10th Annual Earth Day Colloquium

Thursday, April 11 – Friday, April 12, 2012

2013 Earth Day Colloquium Planning Committee

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Jenna Siu	Biology

Keynote Speaker

Brian Craig, President, Long Point World Biosphere Reserve Foundation

Invited Speakers

Sandra Tavares, Group Consulting

Adam Scott, Climate and Energy Program Manager, Environmental Defense

Talks

Deep Ecology: Living in Connection

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Eco-creativity Guide; founder Shamanu: Earth Wisdom Teachings; co-founder and co-director of The Living Centre and Living Arts Institute, London, Ontario

In this time of great change on the Planet, we enter a new adventure. One that requires a human mindfulness and worldview able to craft new relationships with the primary forces of Earth.

Deep Ecology is founded on two philosophies. One is a scientific insight into the interrelatedness of all systems of life on Earth. The second explores the timely need for a shift in consciousness from ‘anthropocentrism’ – human-centeredness – to an ‘eco-centric’ attitude.

Deep Ecology teaches that our way into a thriving and regenerative future lives in the ability to enter into deep relationship with Nature, seeing nature as model, mentor and Self. By opening to the extraordinary ingenuity and creativity of our ecological heritage we cultivate new ways of seeing, of thinking, and acting that supports the integrity of all Life.

Bringing thinking, feeling, spirituality and action together, we look deeply at humanity's relationship with the natural world and how to creatively respond to the needs of a planet that is in crisis.

Geoengineering, ethics and the role of research communities

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Increasingly worried scientists have proposed a range of technological interventions in the Earth's natural systems known as geoengineering to prevent and even reverse climate change. Many different schemes have been concocted, from removing carbon from the air to creating a global sunscreen of sulphur dioxide. Some of these may be cheap, fast and efficient, but may also come with devastating side-effects while not addressing underlying issues. Unsurprisingly, geoengineering research has been met with scepticism and harsh criticism. This presentation examines some of the ethical quandaries that affect research communities. Not least is whether such research is justifiable given various risks, especially if geoengineering options make greenhouse gas mitigation less attractive. Scientists face a difficult relationship with the public as they try to understand both risks and opportunities, and early experiments have become embroiled in controversy. How these issues are resolved could have a critical impact on whether geoengineering will eventually be a viable or accepted tool. However undesirable geoengineering sounds, with dangerous climate change rapidly becoming unavoidable, can we afford to ignore it?

Mitigating Threats to Water Security in the Great Lakes Basin: The Necessity of Canadian-American Policy Harmonization

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A decade into the twenty-first century, threats to global security and development are numerous and growing. Yet, in the midst of growing uncertainty the grave challenges of impending water insecurity are both understated and understudied. Even across one of the most prosperous and cooperative borders in the world, Canada and the United States are subject to increasing tensions over the security of their shared water resources and insatiable thirst for this life-sustaining resource. The Great Lakes Basin, holding roughly twenty percent of the Earth's supply of freshwater faces substantial threats that could hold serious consequences on the environment, economy, and human health of the region. This paper explores these potential consequences, discusses some probable causes, and proposes possible solutions to the problem of water insecurity in the Great Lakes Basin as a model for international water resource management.

Keywords: water; security; Great Lakes; cooperation

Habitat use of two swallowtail butterfly species: testing for positive edge responses in a fragmented landscape

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Landscapes are becoming increasingly fragmented and natural habitat is being lost, contributing to a global decline in biodiversity. Research on the impact of habitat fragmentation on wildlife populations has mainly focused on species that rely on the interior of one habitat type. However, species that respond positively to the boundary between two habitat types should also be considered to gain a full understanding of these landscape changes. The eastern tiger (Papilio glaucus) and the spicebush (Papilio troilus) swallowtails require two different, or complementary, resources (larval host plants and adult nectar sources) that occur in different habitat types (forest and field). They must cross habitat boundaries to obtain these resources, making them edge species. My behavioural study quantifies the edge response of these charismatic swallowtail butterfly species at field/forest edges by assessing the distribution of their relative abundance and flight orientation in both habitats and at the field/forest boundary. My work contributes to better understanding of the connectivity of populations in the fragmented landscape of southwestern Ontario.

Keywords: Habitat fragmentation, conservation, edge species, swallowtail butterfly, landscape ecology

Increasing atmospheric nitrogen deposition: implications for tallgrass prairie and forest restoration

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As the use of fossil fuels and synthetic fertilizers continue to increase, so does the emission of nitrogen pollution into the atmosphere, resulting in increased nitrogen deposition across the landscape. Typically, terrestrial ecosystems are nitrogen limited, and increased nitrogen deposition has a strong effect on plant biomass and species composition, in that it favors fast-growing, nitrogen-demanding species. Therefore, increasing nitrogen deposition has important implications for plant community restoration. I am using a field experiment to assess the effects of nitrogen addition on tallgrass prairie restoration, and the ability of native trees to establish in the restored prairie. I will also use a common garden experiment to examine the success of transplanted tree seedlings in response to competition from tallgrass versus non-tallgrass species in the context of nitrogen addition. Overall, this project will lead to an improved understanding of how tallgrass prairie restoration will be influenced by increased atmospheric nitrogen deposition due to global change.

Keywords: Restoration, Tallgrass Prairie, Ecology, Plants, Atmospheric Nitrogen Deposition

Combined effects of soil freezing and N addition on losses and interception of N over winter and summer

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In northern temperate regions, climate warming is predicted to decrease the proportion of precipitation that falls as snow. Reduced snow cover can increase soil freezing, causing microbial lysis, disruption of soil aggregates, and damage to roots, ultimately leading to decreased ecosystem nitrogen retention. Coupled with increased atmospheric nitrogen deposition and ecosystem nitrogen saturation over the next century, an increased quantity of nitrogen may be transferred from terrestrial to aquatic systems. The objective of this study was to investigate the interactive effects of soil freezing and N deposition on ecosystem nitrogen retention at snowmelt and peak biomass. To do this, we added a nitrogen (15N) isotope tracer to plots treated with combinations of snow removal and nitrogen addition at snow melt and at peak biomass to assess short-term uptake of simulated nitrogen deposition at these times. Soil freezing had no effect on short-term retention of 15Nitrogen added just after snowmelt, whereas nitrogen addition decreased retention of this added 15Nitrogen. Short term retention of 15Nitrogen added at peak plant biomass was reduced by ~45% in snow removal plots, due to reduced plant biomass. In contrast, retention of 15Nitrogen added at peak biomass increased by ~30% in nitrogen addition plots, due to increased plant biomass. Our findings highlight the potential importance of extreme climate events over winter in modifying ecosystem nitrogen retention over the next century.

Keywords: Soil freezing, climate change, Nitrogen, Nitrogen deposition

Antibacterial Studies on Green Coatings

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While temporarily disinfection of a surface is possible with the help of strong cleaners, tremendous interest exists for the control of microorganisms on surfaces by effective, durable antimicrobial coatings for the presence of multidrug resistant pathogens. There is wide spectrum of potential applications of antimicrobial coatings, spanning from surface coatings to biomedical applications, where sterile conditions are crucial. The nanotitanium dioxide (nTiO2) / polyurethane (PU) polymer composite coatings can inhibit microbial growth by photocatalysis when exposed to solar irradiation. In this study, the antimicrobial behavior of virgin PU, nTiO2/PU, DMPA (2,2-Dimethylolpropionic acid)-nTiO2/PU, and silver nTiO2/PU composites was investigated qualitatively and quantitatively against both gram-negative (E. coli) and gram-positive (M. luteus) bacteria at different exposure time using a UV lamp and Solar Simulator by monitoring the growth of bacterial populations in the presence and absence of the above-mentioned nanocomposites. The distribution of nTiO2 in the polymer matrix was enhanced by monomer (DMPA-nTiO2) functionalization. Since silver is one of the most effective antibacterial agents used for its high degree of biocompatibility and long-term antibacterial effectiveness against many different bacterial strains, it was used in the present study. The quantitative examination of bacterial activity was determined by the survival ratio as calculated from the number of viable cells, which form colonies on the petri dishes with nutrient agar. Good inhibition results were observed and demonstrated visually. In summary, nTiO2/PU, DMPA-nTiO2/PU, and silver nTiO2/PU composite coatings displayed considerable antibacterial activity against both gram-positive and gram-negative bacteria under UV and solar irradiation.

Keywords: Nanomaterials, Green Coating, Antibacterial, Photocatalysis, Monomer Functionalization

Effect of plant hormones of growth of algae

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"Limited fossil fuel reserves, increasing demand for energy in all parts of the world and global warming that causes health problems are some driving forces to look for new sources of energy. Among different options available, microalgae are currently attracting wide interests as an alternative fuel source which is renewable and causes less pollution. Microalgae are single cell photosynthetic organisms that are known for rapid growth and high energy content and as a part of photosynthesis; they produce oil that can be used as a feedstock for biodiesel production. Some algae strains could contain lipid up to 60% of dry biomass. The amount of lipid production is in direct relation with the medium composition and growth conditions of algae.
For biodiesel production from microalgae, increasing the growth rate and lipid content are the main goals.It has been suggested by some researchers that there are plant hormones capable of improving growth rate and biomass. Plant hormones are chemicals that are produced by plants and work as signal molecules. They play a crucial role in controlling the way in which plants grow and develop. Depending on the role of the hormones, they have various behaviors in different parts of plants such as regulating cellular process or formation of flowers, seeds and leaves or cell division or seed germination or inhibiting stem elongation, they also play a controlling role in the processes of reproduction

Keywords: Biodiesel, Biomass, Microalgae, Plant Hormones

Toxic Tides: How will changing ocean acidity alter the growth and toxicity of the marine raphidophyte Heterosigma akashiwo?

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Harmful algal blooms (HABs) are a global issue that have been garnering the attention of scientific studies, industries, and coastal communities in the past 20-30 years. Negative impacts of these blooms on coastal waters include: toxin production, disruptions to marine food chains, and altered ecological relationships. Despite an increasing frequency of HABs, these harmful relationships are generally poorly defined and not fully understood. This is especially true in the case of the marine raphidophyte Heterosigma akashiwo, whose fish-killing toxic mechanism remains a mystery. My project addresses the variable toxicity from H. akashiwo and its relation to environmental changes. Specifically, I will examine whether acidification of coastal waters and high carbon dioxide levels (the driver of ocean acidification) stimulate toxicity from H. akashiwo. I hypothesize that acidified ocean waters with low pH will increase the level of toxicity in Heterosigma akashiwo. By closely examining the connection between pH, CO2, and the variable toxicity in H.akashiwo, this project will provide insight on this species' toxic mechanism and enhance the current understanding of HAB dynamics as a whole.

Keywords: CO2, ocean pH, toxic algal blooms, growth, aquaculture

Treating Milk-House Wash-waters Using a Horizontal Subsurface Flow Constructed Wetland

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The objective of this research study is to design, construct and assess a 3 horizontal sub-surface flow constructed wetlands (HSSFCW) coupled with the use of a passive phosphorus (P) filter to treat milking centre wash waters and/or barnyard runoff. The passive subsurface flow (SSF) wetland filter technology enabled farms to divert wash waters from liquid manure storages. This technology was able to provide an effective solution to dairy producers, who are required to properly treat and dispose of their wash waters with the amended General Nutrient Management Regulation (O. Reg. 267/03).

Keywords: Constructed Wetlands, Phosphorus, Dairy Milk-house

Up in Smoke: The Detrimental Ecosystem and Human Health Effects of the North American Illicit Cigarette Market

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The illegal cigarette market is a growing concern in North America; Canada for instance has experienced a significant rise in the number of contraband and counterfeit cigarettes consumed, imported, and sold since the 1990s. The production and consumption of illicit cigarettes has been shown to have negative effects on ecosystems and human health. Widespread availability and affordability are root causes that encourage consumption, especially in certain socioeconomic groups such as at-risk youth. Key players include government, anti-smoking organizations, tobacco producers, and First Nations communities who maintain the right to import, manufacture, and sell Native brands. The implementation of more stringent regulations surrounding growth, sale, consumption, and disposal of tobacco products are needed to ensure that current tobacco control initiatives are serving their purpose. Improved education is a key starting point in mitigating many of the issues surrounding illicit cigarettes.

Keywords: Ecosystem Health, Health Impacts, Contraband, Cigarettes, Smoking

Climate Change Induced Migration and Ecosystem Health Impacts

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Climate change impacts vary in different areas of the world, causing effects such as sea level rise, drought, excessive rainfall, and warmer temperatures. These changes may lead to human migration over short and long distances due to environmental conditions becoming degraded, and subsequently uninhabitable. In certain regions migration has already occurred, and the impacts of these movements are becoming more apparent. Effective mitigation strategies to slow climate change can help prevent unnecessary migration from occurring, however, in many cases, migration is unavoidable. It is important for host communities to adequately prepare for migrant populations and any ensuing impacts. The creation of proper policy and protocols to address land use, health services, and resource management are crucial to coordinate an appropriate response to migration.

Keywords: Climate change, migration, ecosystem health, environmental refugees, sea level rise

Understanding eutrophication through landscape change: how gradients of human activity relate to physicochemical conditions in southwestern Ontario

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River, stream and lake nutrient concentrations are influenced at a landscape scale by anthropogenic activities. In response to eutrophication within the Great Lakes, the Government of Canada aims to develop nutrient targets through the Great Lakes Nutrient Initiative (GLNI). In this study we determine the association between gradients of human activity (urbanization, agriculture, Waste Water Treatment Plants) and annual/seasonal nutrient flux within catchments of the Great Lakes. Using GIS analyses 29 sites with similar physiographic characteristics of the landscape but varying exposure to human activity were selected across southwestern Ontario. At each site biweekly water chemistry samples were collected from April, 2012 through November, 2012 and analyzed for major nitrogen and major phosphorus forms, as well as TSS and turbidity. Results show the varying influence of human activity on nutrient concentrations in southwestern Ontario streams highlighting the importance of land management policy for aquatic ecosystem function and integrity. The understanding of the relationship between nutrient flux and land use will be used to direct further research towards the establishment and implementation of nutrient targets in the Great Lakes region.

Keywords: nutrient concentration, Land Use, Human Activity

Does the overproduction of corn in the US negatively impact ecosystem health?

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The oversaturation of corn in the American market has led to a number of ecosystem and human health issues. Human health is negatively impacted as cheap corn prices facilitate the inclusion of corn-derived additives in consumer food products. This, coupled with other factors, has led to high rates of obesity in the United States. Natural ecosystems are also under stress from corn mono-cropping. This has led to the overuse of fertilizers, pesticides and herbicides, which have negative effects on biota and human well-being. Furthermore, policy makers have been championing the use of corn for ethanol, which has resulted in the preferential production of corn over other viable food crops. The expansion of corn production for biofuel has exacerbated climate change due to the inefficiency of energy conversion of corn to ethanol. One root cause of these problems can be traced back to American farm subsidies for corn. Other incentives should be developed to encourage farmers to diversify crops and farm in a more sustainable manner.

Keywords: ecosystem health, corn, subsidies, biofuels, monoculture

Superfoods: An Analysis of Human, Environmental, and Socio-Economic Implications

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Superfoods, such as berries, green tea, and turmeric contain various chemical compounds that promote well-being and aid in disease prevention. Marketing of superfood's health benefits has led to increased consumer demand which has resulted in various environmental and socio-economic impacts. Environmental impacts include land intensification and unsustainable agricultural practices. Superfoods contribute to an increased carbon footprint due to extensive transportation systems allowing for year-round availability of exotic foods for North American consumers. Socio-economic impacts include further disempowerment of local farmers as well as problems with product safety and quality regulations. Significant improvements are needed through robust land-use and labour regulation, trade agreements and increased access to knowledge-sharing programs to improve agricultural practices.

Keywords: Superfoods, phytochemicals, food miles, agroforestry, consumer demand, smallholder training

Effects of BPA Contamination on Ecosystem Health: Impetus for Precautionary Principle

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Bisphenol-A (BPA) is a synthetic chemical used in epoxy resins and plastics and is a known endocrine disruptor. BPA is a recognized contaminant of air, water, soil and food. Dietary ingestion from food container leachate is the main source of BPA exposure in humans. While BPA is known to readily break down due to a short half-life, persistent exposure causes adverse human and environmental health impacts. Impacts on human health include cancers and improper development of male and female reproductive organs, decreased metabolism and obesity, improper neurodevelopment and function, and diminished immune system function. Decreased viability of offspring, lower hatching rates and disrupted population dynamics occur in a variety of animal populations including fish, bird, amphibian and mammal species. Legislative efforts to mitigate these effects in North America have thus far been inadequate due to the body of research being inconclusive until quite recently. More research to confirm the dose response relationship on humans and other biota is required, along with detection methods of BPA, and studies on alternative product packaging.

Keywords: Bisphenol-A (BPA), endocrine disruptor, ecosystem health, human health

Gardening with native species

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Landscaping a home or business is a daunting experience and many decide to hire landscaping companies to do the work to make it easier for them. Unfortunately, there are very few companies that will landscape with exclusively native species as there is a stigma that they are hard to come by or don't grow as well as non-native plants. I will present about common non-native species in the garden (herbaceous and woody species) and why they are not the best to plant, as well as some native alternatives. I will also talk about uses of native species aside from just aesthetic use; many native species have a long history of being used as medicinal or edible plants. What species are used in this way and how are they prepared? Which species, common non-native species and native alternatives, are toxic to children and animals and what plants can be put in their place? Which species of non-native plants poison the soil to prevent other species from growing? I will talk about noxious weeds and why they should be avoided, as well as clarifying misconceptions about native gardens requiring more care. Gardening with native species doesn't require a complete re-do of a garden; it could be as simple as removing the most dangerous plants to a native landscape and replacing them with native alternatives, gradually incorporating native species into the garden.

Keywords: native species, gardening, plants, ecology, invasive species

The relative influence of patch size, isolation and quality on the population genetic structure of a specialist butterfly (Lycaena epixanthe)

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Effective, long-term management of threatened species experiencing habitat fragmentation requires an understanding of the genetic consequences of such habitat change on populations. In this study we investigated the influence of landscape structure (configuration and composition) on patterns of genetic variation among local populations of the bog copper butterfly (Lycaena epixanthe) which inhabits a naturally patchy habitat network. Based on 190 amplified fragment length polymorphism (AFLP) loci, generated from non-lethal samples of butterfly wing tissue, we related the observed spatial patterns of genetic diversity for 13 local populations (total n=505) to the surrounding landscape configuration (patch area and isolation) and composition (patch quality and relative abundance). We quantified the relative importance of each landscape element on patterns of genetic diversity using multiple regressions. Using this system as a model, the results from this study will contribute to efforts to predict future population trends and preserve evolutionary potential for threatened butterflies experiencing habitat loss, particularly those with specialized habitat requirements.

Keywords: conservation genetics, habitat fragmentation, butterfly, population genetic structure, habitat specialists

Ecosystem and Human Health Implications of the 2010 Haitian Earthquake

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The magnitude 7.0 earthquake that shook Haiti on January 12, 2010 caused several negative effects on environmental and human health. Although Haiti is a biodiversity hotspot, having high levels of endemic species, the existing prevalence of poverty has caused soil degradation, deforestation, and habitat fragmentation. Due to poor environmental health, inadequate infrastructure, and poverty, the effects of the earthquake were exceedingly severe. The casualty rate was estimated at 220,000 people with an additional 300,000 injured. If a better health care system had been available, many deaths could have been prevented and the spread of infection curbed. Aid provided by the United Nations, while beneficial, was speculated to cause an unfortunate outbreak of cholera claiming the lives of about 7,900 individuals. Poverty-reduction strategies must be implemented to address this issue as the root cause of poor ecosystem health. Possible elements of these strategies may include eco-tourism, education, and social programs for local citizens.

Keywords: Haiti, earthquake, ecosystem health, human health, eco-tourism.

Citizen Science and Conservation Authorities: the role of volunteer benthic monitoring in freshwater management

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The collection of freshwater monitoring information by volunteers is on the rise across North America. Citizen science has many well recognized benefits (e.g. promoting public education of ecosystem services, increased public contribution to decision making). Although citizen science does not currently achieve its full potential in the context of Ontario's Conservation Authorities (CAs), these quasi-governmental, watershed based management agencies could be an effective agent for use of citizen science since they regularly collaborate with municipal governments, private industry, and community members. There is a gap in our current knowledge of how, and how often, CAs use volunteer benthic monitoring (VBM) data in the assessment of their freshwater ecosystems.

My objectives are to determine the factors that contribute to 1) the maintenance of partnerships between citizen science groups and CAs and 2) the use of citizen science data by CAs in management. I used an inductive, mixed method approach including qualitative (interviews, document analysis and participant observation) and quantitative (survey) methods.

Preliminary results suggests CAs do not use VBM in freshwater management although all CA participants believed that to some degree the benefits of citizen science align with the institutional mandates of their CA. Most of them also believed that VBM should only be considered if their current programs were at risk. Despite these attitudes, there was an overwhelming desire to explore the potential use of VBM by CAs. This research will provide recommendations to CAs on how to improve the contribution of VBM to freshwater management.

Keywords: citizen science, volunteer, benthic monitoring, Conservation Authorities, public participation

Tree seedling establishment in response to warming and nitrogen addition

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In some northern temperate regions, areas previously used for agricultural production have been abandoned, leading to increased old field habitat. While in the absence of disturbance these old fields will develop into secondary forest, increased temperature and nitrogen deposition may alter the ability of woody species to germinate and compete with grasses and forbs. We transplanted newly germinated seedlings of four early successional species into plots of a field experiment receiving warming and nitrogen addition treatments. We predicted seedling survival would decrease with warming and nitrogen addition and surviving seedlings in the treatment plots would have decreased growth, leaf area and biomass. As we predicted, Malus coronaria (crab apple) seedlings had higher survival, leaf number, leaf area, and total biomass in control plots than in treatment plots. However, the other species had higher survival and growth in treatment plots than in control plots. Both the nitrogen addition and warming treatments increased grass biomass and percent cover, despite decreased soil moisture in warmed plots. Our results suggest that increases in temperature and nitrogen deposition may exert strong effects on survival and productivity in temperate old fields, particularly for species that are shade intolerant or drought sensitive. However, for shade tolerant species, increased aboveground grass biomass may provide a beneficial microclimate during stressful hot and dry periods.

Keywords: seedling, competition, warming, nitrogen

Effects of Future Warming to Alpine Lakes: The Case of Uinta Mountain Lakes, Utah, USA

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Warming in the last decade in the western U.S.A has increased more than the rest of the country (Saunders et al., 2008). From past research, scientists have found relationships between climate warming and limnological properties, such as decrease in ice-cover, which potentially affects the aquatic community composition (Smol et al., 2005). However, there still remains much uncertainty about how lakes will respond to future warming, particularly lakes in alpine areas, which experience a reduced amount of anthropogenic disturbances, but are expected to be sensitive to climate change (Battarbee et al., 2002). This study investigates air and water temperatures from spring 2010 to autumn 2011 at four lakes that span an elevational gradient in the Uinta Mountains (Utah, USA). Temperature for various water depths was measured at each site. Air temperatures were strongly linked to surface water temperatures, but showed little relationship to water temperatures at depth. Temperature measurements showed that surface water temperatures generally increased with decreasing elevation, but high elevation microclimates affected this relationship. Deeper water temperatures did not increase with elevation owing to differences in water chemistry and associated lake water transparency. Due to differences between weather conditions in 2010 and 2011, lake heating varied between the two years; heating at depth was much less in the colder year, and therefore the thermocline was shallower and weaker. This has important implications for the effects of future warming of these remote lake ecosystems.

Keywords: air temperature, water temperature, alpine lakes, Uinta Mountains, Utah

The Adaptive Capacity of Thermal Tolerance: Reintroduction of Atlantic Salmon into Lake Ontario

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Global climate change is projected to have widespread effects which could threaten the viability of natural populations. The ability of a species to adjust to climate change is modulated by its adaptive capacity, some of which involves an evolutionary response. Physiological processes of aquatic ectotherms critically depend on their thermal environment, such that the optima for performance often correspond to historic temperatures. In the face of impending climate change, conservation managers must consider augmenting or reintroducing individuals that have high thermal tolerance or those from a population with high adaptive capacity for temperature. Current restoration efforts for Atlantic salmon (Salmo salar) in Lake Ontario are focused on three source populations as candidates for reintroduction. In this study, I will evaluate the thermal tolerance and its underlying adaptive capacity in these candidate source populations using maximum heart rate measurements. The goal of my research is to identify which populations have the highest relative survival and thereby greatest likelihood for long-term restoration success in the face of projected warming temperatures.

Keywords: Thermal Tolerance, Atlantic

Habitat Selection of Eastern Population Tundra Swans during the non-breeding period

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"Understanding habitat selection is essential to assess a species' biological requirements, justify habitat conservation, predict effects of habitat change, and test hypotheses underlying ecological processes. Around 1970, Eastern Population (EP) Tundra Swans began including substantial quantities of waste agricultural grains in addition to traditional aquatic resources in their diet. Identifying how Tundra Swans select wetland and terrestrial habitats in these altered landscapes will enable conservation strategies to ensure adequate foraging habitats are available. Further, understanding habitat selection is essential to assess Tundra Swans' biological requirements, predict effects of further habitat change, and test hypotheses underlying ecological processes. We will use satellite telemetry data from 55 EP Tundra Swans to investigate selection of agricultural and wetland habitats during the non-breeding period. Due to the assumption that Tundra Swans respond to nutritional requirements and habitat availability and accessibility, we make the following hypotheses and predictions. We hypothesize that diurnal habitat selection will differ seasonally both within and between the Atlantic Coast, Great Lakes and Prairie regions. We predict that Tundra Swans will select wetland habitats during autumn, shift to agricultural habitats during late autumn and early winter and continue using agricultural habitats throughout spring. When swans occur in aquatic habitats we hypothesize that they will select wetlands based upon habitat accessibility and the density of shallow wetlands. We predict that swans will select palustrine and estuarine wetlands during autumn and winter, respectively, and lacustrine wetlands during spring because ice cover can preclude foraging in palustrine wetlands during spring migration. We also predict that swans will select habitat with greater wetland coverage and density. We will compare independent habitat variables at used locations to two random locations using mixed conditional logistic regression models. Habitat variables that will be compared between locations will be percent wetland cover, percent agricultural cover, longitude, and latitude. The type of wetland system (palustrine, lacustrine, riverine, estuarine, or marine) and wetland size also will be recorded when locations occur over wetland systems. Season, region, standardized date, and length of stay in region are habitat variables that will be the same between used and paired random locations. Candidate model sets will be developed using an information-theoretic approach and tested with Akaike's Information Criterion (AIC) to determine weight of evidence among competing EP Tundra Swan habitat selection models. Analyses are ongoing and I will present information about habitat selection obtained from this study to help inform conservation strategies for EP Tundra Swans and other waterfowl at staging and wintering areas."

Keywords: habitat, selection, ecology, waterfowl, tundra swan

Human Health and Ecosystem Effects from exposure to organochlorines and their byproducts, in particular 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

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2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is a persistent organic pollutant released as a by-product of industrial processes, and herbicide manufacturing and application. The most detrimental case of TCDD contamination occurred during the Vietnam War as a result of the US military's use of Agent Orange, a herbicide used as a defoliant. This had devastating effects on both ecosystems and human populations. Release of TCDD into the atmosphere, soils and water has led to bioaccumulation in animal species, including humans. This accumulation and exposure has been associated with a variety of acute and chronic conditions and diseases in humans such as chloracne and cancer.
These impacts continue to burden the health care system and the economies of both Vietnam and North America. In particular the poverty stricken Vietnamese population must contend with devastation of local food supplies. Recommendations to remediate the effects of organochlorine byproducts include regulatory requirements for monitoring, contingency plans and transparency in disclosing TCDD contamination events.

Keywords: Agent Orange, TCDD, ecosystem health, bioaccumulation, dioxins

Assessment of Multi-temporal RADARSAT-2 Polarimetric SAR Data for Crop Classification in Southwestern Ontario, Canada

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Complete and accurate information on crop types and acreages in the early season is desirable for crop growth modeling and yield forecasting. Conventionally optical satellite data have been widely used in crop classification and agricultural land use mapping. However due to unfavorable weather conditions, optical sensors cannot meet the time requirement when information on key growth stages is needed. Synthetic Aperture Radar (SAR) sensors are able to transmit microwave through haze, cloud, and light rain, therefore offer an alternative data source.
This study investigated the potential of multi-temporal Quadpol RADARSAT-2 data for crop classification using supervised Maximum Likelihood Classification (MLC) method. A total of five scenes of fine beam Quadpol RADARSAT-2 were acquired during the 2012 growing season (May to September) to identify five main crops(wheat, soybean, corn, forage, and field peas), and built up areas.
Classification accuracy assessments were conducted covering three aspects, namely the polarimetric parameters used for classification, the distributions which the classifier was based on, and the selection of multi-date dataset. Preliminary results show Assessments demonstrate that the best classification result with an overall accuracy of 91.0% was obtained using the five-date dataset. However under the same classification scheme, an overall accuracy of 87.8% can be achieved using only three dates of data given that the images cover critical crop growth stages.

Keywords: remote sensing, crop, classification, multi-temporal, polarimetric SAR

Evolutionary and plastic responses of sperm traits to increased temperatures in an ectothermic fish

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The Intergovernmental Panel on Climate Change predicts an average global temperature increase of 1.4-5.8°C by 2100. Poikilotherms are expected to be particularly sensitive to this temperature change because their physiological processes are dependent upon ambient temperatures. We investigated the phenotypic plasticity and evolutionary responses of sperm traits in guppies (Poecilia reticulata) to increased temperatures. Guppies with ancestral populations of 25°C (control) or 28°C were reared in either 25°C or 28°C in a 2 × 2 common garden environment experimental design. The plastic response to increased temperature was a decreased sperm length and velocity. The 'evolutionary' response was that guppies were able to evolve their sperm lengths after just 6 months of exposure to 28°C, yet sperm velocity showed no sign of evolution after 24 months, suggesting that sperm length may be crucial in reproduction in guppies. This study provides much needed data on the response of populations to increased temperature and will thereby help in preserving tropical aquatic biodiversity in the face of global warming.

Keywords: Sperm, guppy, climate change, evolution, phenotypic plasticity

Spatial Patterns of Soil Organic Carbon in Canadian Forest Regions: An Eco-Region Based Exploratory Analysis

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The goal of this study is to examine spatial patterns of soil organic carbon (SOC) in Canadian forest areas on the eco-region scale and to explore its relationship with different ecological variables. In this study, the first Canadian forest soil database published in 1997 by the Canada Forest Service was analyzed, along with other long-term eco-climatic data (1961 to 1991) including precipitation, maximum and minimum air temperature, NDVI, and elevation. Correlation analysis and exploratory spatial data analysis techniques were applied to determine the most dominant eco-climatic factor influencing SOC. We employed spatial autocorrelation analysis to explore how forest SOC is spatially distributed in Canada. A spatial error model was estimated to adjust for spatial effects and to estimate SOC patterns based on ecological and ecosystem property predictors. Findings from this study suggest that SOC in Canadian forest region is closely related to precipitation regimes. Although overall SOC content is influenced by both climatic and topographic variables, SOC patterns were shown to differ significantly among eco-regions, thus verifying the eco-region classification framework for soil zonation mapping in Canada.

Keywords: soil organic carbon, eco-region, spatial distribution

Mathematics in Nature

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An exploration of mathematical constants, patterns, and relationships that can be found in the natural environment, including the "Golden Ratio", fractals, and chaos theory, with a discussion of research in the field of mathematical biology that has advanced understanding of ecological systems.

Keywords: mathematical biology, biomath, models

Invisible eyes monitoring the Earth - using remote sensing to reconstruct 3-D campus

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The development of satellites and sensors provides unprecedented chance to monitor the Earth. Remote sensing techniques have been used in natural disaster management, global climate change, eco-system evaluation, and researches in uninhabited regions (e.g., polar areas). It affords continuous observation, quickly response to emergencies, and covers large areas in a cost effective way. The improvement of spatial, temporal, and spectral resolution in new launched satellite sensors gives further opportunities to monitor urban areas. In this study, a stereo pair of high resolution satellite images is used to reconstruct buildings and trees in a campus. A digital surface model (DSM), which represents the Earth surface elevation, is generated from stereo imagery based on stereo vision and photogrammetry techniques. Building's location is identified by color of ground objects and their spatial connection. Building's height is derived from the DSM with the assistant of building's location information. The Normalized Difference Vegetation Index (NDVI), together with height information, is utilized to separate trees with other objects. Finally, buildings and trees are reconstructed in a 3D environment. It provides a virtual campus for visualization, city planning, spatial analysis, new facility site selection, and decision making.

Keywords: Remote sensing, stereo imagery, 3D model, buildings, virtual earth

Road salt impacts on surface water quality

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Road salt can keep roads free of ice and snow for safe winter traveling in northern climate areas. It is widely used in Canada during winter time. Nevertheless, road salt comes along with threaten to the infrastructure and the environment especially in urbanized areas with high road network densities. This study uses regression analysis to investigate the correlations between Chloride concentrations in surface water with different categories of roads, elevation and slope. Based on the linear regression model, the threaten weights from different types of roads, elevation, and slope can be decided. In this way, a road salt risks map based on the transportation network can be developed.

Keywords: road salt, surface water quality, chloride concentration, regression, GIS analysis

L'énergie peau neuve: How to transform agricultural waste into renewable biofuel?

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Increased world population growth and industrial development in recent years has resulted in a higher energy demand, which has caused crude oil prices to reach record high levels (Margaritis 1980). Additionally, the high-power consumption lifestyles that our Society has developed coupled to concerns over CO2 emissions and greenhouse effect have resulted in renewed interests in biofuels and alternative energies, which are produced via fermentation processes from renewable resources (Hoekman 2009). Liquid biofuels, such as biobutanol, bioethanol and biodiesel; can compensate the high demand of oil based liquid fuels. (Yang 2008; Dermidas 2009; Naik 2012). Unfortunately, the main reason alternative and renewable energies are difficult to implement in the real world is that they are diluted. In order to compete economically with oil, biorefineries must adopt and adapt the process integration approaches used by oil refineries in order to enhance their economics (Campbell 2006). An analysis done in 2006 by National Research Council Canada predicts that for 2050 a growth of biofuels and bioenergy global market of 150 billion (US$) will be achieved (NRC-CNRC 2006). Biobutanol is a superior renewable biofuel to bioethanol, and can be used in cars or as an industrial chemical commoditiy in the plastics industry and as a foodgrade extractant in the food and flavor business. Also, butanol has a greater energy density and minor vapor pressure than ethanol, intrinsic better qualities as fuel (Dürre 2007; Cascone 2008). Butanol can be produced during fermentation by anaerobic bacteria, such as Clostridium acetobutylicum in a process denominated as ABE (i.e. acetone, butanol, ethanol fermentation). In order to generate a green technology, we are looking to establishing a technological infrastructure to produce it from sustainable and renewable lignocellulosic materials. Usually, corn cob and corn stover are residues left behind on collected corn fields, as a measure to maintain soil quality (Jansen and Lübberstedt 2012). However, U.S. Department of Agriculture report from January 2013, indicates that soil quality would not decrease if the cobs are removed. Furthermore, this agricultural waste makes up 20 % of residue by weight, so it can provide around 50 million tons of cobs every year (UPI 2013). In Canada, the provinces of Ontario and Quebec are the two principal corn producers. In 2011, Ontario produced 70% percent of the country crop. (OMAFRA 2011). So, around 1.4 million tons per year of cobs can be used in Ontario. Cob can be described as a lignocellulose layers matrix with economic and environmental horizons. For example, some oligosaccharides co-obtained from cob outer layer chaff can be processed via extraction to recover arabinoxylans (AX) valuable components. Also the remainder of the woody-part of the cob, which is predominantly composed of cellulose, can be converted via anaerobic fermentation into butanol. (DOE 2006) This approach can transform cobs into new commercial products and can be integrated in the biorefinery scheme, without competing with food supply. On the other hand, Jerusalem artichoke (Helianthus tuberosus) is a native plant of North America, widely distributed in Canada, Unites States and Europe. It has been reported to yield one of the maximum carbohydrate concentrations of known crops, minimal fertilizer requirements and high tolerance to

frost. (Dorrel 1977) This plant can develop to about six feet in height with branches and yellow flowering heads, and produces tubers which grow in the ground. These tubers contain inulin which is a polymer mainly formed by glucose and fructose in a 30 to 1 ratio (Fleming 1979; Kierstan 1980) and can be used as a substrate for bioethanol (Margaritis and Bajpai 1981). Previous investigation suggests a suitable option to use inulin sugars from Jerusalem artichoke as another biomass source for the production of biobutanol. (Marchal, Blanchet et al. 1985) Although researchers have been investigated different substrates for butanol fermentation, there is a lack of knowledge if sugars from corn cobs and Jerusalem artichoke can be used as substrates. Therefore, the study of microbiological conversion of sustainable and scalable lignocellulose biomass and inulin sugars available in Ontario, into butanol energy feedstock; is a key research for the technological development of the province and the nation (OMAFRA 2008) Clostridium is an anaerobic bacteria genre which can metabolize different sugars, hexoses and pentoses, to grow and produce acetone, butanol, ethanol, H2 and CO2. The industrial biotechnological importance of this microorganism has been broadly investigated during the last decade. (Dürre 2007; Choi, Lee et al. 2012; López-Contreras 2012) Furthermore, yields and productivities can be improved by immobilized cell reactors (Bajpai and Margaritis 1986) in order to deliver a physical understanding in how the Clostridium beijirinckii cell can interact with the immobilization surface and how biofilms can positive or negative affect the cells behavior and biobutanol production. The motivation of this research is to assess the conversion of feasible lignocellulosic biomass into butanol done by immobilized anaerobic bacteria in a continuous fermentation and to evaluate a coupled pervaporation recovery stage.

Keywords: butanol alternative biofuel fermentation lignocellulosic biomass

Using optical signatures of the fish-killing alga Heterosigma akashiwo to characterize algal physiology

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Harmful algal blooms (HABs) represent a significant threat to ocean ecosystems, and due to their unpredictable distribution, toxicity and duration, characterizing the magnitude of HAB events remains a challenge. Even when blooms are readily accessible, determining the community composition and toxin levels requires extensive and tedious sampling and microscopic enumeration techniques, even before understanding which of the myriad of toxins should be studied.
In this study we examined the fish-killing alga Heterosigma akashiwo. The mechanism of toxicity of Heterosigma akashiwo is variable, but we do know it is associated with different stages of growth. HAB progression of this alga involves physiologically distinct growth phases, with only the stationary phase considered to be toxic. Therefore accurate temporal characterization is critical to understanding bloom physiology. Here we have successfully used bio-optical characteristics to delineate physiological states, specifically absorbance and fluorescence over different growth conditions.

Keywords: Harmful algal blooms, bio-optics, oceanography, fluorescence

An Analysis of the Rio +20 Discourse Using an Ability Expectation Lens

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The aim of the study was to content analyse documents related to Rio +20 through an ability expectation lens and to evaluate the impact of the exhibited ability expectations on marginalized groups, specifically people with disabilities. An ability expectations implies that certain abilities are seen essential within a discourse (Wolbring 2011). Content analysis of academic and grey literature sources covering Rio+20 using the software's Atlas-ti and knowledge share. Academic databases being used include EBSCO; 275 articles have been found relevant (English language, not books and PDF available). Non-academically sources included the International Institute for Sustainable Development (IISD) Reporting Services and Google. Data collection continued until the end of August 2012 in order to include the literature post-dating Rio+20, which offers a rich source of newspaper articles. From the articles we can identify certain ability expectations (e.g. the ability to consume, the ability to work, etc.) which come with certain consequences, such as the lack of development in certain economies due to exclusion. This exclusion can be related to climate, energy, and environmental justice, or rather lack of justice; exclusion can be detrimental to a population, leading to issues with health, poverty, and education. The authors submit that this may lead to further marginalization of certain groups. This marginalization can lead to even greater health, poverty and education issues for these marginalized groups. This research is beginning to reveal the potential issues which may arise in the climate change discourse.

Keywords: Ability expectations, Rio +20 discourse