

**7th ANNUAL
EARTH DAY
COLLOQUIUM**



April 23rd, 2010

Book of Abstracts

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Schedule of Talks

Time	
8:45 – 9:00	<i>Registration and Continental Breakfast</i>
9:00 – 9:10	<i>Greetings from the Centre for Environment and Sustainability (SEB 2200)</i>
9:10 – 9:45	<i>Keynote Speaker – Dr. Dean Jacobs (SEB 2200)</i> <i>Spirit of the Land: Sustaining the Circle of Life</i>

Session 1: 9:50 – 10:35

Concurrent Session 1a: SEB 2200

Time	Author(s)	Title
9:50 – 10:05	Dina Najjar	Farming Desert Land: Social & Environmental Sustainability in Egypt's Resettlement Scheme
10:05 – 10:20	Zainub Ibrahim	Environmental Management and Egyptian Tourism
10:20 – 10:35	Sal Spitale	Succession in the Understory of Red Pine Plantations in Southern Ontario
10:35 – 10:50	<i>Break/Poster Session</i>	

Concurrent Session 1b: SEB 2202

Time	Author(s)	Title
9:50 – 10:05	James Voogt	Intentional Modification of Urban Climates: The Impact of Roof Albedo Increase on Urban Air Temperature at Daily Through Annual Time Scales
10:05 – 10:20	Lauren Barhydt	North House: Energy, Buildings and People
10:20 – 10:35	Nasrin Farhangi	Synthesis of Functionalized Graphite Sheets – TiO ₂ Nanocomposites by using Sonication
10:35 – 10:50	<i>Break/Poster Session</i>	

10:50 – 11:10	<i>Invited Speaker – Prof. Jamey Essex (SEB 2200)</i> Foodsheds, Locavores, and Backyard Chickens: The Promises and Perils of Local Food Movements
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Session 2: 11:15 – 12:15

Concurrent Session 2a: SEB 2200

Time	Author(s)	Title
11:15 – 11:30	Alissa Mazar	Marx, Nature and Environmentalism
11:30 – 11:45	James Southworth	Rights-based Liberalism and Environmental Justice: Are they Compatible?
11:45 – 12:00	Hélène Lawler	Is There Space for Sustainability? Neo-Liberalism, Consumer Culture and Alternative Food Systems
12:00 – 12:15	D. Matthew Dunnet	Sea Level Rise Threatening Small Island States: A Commentary on Policy Options

Concurrent Session 2b: SEB 2202

Time	Author(s)	Title
11:15 – 11:30	Anton Lamers	Low-Input Closed Loop Algae Culture as a Lipid Source for Biodiesel Conversion
11:30 – 11:45	Mohammad M. Hossain	Pyrolysis of Lignin to Produce Biopesticide
11:45 – 12:00	Gaurav Goel	Experimental Study of Dynamic Effects in Capillary Pressure
12:00 – 12:15	Mohammad Siddiquee	Lipid Extraction and Biodiesel Production from Municipal Primary Sludge

Lunch at the Spoke
12:15 – 1:30

1:30 – 1:50	<i>Invited Speaker – Prof. Doug Haffner (SEB 2200)</i> Collapse: Food Webs of the Great Lakes are in Peril
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Session 3: 1:55 – 2:55

Concurrent Session 3a: SEB 2200

Time	Author(s)	Title
1:55 – 2:10	Melissa Raffoul and Rachel White	Don't Drink the Water: Ecological Responses to Human Influences on Lake Naivasha, Kenya
2:10 – 2:25	A.E.M. Tanvir Hassan	An Assessment of Ground Water Level in Bangladesh
2:25 – 2:40	Shohan S. Ahmad	Fuzzy Risk Analysis for Sustainable Water Resources Management
2:40 – 2:55	Tekleab Gala	Monitoring the Hydrology of Prairie Wetlands During the Snow-Free Period: A Multi-temporal Analysis fo LANDSAT ETM +, RADARSAT-1 SAR and Ancillary DEM Data from LiDAR
2:55 – 3:10	<i>Break/Poster Session</i>	

Concurrent Session 3b: SEB 2202

Time	Author(s)	Title
1:55 – 2:10	Bipro Ranjan Dhar	Application of Peroxide Regenerated Iron Sulfide Control (PRI-SC) Technology in High Pressure Reactor for Sludge Treatment
2:10 – 2:25	Rajib Roy Chowdhury	Fate of Estrone in Solar Photodegradation
2:25 – 2:40	Shahram Amirnia	Concentration, pH, and Surface Charge Effects on Copper Biosorption by <i>Saccharomyces cerevisiae</i>
2:40 – 2:55	Anupam Agarwal	Cost Effective Technologies for Wastewater Recycling
2:55 – 3:10	<i>Break/Poster Session</i>	

3:10 – 3:30	<i>Invited Speaker – Sean Galloway (SEB 2200)</i> Urban Design: It's a Place, Not a Project
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Session 4: 3:35 – 4:35

Session 4: SEB 2200

Time	Author(s)	Title
3:35 – 3:50	Victoria Hewlett	Understanding the Toxicity of the Fish-killer Culprit, <i>Gymnodinium mikimotoi</i>
3:50 – 4:05	Ross D. Breckels	Pollution-induced Behavioural Evolution in the Brown Bullhead
4:05 – 4:20	Dave Cooper	Effects of Chemical and Mechanical Weathering Processes on the Degredation of Plastic Beach Debris
4:20 – 4:35	Katrina Iglie	Anemic Corals: The Role of Trace Metals in Coral Bleaching

Talk Abstracts

The abstracts in this book are reproduced verbatim from the submissions by the presenting authors; no attempts were made to edit them. The contents of the abstracts and the presentations are entirely the responsibility of the presenters.

Keynote Address: "Spirit of the Land: Sustaining the Circle of Life"
Dr. Dean Jacobs

Dean Jacobs will speak about his over three decades of public service working: to help preserve and conserve natural and cultural heritage; to restore the rights and improve the governance capacity; and to promote the sustainable development and community well being of the WIFN within its homeland.

Biography:

Dean Jacobs is the Consultation Manager for the Walpole Island First Nation, the founding Director of the Walpole Island Heritage Centre and was instrumental in the establishment of Nin.Da.Waab.Jig (meaning those who seek to find) a community-based research program at Walpole Island First Nation (WIFN). The work of this community-based group has been recognized internationally by scholars as one of the best First Nation community research offices in Canada and the Walpole Island Heritage Centre was designated by Department of Indian Affairs and Northern Development as a "First Nations Effective Practices" site.

The WIFN community is nestled between Ontario and Michigan at the mouth of the St. Clair River. Bkejwanong (meaning where the waters divide) has been occupied by First Nation peoples for thousands of years, it is today home of Ojibwa, Potawatomi and Ottawa as represented by the WIFN - The Council of Three Fires.

Walpole Island is blessed with a unique ecosystem including 6,900 hectares of the richest and most diverse wetlands in the entire Great Lakes region.

Invited Speakers

***Foodsheds, locavores, and backyard chickens:
The promises and perils of local food movements***
Prof. Jamey Essex

This presentation examines the place of locality and localization in recent food activism and politics, emphasizing the importance of the local scale in such movements while also recognizing the limits of localization in correcting the wide range of inequalities in the conventional food system. Numerous consumer groups, social movement activists, and researchers argue passionately and persuasively in favor of localization as the appropriate response to the environmental, social, and economic harms of industrial and globalized food. While laudable, it must also be recognized that localization is not a panacea for the wide range of inequalities that exist within the food system as currently structured, and that many manifestations of local food movements can actually exacerbate other social and economic problems. I will argue instead for a form of food localization that centers considerations of urban space, regional planning, and vulnerable and marginal populations.

Biography:

Jamey Essex is assistant professor of political science at the University of Windsor, with an academic background in geography and history. His research focuses primarily on political and economic geographies of globalization, development, and food and agriculture. His recent and ongoing research has examined the geopolitics of food and development aid, constructions of hunger and the hungry in food aid programs, and local food activism in urban contexts. He has published work on these and other topics in *Geoforum*, *Antipode*, *Environment and Planning C*, and *Studies in Political Economy*, and has been active in local food activism and community gardening in Windsor, Ontario.

Collapse: Food Webs of the Great Lakes are in Peril
Prof. Doug Haffner

Although ecologists continue to argue on behalf of concepts like equilibrium and steady states in aquatic ecosystems, change is the law of nature. Everything changes, including supposed stable concepts such as food webs. Recent changes in foraging habits by herring gulls, collapse of prey fish populations and decreased measures of fitness in top predators provide strong evidence that the Great Lake food webs are in or are approaching a state of collapse. There is little evidence that a decrease of primary production has led to this collapse, and therefore it is predicted that shifts in energy flow within the food webs are the main cause of the observed changes. This presentation considers the relative importance of key stressors, nutrients, species invasions, contaminants and prey stocking, and presents evidence that we need to manage Great Lakes fisheries within their food webs, and account for the combined effects of multiple stressors.

Biography:

Doug Haffner did his PhD at the University of London, England on the production dynamics of reservoirs. He then became interested in the questions associated with carbon flow in aquatic food webs, and linked this interest with the bioaccumulation of persistent organic carbons such as PCBs in freshwater ecosystems. These initial bioaccumulation models were used to set environmental guidelines with respect to the development and management of fish consumption guidelines. Later research recognized how these persistent chemicals were tracers of bioenergetic processes in food webs such that body burdens of superhydrophobic chemicals represented a measure of total food intake by fish of different age and size classes. Research also considers the role of resource partitioning in the speciation processes of ancient lakes, these studies are carried out in the Malili Lakes of South Sulawesi, often referred to as Wallace's Dream Ponds. Doug is currently a Senior Canada Research Chair and the Founding Director of the Great Lakes Institute for Environmental Research.

Urban Design: It's Place Not a Project
Sean Galloway

Biography:

Sean Galloway was hired in 2007 as the City of London's Urban Designer. He has worked in various capacities for municipalities in Australia and Canada. He was the lead municipal urban designer on the largest greenfields development area in North America and assisted municipalities with implementing the State Government of Victoria's Melbourne 2030 Planning Strategy.

Sean holds a Bachelor's of Environmental Studies in Planning from the University of Waterloo and Master's Degree in Urban Development and Design from the University of New South Wales in Sydney, Australia. He is a member of the Ontario Professional Planning Institute, the Urban Land Institute and a Board Member of the London and Regional Children's Museum. Sean has seen what cities around the world can become; he has seen welcoming, integrated, livable communities; and he sees lots of potential in London.

Session 1a

Farming Desert Land: Social and Environmental Sustainability in Egypt's Resettlement Scheme

Dina Najjar (Anthropology, University of Western Ontario)

This paper presents a case study from the Mubarak Resettlement Scheme in Egypt on the social and environmental sustainability of resettlement, which focuses on eradicating poverty by providing landless farmers with land to farm on. While the government is reluctant to give women land access, development agencies, which provide funding and services in the settlements, encourage women's access to land. Gender constitutes a strong determinant for the success of resettlement. While men are reluctant to relocate with their families, women, often accompanied by their brothers, set down roots with their children in the new land. I propose to examine the gendered impacts and strategies in the new lands in settlements predominantly inhabited by women, using standard ethnographic methods, such as participant observation, focus group discussions, and interviews. It is concluded that settlement in Egypt is not sustainable limited by the availability of water and the isolation and marginality of farming land. Despite the fact that in the long term resettlement is not sustainable, it offers settlers a new land and hope for a better life.

Keywords: Egypt, resettlement, desert farming, sustainability, ethnographic methods

Environmental Management and Egyptian Tourism

Zainub Ibrahim, Geoffrey Wall (Geography, University of Waterloo)

This study examines the growth of tourism and the subsequent issues related to environmental policy. Egypt has a substantial history of environmental policy but environmental degradation still occurs for a variety of reasons. This presentation outlines the evolution of environmental policy in Egypt, and presents key limitations that hinder the implementation of these policies. These limitations are based on an examination of environmental policy to Red Sea tourism practice and development. These were determined by analysing laws and legislation, conducting in-depth, unstructured interviews with key informants, and through observation and recording along the Egyptian Red Sea coast. It was found that external and top-down initiation of environmental awareness, multiplicity of institutions and authorities, lack of a clear political voice for the environment, poorly-planned privatization, and changing role of government impede the practice of environmental policy.

Keywords: Egypt, Red Sea, tourism, environmental policy

Succession in the Understory of Red Pine Plantations in Southern Ontario

Sal Spitale, Stephen Murphy, Maren Oelbermann, Bill Parker (Environment and Resource Studies, University of Waterloo)

Thousands of hectares of red pine (*Pinus resinosa* Ait.) plantations were established during the early 20th century in southern Ontario in order to prevent soil degradation on abandoned unproductive farm lands. Concern over the health of these plantations and a desire to increase vegetative diversity has prompted a more thorough understanding of the succession of these plantations. The purpose of this study is to determine how conventional thinning regimes for red pine plantations in southern Ontario affect the diversity of the understory vegetation and soil characteristics over time. The understory was examined by measuring leaf area index (LAI), determining herbaceous and tree diversity, and analyzing soil chemical, physical, and biological characteristics. Initial results indicate major limiting factors to understory regeneration in plantations are a deep litter layer and high LAI (darker understory). Understory diversity increased over time in plantations, however, there was little overlap in herbaceous species composition in plantations when compared with reference forests. These findings suggest earlier thinnings would more rapidly increase understory diversity and produce conditions more similar to reference forests.

Keywords: red pine, plantation, understory, succession, biodiversity

Session 1b

Intentional modification of urban climates: The impacts of roof albedo increase on urban air temperature at daily through annual time scales.

James Voogt (Geography, University of Western Ontario), E. Scott Krayenhoff (Geography, University of British Columbia)

The impacts of proposed roof albedo modifications in two Chicago IL neighbourhoods are assessed using a coupled one-dimensional modeling system. The modeling system combines urban and soil-vegetation surface parameterization schemes with a one-dimensional (1-D) boundary-layer model. The combined model is evaluated with measurements from Basel, Switzerland. Clear-sky summertime results from Chicago show reductions in diurnal maximum air temperature for the residential neighborhood of -1.1°C, -1.5°C and -3.6°C for uniform roof albedo increases of 0.19, 0.26 and 0.59, respectively. The air temperature reductions are about 40% larger in the downtown area. Actual impacts will be smaller because the modeling approach ignores advection; implementing a lake breeze scenario leads to a decline in the temperature reductions by 80%. Yearly average temperature decreases for a 0.59 roof albedo increase (assuming no advection) in the residential

neighbourhood are about -1°C , with summer (winter) reductions about 60% larger (smaller). Annual cooling degree day decreases are approximately offset by heating degree day increases and the frequency of very hot days is reduced.

Keywords: urban climate, urban heat island, atmospheric modelling

North House: Energy, Buildings and People

Lauren Barhydt (School of Architecture, University of Waterloo)

The North House is a prototype solar-powered home, designed for northern climates, that produces more energy than it consumes. It was designed and built by students and faculty from the University of Waterloo, Ryerson University, and Simon Fraser University, working with engineering professionals and custom fabricators. The project finished fourth in the US Department of Energy's 2009 Solar Decathlon competition, where it was toured by almost 20,000 people.

North House is designed from a paradigm that sees buildings not as stand-alone objects, rather as systems that respond to interactions with inhabitants and the exterior environment. From this perspective, energy consumption in buildings is considered a socio-technical problem, one that must be solved by addressing both the energy consumption of technology and the motivations of those using it. North House features two 'responsive' elements: a window-wall that manages the interior temperature by harvesting solar heat when it is needed, keeping it out when it is not; and a digital control and monitoring system that supports the inhabitants in living an energy-aware lifestyle by providing meaningful feedback.

Keywords: green buildings, interaction design, solar technology

Synthesis of Functionalized Graphene sheets -TiO₂ nanocomposites by using sonication

Nasrin Farhangi, Yaocihuatl Medina-Gonzalez, Bo Chen and Paul Charpentier (Chemical and Biochemical Engineering, University of Western Ontario)

Recently, several reports have examined different carbonaceous materials for enhancing the properties of TiO₂ due to their high mechanical and chemical stabilities, superior electronic properties along with higher surface areas. Most of these studies have focused on activated carbon and recently carbon nanotubes (CNTs). When using these mesoporous materials with small band gap, TiO₂ can be dispersed on their surface with greater uniformity creating active sites for photovoltaic cells. After interfacing of the materials, electrons of TiO₂ and carbonaceous materials flow between one another to align the Fermi energy levels

and extend absorption of TiO₂ to the visible region for producing high efficiency photovoltaic cells. One kind of carbonaceous material that has not been studied yet is functionalized graphene sheets (FGS). These materials have very high surface areas per volume and can be synthesized inexpensively in low pressures in comparison to CNTs. They have different functionalized groups such as hydroxyl, carboxyl and carbonyl on their surfaces so functionalization is not required.. In this report, functionalized graphene sheets used for improving TiO₂ photocatalytic reactivity using sonication TiO₂ nanoparticles well dispersed on the surfaces and between the sheets uniformly without any observation of agglomeration. This morphology played a key role on the UV-vis absorption of the materials obtained which presented a dramatic enhancement compared to Graphene sheets and TiO₂.Synthesized materials can be used in water and air treatment and solar cells as well.

Keywords: FGSs, TiO₂, UV

Session 2a

Marx, Nature and Environmentalism

Alissa Mazar (Sociology, University of Western Ontario)

The works of Karl Marx have been and are frequently misused and misinterpreted (Fromm 1978:1). Hence, Marx declared that he was not a Marxist (Letters 2000). Some argue that Marxism and environmental concerns are antithetical. This misconception is based largely on the denial of Marx's early work. I argue that a thorough reading of Marx's early texts show quite the opposite about such misgivings. Through the dissolution of private property, nature will no longer be commodified and exploited. Marx's conception of humanism is oriented to environmental stewardship. First, I examine the epistemological battle between historical materialism and German idealism. Next, I explore Marx's critique of historical narratives as reflecting a metaphysical mystification, increasing man's alienation from nature. I then examine how the capitalist mode of production negates self-realizing labour activity while highlighting how nature, under capitalism, is commodified and used as a means to an end. Finally, I discuss how Marx's proletariat revolution will not only liberate man from exploitation, but also nature. Marx's conception of humanism and species-being include nature and the decommodification of the environment. The human essence is intertwined with and realized through nature. Environmental sustainability flows from Marx's revolution and his conception of humanism, having the possibility of creating a materialist environmentalism.

Keywords: Marx, Humanism, Environmentalism, Nature, Species-being

Rights-Based Liberalism and Environmental Justice: Are they Compatible?

James Southworth (Philosophy, University of Western Ontario)

Rights-based liberalism is a thoroughgoing anthropocentric theory. The principles of justice are arrived at, and apply to, rational, self-interested and independent human beings. Non-human animals and nature are thereby excluded from liberal theories of justice. They are valued only insofar as human beings value them. This atomistic liberal ontology is clearly antithetical to a holistic environmentalism (ecocentrism), which highlights the interdependence of natural systems. Rights-based liberalism and environmentalism seem to be irreconcilable. I will argue that a lot of headway can be made in reconciling the two. The starting ground for this reconciliation is Martha Nussbaum's capabilities approach, which provides a much more amenable social ontology to environmentalism than the traditional social contract model. By extending the capabilities approach to include environmental justice, I argue that many of the shortcomings of both liberalism and ecocentrism can be overcome. Although the capabilities approach can take us a long way toward integrating environmental justice within a rights-based liberal framework, it is ultimately insufficient. Some kind of utilitarian metric is necessary for environmental justice.

Keywords: liberalism ecocentrism capabilities

Is There Space for Sustainability? Neo-liberalism, Consumer Culture and Alternative Food Systems

Hélène Lawler (Political Science, University of Western Ontario)

Over the last couple of years, local, organic food has begun to make a revival. New farmers markets are popping up all over the map, CSAs and local buying clubs are becoming increasingly popular, and health-food stores are actually starting to carry real food again. Indeed, for proponents of alternative food systems, the picture is starting to look almost rosy. Yet a necessary requirement of holistic Sustainability is economic sustainability. As the drive for keeping food prices low coupled with our culture of efficiency push small, organic farmers towards economies of scale, "value-added" products, and taking on the burden of getting their products to venues convenient for consumers, the question must be asked: is there really space in a consumer-oriented, neoliberal society for sustainable food production on a scale larger than that of a niche market?

Keywords: Sustainable food systems, neoliberalism, consumerism

Sea Level Rise Threatening Small Island States: A Commentary on Policy Options

D. Matthew Dunnet (Political Science, University of Western Ontario)

Scientists have recorded and modeled sea level rise, and predict that with a further increase in temperature, global sea levels could rise drastically. Small island states are already suffering from sea level rise, and global warming will result in many states becoming uninhabitable within a few decades to the end of the century. Despite the threat to these island states, little has been done in terms of mitigation and adaptation in these states. This study analyzed many scientific reports, including IPCC Assessment Reports, as well as various scholarly articles and books to assess the threat and response in specific nations like Tuvalu and the Maldives. It concludes that both multilateral and bilateral international agreements have to be pursued in terms of climate refugees, territorial reallocation, and government survival. Domestic and international financial sources must begin to fund adaptation projects to relocate entire island state populations in anticipation of failed global mitigation. Without such measures, entire states and communities of people could disappear, as their Weberian notion of statehood and their unique cultures will be lost.

Keywords: Climate-Change, Sea-level-rise, Small-island-states, Refugees

Session 2b

Low-Input Closed Loop Algae Culture as a Lipid Source for Biodiesel Conversion

Anton Lamers (Engineering, University of Guelph), David Lubitz (Engineering, University of Guelph), Rob Nicol (Land Resource Science and CARES Centre, University of Guelph)

Algae have been proven to be a plausible lipid source for biodiesel production and could possibly be a main source of biodiesel in the future. The research presented here is affiliated with the Ridgetown Campus Biodiesel project which is a closed-loop soybean-to-biodiesel farm scale project which aims to maximize benefits to soybean producers and the local rural economy. The algae research aspect aims to assess the feasibility of using wash water from the biodiesel production process as a medium for algae growth, while remediating the water for re-use. The lipids inside the algae may be extracted to use as a feedstock for biodiesel production and the algae residuals could be used as feed for livestock. Emphasis is placed on processes that are adaptable to farm locations and have minimal input requirements to lower the energy requirements and increase efficiency.

Substantial analysis has characterized the wash water from several biodiesel plants and various species of algae have been cultured at the University of Guelph. Initial

screening of over 25 strains of algae suggests that *Chlorella* sp. could be feasible for cultivation in wash water-based media and relatively simple to grow. The continuing focus of the research is on larger scale tests and chemical constituent remediation.

Keywords: Biodiesel, Algae, Remediation

Pyrolysis of lignin to produce biopesticide

Mohammad M. Hossain, Ian M. Scott, Cedric Briens, Franco Berruti, Brian D. McGarvey, Ken K.-C. Yeung, Luis A. Caceres (Chemical and Biochemical Engineering, University of Western Ontario)

Alternatives for synthetic pesticides are desirable to reduce environmental problems. A novel source of bioactive products is potentially available in plant biomass. Chemicals from agricultural crop residue could become value-added products, including solvents and pesticides. Lignin is one of the major components of plants and offers many diverse and bioactive chemical compounds. The main objective of the work is to identify lignin-pyrolyzed products, and to determine if the resulting chemicals have bioactivity against selected crop pests.

Lignin was fast pyrolyzed in a fluidized bed reactor at 550°C to produce bio-oil. Preliminary experiments have examined the bioactivity of bio-oil using 3 insects, the Colorado potato beetle (*Leptinotarsa decemlineata*), the cabbage looper (*Trichoplusia ni*) and the pea aphid (*Acrythosiphon pisum*). We observed that potato leaves treated with 30 mg/ml bio-oil were toxic to the potato beetle 2nd instar larvae within 2 days and bean leaves treated with 3 mg/ml bio-oil caused a reduction in pea aphid reproduction. Cabbage leaf treated with bio-oil was not active against the cabbage looper 2nd instar larvae.

Keywords: lignin, pyrolysis, biopesticide, bio-oil

Experimental Study of Dynamic Effects in Capillary Pressure

Gaurav Goel (Civil and Environmental Engineering, University of Western Ontario)

In the past 200-300 years due to increased human and industrial activities many types of hazardous chemicals have made their way into the surface and subsurface environments. Migration of these immiscible fluids/chemicals in subsurface is governed by gravitational, buoyant, viscous and capillary forces. Traditional equations that describe two-phase flow in porous media are based on conservation equations which are coupled to material dependent constitutive equations. The capillary pressure-saturation (Pc-S) relationship is one of the important constitutive equation used to solve the system of multiphase flow equations. It is both flow direction and rate of change of saturation dependent. The flow direction dependence of Pc-S curve has been identified as hysteresis. The dependence on rate of change of saturation is called dynamic effects and is relatively new. Traditional experiments to obtain Pc-S relationship may take the duration of weeks and months whereas the dynamic experiments are conducted under non-equilibrium conditions and takes less time to conduct. In this presentation an experimental study to determine dynamic effects in oil-water system will be presented.

Keywords: Two-phase flow, non-equilibrium effects, dynamic coefficient, subsurface, capillary pressure

Lipid Extraction and Biodiesel Production from Municipal Primary Sludge

Muhammad Siddiquee, Sohrab Rohani (Chemical and Biochemical Engineering, University of Western Ontario)

Worldwide oil crises and reducing fossil fuel reserve act as a driving force to search alternative fuels. Biodiesel is the most attractive among the options explored for alternative sources, but higher production cost due to costly raw materials. Production of biodiesel from a free of cost or negative cost waste source is very important. Municipal primary sludge is a potential source of various lipids like oil, fats and greases that can be extracted and converted to biodiesel. In this study lipid was extracted from dried primary sludge, collected from Adelaide Pollution Control Plant, London, ON, by using various organic solvents and the maximum amount extracted lipid was 18 (wt/ wt) % on the basis of dry primary sludge. The FFA present in lipid was 40% (wt/wt) on the basis of extracted lipid that contained higher percentage of C16 & C18 and the maximum yield of biodiesel was 14 % (wt/wt) on the basis of dry primary sludge. The amount of lipid and the quality of biodiesel was determined by GC equipped with FID.

Keywords: Lipid, Biodiesel, Sludge, Free Fatty Acid (FFA)

Session 3a

Don't drink the water: Ecological responses to human influence on Lake Naivasha, Kenya

Melissa Raffoul and Rachel White (Biology, University of Western Ontario)

Lake Naivasha is the second largest freshwater lake in Kenya and is located in the Great Rift Valley Province. It is one of the most fertile agricultural regions in the country. As a result, economic activity, especially flower growing, is increasing around the lake. Increased population demands for drinking water and waste treatment, expansion of stakeholders and climatic lowering of water levels all contribute to a significant stress to the water resource and the community. Water levels fluctuate naturally in cycles, but due to climate change and anthropogenic influences the current lake levels are meters lower than expected. This has serious consequences on the lake and surrounding flora and fauna. Unregulated chemical and biological pollution, and other ecological stresses like algae blooms influence the water quality and are concerns to the health of the entire ecosystem. This project uses interdisciplinary approaches to assess ecosystem health and propose solutions to sustainability manage resources of the Lake Naivasha basin ecosystem. Two M.Sc. students will present their work on botany and harmful algal blooms in Lake Naivasha.

Keywords: Lake Naivasha, sustainability, water quality, biodiversity

An assessment of ground water level in Bangladesh

A.E.M. Tanvir Hassan (Civil and Environmental Engineering, University of Western Ontario)

Most of the cities of Bangladesh are primarily depend on ground water source for water supply. Due to ever increasing water demand and the presence of favorable geohydrological situations, extensive groundwater extraction programs have been undertaken in this country over the last three decades. There is a scope of investigation the groundwater abstraction for water supply and to appraise the possible consequences of ground water exploitation on hydrological and the ecological environments in Bangladesh. This study will over view the ground water level situation throughout the country based on the data available for the year 2001. DEM (Digital surface elevation model) and contour will be presented for ground water level by comparing different interpolation method by using ARCGIS 9.3. Based on DEM, regional distribution suitable location of different pumps will be discussed in this study. The final objective of this study is to find out unsuitable locations for groundwater abstraction in different region of Bangladesh considering

ground water level, population and trend of ground water level increasing and decreasing over the year.

Keywords: DEM, Interpolation, ArcGIS

Fuzzy Risk analysis for sustainable water resources management

Shohan S. Ahmad, Slobodan P. Simonovic (Civil and Environmental Engineering, University of Western Ontario)

Risk is identified as one of the key sustainability issues in water resources management. Sustainability requires innovative approaches for the derivation of appropriate risk measures since the use of the expected value of risk, and/or the conditional expected value, is no longer sufficient. A conceptual understanding of the sources of uncertainty will be presented. Probabilistic approach and the fuzzy set theory are suitable tools for quantifying uncertainties which may induce a risk of failure. In this presentation fuzzy set approach is used to address both, objective and subjective uncertainties. Traditional modeling approaches focus on either temporal or spatial variability, but not both. Sustainable water resources management requires proper understanding of the dynamic characteristics of risk and their spatial variability. The main contribution of the work that will be presented is in the development of an original methodology for flood risk management that is capable of (a) addressing uncertainty caused by spatial and temporal variability and ambiguity; (b) integrating objective and subjective risks; and (c) assisting flood management decision making based on better understanding of temporal and spatial variability of risk.

Keywords: Fuzzy set theory, uncertainty, sustainability, risk analysis

Monitoring the Hydrology of Prairie Wetlands during the Snow-Free Period: a Multi-temporal Analysis of LANDSAT ETM +, RADARSAT-1 SAR and Ancillary DEM Data from LiDAR

Tekleab Gala (Geography, University of Western Ontario)

Prairie wetland mapping and monitoring are critical for conserving and restoring wetlands for their socio-economic and hydro-ecological functions and services. Remote sensing (i.e. optical and radar) have capability of characterizing various hydrologic features of prairie wetlands over large and in remote area. Therefore, this study intends to develop a technique based on multi-temporal, integrated LANDSAT ETM+ and RADARSAT-1 SAR data to monitor prairie wetlands and characterize the regional and temporal hydrodynamics of wetlands during the snow-free period. Twelve LANDSAT ETM+ (optical) and 19 RASARSAT-1 SAR (radar)

data, which covered the three study sites (i.e. Harrt, Allan Hills and Old wives) selected for this study were acquired. Different wetlands mapping techniques applied and were compared based on their merit. A method, which involved deploying fuzzy threshold for mapping wetlands from radar data (i.e. average classification accuracy = 67%) and knowledge-based rule applied LANDSAT TM5 (i.e. average classification accuracy = 84%) produced superior results for SAR data and LANDSAT data, respectively. The combination of the optical and radar data gave quality wetlands maps (i.e. mapping accuracy = 84%- 96% and categorical kappa = 0.81 – 0.95). The wetlands maps developed were able captured variation in pond density and wetland area coverage among regions of central Canadian PPR. The time-series wetland maps also demonstrated the regional and temporal variations of the prairie wetlands' water-level fluctuation in the summer. In conclusion, the research has shown the capability of integrated optical/radar data for monitoring prairie wetlands and characterizing their hydrodynamics.

Keywords: Prairie Potholes Region, Prairie Wetlands Hydrodynamics, Wetland Mapping, RADARSAT-1 SAR and LANDSAT ETM+

Session 3b

Application of Peroxide Regenerated Iron Sulfide Control (PRI-SC) Technology in High Pressure Reactor for Sludge Treatment

Bipro Ranjan Dhar, George Nakhla, Madhumita B. Ray (Chemical and Biochemical Engineering, University of Western Ontario)

Biological treatment of wastewater produces a large amount of sludge. Sludge management is one of the major challenges in wastewater treatment plant (WWTP) operation, as they are composed of various types of compounds responsible for negative environmental impact. Sludge management costs 50-60% of the total WWTP operation. Anaerobic digestion (AD) is widely used sludge stabilization process that also produces renewable energy biogas (methane). It reduces the final volume of solids and pathogen content of the sludge prior to disposal. Rate limiting hydrolysis, low solid destruction, odor generation are the major limitations of AD. Pretreatment of sludge prior to AD is a common approach to deal with those challenges.

PRI-SC is an odor and corrosion control technology developed and patented by US Peroxide. PRI-SC is a technology that integrates iron salts with hydrogen peroxide. In this research, this technology is applied in a bench scale high pressure reactor (75 psi) for waste activated sludge (WAS) treatment. The major goal is to evaluate the impact of treatment on various odor precursors, anaerobic digestibility and digested biosolids quality.

Keywords: Wastewater, Anaerobic Digestion, Biogas, Sludge, PRI-SC

Fate of Estrone in Solar Photodegradation

Rajib Roy Chowdhury, Paul A. Charpentier and Madhumita B. Ray (Chemical and Biochemical Engineering, University of Western Ontario)

The photodegradation of the steroid estrone (E1), an endocrine disrupting hormone which is commonly released into aquatic environments, was investigated in aqueous solution using natural sunlight (290-700 nm) produced using a solar simulator. The degradation of E1 was found to follow pseudo-first-order kinetics, with the rate constant decreasing slightly with increasing initial concentration and varying linearly with solar intensity in the region of 25-100 mW cm⁻². The half-life of E1 using 1 Sun (100 mW cm⁻²) was measured to be 52.50 min in natural conditions. The rate of mineralization based on total organic carbon (TOC) reduction was lower than E1 degradation, while the TOC of the solution decreased steadily with increased irradiation time. In the presence of humic acid, the photodegradation rate increased significantly, attributed to photosensitization by the reactive species. The solution pH also had a considerable effect on the rate with maximum degradation occurring around neutral pH of 7.

Keywords: Estrone; EDCs, Steroids; Photodegradation; GC-MS; Solar Simulator

Concentration, pH, and surface charge effects on copper biosorption by *Saccharomyces cerevisiae*

Shahram Amirnia, A. Margaritis, M. Ray (Chemical and Biochemical Engineering, University of Western Ontario)

Cells of *Saccharomyces cerevisiae* obtained from aerobic cultures were used to adsorb copper ions from copper-bearing solutions in batch experiments. The capacity of yeast cells to adsorb copper ions with respect to pH, sorbent dose, and initial Cu concentration was determined. The maximum uptake for Cu was 10 mgCu/gBiomass at pH of 5.5 by the yeast cells collected from log phase of cell growth, and 90% of the adsorption capacity reached within first 2 minutes of biosorption experiment. The adsorption data fitted very well by Langmuir isotherm model. Zeta potential measurements also indicated that the surface of the yeast cells have a maximum negative charge at pH's greater than 5.

The purpose of this work is to implement an inexpensive and effective technology for Cu removal from industrial effluents. The yeast biomass used in this study did not undergo any chemical or physical alterations, which added to the low cost and high metal uptake, makes it a good treatment method for removal of Cu from wastewaters.

Keywords: Heavy metal, *Saccharomyces cerevisiae*, Waste treatment

Cost Effective Technologies for Wastewater Recycling

Anupam Agarwal, Madhumita B Ray (Chemical and Biochemical Engineering, University of western Ontario)

The world water supply is in crisis. Global consumption of water has increased twice as fast as the population in the last century. If current trends continue including draught, rising population, increased urbanization, climate change, indiscriminate disposal of waste and mismanagement of existing resources, the world may be heading for a catastrophe. Approximately 2 million tons of waste water per day is disposed of with in receiving waters, including industrial wastes, human waste and agricultural wastes. Properly treated, this effluent has the potential to be a major source of water reuse in regions with water scarcity. Even however where water is abundant, reuse could reduce the contamination of natural water resources.

This presentation focuses on the cost effective potential technologies, and the need of research and development of these technologies for reuse of wastewater for potable and non potable purposes. Based on the literature survey, it was found that membrane and oxidation based processes have the maximum potential for advanced treatment of wastewater.

Keywords: wastewater recycling, cost analysis, membrane technology, advanced oxidation technology

Session 4

Understanding the toxicity of the fish-killer culprit, *Gymnodinium mikimotoi*

Victoria Hewlett (Biology, University of Western Ontario)

Harmful Algae Bloom (HAB) events are expanding globally, with great economic loss and ecological harm to coastal waters. A persistent HAB event occurred off the coast of United Arab Emirates (UAE) in September 2008 and caused massive fish kills and coastal ecological devastation. A well known fish-killing species, *Gymnodinium mikimotoi*, new to this region, has been isolated from this red-tide event in the Persian Gulf. The mechanism of toxicity for this species is not clear, but it has been suggested that some fish-killing species have a combinatorial mechanisms involving the production of reactive oxygen species (ROS), haemolytic activity and/or mucus. The toxicity may not be formed continuously but regulated by the nutrient status of the cell. Using the mortality of *Artemia salina* (brine shrimp) as an indicator of overall toxicity, the co-regulation of ROS, haemolytic activity and mucus was examined. Differences in levels of toxicity at variable N:P

ratios suggest possible environmental conditions that induce algal toxicity of *G. mikimotoi*.

Keywords: Nutrient, Harmful Algal Blooms, Red-tides, Toxicity, Phytoplankton

Pollution-induced behavioural evolution in the brown bullhead

Ross D Breckels, Bryan D Neff (Biology, University of Western Ontario)

Aquatic ecosystems are major sinks for pollutants which can have adverse effects on biodiversity. Thus, it is important to understand the nature of pollution-induced change in aquatic ecosystems. We show that brown bullheads (*Ameiurus nebulosus*) have evolved in response to chronic pollution exposure. We collected adults from the Detroit River (polluted) and Belle River (control). Both adults and common-garden raised juveniles were tested for aggression, locomotion, and escape response using consecutive unchallenged (clean) and challenged (polluted) trials. Detroit River fish were more aggressive than Belle River fish when challenged. Furthermore, Belle River fish showed increased locomotion when exposed to pollutants, whereas Detroit River fish were unaffected. The consistent difference in adult and juvenile behaviour across trials indicates a genetic response to pollution. Escape response on the other hand, showed inter-population differences, but no consistency between adults and juveniles, suggesting that this behaviour is influenced by non-genetic factors. These results give us new insight into polluted areas and enable us to provide suggested conservation methods.

Keywords: aggression, behaviour, evolution, locomotion, pollution

Effects of Chemical and Mechanical Weathering Processes on the Degradation of Plastic Beach Debris

Dave Cooper, Dr. P.L. Corcoran (Earth Sciences, University of Western Ontario)

Beach environments contribute to mechanical erosion of plastic debris through abrasion, particularly in swash/backwash and breaker zones. Plastic debris were sampled from beaches on the island of Kauai, Hawaii to determine daily accumulation rates, and to examine relationships between polymer composition, surface textures and oxidation level using both Fourier Transform Infrared Spectroscopy analysis and Scanning Electron Microscopy. During a ten day period approximately 6000 pieces of microscopic plastic debris 1mm – 2mm in size accumulated on Maha'ulepu beach, averaging 484 pieces per day. Surface textural analysis revealed evidence of significant differences in weathering of polyethylene and polypropylene samples. Cracks/fractures, flakes, grooves, pits, adhering particles and vermiculate textures were common. Results from both analytical

techniques suggest a strong relationship between chemical and mechanical degradation of plastics in beach environments. Our continuing investigations into surface textures and oxidation will lead to a better understanding of processes promoting breakdown of plastic litter thereby decreasing environmental threats to marine organisms.

Keywords: Plastic, Debris, Beaches, FTIR, SEM

Anemic coral's: The role of trace metals in coral bleaching

Katrina Iglic (Science/Biology, University of Western Ontario)

The oligotrophic nature of coral reef environments suggests that coral bleaching may be the negative response of the algal portion of the coral-zooxanthellae (algae) symbiosis under conditions of extensive nutrient stress-particularly trace metals. One mechanism that has drawn attention as a mechanism contributing to coral bleaching is that cells can no longer scavenge the potentially damaging reactive oxygen species (ROS). Since many of the enzymes involved in antioxidation are metalloenzymes, I hypothesize that low ambient concentrations of dissolved iron, copper and manganese restrict the metal-dependent antioxidant defenses in zooxanthellae of *Stylophora pistillata*, contributing to coral bleaching under high light and elevated temperatures. This study has shown that photosynthetic electron transport is negatively affected by iron limitation under conditions of high temperature and irradiance. Furthermore, temperature stress increases ROS and reactive nitrogen species load in zooxanthellae. The negative effect of iron limitation on zooxanthellae photophysiology emphasizes the need to understand the role of iron in global coral reef ecosystems in hopes of mitigating future bleaching events.

Keywords: Coral bleaching, reactive oxygen species, trace metal limitation, photophysiology

Poster Session

Sediment deposition modelling and virtual coring in a high alpine lake

Tristan A. Martel, Marco Van De Wiel (Geography, University of Western Ontario)

Sediment deposition by density flow and plume formation has been modelled in a high alpine lake setting. Virtual sediment core extraction reveals grain-size and layer thickness at pre-defined locations in the sediment fan. The newly developed Lake Sediment Deposition Model utilizes an event-based iterative structure to drive distinct short lived intense inflows, or long durations of low flow, treated as single instantaneous events. Bulk quantities of sediment placed in grain size categories and discharge rates from the river mouth are used as inputs. Results show how lake sediment laminae accumulate, with distinct variations in layer thickness and grain-size sequences. The model is also sensitive to the effects that the existing and evolving bed topography have on subaqueous density flow routing and the location where sediment plume formation occurs. The model and virtual coring could provide an improved understanding of real world lake sediment transportation dynamics, and the inferences based upon lake sediment cores.

Keywords: sediment deposition, grain size, laminae, river plumes

Western Heads East Intern Poster Programs

Student interns (Western Heads East, University of Western Ontario)

Poster programs featuring the goals and experiences of interns who travelled to Tanzania, Kenya and Rwanda with the Western Heads East (WHE) project may be displayed. The WHE Project collaborates with women's groups and African institutions to support the development of community kitchens that produce a probiotic yoghurt to empower women economically, build capacity and skills in the area and to promote community health. The strain of probiotic used builds immune response, improves urogenital disease and improves general health.

Keywords: probiotics, community-based enterprise, empowerment of women in africa

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