ENVIRCON

Inspiring Change, Education, and Awareness

March 26, 2021

University of Western Ontario

Online Conference

Schedule	
Time	**Session**
9:00 am - 9:15 am	**Welcome Address**
9:15 am - 10:15 am	**Graduate Student Talks** **Undergraduate Student Talks**
10:15 am - 10:30 am	**Break**
10:30 am - 11:45 am	**Graduate Student Talks** **Undergraduate Student Talks**
11:45 am - 1:00 pm	**Lunch Break**
1:00 pm - 2:30 pm	**<u>Panel Discussion:</u>** **Exploring career options in environment and sustainability: Inspiring pathways outside of academia**
2:30 pm - 3:00 pm	**Closing Remarks**

Research Conference
March 26, 2021

Panel Discussion:
Exploring career options in environment and sustainability: Inspiring pathways outside of academia

1:00 PM – 2:30 pm

Panelists:

Ahmed El Ganzouri
General Motors, Sustainability Strategy Manager

Tom Millard
Research Geomorphologist, West Coast Region, BC Ministry of Forests Lands Natural Resource Operations and Rural Development

Lucas Oshun
Director of International Business Development for Resource Fiber, Director of the Regeneration Field Institute (RFI), and founding member of the Regenerative Industry Think Tank (RITT).

Join us for a discussion with professionals outside of academia to hear about our panelists' experience finding environmental work outside of academia as they share their advice.

Topics areas to be addressed include:

- What is your background and how did you get into the career you are in now?
- What can I do now as part of my education that will help me in the job field?
- What can I do after graduation to improve my chances of a successful career?

Graduate Student Talks: Presentation Schedule

Graduate Student Talks 9:15 am – 10:15 am		
Nature	**Technology**	**Social Impacts**
A Statistician's Experience of Getting Dirt on Her Boots Chelsea Uggenti	**Solar-tracking arrays: Engineering challenges and opportunities** Eric Rowland Lalonde	**The triple 'E' conundrum- factors shaping women's access to shea in the savannah landscape of sub-Saharan Africa** Eunice Annan-Aggrey
Cadmium uptake in plants as influenced by selenium uptake and sulphate availability Marnie Demand	**Molybdenum disulfide Arginine nanosheets as point-of-use sensing system for lead detection** Munirat Idris	**Energy Transition and Reconciliation: Indigenous and Non-Indigenous Media and Policy Discourses** Carelle Mang-Benza
Particle mobility and scour in a large gravel bed river: implications for salmonid spawning habitat Meghan Sauro	**Process optimization of a submerged photocatalytic oscillatory membrane reactor (SPMR) for effluent polishing** Siddharth Gupta	**The environment in contemporary French fiction: the case of "Le Club des miracles relatifs" by Nancy Huston** Fanny Leveau
Evaluating Morphological Complexity of River Restoration Designs Corey Dawson	**Silicates as a Corrosion Control Option for Lead** Hailey Holmes	**Unveiling the Tropes of Empire: A Reading of the Documentary *Cholitas* (2019)** Victoria Jara

Graduate Student Talks 10:30 am – 11:45 am		
Nature	**Technology**	**Social Impacts**
Deer movement and hunting for management Rhiannon Kirton	**How variable renewable energy technologies affect firm generation strategies: Evidence from the Turkish electricity market** Selahattin Murat Sirin	**A Critical Review of "Smart Cities" as an Urban Development Strategy in Africa** Elmond Bandauko
Assessment of Nitrogen Inputs from Groundwater to a Coastal Atoll Lagoon James Gale	**Interfacial Design of High-Performance All-Solid-State Batteries for Electric Vehicles** Sixu Deng	**Intra-household decision-making and perceived climate change resilience among smallholder farmers in semi-arid northern Ghana** Evans Batung
Assessment of the Impacts of Climate Change, Land Cover Transition, and Internal Climate Variability on the Hydrology of a Forested watershed Vahid Mehdipour	**Field performance of engineered cover systems for mine waste rock piles: a focus on the Sydney Coalfield in Nova Scotia, Canada** Deanna Hersey	**Livelihood diversification strategies and resilience to climate change in semi-arid northern Ghana** Kamaldeen Mohammed
An investigation of epiphytic diatom substrate specificity and its implications for paleolimnology David Zilkey	**Optimization of Porous Geometry for Collecting Concentrated Solar Energy** Elizabeth Blokker	**Analysis of the communities around wind energy projects in Canada: Priorities, policies and power** Sara Wilson
Assessing seasonal variations in phosphorus behaviour near the groundwater-stream interface Meghan Vissers	**Please Remain Seated: Using 360° video headsets to conduct virtual field trips and facilitate experiential learning in the environmental classrooms** Paul Mensink	

Undergraduate Student Talks: Presentation Schedule

Undergraduate Honor's Thesis Talks **9:15 am - 10:15 am** **10:30 am - 11:45 am**
The impact of seasonality on the accessibility and use of parks in London, Ontario Alyssa Aglipay
(Re)introducing the workplace. A partial solution to slow climate change and prevent the next pandemic Taim Al-Bakri
TBD Shae-Lynn Dehens
Examining knowledge gaps in the federal Environmental Assessment process: Investigating the relationship between Western science and Indigenous knowledge Shannon James
Evaluating the relationships between median household income and greenspace on PM2.5 concentrations during the commute to school in Hamilton, Ontario Carley Langleben
Mercury and methylmercury concentration-discharge relationships in Medway River and North Thames River at London Ontario, Canada Yi Li
The relative use and distribution of recycling bags within London, Ontario Joseph Workentin

Graduate Student Talk Abstracts
9:00 am - 10:15 am, 10:30 am - 11:45 am

Eunice Annan-Aggrey, University of Western Ontario
The triple 'E' conundrum- factors shaping women's access to shea in the savannah landscape of sub-Saharan Africa

The shea tree is a naturally occurring forest tree found in the savannah landscape of over 20 countries in sub-Saharan Africa. The collection and processing of shea nuts is traditionally considered the preserve of women who pick and process the nuts into oil and butter for cooking. Unlike other economically viable species managed by men, the shea value chain is mostly controlled by women. Shea is therefore considered 'women's gold' as the proceeds gained from the sale of the nuts provide much needed supplementary income for many rural households. The recent recognition of shea as a viable substitute for cocoa in the confectionary industry, has heightened the economic potential of the product.

Therefore, several women have organized themselves into cooperatives to either aggregate or process nuts for export. Paradoxically, volumes of shea nuts are recorded to be decreasing just as the value for the commodity is increasing. While some scholars attribute the decline to environment factors including bush burning and climate change, others attribute it to equity related issues such as lack of decision-making roles in determining the use of land. Still others point to the global trade process which contributes to over- exploitation of the resource. This paper argues that access to shea is shaped by interconnected factors related to environment, equity and economic, 'the triple 'E' conundrum'. The paper further proposes strategies to support the shea commodity to live up to its title as 'gold for women'.

Elmond Bandauko, University of Western Ontario
A critical review of "Smart Cities" as an urban development strategy in Africa

Smart cities have emerged as an urban development strategy promoted to address challenges confronting cities globally. In Africa, new urban residential developments and new master-planned cities are rapidly spreading across the continent. Examples of these projects include Eko Atlantic City, Lagos-Nigeria, Waterfall City, Johannesburg, South Africa, Hope City-Accra, Ghana. These projects are often branded as "eco-cities", "smart cities" and are considered different from traditional cities because of their focus on sustainability through the incorporation of ideas such as green urbanism in their plans and designs. This paper critically reviews the practicality and potential of the 'smart city' concept in addressing Africa's daunting urbanization challenges - infrastructure deficit, socio-economic inequalities, climate change vulnerabilities and the proliferation of slums. The central question guiding this paper is: are "smart cities" the panacea to Africa's quest for a sustainable urban future? Our analyses demonstrate that, if carefully planned and implemented, smart city ideas have the potential to transform the ways African cities are planned and contribute to sustainable urbanization, in line

Sustainable Development Goal (SDG #11) on resilient and sustainable cities and human settlements. At the moment, "smart cities" are being promoted as 'silver bullet' solutions to challenges of Africa's urbanization processes; without factoring in urban realities in Africa such as lack of adequate infrastructure and services, rising urban poverty and proliferation of slums/informal settlements. The implications for planning and policy are also discussed.

Evans Batung, University of Western Ontario
Intra-household decision-making and perceived climate change resilience among smallholder farmers in semi-arid northern Ghana

Climate change vulnerability remains a major challenge for smallholder farmers. There is consensus that the climate change resilience of smallholder farming households could be enhanced if agricultural decision-making incorporates the perspectives of all household members. Yet in smallholder farming communities such as northern Ghana, deep-seated socio-cultural and intra-household structures continue to influence joint decision-making. Although smallholder climate resilience has received enormous research attention, the role of household decision-making arrangements on climate resilience remains underexplored. Using cross-sectional data (n = 1100) from the Upper West Region of Ghana (UWR), we examined the relationship between smallholder household decision-making arrangements and their perceived resilience to climate change impacts. Findings from a regression analysis indicate that households practicing joint decision-making were more likely (OR=3.74, $p \leq 0.001$) to report good resilience compared to households with only male head decision-makers. Moderately food insecure (OR=3.45, $p \leq 0.001$) households were also more likely to report good resilience. In contrast, households with primary farmers aged between 46 to 59 (OR=0.36, $p \leq 0.05$) and formally educated (OR=0.47, $p \leq 0.01$) were less likely to report good resilience. In a context with age-long sociocultural beliefs and practices, our findings highlight the importance of joint decision-making in climate change resilience, and the need for practical programs that are aimed at encouraging intra-household decision-making toward climate change resilience.

Elizabeth Blokker, University of Western Ontario
Optimization of porous geometry for collecting concentrated solar energy

Fossil fuel usage is resulting in global warming. There is a need to switch to renewable energies, but existing technologies lack the efficiency for widescale adoption. Solar energy is the most abundant source of renewable energy that has the potential to replace fossil-based energy resources. However, the commercially available solar energy technologies typically have low conversion efficiencies, making them less competitive as compared to conventional fossil-based systems. Concentrated solar power (CSP) is an efficient approach to convert solar energy into high-grade thermal energy at very high efficiency. Among CSP systems, the parabolic-dish CSP system is considered as the most efficient. In a parabolic-dish CSP system, a parabolic dish directs sunlight to a single focal point where it is converted to thermal energy through absorption into the receiver. A challenge with current designs is that the surface of the thermal receiver reaches a high temperature and does not efficiently transfer the heat

due to re-radiation losses. Thus, there is a need to re-design the thermal receiver to maximize the efficiency of CSP.

This project investigates the use of a metal foam with varying porosity as the thermal receiver. The porosity of the material allows incident solar radiation to absorb fully into the foam structure, thus, minimizing re-radiation losses and effectively converting it into thermal energy. To analyze the radiation capture in porous media, a computational model has been developed in ANSYS Fluent using the Discrete Ordinance method to model radiation heat transfer.

The model is validated against experimental data. This experimental setup comprises an aluminum block with a single pore that has a gradually decreasing diameter down the centre. A halogen lamp has been used to simulate solar radiation. A thermal camera was used to measure the temperature field of the aluminum block. The validated model is being used to simulate complex porous geometries to characterize the radiation heat transfer. A parametric study will be conducted to optimize the geometry of porous medium used as solar thermal receiver.

Corey Dawson, University of Western Ontario
Evaluating morphological complexity of river restoration designs

Natural riverscapes are highly dynamic systems and fluvial geomorphology research has developed analytical methods able to estimate and predict some form-process relationships but the complexity of natural variables influencing river behavior is not fully understood. River restoration has widely become a form-based approach to design in North America, where stream channels are constructed as single-thread, symmetrically meandering, rigid features. Fluvial geomorphologists, ecologists, and landscape architects have suggested a shift from form-based to process-based approaches aimed at re-creating dynamic interactions so rivers can behave more naturally by designing channels and floodplains able to adjust to future changes in the riverscape with more resilience to disturbances.

The aim of my research is to test a multi-scalar framework as a new tool for stream assessment and river design, recognizing form-process dynamics by comparatively analyzing geomorphic form complexity of engineered, or degraded, river reaches and those designed for restoration. My research exploits increased availability of high-resolution channel morphology data to develop a broadly applicable and reproducible quantitative metric to evaluate geomorphic form complexity of restored river channels compared to pre-restored. Development and testing of the Compound Terrain Complexity Index (CTCI) can lead to improvements of current design practices and basic understanding of morphological complexity beyond the mainly descriptive methods used in current practice.

The quantification of morphological complexity can provide opportunities for novel process-based river restoration designs with the use of River Builder software, able to adjust design parameters to meet river restoration objectives by comparing CTCI values of affected and designed channel surfaces. In-channel geomorphic forms derived from the Geomorphic Unit Tool (GUT) are also analyzed, measuring

shape configurations and assemblage. The application of landform grading standards from landscape architecture, in-channel geomorphic principles, and ecological diversity concepts may significantly contribute to complex riverscape designs for more resilient, reproducible, and successful river restoration.

Marnie Demand, University of Western Ontario
Cadmium uptake in plants as influenced by selenium uptake and sulphate availability

Cadmium-contaminated soils can pose a risk not only to plants but also to consumers. This risk may be reduced by applying selenium, an essential nutrient for animals, which decreases plant cadmium uptake. One possible mechanism of action is through selenium-induced lignification of root cell walls, preventing cadmium from being transported to the shoots. However, where excess sulphate is present, this may not work. Selenium in the form selenate competes with the nutrient sulphate for uptake. Thus, sulphate can interfere with selenate uptake, potentially impacting cadmium uptake. I tested the interactions among cadmium, selenate, and sulphate comparing two species that hyperaccumulate selenium, Astragalus bisulcatus and A. racemosus, and A. canadensis, which takes up much less selenium, along with five crops. Results to date, examining Astragalus spp. found no significant difference in total lignin content of roots in response to selenate. Additionally, increased selenium concentrations were correlated with increased cadmium concentrations across species but trends within species were inconsistent. Additional data on selenium and cadmium concentrations in the crop species is forthcoming. These results will be useful in agronomy, indicating whether selenium biofortification of crops being grown on mildly cadmium-contaminated soil may improve their safety, or if it would be detrimental.

Sixu Deng, University of Western Ontario
Interfacial design of high-performance all-solid-state batteries for electric vehicles

The interfacial stability in composite cathodes is crucial for the realization of high-performance inorganic all-solid-state lithium-ion batteries (ASSLIBs). With the help of interfacial engineering strategies, the cycling stability of inorganic ASSLIBs has been significantly improved. However, the high-rate capability is still under the expectation, impeding the practical application of ASSLIBs in electric vehicles. Simulation result predicts that the limited Li+/electron transfer kinetics at the interface of current collector is a significant obstacle for the high-rate capability. Accordingly, understanding the degradation mechanism and designing the rational strategy at the interface of current collector are of critical importance for the high-rate performance of inorganic ASSLIBs. In our study, the interface evolution of Al foil current collector is comprehensively studied in the halide-based Li3InCl6 (LIC) ASSLIBs. The detailed electrochemical and X-ray characterizations combined with microscopy results indicate that the degradation mechanism at the interface of current collector is highly related to the operating temperature of ASSLIBs. At room temperature, the side reactions between Al foil and LIC are the main challenge that deteriorate the electrochemical performance. At low temperature, instead of side

reactions, the low Li+/electron transfer kinetics limit the electrochemical performance of inorganic ASSLIBs. Promisingly, a design of graphene like carbon (GLC) coating for the modification of Al is beneficial towards both the stability and Li+/electron transfer at the interface of current collector, resulting in the improved rate capacity. This study suggests that both the interfacial reactions and kinetics should be considered when designing the fast-charging ASSLIBs in all-climate environments.

James Gale, University of Western Ontario
Assessment of nitrogen inputs from groundwater to a coastal atoll lagoon

Small island development states (SIDS) are subject to compounding anthropogenic and climate change stresses including growing populations and sea level rise. The inhabitants of low-lying coral atoll islands are especially vulnerable and facing numerous challenges including increasing pollution of coastal lagoons and subsequent deterioration of fisheries. Due to the high connectivity between the ocean and land on coral atolls, it is challenging to evaluate the pathways delivering land-derived pollutants to coastal lagoons. Groundwater may be a potentially important pathway but its relative contribution to coastal nutrient loads remains unclear. This study focuses on Funafuti Atoll, Tuvalu where excessive nitrogen inputs to Fongafale lagoon have caused eutrophication and associated macro-algal blooms. Poorly functioning septic systems and pig manure are thought to be the main contributors to the excessive nitrogen loads to the lagoon. Studies have shown that the groundwater is highly polluted and therefore discharge of nutrient-rich groundwater to the lagoon may be an important delivery pathway. The study objective was to examine the potential role of groundwater in delivering nutrients to the lagoon. This was addressed by variable density groundwater and nutrient transport (conservative and reactive) modelling. A vertical cross-section of the atoll was simulated and spatial and temporal variability of groundwater discharge to the lagoon driven by seasonal and tidal fluctuations was considered. Subsurface transport of nitrogen was simulated with consideration of nutrient sources, pathways, residence times and potential for natural attenuation to occur prior to its discharge to the lagoon. The study findings will be used specifically to inform future field investigations and management decisions on Funafuti Atoll related to groundwater nutrient inputs to the lagoon. Moreover, the findings will increase knowledge of nutrient groundwater contamination on atoll islands and its potential contribution to coastal eutrophication.

Siddharth Gupta, University of Western Ontario
Process optimization of a submerged photocatalytic oscillatory membrane reactor (SPMR) for effluent polishing

Submerged photocatalytic membrane reactors (sPMR), a hybrid process combining membrane separation and photocatalysis, represents a promising technology for final treatment of municipal and industrial wastewater effluents for recycling. Generally, sPMR can be broadly categorized into two configurations: 1) sPMR with catalyst immobilized in/on the membrane surface; 2) sPMR with catalyst suspended in the reactor. Although, suspended catalyst reactor configurations have higher reaction rates, they still suffer from membrane fouling contributed by the background water quality and catalyst

particles. The later not only decreases the permeate flux leading to higher trans- membrane pressure (TMP) and higher pumping energy, but also reduces the available catalyst concentration in the system, which decreases the overall efficiency of the process. To alleviate fouling in sPMR, various strategies are reported in literature , including 1) feed pre-treatment; 2) membrane modification; 3) aeration; 4) intermittent membrane back flushing; 5) chemical cleaning. An approach that has been effective in reducing membrane fouling is dynamic filtration, which involves the creation of relative motion between membrane surface and its housing, using oscillation/rotation. This results in generation of high shear rates at membrane surface without coupling it with retentate flow, which not only enhances membrane flux and reaction rates but also gives another degree of freedom to control the reactor residence time.

In this work, a novel hybrid suspended-catalyst system is proposed, which uses the principle of dynamic filtration to mitigate membrane fouling using oscillatory motion. The design involves use of microfiltration membrane instead of ultrafiltration or nanofiltration membrane which offers lower material cost as well as lower TMP pumping energy. The efficiency of oscillatory sPMR combining UV/TiO2 and polyvinylidene fluoride (PVDF-0.22 μm) membrane was investigated in a continuous system for degradation of antipyrine as a model compound. Effects of operational parameters such as hydraulic residence time (HRT), amplitude and frequency of oscillation, and airflow rate (0 - 1 mL/min) on the permeate flux and % degradation of antipyrine were evaluated and the optimum conditions for reactor operation were determined to maximize the flux and % degradation simultaneously. To analyze the effect of various parameters, response surface methodology (RSM) based on central composite design (CCD) as a statistical approach was used and a process model was developed.

Deanna Hersey, University of Western Ontario

Field performance of engineered cover systems for mine waste rock piles: a focus on the Sydney Coalfield in Nova Scotia, Canada

Mine waste rock piles (WRPs) are anthropogenically created landforms at active and former mining sites that pose a substantial risk to the environment. WRPs can contain significant quantities of sulfidic minerals whose exposure to atmospheric oxygen and water can produce a complex sequence of reactions that result in highly toxic acid mine drainage (AMD) to environmental receptors. A common solution is the installation of cover systems over WRPs to isolate the reactive waste from the atmosphere, thereby controlling AMD. A variety of cover compositions exist, ranging from single soil layers to multiple layers of different material types. Multi-layer covers utilizing geomembrane liners are expected to be highly effective, but this has not been thoroughly investigated at the field-scale. The objective of this study is to evaluate the performance of in-service geomembrane-lined cover systems installed at WRPs. Four mine WRP sites located in the Sydney Coalfield (Nova Scotia, Canada) were remediated with engineered cover systems: three cover systems contained the same geomembrane liner but overlain with differing drainage materials (natural soil, clean gravel and geonet), while the remaining single soil layer cover system provided a reference for the geomembrane-lined cover performance. Extensive field monitoring was conducted over seven years to collect numerous parameters within the atmosphere, cover, waste rock, groundwater and surface water. Comprehensive

water balances and leakage estimates demonstrated that the geomembrane liner dramatically reduces the water flux from 28% PPT in the single layer soil cover to 3% PPT. Furthermore, the drainage material type strongly affected the water head and leakage through the geomembrane. The geomembrane liners were also highly effective at reducing oxygen fluxes into the waste rock. Significant improvements in groundwater and surface water quality confirmed the decrease in AMD generation and release that resulted from the reduction in atmospheric fluxes through the cover systems.

Hailey Holmes, University of Western Ontario
Silicates as a corrosion control option for lead

Lead solder, pipes and fittings that were installed in Canada's drinking water networks until 1986 currently pose a health risk to adults and present severe health problems for infants and children. Drinking water treatment processes have evolved with time resulting in frequently changing chemistry of the water flowing through the lead pipes. As they corrode over decades of use, lead is released into drinking water resulting in dangerous exposure to elevated lead levels for adults and children. Orthophosphate and pH adjustment by sodium hydroxide are two common methods of corrosion control, although they both have significant drawbacks. Many researchers have shown that sodium silicates can be used for corrosion control of lead, but none have determined the mechanism by which this occurs. This presentation will describe the results of experiments conducted that allowed the writer to determine how silicates interact with lead and aluminum to function as a corrosion control option for lead in drinking water. The presence of silicates stopped cerussite from oxidizing to lead (IV) oxides in the presence of free chlorine. Aluminum, commonly found in drinking water due to the addition of alum during the treatment process, interacts with silicates resulting in the formation of an aluminosilicate layer on the lead corrosion scale inhibiting lead release. These findings will result in more effective and environmentally friendly drinking water treatment.

Munirat Idris, University of Western Ontario
Molybdenum disulfide Arginine nanosheets as point-of-use sensing system for lead detection

Lead (Pb) is a well-documented toxic heavy metal that is now common as a contaminant in drinking water distribution system due to leaching from aged pipelines still in use. Long term exposure to lead at concentrations less than parts per billion tend to bioaccumulate in the human body leading to adverse effects on the brain and the nervous system. Point of use (POU) devices are becoming increasingly popular due to their ease, flexibility and compatibility and they can be harnessed as treatment or sensing units. To fabricate POU requires using materials that are sensitive to detect contaminants in minute concentrations. Molybdenum disulfide (MoS2) is a two-dimensional transition metal dichalcogenides (TMDs) that has been researched to be an ideal material used as a POU filter to treat as well as sense heavy metals due to the presence of sulfur sites that attach heavy metals. MoS2 nanosheets in solution are functionalized with amino acids that helps to detect heavy metals at extremely low concentrations. The solution is deposited on a polycarbonate filter membrane making it a

functionalized POU filter. In this study, MoS2 nanosheets were functionalized with arginine, then used as a POU filter. Incorporating arginine to functionalize the nanosheets increased the sensitivity of the POU filter against lead. The sensitivity was detected using a digital-analog data acquisition converter (DAQ) solid state chemiresistor gap cell connected to a computer system. This resistivity results obtained after passing varying concentration of lead acetate in solution on the filter membrane shows detection of lead acetate at parts per million level. Although, further experiment is required to detect Pb ions in parts per billion.

Victoria Jara, University of Western Ontario

Unveiling the tropes of empire: A reading of the documentary Cholitas (2019)

The documentary Cholitas (2019) directed by Spanish filmmakers Jaime Murciego and Pablo Iraburu represents the story of six Bolivian women from the Aimara nation whose dream is to hike the Aconcagua. This film is currently being presented in the film festival circuit, for instance FINCA (Festival Internacional de Cine Ambiental) and the critics so far have read it as a documentary that empowers indigenous women (Housman, 2019). In this paper I offer a critical analysis of this film from an ecofeminist perspective and indigenous studies. Throughout the text there are traces that bring to the foreground the colonizing and patriarchal gaze with which both directors present the protagonists. These women are represented as an ethnographic oddity which is worthy of being documented and exhibited. The systematic use of high-angle shots highlights the pejorative gaze towards this groups of women. The insistence of naming them “cholitas” and “chicas” evidences a discourse that denies their agency by identifying them as infants that need to be guided. The filmmakers have a manifest interest in emphasizing the particularity of the Aimara rituals and traditions, thus perpetuating hegemonic binarisms.

Rhiannon Kirton, University of Western Ontario

Deer movement and hunting for management

White-tailed deer (*Odocoileus virginianus*) are the most widely distributed game species in North America and hunting is key to managing populations. However, hunters also indirectly influence deer behavior, which may have implications on management success. Using a novel dataset containing simultaneous high-resolution GPS tracking data of 83 hunters and 37 white tailed deer during the 2008 and 2009 hunting seasons, I identify encounters between hunters and deer to show how these encounters influence deer behaviour, flight response, and resource selection. The results highlight how deer alter movement in response to interactions with anthropogenic hunters and their subsequent resource use. This work utilizes new methods to gain greater insight into questions that can have important impacts for the knowledge of animal movement, physiology, spatial ecology and wildlife management.

Eric Rowland Lalonde, University of Western Ontario
Solar-tracking arrays: Engineering challenges and opportunities

Traditional solar energy generation in North America uses solar panels at fixed angles that face southwards: this allows them to generate the maximum power possible during the middle of the day but means they are significantly less effective in the morning and evening. Modern solar-tracking arrays, on the other hand, are able to take advantage of this morning and evening sunlight. By allowing the panels to rotate to the east and west during the day, following the path of the sun, they can maximize their power output, increasing their efficiency by 25-50%. Unfortunately, new engineering advancements always come with new engineering challenges; since these solar-tracking arrays are fixed around a single, long axis, they are significantly more vulnerable to twisting under wind loads than traditional solar panels and are at risk of aerodynamic instability and failure. Using computational techniques such as finite-element modelling to simulate these solar-tracking arrays under wind loading, mitigating techniques can be developed by combining mechanical systems with mathematical control theory. Specifically, the use of a semi-active eddy current brake on the panel axis is investigated here for reducing the amount of twisting in the solar-tracking array. This presentation will offer a look at the near future of solar energy and highlight the fusion of multi-disciplinary techniques that will be required to get there.

Fanny Leveau, University of Western Ontario
The environment in contemporary French fiction: the case of "Le Club des miracles relatifs" by Nancy Huston

The environment constitutes a recurring theme in contemporary French fiction. Depicting activism (Alice Ferney), ecological disasters (Nancy Huston), a living and sovereign nature (Jean Rolin, J.M.G Le Clézio) or, on the contrary, its disappearance behind technological spaces (Michel Houellebecq), today's writers are deeply concerned with environmental issues. While American literary critique has explored the environmental question in anglophone corpuses since the 1990s, the French critique has only started to develop its own form of ecocriticism in the past 10 years. As such, this new and growing field of research is attempting to map its borders and tendencies. While Peter Sloentjes has developed an "écopoétique", insisting on the formal aspects pertaining to the French writing of landscapes, Stephanie Posthumus argues for a "French ecocritique", insisting upon the necessity to replace ecological thinking within a specific cultural context. In an effort to continue bridging the existing gap in research about French literary representations of the environment, I propose to discuss the topic through the case study of a recent novel: Le club des miracles relatifs, by Nancy Huston (2016). This dystopia shows an inhuman world where nature and humans are destroyed by the exploitation of oil sands in Alberta. The book questions what it means to be human, arguing for a material being situated in its environment. In this presentation, I will contextualize French literary thinking about the environment (I) and highlight key themes (II) and formal aspects (III) of the novel that problematize and shape French ecological thinking.

Carelle Mang-Benza, University of Western Ontario
Energy transition and reconciliation: Indigenous and Non-Indigenous media and policy discourses

This paper critically analyzes the energy transition as a locus of reconciliation between Indigenous and non-Indigenous Canadians. As Canada addresses its colonial legacies, it is also transitioning to less-carbon intensive economic activities, especially in the energy sector. Using content and discourse analysis of policy documents, white papers, and media articles from 2007-2018, we draw attention to language on reconciliation and energy adopted by Indigenous and non-Indigenous Canadians, before and after 2015, the year that marks both the release of the Truth and Reconciliation Commission (TRC) report and the adoption of the Paris Agreement on climate change. Our findings highlight that public discourses connecting energy transition and reconciliation encompass somewhat antithetical issues of inclusion and exclusion, dependency and autonomy, as well as various representations of Indigenous people. Those discourses are entrenched in deep societal concerns and are mainly articulated by non-Indigenous voices. We also observed that the three-fold expansion of those discourses after 2015 did not eliminate the colonial ways of thinking and living. We suggest that Indigenous and non-Indigenous Canadians may be brought together by the prospects of mutual benefits potentially available for Indigenous and non-Indigenous Canadians at the intersection of energy transition and reconciliation journeys.

Vahid Mehdipour, University of Western Ontario
Assessment of the impacts of climate change, land cover transition, and internal climate variability on the hydrology of a forested watershed

The impacts of climate and land cover changes on the hydrologic processes of the Batchawana watershed in Central Ontario are assessed. A snow-dominated forested watershed with coniferous, deciduous and mixed trees and numerous small lakes. A semi-distributed hydrological model, based on the Raven, is step up using observations for 1981-2011. Eight downscaled General Circulation Models (GCMs) that participated in the Coupled Model Intercomparison Project Phase 5 and three large ensembles of Regional Climate Model (RCMs) simulations, under the Representative Concentration Pathway (RCP) 8.5, are used to characterize the role of anthropogenic forcing and internal climate variability in projected changes of watershed runoff. Analyses are performed in the historical and future time frames corresponding to 6 milestones of global mean temperature increase compared to the preindustrial (1851-1900) level. The historical trends of land cover changes are extended to develop future LC scenarios including changes from coniferous to deciduous and mixed forests. Besides, to assess the influence of lakes four scenarios are investigated considering 25% lake shrinkage increments. Deciduous and mixed tree cover result in higher flow rates during fall compared to the base model with partial coniferous tree cover. A decrease in the area of lakes can decrease the streamflow in all seasons. Responding to climate change, the snowpack is projected to decline in the future indicating a shift from nival to a rainfall-dominated hydrological regime in a warmer climate. Further, the mean annual streamflow is projected to increase while the annual maximum flow is expected to decline. Analysis of

Internal Variability indicates that human-induced climate change, compared with natural variability, will dominate the hydrological changes in the region during the last decade of the 21st century. Overall, the results show significant changes in the hydrological processes of this forested watershed associated with both climate and land cover changes. This will affect the flood and drought hazards and consequently endanger the agriculture, wood industry and lives of indigenous residents of Batchawana.

Kamaldeen Mohammed, University of Western Ontario
Livelihood diversification strategies and resilience to climate change in semi-arid northern Ghana

Climate change threatens the livelihoods of smallholder farmers in the Global South. In semi-arid northern Ghana, where over 73% of the population is engaged in smallholder agriculture, climate-induced food insecurity is of major concern. Livelihood diversification is acknowledged to have the potential to improve climate resilience in smallholder farming systems through risk spreading. That notwithstanding, little is known about the links between livelihood diversification strategies and climate resilience in such vulnerable settings. Drawing data from a cross-sectional survey with 1100 smallholder households in semi-arid northern Ghana, this study contributes to the literature by examining the association between livelihood diversification and climate change resilience. Findings from logistic regression analysis revealed that smallholder farming households that practiced only farm diversification (OR = 4.66; $p \leq 0.001$) and a combination of both farm and nonfarm diversification (OR = 6.28; $p \leq 0.001$) had significantly higher odds of reporting stronger resilience to climate change compared to those who did not employ any diversification strategy. The study further revealed that land preparation techniques, source of climate information, and religion were significantly associated with smallholder farmers' perceived climate change resilience. These findings point to the need for agricultural policy to promote both farm and nonfarm livelihoods as complementary risk-spreading strategies. Exploring the synergies between farm and nonfarm livelihoods may prove beneficial in semi-arid agrarian contexts. In doing so, critical contextual dynamics such as source of farm power and sources of climate information must not be overlooked.

Meghan Sauro, University of Western Ontario
Particle mobility and scour in a large gravel bed river: implications for salmonid spawning habitat

The San Juan River, Vancouver Island is a large gravel-bed river that has historically experienced increased sediment supply and bar sedimentation, and subsequent declines in salmonid populations as a consequence of logging in the watershed. Analyzing the movement of gravel along the river is necessary to understand the current river dynamics. Previous work (2015-2019) using radio-tagged particles found that mobilized particles seeded at bar heads remain within one riffle-pool-bar sequence during each annual winter flood flow season. This study builds on these previous results by investigating the mobility and transport of particles seeded at other locations, focussing at observed salmonid spawning locations, using radio-tagged stones and repeat topographic surveys. In October 2019, prior to winter flooding,

318 surface tracers with a range of sizes representative of the bed material were evenly distributed across pool tail-outs, just upstream of riffles at three gravel bars and 36 tracers were buried at varying depths (10, 20, and 30cm) adjacent to pool tail-out locations. This placement was designed to reveal both whether bed material is mobile and if there is significant bed scour near spawning sites during winter flooding. Results show near full mobilization (> 90%) of surface tracers at all three study locations, influenced by the 100-year flood occurring in January, 2020. Scouring of buried tracers show high spatial variation with significant mobilization at two of the bars (~50%) but much less at the third one (<%10). Annual travel distance for both buried and surface tracers tended to remain within one riffle-pool unit with deposition concentrated at bar margins and near the bar apex, agreeing with past work on this river. These findings provide insight on channel morpho-dynamics and disturbance depth relevant to ongoing restoration work on the San Juan.

Selahattin Murat Sirin, University of Western Ontario
How variable renewable energy technologies affect firm generation strategies: Evidence from the Turkish electricity market

The share of intermittent renewable energy technologies in the global power supply has seen a fast increase in the past decade as a part of efforts to reduce greenhouse gas emissions. Having almost zero marginal costs, these technologies affect the electricity system by forcing the marginal power plants (mostly natural gas-fired plants) out of production. This phenomenon, known as the merit order effect, has a variety of implications for market operations, bidding strategies, and portfolio management. While there is a growing body of literature studying the merit order effect at the system level, more studies focusing on firm-level market operations are needed to design better policies for transitioning to cleaner and sustainable energy systems. In this respect, this study analyzes the effects of variable renewable energy technologies on firm behavior using actual data from the Turkish day-ahead market. Our paper starts out with developing a theoretical framework of firm behavior in the presence of VRE technologies. Afterward, we analyze firms' generation strategies using unsupervised machine learning methods. The study continues with a panel data analysis of the short-run marginal effects of VRE generation on firms' day ahead projected available capacity and projected generation. Our analyses show that while the majority of the firms respond to increasing VRE generation as the economic theory has predicted; however, EUAS, the state-owned enterprise, behaves differently indicating the possibility of motives different than profit maximization.

Chelsea Uggenti, University of Western Ontario
A statistician's experience of getting dirt on her boots

Chelsea is a graduate student in statistics who has worked with Canadian wildland fire data for the past six years. During the summer of 2019, she travelled to Oregon, USA for three weeks to work with fire ecologist Meg Krawchuk from Oregon State University. Chelsea had the opportunity to observe and perform ecological field work on various burnt landscapes, clear cuts (i.e., areas with harvested trees),

and arid grasslands in southwest and central Oregon which provided her with a better understanding of the key ecological drivers and effects of wildland fires in the Pacific Northwest.

Join Chelsea as she regales on the ups and downs of performing field work; an experience not often undertaken by people analyzing the data from a computer screen. She will share her many lessons learnt and, most importantly, how they have affected her research going forward.

Meghan Vissers, University of Western Ontario
Assessing seasonal variations in phosphorus behaviour near the groundwater-stream interface

Agricultural practices can cause excess inputs of phosphorus (P) to freshwater catchments leading to eutrophication and harmful algal blooms. The contribution of groundwater and hyporheic discharges in the delivery of P to streams remains unclear although they may affect the timing and P form (particulate vs dissolved) delivered. These discharges may contribute to the limited success of prior efforts to reduce P loads in agricultural streams. Better understanding of the hydrological and geochemical processes governing P fate near groundwater-stream interfaces, and the influence of changing conditions (e.g. seasonally) is needed to better quantify P inputs from groundwater and from streambed sediments to streams. The objective of this study is to evaluate how spatio-temporal variability in groundwater-stream interactions and stream sediment conditions affect P delivery to a headwater agricultural stream.

Field investigations were conducted along a 40-m stream reach in an agricultural area of the Thames watershed, Ontario, Canada. Streambed temperature mapping and vertical hydraulic gradient measurements provide identification of groundwater discharge patterns along the stream reach. Groundwater, tile drain and surface water samples were analyzed for soluble reactive phosphorus (SRP), total P, and parameters that influence P mobility including oxidation-reduction potential (ORP), pH, and iron. Sampling was complemented with continuous ORP measurements in streambed sediments at select locations along the reach. Preliminary results indicate low porewater SRP concentrations (typically 5 to 70 ug/L) in the high groundwater discharge zones, and high porewater SRP (reaching 1000 to 1980 ug/L) in the low groundwater discharge zones. Porewater SRP concentrations are negatively correlated with ORP, and were found to be higher in summer and early fall compared with winter. High concentrations of dissolved iron were found in the high SRP/reducing zones, suggesting possible redox-controlled release of SRP through reactions such as iron oxide reduction dissolution. The findings from this study are needed for understanding the importance of groundwater and streambeds as legacy storage zones and the factors that contribute to release of P to the stream.

Sara Wilson, University of Western Ontario
Analysis of the communities around wind energy projects in Canada: Priorities, policies and power

The energy transition will require the creation of new energy infrastructure in Canada. This provides an opportunity to do things better; to actively avoid perpetuating environmental racism in the energy sector and mitigate existing threats to communities through retiring old structures and sites and safely restoring them. Before making decisions about the placement and operative capacity of new energy infrastructure, community consultation and deliberation will be necessary, and the effectiveness of existing policies and practices should be reconsidered. The purpose of the present research is to establish what kinds of wind energy projects are most often accepted by the communities they are proposed in, and why. Specifically, we hope to establish what particular qualities a successful project may have, and which dimensions of development are most highly prioritized within our survey sample of 368 Ontario and Nova Scotia residents who currently live near a completed wind project. From this analysis, we will determine how future energy developments can best incorporate meaningful and productive community consultation in the proposal and development process. If new developments more adequately benefit the communities in which they are situated, and communities feel a sense of ownership toward their local project, the speed and effectiveness with which Canada transitions toward a green energy future can improve.

David Zilkey, University of Western Ontario
An investigation of epiphytic diatom substrate specificity and its implications for paleolimnology

Submerged macrophytes (otherwise known as aquatic plants) are an important component of lake ecosystems, but long-term monitoring of macrophyte communities is often limited. However, paleolimnological inferences from proxies preserved in lake sediments offer an alternative to direct observation. Previous studies have used diatoms (a type of unicellular microalgae well preserved in lake sediments) to resolve changes in macrophyte biomass, but are limited in their ability to resolve macrophyte community composition. We investigated the composition of diatoms living directly on three submerged macrophyte species in Gilmour Bay (Chandos Lake, Ontario, Canada) to explore diatom substrate specificity and its application to paleolimnological inferences. Ten individuals each of Chara, Potamogeton robbinsii, and the invasive Myriophyllum spicatum were collected and analyzed for diatoms. Diatom assemblages on all macrophytes had abundant Achnanthidium minutissimum and Cocconeis placentula, but Encyonopsis microcephala was more abundant on Chara and Rossithidium anastasiae was more abundant on P. robbinsii. Principal components analysis indicated overlap between macrophyte species, but despite this overlap, analysis of similarity indicated a statistically significant difference in epiphytic diatom community among macrophytes. The association of E. microcephala with Chara and R. anastasiae with P. robbinsii illustrates a potential method for inferring historical changes in macrophyte community composition in paleolimnoloical studies of Ontario lakes.

Undergraduate Honor's Thesis Talk Abstracts
9:00 am - 10:15 am, 10:30 am - 11:45 am

Alyssa Aglipay
The impact of seasonality on the accessibility and use of parks in London, Ontario

Objective
This study explores the impact of seasonality on park use and accessibility across London, Ontario.
Study design and methods
Park audits are conducted on a socio-spatial stratified sample of eleven parks across London, Ontario to identify key features that could support winter-time use of parks and recreational facilities. Four sets of tools: the electronic Natural Environment Scoring Tool (eNEST), Neighbourhood Green Space Tool (NGST), Systematic Audit of Green Space Environments tool (SAGE), and Community Park Audit Tool (CPAT) are utilized to determine which tool provides the best assessment of park quality and park use to be used for the pilot study of ParkSeek in the Human Environments Analysis Laboratory.
Results
Through anecdotal and observational evidence, it appears that park use is still prevalent in the winter season and that the lack of maintenance is a barrier to supporting longer periods of use during the cold weather. The evidence suggests that salt is rarely used, meaning there is a reduced impact of salt accumulation on tree health.
Conclusions
The maintenance of parks to support wintertime use such as shoveling, washroom accessibility, and trash bins near activity areas should be considered to provide better accessibility and use of parks. By providing features that support wintertime activities, an increase in physical activity and social connections may be seen, improving overall health and wellbeing. Future research should consider focusing on the impact of minimal salt use on park accessibility and park use to determine if this feature can remain to protect urban tree health.

Taim Al-Bakri
(Re)introducing the workplace. A partial solution to slow climate change and prevent the next pandemic

The Covid-19 lockdowns have forced many industries/companies to shift into remote work, prior to this Remote work constituted only a small fraction of the formal workforce. This research is utilizing the lockdown to assess and investigate the possibility of converting permanently into a new model of the workplace that aims to reduce emissions. The study is done by interviewing remote workers during the lockdown to determine an average commute time and observe the trends of other work-related waste and emissions. Moreover, investigate services that have shifted to a digital form to gain an insight on reduced carbon emissions by avoiding the use of paper and postage. Remote work has the potential to reduce the ecological footprint by reducing greenhouse gases emissions and office waste through

different components of the workday. The findings revealed that remote work has maintained the functionality of the workplace while reducing emissions and providing workers flexibility and other advantages. By gauging the willingness of the workers to remain remote partially or fully after the pandemic; a new workplace is introduced that augments the benefits of remote work with the use of a hybrid model that enables companies to share spaces for partial in-person work, which maximizes the use of the workspace while minimizing associated emissions. The feasibility of a hybrid module that combines both traditional work practices with remote work as a sustainable option and a potential solution to the climate change problem. While recognizing the drawbacks of remote work and the potential negative impacts on the wellbeing of workers, problems with isolation and inequity.

Shannon James

Examining knowledge gaps in the federal Environmental Assessment process: Investigating the relationship between Western science and Indigenous knowledge

The purpose of Environmental Assessment (EA) is to identify and mitigate potential environmental and social impacts of proposed development projects, and to ensure public interest is in favour of such development. In 2019, the Canadian government enacted the Impact Assessment Act (IAA), in part to promote partnerships with Indigenous peoples and to ensure decisions are based on both science and Indigenous knowledge (IK). For Indigenous peoples, concerns about living in a country with a strong interest in resource extraction, a history of colonialism, and heavy entrenchment in Western scientific methodology, they argue that Indigenous relational worldviews are not well represented in EA. This scoping literature review aims to identify knowledge gaps that bar the meaningful engagement of Indigenous communities and their knowledges in the federal EA process. The research methodology includes the review and qualitative analysis of peer-reviewed publications to identify and accrete the shortcomings of EA structural processes and knowledge hierarchy. Several structural failures are identified (rushed timelines, lack of consultation, recognition of Aboriginal and Treaty rights), and the general cultural insensitivity of the dominant knowledge power systems to treat IK respectfully. The EA process must be reimagined in order to engage Indigenous knowledge systems in an impactful way.

Carley Langleben

Evaluating the relationships between median household income and greenspace on PM2.5 concentrations during the commute to school in Hamilton, Ontario

Air pollution is a global health concern, particularly for children. Those residing in and spending time in urban areas are more likely to be exposed to poor air quality conditions due to high volumes of mobile vehicles, especially those with diesel engines, road dust, and construction (Government of Canada, 2020). Children are particularly vulnerable to the impacts of air pollution during the school commute, where they are subject to breathing in traffic-related air pollutants. The current project explores the air pollution exposure experienced by children living in and attending schools in urban Hamilton, Ontario. The study investigates the relationships between fine particulate matter (PM2.5) concentrations, quantity of greenspace, and median household income within each dissemination area in Hamilton.

Particulate matter includes dust, smoke, dirt, and soot suspended in air and is measured by its aerodynamic diameter size in microns. The study was conducted by analyzing data collected by air pollution monitors located across Hamilton, 2016 Canadian census income data, and GIS software to determine the quantity of greenspace. It is hypothesized that lower income areas will have higher levels of PM2.5 and less greenspace in comparison to higher income dissemination areas where greenspaces will have a moderating effect on air quality. Children living in and attending schools in lower income areas will therefore be exposed to more air pollution during their commutes to school, highlighting the environmental injustices that exist in Canada. Results from this study will contribute to the Active and Safe Routes to School and ParkSeek projects in the Human Environments Analysis Lab at Western University.

Yi Li

Mercury and methylmercury concentration-discharge relationships in Medway River and North Thames River at London Ontario, Canada

Mercury is a global contaminant due to its high toxicity and persistence in the environment. Specifically, methylmercury is a threat to aquatic species and reduces the fishery resources' benefits in many North American rivers. Previous studies have already demonstrated that urban runoff can increase mercury concentrations in rivers. The objectives of this study were to determine how dissolved and particulate mercury and methylmercury concentrations in Medway River and North Thames River change during runoff events, and to measure other heavy metal concentrations to link changes in mercury concentrations to runoff from urban surfaces. River water was collected at each study site in Medway River and North Thames River and filtered to measure dissolved mercury concentrations. Temperature, pH, conductivity and turbidity were measured by a YSI ProDSS multiparameter water quality meter. Discharge data were collected from the Water Survey of Canada website. The log-log linear regression model was used to understand the concentration-turbidity relationship and the concentration-discharge relationship in Medway River and North Thames River. The potential mercury source was identified by Pearson correlation matrix. Between October and December 2020, both of turbidity and particulate mercury concentrations increased with an increase in discharge in Medway River and North Thames River, which suggests total suspended solids are a potential controlling factor in Medway River and North Thames River. Between October and December 2020, dissolved mercury concentration significantly declined with an increase in discharge in Medway River. However, dissolved mercury concentration did not change with discharge in North Thames River, which implies that dilution effect has more significant impacts on dissolve mercury concentration in Medway River than in North Thames River. The correlation coefficient results of heavy metals show that urban runoff is a potential source of mercury in both of Medway River and North Thames River.

Joseph Workentin

The relative use and distribution of recycling bags within London, Ontario

Multi-material curbside recycling programs are important waste management currently practiced all over the developed world. Though such programs have historically used bins and carts as recycling receptacles, increasing numbers of recycling programs now allow single-use, high-density polyethylene plastic bags for the storage and collection of recyclable waste. Though the use of recycling bags has proven beneficial in some jurisdictions, their continued use, particularly in conjunction with bins, has been criticized as unnecessary, especially when considering the processing cost and environmental impact the use of these single-use bags can have. Unlike other provinces in Canada, Ontario has no clear mandate on whether recycling bags should be used, and therefore the relative use of recycling bags within many municipalities remains largely unknown. This study sought therefore to better understand the distribution and abundance of recycling bag use in London Ontario, a medium municipality setting that permits the collection of recyclable goods in both bags and bins. Data was collected by surveying a residential neighbourhood by car and recording the GPS coordinates of all recycling bags observed. Plotted bag coordinates were then used to determine both the frequency of use and whether houses using recycling bags were clustered networks in such a way that would suggest neighbourhood influence on recycling bag usage. This study found that only 9.0 ± 1.3% of households used plastic bags for recycling collection, with the total frequency of use within the neighbourhood amounting to 0.15 ± 0.02 bags per house for all houses surveyed. Significant evidence of moderate neighbourhood clustering was also observed. This study therefore outlines how the use of single-use bags might be an unnecessary practice within such a setting, as it is a practice used by a small minority and one that appears to be influenced by neighbourhood behaviour rather than individual household necessity.