University of Illinois at Chicago

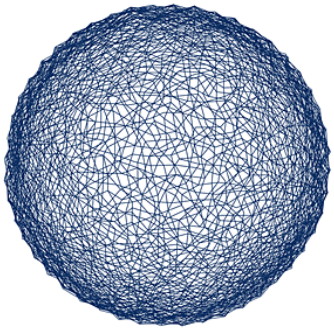
Newsletter
Winter 2010

Institute for Environmental Science and Policy

Report from Copenhagen

Michael Iversen, Institute for Environmental Science and Policy Doctoral Fellow and PhD student in the Department of Urban Planning and Policy at UIC, attended the United Nations Climate Change Conference held in Copenhagen during December 7-18, 2009. The intent of attending the conference was to allow first-hand observation of the cultural behavior aspects underlying the issue of climate change within a socio-ecological framework.

The intended outcome of the Climate Change Conference was to follow the Kyoto Protocol, which starts to expire at the end of 2012, with a legally-binding treaty agreement to stabilize greenhouse gas concentrations in the atmosphere at a level that will prevent adverse human interference with the climate system. The agreement was intended to include the key issues of mitigation (reducing greenhouse gas emissions), adaptation (coping with the inevitable consequences of climate change) and finance / technology transfer (needed to assist developing countries to implement actions mitigating their emissions and adapting to climate change impacts). An agreement, dubbed the Copenhagen Accord, was drawn up by leaders from the US, China, India, Brazil and South Africa the last night of the conference. The UN Conference of the Parties neither adopted nor endorsed the Accord, but



COP15
COPENHAGEN
UN CLIMATE CHANGE CONFERENCE 2009

agreed to "take note" of it, although its provisions do not have any legal standing within the UN Framework Convention on Climate Change process.

Relative to the conference's intended outcome, the Accord fell short of its stated goals. While the Accord agreed to reduce global emissions so as to hold the increase in global temperature below 2 degrees Celsius, it is not legally binding and has no enforcement provision. Each nation was asked to set its own emissions reduction pledge by January 31, 2010. According to the World Resources Institute, as of February 10, 95 countries, were likely to, or have submitted emission reduction as per the Accord, representing 81% of global GHG emissions. While their combined efforts, if they came to pass, would reduce the emissions associated with global warming, they are not enough to hold global temperature below the agreed upon 2 degrees Celsius limit.

Also included as part of the Accord, developed countries are to commit USD 30 billion to developing countries for the period 2010-2012, so as to reduce GHG emissions from deforestation and forest degradation (REDD+), as well as another USD 100 billion per year by 2020 to address the mitigation and adaptation needs resulting from climate change.

Next year's United Nations Climate Change Conference will be held in Mexico from November 29 to December 10, 2010.

Inside

Letter from the Director	2
Energy Initiative: Vegetable Oil to Biodiesel	3
Research Funding: IESP Seed Grant: ULTRA-Ex	3
Predicting Climate Change: Rafail Abramov	4
Sustainable Architecture: Lincoln Hall	5
Faculty Achievements	6
Energy Initiative: Campus Office Audit	6

Institute for Environmental Science and Policy
School of Public Health West Room 529
2121 West Taylor Street
(M/C 673)
Chicago, IL 60612-7260
Ph: 312-996-1081

iesp@uic.edu
www.iesp.uic.edu

UIC INSTITUTE FOR ENVIRONMENTAL SCIENCE AND POLICY

Mission Statement

The mission of The Institute for Environmental Science and Policy (IESP) at the University of Illinois at Chicago is to advance multidisciplinary research and scholarship within the environmental and health sciences, engineering, economics, urban planning and the social sciences among UIC's faculty and students, to prepare the next generation of environmental scientists and decision makers, and to transmit workable solutions for environmental problems to the public sector.

From the Director

Thomas L. Theis, Director

It seems that greater numbers of students these days are interested in careers in environmental sustainability, at least according to my informal sampling of news articles, conversations with colleagues, and perusal of job listings that I receive. And I have to admit that increasing numbers of students in the local area, from inside and outside the UIC community, stop by my office to inquire about what's out there and what they should do to make themselves more marketable. My advice depends a great deal on their particular circumstances, but typical questions go something like this: Do you have a major? What do you see yourself doing in five or ten years? What do you think you would like about working in the sustainability area? Are you looking for specific courses, specialized training, continuing education, graduate opportunities?

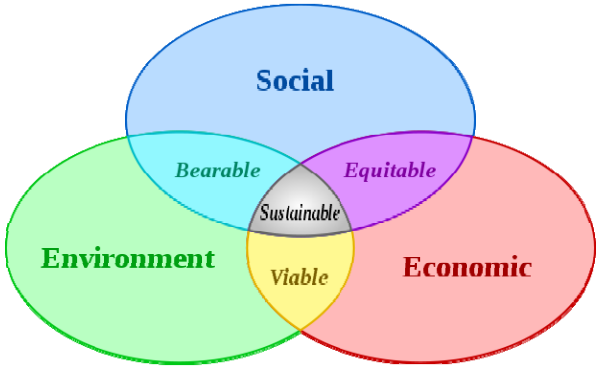
Before all of this takes place, I usually initiate a conversation that begins with one overarching question: What does environmental sustainability mean to you? Almost everyone can recite the words from the UN report "Our Common Future" (the Brundtland Commission) that defines sustainable development as that which "meets the needs of the present without compromising the ability of future generations to meet their own needs". Most go further, pointing to the long term dependency of human life on environmental stability, noting that the earth is finite and hence making excessive demands on the services that the earth provides to us is not tenable, and expressing the need to make wise (or wiser) decisions if we are to fulfill the mandate of Brundtland.

In other words, these students are pretty well informed, and savvy too. They are well aware that new employment in the sustainability sector is increasing at a rapid rate (just to provide a sense, a recent Pew Charitable Trust study found that, between 1998 and 2007, employment in the "green" economy grew at two and a half times the rate of the economy as a whole, with expectations to continue). Even so, most are daunted by the enormity of the types of problems that have come to characterize the sustainability challenge. Climate change, maintenance of air and water quality, urban sprawl, loss of biodiversity, human waste management, overconsumption (to name a few); these are problems and issues on a scale and level of complexity not envisioned until recently. It's enough to bring on a sense of panic, and when combined with the understandable anxiety most students feel about landing a job, the urgency is palpable.

In our conversations, I like to refer to the basic elements of the sustainability paradigm, the so-called three legs: environment, economy, and society (I usually use the diagram from the International Union for the Conservation of Nature, on the right, to help), and how it is the integration of these elements that define the basis of sustainability. But to leap directly to the triple intersection point is probably more than most people can manage, especially at an early stage of their careers, so I suggest to them that the important thing is to grab on from whatever direction works the best. Although I'm a strong proponent of interdisciplinary scholarship, a model tailor made for sustainability, a firm grounding in the discipline of one's choosing, particularly at the undergraduate level, is probably the most realistic.

Most students have two reactions. They are reassured that they won't make a mistake, with respect to a career in sustainability, by doing what they like to do. On the other hand, they still wonder if there aren't some specific skills they should look toward acquiring now, and might there be an internship in sustainability somewhere, and after all what about those graduate programs... "Well yes", I say, "let's talk specifics. Have you considered a course in life cycle assessment?"

"I like to refer to the basic elements of the sustainability paradigm, the so-called three legs: environment, economy, and society and how it is the integration of these elements that define the basis of sustainability. But to leap directly to the triple intersection point is probably more than most people can manage, especially at an early stage of their careers, so I suggest to them that the important thing is to grab on from whatever direction works the best."



Vegetable Oil to Biodiesel

In the summer of 2009, Britt Mork, an Illinois Environmental Protection Agency intern at UIC, began to experiment with converting vegetable oil to biodiesel fuel using basic household containers and common ingredients. Less than five months later and with a budget of $5,000, Mork's simple experiment culminated into a large Biodiesel Reactor system located in UIC's Environmental Chemical Waste Facility. This Biodiesel Reactor system will not only reduce the University's carbon footprint by providing the Physical Plant with cleaner burning fuel, but also by reusing waste materials from both the UIC Hospital Cafeteria and the College of Pharmacy. A gallon of biodiesel costs The UIC Environmental Health and Safety Office (EHSO) $1.50 to produce and will be shipped to the Physical Plant's Transportation Department in 55 gallon barrels where the biodiesel will be mixed at a 20/80 ratio with regular diesel to be used in the University's vehicles. The resulting fuel that burns produces fumes that are 20-30% carbon neutral. While the market price of biodiesel varies anywhere from $.90 to $2.00, EHSO will always sell their produced biodiesel to the Physical Plant for $.10 under the market rate. Rich Anderson, Associate Director of EHSO, expects that his department will profit around $5,000 a year from this pricing structure. Thus, not only does UIC save money on fuel, the disposal of waste vegetable oil and methanol, but also manages to turn a small profit for the university. This program will also benefit a women's shelter that will use the waste glycerin to produce "Dragon Soap" to be sold at the UIC Bookstore.

IESP Seed Grant to develop an ULTRA-Ex Proposal to the US National Science Foundation

IESP awarded a Seed Grant to three IESP researchers, Dr. Emily Minor (Biological Sciences), Dr. Moira Zellner (Urban Planning and Policy) and Dr. David Wise (Biological Sciences), to support collaboration with researchers and urban planners at other institutions in preparation of a research proposal to the NSF ULTRA-Ex Program. The seed grant funded a two-day workshop to lay the groundwork for an ULTRA-Ex proposal.

The workshop brought together a research team that produced a pending ULTRA-Ex proposal submitted through IESP on behalf of a team of researchers and planners from the City of Chicago Department of the Environment, DePaul University, the Field Museum, Lincoln Park Zoo, Loyola University, Purdue University, UIC and USDA Forest Service. "ULTRA-Ex" stands for "**U**rban **L**ong-**T**erm **R**esearch **A**reas – **Ex**ploratory projects." These exploratory awards are designed to (1) fund basic research into the dynamics of socio-ecological systems in complex urban landscapes, and (2) foster development of a broadly interdisciplinary research team that will be poised to submit a 6-year proposal to a future full ULTRA Program.

Cities that function well ecologically are critical to meeting pressing needs like mitigating and adapting to climate change and providing high-quality places to live for a growing and diversifying populace. Research to be conducted under the pending Chicago ULTRA-Ex research will help increase the ecological functioning of cities by addressing a fundamental question: In a complex urban/metropolitan system, what are the synergies and tradeoffs between conserving biodiversity and providing ecosystem services to people? The project will focus on the Green Infrastructure Vision of the Chicago Wilderness alliance, a conservation consortium of over 250 organizations. The Green Infrastructure Vision, designed to implement the Chicago Wilderness Biodiversity Recovery Plan, is already influencing long-range land planning throughout the Chicago metropolitan region.

Two postdoctoral researchers will work with the ULTRA-Ex research team to accomplish two major objectives: (1) Conduct a critical examination of the connections between the biodiversity-recovery goals of the region-wide Green Infrastructure Vision and the delivery of critical ecosystem services to human communities throughout the Chicago region. (2) Develop a multi-faceted, interactive, web-based Chicago ULTRA-Hub. The ULTRA-Hub will include an interactive platform for managing data; communicating research findings to planners and the public; and promoting collaborations between scientists and practitioners.

A major objective of the IESP Seed Grant was to expand the effectiveness of the interdisciplinary Science Team of the Chicago Wilderness alliance. The Science Team recently received $1.5 million in funding from the NSF Dynamics of Coupled Human-Natural Systems Program to fund another collaborative research project between UIC, DePaul, the Field Museum, the USDA Forest Service and UIUC. IESP's Wise and Zeller, as well as several others from the ULTRA-Ex team, are part of this project. The IESP Seed Grant significantly expanded this nascent research team, thereby contributing to IESP's mission to "gather together multidisciplinary teams of scholars and counterparts in the public and private sectors to devise sustainable solutions for society's complex environmental challenges."

Using Algorithms to Predict Climate Change

In 2009, UIC mathematician Rafail Abramov, won a $473,000 NSF Career Award to create a set of algorithms that will aid scientists in climate predictions. The following is an interview IESP had with Dr. Abramov about his work.

When did you first become interested in developing algorithms to predict climate change? How new is this approach to predicting climate change?

I became interested in algorithms to predict climate change while I was working as a postdoc with Andrew Majda at New York University. Regarding the approach, the general idea is not particularly new, tracing back to mid-seventies of the past century, when it was suggested among the atmospheric/ocean science community that the fluctuation-dissipation theorem, which has origins in statistical physics, can be used to predict the response of the climate to small changes of parameters like solar forcing, greenhouse gases, etc.

Could you describe the basic concept of developing algorithms to predict climate change? Also, could you explain the Fluctuation Dissipation Theorem and Irreducible Imprecision?

In order to explain the basic concepts behind algorithms to predict climate change, first I need to explain what is conventionally understood under the titles "climate" and "climate change". So, what we directly observe (and experience) is, scientifically speaking, a time sequence of momentary "snapshots" of winds and precipitation in the atmosphere, currents in the ocean, etc. In a sense, a momentary snapshot of the geophysical state of the atmosphere and oceans can be called "weather". Typically, ocean phenomena are not regarded as part of the "weather", however, the system of currents in the ocean is akin to a cooling system in an automobile, or a central heating system in a building, and so they play one of the key roles in distributing the heat around the surface of the planet, which directly affects local weather. For instance, if the configuration of the oceanic currents is altered, but all other things (like atmospheric carbon dioxide and such) do not change, there would still be the change in the weather states. The "climate" is in a certain sense the average state of "weather", typically over a large geographic region, and, therefore, "weather" can be treated as rapid fluctuations around the state of "climate". Despite the fact that "climate" does not tell you the momentary state of "weather" at a given time and a particular geographic point, it is still important to know how, on average, "weather" looks like over a region to plan for heating or cooling needs, for overall agricultural outlook due to temperatures and precipitation and such.

Now, the concept of "irreducible imprecision" is the fundamental inability of predicting the precise sequence of "weather" snapshots significantly far into the future. The reason for that is the property of "weather" dynamics called "chaos". In semi-mathematical terms, "chaos" is the phenomenon, related to the underlying physics of weather dynamics (and thus is unavoidable), which makes two very nearby momentary weather snapshots to diverge in time indefinitely far from each other. This is the main problem in weather prediction: no matter how good your numerical models are, you cannot possibly observe the weather snapshot with absolute precision in every cubic inch of the atmosphere, and there will always be some measurement error. When you compute the weather prediction from the measured weather snapshot, this error will grow exponentially rapidly in time due to its chaotic properties, and, a few days into the future, the weather you predict will have very littler relevance to what will actually happen. This is what the "irreducible imprecision" is. This may have various manifestations and interpretations throughout the community, depending on a particular problem being studied, but the key source of the "irreducible imprecision" is what I described.

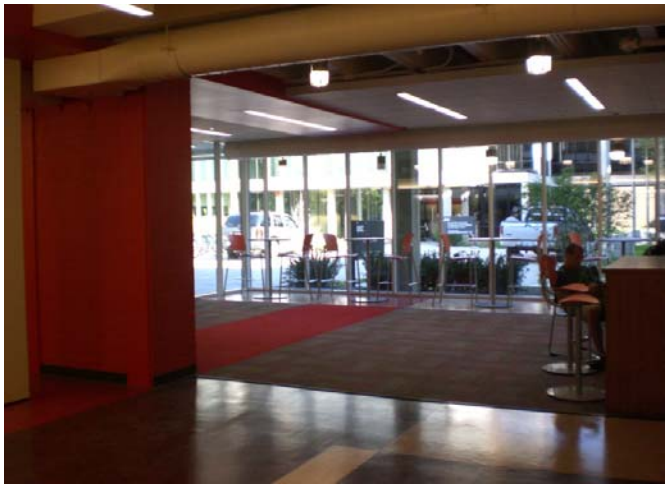
Now, to the fluctuation-dissipation theorem. As I said, the "climate" is the average state of the "weather", and it is known that even though the errors in the predictions of the "weather" can be quite substantial, the average state is not affected as much. In other words, even though the predicted time sequence of "weather" snapshots around the average "climate" state will be different from what will actually occur, the average "climate" state itself will not be significantly different from what is eventually observed. Then, the fluctuation-dissipation theorem is a mathematical framework which predicts the change (or response) of this average "climate" state due to various altered parameters of the climate dynamics, such as the amount of greenhouse gases in the atmosphere and stuff like that. One of the key features of the fluctuation-dissipation theorem is that it predicts the response of the climate state by analyzing the data obtained in the current, that is, unperturbed climate state, and connecting this data to the perturbations which are to be introduced. It looks like some kind of an arcane spell (indeed, how one can say anything about the changed climate state by looking at the unchanged climate state, it is nonsense, isn't it?), however, there is a solid mathematical foundation behind the fluctuation-dissipation theorem. So, the key idea is to use the fluctuation-dissipation theorem to analyze the current unperturbed climate data from modeling (or observations, for that matter) to produce the prediction of the climate response depending on the changes in the content of greenhouse gases or other parameters to be introduced.

How will this help climatologists in their predictions versus only relying on Atmospheric and Oceanic Science Models?

The key idea is that the new algorithms will complement the models, simulations and observations that the climate scientists already have. Basically, it is how to interpret the data and simulations which have been accumulated, in a strict mathematical framework. It is not about some completely new method from the ground up to compute climate change. The current climate models reflect many important things known about geophysics, given the current state of the computational limitations. The concept of "diagnostic toolbox" is to help scientists to identify possible changes of geophysical parameters which would cause a catastrophic climate response, that is, the types and levels of activity that mankind stay away from. If it is found that a catastrophic climate response is being caused by natural changes, well, I guess we'll just have to sit tight and endure.

Lincoln Hall

Lincoln Hall, the newly renovated and first ever UIC LEED Silver certified building, was opened to students and faculty in the fall of 2009. The renovated building maintains the architectural integrity of Walter Netsch's original design but is now over 50% more energy efficient due to several new green technologies that were integrated into the 45 year old structure. Lincoln Hall belongs to a triad of buildings which also include Douglas Hall and Grant Hall. While not LEED certified, Grant Hall was first of the three buildings to undergo a green renovation in 2007. Renovation of Douglas Hall, projected to commence during the summer of 2010, is expected to be LEED Silver if not LEED Gold certified.



The green features of Lincoln Hall extend from the solar panels on the roof to the geothermal pipes located 400 feet below the ground. The geothermal heating and cooling system is by far the most energy saving and cost saving feature of the building. A geothermal system uses water to heat and cool the building by circulating the water through pipes that are located in the upper crust of the earth's surface that remains at a nearly constant temperature between 50 and 60 degrees. Through the use of a heat exchanger, the water warms the building during the winter and cools the building during the summer to keep Lincoln Hall at a constant 73 degrees Fahrenheit. Based on Grant Hall's success with geothermal heating and cooling, Lincoln Hall's energy consumption is expected to decrease by approximately 50%. Once the renovation of Douglas Hall is completed, all three buildings will be running on the same geothermal system.

Another key feature of the building includes the new solar film windows that are expected to reduce the amount of solar radiation that enters the interior by 40% due to their high reflectiveness. In addition, the windows are covered by automatic shades that adjust themselves based on the amount of heat load that is filtering through from the outside. However, even when the shades are closed, the building maintains a light airy feel that was not present before the renovation of the cave-like building. Other green features inside the building include linseed oil and cork floors, recycled carpet squares in oases, 50% recycled white boards in the classrooms, compact fluorescent lamp lighting and light sensors, doors made from Forest Stewardship Council certified wood and automatic, low flow fixtures in the restrooms.

The newest feature of Lincoln Hall is located on the roof of the building. In November of 2009, SoCore Energy installed 224 solar panels that are expected to produce over 59,000 kWh of energy over the coming year and save the University nearly $6,500. It is expected that the solar panels will reduce UIC's carbon footprint by 21.64 metric tons which is the equivalent of consuming nearly 2,434 gallons of gasoline. Other green features located outside Lincoln Hall include a shallow bioswale that captures and filters the storm water run-off and also low maintenance native plants rooted in highly absorbable pebble topsoil.

Cynthia Klein-Banai, Associate Chancellor for Sustainability, hopes that research and learning possibilities arise from the new green technologies of Lincoln Hall. Students and faculty are encouraged to visit the building and understand the vital role that green architecture plays in improving and maintaining a healthy environment. For more information about Lincoln Hall please visit the Office of Sustainability's website: www.uic.edu/sustainability/.

Faculty Awards and Appointments

Moira Zellner, IESP and Urban Planning and Policy professor, has been appointed a Faculty Scholar of the Great Cities Institute for the 2009-2010 Year. Moira's contribution to the Great Cities Institute Working Paper Series is: *Towards Urban Sustainability in the Chicago Region: Using Agent-Based Modeling for Social Learning and Environmental Planning.*

Jane Lin has been promoted from Assistant Professor to Associate Professor of Civil and Materials Engineering effective Fall 2009. She was also recently elected to be the vice president of the Association of the Tsinghua Alumni in Transportation (ATAT), an organization that consists of transportation professionals who are alumni of Tsinghua University, Beijing China.

UIC Energy Initiatives

2009 External Advisory Board Meeting: September 28-29

UIC is taking steps to ensure that it reduces both energy consumption and greenhouse gas emissions. From smaller student led projects such as a solar energy project demonstration and office energy audits to the larger the UNPLUG campaign and metering project, UIC hopes to reduce its total energy consumption by 20-40% while simultaneously saving as much as $10 million. As stated by the Office of Sustainability, in this time of University financial hardship, there hardly seems to be a better way to save money.

The Office of Sustainability (OS) initiated the UNPLUG Campaign during the 2009 fall semester. The UNPLUG Campaign encourages small behavioral changes that individuals can make to directly impact the University's energy and money savings. The OS utilizes high school seniors who are part of a mentorship program to walk through UIC buildings and count energy producing office fixtures such as lights, computers and copiers. While the students do the walk-throughs, they encourage the University employees to lower their energy consumption by shutting off lights and computers when they are not in use. The students calculate the savings and participation level of the UNPLUG Campaign that will undergo an audit and evaluation at the end of the 2010 spring semester.

Another important energy saving initiative is the Metering Project led by the Facilities Management Group and Utilities Director. Meters are being installed in 70% of the campus state buildings to measure electricity, steam and chilled water consumption. The meters will be monitored by engineers to evaluate energy consumption and detect unusual patterns that could indicate "hot spots." This will point to problematic buildings and allow for economic evaluation and prioritization of energy projects. While the installation of the east side of campus is complete, the west side should be complete by this summer. According to the Office of Sustainability, once appraised, the data will be an excellent baseline for evaluating future energy projects such as energy performance contracting.

The energy performance contracting is one way to provide funds for investment in efficiency projects around campus. Since office audit programs usually involve large capital investment, UIC is looking to contract the work to an energy services company who would identify areas or buildings that could be retrofitted to ensure energy efficiency and conservation. Because the energy services company guarantees energy savings, UIC would then be able to pay for the service with the saved energy equity funds. In the case that UIC does not save the amount of money that the energy services company predicts, the company would write a check to UIC. Thus, the energy services company mitigates any financial risk for the University in either scenario. Energy efficiency projects are expected to reduce UIC's emissions of carbon dioxide by over 65,000 tons a year. Several universities have successfully used energy services companies as a financing mechanism including Eastern Illinois University and University of Buffalo.