



Annual Report 2015-16



Actionable Research ...

Introduction from the Director: Looking Back; Looking Ahead

Now approaching 3 years old, the Institute for Sustainability, Energy, and Environment (iSEE) continues to grow stronger as a force on the Illinois campus for research, funding, campus sustainability leadership, education, and outreach activities.

This shows our progress in 2015-16:

- Our thematic, cross-disciplinary research projects have made remarkable strides toward solving the grand world challenges outlined in their proposals. Three teams recently marked Year 2 of collaboration; four other teams just finished Year 1.

- iSEE also helped bring together two research centers in the past year, one through external funding and another through a partnership with the College of Engineering and the Department of Civil & Environmental Engineering. The Institute put major grant proposals together for its own researchers — while obtaining funds for another research team it built in 2015. Grant proposals went out for campus sustainability efforts and education and outreach activities as well — and iSEE found a unique way to fund future energy efficiency projects that will reduce campus greenhouse gases.



- Illinois water and energy scholars are now featured on their new web pages, built to bring them together to work on major research proposals.

- iSEE published the 2015 Illinois Climate Action Plan, a road map to carbon neutrality, and is spearheading efforts toward near- and long-term objectives approved by campus administration.

- We have continued to refine the Certified Green Office Program, while also taking on initiatives for Styrofoam recycling, conversion of campus dining's used cooking oil into biodiesel for the campus fleet, and pilot trials for a bike share program.

- Our undergraduate minor, the SEE Fellows Program, has enrolled 29 students in one short year, and nine will be engaged in capstone projects this year as they finish their degrees.

- And we continue to engage the community with our international Congress, Sustainability Week, Earth Week, annual lectures, and more.

Looking back, we feel a sense of accomplishment. Looking ahead, we see so much more to do!

Sincerely,

Evan H. DeLucia, iSEE Director

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A Big Boost: Our Major Donors

The Institute enjoys continued support for its research, campus sustainability, and education and outreach efforts from:

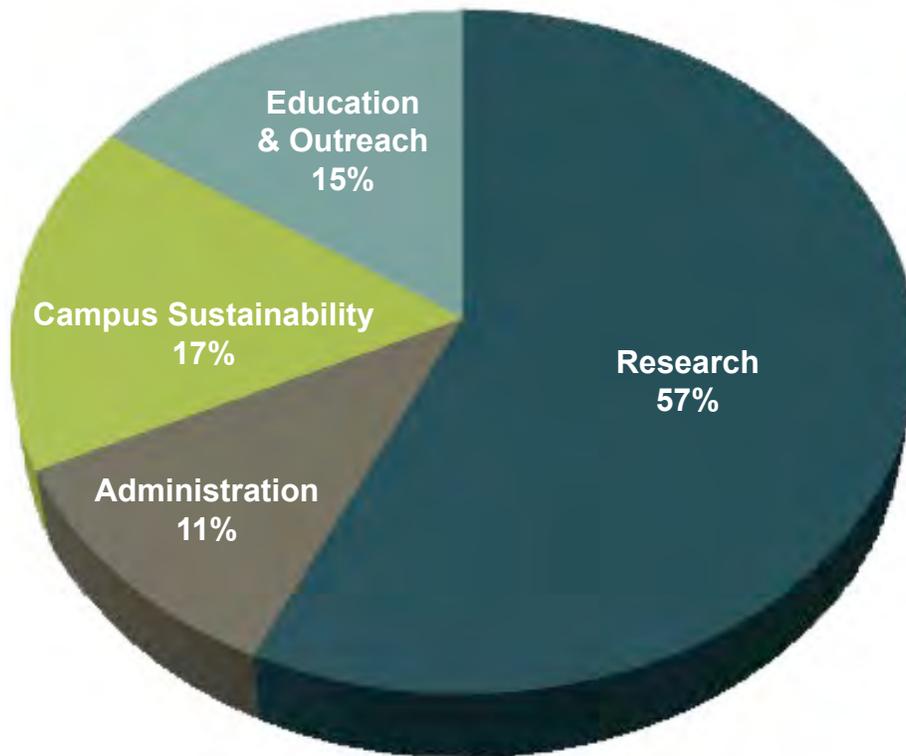


• iSEE founding benefactor the Alvin H. Baum Family Fund, under the administrative leadership of Joel Friedman. The Baum Fund has given more than \$2 million to support iSEE and its Baum Family Director, Evan H. DeLucia. Baum also supported iSEE's predecessors, the Center for a Sustainable Environment and the Environmental Change Institute.

• Illinois alumnus Stuart L. Levenick and wife Nancy J. Levenick of Peoria, whose \$500,000 endowment supports the Levenick iSEE Fellows Program of scholars, research fellows, environmental fellows, and policy fellows. (*More on the program, page 14.*) A \$500,000 match by Caterpillar Inc. will be used for the Levenick-Caterpillar Collaboratory, a new facility for education, communications, and collaboration to support the Fellows and iSEE.



FY16 iSEE OPERATIONS BUDGET BREAKDOWN



Carbon Credits Sale to Bolster Campus Sustainability Efforts

In 2016, iSEE helped the University of Illinois at Urbana-Champaign earn more than \$700,000 from a sale of certified carbon credits to BP Target Neutral as part of a new Carbon Credit and Purchasing Program through Boston-based nonprofit

organization Second Nature.

Proceeds from the sale will be held at the campus level and used toward further reductions of the campus carbon footprint. (*For more details on the sale, see page 20.*)

External Funding Grant Requests

During 2015-16, the Institute submitted grant requests — or helped facilitate requests — totaling \$17,270,552 in support of its own research, existing Illinois research teams, new collaborative centers and teams compiled by iSEE, campus sustainability initiatives, and education and outreach activities.

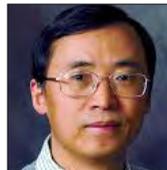
Three projects, totaling \$1,638,665, have been funded thus far with several more still pending.

Proposals were submitted to the following organizations in 2015-16:

- Eight to the National Science Foundation (NSF); three pre-proposals and five full.
- Four to the U.S. Department of Agriculture (USDA).
- Three to the U.S. Department of Energy (DOE).
- And one each to the U.S. Environmental Protection Agency (EPA), the Global Innovation Fund (GIF), the Illinois Clean Energy Community Foundation (ICECF), the Gates Foundation, the U.S. Army Construction Engineering Research Laboratory (CERL), the Leverhulme Trust, and the U.S. Department of the Interior.

Specifically for its existing research projects, iSEE has submitted or helped facilitate the following proposals:

- \$6,498,708 (three proposals) for the Critical Infrastructure and Transportation project through PI Ximing Cai, co-PI Madhu Khanna, and Civil & Environmental Engineering Professor Praveen Kumar. (*More on the project, page 11.*)
- \$3,554,204 (two proposals) for the Crops *in silico* project and PIs Stephen P. Long and Amy Marshall-Colón. (*More on the project, page 7.*)
- \$1 million (two proposals) for the Agroforestry for Food project and PI Sarah Taylor Lovell and co-PI Wendy Yang. (*More on the project, page 10.*)
- \$999,482 for the Stormwater and Mosquito Control Project and co-PI Carla Cáceres. (*More on the project, page 13.*)
- \$499,964 for the Extreme Events & Resilient Communities project and PI Yanfeng Ouyang. CERL awarded this project. This is the second award for this project team, which iSEE brought



CAI

together. (*See blue box for more details.*)

- \$244,977 (and a Letter of Intent to the Gates Foundation) for the Stored Solar Stove project and PI Bruce Elliott-Litchfield (*More on the project, page 18.*)

Other externally funded projects include:

- \$910,441 from the Leverhulme Trust for Professor Evan H. DeLucia (PI) and Associate Professor Carl Bernacchi (co-PI) to be part of the Leverhulme Centre for Climate Change Mitigation, partnering with nine other institutions. (*More on the new Centre, page 6.*)
- \$228,260 from ICECF for a biomass boiler to heat the Energy Farm greenhouse, a project initiated by iSEE Associate Director Ben McCall. (*More on the project, page 19.*)

Added to the \$22,868,272 applied for in FY14 and FY15, iSEE has made or facilitated \$40,138,824 in external funding requests thus far.

iSEE will finish 2016 strong: Two more major external grant requests, totaling \$140 million, will be submitted in September 2016.

Resilient Communities Project Earns Extension

In April 2016, the U.S. Army Construction Engineering Research Laboratory (CERL) awarded Principal Investigator Yanfeng Ouyang and co-PIs Paolo Gardoni and Colleen Murphy an additional three years and \$499,964 to continue their research into the resiliency of communities during times of manmade or natural extreme events.



OUYANG

In addition, the Extreme Events & Resilient Communities Project team will receive direct funding for four graduate students to assist in the project. iSEE, which helped form the team and gain the \$220,000 initial CERL grant in 2015, also assisted in applying for this extended federal grant.

New iSEE-Affiliated Research Centers

The Institute is proud to partner with campus academic units and other institutions on new research endeavors announced during the 2015-16 fiscal year:

The Center for Applied Collaboration on Human Environments (CACHE)

The Department of Civil and Environmental Engineering (CEE), College of Engineering (CoE), and iSEE provided seed funding for this new center in early 2016.

At the heart of CACHE's mission is a desire to learn how basic services within a home — energy, sanitation, and drinking water — impact human health and the environment.



BOND

Research initiatives in three thrust areas build upon one another to shape understanding of emissions at scales as small as one household system and as large as worldwide.

By examining the small scale, physical and social scientists can tailor technologies and education strategies to achieve lasting improvements in human environments; and by examining collective knowledge of many small-scale studies, they can create increasingly accurate scenarios for future emissions levels regionally and worldwide.

Led by MacArthur Fellow and Illinois CEE Professor Tami Bond, CACHE integrates initiatives on modeling and sensing, global and regional scenario modeling, and the elucidation of social and technical principles governing interactions between humans and technology. Its ultimate goals are to chart plausible paths toward a better future and to provide tools and understanding that allow people to walk those paths.

Visit CACHE online at <http://publish.illinois.edu/HumanEnvironments>.

The Leverhulme Centre for Climate Change Mitigation

In Summer 2016, iSEE secured \$910,441 for Professor Evan H. DeLucia (PI) and Associate Professor Carl Bernacchi (co-PI), both in the Department of Plant Biology, to study enhanced weathering (EW) as part of this new Centre.

DeLucia, Bernacchi, iSEE Postdoctoral Research Associate Ilsa Kantola, Department of Plant Biology Technician Michael Masters, and iSEE Technician Chris Sligar comprise the Illinois team.



DeLUCIA

For five years, team members will work on quantifying rates of EW and carbon balance of food crop/bioenergy agroecosystems; testing hypotheses about interactions between enhanced weathering, crop performance, mycorrhizal growth, and soil properties; and investigating the role of rising CO₂ fertilization on enhanced weathering, the root microbiome, and plant performance.



BERNACCHI

Illinois is one of 10 partners in the Centre. Others include the University of Sheffield (lead), the University of Southampton, the University of Bristol, the University of California, the University of Cambridge, the Open University in UK, Cardiff University, the University of Leeds, and the Southeast Asia Rainforest Research Partnership. The work from this centre is funded by a £10m grant from the Leverhulme Trust, which was established by the Will of William Hesketh Lever, the founder of Lever Brothers.

Since 1925, the Leverhulme Trust has provided grants and scholarships for research and education; today, it distributes approximately £80m a year.

Thematic Research: Climate Solutions

Crops *in silico*

Predicting crops' responses to climate change is crucial in solving the grand food security challenge. This project seeks to computationally mimic the growth and development of crops at the molecular, cellular, plant and ecosystem levels. Creation of an *in silico* — computer simulation — platform that can link models across different biological scales has the potential to provide faster and more accurate simulations of plant response to the environment than any single field model.

When funded in 2015, the project was called Plants *in silico*. But project leaders chose to change the name to Crops *in silico* (*Csi*), reinforcing the message that digital models of food and fuel crops are needed to rapidly create breeds that are suited to a changing climate.

First-year progress ...

Csi has developed multiple models:

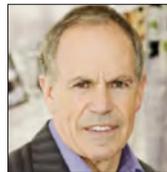
- a molecular model of At1, a key nitrate transporter;
- a gene-level model of the effects of changing nitrate uptake rate and cellular concentrations on transcript and metabolite levels;
- a gene-level model of the effects of changing atmospheric carbon dioxide concentrations on transcript and metabolite levels;
- a metabolic model that simulates the processes of photosynthesis under elevated atmospheric CO₂ concentrations;
- a system-level model that simulates carbon partitioning between the leaf and roots, and sugar-starch partitioning under elevated atmospheric CO₂ concentrations; and

- a solar light absorption model using bi-directional path tracing.

The team has rendered plant- and canopy- level data from the system model and measured field data of soybeans over a growing season — including phenotypic differences between soybeans growing under ambient and elevated atmospheric CO₂.

And *Csi* constructed a run-time communications system for integration, which provides global control, logging, and debugging support and permits new models to be integrated without requiring change to existing models. The metabolic and bio-system models are online, with others being added as they become ready for testing.

Read more about the project at bit.ly/Cropsinsilico.



LONG



MARSHALL-COLÓN

Funding applications ...

Team leaders Steve Long and Amy Marshall-Colón applied for a \$3 million grant through the National Science Foundation in February, and Marshall-Colón also applied for a \$500,000+ grant from the U.S.

Department of Energy.

Psi Symposium & Workshop ...

On May 18-20, 2016, the Psi Symposium & Workshop brought together local, national, and international experts to exchange information and collaborate on a course for achieving plants *in silico*. The event was funded by \$23,700 from the Olga G. Nalbandov Lecture Fund and \$21,000 in cost share contributions by different units across campus. See presentations from the event at bit.ly/WatchPsi.

CROPS IN SILICO PRINCIPAL INVESTIGATORS AND CO-PIs

Stephen P. Long (PI)	Professor, Crop Sciences and Plant Biology
Amy Marshall-Colón (PI)	Assistant Professor, Plant Biology
H. Edward Seidel	Director, National Center for Supercomputing Applications (NCSA)
John Hart	Professor, Computer Science
Diwakar Shukla	Assistant Professor, Chemical and Biomolecular Engineering
James O'Dwyer	Assistant Professor, Plant Biology
Xinguang Zhu	Group Leader, Institute of Computational Biology, Chinese Academy of Science

Thematic Research: Energy Transitions

Stored Solar Stove

Nearly 3 billion people rely on solid fuels like wood, charcoal, animal dung, and grasses to cook daily meals. The resulting indoor air pollution causes 4 million deaths each year — more than malaria, tuberculosis, and HIV/AIDS combined.

By developing a technology to collect, concentrate, store, and recover abundantly available solar thermal energy at near-flame temperatures, this project hopes to eliminate harmful emissions from cooking.



LITCHFIELD

Second-year progress ...

The team reports several new developments:

- A means to quickly recover the stored energy from the “Sun Bucket” vessel for cooking and other uses.
- A new way to seal the vessel and ensure safe operation.
- A prototype that keeps the vessel in the focal point of the charging dish, thereby reducing charge times by 25-40%.
- Testing on a tracking mechanism to maintain focus on the sun throughout the day.
- New contacts (and new testing of the Sun Buckets system and cooking) at Navajo Tech University in Crownpoint, N.M., Climate Healers in India and Navajo Nation; LSM NGO in Haiti; and an Environmental Education Center in Namibia.
- A cooking blog — cookingwithsunbuckets.com — by team member Samantha Lindgren.
- A connection with the Green Restaurant Association to explore domestic markets.
- Continued data processing toward construction of solar mapping, total global potential, and prime starter locations.

Read more on the project at bit.ly/sunbuckets.

‘Best Energy-Specific Venture’ — 2016 Cozad Awards

Students working with the Stored Solar Stove project received multiple recognitions at campus’ annual Entrepreneurship Forum held by the College of Engineering’s Technology Entrepreneurship Center:

- Students working with “Sun Buckets Inc.” — the team’s business arm to market their innovation — earned the Cozad Best Energy-Specific Venture Award and \$5,000 cash funding for the startup.
- Team member Matthew Alonso, a Ph.D. Candidate in Agricultural and Biological Engineering, was named one of the top three finalists for the Illinois Innovation Prize, which recognizes passionate, entrepreneurship-minded students working to change the world through technology.



Funding applications ...

Primary Investigator Bruce Elliott-Litchfield and the team received \$40,000 from the ADM Institute for the Prevention of Postharvest Loss to lead a project on creating a solar dryer. They also applied for several small grants totaling about \$100,000, and the team is a semifinalist for the Ocean Exchange 2016 fall startup competition.

STORED SOLAR STOVE PRINCIPAL INVESTIGATOR AND CO-PIs

Bruce Elliott-Litchfield (PI)	Professor of Agricultural and Biological Engineering (ABE)
Tami Bond	Professor of Civil and Environmental Engineering (CEE)
Madhu Viswanathan	Professor of Business
Joe Bradley	Teaching Associate at Illinois Engineering First-Year-Experience (IEFX)

Thematic Research: Energy Transitions

Nano-CarboScavenger

As demand for petroleum increases, so will transport of oil — leading to inevitable spills and environmental disasters. The aim of this project is to optimize a Nano-CarboScavenger (NCS), a particle designed to clump oil molecules together for easy removal from water using nets and booms and in some cases to disperse oil for natural digestion by microorganisms.



PAN

Chemical dispersants and coagulant treatments for oil spills create environmental problems of their own when they are added to water bodies. In contrast, the NCS leaves behind no residual footprint because it degrades in the environment and in living systems with no

harmful effects to organisms.

First-year progress ...

Dipanjan Pan reports that his team is “totally in line with our proposed timeline for reaching all the milestones.” Specifically:

- Significant research progress has been made — and key data collected — to take the project beyond the level of proof of concept. New student members have been added to the team (see those updates below).

- And new research directions have been identified — and progress has been made in those directions. They include:

- “Utilizing our platform technology based on carbon nanoparticles, we are proposing a novel ‘smart water purification system’ for remediation of pharmaceuticals, hormones, polyaromatic hydrocarbons and other contaminants,” Pan said.

- A second project is looking at production of mineral-rich algal nanoparticles from biomass (algae) for agricultural, biomedical and environ-



mental (metal, e.g. mercury scavenging) application.

- “A third spinoff project is looking at a self-‘reproducing’ bacterial-nano-enzyme architecture for novel solution of biofuel production,” he said.

Read more about the project at bit.ly/NCS-project.

Funding applications ...

Pan and his team have applied in 2015-16 for small grants from the ACS Petroleum Research Fund and two U.S. Department of Agriculture grants; the latter two both have resubmissions pending.

Publications in 2015-16 ...

The team’s manuscript on NCS rehabilitating petroleum-contaminated water has been reviewed twice with *Nature Communications*, and another revised version is ready to be submitted.

NANO-CARBOSCAVENGER PRINCIPAL INVESTIGATOR AND CO-PIs

Dipanjan Pan (PI)

Assistant Professor of Bioengineering

B.K. Sharma

Senior Research Engineer at Illinois Sustainable Technology Center (ISTC)

John Scott

Senior Analytical Chemist at Illinois Sustainable Technology Center (ISTC)

Thematic Research: Secure & Sustainable Agriculture

Agroforestry for Food

Agroforestry is the practice of farming with fruit- and nut-bearing perennial trees and shrubs rather than resource-intensive annual crops like corn and soybeans. In a 30-acre field trial, this project — originally called Multifunctional Woody Polyculture — will examine the ecological, economic, and climate benefits of perennial mixed-crop agriculture.

In May 2015 on the project site at the Energy Farm, roughly 12,000 seedling trees and shrubs of 10 different species were planted. Forage crops like alfalfa and hay were planted between the rows of trees and harvested as the young trees grow to fruiting age.

In addition to providing food and fiber in abundance, these alternative systems are expected to offer environmental benefits such as permanent wildlife habitat, efficient use of nutrients, and storage of carbon — all of which the team is measuring.

Team researchers are also accounting for all costs and income streams to compare with a conventional corn-soybean rotation.

Second-year progress ...

Updates on this long-term field trial, established with seven treatments replicated four times:

- Maintenance has been a primary focus over the past year: weed control, wildlife damage, etc.
- An eddy covariance tower was set up to measure carbon and water flux.
- A first cutting of the hay grown in the alleyways between crops was harvested in May 2016.
- Performance trials for individual crop species are underway as well:

— New hybrids of hazelnuts are being studied for resistance to Eastern Filbert Blight.

— Black currants are being tested for tolerance to shade, to simulate conditions of growing in the understory, beneath chestnuts and hazelnuts.

- Light interception has been modeled for component species at system maturity.

- A Life Cycle Assessment (LCA) has focused on the unproductive years (prior to harvesting of tree products).

- The nursery phase of chestnut trees was completed based on inventory data from a large Midwest nursery, and data for establishment was collected.

Read more about the project at bit.ly/ag4food.



LOVELL

Funding applications ...

Principal Investigator Sarah Taylor Lovell was awarded \$97,660 from the Illinois Specialty Crop Program for hazelnut breeding; another study of currants by co-PI Bruce Branham is under review by the same program.

In addition, Lovell and co-PI Wendy Yang applied for \$500,000 each from the U.S. Department of Agriculture.

Publications in 2015-16 ...

- “Agroforestry – The Next Step in Sustainable and Resilient Agriculture,” by M.S. Candidate Matthew Wilson and Lovell in *Sustainability Journal*.

- “Preliminary Modeling of Light Availability in a Diverse Agroforestry System Using a Spatially Explicit Forest Simulator,” by M.S. Candidate Erik Stanek, Ph.D. Candidate Kevin Wolz, and Lovell in *i-ACES*.

AGROFORESTRY FOR FOOD PRINCIPAL INVESTIGATOR AND CO-PIS

Sarah Taylor Lovell (PI)	Associate Professor of Crop Sciences
Nick Paulson	Associate Professor of Agricultural and Consumer Economics (ACE)
Michelle Wander	Professor of Natural Resources and Environmental Sciences (NRES)
Wendy Yang	Assistant Professor of Plant Biology
Jeremy Guest	Assistant Professor of Civil and Environmental Engineering (CEE)
Bruce Branham	Professor of Crop Sciences

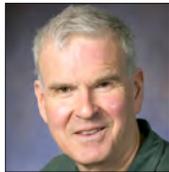
Thematic Research: Sustainable Infrastructure

Critical Infrastructure & Transportation

Changes in the availability of water and fuel, in energy production methods and regulation, and in community interactions have made the interdependencies between critical infrastructure systems in the United States an important topic of study.

This project focuses on developing an analytical framework for modeling and analyzing these Interdependent Critical Infrastructure (ICI) systems, incorporating both renewable energy and national transportation systems. The results will be used

to create a wealth of knowledge that will drive future energy and environmental policies, infrastructure design and management, and educational curricula.



OVERBYE

First-year progress ...

PIs Tom Overbye and Ximing Cai report the following successes:

- The dependence of the electric grid on water has been analyzed, using droughts and heat waves to develop generation operating points and constraints.

• The team has quantified the tradeoffs between profitability, food and fuel production, greenhouse gas (GHG) emissions and nitrate runoff reduction with different types of biofuels in the Sangamon watershed in Illinois and analyzed the optimal mix of biofuels as well as the policies that should supplement the mandate to achieve multiple environmental outcomes.

- Project researchers have modeled the load of electric vehicle (EV) charging stations in response to day-ahead electricity prices; the next step will be to incorporate EV load modeling as a demand response program into the electricity market.

- The team is continuing a study that found that on average, the total mining water used in U.S. oil/



gas producing counties has increased by 62% since fracking expanded in the late 2000s; results suggest that the majority of additional water used was withdrawn from groundwater resources.

- And the team has developed a model used to examine the synergies and trade-offs generated by overlapping renewable energy policies in the transportation sector and their implications for the cost of GHG mitigation.

Read more on the project at bit.ly/ICI-project.

Funding applications ...

The team worked with Civil & Environmental Engineering Professor Praveen Kumar on a nearly \$3 million National Science Foundation proposal involving food-energy-water systems. Cai and others have submitted a nearly \$2.5 million NSF proposal on ICIs and multiple energy sources for transportation. And co-PI Madhu Khanna submitted a nearly \$1 million proposal on food, bioenergy and the environment in the Mississippi River Basin.

Publications in 2015-16 ...

- “Mix of First- and Second-Generation Biofuels to Meet Multiple Environmental Objectives: Implications for Policy at a Watershed Scale” co-authored by Khanna, Cai, and others in *Water Economics and Policy* (World Scientific, 2015).

CRITICAL INFRASTRUCTURE & TRANSPORTATION PRINCIPAL INVESTIGATORS AND CO-PIs

Thomas Overbye (PI)	Professor of Electrical and Computer Engineering (ECE)
Ximing Cai (PI)	Professor of Civil and Environmental Engineering (CEE)
Madhu Khanna	Professor of Agricultural and Consumer Economics (ACE)
Yanfeng Ouyang	Associate Professor of Civil and Environmental Engineering (CEE)
Ashlynn Stillwell	Assistant Professor of Civil and Environmental Engineering (CEE)

Thematic Research: Water & Land Stewardship

Smart Water Disinfection

Billions of people around the world rely on drinking water sources contaminated with disease-causing organisms. Much research attention has been paid to fighting bacterial illnesses, but viruses have been largely ignored. No more. This project seeks a more detailed understanding of how viruses become noninfectious after contact with common disinfection treatments, including ultraviolet (UV) light exposure and chlorine. The hope is to create new ways to control viruses at the molecular level.

Researchers in this project are also creating a real-time sensor that can be dipped into a water sample and indicate whether infectious viral particles are present.

Second-year progress ...

Updates from PI Benito Mariñas and his team:

- Team members determined that UV irradiation emitted by a medium pressure (MP) source inactivates human adenovirus (HAdV) through different mechanisms depending on specific wavelengths. The knowledge of which viral component gets affected during UV light inactivation will allow the monitoring of this pathogen in drinking water.
- In the case of free chlorine and monochloramine disinfection, the team found that inhibition of an event occurring at or before early gene transcription must be the cause of adenovirus inactivation. The findings will be the foundation to develop novel effective disinfectants and rapid methods for detection of infectious viruses in drinking water.
- The team developed a method to express the major capsid proteins of adenovirus in *Escherichia coli*. This part of the study may play a role in understanding inhibition of viral entry, thus leading to adenovirus inactivation by free chlorine.
- The team has reported a simple and highly



MARIÑAS

sensitive amplified aptamer-based fluorescent sensor for aflatoxin B1.

- Working with an NGO partner in Tanzania, team members have begun marketplace and sustainability literacy education, using trainers. Co-PI Madhu Viswanathan will be traveling to Tanzania to guide training of trainers.

Read more about the project at bit.ly/smrtwtrdis.

Funding applications ...

The Mariñas team has in the past year submitted two full National Science Foundation proposals — one to the NSF Research Traineeship Program, and one to the NSF Science and Technology Center; and one pre-proposal to the NSF Engineering Research Center.

Publications in 2015-16 ...

- “Analysis of the viral replication cycle of adenovirus serotype 2 after inactivation by free chlorine,” by Ph.D. Candidate Aimee Gall, co-PI Joanna Shisler and Mariñas in *ES&T* 2015.
- “Fluorescent Assay methods for the detection of AFB1 based on DNA aptamer and GO,” co-authored by co-PI Yi Lu and others in *Analysts* (2016).
- “A Bottom-Up Approach to Short-Term Immersion in Subsistence Marketplaces: Methodological and Substantive Lessons on Poverty and the Environment From Tanzania,” co-authored by Viswanathan, Mariñas and others in *Organization & Environment* 2016.
- “Inactivation Kinetics and Replication Cycle Inhibition of Adenovirus by Monochloramine” by Gall, Shisler, and Mariñas in *ES&T Letters* 2016.
- “Characterizing Bacteriophage PR772 as a Potential Surrogate for Adenovirus in Water Disinfection,” by Gall, Shisler, and Mariñas in *ES&T* 2016.

SMART WATER DISINFECTION PRINCIPAL INVESTIGATOR AND CO-PIs

Benito Mariñas (PI)	Professor and Head of Civil and Environmental Engineering (CEE)
Yi Lu	Professor of Chemistry
Joanna Shisler	Associate Professor of Microbiology
Madhu Viswanathan	Professor of Business

Thematic Research: Water & Land Stewardship

Stormwater & Mosquito Control

Mosquito-borne diseases pose a major threat worldwide despite substantial global eradication efforts. This project studies how “green infrastructure” — technologies to manage stormwater, runoff, and contaminants — can be used to limit the number of aquatic breeding habitats for mosquitoes to keep their numbers low.

The team also studies how the aquatic microbiome can be manipulated to “starve” larvae to control mosquito populations.

First-year progress ...

PI Brian Allan said three major areas of development stand out in 2015-16:



ALLAN

- The primary area of activity has been to unite the mosquito control, hydrological modeling, and cyberGIS experts on the team in an ambitious project to forecast for the continental U.S. a) what

will be the extent of the adoption of green stormwater infrastructure based on state and municipal regulations combined with local hydrology and soil characteristics, and b) what is the likely impact of the widespread adoption of green infrastructural practices for mosquito control based on the known biology of local vector mosquito species.

- The arrival of Zika virus in the Americas has created several funding opportunities directly relevant to the efforts of this project, including a synthesis of the team’s empirical research into the stormwater environment and employing cyberGIS to use large data sets and project forecasts of disease risk and movements across landscapes.

- Findings to date have motivated several



additional field and laboratory studies, including surveys of green and conventional stormwater infrastructure here in Illinois to better understand the consequences of the adoption of green technologies for mosquito control.

Read more on the project at bit.ly/stormmosq.

Funding applications ...

The team has applied for two National Science Foundation grants, one of which is pending: a \$999,482 proposal by co-PI Carla Cáceres.

In addition, postdoc Allie Gardner and the team submitted a proposal to USAID on urgent research into the Zika virus; the proposal earned an in-person pitch to a panel of experts in Washington, D.C.

Publications in 2015-16 ...

- “Effect of Trapping Methods, Weather, and Landscape on Estimates of the Culex Vector Mosquito Abundance” co-authored by Ph.D. Candidate Surendra Karki, co-PI Marilyn O’Hara Ruiz and others in *Environmental Health Insights* 2016:10.

STORMWATER & MOSQUITO CONTROL PRINCIPAL INVESTIGATOR AND CO-PIS

Brian Allan (PI)	Assistant Professor of Entomology
Carla Cáceres	Professor of Animal Biology
Allison Hansen	Assistant Professor of Entomology
Juma Muturi	Research Scientist at USDA
Marilyn O’Hara Ruiz	Clinical Associate Professor of Pathobiology
Arthur Schmidt	Research Assistant Professor in Civil and Environmental Engineering (CEE)
Shaowen Wang	Professor of Geography and Geographic Information Science

First Levenick Fellows Project Underway

On March 1, iSEE appointed its first two Levenick Fellows: Research Fellow Erica Myers, Assistant Professor of Agricultural and Consumer Economics (ACE); and Scholar Mateus Nogueira Meirelles de Souza, Ph.D. Candidate in ACE.

During their time in residence with iSEE, they will examine how individuals on the Urbana-Champaign campus make decisions relating to energy use and test a variety of behavioral intervention strategies to reduce that consumption.



MYERS



de SOUZA

“Fuel costs — particularly in a campus setting — are often not well understood or salient for consumers,” Myers said. “Students, faculty, and staff do not see billing or consumption information, making it difficult to translate use of particular energy services into costs.

“As a result, energy consumption is often ‘out of sight, out of mind’ as we go through our busy days on campus.”

The new project will be completed in two phases:

- During spring 2016, Myers and de Souza worked with engineers and building managers on campus to identify behavioral energy savings opportunities related to office and classroom heating and cooling, electronics and lighting.
- In summer and fall 2016, they are designing and testing the relative effectiveness of behavioral interventions such as educational campaigns, usage information provision, and social comparisons for taking advantage of savings opportunities and reducing energy consumption. Myers and de Souza plan to share their findings in meetings with University stakeholders, in presentations at academic conferences, and through a publicly published University of Illinois white paper in early 2017.

“Our results will not only be relevant for the



About the Levenick iSEE Fellows — and Plans for the Future

The Levenick iSEE Fellows Program is supported by a \$500,000 gift from Illinois alumnus Stuart L. Levenick and his wife Nancy J. Levenick, both of Peoria (see *more about donors, page 4*). It contributes to iSEE’s mission of actionable research — that is, work that leads to lasting, real-world solutions to the world’s current and future sustainability-, energy- and environment-related issues.

The Levenick iSEE Fellows and the Institute mission will be further supported by a matching gift from Caterpillar, which will help fund the Levenick-Caterpillar Collaboratory, a new space for learning, research, communicating, and collaborating with a state-of-the-art classroom and media center.

U of I in meeting its campus sustainability goals, but for other campus and commercial settings where energy use is not well understood or salient for consumers,” Myers said.

Read more about this Levenick Fellows Program: <http://sustainability.illinois.edu/about/partnerships/levenick-isee-fellows-program/>.

Energy at Illinois Website Launched

On Aug. 1, iSEE launched a new website to unite the numerous energy scholars on the University of Illinois' Urbana-Champaign campus.

Illinois is known for its scholars across dozens of disciplines, experts who are willing to work across campus to solve the issues the world faces in creating a secure and sustainable energy future — and “Energy at Illinois” (energy.illinois.edu) is the new access point for energy-related research, collaborations conducted across campus.

The website showcases Illinois scholars' research and engagement programs spread across the continuum of energy from its generation to end user:

- Production / Harvesting, including renewables, fossil fuels, and nuclear;
- Delivery, including physical and wired transmission;
- Storage, including fuel cells and batteries; and
- Demand / Conversion, including motors and residential, commercial and industry use of energy.

In addition, Energy at Illinois has individual pages for eight issue-focused, cross-cutting research areas. On all 12 of these research strengths pages, individual scholars are listed with links to their profiles and work, making it easy to find research collaborators and expert sources.

The site serves as a “front porch” to various energy centers on campus as well as Illinois-affiliated centers across the nation and overseas. And the site contains links to faculty-led research groups, state surveys, and academic units featuring energy research.

Finally, Energy at Illinois will be a repository for opportunities in the energy field, including

those for funding, education, and jobs. And when funding opportunities arise, iSEE stands ready to help build teams of Energy Scholars — and to organize and submit large interdisciplinary research grant applications involving multiple campus units.



Water at Illinois Update ...

In summer 2016, a new article by the Illinois Sustainable Technology Center (ISTC, a Division of the Prairie Research Institute) outlined a new collaboration by Illinois Water Scholars:

ISTC researchers Nandakishore Rajagopalan and Wei Zheng are part of a team of experts from government and academia who are working to improve the filtration of household drinking water using new ultrathin nanoparticle-based membranes to remove trace organic contaminants (TrOCs).

The U.S. Department of Energy will fund the work through its Technology Commercialization Fund, which moves promising energy technologies developed by 12 national laboratories and their research partners to the marketplace.

ISTC will assist in testing the performance of prototype TrOCs filtration membrane devices which may be commercially viable for the home water filtration market.

Argonne National Laboratory and the University of Chicago developed the technology for the new membrane structure using gold nanoparticles which are strong and porous, and which can be “dialed” to selectively trap different contaminants by engineering the ligand on the particle surface.

Read the full article — and get to know more about the Illinois Water Scholars — at water.illinois.edu.



Big Picture: iCAP, Climate Commitment Signed

In October 2015, Interim Chancellor Barbara Wilson signed the 2015 Illinois Climate Action Plan (iCAP), an updated roadmap for campus sustainability initiatives as the Illinois campus seeks its ultimate goal of carbon neutrality by the earliest possible date.

The plan is ambitious: outlining goals, time-bound objectives, and potential strategies to reach them in 11 major areas: Energy Conservation and Building Standards; Energy Generation, Purchasing, and Distribution; Transportation; Water and Stormwater; Purchasing, Waste, and Recycling; Agriculture, Land Use, Food, and Sequestration; Carbon Offsets; Financing; Curricular Education; Outreach; and Research.

By no later than 2050, campus will reduce its net emissions to zero. The iCAP specifies incremental targets along that path. For example, by FY20 our campus will seek to:

- reduce campus energy usage and energy emissions by 30%;
- return emission levels from transportation to the FY08 baseline (reversing an observed 30% increase from FY08 to FY14);
- reduce water consumption by 30%; and
- reduce agricultural and landscape emissions by 30%.

Note: All reductions are relative to campus' FY08 baseline measurements.

Read the full iCAP and more summaries at sustainability.illinois.edu/campus-sustainability/icap/.

Resilience Commitment ...

In February 2016, campus further strengthened its dedication to climate leadership when Wilson signed the Second Nature Climate Resilience Commitment, through which the University acknowledges that the effects of climate change are already being felt —

and that universities and colleges must pursue both mitigation and adaptation to combat the unfolding crisis.

Illinois is now a Charter Signatory of the Second Nature Climate Commitment, which combines a Carbon Commitment the campus signed in 2008 with the newly signed Resilience Commitment.

By adding the Resilience Commitment, Illinois has made a pledge to evaluate campus vulnerabilities to a changing climate in its landscapes, natural resources, and energy production — and to make an action plan that addresses those weaknesses.

Read remarks from Wilson and iSEE Director Evan H. DeLucia on the new commitment on the iSEE website at sustainability.illinois.edu/ui-remains-green-campus-leader-as-chancellor-signs-climate-resilience-commitment/.



Campus Sustainability Leadership

2015-16 iCAP WORKING GROUP

The Illinois Climate Action Plan Working Group (iWG) is made up of representatives from major stakeholder groups across campus, and it was tasked with a) reviewing Sustainability Working Advisory Team (SWATeam) recommendations and transmitting them to the affected units or to the Sustainability Council, as appropriate; and b) initiating a process for meeting 2015 iCAP goals. The 2015-16 members:

NAME	TITLE
Ben McCall	Associate Director for Campus Sustainability, representing iSEE and serving as iWG Chair
Morgan Johnston	Associate Director of Facilities & Services (F&S)/Director of Sustainability, F&S, representing F&S
Lowa Mwilambwe	Associate Vice Chancellor for Student Affairs/Director of Auxiliary Services, representing Student Affairs
Matthew Tomaszewski	Associate Provost for Capital Planning, representing the Office of the Provost
Nancy O'Brien	Chair of Senate Committee on Campus Operations, representing the Academic Senate
Jess Tang	Undergraduate, Chair of the Student Sustainability Leadership Council
Kevin Duff	Assistant Director of Planning and Design, representing the Office of Business and Financial Services
Rob Fritz	Beckman Institute Director of Facilities, representing the community of college-level facility managers

Progress in the Process: iWG in Action

Over two years of existence, the iCAP Working Group has received, considered, and passed on 17 SWATeam recommendations — and during the past year, a 2014-15 recommendation came to fruition with the hiring of Active Transportation Coordinator Lily Wilcock at Facilities & Services.

Here is a look at the nine SWATeam recommendations from 2015-16 (and the varied progress toward accomplishment), from most recent to oldest:

- The Energy Conservation and Building Standards SWATeam in May sent a recommendation to the iWG that the University restore funding for energy conservation work on campus to FY15 levels; increase recommissioning and preventive maintenance teams to upgrade building control system; push to maintain the State Utilities Budget; and coordinate with the Campus Master Plan to retire campus space and reduce overall square footage.

- The Purchasing, Waste, and Recycling SWATeam in May sent a recommendation that a campus stakeholder lead an effort to expand and improve the effort to capture reusable items during Move Out — collaborating with the University YMCA Dump & Run event.

- The Agriculture, Land Use, Food, and Sequstration SWATeam in January sent a recommendation that a researcher be hired to estimate current greenhouse gas fluxes in the University's agricultural land holdings.

Read More on iWG, SWATeams ...

iWG: sustainability.illinois.edu/campus-sustainability/icap/icap-working-group/

SWATeams: sustainability.illinois.edu/campus-sustainability/icap/swateams/

- The Energy Conservation and Building Standards SWATeam in March sent a recommendation on an energy conservation engagement activity in which volunteers would spend an hour turning out lights and closing windows in buildings on the U of I Main Quad. The iWG supported the proposal, iSEE offered its support. (*More about the Illini Lights Out event, page 23.*)

- The Energy Generation, Purchasing, and Distribution SWATeam in February sent a recommendation that a consultant be hired to study electrification of most campus space and water heating. It also sent a recommendation that the University take steps to allow a power purchase agreement for electricity without any restrictions on length of term.

- The Transportation SWATeam in February sent three recommendations to the iWG: 1) a travel demand analysis on reducing air travel emissions; 2) a feasibility study on differential parking pricing for shared vehicles; and 3) a campus fleet analysis and planning study.

Campus Sustainability Leadership

2015-16 SUSTAINABILITY WORKING ADVISORY TEAMS

Each fall, iSEE charges six teams consisting of faculty, staff, and students to examine the six broad themes within the Illinois Climate Action Plan. Among their duties, these Sustainability Working Advisory Teams (SWATeams) recommend concrete steps the campus should take to meet its iCAP targets — and members also develop suggested revisions and updates to the plan. The 2015-16 teams:

ENERGY CONSERVATION AND BUILDING STANDARDS

Name	Title
Marian Huhman (Chair)	Assistant Professor, Communication
Fred Hahn	Associate Director of Engineering Services, Facilities & Services
Karl Helmink	Energy Conservation and Retrocommissioning, Facilities & Services
Dhara Patel	Undergraduate Student, Civil and Environmental Engineering
Alex Dzurick	Graduate Student, Communication
Claudia Szczepaniak (Clerk)	Undergraduate Student, Psychology and Communications

ENERGY GENERATION, PURCHASING, AND DISTRIBUTION

Name	Title
Scott Willenbrock (Chair)	Professor, Physics
Xinlei Wang	Professor, Agricultural and Biological Engineering
Mike Larson	Director of Utility Operations, Facilities & Services
Tim Mies	Deputy Operations Director, Illinois Energy Farm
Jack Morrissey	Undergraduate Student, Civil and Environmental Engineering
Catherine Yee	Undergraduate Student, Earth, Society and Environmental Sustainability
Ben Reeber (Clerk)	Undergraduate Student, Chemical Engineering

TRANSPORTATION

Name	Title
Yanfeng Ouyang (Chair)	Associate Professor, Civil and Environmental Engineering
Bumsoo Lee	Associate Professor, Urbana and Regional Planning
Brian Farber	Executive Assistant to the Vice Chancellor for Student Affairs
Peter Varney	Director of Transportation & Automotive Services, Facilities & Services
Claire Dodinval	Undergraduate Student, Civil and Environmental Engineering
Zhaodong Wang	Graduate Student, Civil and Environmental Engineering
Joshua Feldman (Clerk)	Undergraduate Student

WATER AND STORMWATER

Name	Title
Rabin Bhattarai	Assistant Professor, Agricultural and Biological Engineering
Art Schmidt	Research Assistant Professor, Civil and Environmental Engineering
Keith Erickson (Chair)	Utility Distribution, Facilities & Services
Kishore Rajagopalan	Associate Director for Applied Research, Illinois Sustainable Technology Center
John Berens	Undergraduate Student, Civil Engineering
Scott Douglas	Graduate Student, Landscape Architecture
Carley Meeks (Clerk)	Undergraduate Student, Crop Sciences

PURCHASING, WASTE, AND RECYCLING

Name	Title
Dilip Chhajed	Professor, Business Administration
Warren Lavey	Adjunct Professor, Natural Resources and Environmental Sciences
Bart Bartels (Chair)	Zero Waste Coordinator, Illinois Sustainable Technology Center
Marcy Wright	Administrative Associate in Strategic Procurement, Office of Business and Financial Services
Karin Hodgins Jones	Graduate Student, Urban and Regional Planning
Rachel Baits	Undergraduate Student, Integrative Biology
Alexia Bedolla (Clerk)	Undergraduate Student, Earth, Society and Environmental Sustainability

AGRICULTURE, LAND USE, FOOD, AND SEQUESTRATION

Name	Title
Bruce Branham (Chair)	Professor, Crop Sciences
Jennifer Fraterrigo	Associate Professor, Natural Resources and Environmental Sciences
Brent Lewis	Campus Landscape Architect, Facilities & Services
Thurman Etchison	Assistant Director of Dining, Equipment and Facilities, Housing Dining Services
Joseph Edwards	Undergraduate Student, Natural Resources and Environmental Sciences and Integrative Biology
Adriana Noboa	Undergraduate Student, Agricultural and Biological Engineering and Horticulture
Chibu Asonye (Clerk)	Undergraduate Student



SSC: The Year in Review

The 2015-2016 school year saw a number of changes and opportunities for the Student Sustainability Committee (SSC).

One of the biggest and most immediate changes was structural: In summer 2015, SSC transitioned to being primarily housed within the Institute for Sustainability, Energy, and Environment (iSEE). After one year, it is already clear that the move was a success. The cross-promotion opportunities afforded working within iSEE alone have expanded SSC's reach across campus, and the greater integration with campus sustainability experts in the Institute has improved SSC's funding review process.



A major SSC-funded project was one of the top campus news items in fall 2015, as the 21-acre campus solar farm went online. Other past and current SSC projects were highlighted regionally in media as diverse as the Decatur Herald & Review, the Smile Politely blog, and WCIA-TV.

SSC's outreach efforts included partnering with a first-year seminar course for in-class projects (ENVS 491, taught by iSEE Associate Director Ben McCall; *more on page 24*), partnering with the residence halls for Sustainability Month and Earth Week promotions, and cross-promotion with the Sonified Sustainability Festival.

The depth and breadth of applications for SSC funding has grown significantly. SSC's total number of project applications grew to 52 in FY2016, with 23 ultimately receiving funding. Compare this to 39 proposed projects (21 funded) in FY2015 and 32 proposed projects (19 funded) in FY2014. About \$3

Energy Farm Getting Biomass Boiler

An iSEE-led project is now underway to integrate a biomass-fueled heating system into the main greenhouse at the campus Energy Farm. The new 198 kW boiler will burn part of the farm's energy crop harvest to generate hot water, which will be piped through the greenhouse and help maintain the warm conditions needed to conduct research without any net greenhouse gas emissions.

The purchase of the boiler and its installation are being supported by the Student Sustainability Committee (SSC), the Illinois Clean Energy Community Foundation (ICE-CF), the Dudley Smith Initiative, and proceeds from the 2015 campus sale of verified carbon credits to Chevrolet.

Contractors began work in summer 2016; the boiler should be fully operational by January 2017.

million total in project funding was requested, and SSC was able to allocate \$750,630 for new projects.

Most importantly, this past year was a banner one for student involvement. SSC saw its best year yet for student-led small project applications, with more than half the approved projects submitted directly by students. SSC members were a part of several major campus events, including speaking at the grand opening of the solar farm and the April celebration of Illinois' designation as a Tree Campus USA.

For more details, including full summaries of all SSC-funded projects, visit ssc.sustainability.illinois.edu.

Carbon Credits Sale an Innovative Way to Fund Campus Sustainability

iSEE and the University of Illinois at Urbana-Champaign have come up with a creative way to fund future sustainability on campus.

The 2016 sale of certified carbon credits to BP Target Neutral has earned more than \$700,000, and iSEE and Facilities & Services will work together to allocate funds for new projects that will improve campus energy efficiency and greenhouse gas emissions reductions.

“We have taken this step to ensure that our campus can continue to fund the energy efficiency activities that help us push toward carbon neutrality by 2050 or sooner,” iSEE Director Evan H. DeLucia

said. “We are glad that we have an innovative way to fund further work to reach the ultimate goals of the Illinois Climate Action Plan (iCAP).”

Ben McCall, iSEE’s Associate Director for Campus Sustainability, said Illinois remains committed to being a leader in sustainability — and the sale is evidence of that commitment.

“By monetizing our emissions reductions, we have found a creative new funding source for campus sustainability projects,” McCall said. “This reinvestment in our campus will drive new studies, new ideas, and new techniques that will help us reach our climate goals even sooner.”

Housing Earns Governor’s Sustainability Award

In October 2015, Illinois’ campus sustainability efforts were again recognized as University Housing became a first-time winner of the Illinois Governor’s Sustainability Award.

Regarded as the “Emmy Awards for Sustainability,” the annual Governor’s Award conferred by the Illinois Sustainable Technology Center (ISTC, a division of the Prairie Research Institute) honors public organizations in Illinois for their implementation of sustainable principles and practices. iSEE nominated Housing for the award in May, and worked with Housing on a six-page submission.

Food — and its procurement, storage, and disposal — is one of University Housing’s greatest sustainability thrusts. Dining Services has worked hard to make sure that each plate is the greenest it can be. It buys more than a quarter of its food from local sources, including a tomato sauce that is made right here on campus, to reduce travel emissions.

To minimize food waste, all dining halls switched to trayless dining in 2010 — making it harder for students to let their eyes rather than their stomachs decide how much food to take. The scraps still left on plates are processed in an organic food digester to create grey water to be flushed into the local wastewater system, rather than put in plastic bags bound for the landfill. All leftovers are

Sustainable Practice: Tomato Sauce

The Sustainable Student Farm’s best tomatoes have gone to University Housing’s Dining Services for years. But now, even the “ugly” tomatoes are processed and converted into sauce by the Department of Food Science and Human Nutrition’s Pilot Plant. The sauce is then used by Dining Services for pasta and pizza dishes.

Funded by a \$564,500 grant from the Student Sustainability Committee (SSC), this project is just another way that Dining Services and this campus use resources sustainably. Watch a video at bit.ly/sauceUI.



weighed and categorized before disposal or donation to help production teams fine-tune portion sizes to limit waste.

University Housing serves more than 10,000 residents in 25 University residence halls and 1,100 University-owned apartments. Dining employees serve more than 4 million meals each year through their on-campus dining halls and in their catering venues. The staff of 650 professionals provides services 24 hours a day.



Styrecycle: Waste Diversion Innovation on Campus

Styrecycle, a new iSEE-supported and student-pioneered program at Illinois, will cut down on the amount of expanded and extruded polystyrene (more commonly known as Styrofoam) headed to landfills at the campus' expense.

Styrofoam is notoriously hard to get recycled — not because it is difficult to process into new products, but because it isn't economical for recyclers to transport large volumes of a material designed to weigh little more than air. The solution, then, is to get more of the raw commodity into the truck to make the trip more profitable.

In 2015, iSEE was given a grant by the Student Sustainability Committee (SSC) to buy a Styrofoam densifier, a machine that grinds the polystyrene col-

lected from campus into small beads and extrudes it in a very dense tube that looks a bit like toothpaste.

Local recycler Community Resource Inc. (CRI) in Urbana houses and operates the University-owned densifier for free, in exchange for the proceeds from the sale of the densified Styrofoam.

The program has grown to include seven campus buildings: Turner Hall, Carl R. Woese Institute for Genomic Biology, Illinois Sustainable Technology Center, Edward R. Madigan Laboratory, Loomis Laboratory, National Soybean Research Center, and the Architecture Annex.

To read more about the program, visit the iSEE webpage at sustainability.illinois.edu/styrecycle/ or the Facebook page at facebook.com/Styrecycle.

Institute Plays Supporting Role in Illinois Biodiesel Initiative

The student-pioneered Illinois Biodiesel Initiative takes used cooking oil from Dining Services and processes it in biodiesel reactors to create fuel for the University fleet as well as soap.

iSEE, which helped deliver the reactors in 2015,

is now supporting the initiative by handling the financial logistics for purchases of reactants and sales of the products.

Read more on the IBI Facebook page at facebook.com/illinibiodiesel.

I-Bike: More Testing Needed Before Bike Share Launches

During the 2015-16 school year, iSEE shepherded two pilot programs to test the effectiveness of a bicycle sharing program on Illinois' Urbana-Champaign campus.



Student project leaders Catherine Kemp and Noah Feingold, who served as iSEE interns, recruited more than 40 student volunteer riders to share the use of 12 bicycles at 11 parking stations around campus for their everyday travel needs.

The program, aimed at making bicycle travel more accessible to the campus population, is relatively simple in its operation: After paying a small subscription fee, users download a phone app providing a map of available bikes. To “check out” a bike, users just click the bike’s icon on the app, tap their phone to the electronic lock to release it, and then enjoy unlimited use of the bike during the one- to two-hour checkout session.

While the test riders offered great feedback and were eager to see the program’s full launch of 50 bikes and several additional parking stations, technical difficulties with the smart lock GPS systems have delayed the full expansion of the program until the 2016-17 school year.



I-Bike: University of Illinois Bike Share Program
Interim Chancellor Barbara Wilson took one of the I-Bikes out for a spin during Earth Week 2016.

Certified Green Office Program Undergoes Revisions

The Certified Green Office Program is designed to help offices on the University of Illinois' Urbana-Champaign campus implement sustainable practices in their workplaces.

By making a few simple changes, offices can reduce their environmental footprint, help the campus save money, meet Illinois Climate Action Plan (iCAP) objectives, and respond to the overwhelming interest of students, faculty, staff in sustainability.

Using feedback gathered from offices certified



during the 2014-15 school year and 2015-16 school years, iSEE is revising parts of the process to make it more user-friendly.

New features include a redesigned online enrollment form, an employee engagement survey, and a more-than-doubled list of eligible actions offices can take to reach one of three certification levels: bronze, silver, or gold.

We anticipate the new version of the Certified Green Office Program to be launched in Fall 2016.

iSEE Helps Lead Campus ‘Kill the Cup’ Efforts

For six weeks in October and November 2015, iSEE intern for campus sustainability Katie Pollman helped lead a campus movement of the national “Kill the Cup” campaign, a competition between



16 universities nationwide to raise awareness about the wastefulness of disposable paper and foam coffee cups and change student behavior.

Through a series of information booths, free reusable mug giveaways, and a social media campaign, Pollman got the word out to hundreds of students.

More than 180 students took photographs of themselves using reusable mugs rather than nonrecyclable to-go cups at campus coffee shops, nabbing Illinois the first place spot for participation in our four-school division. Illinois also ranked fourth overall for Waste Reduction, with reusable mugs accounting for 14.7 percent of drinks purchased at our designated coffee shop location.

As a reward for students’ efforts, campus received a \$500 prize, which funded the groundwork for another student-led, anti-waste campaign called “Skip the Bag,” which raises awareness about the harm discarded plastic bags do to the environment, and encourages shoppers to avoid their use.



First ‘Illini Lights Out’ Event a Glowing Success



iSEE’s Energy Conservation and Building Standards (ECBS) SWATeam organized the Illini Lights Out event right before Earth Week to highlight ways the campus community can help eliminate energy waste.

On April 15, student volunteers turned out more than 1,500 lights and closed 71 windows in classrooms, labs, and lounges in eight Main Quad buildings — in just 40 minutes!

This small act of energy conservation by 22 people saved the campus \$200 in energy generation expenses — a small figure now, but the ECBS SWATeam hopes to grow this initiative, and its impact, in the coming year.

Ideas include expanding to additional areas of campus and creating weekly Friday night “go-dark” brigades.



Minor, Courses Up & Running

During the fall 2015 and spring 2016 semesters, the Institute enrolled its first two cohorts for the Sustainability, Energy, and Environment Fellows Program (SEE FP) students. A total of 29 students are developing a systems perspective of sustainability and the environment through coursework, and finish their studies with a hands-on campus sustainability capstone project.

Nine students will start capstone projects in Fall 2016, and the Institute has been hard at work to pair them with campus and community partners.

One capstone project, in particular, dovetails with iSEE's campus sustainability mission: Two students will study the desires, capabilities, and perceived obstacles for sustainable, energy-efficient practices in laboratories on campus — then draft a Green Labs pilot program.

The SEE FP, a campuswide undergraduate minor, is offered in partnership with six academic units — the Department of Agricultural and Consumer Economics (ACE), the Department of Civil and Environmental Engineering (CEE), the School of Integrative Biology (SIB), the Department of Natural Resources and Environmental Sciences (NRES), the School of Earth, Society and Environment (SESE), and the Department of Urban and Regional Planning (DURP) — which are also contributing teaching faculty.

Two iSEE-led courses

- ENVS 491: The Sustainability Experience allows undergraduate and graduate students to earn course credit for working with faculty, staff, and/or the Student Sustainability Committee (SSC) to advance Illinois Climate Action Plan goals and other campus sustainability initiatives. Instructed by iSEE Associate Director Ben McCall, students contribute their disciplinary knowledge to tackle interdisciplinary problems on campus as Campus Sustainability Interns, SSC members or working group members, or iSEE clerks serving Sustainability Working Advisory Teams (SWATeams).

- ENVS 301: Tools for Sustainability, which was specifically created for the SEE FP, was offered for the first time in January 2016. iSEE Associate Director Madhu Khanna led the team-taught course, which teaches systems-thinking skills to enable better understanding of the different dimensions of sustainability — and the problems and tradeoffs involved in achieving that sustainability. This course will be offered each spring and is required for all SEE FP students. The spring '16 teaching team included Khanna, a Professor of ACE; Jeremy Guest, Assistant Professor of CEE; Lulu Rodriguez, Associate Professor of Agricultural Communications; and Daniel Miller, Assistant Professor of NRES.

Congress '15 a Water Discussion; Congress '16 to Address Energy

Each fall, iSEE hosts a major scientific Congress highlighting a specific facet of global sustainability. The Institute assembles leading national and international experts from varying disciplines to foster serious discussions about solutions to grand world challenges. A look back and a look ahead:

- **Water Planet, Water Crises?** In September 2015, iSEE convened “Water Planet, Water Crises? Solving the World’s Water-Food-Energy Needs Sustainably,” which brought together scholars, researchers, policy experts, and industry representatives from Illinois, the nation and the world to discuss that most basic human need of clean, fresh water.

Student rapporteurs summed up the experience at the end. Here are a few takeaways:

- Water is a place-based science; vulnerabilities of water sources are based both on region and climate — as well as on extreme weather events. Solutions will come only when models take into consideration that we have limited prediction skills.
- Agriculture and power production impact our national water supply’s quantity and quality — and it’s not just the overuse of water. Nutrient runoffs and other pollutants are damaging the environment, too.
- There is not a single solution to optimize the balance between water, food, and energy: socio-political dynamics are also in play.
- Water, human health, and ecosystem services are inextricably linked to climate change. We need large-scale, long-term, interdisciplinary studies to understand these connections and to advance scientific and societal goals.
- Culture, values, and preferences must be considered when making decisions about water use. Governments must find a way to lead policy change so that technology can solve the issues.
- Water quantity and quality issues are on several scales, from individual to global, but more holistic and integrated strategies — and technical innovations — are needed to solve the issues.



- **Energy 2030:** Former U.S. Department of Energy Undersecretary for Science Steven Koonin and environmental journalist and author Jonathan Mingle are among the keynote speakers who will visit Illinois on Sept. 12-14, 2016, for its third annual iSEE Congress, “Energy 2030: Paths to a Sustainable Future.”

The conference, which will be in the Alice Campbell Alumni Center, will feature more than two dozen local, national, and international speakers with expertise in energy. It will focus on the potential for improvements in energy efficiency, alternative forms of renewable energy, and other forms of low-carbon sources of energy to meet societal needs for electricity, transportation, and heating more sustainably in the future.

Read more about our annual Congress at sustainability.illinois.edu/isee-congress/.





iSEE Initiates Community Conversation on Energy Conservation

On Oct. 20, 2015, iSEE hosted a Community Conversation on Energy Conservation for local business leaders to discuss not only the incentives and opportunities for energy conservation in their operations, but also the barriers that constrain the participation of local business in energy efficiency projects.

More than 20 off-campus attendees joined University students, faculty, and staff for an afternoon of presentations by business leaders, local government representatives and campus sustainability staff, followed by roundtable discussions. Participants shared their views on the hurdles to increasing the energy efficiency of their businesses and discussed ways in which iSEE and the University could help to promote energy conservation in the Champaign-Urbana community.

Presentations are available to view at bit.ly/24V4wkX.

In addition to the small group discussions, 10 attendees were asked a different set of question depending on if they had or had not participated in energy efficiency programs in the past. Here are some of our insights:

Saving money and environmental concerns are the top motivators for participation in energy efficiency programs. Other factors included customer expectations, top management directive, other businesses are doing it, and pride in “doing the right thing” Participants also suggested that the U of I become a “sustainable resource clearinghouse,” offer a library of easy-to-use tools, and spread awareness of programs to aid businesses’ efforts to be more sustainable.

Notetakers recorded the thoughts shared during roundtable discussions. From these collected ideas, iSEE has established next steps for growing local participation in energy conservation.

iCAP Forum, Tours, Film Highlight Sustainability Week

Sustainability Week 2015 was celebrated Oct. 19-23 and catered to a wide variety of environmental interests with a full schedule of events, including a campus tree walk with Professor Gary Kling, an Illinois Climate Action Plan (iCAP) Forum on the latest progress toward a carbon neutral campus, and a tour of the campus Waste Transfer Station.

The keynote of the week was a screening of

the film “Catching the Sun: The Race for the Clean Energy Future” and remarks by the film’s creator Shalini Kantayya. The film followed the lives of unemployed American workers training for jobs in the solar industry to expose some hard questions about creating a clean energy economy, and it led to some interesting discussion from the students, faculty, staff, and community members in attendance.

Keeling Lecture Headlines Earth Week

Stanford Ecologist Christopher B. Field, known for his climate change research, delivered the 2016 Charles David Keeling Lecture on April 14.

More than 110 students, faculty, staff, and community members gathered to hear his presentation, “Climate Change: The Road through Paris.” He compared goals in the landmark Paris Accord with the path necessary to reduce and manage the worst risks of climate change, emphasizing the way that new science sharpens the focus on the seriousness of the climate challenge, while also highlighting compelling opportunities for solutions.

Field, the founding director of the Carnegie Science Department of Global Ecology and Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies at Stanford, focuses his research on climate change, ranging from work on improving climate models, to prospects for renewable energy systems, to community organizations that can minimize the risk of a tragedy of the commons.

The Keeling Lecture is named for Charles David Keeling, a 1948 graduate of the Department of Chemistry at the University of Illinois who was renowned for making extremely precise measurements of atmospheric carbon dioxide (CO₂).

The event was sponsored by iSEE, the School of Chemical Sciences (SCS), the School of Earth, Society and Environment (SESE), the Department of Chemistry, and the Department of Atmospheric Sciences.



Arbor Day a Celebration of Tree Campus USA Status

In Early April, the University of Illinois at Urbana-Champaign was awarded designation as an official Tree Campus USA by the Arbor Day Foundation for its commitment to effective urban forestry. To care for its more than 20,000 trees, campus maintains a tree advisory committee and a campus tree-care plan.

To celebrate this achievement and to mark the occasion of Arbor Day 2016, the Institute and Facilities & Services planted a young maple tree on the main quad in front of Noyse Laboratory. Dignitaries from the cities of Urbana and Champaign each

offered a few words of congratulations and then put the first shovels of soil over the new tree. Students and other passersby lined up to leave their legacy at Illinois by helping to bury the tree's roots.

Tree Campus USA is a national program created in 2008 by the Arbor Day Foundation to acknowledge colleges and universities for successful campus forest management initiatives and for engaging staff and students in conservation goals. Currently, only 10 percent of four-year, degree-granting campuses nationally have achieved this prestigious certification.





New Hires Offer Support to iSEE Mission

In Spring 2016, iSEE added two full-time positions to its office:

- **Olivia Harris, Communications Specialist (left).** Harris earned her Bachelor's Degree in Agricultural and Environmental Communications with a focus in Journalism from Illinois in May 2015.

She first started working with iSEE in May 2014 as an undergraduate intern and loves uncovering the inspiring stories of students, faculty, and staff who make Illinois an environmental leader.

- **Olivia Webb, Sustainability Programs Coordinator (right).** Webb earned her Bachelor's Degree in Bioengineering from Illinois in May 2015.

As an undergraduate, she served three years on the Student Sustainability Committee (SSC) as the Vice Chair of the organization, and Chair of its Food and Waste working group.

After graduating, she worked with John Marlin of the Illinois Sustainable Technology Center (ISTC, a Division of the Prairie Research Institute) on native plantings projects in Urbana.

2015-16 iSEE DIRECTORS, STAFF

Name	Title
Evan H. DeLucia	Director
Madhu Khanna	Associate Director, Education & Outreach
Ben McCall	Associate Director, Campus Sustainability
Jenny Kokini	Managing Director
Stephanie Lage	Assistant Director
Morgan Johnston	Associate Director of Facilities & Services (F&S)/Director of Sustainability, F&S
Micah Kenfield	Student Sustainability Committee Coordinator
Tony Mancuso	Communications and Public Affairs Coordinator
Amy Rosenbery	Office Administrator
Olivia Webb	Sustainability Programs Coordinator
Olivia Harris	Communications Specialist
Katie Pollman*	Student Intern for Campus Sustainability
Noah Feingold*	Student Intern for Sustainable Transportation (Bike Share)
Catherine Kemp*	Student Intern for Sustainable Transportation (Bike Share)
Kate McQueen+	Graduate Student Intern for Communications
Lois Yoksoulian+	Graduate Student Intern for Communications

* Worked for iSEE in 2015-16; + Hired Summer 2016

Our People from Across Campus

2015-16 iSEE STEERING COMMITTEE MEMBERS

Name	Title	Academic Unit
Brian Allan*	Assistant Professor	Department of Entomology
German Bollero	Professor/Head	Department of Crop Sciences
Jeff Brawn	Professor/Head	Department of Natural Resources and Environmental Sciences
Carla Cáceres	Professor/Director	Department of Animal Biology/School of Integrative Biology
Arnab Chakraborty	Associate Professor	Department of Urban and Regional Planning
Don Fullerton	Professor	Department of Finance
Sharon Hammes-Schiffer	Professor	Department of Chemistry
Praveen Kumar	Professor	Department of Civil and Environmental Engineering
Bruce Elliott-Litchfield*	Professor/Assistant Dean	Department of Agricultural and Biological Engineering
Wen-Tso Liu	Professor	Department of Civil and Environmental Engineering
Sarah Taylor Lovell*	Associate Professor	Department of Crop Sciences
Stephen Long*	Professor	Departments of Crop Sciences and Plant Biology
Benito Mariñas*	Professor/Head	Department of Civil and Environmental Engineering
Stephen Marshak	Professor/Director	Department of Geology/School of Earth, Society and Environment
Thomas Overbye*	Professor	Department of Electrical and Computer Engineering
Dipanjan Pan*	Assistant Professor	Department of Bioengineering
Jesse Ribot	Professor	Department of Geography and Geographic Information Systems
Peter Sauer	Professor	Department of Electrical and Computer Engineering
Rizwan Uddin	Professor	Department of Nuclear, Plasma and Radiological Engineering
Don Wuebbles	Professor	Department of Atmospheric Sciences
Paul Couston	Undergraduate (Student Sustainability Committee Chair)	

* Primary Investigator on iSEE-funded project (see pages 7-13)

2015-16 iSEE FACULTY AFFILIATES

- **Brian Allan**, Assistant Professor, Entomology
- **German Bollero**, Professor and Head, Crop Sciences
- **Bruce Branham**, Professor, Crop Sciences
- **Jeff Brawn**, Professor and Head, Natural Resources and Environmental Sciences
- **Carla Cáceres**, Professor, Animal Biology; Director, School of Integrative Biology
- **Ximing Cai**, Professor, Civil and Environmental Engineering
- **Arnab Chakraborty**, Associate Professor, Urban and Regional Planning
- **Don Fullerton**, Professor, Finance
- **Jeremy Guest**, Assistant Professor, Civil and Environmental Engineering
- **Sharon Hammes-Schiffer**, Professor, Chemistry
- **Allison Hansen**, Assistant Professor, Entomology
- **Madhu Khanna**, Professor, Agricultural and Consumer Economics; Associate Director, iSEE
- **Praveen Kumar**, Professor, Civil and Environmental Engineering
- **Bruce Elliott-Litchfield**, Professor, Agricultural and Biological Engineering
- **Stephen P. Long**, Professor, Plant Biology and Crop Sciences
- **Sarah Taylor Lovell**, Associate Professor, Crop Sciences
- **Yi Lu**, Professor of Chemistry, Biochemistry, Bioengineering, and Materials Science and Engineering
- **Benito Mariñas**, Professor and Head, Civil and Environmental Engineering
- **Stephen Marshak**, Professor, Geology; Director, School

- of Earth, Society & Environment
- **Amy Marshall-Colón**, Assistant Professor, Plant Biology
- **Ben McCall**, Professor, Chemistry and Astronomy; Associate Director, iSEE
- **James O'Dwyer**, Assistant Professor, Plant Biology
- **Yanfeng Ouyang**, Professor, Civil and Environmental Engineering
- **Thomas Overbye**, Professor, Electrical and Computer Engineering
- **Dipanjan Pan**, Assistant Professor, Bioengineering
- **Nick Paulson**, Associate Professor, Agricultural and Consumer Economics
- **Jesse Ribot**, Professor, Geography and Geographic Information Science
- **Peter Sauer**, Professor, Electrical and Computer Engineering
- **Edward Seidel**, Professor, Physics and Astronomy; Director, National Center for Supercomputing Applications
- **Joanna Shisler**, Associate Professor, Microbiology
- **Ashlynn Stillwell**, Assistant Professor, Civil and Environmental Engineering
- **Rizwan Uddin**, Professor, Nuclear, Plasma, and Radiological Engineering
- **Madhu Viswanathan**, Professor, Business
- **Michelle Wander**, Professor, Natural Resources and Environmental Sciences
- **Shaowen Wang**, Professor, Geography and Geographic Information Science
- **Scott Willenbrock**, Professor, Physics
- **Wendy Yang**, Assistant Professor, Plant Biology and Geology

Keep Up with iSEE and its Partners

Be a part of the sustainability story at Illinois by contacting us directly, checking us out online, or engaging with us on social media. Here's how:

CONTACT US

iSEE office phone: 217-333-4178

iSEE mailing address: 1101 W. Peabody, Suite 350 (NSRC), MC-635 Urbana, IL 61801

iSEE email address: sustainability@illinois.edu

SSC office phone: 217-244-9342

SSC mailing address: 1101 W. Peabody, Room 291 (NSRC), MC-635 Urbana, IL 61801

SSC email address: sustainability-committee@illinois.edu

ON THE WEB

iSEE main website: sustainability.illinois.edu

Energy at Illinois website: energy.illinois.edu

Water at Illinois website: water.illinois.edu

iCAP Portal website: icap.sustainability.illinois.edu

Student Sustainability Committee (SSC) website: ssc.sustainability.illinois.edu

SOCIAL MEDIA

iSEE Facebook page: facebook.com/iSEEatUofI

Sustainability @ Illinois Facebook group page: facebook.com/groups/123074238038372/

SSC Facebook page: facebook.com/UIUCssc

Styrecycle Facebook page: facebook.com/Styrecycle

I-Bike Facebook page: facebook.com/I-Bike-University-of-Illinois-Bike-Share-Program

Illinois Biodiesel Initiative (IBI) Facebook page: facebook.com/illinibiodiesel

iSEE Twitter page: twitter.com/sustainILLINOIS

SSC Twitter page: twitter.com/ssc_uiuc

iSEE Google+ page: plus.google.com/101194230489291155598/about

iSEE YouTube channel: bit.ly/iSEEyt

iSEE LinkedIn page: linkedin.com/groups/8519947

**University of Illinois
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