolution of Extreme Climate in Ontario and Implications for Lake Phenology.
Akunne Okoli, George Arhonditsis

This study characterized the evolution of extreme climatic events in two sites in southeastern (Trenton) and northeastern (North Bay) Ontario. Using both observed records and simulated data from eight statistically downscaled Global Climate Models (GCMs) under the IPCC representative concentration pathway (RCP) 4.5 scenario, a set of extreme temperature and precipitation indices were computed. First, we evaluate the capability of each GCM to replicate the observed trends in the indices. Then, a retrospective analysis was conducted over two-time stanzas: historical (1950–1984) and present (1985-2019), and projections in the near (2020-2059) and far future (2060-2099) climates were examined. Our analysis showed that both sites experienced changes in extreme temperature that is indicative of a warming trend and changes in extreme precipitation that suggests a shift towards short-duration intense precipitation, with an increase in total precipitation amount in Trenton. Profound changes in future temperature extremes will occur at both sites, with drastic increases in hot/warm extremes and more decreases in cold extremes. Sustained increases in extreme precipitation intensity are projected at both sites, but a greater tendency for an increase in extreme precipitation will occur in Trenton. Seasonal variability suggests increases in the frequency of precipitation extremes in summer and fall. Following the results obtained from this study, it is hypothesized that the Bay of Quinte and Lake Nipissing (two neighboring water bodies in the studied locations) will likely experience significant phenological shifts in their physical (stratification patterns), chemical (nutrient seasonal cycle), and biological (likelihood of harmful algal blooms) components.

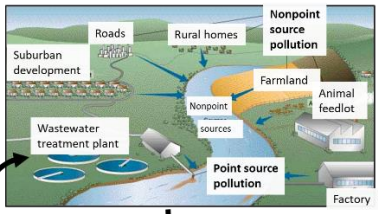
Year: 3rd
Research Category: Applied Science and Technology

Towards the Development of a Long-Term P Management Tool in the Bay of Quinte, Ontario

Aisha Javed, *George Arhonditsis*



Map of the Bay of Quinte Area of Concern (AOC) relative to Lake Ontario, displaying the major tributaries and coloured waterbody segments. The case study, Napanee and Wilton Creek Rivers, are circled in red.



Modified version of image retrieved from: https://www.tes.com/lessons/VTEci9WPntX6PA/point-and-nonpoint

At the watershed scale, there are two main sources of water pollution: point source and nonpoint source pollution.

Image of the eutrophicated Bay of Quinte water, showing the impact of nutrient pollution from the land to the waterbody.

The Bay of Quinte is an Area of Concern located at the northeastern end of Lake Ontario and is well known for its long history of eutrophication problems manifested as extensive algal blooms, prevalence of toxic cyanobacteria, and hypolimnetic oxygen depletion. Emerging evidence suggests that phosphorus inputs from the Napanee and Wilton Creek watersheds are significantly higher than historically assumed and may be modulating the frequency of harmful algal blooms in the receiving waterbody. In light of this evidence, our modelling work involves the development of a multivariable P calibration approach using the Soil and Water Assessment Tool (SWAT) with special focus on the role of extreme events in exporting P losses. The work being presented will attempt to bridge the gaps in our understanding of the potential factors driving the eutrophication phenomena in the Bay of Quinte. My analysis suggests that a significant fraction (>50%) of the annual phosphorus loads can be generated during a small number of brief but intense precipitation events. While the association of phosphorus with stormwater is plausible, the flow-concentration relationship can be profoundly modulated by factors such as watershed physiography, land use patterns, and antecedent conditions. The research framework will aim to serve as a long-term management tool for the protection and restoration of water quality in the area by accounting for the long-term effects of climate change including the predictions of an accelerated hydrological cycle.

Year: 5th

Research Category: Applied Science and Technology

The importance of the volatile carbon fraction in estimating deadwood carbon stocks in temperate forests

Mahendra Doraisami, Adam Martin

Wood carbon (C) fractions are a key wood functional trait that is critical for refining estimates of tree- and forest-level C stocks. While many empirical studies have focused on uncertainties in wood C fractions of live wood, the importance of variation in dead wood C fractions for forest C accounting has received less attention. This is despite dead wood representing a major C pool in forest ecosystems, and dead wood C fractions varying widely across boreal, temperate, and tropical species. There also remains no studies that have quantified the volatile C fraction in dead wood: low molecular-weight C-based compounds in wood that may be lost during sample preparation, but are critical components of wood- and forest C stocks. My thesis quantifies inter- and intraspecific variation in total and volatile C of dead wood, and evaluates how this variation influences estimates of tree- and forest C stocks. Specifically, my most recent research has established a large-scale dead wood census in an unmanaged temperate forest, where I surveyed >1,000 individual pieces of coarse woody debris, across a 13.5-ha long-term monitoring plot. This information was used to inform sampling for quantification of total and volatile C fractions, taken from 106 individual dead trees, across 11 species, 4 decay classes, and 2 tissue types. My results indicated that mean volatile C across all tissues was 4.3±2.8% (s.e.), with values ranging widely from 1.7-8.5%. Counter to my hypotheses, volatile C was significantly larger in dead wood vs. live wood, indicating that accounting for the volatile fraction is especially critical when estimating dead wood C stocks and fluxes.

Year: 3rd
Research Category: Applied Science and Technology

Ammonia variability and trends from urban and remote ground-based FTIR measurements

Beatriz Herrera, Kimberly Strong

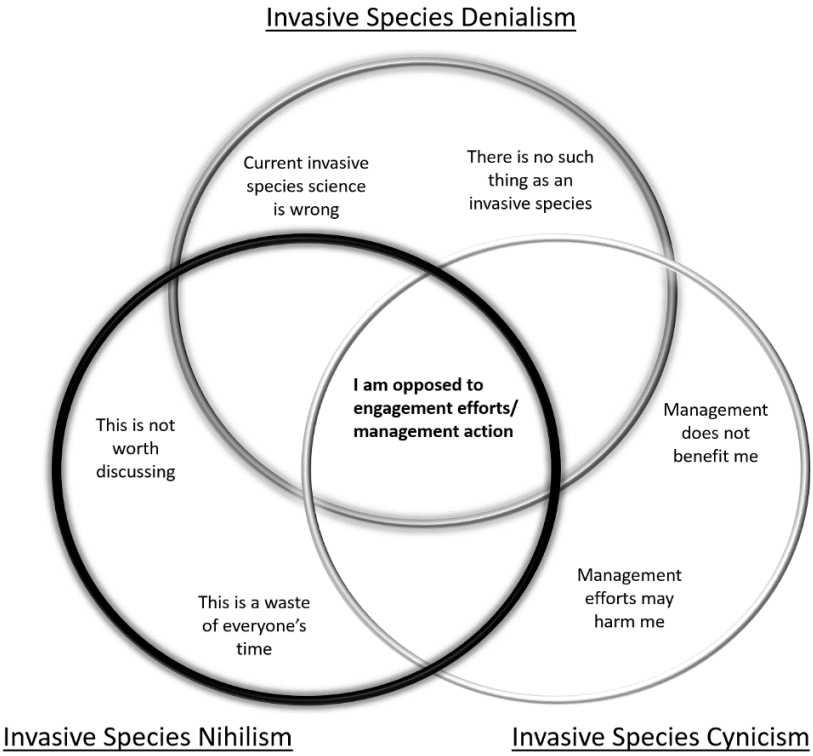
Ammonia (NH_3) is the most abundant alkaline compound in the atmosphere. NH_3 neutralizes acids and contributes to the formation of aerosols and particulate matter (PM), including PM2.5, with potential consequences to the environment, human health, and radiative forcing. NH_3 is primarily emitted by agricultural and livestock activities; however, it is also present in urban environments. Several studies have used satellite measurements to assess the global variability of NH_3; however, the interannual variability does not reveal clear trends and is not possible to determine the diurnal variability as a consequence of the limited satellite observations per day. The objective of this study is to obtain and compare the temporal variability and trends of NH_3 at urban and remote areas around the world, including megacities and Arctic regions. This work uses NH_3 total columns retrieved from solar absorption measurements from

sixteen ground-based Fourier transform infrared (FTIR) spectrometers, located at seven urban and nine remote stations globally dispersed in both hemispheres from 80.05°N to 45.04°S and from 105.26°W to 169.68°E, most of them part of the Network for Detection of Atmospheric Composition Change (NCACC). In addition, modelled NH_3 from GEOS-Chem and from the preliminary Tropospheric Chemistry Reanalysis (TCR-2) NH_3 product will be included to complement and further investigate the diurnal and seasonal variability as well as NH_3 trends over the diverse urban and remote areas.

Year: 3rd
Research Category: Applied Science and Technology

BREAK

The Fata Morgana of Invasive Species Denialism
Noelle Gadfly Stratton, Nicole Klenk, Nicholas Mandrak



Invasive species are an ongoing environmental challenge to which significant financial and human resources are allocated to the task of preventing and managing. In recent years, discussion of invasive species "denialism" has emerged in the invasion science literature. Much of the literature characterizes all invasive species denialism as a denial of established scientific facts. Yet, the impacts of this characterization on management, engagement and policy-making have been underexplored. We sought to assess how the term "invasive species denialism" is being used and framed by those involved in invasive species management, engagement, and policy-making. Key informants from different stakeholder groups (academic researchers, government policy-makers or managers, public outreach) were asked to define "invasive species denialism" in their own words, the impacts of excluding vs including those they perceived as denialists in engagement efforts, and how to mitigate those impacts. Three framings of ISD were identified: 1) Invasive Species Denialism; 2) Invasive species Cynicism; and 3) Invasive Species Nihilism. Recommendations were provided by participants regarding how to mitigate the impacts of denialism on outreach and engagement efforts. This research contributes to the study of denialism, particularly invasive species denialism, and will enable improved outreach and communication by invasive species managers and decision-makers.

Year: 6th +
Research Category: Environmental Social Science

Silence in the climate regime: We do not talk about CBDR [Work in Progress]
Raúl Salas Reyes, William Gough, Nicole Klenk

Silence in the international climate change negotiations is widely understood as an agreement. If countries do not voice their concerns, influence an outcome, or vote, they ultimately agree with decisions taken by other Parties to the UNFCCC. Recent studies in norm contestation have started to problematize the role and meaning of silence. Using the differential treatment norm as a case study, we ask if silence can have any other role or meaning beyond agreement through a lens of norm contestation. We found that the differential treatment norm has been contested even after the adoption of the Paris Agreement, although this contestation has taken a subtler form, silence. Our study also shows that silence can be an indication of capacity and political power constraints and barriers that hinder the capability of countries to influence outcomes or even participate in the international climate change negotiations. Our study contributes the norm contestation scholarship by elucidating how silence can have intentions to provide new meanings, or even to weaken or delegitimize a norm. Our study also finds that ignoring the silence of Parties can contribute to barriers to fairness, justice, and equity in the international climate regime.

Year: 6th +
Research Category: Environmental Social Science

How can just nature-based solutions be integrated into urban governance?
Ichha Ravinderpal Kaur Kohli, Laura Tozer

Nature-based solutions have recently become popular as a means to achieve sustainable cities and are being used to address urban sustainability challenges such as climate change and biodiversity loss. However, nature-based solutions often fail to make meaningful space for both vulnerable humans and nonhuman animals disproportionately facing the impacts of climate change. As such, there is a gap in our understanding of how urban sustainability plans and projects can aid vulnerable humans and nonhuman animals in accessing the benefits of nature-based solutions. This research aims to explore how urban sustainability action is planned and implemented, and to examine opportunities to enable socially and environmentally just nature-based solutions through urban governance. A novel definition of just nature-based solutions incorporating multispecies justice and compassionate conservation principles will be used to examine how equity and nature are framed in municipal climate and biodiversity plans through a discourse analysis of the City of Toronto TransformTO and Biodiversity Strategy documents, and how equity is integrated into measuring success in neighborhood-scale sustainability action implementation through a case study of a Sustainable Neighborhood Action Plan (SNAP) to assess whether such programs can be successful for advancing justice for both humans and nonhuman animals. Data from both phases will be synthesized to identify the gaps and opportunities for enabling just nature-based solutions in a practical manner for cities to overcome sustainability challenges.

Year: 3rd
Research Category: Environmental Social Science

What are the primary covariates of environmental attitudes and behaviours in Canada? A national-scale analysis of socioeconomic, political, and demographic factors
Cindy Yang, George Arhonditsis

There is considerable ambiguity around the importance of demographic and socio-economic characteristics that catalyze pro-environmental behaviours. These factors are typically deemed responsible for environmental skepticism, such as the degree of trust in social institutions, fundamental views of the individuals (e.g., religiosity and political ideology), and competing priorities. In this context, the present study analyzed a comprehensive dataset of survey responses to discern the most reliable predictors of environmental attitudes of Canadians related to activism, lifestyle, household practices on air quality, waste disposal, energy and water conservation. To achieve this objective, we capitalize upon the wealth of publicly available data from surveys conducted by Statistics Canada's Households and the Environment Survey. Our analysis suggests that individuals with university-level education and higher income or families with children generally display pro-environmental behaviours. Our assessment of environmental

attitudes in different Canadian provinces suggests an aptitude for more sustainable living in Ontario and British Columbia. Our analysis also provides evidence that the intent to support efforts that reduce emissions from burning fossil fuels or promote clean energy and technology – which has been overwhelmingly communicated in recent national polls – is not necessarily actualized. This established trend of Canadians failing to "walk the talk" and materialize their stated commitment with tangible participation into environmentally supportive behaviours could stem from barriers imposed at the household and societal levels.

Year: 6th +
Research Category: Environmental Social Science

Indigenous Approaches to Well-being: Land-based Interventions in Subarctic Canada
Fatima Ahmed, Len Tsuji

The act of decolonizing knowledge systems involves recovering and renewing traditional, non-commodified cultural patterns, such as the sustenance of intergenerational relationships and traditional practices. A decline in beaver harvesting, which was once an integral part of the Omushkego Cree culture, has resulted in an overabundance of beavers and dams, which has negatively affected communities by increasing the local flooding events and impacting the water quality. The aim of the Amisk (beaver) program was to reconnect the Elders and youth to revitalize traditional on-the-land activities and, beaver harvesting and associated activities within the community. The program and evaluation were built using a two-eyed seeing and community-based participatory research approach. Salivary cortisol, a biomedical measure of stress, was collected before and after participation in the program. Photovoice, along with semi-directed interviews, were employed to identify the key elements of well-being from a First Nations' perspective. For the beaver harvesting activities, the changes observed in the cortisol concentrations were not statistically significant ($p = 0.094$). However, the act of beaver dam removal was associated with a statistically significant increase in the post-participation cortisol concentration ($p = 0.021$). It was noteworthy that increased stress during the removal of the beaver dams– as indicated by the elevated post-activity cortisol levels–were not reflected in a decrease in the qualitative measures of well-being from an Indigenous perspective. In fact, there was a noted increase in the subjective well-being of the participants highlighting the importance of multiple perspectives when assessing well-being, especially in Indigenous peoples.

Year: 5th
Research Category: Environmental Social Science

Day 2 Oral Presentations:

Plastic in the deep sea - the ocean floor reservoir
Xia Zhu, Chelsea Rochman

Researchers estimate that approximately 4 -12 million metric tonnes (MMT) of mismanaged plastic waste enter the oceans annually. However, the fate of this plastic in the marine environment is poorly understood. The deep ocean has been hypothesized to be a reservoir of plastic pollution, and it is often thought of as a permanent resting place, or a sink. While the mechanisms for the transport of plastic to the deep ocean are still under investigation, there is no doubt that plastic objects are being deposited on the seabed and plastic particles are becoming mixed into deep ocean sediments. Globally, it has been proposed that 14 MMT of microplastic may reside within the top 9 cm of deep ocean sediment; however, no estimate of the total mass of larger plastic objects residing on the ocean floor exists. This study aimed to estimate the mass of plastic pollution on the ocean floor. First, a systematic review of the abundances of plastic pollution reported in the deep ocean was conducted to identify studies that published findings on the amount and types of plastic on the seabed from the 1970's until January 1st, 2020. These data were then used to build a Bayesian regression model with relevant covariates such as latitude, longitude, fishing effort, shipping intensity, depth, slope, distance to shore, and distance-weighted population density to model how much plastic resides on the ocean floor on a global scale.

Year: 4th
Research Category: Experimental and Theoretical Science

Metabolic profiling of Daphnia magna exposure to phthalates using targeted liquid chromatography tandem mass spectrometry
Erico Oliveira Pereira, Myrna Simpson

Phthalic acid esters, also known as phthalates, are commonly used chemicals in the production of personal care and plastic products. As a result of their multitude of applications, phthalates are widely detected in aquatic ecosystems. Some phthalates can be biodegraded, which results in the transformation of phthalate diesters into monoesters. Their widespread presence has been reported to impact the health of freshwater organisms. Daphnia magna is a small crustacean frequently used in ecotoxicology as a sentinel species for aquatic toxicity studies. Toxicological endpoints of D. magna have been investigated for several phthalate pollutants but more information about how they disrupt the sentinel species' health is needed. The current study compared the D. magna metabolic profiles of two phthalate diesters (dimethyl phthalate and diethyl phthalate) and two phthalate monoesters (monomethyl phthalate and monoethyl phthalate) to better understand their short-term toxicity. In a 48-h test, D. magna was exposed to sub-lethal concentrations of all four phthalates. Targeted analysis by liquid chromatography-tandem mass spectrometry (LC-MS/MS) was used

to measure 51 polar metabolites from which 46 were detected. The metabolic profiling of D. magna indicated that not all phthalates impacted the species in the same manner, however, associated biochemical pathways were disturbed, signalling a general chemical class response. These results demonstrate that phthalate pollutants invoke similar and unique responses in aquatic organisms that cannot be directly correlated to other commonly assessed endpoints.

Year: 5th
Research Category: Experimental and Theoretical Science

Assessment of Salinity and Temperature Impacts on Dissolved Organic Matter Chemistry in Bentonite for Used Nuclear Fuel Storage

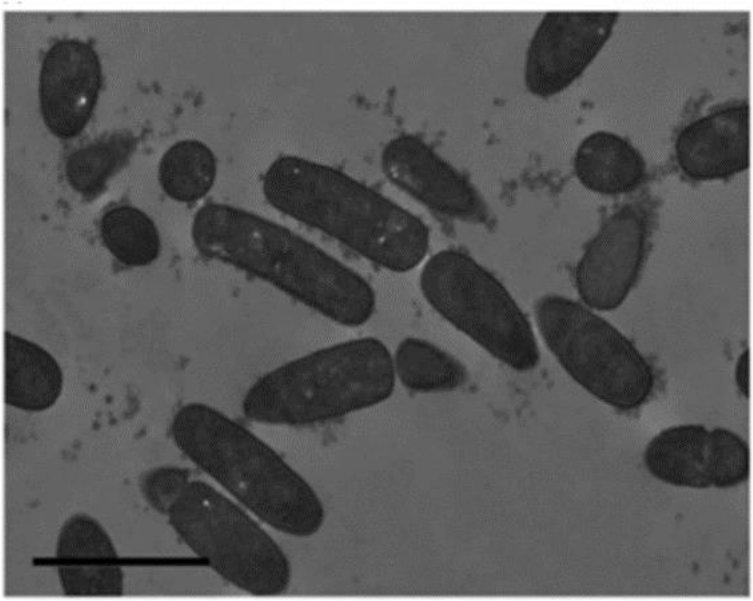
Huan (Phoebe) Tong, Myrna Simpson

Bentonite clay (MX-80, Wyoming, USA) is proposed as buffer material for used nuclear fuel containers in a deep geologic repository (DGR). Bentonite will limit radionuclide mobilization, minimize air circulation and microbial activity near the container, but dissolved organic matter (DOM) generated from the mined MX-80 may serve as microbial substrates and change radionuclide mobility. In a DGR setting, MX-80 will be exposed to high salinity and temperature due to the nearby saline groundwater and porewater and the heat released from used nuclear fuel. Changes in terrestrial-derived DOM composition and exportability under saline and heat conditions have been reported previously, however, there is limited knowledge about how DOM chemistry in MX-80 may change after being exposed to the potential environment in the DGR. To explore this, DOM quantity and quality in MX-80 after exposure to different salinity (deionized water, and 1-5 M NaCl solutions) and temperature (23 ℃ and 90℃) were analyzed. Dissolved organic carbon concentrations were very low and not changed significantly across treatments. Ultraviolet-visible analysis revealed more unsaturated components in DOM with deionized water extractions than in NaCl solutions. The solution-state 1H nuclear magnetic resonance results indicated that DOM samples from varied salinity and temperature had similar chemical signatures. Thus, higher temperature and salinity do not change the overall DOM quantity and quality significantly, but might decrease the contribution of the unsaturated component in the portion of chromophoric DOM. This study expands the understanding of DOM chemistry in bentonite and potential impacts with long-term used nuclear fuel storage.

Year: 5th
Research Category: Experimental and Theoretical Science

Positively charged nanoplastics inhibit Bacillus subtilis planktonic growth and biofilm formation

Franklin Perez, Ruby Sullan



Transmission electron microscopy showing positively charged nanoplastics interacting with *Bacillus subtilis* in planktonic state. Scale = 2 μm.

Nanoplastics (< 1 μm) are small, plastic particles that have been discovered in soil. Due to their small size, chemical and physical diversity, nanoplastics are potentially the most dangerous kind of plastic towards biodiversity. Since the success of biodiversity depends largely on microorganisms, the effects of plastics towards microorganisms has been intensely studied. Yet, majority of studies on plastics and microorganisms focused on aquatic environments with larger, plastic particles, known as microplastics (1 - 5000 μm). To address the impact of nanoplastic in a soil microorganism, I used a suite of analytical tools and microbiological methods to ascertain how nanoplastics of different sizes and functional groups impact the modes of growth of a model soil bacteria, Bacillus subtilis. Positively charged nanoplastics were found to have the greatest effect on B. subtilis in both its planktonic free-living and surface-associated biofilm forms of life. These effects are detrimental, and include cell death, slower growth, a reduction in biomass and changes in its surface-associated structure which could potentially affect its performance in the natural environment. As Bacillus subtilis is known to symbiotically associate with plant roots, the negative effects of positively charged

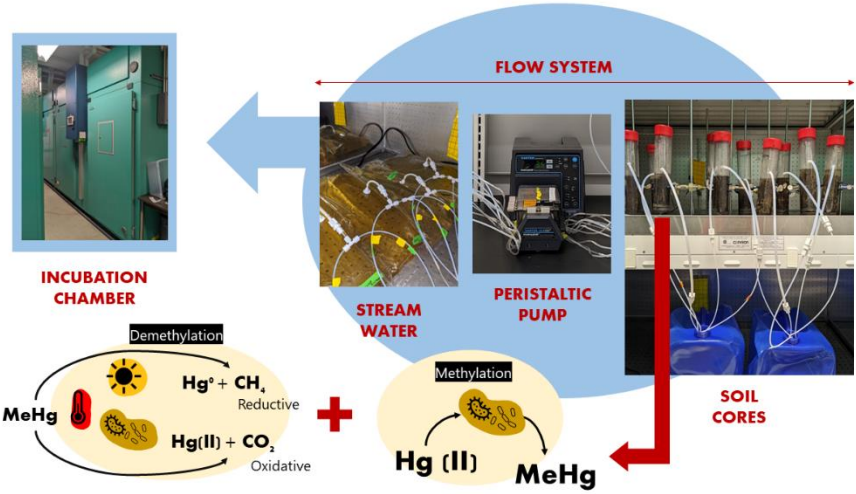
nanoplastics might inhibit the ecologically significant relationship between B. subtilis and plant health.

Year: 3rd
Research Category: Experimental and Theoretical Science

BREAK

Mercury methylation and demethylation on impacted wetland soils: effects of temperature

Sayuri Sagisaka, *Carl Mitchell*



The methylation of mercury by anaerobic microbes in wet soils and sediment significantly increases its bioaccumulation potential into wildlife. Methylation is also counter-acted by demethylation processes, with the balance between methylation and demethylation processes ultimately controlling the amount of methylmercury in a system. Given that microbial activities are closely linked with temperature, climatic changes should impact mercury methylation and demethylation processes, but this is not well-characterized in mercury research. In this presentation, I will discuss proposed research that should help to better understand mercury methylation and demethylation rates in boreal wetland soils affected by shifts in temperature. The proposed experimental design will include a series of controlled, closed-system, flow-through experiments using boreal wetland soils from both forest-impacted and unimpacted watersheds in dark growth chambers across a range of realistic temperatures (5, 10, 15, 20, 25 °C). Mercury methylation and demethylation rates will be examined in the soil

cores using enriched mercury isotope incubations and analyzed against measures of microbial activity and soil/water chemistry. Results from this study are expected to allow us to contribute to modeling of mercury cycling processes with respect to climate and other environmental changes. Furthermore, the data generated will address the impact of harvesting activities in boreal regions of Canada on mercury methylation and demethylation in wetland soils and allow for implementation of better management practices.

Year: 3rd
Research Category: Experimental and Theoretical Science

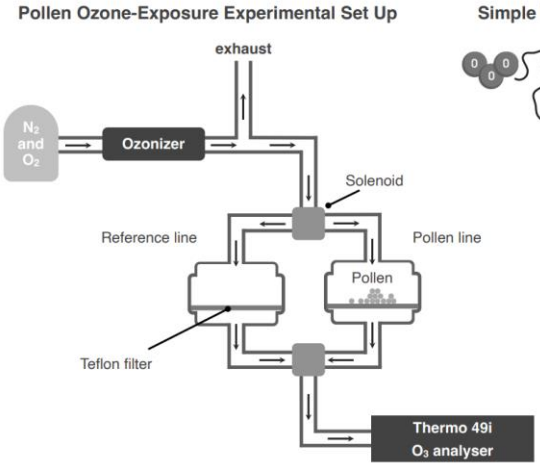
GPS-tracking of buoyant plastic bottles in Toronto Harbour, Lake Ontario
Patricia Semcesen, Mathew Wells

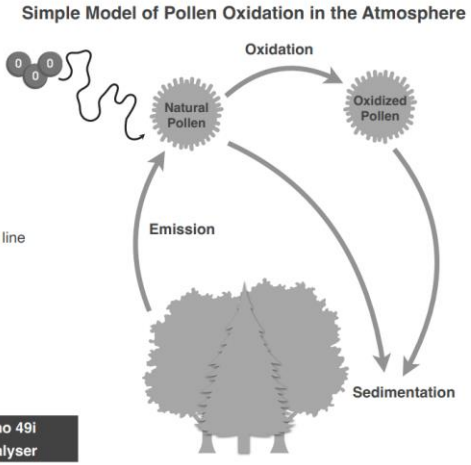
Plastic bottles fitted with GPS-trackers were used to emulate real plastic debris and investigate the transport and accumulation patterns of floating plastic debris in Toronto Harbour. Toronto Harbour (dimensions of 2 km x 3 km) is a potential urban upstream source of plastic pollution to Lake Ontario, St. Lawrence River, and the Atlantic Ocean. From May through August 2021, GPS-tracked bottles were released at strategically-selected locations based on visual audits, tourist hotspots, and areas of hydrodynamic-interest. The GPS-tracked bottles travelled between tens of meters to several hundred kilometers within two weeks of entering the harbour. They were found with hundreds of other bottles and pieces of micro- and macroplastic litter in sheltered areas like slips, bays, under piers and docks, in trash bins (discarded by civilians), or stranded on the shoreline. The transport of these GPS-tracked bottles was heavily dependent on wind-transport because of their density (0.450-0.459 g/cm^3), shape, and windage. It is likely that much of the plastic litter within Toronto Harbour originates from Toronto since 15% of GPS-tracked bottles managed to escape into Lake Ontario. The prevailing southwesterly winds and general anti-clockwise circulation of water currents in Lake Ontario support the potential for downstream transport of plastic debris to the Atlantic Ocean. My research provides information on where pollution-mitigation technology (e.g. Seabins) should be prioritized in Toronto Harbour to reduce loading, accumulation, and large-scale transport of floating plastic debris.

Year: 5th
Research Category: Experimental and Theoretical Science

Uptake of Ozone by Pollen

Sarah Simon, *Jennifer Murphy*





Ground-level ozone is a highly reactive air pollutant, known to cause detrimental effects to plants. Recent studies show a link between high ozone events and increased allergic sensitivities to pollen due to the modification of the pollen. The reaction of ozone with pollen is important to investigate to determine the impact on allergenicity and understand the potential exposure of oxidized pollen in the atmosphere. We investigated the uptake of ozone to pollen for the common Canadian tree species: Acer pseudoplantanus (Sycamore Maple), Acer negundo (Box Elder Maple), Alnus incana (Grey Alder), Betula pendula (Silver Birch), Cupressus arizonica (Arizona Cypress), Fraxinus pennsylvanica (Ash), Juniperus communis (Juniper), Morus rubra (Red Mulberry), Pinus strobus (White Pine), Populus nigra v. italica (Lombardy Poplar), Quercus rubra (Red Oak), and Quercus velutina (Black Oak). By exposing pollen to atmospherically relevant levels of ozone (120 – 150 ppb) in small air chambers we measured the uptake coefficient of ozone to the pollen surface between 2.4×10^{-6} and 3.2×10^{-5} and the total adsorbed ozone during exposure was measured between 9.4 - 2200 ng O_3 per mg of pollen. Using these experimentally determined values from the lab, we were able to model the extent of ozone uptake to pollen grains in the real atmosphere. The results suggest that the modification of pollen by ozone is dependent on the concentration of ozone, and high pollen and ozone days can result in higher exposure of polluted pollen to the public.

Year: 6^{th} +
Research Category: Experimental and Theoretical Science

Spatial and seasonal patterns of mercury concentrations, methylation and demethylation in boreal soils and stream sediment

Haiyong Huang, Carl Mitchell

Forests store a large amount of mercury (Hg) which can transform to methylmercury (MeHg), a potent neurotoxin that bioaccumulates through food webs, in saturated soils and stream sediment. Knowing the concentrations and distributions of Hg, as well as the biogeochemical processes in relation to MeHg production in soils and sediment is important for understanding Hg biogeochemistry in boreal forests. A large-scale investigation was therefore conducted in 17 undisturbed, central Canadian boreal forested watersheds to characterize the spatial (upland and riparian/wetland soils, and stream sediment) and seasonal patterns of total Hg (THg) and MeHg concentrations, as well as Hg methylation and MeHg demethylation potentials (Kmeth and Kdemeth). Upland soil had the highest THg concentrations, followed by riparian/wetland soils and stream sediment. Stream sediment showed considerable MeHg production and accumulation, manifested by the larger Kmeth values, MeHg concentrations and %-MeHg compared to soils. Significantly greater THg and MeHg concentrations, %-MeHg and Kmeth in stream sediment were observed in watersheds within physiographic regions dominated by exposed bedrock and shallow surface soils compared to those characterized by deeper glaciolacustrine sandy plain soils. Kdemeth was variable across the watersheds, but discernible spatial patterns were not observed. Kmeth exhibited the most seasonal variation compared to other variables and was substantially higher in summer, particularly in stream sediment. This study suggests that even compared to wetland soils, forested stream sediment plays a disproportionately important role in Hg methylation within this region, which is an important finding in relation to exposure of aquatic biota to MeHg.

Year: 6th +
Research Category: Experimental and Theoretical Science

BREAK

Phosphorus diagenesis linked to methane and iron in lake sediments

Xiaoqing Shao, Maria Dittrich

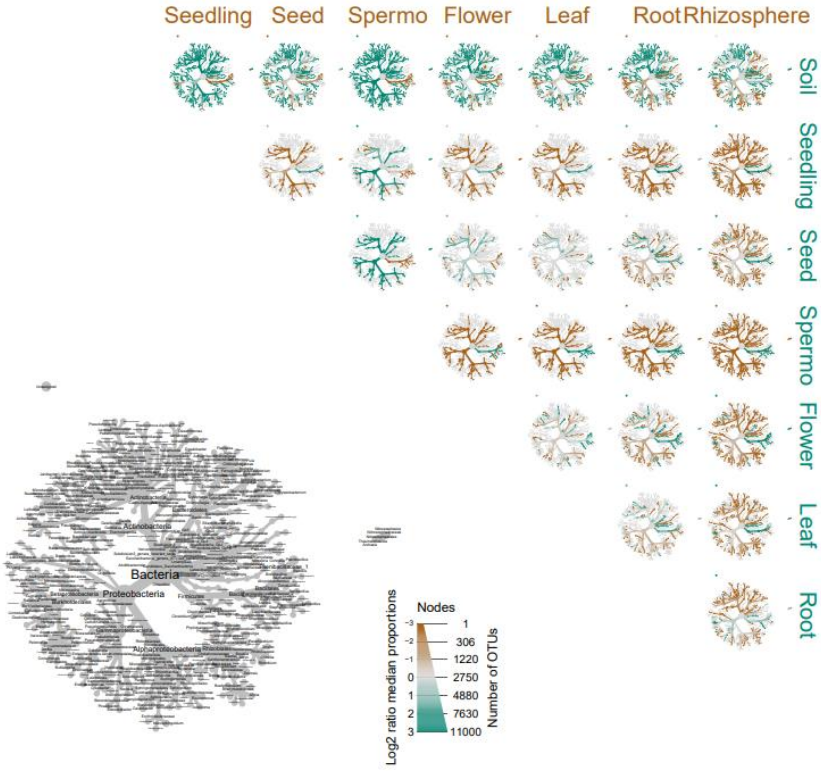
Methane (CH_4) is produced in sediments during the last step of the microbial breakdown of organic matter. In the absence of sulfate, iron (Fe) oxides are important electron acceptors to facilitate anaerobic oxidation of CH_4. One concern is the release of legacy phosphorus (P) from sediments to the overlying water column, leading to elevated nutrient levels. In this study, we focus on the impact of CH_4 and Fe transformations on P cycling in the sediments, combining microbial community composition changes.

Six to seven sediment cores were collected in the Georgian bay using a gravity corer in July and September 2021. Depth profiles of P and Fe binding forms, CH_4, and porewater chemical parameters, were analyzed. Microbe community analysis was also carried out at specific depth. We observed that the CH_4 concentration increased with the sediment depth and reached the maximum concentration of 686 µg/L in the deepest layers. High relative abundance of Methanobacterium genus in the Archaea was in accordance with the observed high methane concentration in the sediment. In the sulfate depletion layer, the porewater profiling let us assume that Fe^{2+} results from iron oxides reduction coupled with AOM. The redox-sensitive bound P fraction, called BD-P, is the dominant fraction of total P, with up to 55% contribution to the total P. The low BD-Fe to BD-P ratio suggests that the Fe hydroxides have a limited spare capacity to bind P.

Year: 3rd
Research Category: Experimental and theoretical Science

Tracing microbiota during the germination cycle and growth of Romaine lettuce plants in two soil types

Patricia Miller, *Roberta Fulthorpe*



The spermosphere is a key contributor to the germination process and shares significant microbiota with the rhizosphere and other plant tissues. In order to assess the contribution of spermosphere microbiota to the rhizosphere, microbiota were isolated and sequenced over two generations. The rhizosphere was then sampled throughout the plant life cycle at 4 stages of growth and in both sterile and forest soils. Understanding germination dynamics is important in order to ascertain the possible role that seed endophytes play in plant establishment and for future plant growth promoter discovery.

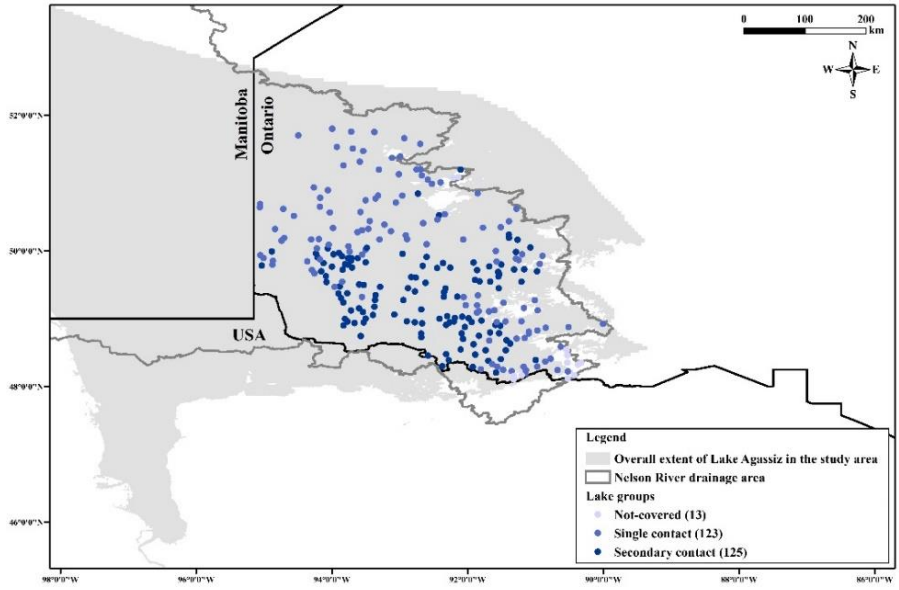
Year: 6th +
Research Category: Experimental and Theoretical Science

LUNCH BREAK (Location: EV141)

Day 2 Poster Presentations:

Glacial Lake Agassiz influenced contemporary lacustrine fish community composition

Edina Illyes, *Nicholas Mandrak*



Community composition patterns in nature are driven by the processes of community assembly and succession. The assembly of northern North American freshwater fish communities was dominantly driven by postglacial dispersal and colonization of the newly forming aquatic habitats at the end of the last glacial cycle. We examined the

effects differential contact to the past dispersal corridor of Lake Agassiz had on the contemporary fish community composition of 261 lakes in northwestern Ontario, using Jaccard dissimilarity and principal coordinate analyses. Our results indicate that differential connections to the glacial lake led to differences in contemporary lacustrine fish communities. Community composition of lakes not covered by Lake Agassiz are more dissimilar to lakes covered by the lake once or twice than the latter two are to each other. Species present in the lakes not covered are nested within the taxa inhabiting lakes covered by Lake Agassiz, and species composition in the former is positively correlated with lake elevation. These patterns are likely driven by isolation of these lakes preventing colonization by some species. Most of the dissimilarity between the lake groups covered by the glacial lake can be attributed to turnover, likely indicating variation in the species present during the colonization process, driven by community succession and/or dispersal abilities of taxa. Our study shows that postglacial colonization influenced contemporary freshwater fish communities within the same geographical region, and it underscores the importance of understanding the historical drivers influencing contemporary assemblages.

Year: 2nd
Research Category: Applied Science and Technology

Do stormwater drain filters installed at industrial facilities reduce plastic pellet pollution at the watershed scale?

Eden Hataley, Chelsea Rochman, Dimple Roy

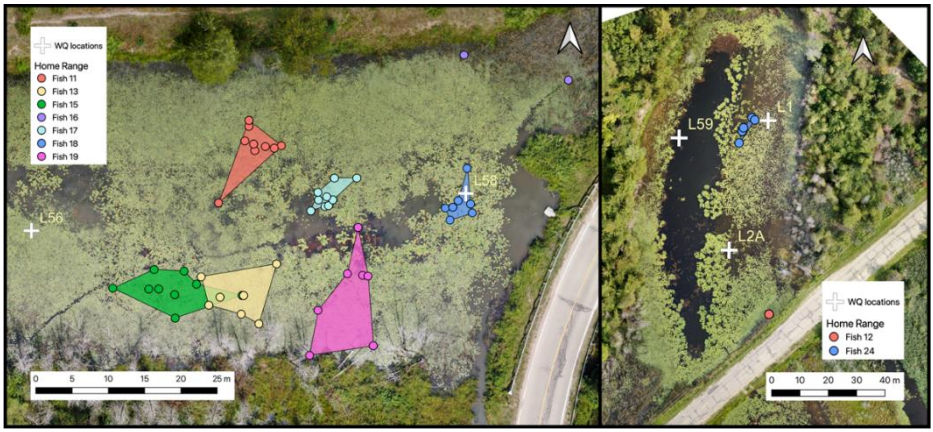
Operation Sweep the Creek (OSC) is a multi-year collaborative initiative designed to address the problem of plastic pellet loss from industry in the Greater Toronto Area. This poster will highlight the third and current phase of OSC (OSC 3.0). Plastic pellets, the raw material used to make plastic products, are a less familiar but prevalent source of microplastic pollution. Due to their small size, plastic pellets are often spilled during

routine operations at industrial facilities. Leaked plastic pellets that are not cleaned up promptly or adequately can be picked up by precipitation and washed into the stormwater system, whereby direct release to the local aquatic environment is probable. The aim of OSC 3.0 is to assess the impact of stormwater drain filters—designed to sit inside stormwater drains and prevent litter carried by precipitation from entering the stormwater system—at the watershed scale. We will do this by measuring the number of plastic pellets in the surface waters of the Humber River both before and after installing 14 stormwater drain filters at six plastics companies located upstream in the watershed. This summer, we began sampling in the Humber River during wet-weather events to determine baseline plastic pellet contamination. This fall, we will install the stormwater drain filters. Over the following year, we will characterize the captured content from each filter to measure diversion and continue sampling in the Humber River. We hope this research will help motivate and inform provincial regulation to effectively manage plastic pellet emissions and ultimately help improve Great Lakes' water quality and ecosystem health.

Year: 2nd
Research Category: Applied Science and Technology

High summer site fidelity of Lake Chubsucker (*Erimyzon sucetta*) in a low dissolved oxygen environment.

Jennifer R. Powell, Nicholas Mandrak



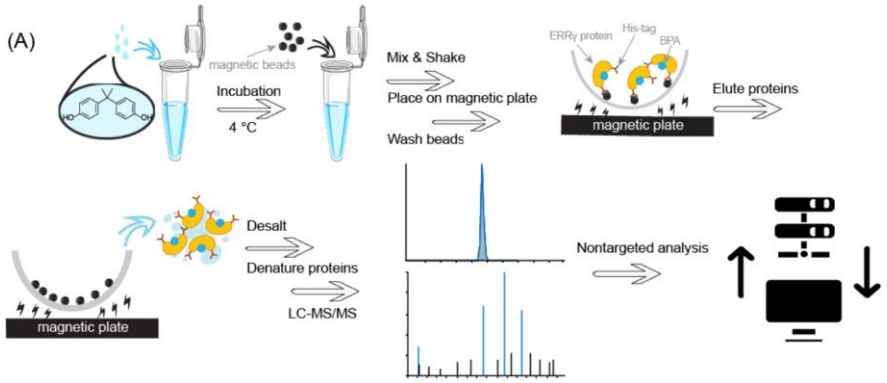
Lake Chubsucker (*Erimyzon sucetta*) has been listed as endangered in Canada since 2008. Developing an effective recovery strategy for this fish species has been difficult due to a lack of understanding of their basic biology, including habitat preferences and usage. In June of 2022, 9 adult Lake Chubsucker were captured in L-Lake, Lambton Shores, Ontario implanted with radio-tags, and their location tracked regularly by boat during the day between July 18 and Sep 1. Tagged fish showed very high site fidelity

and small home ranges largely distinct from the other tagged fish, suggesting they have territories. Most home ranges ranged between 11-79 m^2 with one fish rarely moving from the same 1 m^2 patch. Home range size was moderately negatively correlated with maximum dissolved oxygen concentration, with fish living in areas with the lowest dissolved oxygen moving around more, but not entering the ranges of fish with better dissolved oxygen conditions. For 7 of the fish, dissolved oxygen levels in their habitat were consistently hypoxic throughout the summer and often anoxic suggesting reasonably high hypoxia tolerance in the species. Upcoming tracking work throughout the fall, winter and spring will help determine if this is a seasonal behaviour. Diel dissolved oxygen cycling in the system showed peaks between midnight and early morning or late afternoon and early evening, which may result in higher fish movement at night and warrants further investigation.

Year: 2nd
Research Category: Applied Science and Technology

Widespread formation of toxic nitrated-bisphenols indoors by heterogeneous reactions with HONO

Diwen Yang, *Hui Peng*



With the immense number of structurally diverse indoor contaminants, indoor transformation chemistry has been largely unexplored. Herein, by integrating protein affinity purification and nontargeted mass spectrometry analysis (PUCA), we identified a significant class of previously unrecognized indoor transformation products formed through gas-surface reactions with nitrous acid (HONO). Through the PUCA, we identified a non-commercial compound, nitrated bisphenol A, from indoor house dust extracts strongly binding to estrogen related receptor γ. Nitrated bisphenol A was further detected in 28 of 31 house dust samples, with comparable concentrations (ND – 0.30

μg/g) to BPA. Via exposing gaseous HONO to surface-bound BPA, we demonstrated that it likely forms via a heterogeneous indoor chemical transformation. Moreover, the nitration reaction was highly selective towards bisphenols with electron-rich aromatic rings. We further employed 15N-nitrite for in situ labeling and discovered 110 nitration products formed from indoor contaminants with distinct aromatic moieties. This study demonstrates a new class of chemical reactions involving indoor HONO, which need to be incorporated into the risk evaluation of indoor contaminants, particularly bisphenols.

Year: 1st
Research Category: Experimental and Theoretical Science

Host-Parasite Dynamics at the Domestic-Wildlife Interface in the Greater Toronto Area

Joe Kawalec, *Peter Molnar*

As anthropogenic disturbances related to urbanization increase around the world, landscapes are slowly transforming into mosaics of natural patches connected by corridors amidst a matrix of human development. Wildlife navigating through these urban green spaces, such as parks, are often traveling close to residential areas and can be carrying parasites, which could potentially pose threats to human health. Through my research, I will examine the effects of fragmented green habitats on the movement of urban wildlife and the transmission of parasites by using the Greater Toronto Area (GTA) as a study system. To monitor the movement and density of wildlife across urban green spaces in the GTA, a network of camera traps will be established, with a focus on the detection of mammalian species, such as foxes & coyotes, that may be carrying parasites of interest. To identify the composition and spatial structure of the parasite community in the GTA, fecal samples will be collected in urban green spaces. These samples will be analyzed in the laboratory to determine their host species and if the host was carrying parasites, typically identified through an examination of eggs excreted in the feces. Finally, mathematical modelling to examine transmission pathways between hosts on a spatially explicit network of urban green spaces across the GTA will inform on the risk of parasite spillover from wild to domestic areas. This research has implications for health city planning, providing information that will help cities function within the best possible interests of both humans and wildlife.

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END OF PRESENTATIONS

NOTES:

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