ENVIRCON

Inspiring Change, Education, and Awareness

March 22, 2019

University of Western Ontario

International and Graduate Affairs Building (IGAB)

and University College (UC)

Schedule		
Time	**Room(s)**	**Session**
8:00 am - 8:40 am	IGAB Atrium	**Registration**
8:40 am - 8:50 am	IGAB Atrium	**Welcome Address**
9:00 am - 11:00 am	UC1105 UC1225 UC2105	**Graduate Student Talks**
	UC3220	**Undergraduate Student Talks**
11:00 am - 11:30 am	IGAB Atrium	**Coffee Break**
11:30 am - 1:00 pm	IGAB Atrium	Panel Discussion: **Plastics in the Anthropocene: Problems and Solutions**
1:00 pm - 2:00 pm	IGAB Atrium	**Lunch**
2:00 pm - 3:00 pm	IGAB Atrium	Keynote Address: **Lauren Smith and Nicole Balliston** **Polygone Technologies**
3:00 pm - 3:25 pm	IGAB Atrium	**Graduate Student Speed Talks**
3:25 pm - 4:00 pm	IGAB Atrium	**Poster Session**
4:00 pm - 4:15 pm	IGAB Atrium	**Closing Remarks and Awards Ceremony**
4:30 pm - 6:00 pm	The Wave	**Reception**

ENVIRCON

Research Conference

March 22, 2019

Panel Discussion:
Plastics in the Anthropocene: Problems and Solutions

11:30 am - 1:00 pm

Panelists:

Dr. Patricia Corcoran

Associate Professor and Department Chair of Earth Sciences at the University of Western Ontario

Dr. Amar Mohanty

Premier's Research Chair in Biomaterials & Transportation at the University of Guelph

Dr. Stephanie Borrelle

David H. Smith Postdoctoral Fellow at the University of Georgia, with Ocean Conservancy at the University of Toronto

Hasitha de Alwis Weerasekera

Director of Biochemistry, Genecis Bioindustries

Join us for a discussion on plastic pollution to hear about some of the issues surrounding plastics and possible alternatives and solutions. A discussion by professionals in the field of plastics research will be followed by an open session for questions from the audience.

Topics areas to be addressed include:

- Fate of plastics in the environment
- Environmental and ecosystem impacts of plastic pollution
- Green materials as alternative to contemporary plastics
- The breakdown and environmental impacts of green materials
- Adoption of, and investment in, green materials by industry
- Recommendations of possible solutions, including both engineered and policy-based

Keynote Address:
Lauren Smith and Nicole Balliston
PolyGone Technologies
2:00 pm - 3:00 pm

Lauren Smith

Nicole Balliston

EnviroCON 2019 welcomes Lauren Smith and Nicole Balliston, co-founders of PolyGone Technologies, as our keynote speakers! PolyGone is a company dedicated to reducing microplastic release to the environment and into our diets. Microplastics are an emerging contaminant, being found in many food and beverage products, including 83% of all tap water and 93% of all bottled water. Despite efforts to reduce microplastic emissions, there is still no standardized, reliable method to detect these plastics quickly and affordably. PolyGone is developing rapid microplastic detection methods to not only detect the amount of plastics in products we consume, but also to determine the efficacy of products aiming to remove microplastics. The team is providing the first certification system for plastic content of products and certification ratings of microplastic removal. PolyGone makes it easy for consumers to know what is in the products they choose and how effective filtration products are at keeping microplastics out of our diets and waters. With diverse academic backgrounds in sustainability management, environmental engineering, water management, and behaviour change, these University of Waterloo graduates have applied their interdisciplinary knowledge outside the classroom to tackle a growing environmental and public health concern.

PolyGone Technologies

Graduate Student Talks: Presentation Schedule

Graduate Student Talks 9:00 am - 11:00 am		
Communities and Diversity *Room: UC1105*	**Agriculture and Nutrients** *Room: UC1225*	**Policy and Technology** *Room: UC2105*
Boreal peatlands: Characterized in terms of both aboveground and belowground components and the impacts of climate warming on the aboveground plant communities **Caitlyn Lyons** **University of Western Ontario**	Mercury methylation along a latitudinal sulphate deposition gradient in Ontario peatlands **Jennifer Blythe** **University of Western Ontario**	Green gasoline: Producing n-butanol via fermentation of waste crude glycerol from biodiesel production **Colin Couper** **University of Western Ontario**
Intraspeciation **Ashley Snook** **University of Western Ontario**	Evaluating the potential for resource recovery from smouldering treatment of biosolids **Taryn Fournie** **University of Western Ontario**	Mechanisms of bacterial aggregation at liquid-air interface **Zahra Habibi** **University of Western Ontario**
Habitat-based drivers of arthropod abundance, richness and composition in agricultural landscapes **Aleksandra Dolezal** **University of Guelph**	Effect of hot phenomena on groundwater derived nutrients in the nearshore aquifer in the Great Lakes **Sabina Rakhimbekova** **University of Western Ontario**	Development of a compact, energy-positive food waste treatment process **Swakshar Saha** **University of Waterloo**
Break: 9:55 am - 10:05 am		
Plant structure as a driver of arthropod predator community **Bernal Arce** **University of Guelph**	Following the fate of nitrogen transfer between cover crop and main crop through 15N tracing **Spencer Heuchan** **University of Western Ontario**	The welfare impact of public climate change awareness **Meghdad Rahimian** **University of Western Ontario**
Diversity of arthropods in Boreal peatlands **Grace Carscallen** **University of Western Ontario**	Is grassland ecosystem stability impacted by simultaneous changes in the availabilities of multiple nutrients? **Oliver Carroll** **University of Guelph**	Smouldering (STAR) Remediation of PFAS-Contaminated Soil **Alexandra Duchesne** **University of Western Ontario**
		Where can I get my food? Assessing Ontario municipal policy impacts on local food environments **Alexander Wray** **University of Western Ontario**

Undergraduate Honor's Thesis Talks: Presentation Schedule

Undergraduate Student Talks **9:00 am - 11:00 am**
Honor's Thesis Talks *Room: UC3220*
Secondary invasion? Interacting effects of the emerald ash borer (*Agrilus planipennis*) and ecological integrity on invasive shrub establishment **Jen Baron** **University of Western Ontario**
Reeling it all in: comparing data collected from anglers, naturalists and traditional fisheries management approaches **Becca Cambridge** **University of Western Ontario**
Assessing the performance of Credit Valley Bioretention Media as source or sink for phosphorus in cold climate storm-water runoff **Julia Cantelon** **University of Western Ontario**
A paleolimnological investigation of changes in primary production in subalpine lakes of the Uinta Mountains **Holly Dunne** **University of Western Ontario**
Living on the edge: Soil microedges provide an ecological niche for marginalized species **Jessica Kowalski** **University of Western Ontario**
Patterns of cellulose decomposition are not concordant to groundwater inputs in an agricultural stream **Shayla L. Kroeze** **University of Western Ontario**
The influence of concentration and delivery of phosphorus on stream decomposition: A mesocosm experiment **Meghan Sauro** **University of Western Ontario**

Graduate Student Speed Talks: Presentation Schedule

Graduate Student Speed Talks **3:00 pm - 3:25 pm** *Room: IGAB Atrium*
Exploring governance mechanism in conventional agriculture systems to reduce GHG emissions **Lisa Ashton, University of Guelph**
Assessing the relationship between the size and number of wildland fires **Devan Becker, University of Western Ontario**
Mega-dam fever in Latin America: the intersection of indigenous rights and environmental justice in Bolivia and Brazil **Giada Ferrucci, University of Western Ontario**
The use of alternative measures to GDP at the provincial level **Jason Robinson, York University**

Graduate Student Posters

Graduate Student Posters **3:25 pm - 4:00 pm** *Room: IGAB Atrium*
Incorporation of anthropogenic debris into double-crested cormorants' nests, Toronto, Ontario **Melina Damian, York University**
Optimal resource allocation theory predicts canola production under drought and nutrient stress **Kristin Doherty, University of Guelph**
Mega-dam fever in Latin America: the intersection of indigenous rights and environmental justice in Bolivia and Brazil **Giada Ferrucci, University of Western Ontario**
Charcoal and common worlds: What tracks can we leave as educators? **Sarah Hennessy, University of Western Ontario**
Irrigation scheduling of *Spiraea japonica* "Goldflame" **Katherine Keary, University of Guelph**
Groundwater quality linked to ecosystem services on marginal lands of intensively managed farms **Daniel Noble, University of Guelph**
A green mindset: A study of Nigeria's electricity legislative framework, with a specific focus on the viability of grid connection, transmission and offtake potential for small scale renewable generation purposes **Njokuji Ogechi Judith, University of Western Ontario**
Ontario crop productivity: Variation in yield with varying land suitability for agriculture using NDVI **Samantha Ramirez, University of Guelph**
Air pollutants and school development **Amritpal Rathore, University of Western Ontario**
Assessing the relationship between political ideology and climate change attitudes: An analysis of 18 European countries **Vanessa Sinclair, University of Western Ontario**

Graduate Student Talk Abstracts

9:00 am - 11:00 am

Bernal Arce, University of Guelph

Plant structure as a driver of arthropod predator community

Physical structure, a component of every habitat, is one of the many abiotic factors that drive arthropod communities. Herbaceous plants can drive the availability of space and shapes in a terrestrial habitat, which affects the community by limiting the arthropod predators' ability to catch prey. This could make predators more sensitive to changes in structure than non-predators, and if so their recruitment into new habitats and community assembly should be different than non-predators in different levels of structural heterogeneity and space availability. This study used a factorial experimental design to evaluate the arthropod community composition in 48 plots of common crops (as analogs of different levels of structural heterogeneity) planted at two different levels of density (to test the effect of the availability of space). Crops used, in order of ascending complexity, were oats, soybeans, flax, and a mixture of all three. Arthropods were identified to family, and richness, abundance, and measures of beta-diversity (multiple site Bray-Curtis) were evaluated. Plant biomass quantity was measured at the conclusion of the experiment as an important co-variate with structure. Predator and non-predator abundances responded similarly to the treatment combinations. Non-predator richness responded differently to density based on crop identity (i.e. the crop-density interaction) where richness was 11% lower on average in spare versus dense oats but did not vary significantly between density for the other crops. Predator richness declined 38% in oats versus plots containing all four plant species. The major components of beta diversity across the eight treatment combinations (Bray-Curtis dissimilarity, multiple site balanced changes, and abundance gradients) were symmetrical among predators and non-predators. Overall this study adds evidence that predator and non-predator arthropods track each others' responses to physical structures instead of having differing sensitivities.

Jennifer Blythe, University of Western Ontario

Mercury methylation along a latitudinal sulphate deposition gradient in Ontario peatlands

Peatlands are wetlands characterized by organic, nutrient-poor, inundated soils dominated by a variety of anaerobic microbes, including sulphate-reducing bacteria (SRB). SRB are the principal methylators of inorganic mercury (Hg) in the natural environment. Factors that control the activity of SRB communities are of particular relevance to ecosystem health as MeHg is the bioaccumulating, and neurotoxic form of Hg. As a key nutrient in SRB metabolism, sulphate constitutes a well known control on SRB methylation of Hg. It is well established that increasing the supply of sulphate to nutrient-limited systems such as peatlands increases bacterial methylation of Hg. This effect, however, has been shown to differ based on the legacy of sulphate deposition to the wetland, though the exact mechanism behind this apparent difference is still unclear. The goal of my Master's research is to investigate the effect that legacy sulphate deposition has on bacterial Hg methylation by exploring a latitudinal gradient of sulphate deposition in Ontario peatlands. Peat cores were taken from three Ontario peatlands along a latitudinal gradient; the Sifton Bog in London, White River, and James Bay. The cores were packed into glass chromatography columns, and placed in a flow-through system where sulphate solutions of increasing concentration were pumped through the columns for a period of 14 days. The column outflow was sampled periodically for biogeochemical indicators of methylation, including MeHg, dissolved organic carbon (DOC), sulphate removal, sulphide, and total mercury (THg). Results from the Sifton Bog and White River experiments show that although both sites exhibit an increase in methylation with increasing sulphate supply, methylation is

highest in White River peat when supplied with the same amount of sulphate, despite legacy sulphate deposition being highest at the Sifton Bog site. This suggests that geochemical differences in peat composition exist between the two sites that create different methylation potentials. This research can inform management and restoration strategies for peatlands affected by legacy, or current sulphate deposition.

Oliver Carroll, University of Guelph

Is grassland ecosystem stability impacted by simultaneous changes in the availabilities of multiple nutrients?

Simultaneous changes in the availabilities of multiple nutrients, a common consequence of human activity, have the potential to synergistically impact ecosystems. This effect may be particularly severe in communities of grassland plants, where nutrients are the currency of plant species interactions, and influence productivity and diversity. Despite rising interest in resource co-limitation, the role of multiple limiting factors in ecosystem stability is poorly understood. To determine if multiple limiting factors impact stability, we assessed temporal variation, over 7 years, in the biomass production of 29 grassland sites which received single- and multiple-nutrient treatments. These sites are located across 4 continents and are part of the Nutrient Network, a globally distributed grassland experiment. Across these sites, the addition of both nitrogen and phosphorus increased variability, suggesting temporal stability is independently impacted by multiple resources. In contrast, inputs of potassium and micronutrients had no effect on stability and reversed the destabilizing effect of phosphorus. Previously, attempts have been made to categorize multiple resource limitations, but these have not considered interannual variation in responses to limiting resource inputs. By including this effect, we demonstrate that biomass was co-limited by multiple nutrients in at least one year at all grassland sites included in this study. This challenges previous findings that some grasslands are not nutrient limited and instead suggests nutrient limitation and limitation-type is dependent on temporal variability in other ecological or global-change processes.

Grace Carscallen, University of Western Ontario

Diversity of arthropods in Boreal peatlands

Even though they are hyperdiverse, have high biomass, and are a vital food source, soil arthropods are not well understood because they are difficult to directly observe. Many species are organisms which only live in soil for part of their life cycles, emerging when they reach maturity. Along with predatory arthropods on the soil surface, these emergent arthropods connect the below-ground system to the above-ground food web. My study aims to classify the diversity of the arthropods which facilitate the above to below-ground connection in peatlands. I collected arthropods using insect emergence traps, pitfall traps, and by directly sorting peat samples. I found that 85% of all emergent arthropods were flies in the suborder Nematocera, and 65% of all surface-dwelling arthropods were spiders. The identity of these arthropods is vital to know for future examinations of peatland habitat, reclamation activities, and to understand the peatland food web.

Colin Couper, University of Western Ontario

Green gasoline - Producing n-butanol via fermentation of waste crude glycerol from biodiesel production

Transportation fuels account for 25% of CO_2 emissions in Canada, with roughly 50% of those coming from gasoline fuels, and total emissions are increasing. Butanol is a carbon neutral fuel that can replace traditional gasoline, decreasing emissions and helping abate climate change, and can be produced from renewable crude glycerol, a low-cost waste product from biodiesel production.

Butanol production suffers from limitation due to toxicity and inhibition from fermentation products. This can be overcome by integrating in situ extraction via pervaporation to remove toxic products, and using cell recycle to increase productivity.

Fermentations have been performed using batch and continuous configurations, and integration and testing of pervaporation and cell recycle is currently underway.

Aleksandra Dolezal, University of Guelph

Habitat-based drivers of arthropod abundance, richness and composition in agricultural landscapes

Large declines in arthropods are increasingly reported, but we lack knowledge of key limiting factors especially habitat related factors. Not all remaining habitat is likely to be similarly suitable for the life-history needs of insects, with three potential filters: regional based on the acute isolation of suitable habitat, farm-level depending on plant cover type, and plot-level depending on plant composition. I conducted detailed sampling of arthropods to test the relative influence of these habitat filters, in an intensively managed farm landscape of central North America. I identified 27,080 arthropods from 223 families categorized into 9 functional groups, spanning 10,000 km^2 (regional scale), 13 farms with cover types of crop field, prairie strips, and woodlots (farm scale), and varying richness and composition of plants within cover types (plot scale). I compared my farm data with regional databases from conservation areas, to test the if farm communities are significantly less diverse and dominated by insect herbivores. I also tested the relationship of cover type with beneficial insects, including whether non-crop habitat fosters predators and parasitoids that reduce crop damage. Our results show that arthropods responded to habitat filters at the farm and plot level - cover type and composition were key. The main habitat driver was prairie strips, which produced two times greater arthropod abundance and richness than crop fields or woodlots. Within prairie strips, plant tissue quality and plant composition were important factors at the plot-level. Regional factors were not key and, surprisingly, surrounding conservation areas had similar arthropod richness as farmed areas. Excitingly, the addition of prairie strips on a farm resulted adjacent to resulted in a two-fold reduction of crop leaf damage in adjacent crop fields. My study confirms that increasing habitat matters at the farm and plot level to foster beneficial arthropod communities which provide herbivore reduction services.

Alexandra Duchesne, University of Western Ontario

Smouldering (STAR) remediation of PFAS-contaminated soil

Per- and polyfluoroalkyl substances (PFAS) are emerging contaminants that are widespread in the environment and challenging to remediate. Self-sustaining Treatment for Active Remediation (STAR) uses smouldering combustion to destroy organic contaminants embedded in porous media. Smouldering is a flameless, exothermic oxidation reaction; charcoal in a BBQ is a typical example. Under self-sustaining conditions, the smouldering reaction will propagate through the contaminated porous media without any external energy input, making STAR an energy and cost-efficient process. This study evaluated STAR as a remediation technique for PFAS-impacted granular activated carbon (GAC) and PFAS-impacted soil. In the first set of tests, GAC loaded with PFAS was combined with sand to produce a smoulderable mixture. The second set of tests used a soil exhibiting a wide grain size distribution, 1% organic carbon, and also contaminated with PFAS. Uncontaminated GAC was added to this soil to create a smoulderable mixture. In all tests, the PFAS-contaminated mixtures were subject to smouldering (STAR) tests in 20 cm high, 15 cm diameter steel columns instrumented with thermocouples. Results reveal that the smouldering front propagated in a self-sustained manner through the PFAS-impacted mixtures, destroying all the GAC and organic carbon and generating temperatures in excess of 900°C, which is expected to be sufficient to thermally destroy PFAS compounds. Post-treatment concentrations of PFAS in the remaining sand, soil, and ash

were below detection limits (0.05 µg/kg). An analysis of emissions is underway, exploring PFAS destruction via hydrogen fluoride capture, as well as potential PFAS compounds emitted. Considerable destruction appears to be present with PFAS emissions being small relative to the high starting concentrations; further quantification is in progress. Results to date are promising, suggesting STAR may provide an effective remediation technique for PFAS-impacted soils and PFAS-laden GAC.

Taryn Fournie, University of Western Ontario

Evaluating the potential for resource recovery from smouldering treatment of biosolids

For modern agriculture to meet future global food demands, large quantities of phosphorus (P) rich fertilizer will be required (Johnston & Steen, 2000). Almost all P for fertilizers comes from mined phosphate rock, where current global phosphate reserves are declining and may be depleted in the next 50-100 years (Li *et al*., 2016). Therefore, there is significant interest in exploring recovery methods to extract these resources from human waste streams (e.g., biosolids from wastewater treatment plants). Rashwan *et al*. (2016) explored the use of self-sustaining smouldering combustion as a simple, energy efficient method for treating biosolids. The smouldering process burns the biosolids, much like an incinerator, but operates at lower temperatures, is more resistant to quenching, and is much more energy efficient. This research seeks to better understand the resource recovery and reuse opportunities from the smouldering treatment of biosolids.

Elevated temperatures, such as those reached during incineration, may change the forms of P-compounds present in the waste and potentially alter the biological availability (Pape *et al*., 2014). Though there is some research investigating how incineration affects the quantity and bioavailability of P, little is known about how smouldering affects these parameters. A review of existing bioavailable-P test procedures revealed issues and inconsistencies with drawing correlations between laboratory results and natural conditions. Therefore, a new bioavailable-P test procedure is being developed. The data collected will be used to develop a model that will simulate the leaching of P and other regulated elements of concern. The model will provide best practices for the land application of the post-treatment smouldered ash.

This research will answer important questions about some concerns and some opportunities that may be unique to smouldering treatment of biosolids. The results from this research will contribute to advancing the use of smouldered biosolids ash as a P-rich fertilizer. Additionally, the development of the new bioavailable-P test procedure will improve the understanding of P uptake by plants, essential to achieving sustainable food production.

Zahra Habibi, University of Western Ontario

Mechanisms of bacterial aggregation at liquid-air interface

Microorganisms, including algae and bacteria, can live in freshwater and can produce harmful bacterial blooms in lakes and river basins in Canada. Cyanobacteria produce secondary metabolites which are known to cause serious concern to humans, animals, and the ecosystem. To proliferate, bacteria usually form aggregates as a precursor to biofilms. This is an important virulence mechanism on solid surfaces as well as at the interface between water and air. We have recently shown that the diffusion of *Synechocystis* sp. PCC 6803 slows down due to the surface recognition of traces of secreted extracellular matrix. This slowdown provides a precursor mechanism for biofilm formation. Thereafter, the bacteria continue to diffuse slowly and frequent interactions start to occur between them due to their high surface density. We experimentally measured the rate at which aggregates form and observed its dependence on the cellular motility as provided by surfaces of different hardness. We developed an

analytical theory based on a modified Smoluchowski master equation showing that the probability for the bacteria to be motile is key; it allows individual bacteria preferentially to detach from microcolonies, therefore decreasing the number of microcolonies. Numerical simulations confirm this mechanism. However, further investigations are required on the details of the interaction mechanism among the individual bacteria and their aggregation in quiescent conditions and also under an imposed flow. Hence, future work will focus on the interaction of a few bacteria in a closed microchip for understanding how the bacteria establish contact. This work will be followed by the study of the effects of a laminar and a turbulent flow on the aggregation process.

Spencer Heuchan, University of Western Ontario

Following the fate of nitrogen transfer between cover crop and main crop through ^{15}N tracing

Conservation of soil health is crucial for the reduction of environmental contaminants associated with agricultural systems. Cover crops can potentially improve the sustainability of agroecosystems by reducing nutrient losses from soil erosion, increasing plant biodiversity and increasing soil organic matter. The success of cover crops in reducing nitrogen (N) losses and benefiting the yield of the subsequent main crop is contingent on the N release from the decomposition of cover crop residues being well-synchronized with the N demand of the main crop. Not only is this transfer of cover crop N to the main crop poorly documented, but because they alter the timing and form of N losses from agricultural systems, there is the potential for cover crops to be a liability from an environmental and economic standpoint. The objective of my research is to quantify and characterize the transfer of N to the main crop for a range of cover crops and cover crop mixtures. I will be utilizing state of the art field lysimeters (used for measuring soil water and nutrient fluxes) as well as a long-term cropping system experiment, both located at the Elora Research Station in Guelph, ON. For both study systems, I am applying stable ^{15}N-labelled fertilizer tracer to cover crops and main crop mixtures in the spring. ^{15}N recovery will be assessed in the harvested crops and soil solutions in the fall. Thereafter, I will track the fate of the ^{15}N in this residual material over-winter and subsequently assess the balance of the transfer of the cover crop ^{15}N to the main crop vs. losses to the surrounding environment over multiple crop rotations. This study will confirm the extent to which increased N retention and fertility by cover crops can reduce N losses to the surrounding environment and benefit crop yield.

Caitlyn Lyons, University of Western Ontario

Boreal peatlands: Characterized in terms of both aboveground and belowground components and the impacts of climate warming on the aboveground plant communities

Boreal peatlands are important global carbon sequesters due to the accumulation of peat (partially decomposed plant material). Therefore, the aboveground plants are important determinants for carbon storage potential. Boreal peatlands are mainly dominated by three different plant functional groups: *Sphagnum* mosses, *Carex* sedges, and shrubs. *Sphagnum* mosses comprise a vast majority of peat, meaning *Sphagnum* spp. contribute the most to carbon storage potential of Boreal peatlands. I have characterized two Boreal peatlands, a *Sphagnum* dominated and *Carex* dominated peatland, in terms of aboveground plant community, litter composition and belowground microbial community. I have also performed a field experiment at theses sites, looking at the effects of passive warming on the aboveground plant communities. Under climate warming, a shift from *Sphagnum* mosses to *Carex* sedges in peatlands is expected. I have two field seasons of plant community composition data collected using the point intercept method under passive warming and control treatments. I have also measured leaf area index (LAI) as an indicator of aboveground biomass. After only one growing season there were detectable changes in LAI under passive warming where the *Carex* dominated peatland demonstrated larger LAI in the warming treatments. In the *Carex* dominated peatland there was also a significant shift in plant communities under

passive warming, demonstrating an increase in shrub dominance. In the S*phagnum* dominated peatland there are trends depicting seasonal shifts in plant communities. Climate warming has the potential to impact the plant community composition at these two Boreal peatland sites and this could shift these sites from carbon sinks to carbon sources, exacerbating climate warming effects.

Meghdad Rahimian, University of Western Ontario

The welfare impact of public climate change awareness

There is a substantial public disagreement regarding fundamental knowledge of climate change among the U.S. citizens. Regardless of the reasons for this disagreement or lack of awareness, estimating the impact of public climate change awareness (PCCA) on the choice of greenhouse-gas (GHG) emission of industrial facilities in U.S. is difficult because of endogeneity and omitted variable bias. I used variation in the short-term temperature anomalies as an instrumental variable for PCCA across the U.S. counties in 2014 and 2016. PCCA is strongly negatively related to GHG emission generated by large emitting facilities in US: a positive public awareness shock of one percentage point increases the likelihood of GHG emission reduction by 0.44 percentage point in the following year. I exclude other channels through which temperature anomaly may affect GHG emission. The annual negative welfare consequences of the extra emitted GHGs may exceed 68 dollars for every US citizen, and the adverse impact on the global environment is even more substantial. This damage could have been avoided by rectifying the information gap regarding climate change among Americans.

Sabina Rakhimbekova, University of Western Ontario

Effect of hot phenomena on groundwater derived nutrients in the nearshore aquifer in the Great Lakes

The contribution of direct groundwater discharge as a source of nutrients (phosphorus and nitrogen) to the Great Lakes is unclear. In particular, the role of hot spots and hot moments in controlling the fate of nutrients near the groundwater-lake interface is uncertain. The objective of this study was to evaluate the transport and transformation of septic-derived nutrients through a sandy beach aquifer and assess their ultimate discharge to the lake. Field investigations were conducted in 2014 and 2015 downgradient of a large public septic system near Lake Huron. The sampling was designed to understand the seasonal variability as well as physical and geochemical factors controlling nutrient distribution near the groundwater-lake interface. Elevated nitrate (110 mgNO_3^-/L) and phosphate (450 µgPO_4^{3-}/L) were observed between 1-3 m below the ground surface with concentrations decreasing towards the lake. Coupled dissolved and solid phase analysis showed the potential sequestration of PO_4^{3-} to the aquifer sediments. Artificial sweetener data confirmed anthropogenic origin of the nutrient-rich groundwater plume. Seasonal changes in hydrologic regime and septic system use have direct impact on the nutrient distribution in the beach aquifer. Findings of this study are valuable in improving prediction of groundwater nutrient loading to the lake.

Swakshar Saha, University of Waterloo

Development of a compact, energy-positive food waste treatment process

This study developed an innovative bioprocess for food waste (FW) treatment by combining a leach bed reactor (LBR) with an anaerobic membrane bioreactor (AnMBR). The two bioreactors were consistently operated at neutral pH and room temperature. Best performance was observed in the LBR run at the conditions of inoculum to substrate ratio 10% and leachate circulation rate 4.4 L/h without any clogging issues in the LBR: removal of volatile solids 88±2%, and hydrogen production 3.45 L/ kg VS added, VFA yield 571 g COD/kg VS added only in a reaction

time of 14 d; part of FW remained in the LBR, accounting for 10-14% of initial FW. LBR leachate (i.e., effluent from the LBR) was further stabilized in the AnMBR, and hydraulic retention time (HRT) related to membrane flux and organic loading rate were mainly optimized in the AnMBR. Only in 13 d HRT, the AnMBR achieved 85% COD removal and complete solid reduction due to membrane separation, along with the specific methane yield of 0.3 L/g COD removed. Under this short HRT, membrane flux was ~ 6 L/m^2-h and maintenance cleaning once every five days was required to keep the flux. Energy balance showed that the combined FW bioprocess is energy-positive with net energy benefit of 2,588 kWh/ton VS removed. The study proved that the newly developed FW process could achieve around 83.5% VS removal of FW only in 20 d of overall reaction time, along with net energy profit.

Ashley Snook, University of Western Ontario

Intraspeciation

"Intraspeciation" is a presentation and partial research for my current PhD project entitled "Phylogenetic Interconnectivity: A Biophiliac Approach to Human and Nonhuman Kinship." As an interdisciplinary artist, my studio practice (see www.ashleysnook.com), involves studying instinctive characteristics of animality. Within this concept, I address intuitive and physical connections between human and nonhuman species, including vegetal and botanical life. This has led me to a term I am currently developing: intraspeciation.

I define the term intraspeciation as a process that positions my working thesis in proximity to evolutionary theories of phylogenetic exploration by blurring taxonomic divides, which can be seen in my work that amalgamates human and nonhuman characteristics through sculpture, installation and drawing. Intraspeciation is a term that proposes one to identify with a rooted animality, physically and mentally, and takes keen interest in other living organisms because of seemingly inherent relatability. By definition, intraspeciation involves a personal discovery or realization of human animality: the becoming of a new species by a shift in perspective—to be intraspeciated. I argue that my term materializes a perspective that rejects the separation and hierarchy between species. Intraspeciation focuses on the support of kinship between human and nonhuman species in an attempt to fortify relationships and rethink treatment within and without the biosphere. Within this context, I move beyond the notion of anthropocentrism to acknowledge and embrace the interconnectivity that exists amongst species. I position my research within the current destructive age of the Anthropocene, and using as a subcategory, the Chtulucene. The Chthulucene addresses living and dying together on an irreparable earth while composting and reworlding the Anthropocene.

Intraspeciation is a concept that pushes boundaries of what is considered human. It proposes a contemporary loss of affinity between human and nonhuman by arguing that we cannot survive as a human species without the agency of nonhuman species. Intraspeciation provides the opportunity to investigate a world where divides are suspended, and animalistic curiosities are explored through artistic visualization, providing new knowledge of understanding and embracing animality. Intraspeciation acts as a platform to stimulate and encourage activism and new types of actions for recognized agency of nonhuman species.

Alexander Wray, University of Western Ontario

Where can I get my food? Assessing Ontario municipal policy impacts on local food environments

Ontario municipalities have increasingly focused on the role of their bylaws and policies in shaping local food environments. Many planners have chosen to incorporate elements of food access into their land use planning and development documents. However, access is a nebulous concept in the context of health policy research. As a

multi-faceted concept, how food environment access is presented in municipal planning and policy documents is worthy of further intensive study. We present a food environment oriented content analysis of land use planning policy documents from twelve Ontario cities: Brampton, Cambridge, Hamilton, Kingston, Kitchener, London, Mississauga, Oshawa, Ottawa, Toronto, Waterloo, and Windsor. We deploy Pechansky and Thomas' (Med Care 1981,19:127) healthcare accessibility framework to guide our content analysis. Municipal bylaws and policies were assessed for their contribution to promoting availability, accessibility, affordability, acceptability, and accommodation within the local food environment. The bulk of municipalities incorporate features of accessibility and availability into their documents. However, few municipalities addressed issues of affordability, acceptability, and accommodation in their approaches to food environment related policy and regulations. Community gardens and urban agriculture were a popular theme across the sample. We found significant use of urban growth containment policies to protect agricultural landscapes, and extensive conflicts between current retail zoning and the expressed desire for smaller format retail food outlets. The approaches tended towards easily implementable policies that require little government investment or oversight, such as urban agriculture and community gardens. Much of the justification provided for various policies were not informed by evidence, or were in direct contravention to peer-reviewed findings. Given the lack of evidence-based policy in this space, there is a clear need for more translational policy-oriented research.

Undergraduate Honor's Thesis Talk Abstracts

9:00 am - 11:00 am

Jen Baron, University of Western Ontario

Secondary invasion? Interacting effects of the emerald ash borer (Agrilus planipennis) and ecological integrity on invasive shrub establishment

The emerald ash borer (*Agrilus planipennis*; EAB) is an invasive wood-boring beetle that causes high levels of ash (*Fraxinus* spp.) mortality in eastern North American forests. While the immediate impacts of the EAB are well studied, the indirect and long-term consequences are less well understood. Secondary invasions occur when one invasive species facilitates the entry or establishment of another invasive species. While limited previous work shows evidence of EAB-facilitated secondary invasion, further description of this process is needed. Forest responses to insect invasions may be influenced by ecological integrity—the degree to which ecosystem composition, structure, and function deviate from their natural or historical range of variation. Here we investigate the effect of the EAB on understory vegetation diversity and invasive shrub establishment and, for the first time, assess its interaction with an index of ecological integrity. We quantify these impacts by comparing understory vegetation communities in EAB-induced canopy gaps, other canopy gaps, and regions without a canopy gap at sites near London, ON. We hypothesize that the EAB facilitates invasive shrub establishment through the rapid and synchronous creation of canopy gaps, and that plots with lower ecological integrity are more susceptible to non-native plant invasions following EAB infestation. Preliminary results suggest that the EAB may facilitate the establishment of European buckthorn (*Rhamnus cathartica*), an invasive shrub, at some sites. Continued research expands on these preliminary results and contributes to an understanding of the indirect and long-term impacts invasive insects have on forest structure and function.

Becca Cambridge, University of Western Ontario

Reeling it all in: Comparing data collected from anglers, naturalists and traditional fisheries management approaches

Fish around the world are facing complex environmental threats including climate change, pollution and the introduction of invasive species. Comprehensive monitoring programs to assess population health can be vital in mitigating these threats; however, data collection at larger spatiotemporal scales in aquatic environments can become prohibitively costly. Citizen science, data collection by non-scientists, has been growing in popularity and has potential to fill in gaps in fisheries management data for comparatively low cost and effort. Through analysis of angler app data and more holistic nature enthusiast citizen science app data, this talk will identify overlap between traditional monitoring programs and citizen science data. The potential for citizen science to contribute to more traditional methods of data collection (e.g., stock assessments and creel surveys) and its role in guiding future directions of fisheries management will be discussed.

Julia Cantelon, University of Western Ontario

Assessing the performance of Credit Valley bioretention media as source or sink for phosphorus in cold climate storm-water runoff

Bioretention systems are a low-impact development technology that collects and infiltrates polluted road runoff through engineered soil media to improve water quality. The performance of these systems is highly variable,

especially in regards to their ability to reduce phosphorous concentrations. The objective of this study was to evaluate the extent by which bioretention media, made following Credit Valley composition guidelines, acts as a source or sink for phosphorus when exposed to road runoff. Laboratory columns experiments to evaluate the amount of phosphorus released from bioretention media over long-term maturation periods with repeated infiltration events. Column experiments were also designed to evaluate how winter salt loading impacts the release of phosphorus. Columns of bioretention media were infiltrated with repetitive inputs of either deionized water, road runoff, and salt loaded road runoff. Influent and effluent phosphorus concentrations demonstrated that the Credit Valley bioretention media increased concentrations of total phosphorus and soluble reactive phosphorus. Over subsequent infiltration events, the release of phosphorus decreased. Salt loading in column influent resulted in higher effluent phosphorus concentrations, and a greater cumulative release of phosphorus. These results suggest that this bioretention media is not effective at removing phosphorus in cold climates, and composition changes may be required.

Holly Dunne, University of Western Ontario

A paleolimnological investigation of changes in primary production in subalpine lakes of the Uinta Mountains

In recent years, nitrate deposition in lakes has increased in response to anthropogenic activities including fossil fuel burning, and fertilizer use. Increased nutrient deposition could lead to eutrophication of these water bodies by way of runoff, and/or atmospheric deposition. While past research has shown that deposition of nitrogen can affect primary production in alpine (i.e. above tree line) lakes, there has been little research on the effects on subalpine (i.e. within tree line) lakes. In this study, lake sediment concentrations of chlorophyll *a* and its degradation products (Chl *a* + DP), as well as total organic carbon (TOC) from several lakes in the Uinta Mountains, Utah, USA, were analyzed using visible near infrared spectroscopy (VNIRS). Using this data, a reconstruction of the trends shown through time in subalpine lakes of Chl *a* + DP and TOC concentrations was created. When compared with Chl *a* + DP trends outlined in previous studies of alpine lakes in this region, which showed a dramatic increase in concentration following a swell in nitrogenous fertilizer use in the 1940s, the subalpine lakes' trends were varied and lacked any clear or steady spikes. As for TOC, concentrations track the Chl *a* + DP trends closely in the subalpine lakes, suggesting some linkage between [TOC] and primary production. In the alpine sites, TOC concentrations show a steady trend of low concentration, and do not follow the [Chl *a* + DP] increase around 1940. These results are valuable in aiding understanding of the differences in, and effects of, nutrient deposition in subalpine versus alpine lakes.

Jessica Kowalski, University of Western Ontario

Living on the edge: Soil microedges provide an ecological niche for marginalized species

Variation among plant species in their preferences for growth in specific soil patches can promote increased species diversity in heterogeneous soil environments. It was recently suggested that some species may also be disproportionately abundant along the edges between patches (i.e. microedges). To examine the mechanism whereby microedges can serve as distinct ecological niches, two common tallgrass prairie species (*Andropogon gerardii* and *Solidago juncea*) and one rare species observed anecdotally along patch edges (*Desmodium canadense*) were grown in either homogenized sandy loam, clay loam, or along the microedge, in the presence or absence of neighbours. Field and pot experiments were used to compare *D. canadense* establishment, foraging strategies, and competitive ability among the different treatments, as well as to those of *A. gerardii* and *S. juncea. D. canadense* established better along the microedge in the presence of competitors than in their absence, a pattern which was not observed for *A. gerardii* and *S. juncea*. Shifts in the above and belowground foraging

strategies of *D. canadense* along the microedge also were observed, with the most notable being the preferential allocation of roots into clay loam over sandy loam. These results suggest that microedges provide an ecological niche for inferior competitors to avoid intense competition effects, and thus, enhance their growth and survival.

Shayla L. Kroeze, University of Western Ontario

Patterns of cellulose decomposition are not concordant to groundwater inputs in an agricultural stream

Organic matter breakdown in streams is hypothesized to be driven by physicochemical parameters such as temperature and nutrients that are associated with significant inputs of groundwater. However, few studies have assessed how organic matter breakdown might be impacted by groundwater fluxes into river systems. To address this knowledge gap, I conducted a study to assess the relationship between decomposition levels and groundwater inputs. This study aimed to establish if spatial patterns of decomposition vary with groundwater inputs. Additionally, it aims to determine which groundwater characteristics (nutrients, temperature, velocity) might influence decomposition. It was hypothesized that rate of organic matter breakdown would be positively influenced by groundwater because of increases in nutrients and velocity. Cotton strips were deployed in 19 different reaches along Kintore Creek with varying inputs of groundwater. A Spearman correlation found no significant relationship between rate of organic matter breakdown and groundwater. Moreover, a partial least squared (PLS) analysis found no significant correlations found with any environmental factors. The lack of association between organic matter breakdown and groundwater inputs may be due to nutrient saturation as a consequence of input from adjacent agricultural area. Future studies should investigate seasonal variation of organic matter breakdown and groundwater to test whether groundwater might be a more significant control of temperature in extreme conditions (e.g., droughts) or compare organic matter breakdown rates in similar streams not driven by groundwater inputs. Results of this study will inform future research of functional stream characteristics and provides important indications about the development of more accurate stream assessment tools such that they may or may not include associations with groundwater.

Meghan Sauro, University of Western Ontario

The influence of concentration and delivery of phosphorus on stream decomposition: A mesocosm experiment

Eutrophication of freshwater bodies has become a global issue due to an increase in nutrient emissions associated with human disturbance. Human activities release nutrients to watersheds from point sources (pressed inputs), such as wastewater treatment plants, and non-point sources (pulsed inputs), such as agricultural lands, impacting ecosystem processes, such as decomposition, in lakes and rivers. The purpose of my study was to determine the influence of phosphorus delivery pattern (press vs. pulse) and concentration on decomposition in streams. I used the cotton strip assay to measure cellulose decomposition, an important part of the carbon cycle and an indicator of stream health. Three past mesocosm experiments were conducted at the Thames River Experimental Stream Sciences (STRESS) center in London, Ontario. Experiments included: (1) a continuous phosphorus concentration gradient, (2) a pulsed phosphorus concentration gradient, and (3) a comparison of pulsed and continuous phosphorus delivery patterns. Results indicated no significant linear association for the pulse experiment, but did have a significant breakpoint association at 10μg/L in the segmented regression for the press experiment. The ANOVA and post-hoc tests showed significant differences between both press and pulse and the control, with no significant difference between the press treatment and pulse treatment. My research indicates that decomposition is sensitive to nutrient enrichment, but the delivery mode does not influence decomposition rates in streams. The press experiment shows that decomposition attains maximum rates at fairly low phosphorus levels, indicating that use of the cotton strip assay as a biomonitoring tool is only useful under oligotrophic conditions.

Graduate Student Speed Talk Abstracts

3:00 pm - 3:25 pm

Lisa Ashton, University of Guelph

Exploring governance mechanism in conventional agriculture systems to reduce GHG emissions

To address the increasing need to act on climate change and to investigate the potential of the Ontario agricultural sector's capacity to fulfill this challenge, I ask: how can conventional agriculture systems be governed to reduce GHG emissions? To achieve this aim, my work consists of four consecutive objectives, complimented with ongoing dissemination activities. Objective (1) is systematically reviewing literature on governance models that demonstrate empirical evidence in GHG emission reductions, by conducting a meta-analysis. In objective (2) I explore stakeholders' (farmers, food processors, and policy makers, and civil society) concerns, and terms of support for the governance models identified in objective (1). This will be done by facilitating dialogue with and between stakeholders by first, distributing an open survey, next conducting one-on-one interviews, and lastly, coordinating a Delphi method with a diverse selection of stakeholders. Objective (3) is focused on understanding how ecological economic models depict the potential environmental and financial benefits and risks from implementing the forms of governance outlined in objective (1). Scenarios are forecasted based on the mechanisms and regulations employed by governance, to observe their impact on behavioural change and practice adoption. Objective (4) utilizes cross-sectional analysis methods to uncover the differences and similarities between objectives (2) and (3) to determine how the dialogue on climate action in agriculture compares to the results from the ecological economic model (Pelletier et al. 2014). Ultimately, these four objectives will be pursued to uncover effective and applicable GHG mitigation solutions that are based on findings from computed ecological economic models and qualitative results based on stakeholders' opinions and expertise.

Devan Becker, University of Western Ontario

Assessing the relationship between the size and number of wildland fires

Fire managers use many different models to aid in their resource allocation decisions. There are models that predict the size of fires and there are models that predict the number of fires, but these aspects of fires are almost always modeled separately. In this work, we ask whether a model that predicts large fires indicates that the fires can be expected to grow larger, and vice versa. This is intuitively true - if it's hot and dry, we expect more and larger fires - but has not been studied in the literature. Our model takes this a step further: is there still an association after we account for the seasonal variation of the weather? Our data include the spatial location of a wildland fire, which allows us to ask whether this association changes over space.

The preliminary answers to these questions are surprising. It often occurs that there are either many small fires or a few large fires; On a day with a single fire it is much more difficult to predict the size of that fire; and there are plenty of days with 0 fires where models might have predicted a large fire. Our model takes all of these situations into account and we get a more confident prediction of the fire load for a given day. Of course, no model will be perfect at predicting the exact time and location of a fire, but our model has the potential to give fire managers a more complete view of the interactions between the models they use for resource allocation.

Giada Ferrucci, University of Western Ontario

Mega-dam fever in Latin America: The intersection of indigenous rights and environmental justice in Bolivia and Brazil

Due to rising energy demands and ample untapped potential, the Amazon region has witnessed a rapid increase of new hydropower projects, part of the long-term energy plans of regional governments (Finer, Jenkins, 2012). While supporters claim that mega-dams projects bring wealth, development and job opportunities and provide clean energy, critics argue that dams are in reality monuments of injustice, political corruption, social inequality and increase climate emissions by drowning forests. In this complex context, the intersection of environmental justice with indigenous rights is of key importance.

Through a comparative case analysis of ongoing indigenous resistance to mega-dam projects, Chepete El Bala in Bolivia and Belo Monte in Brazil, my aim is to understand what is happening in Latin America with mega hydropower projects (costs, impacts, and problems), what are the concrete experiences of resistance to mega dam projects, and how indigenous groups mobilize to stop energy projects that threaten their land, their rights and their freedoms. I am interested in exploring how the United Nations Declaration on the Rights of Indigenous People (UNDRIP) is able to provide the legislative framework and instruments to support the resilience and resistance of indigenous groups and gather evidence from these experiences in order to globalize local cases of environmental struggle in pursuit of energy justice.

Starting from the case studies presented, the overall aim of this paper is to gather evidence from the local realities on how to implement sustainable energy projects that respect indigenous rights, in particular the principle of free, prior and informed consultation, and inform other similar cases in the world. Despite their failure in the prevention of these projects, important lessons can be learned from past and current experience of indigenous resistance to inform similar cases in other parts of the world.

Jason Robinson, York University

The use of alternative measures to GDP at the provincial level

In our current society, we tend to look at GDP and economic growth as the sole measure of progress in a country. When a state has a high GDP/capita, it is believed that they have a high standard of living which we tend to examine the overall happiness in a country. But, not only are happiness and GDP largely unrelated, GDP does not consider the environmental externalities which have critical short and long-term economic effects. Due to these factors, GDP can be biased and overestimates the standard of well-being while ignoring the environmental impact of growth and its contribution to inequality and poverty. If a country shifts its focus to sustainable development instead of growth, it will lower the burden the economy places on the environment and foster sustainability.

Alternative economic indicators exist to better meet the goal of measuring progress towards sustainable development. Typically, alternative measures of progress are calculated at the national level. In Canada's case, emphasis should be placed at the provincial level because, under the Canadian constitution, resource management is the responsibility of provinces.

Graduate Student Poster Abstracts

3:25 pm - 4:00 pm

Melina Damian, York University

Incorporation of anthropogenic debris into double-crested cormorants' nests, Toronto, Ontario

There is a paucity of research on the extent of macro debris pollution in freshwater environments, particularly for the larger ecosystems such as the Great Lakes. Birds which use a range of materials from their environment for nest-building may be used as indicators of the characteristics of anthropogenic debris pollution in freshwater ecosystems, and over time, could be used as an index of pollution. In this study we sampled double-crested cormorant ground-nests (*Phalacrocorax auritus*; n = 50) for the presence and type of anthropogenic debris at Tommy Thompson Park, Toronto, Ontario. We measured height and position of each nest because they are reused annually, and older nests are situated away from the edge of a colony. We categorized the types of debris, the colour, and proportion by weight in a subsample of nests. To evaluate whether cormorants are a good indicator species for freshwater debris, nest contents will be compared to The Great Canadian Beach Cleanup data available for the site. Nest height ranged from 3.5 to 18.5 cm. All of the nests sampled had some kind of anthropogenic debris (100%). Nests contained a variety of anthropogenic debris, including plastic items (bags, straws, cutlery, cups), metal bars, electric wires, fishing nets, and cloth items. Cormorants select nesting material from both terrestrial and aquatic environments, thus the results represent the anthropogenic debris available in their environment. Tracking anthropogenic debris in cormorant nests is an effective way to track changes in relative proportions in their environment but reuse of nests presents a challenge in developing an index.

Kristin Doherty, University of Guelph

Optimal resource allocation theory predicts canola production under drought and nutrient stress

Agricultural practices aim to maximize above ground biomass production, often through the addition of mineral nutrients. However, with projected increases in drought severity, fertilizer applications may be less effective. Optimal allocation theory predicts that plants will produce structures necessary to obtain limiting resources. For instance, under drought conditions this theory predicts greater allocation to roots to obtain scare water resources, thus ensuring plant survival and growth. Conversely, soil nutrient enrichment is known to enhance above ground plant growth as below ground nutrient limitation is removed. It is unclear how mineral nutrient availability's interact under drought conditions, particularly within the context of optimal allocation theory. Using a full factorial experimental design, we assigned 400 different levels of nutrient treatments (10 levels each of nitrogen and phosphorous) to 1200 canola plants in the greenhouse. Four watering regimes were applied, consisting of two water levels (drought vs normal water) and two time frames (switching half way through the experiment). We found that early drought reduced plant growth more than low levels of nutrient additions. Intermediate levels of nutrients additions optimized plant growth as high nutrient levels reduced root allocation, thereby leaving the plants vulnerable to drought. This work suggests that intermediate levels of nutrient addition can buffer plant growth responses in an increasingly variable climate.

Giada Ferrucci, University of Western Ontario

Mega-dam fever in Latin America: The intersection of indigenous rights and environmental justice in Bolivia and Brazil

Due to rising energy demands and ample untapped potential, the Amazon region has witnessed a rapid increase of new hydropower projects, part of the long-term energy plans of regional governments (Finer, Jenkins, 2012). While supporters claim that mega-dams projects bring wealth, development and job opportunities and provide clean energy, critics argue that dams are in reality monuments of injustice, political corruption, social inequality and increase climate emissions by drowning forests. In this complex context, the intersection of environmental justice with indigenous rights is of key importance.

Through a comparative case analysis of ongoing indigenous resistance to mega-dam projects, Chepete El Bala in Bolivia and Belo Monte in Brazil, my aim is to understand what is happening in Latin America with mega hydropower projects (costs, impacts, and problems), what are the concrete experiences of resistance to mega dam projects, and how indigenous groups mobilize to stop energy projects that threaten their land, their rights and their freedoms. I am interested in exploring how the United Nations Declaration on the Rights of Indigenous People (UNDRIP) is able to provide the legislative framework and instruments to support the resilience and resistance of indigenous groups and gather evidence from these experiences in order to globalize local cases of environmental struggle in pursuit of energy justice.

Starting from the case studies presented, the overall aim of this paper is to gather evidence from the local realities on how to implement sustainable energy projects that respect indigenous rights, in particular the principle of free, prior and informed consultation, and inform other similar cases in the world. Despite their failure in the prevention of these projects, important lessons can be learned from past and current experience of indigenous resistance to inform similar cases in other parts of the world.

Sarah Hennessy, University of Western Ontario

Charcoal and common worlds: What tracks can we leave as educators?

We offer an alternative way of doing environmental education at the same time we experiment with new ways of doing early childhood education. Through moments of interaction, we propose to learn with materials, animals and places instead of about them. In doing so we question individualist and consumerism behaviours as we propose to distance ourselves from a human-centric perspective. The research is positioned within the Common worlds theoretical framework inviting the art of noticing a world as an imbricated participant, challenging the nature-culture divide and inviting educators and children to new modes of interaction and renewed sensibilities to the messy and imperfect world.

At its core, this research explores non-linear pedagogical considerations of recursion in consideration of climate change education. As a point of departure it begins by de-centring the human. It questions the the tracks we leave as educators in the anthropocene. The research explores these pedagogical considerations through particular moments with charcoal, paper, children and educators. What role does pedagogy in Early Childhood contribute to new ways of thinking with a messy environment we are part of? How else can we approach plants, animals and the earth beyond the lens of human resources? How do we stay with the generative nature of trouble in rethinking practice? The implications of this research act as reminders of the benefits of thinking with lived experience not finding concrete answers towards set environmental curriculum models.

Njokuji Ogechi Judith, University of Western Ontario

A green mindset: A study of Nigeria's electricity legislative framework, with a specific focus on the viability of grid connection, transmission and offtake potential for small scale renewable generation purposes

My research makes an in-depth study of the viability of small-scale renewable generation of electricity in Nigeria, through an examination of the legislative framework in existence. It also makes a comparison of the progressive nature of the renewable energy sector of the Ontario electricity market and also the recent victory occasioned by the installation of the Tesla battery in South Australia. A further study would be carried out as it relates to the issues of grid connection, transmission and offtake potential for small scale renewable generation of electricity in Nigeria, giving the necessary recommendations for both policy and institutional reforms.

Katherine Keary, University of Guelph

Irrigation scheduling of Spiraea japonica "Goldflame"

The increasing scarcity of water globally is a prominent issue facing the nursery industry, which must be dealt with if the industry is to remain viable as climate change continues to escalate. The current irrigation practice involves nursery workers watering plants as they see fit. Usually based off agronomic measurements (e.g. plant height, visual signs of wilting). These are not suitable in providing timely data for interpreting when to irrigate and leads to very subjective watering schedules which lean to the side of over-watering. Past work in this lab has quantified the relationship between plant water stress (PWS) and cumulating vapour pressure deficit (cVPD), identifying species-specific water stress thresholds in relation to cVPD. The objective of this study was to use irrigation schedules based on cVPD correlated to the predicted PWS of the popular containerized ornamental plant *Spiraea japonica* 'Goldflame', with the aim to generate irrigation schedules which decrease water use while not impacting the plant's growth and quality. Three irrigation treatments/schedules were applied via overhead irrigation: (1) conventional practice (control), (2) moderate water stress, and (3) high water stress. The growth and quality of the plants were recorded throughout a growing season. The preliminary data indicates that water use can be cut by roughly 66% of the conventional amount and the production of acceptable sellable plants would still be attained. This demonstrates that irrigation schedules based off of cVPD significantly reduce water use without impacting the growth and quality of the plants.

Daniel Noble, University of Guelph

Groundwater quality linked to ecosystem services on marginal lands of intensively managed farms

Anthropogenic activities have significantly altered the regulation of nutrient and hydrological cycling. In agricultural systems, changes in the availability of these resources has fundamentally changed ecosystem processes. The loss in regulation of nutrient and hydrological cycling has allowed fertilizer inputs to increase connectivity between terrestrial and aquatic systems via agricultural runoff and nutrient leaching. The removal of permanent vegetation cover for annual row crop production systems has significantly reduced water quality. A growing body of evidence has shown that planting tallgrass native prairies between agricultural areas and nearby surface water bodies decreases sediment and nutrient transport from agricultural runoff. In contrast, little is known about the effects of installing prairie filter strips on nutrient leaching to the groundwater. The purpose of this study is to address whether prairie filter strips mitigate nutrient leaching to the shallow groundwater in a clay and sand textured agricultural area. I will investigate the hypothesis that prairie tallgrasses will reduce nutrient transport along the vadose zone and groundwater flow path as their greater rooting depths and dense rooting network, especially in the upper parts of the soils column, will facilitate nutrient uptake and water retention. To test this hypothesis, water samples from shallow groundwater and leachate leaving the root zone will be taken

(April 2019 – October 2019) from cropped fields and prairie and analyzed for nitrogen and phosphorus. Root biomass by depth and tissue samples will be measured, and soil water samples will be taken from both the cropped and prairie vegetation, and analyzed for nutrient uptake. This research will provide greater understanding of how leachate moves in different soil textures as well as cover types, and evaluate the validity of using prairie filter strips as a conservation strategy to offset the environmental footprint intensive farming systems create on terrestrial and aquatic ecosystems.

Samantha Ramirez, University of Guelph

Ontario crop productivity: Variation in yield with varying land suitability for agriculture using NDVI

Agricultural yields are susceptible to losses associated with climate change. The increased frequency of extreme weather events related to climate change can jeopardize food security. These yield losses may be mediated by underlying quality – or variation in soil fertility, topography, drainage, and growing degree days – of agricultural land. For instance, crops grown on poor quality land may be more susceptible to the negative consequences of climate variation as compared to crops grown on high quality agricultural land. This study investigates the crop yield variability for corn, soybeans, and pasture across Ontario. Yield is quantified across a gradient of land quality using the Normalized Difference Vegetation Index (NDVI). NDVI measures the difference between reflected near-infrared light and absorbed red light. When biomass production is low, vegetation absorbs more NIR and reflects more red light while the converse is true for highly productive vegetation. ArcMap and Google Earth Engine were used to calculate the coefficient of variance (CV) of maximum NDVI across the study site. Over 7 years, variance in yield was more strongly linked to crop type, rather than land quality. However, droughts occurring in April and May (near planting dates), and in August and September (near harvest dates), were cumulatively more detrimental to crop yield. Understanding differential crop productivity responses to land quality can help producers mitigate crop losses to climatic variation, thus equally stabilizing profits and food availability.

Amritpal Rathore, University of Western Ontario

Air pollutants and school development

The Region of Peel is home to 1.48 million inhabitants which is expected to increase by 33% to 1.97 million in the year 2043. The Region of Peel consists of Brampton, Mississauga and Caledon. With Caledon consisting of majority of farm lands, comprising of very little urban development and making up for just under half of the physical landmass of the Peel Region, we can expect to see the Peel Board of Education increase the amount of schools to accommodate the rising population in the Region of Peel. Furthermore, with Brampton and Mississauga being saturated with urban development, the Peel District School Board of Education will thrive on the underdeveloped landmasses in the town of Caledon.

With a densely saturated population, comes technological advances, innovations and a surplus of cars, trucks, vans and other transport vehicles, all contributing the carbon footprint. In our busy lives, we rarely think about the long-term consequences of an abundance of motor vehicles on the road and the impact it will have on educational attainment rates, healthy behaviours and health outcomes.

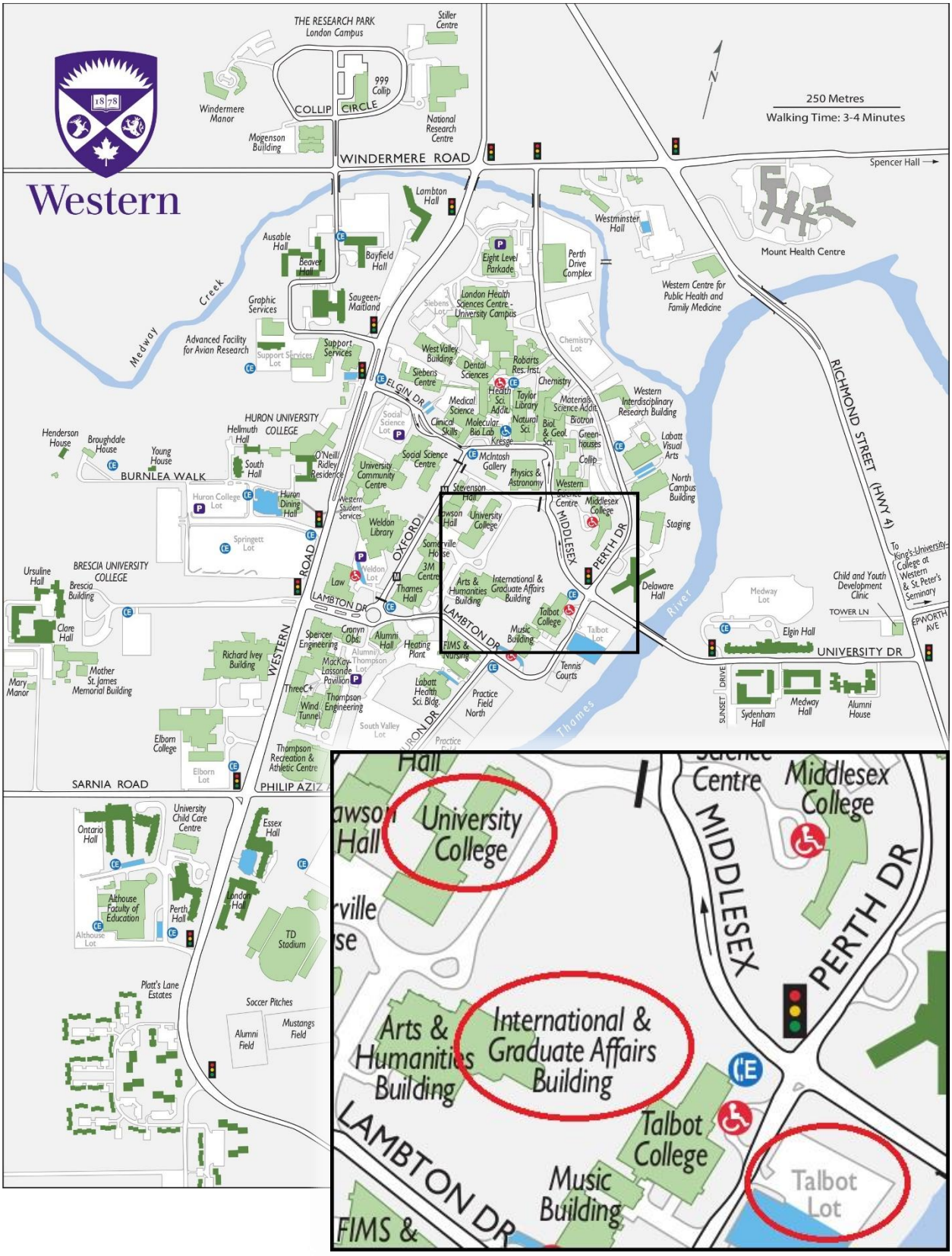
The objective of this report is to look at the impact of traffic-related air pollution on educational attainment regarding cognitive function, literacy skills and healthy behaviors. Ultimately we want to convey whether The Peel District School Board of Education should take traffic-related air pollution into account when spatially organizing the development of new schools in the Town of Caledon. Ultimately, this principle should become a promising factor to consider when designing educational facilities near urban environments.

Vanessa Sinclair, University of Western Ontario

Assessing the relationship between political ideology and climate change attitudes: An analysis of 18 European countries

Despite academic consensus on the veracity of anthropogenic climate change, the topic has been heavily politicized. Climate change denial is consistently linked with right-wing political ideology (a 'bottom-up' or micro-level process), and is also influenced by political institutions (a 'top-down' or macro-level process). Most previous research on ideology and climate change attitudes has been conducted in North America, but these attitudes vary between nations. Data from the most recent wave of the European Social Survey (N = 34,837) were used to investigate the influence of two aspects of right-wing ideology, antiegalitarianism and traditionalism, as well as country-level variables including national development, economic inequality, and institutional environmental performance. Across nations, antiegalitarianism was a more robust predictor of climate change scepticism than traditionalism, which had an inconsistent effect. Multilevel modeling indicated that demographic variables and ideology were much stronger predictors of climate change scepticism than country-level variables. The findings provide insight into the ideological precursors of climate change attitudes that had not been established by research employing only the left-right dimension of ideology.

Map of the University of Western Ontario



Sponsors


Western
Biology


Schulich
MEDICINE & DENTISTRY


PSAC
LOCAL 610


SOGS
Sustainability Committee


SOGS


Nature London
"To Preserve and Enjoy Nature"


Western
Geography


London
Environmental
Network


Western
Research


Thames Talbot
Land Trust


Western
Engineering


ENBRIDGE
Life Takes Energy


Western
Graduate&
PostdoctoralStudies


BioLiNE


Western
Earth
Sciences