

ISEE

Institute for Sustainability,  
Energy, and Environment



# ACTIONABLE RESEARCH

2019-20 Annual Report

# From the Director ...

As the Institute for Sustainability, Energy, and Environment (iSEE) approaches the end of Year 7 at the University of Illinois, we are pleased to report on our accomplishments in research, education, outreach, and campus sustainability.

In 2019-20, iSEE and the Carl R. Woese Institute for Genomic Biology (IGB) continued to lead a \$115 million Bioenergy Research Center. In its third year, the U.S. Department of Energy-funded Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) now employs about 300 scientists, staff, and students from Illinois and 21 partner institutions.

And by helping to attract more than \$6.9 million in new external funding — including its third major DOE grant in three years — iSEE saw new projects take shape and expand their scope. By seed funding interdisciplinary and Campus as a Living Lab projects each year, and offering proposal support, the Institute is starting to see more impressive returns on its investments as those programs mature.

We have convened yet another group of research experts on campus in the form of our Global Climate Change Scholars, and we expect to generate new collaborations across campus.

Thanks to funding from our generous donors — the Baum Fund, the Levenick family, and Janelle Joseph — we also can boast several new aspects in our Education & Outreach portfolio:

- a resident scholars program that already has made an impression on campus with a public lecture and seminar course — and in the world at large with a highly circulated op-ed piece;
- a new program that is bringing sustainability elements



into curricular education across campus;

- a Critical Conversation format that allows multiple stakeholders to help address vexing world problems in a “safe” space without attribution;
- more capstone opportunities for the students completing our campuswide honors minor; and
- funding opportunities for student writers to travel for article research or submit polished pieces to *Q Magazine*.

Despite the COVID-19 pandemic in the second half of this past year — which caused postponements of several events including our Critical Conversation and will also delay our next iSEE Congress — we have found ways to effectively reach people with virtual events.

And that outreach has especially extended to the concepts, writing, and editing of the forthcoming Illinois Climate Action Plan (iCAP 2020). Hundreds of students, staff, faculty, administrators, and community members have contributed to our very inclusive process. We are excited to share iCAP 2020, our plan for campus sustainability and eventual carbon neutrality, during Sustainability Week this coming October.

Please turn the page for a closer look at our work; I am glad to share the outstanding work done by iSEE directors, staff, and partners from across the campus.

Sincerely,

Evan H. DeLucia,  
Baum Family Director, iSEE

## TABLE OF CONTENTS

<b>Overview</b> .....	<b>3-5</b>	<b>Education &amp; Outreach Updates</b> .....	<b>16-21</b>
Evan H. DeLucia Introduction.....	3	Educational Programs & <i>Q Magazine</i> .....	16-17
Our Gracious Benefactors .....	4	Levenick Scholars & Programming .....	18-19
External Grants & Funding Requests.....	5	iSEE Congress & Annual Events.....	20-21
FY20 iSEE Operations Budget Breakdown .....	5	<b>Campus Sustainability Updates</b> .....	<b>22-27</b>
<b>Research Updates</b> .....	<b>6-15</b>	Illinois Climate Action Plan 2020 .....	22-23
iSEE-affiliated Centers .....	6-7	Green Energy & Carbon Unit Sales.....	24
New Federally Funded Projects .....	8-9	Greener Campus Programs & Initiatives .....	25
Interdisciplinary Seed Funding .....	10-11	Illini Lights Out & Student Engagement.....	26
Campus as a Living Lab Programs .....	12	Campus Recognition .....	27
iSEE Research Scholar Groups .....	12-13	<b>Institute Updates</b> .....	<b>28-30</b>
Publications, Inventions, Scholars & Events .....	13	Director & Staff Updates.....	28-29
Ongoing Projects.....	14-15	Contact Info & Reach of our Institute.....	30

## OUR GRACIOUS BENEFACTORS

### Major Financial Support



❖ The Institute's missions receive continued support from iSEE founding benefactor the **Alvin H. Baum Family Fund**, under the administrative leadership of Joel Friedman and Erika Cornelison. The Fund has given **more than \$2.1 million** to support iSEE and its Baum Family Director, Evan H. DeLucia.



FRIEDMAN



CORNELISON

Most recently, the Baum Fund supported iSEE's Critical Conversations (*read more, page 13*) and supported students in the sustainability minor capstone research experience (*more, page 16*).

❖ The Institute has also received considerable support from University of Illinois alumnus **Stuart L. Levenick** and his wife **Nancy J. Levenick** (*pictured*). In 2019, they funded a Levenick Sustainability Chair in the Department of Natural Resources & Environmental Sciences — who oversees iSEE's Resident Scholars in Sustainability Leadership program — also funded at that time by the Levenicks' gift (*more, page 18*).



Earlier, the couple endowed a 2015 fund for iSEE scholars teaching or researching in sustainability fields on campus. In 2019, iSEE began using that fund for small grants to help U of I instructors incorporate sustainability into new or existing courses (*more, page 19*).

That 2015 gift — which led to matching gifts from Caterpillar Inc., the Student Sustainability Committee, and campus partners — helped iSEE build a new collaborative classroom space and media laboratory.



### Gifts Make Major Impact for Aspiring Student Writers on, off Illinois Campus

iSEE is pleased to offer travel stipends for University of Illinois students taking Certificate in Environmental Writing courses and doing background research for *Q Magazine* articles, after a second and third \$5,000 donation from Janelle Joseph during the past year. In addition, the Institute will offer the Janelle Joseph Environmental Writing Award, open to all U of I students interested in submitting articles. Undergraduate contest winners will be published in *Q*.

Joseph's 2019 donation helped three students research stories about the Gila River in the U.S. Southwest and the Hanford Reach in Washington state. The articles appeared in Volume 2, Issue 2 in Spring 2020.

"Through my dear friend Joel Friedman, I became aware of iSEE's dedicated programs," said Joseph (*pictured with her dog Moonbeam*), who prior to funding *Q* travel and writing awards had given a \$5,000 gift to support undergraduates working on iSEE's Agroforestry for Food research project. "The planet and the environment are where all things future begin. All needs and other great causes depend on where we live and are safe."

"After hearing about iSEE and *Q Magazine*, I felt HOPE, for the first time in many years, that brilliant young people are working on improvements and solutions."

The Certificate and the magazine (*read more about both on pages 16-17*) are on solid footing thanks to Joseph's generous support.

## EXTERNAL GRANTS AND FUNDING REQUESTS

### 2019-20 Proposals — and Successes

In 2019-20, iSEE attracted the following funding, either by submitting proposals or by facilitating them with seed funding or other support:

- **\$3.3 million** from the U.S. Department of Energy (DOE) for a new Smart Farms project led by Kaiyu Guan (*pages 8-9*).
- **\$1.2 million** from the U.S. Department of Agriculture (USDA) — a subaward from the University of Maryland for iSEE's new Dashboard for Agricultural Water Use and Nutrient Management (DAWN) project led by four University of Illinois researchers (*page 9*).
- **\$150,000** from the Illinois Clean Energy Community Foundation (ICECF) to support the student-led Solar Decathlon ADAPTHAUS project, which will design and build a livable, full-size, net-zero-energy home.

Existing iSEE projects also had funding successes:

- **\$1 million** from the Bill & Melinda Gates Foundation for a 2019 seed-funded project led by Jeremy Guest now called the Sanitation Technology project (*page 10*).
- **\$500,000** from a Campus as a Living Laboratory project led by Yuanhui Zhang on environment-enhancing food, energy, and water systems (*page 12*).
- **\$325,000** in two awards from the ExxonMobil and McDonald's Foundations through Arizona State University for the Multi-Paddock Grazing project (*page 15*).
- **\$200,000** from the U.S. Department of Agriculture (USDA) for a 2019 seed-funded project led by Helen Nguyen on agricultural resilience in extreme weather (*pages 10-11*).
- **\$200,000** from the DOE Small Business Innovation Research fund for a Campus as a Living Lab geothermal project led by Tugce Baser (*page 12*).

Still pending as of the end of FY20:

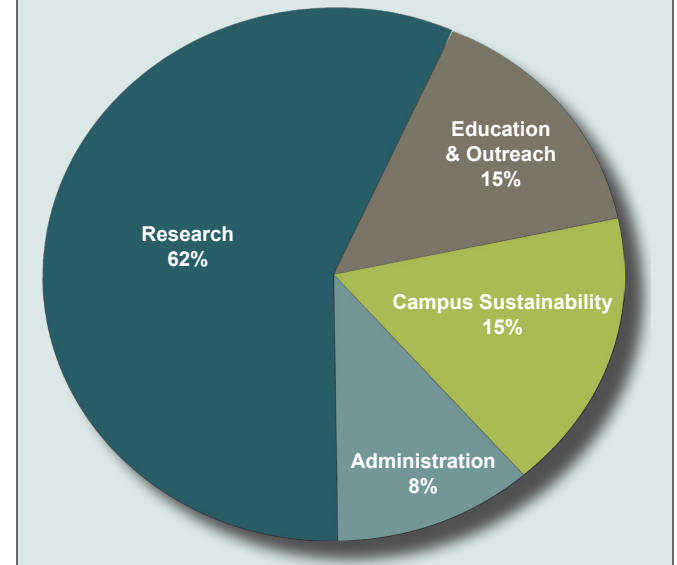
- **\$7.4 million** from DOE for Phase II of Guan's Smart Farms project.
- **\$3.6 million** from the National Science Foundation (NSF) for Guest's Sanitation Technology project.
- **\$3.6 million** from NSF for Nguyen's agricultural resilience project.
- **\$3 million** from NSF for a new proposal led by iSEE Associate Director for Campus Sustainability Ximing Cai.
- **\$1.6 million** from NSF — a subaward from the University of Chicago — for D.K. Lee's Next-Generation Feedstocks project (*page 9*).

### iSEE's Funding Proposal History, By the Numbers

FISCAL YEARS	PROPOSAL SUBMISSIONS	FUNDED PROPOSALS	PENDING
2019-20	\$48.1 million	\$6.9 million*	\$20.4 million
2014-19	\$262.8 million	\$135.8 million	\$1 million*
<b>Current Totals</b>	<b>\$310.9 million</b>	<b>\$142.7 million</b>	<b>\$20.4 million</b>

\* The \$1 million grant pending as of FY19 was funded in FY20. The remaining \$5.9 million received in FY20 was from applications made in 2019-20.

### FY20 iSEE OPERATIONS BUDGET BREAKDOWN



- **\$1 million** from the NSF National Robotics Initiative for a Campus as a Living Lab project led by Nora El-Gohary on autonomous building systems (*page 12*).
- **\$236,000** from the Robert Wood Johnson Foundation — a subaward from the Metropolitan Mayors Caucus for a 2019 seed-funded project by Donald Wuebbles on a cyberGIS system for urban sustainability (*page 11*).

Rejected proposals in FY20:

- **\$10 million** from the USDA for a Campus as a Living Lab project led by iSEE Associate Director for Research Madhu Khanna on agrivoltaics.
- **\$6.2 million** in two separate NSF proposals for the Wuebbles cyberGIS project.
- More than **\$2.7 million** in a DOE proposal for a Campus as a Living Lab project led by Sanjiv Sinha on turning waste into thermochemical batteries.
- **\$1.5 million** from NSF for a 2019 seed-funded project led by Pingfeng Wang on community infrastructure resilience (*page 11*).
- **\$816,729** from NSF for a 2019 seed-funded project led by Sandy Dallerba on pollution transmission and economics (*page 11*).
- More than **\$600,000** from NSF for a Campus as a Living Lab project led by Julie Cidell on student transportation and mobility on and around campus.

## AFFILIATED CENTERS

# CABBI Yields Growing

Led by Principal Investigator Evan H. DeLucia, iSEE's Baum Family Director, the \$115M Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) is about halfway through its five-year U.S. Department of Energy grant. Lead partners iSEE and the Carl R. Woese Institute for Genomic Biology (IGB) report the following in 2019-20:

- CABBI added Penn State (and Co-PI Costas Maranas) as a partner, making the total number of CABBI institutions 21. Co-PIs Zengyi Shao at Iowa State and George Huber at Wisconsin also were added after the departure of Nathan Price at the Institute for Systems Biology and the retirement of James Dumesic at Wisconsin.

- CABBI hosted its third annual science retreat online due to the COVID-19 pandemic. It was attended by more than 250 people, including members of the center's Strategic Advisory Board (representatives from the other three national Bioenergy Research Centers as well as academic, government, and industry experts in bioenergy and bioproducts).

- An internal research data and project website was created — as were shareable research datasets on CABBI's public website. During the next year, the administrative team will add data management support help as well.

- CABBI dealt with COVID-19 delays, and ensured the safety and productivity of scientists with thoughtful plans for a return to field and lab work.

- As of mid-June, the Center employs about 300 people, including 63 faculty-level researchers nationwide, 142 postdocs and technicians, 77 graduate students, more than two dozen under-



graduates, and nine support staff.

- CABBI scientists disclosed five new inventions during the past year (and two provisional patents), and they published 43 papers in scholarly journals.

- Sustainability Theme updates ...
  - With the Illinois Energy Farm (pictured above), Iowa Sustainable Advanced Bioeconomy Research Farm, and a wide range of geographic locations such as Mississippi, Texas, and Florida, CABBI has collected field-scale data on the ways energy crops undertake nutrient and water cycling and generate ecosystem services. These data may improve the accuracy of models that analyze the environmental and economic sustainability of bioenergy crops on diverse locations and land types. An example is research examining nitrogen response across *Miscanthus x giganteus* established over multiple years and sites.

- Conversion Theme updates:
  - New CABBI tools improve the efficiency of synthetic biology in a variety of yeasts. Researchers created two new CRISPR/Cas9 systems — for gene disruption in *Issatchenkia orientalis* and

- for modular, targeted gene knockouts in *Rhodospiridium toruloides*, a promising organism that grows on lignocellulosic sugars. These systems pave the way for further genome and metabolic engineering for bioproduct production. New lab techniques are being aided by model-guided strain design. Scientists developed web-based software to improve the efficiency of a tool for genetic engineering. The center also integrated its biofoundry with a machine-learning algorithm that designs and executes experiments, analyzes resulting data, and determines an improved pathway.

- Getting the most value out of feedstocks requires new, cost-effective methods for processing biomass into useful chemicals. Improvements in a process using sequential deacetylation, followed by hot water pretreatment and disk refining, can make cellulosic ethanol production from sugarcane bagasse economically feasible. Novel pretreatment steps with engineered yeast strains can improve ethanol yields from sugarcane bagasse. And chemical-free, continuous hydrothermal pretreatment of sorghum

- biomass minimizes inhibitor formation and can be successfully scaled up — a promising industrial application.

- Feedstock Production Theme updates ...

- CABBI is creating next-generation feedstock varieties by modifying carbon allocation and metabolism to produce lipids in vegetative tissues, as well as increasing productivity, resource use efficiency, and resilience to stress. Genetic modifications producing novel fatty acids and counteracting growth inhibition in model species are being translated into new lines of sugarcane and sorghum. These advances are an important step toward new feedstocks that can produce lipids at low cost. Researchers are generating structural and functional knowledge of the genomes of target feedstocks — and increasing the efficiency of gene editing and characterizing natural variation in target traits of these C4 grasses. Additionally, computer modeling and field tests are improving the understanding of yield resilience and resource use efficiency.

Stay up to date at [cabbi.bio](http://cabbi.bio).



## LC3M Researchers Expand Types of Crops with Rock Applications

iSEE partners with the Leverhulme Centre for Climate Change Mitigation (LC3M) at the University of Sheffield and collaborates with researchers in the UK, Australia, and Malaysia to investigate methods for removing carbon dioxide (CO<sub>2</sub>) from the atmosphere.

Crushed basalt rock has been applied to fields of different crops at the University of Illinois Energy Farm, and the 2019 research season marked the third year of the field-scale research project — and the first year of soybean production in the basalt-treated maize/soybean fields as part of scheduled crop rotation at the Energy Farm. Basalt application and tillage of maize/soy fields occurred in the fall after the 2018 maize harvest, and basalt was surface-applied to miscanthus before plant emergence in Spring 2019.

Measurements of greenhouse gas production from soils, soil carbon and nitrogen, soil water chemistry, and plant biomass and yield were carried out through the 2019 growing season, while eddy covariance towers monitored gas exchange for each of the crops. Soil and soybean roots and nodules were collected in 2019 to investigate microbial community responses to basalt application that could alter the nitrogen cycle in these soils.

After analyzing the 2019 field measurements, LC3M researchers at Illinois confirmed that nitrogen fertilizer is the source of much of the nitrous oxide (N<sub>2</sub>O) lost in these systems. In 2019, when unfertilized soybeans were planted in place of heavily-fertilized maize, site-wide N<sub>2</sub>O production was extremely limited in both control and basalt-treated plots. Miscanthus, fertilized at one-third of the rate of maize, cycles nitrogen tightly — resulting in N<sub>2</sub>O emissions comparable to unfertilized soybeans.

A major focus of the recent research was to investigate the potential mechanisms that reduce N<sub>2</sub>O production with basalt, particularly soil acidity and phosphorus supply. The ecosystem model DayCent was used to make projections of N<sub>2</sub>O production with different qualities of basalt, demonstrating that maize systems respond to both changes in pH and phosphorus supply.

In Spring 2020, a liming project was initiated alongside basalt application in maize to investigate individual inputs to the mechanism described by the DayCent model.

Before the COVID-19 pandemic hit, Illinois LC3M team members led by Evan H. DeLucia, Carl Bernacchi, and Stephen P. Long had one conference presentation and five invited talks. LC3M members from across the globe contributed to three major scientific papers that were published in 2019-20.

Stay up to date at [sustainability.illinois.edu/research](http://sustainability.illinois.edu/research).

FEDERALLY FUNDED PROJECTS

# DOE Smart Farms Team Added; Next-Gen Feedstocks Group Ramping Up

The Institute has extended its funding successes with the U.S. Department of Energy (DOE) with a new \$3.3 million grant in 2020 — along with a promising start to the work on its \$5 million grant from 2019.

To support and coordinate efforts by the scientists in both of these fledgling projects, iSEE hired Anya Knecht, former Research Coordinator at the DOE Center for Advanced Bioenergy and Bioproducts Innovation (CABBI; see pages 6-7) as a program manager (*more about Knecht, page 29*).

A glance at both of these research endeavors:

## Smart Farms project

In January 2020, the U.S. Department of Energy awarded a \$3.3 million grant to a multidisciplinary research team at the University of Illinois at Urbana-Champaign to develop a precise system for measuring greenhouse gas emissions from commercial bioenergy crops grown in central Illinois.

The three-year project through iSEE is expected to reduce emissions associated with ethanol and other biofuels by enabling new technology for managing bioenergy crops, improving yield, reducing overfertilization, and designing new tools (*see photo above right*) for “smart farms.” The vast data collected will be publicly available and could someday lead to financial rewards for farmers who reduce emissions through sustainable crop management.

Led by Kaiyu Guan, an Assistant Professor of Natural Resources and Environmental Sciences (NRES) and a Blue Waters Professor at the National Center for Supercomputing Applications (NCSA), the team will establish the Midwest Bioenergy Crop Landscape Laboratory (MBC-Lab) to monitor emissions on three 85-acre maize and soybean fields in Champaign County.

Corn and soybeans are the two major crops marketed to biofuel producers, with more than 75 percent grown in the Midwest. But current practices to grow those crops emit nitrous oxide (N<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), and methane (CH<sub>4</sub>) into the atmosphere — all greenhouse gases (GHG) associated with global warming. N<sub>2</sub>O, which also degrades the Earth’s ozone layer, is a product of excessive fertilizer use. And annual tilling aerates the soil, allowing microbes to



break down carbon and release CO<sub>2</sub> into the air.

Ethanol and other biofuels could meet up to 5 percent of U.S. energy demand with net-zero emissions, or even “carbon negativity” — sequestering more carbon in the soil than the production process emits. But that will require new farming practices that drive down emissions and improve yield, such as adopting no-till or cover crops to stabilize the soil or applying fertilizer at the right time and amount.

Through its Advanced Research Projects Agency-Energy (ARPA-E) program, DOE has funded a series of projects, including this one, to measure the impact of crop-management practices on yield and the environment — and to help create

market incentives for efficient feedstock production.

The team has grown to include seven faculty-level researchers at the U of I along with five postdocs and a research scientist and will collaborate with the National Oceanic and Atmospheric Administration. It has already put in a proposal for ARPA-E Phase II funding totaling nearly \$7.4M and plans to request a grant from the Foundation for Food and Agriculture Research (FFAR) in the near future.

*Read more about this project at [go.illinois.edu/SmartFarms](http://go.illinois.edu/SmartFarms).*

## Next-Generation Feedstocks project

Due to a funding delay, this project headed by D.K. Lee is in the middle of its first year of operation.

But in that time, the team has:

- applied for a \$1.6 million subaward grant from the University of Chicago, which is pending;
- expanded to 11 co-PIs, two more research scientists, three postdocs, a field technician, a research aide, two Ph.D. candidates, and four undergraduates spanning six partner institutions and three industry collaborators; and
- established field sites at the Illinois Energy Farm, Brighton, Ill., and at Iowa State University (*pictured left*) to compare switchgrass and other crops with ecosystem services, wildlife, emissions, soil gas, soil water, and many other measurements.

*Read more about this project at [go.illinois.edu/NextGenFS](http://go.illinois.edu/NextGenFS).*

## iSEE Team Part of USDA Crop Production Study

In Spring 2020, iSEE helped University of Illinois researchers gain a \$1.2 million grant as part of a larger study to help the U.S. Corn Belt maximize crop production.

As part of a \$10 million, five-year U.S. Department of Agriculture study led by the University of Maryland that will identify innovative ways of increasing land and water use efficiency, U of I scientists will study:

- Climate variability that includes the rapid switch between floods and droughts, which usually leads to water-logging in the crop planting stage and water stress in the crop growth stage, especially during the flowering stage of corn;

- Biofuel development and landscape change, including adopting more efficient bioenergy crops such as sorghum and perennial grasses like Miscanthus and switchgrass — as well as socio-economic impacts and environmental impacts (water quantity and quality); and

- Nutrient loss, a longstanding issue in the Midwest, and whether it can be positively or negatively affected by climate variability and agriculture landscape change.

The Illinois team includes iSEE Associate Director Ximing Cai, Lovell Endowed Professor of Civil & Environmental Engineering; iSEE Associate Director Madhu Khanna, ACES Distinguished Professor of Agricultural & Consumer Economics; Stephen P. Long, Ikenberry Endowed University Chair of Crop Sciences and Plant Biology; and Reid Christianson, Research Assistant Professor of Crop Sciences.

The goal of the overall project will be to develop a Dashboard for Agricultural Water use and Nutrient management (DAWN).



CAI



KHANNA



LONG



CHRISTIANSON

# Researchers Reap Benefits of 2019 iSEE Seed Funds

In 2019 and '20, iSEE changed its seed funding program — and it has been a marked success.

Early in the Institute's history, research projects were awarded larger sums. After mixed results, iSEE now offers smaller grants — as well as grant proposal help — for teams that specifically target major external funding opportunities.

This interdisciplinary seed funding initiative is for cross-campus teams of faculty looking to develop exploratory research ideas. Teams from multiple disciplines will collect preliminary data or other information to develop a research project; and prepare and submit research proposals for external funding.

The five teams seed-funded in 2019 have already shown measurable results (*project descriptions and full progress reports at sustainability.illinois.edu/seed-funded-research-2019/*):

## Sanitation Technology

In August, team members were awarded a \$1 million grant from the Bill & Melinda Gates Foundation to evaluate the economic and environmental impact of sanitation systems under development and to prioritize research to increase global access to sanitation.

PIs Jeremy Guest and Roland Cusick, both Illinois Water Scholars, and their team will model and assess several designs of novel, "reinvented" toilets as well as modular treatment systems called Omni-Processors (OPs).

Since its Gates grant, the team has also put forth a \$3.6 million National Science Foundation (NSF) Graduate Traineeship Program (GTP) proposal, which is pending, and published two papers in scientific journals.

The team also hosted a workshop at Makerere University in Kampala, Uganda (*pictured at right*).



## Agricultural Resilience in Extreme Weather

In 2019, PI Helen Nguyen's team was awarded \$200,000 for 2019-21 from the U.S. Department of Agriculture for a study titled "Empowering Rural America: Assessment of Risk and Resilience of Livestock and Food Transportation Infrastructure under Extreme Natural Events." The team is awaiting word on its pending \$3.6 million NSF GTP proposal.

In the meantime, while slowed by a downsized team

during the COVID-19 pandemic, the team was able to begin exploring the fallout from extended 2019 flooding in both New England and the Midwest, which sustained infrastructure damage (*pictured above*), crop and livestock loss, and contaminated water supplies.

## CyberGIS System for Urban Sustainability

Project Lead Don Wuebbles is a Co-PI on a \$600,000 proposal pending with the Robert Wood Johnson Foundation titled "Building Health and Equity while Enhancing Climate Resiliency in the Chicago Region." The PI is Edith Makra of the Metropolitan Mayors Caucus; if funded, the U of I will receive \$236,100.

The team previously made two NSF proposals totaling \$6.2 million; neither was funded, but a third NSF proposal is forthcoming later in 2020.

Wuebbles & Co. are developing an innovative framework to diagnose and tackle complex urban challenges by integrating analysis, measurement and modeling. Thus far, the team's initial analyses used the GIS system at the U of I to look at Chicago and Champaign relative to climate change, especially temperature and precipitation — and that in turn has led to a study of crime rates in Chicago relative to temperature.

## Community Infrastructure Resilience

The team's \$1.5 million NSF proposal titled "Decision Support for Chaotic Disaster Events: Forecasting Infrastructure Impacts with Social Dimensions" was declined, but PI Pingfeng Wang and his team will create a new NSF proposal through iSEE in September 2020.

On the research front, Wang generated essential proof-of-concept results on social sensing and data-driven post-disruption disaster recovery for improving the resilience of critical infrastructures, including demonstrating the value of social media after damaging weather events.

And team members authored two publications in scholarly journals during the past year.

## Pollution Transmission & Economics

In late 2019, the team submitted an \$800,000 proposal to the NSF, but that proposal was turned down. The team is now planning for a Fall 2020 push for another funding opportunity.

PI Sandy Dallerba and his team are nearing completion of a first paper that analyzes air pollution and its adverse health effects during the past decades, focusing on carbon monoxide emissions via trade flows and wind flows.

## Research Seed Funding Announced in May 2020:

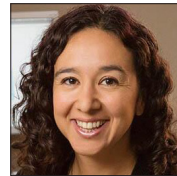
- Investigates the relationship between land use and renewable energy in certain Asian countries, and the impact of "green growth" on the region's social and ecological climate — led by Assistant Professor of Urban & Regional Planning Sean Kennedy.



- Explores the viability for ash generated from waste incineration to be adapted as a component of sustainable construction materials — led by Assistant Professor of Civil & Environmental Engineering Nishant Garg.

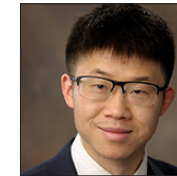


- Combines sophisticated weather forecasting and innovative hydraulic modeling to increase flood tolerance in vulnerable Chicago communities — led by Associate Professor of Atmospheric Sciences Francina Dominguez.



## A Look at iSEE's 6 New Interdisciplinary Projects

- Optimizes the role of wind power in the national move toward renewable energy by enhancing feasibility and performance of offshore floating wind turbines (OFWT) — led by Assistant Professor of Civil & Environmental Engineering Jinhui Yan.



- Provides random metro travelers with subsidies for ride-sharing to and from metro stations to evaluate supplementing public transportation with low-cost, accessible mobility-on-demand technology — led by Assistant Professor of Agricultural & Consumer Economics Peter Christensen.



- Collects precise, comprehensive data on nitrogen in U.S. Corn Belt agricultural systems to encourage stakeholders to adopt efficient nitrogen application practices and foster a sustainable food culture — led by Assistant Professor of Natural Resources & Environmental Sciences Kaiyu Guan.



# In Third Year of iSEE Initiative, Projects Paying off with Grants, Proposals, Publications

With its Campus as a Living Laboratory program, iSEE began seed-funding and supporting research that is tied to a campus sustainability initiative or site in 2018, and the program has grown to 11 projects.

The Institute's support is targeted at helping a research team to acquire external grants that will bolster the research while at the same time enhancing the sustainability project.

In 2019-20, Principal Investigators had the following successes to report:

- A team led by iSEE Associate Director for Campus Sustainability Ximing Cai, Environment-Enhancing Food, Energy, and Water Systems team PI Yuanhui Zhang, and Paul Davidson was awarded \$500,000 from the National Science Foundation's (NSF) Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS) program. In addition, the team, which uses a mobile reactor (pictured) to convert biowaste into clean water and biocrude fuel, published two papers in *Bioresource Technology* as well as papers in *Progress of Energy and Combustion Sciences* and *Energy*.

- Lead Nora El-Gohary and her Autonomous Building Systems team submitted a full funding proposal for \$1 million to the National Science Foundation's National Robotics Initiative program (NRI 2.0: Ubiquitous Collaborative Robots) in early 2020. This pending four-year project, titled "Customizable Co-Robots for Energy-Efficient, Comfortable, and Productive Office Environ-



ments," would start in Fall 2020.

- Lead Tugce Baser and her Geothermal team exploring thermo-hydraulic properties of glacial tills received \$200,000 from the U.S. Department of Energy; a Phase II proposal totaling \$1.2 million is expected in Fall 2020.

- After missing out on a \$10 million proposal to the U.S. Department of Agriculture's Agriculture and Food Research Initiative under its new Sustainable Agricultural Systems initiative, the Agrivoltaics project team led by iSEE Associate Director for Research Madhu Khanna continues to explore its next funding options even as the University of Illinois at Urbana-Champaign prepares for a second solar farm, bringing the number of available acres for potential agrivoltaic exploration to 75.

Meantime, four new projects received iSEE funding support in 2019-20:

- integrating groundwater resources and geothermal energy for water-energy security and resilience;
- introducing and testing a way to help reduce the amount of time cars spend idling — and subsequent transportation-related emissions — by measuring flow of traffic in, out, and around major parking facilities;
- demonstrating a new parking pavilion with a small wind turbine that can generate energy to charge electric cars, bikes, or scooters; and
- surveying campus employees on a possible crowd-sourced ridesharing program.

Read more about the CALL program at [go.illinois.edu/campuslivinglab](http://go.illinois.edu/campuslivinglab).

## iSEE Publishes Website for U of I's

In Spring 2020 iSEE published a new website, "Global Climate Change at Illinois," pulling together work by faculty-level experts across campus to solve the challenges posed by climate change.

Illinois is home to a rich community of world-renowned scholars who are willing to work across disciplines to tackle those challenges. The new website features **more than 120** experts who research, educate, engage, and develop programs in a range of fields — from physical and biological sciences to the impact on humans and nature, vulnerability and climate justice, and adaptability and mitigation strategies.

The Global Climate Change Scholars are faculty from the Col-

Noticias Sustentabilidade

## Software de código analisará economia de biocombustíveis

Por Redação - 20 de Fevereiro, 2020



## CABBI Leads the Way on Patents, New Papers, Media Coverage

The Center for Advanced Bioenergy and Bioproducts Innovation (CABBI; *more on pages 6-7*), a \$115 million U.S. Department of Energy Bioenergy Research Center led by iSEE and the Carl R. Woese Institute for Genomic Biology, has continued to progress amid its third full year.

In 2019-20, CABBI researchers made five invention disclosures and two provisional patent applications — and published 43 papers in scholarly journals.

CABBI's reach was enhanced by five news releases that were posted to EurekAlert!, an online site for journalists. In addition to totaling more than 25,000 pageviews on EurekAlert!, the releases on those papers were picked up online by

news outlets worldwide, including Brazil (*pictured above*), Russia, Germany, South Africa, and Asia.

Other publication successes in 2019-20 by iSEE research teams:

- four each by the Stormwater & Mosquito Control team (*page 14*) and the Campus as a Living Lab Environment-Enhancing Food, Energy, and Water Systems project (*page 12*);
- two each by the Crops *in silico* team (*page 14*), the Sanitation Technology team (*page 10*), and the 2019 iSEE seed-funded Community Infrastructure Resilience team (*page 11*); and
- one each by the Critical Infrastructure & Transportation team (*pages 14-15*) and the MultiPaddock Grazing team (*page 15*).

## Global Climate Change Scholars

lege of ACES, the Grainger College of Engineering, the College of Liberal Arts & Sciences, the Gies College of Business, the College of Law, and more — as well as faculty-level scientists from the Prairie Research Institute.

This is the third U of I research community iSEE has convened, following the Water Scholars (**more than 100** strong) and Energy Scholars (about **120**).

You can also read about global climate change-related campus centers and initiatives, facilities and laboratories, as well as funding, research, and career opportunities.

Check it out at [globalclimatechange.illinois.edu](http://globalclimatechange.illinois.edu).

## Research-Related Events Canceled in 2020 — but Conversation Continues!

The COVID-19 pandemic caused the cancellation of several iSEE research-related events in Spring and Summer 2020.

Rather than move to a virtual format, which was possible with some events such as lectures and presentations, the Institute chose to postpone the following events as they require face-to-face discussions — some without attribution:

- the Crops *in silico* project's fifth annual meeting (*read more about the project, page 14*);
- meetings for the Water, Energy, and newly constituted Global Climate Change Scholar groups (*more on these pages*); and
- iSEE's third annual Critical Conversation on a wicked sustainability challenge with social, legal, economic, technical, and scientific dimensions.

The good news? The discussions and awareness campaign continue from the May 2019 Critical Conversation on genetically modified mosquitoes.

On June 3, 2020, event hosts Brian Allan, Chris Stone, and Holly Tuten — along with participants Natalie Kofler (who spent 2019-20 at the U of I as the first Levenick iSEE Resident Scholar in Sustainability Leadership) and Jennifer Kuzma — published their op-ed piece "Genetically Modified Mosquitoes could be Released in Florida and Texas Beginning This Summer — Silver Bullet or Jumping the Gun?" in *The Conversation*, an online forum. Within one week, **more than 106,000** people had read the article.

Allan and his co-authors now have their sights set on a scientific paper for a scholarly journal.

**THE CONVERSATION**  
Academic rigor, journalistic flair



## ONGOING PROJECTS

# Progress Updates from Funded Research Leads

Beyond iSEE's affiliated research centers, and its endeavors to help University of Illinois scientists gain funding (see pages 6-13), here is a glance at five more iSEE projects, all of which have received external grants (read more about recent grant activity on page 5).

### Stormwater & Mosquito Control

Principal Investigator Brian Allan reports the following successes in the fifth year of this iSEE-funded project, which has been extended with two major National Science Foundation awards since the initial seed funding (read the full update at [bit.ly/stormmosq](https://bit.ly/stormmosq)):

- The team continues to develop a research program using “social sensing” (i.e., the use of geo-located social media activity data) to model networks of human movements and contacts to recreate the pattern of spread of Zika virus in the Americas and apply this to future outbreaks.
- Additionally, several field-based projects into the effects of stormwater management practices on mosquito-borne disease risk have continued, and the team recently published papers on the ecological factors that structure mosquito communities in stormwater ponds, and on the effects of container size on oviposition choice in female mosquitoes.
- The SMC team recently published research showing that stormwater habitats impact the assembly of the mosquito microbiome. These additional efforts contributed to the recently completed Ph.D. research of several graduate students affiliated with the project.
- Finally, Allan, U of I researchers from the Illinois Natural History Survey, and other participants in iSEE's 2019 Critical Conversation on genetically modified mosquitoes, published an oped piece in June 2020 in *The Conversation* (read more on page 13).

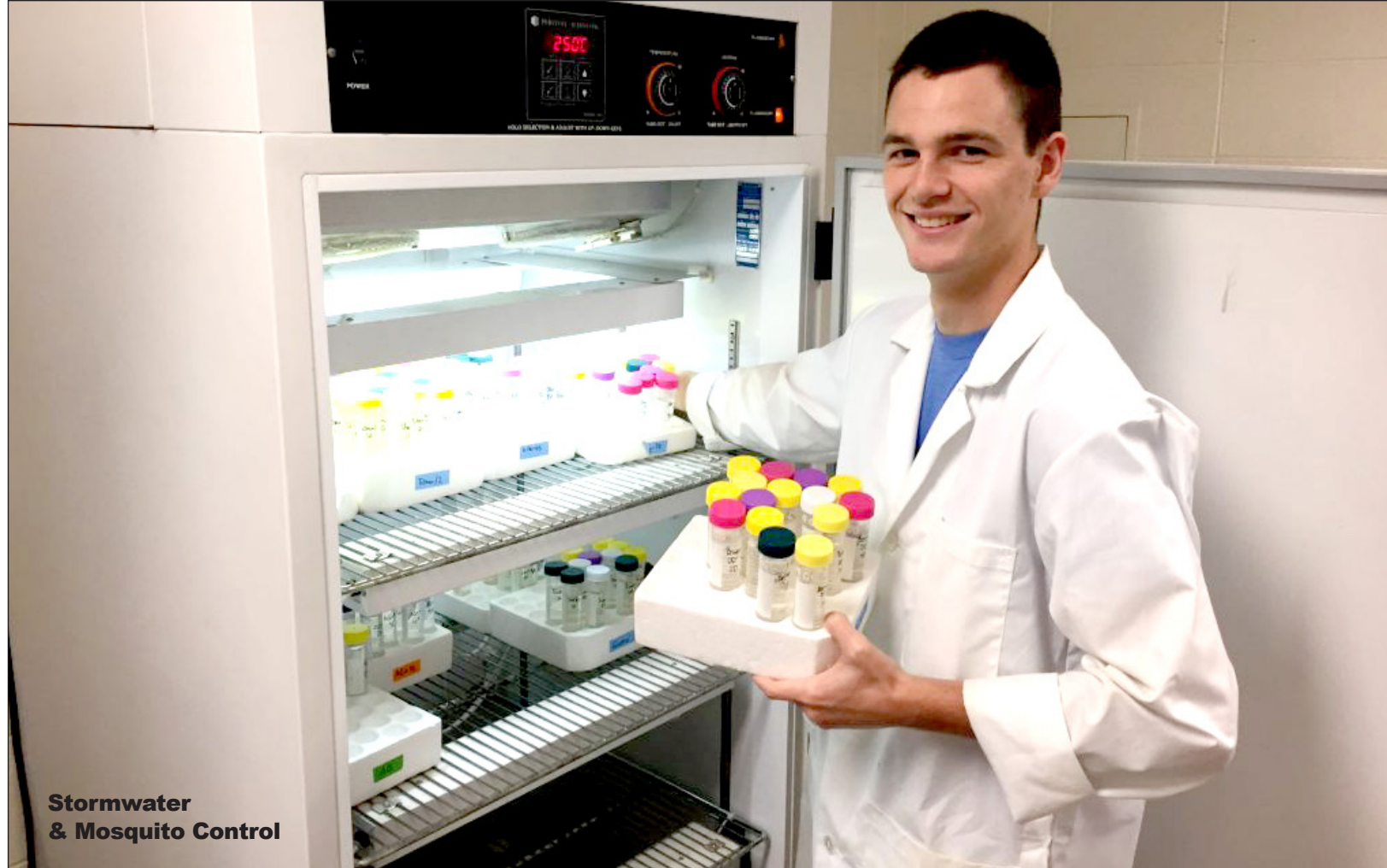
### Crops in silico

News from PI Amy Marshall-Colón and the team in the fifth year of *Crops in silico* since its original iSEE seed funding, and the beginning of its second year with Foundation for Food and Agriculture Research funding totaling \$5 million (read more about the project at [bit.ly/Cropsinsilico](https://bit.ly/Cropsinsilico)):

- Due to the COVID-19 pandemic, the team was forced to cancel its 2020 Symposium, Workshop & Hackathon event. Organizers hope to reconvene in 2021.
- Team members have published two papers in early 2020, and made four presentations at major conferences.

### Agroforestry for Food (A4F)

PIs Alexandra Harmon-Threatt — who is new to the



Stormwater  
& Mosquito Control

project after the departure of original PI Sarah Taylor Lovell — Wendy Yang, and Bruce Branham report on the sixth year of this project, which in past years received two U.S. Department of Agriculture grants totaling \$955,000 (read the full update at [bit.ly/ag4food](https://bit.ly/ag4food)):

- Researchers were able to compare the insect abundance at an agroforestry site vs. a traditional corn/soy row plot.
- The team continued to measure ecosystem services production from three woody polyculture fields, including comparisons between corn/soybean rotations and woody polyculture, and between different fertilizer treatments (conventional, organic, and no fertilizer) in woody polyculture.
- A4F researchers discovered that hazelnuts and chestnuts are marginally adapted to central Illinois — so both types of trees are being replaced with a different variety of hazelnut as well as pecan trees.
- Finally, with the replanting the team has also changed its field design. Rather than interspersing trees and shrubs with 30-foot pasture buffers, the field will feature tree crops in individual rows staggered between the product shrub crop, black currants. This will make harvest more feasible.
- A4F researchers published one paper and made two presentations in 2019-20.

### Critical Infrastructure & Transportation

PI Ximing Cai and Co-PI Madhu Khanna report the following progress during the fifth year of this iSEE seed-funded project as well as after the third year of a \$2.43 million NSF INFEWS grant (read more at [bit.ly/ICI-project](https://bit.ly/ICI-project)):

- Team members made one online presentation and have three papers under review for publication: one on new car pricing strategies under the reformed CAFE standard; a second on modeling electric vehicle charging infrastructure in intercity transportation networks; and a third on the varying geographical patterns of electric vehicle adoption (see Publications, below).

- ICI team members and other Illinois researchers are awaiting word on a proposed Center for Infrastructure Resilience in Cities as Livable Environments (CIRCLE), which would be a Joint Research Center between the U of I and Zhejiang University. Potential funding from the Grainger College of Engineering would amount to \$1.5 million.

- Team members had one publication with three more in review, and made one presentation during the past year.

### Multi-Paddock Grazing

From PI Nuria Gomez-Casanovas, an update on the project midway through its second year (read more at [go.illinois.edu/MPGrazing](https://go.illinois.edu/MPGrazing)):

- The Illinois team has secured two more grants totaling \$325,000 from ExxonMobil and McDonald's foundations through Arizona State University.
- The team completed its first year of gathering eddy covariance data, including CO<sub>2</sub> and CH<sub>4</sub> net ecosystem exchange; N<sub>2</sub>O measurements; and Net Primary Productivity and grazing intensity measurements.
- The team made two presentations in 2019 and has a paper in preparation.



Crops in silico



Agroforestry for Food



Critical Infrastructure & Transportation



Multi-Paddock Grazing



# Minor, Certificate Still Growing; Environmental Leadership Program Coming Soon!

iSEE's curricular educational programming continues to grow — and the Institute is helping to extend the reach of sustainability into all instruction across campus as well (*read more about the Teaching Sustainability Fellows Program, page 19*).

A few items of note:

- The Sustainability, Energy, and Environment Fellows Program — iSEE's honors minor in partnership with six academic units — has had about 130 students enrolled during its first four years. Current enrollment is at 68 (*see students' colleges in graphic at left*) and growing, with 21 enrolling since November 2019. SEE FP graduates in May 2020 totaled 17. New Academic Instructor/Advisor Eric Green (*more, page 29*) will teach the SEE FP introduction (ENVS 301) and capstone (ENVS 492) courses, and he has lined up industry, government, NGO, and other local and University partnerships for student capstone projects in Fall 2020.

• More than 250 students enrolled in the undergraduate Certificate in Environmental Writing (CEW) courses during the first three years, and seven new certificates were awarded in Spring 2020. For Fall 2020, more than 120 students are enrolled in CEW classes!

- To help meet a proposed objective in the 2020 Illinois Climate Action Plan (iCAP, *see pages 22-23*), iSEE has begun to develop different elements for an Environmental Leadership Program for the University of Illinois. When fully up and running, the program will involve instruction as well as off-campus opportunities.

- Green and iSEE also are meeting iCAP objectives by publishing a list of all sustainability-related courses in time for registration for each semester.

## Special Course Offerings in Spring 2020

In addition to the usual courses iSEE offers — through its campuswide minor and environmental writing program — the Institute was able to offer two eight-week courses in Spring 2020, each of which offered a unique learning opportunity for about a dozen students:

- iSEE Academic Instructor/Advisor

Eric Green and Sustainability Programs Coordinator Meredith Moore co-taught “NRES 285: Student iCAP.” Students in the course helped iSEE develop strategies and offered their visionary input as the Institute prepares to publish Illinois Climate Action Plan 2020 (*read more, pages 22-23, 29*).

- And Natalie Kofler, the Levenick Resident Scholar in Sustainability Leadership, taught “NRES 512: CRISPR, Geoengineering, and A.I.,” a seminar on ethical decision-making when it comes to genetic engineering tools (*read more, page 18*).



# Q Publishes Volume 2; V3 in the Works

Some updates on *Q Magazine*, the nation's only entirely student-written, professionally curated environmental publication, a result of the undergraduate Certificate in Environmental Writing offered jointly through iSEE, the School for Earth, Society & Environment (SESE), and the English Department:

- In September 2019, Volume 2, Issue 1 was published online. The theme of the issue — “Born to be Wild” — explored the impacts of human-caused climate conditions and environmental tragedies in nature. Each original essay tackles in its own way the tough-to-answer question: What does it mean for us to “win,” ecologically?

• Volume 2, Issue 2 was published online in February 2020. For this edition, two stories benefited from travel sponsorships (*see below*) to research the Gila River's struggle to survive in the American West and the toxic history of Washington State's Hanford Site (*see photos above*). Other articles explored Chicago's Large Lots Program transforming vacant property into thriving symbols of community and environmental justice, the policy surrounding black carbon, bird species' struggle for survival on the Illinois prairie, and the ethical implications of gene editing technology.

- The Volume 2 print edition (*see sample page at left*), featuring all 12 articles from the online issues, will be printed in late Summer 2020.
- Volume 3, Issue 1 is set for a Fall 2020 release. Senior Sarah Gediman has been named Student Editor for that issue.

## Q Magazine Announces Writing Award

Donor Janelle Joseph, who has sponsored travel awards for *Q Magazine* student writers (*see adjacent story about some of those funded trips*), has also helped foster a new initiative with her continued generosity.

In April, iSEE announced the Janelle Joseph Award for Environmental Writing. *Q* editors will accept manuscripts in late summer and fall, and give cash awards for best article and winners in each of the following categories: op-ed, Q&A, memoir, and feature. The top stories will be published in *Q*.

*Read more about Joseph's gifts, page 4.*

## THE LEVENICK PROGRAMS



### Resident Scholar Contributes to Multiple iSEE Efforts; New Chair to Help Run Program

As the first Levenick iSEE Resident Scholar in Sustainability Leadership in 2019-20, Natalie Kofler made a significant impact to iSEE's missions as a thought leader, teacher, student mentor, and contributing author.

Kofler, who is the Founder and Director of *Editing Nature*, is a molecular biologist and bioethicist, has authored numerous scientific research articles, reviews, and commentary pieces, and chaired international seminars and summits.

In addition to continuing her own research and writing work during her time on the Urbana-Champaign campus, she brought her passion for ensuring that diverse voices and viewpoints steer science and technology.

Some 2019-20 highlights:

- On Nov. 7 in the Spurlock Museum's Knight Auditorium, Kofler delivered a MillerComm Lecture on genetic engineering (pictured above).

The lecture, sponsored by the Center for Advanced Studies and attended by 65 people, was titled "Editing Nature: Governance Hurdles and Ethical Holes in Genetic Engineering."

- She also taught an eight-week Natural Resources and Environmental Sciences course in Spring 2020 (*more on page 16*). A dozen students participated in "NRES 512: CRISPR, Geoengineering, and A.I.," a seminar on ethical decision-making when it comes to genetic engineering tools.

- And Kofler helped co-author an oped titled "Genetically Modified Mosquitoes could be Released in Florida and Texas Beginning this Summer — Silver Bullet or Jumping the Gun?" in *The Conversation* (*read more on page 13*).

#### Brawn Named Levenick Chair

In January, iSEE welcomed Jeffrey Brawn as the inaugural Stuart L. and

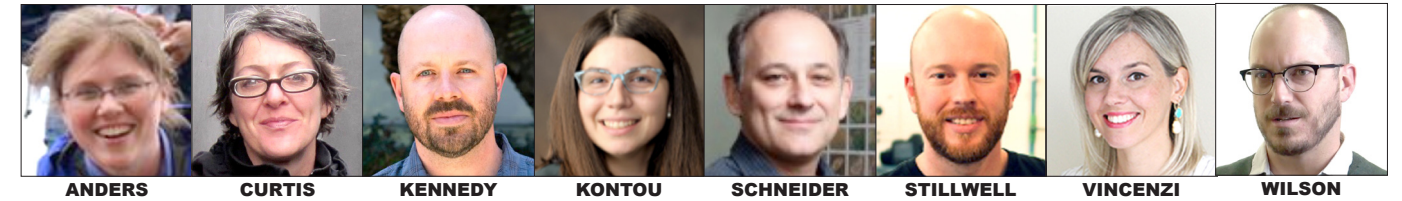
Nancy J. Levenick Chair in Sustainability, the first endowed chair in the Department of Natural Resources and Environmental Sciences (NRES).

Part of Brawn's activities will be to organize and manage the Levenick Resident Scholars Program, and the Institute looks forward to continuing its close ties with him. As the former NRES Head, Brawn has served on iSEE's Steering Committee since its inception in 2013-14.



**BRAWN**

"We are extremely grateful to Stuart and Nancy Levenick for their recognition of NRES faculty and the University of Illinois as global leaders in the interdisciplinary science and practice of sustainability," College of ACES Dean Kim Kidwell said. "Dr. Brawn has been an invaluable part of the ACES leadership team."



## Teaching Sustainability Program Grows, Expands Reach into U of I Classrooms

In February, the Institute named eight instructors as its 2020-21 Levenick iSEE Teaching Sustainability Fellows and will support them in their efforts to integrate sustainability into courses on everything from costume design to urban transportation.

Funded by a generous endowment from Illinois Alumnus Stuart L. Levenick and his wife Nancy J. Levenick, this second cohort of faculty and teachers will incorporate sustainability into existing classes or create entirely new courses built around sustainability elements.

Associate Director for Education & Outreach Gillen D'Arcy Wood said applications nearly doubled for the Levenick iSEE Teaching Sustainability program this year, a positive sign of a growing program — and growing interest in adding sustainability thinking in all academic units.

The 2020-21 cohort and the courses they will undertake:

- Alison Anders, Associate Professor of Geography, "GIS for Geology and Environmental Science;"
- Kim Curtis, Adjunct Lecturer in Theatre, "Theater Design and Production;"
- Sean Kennedy, Assistant Professor of Urban + Regional Planning, "Food and the City;"
- Eleftheria Kontou, Assistant Professor of Civil and Environmental Engineering, "Urban Transportation Models;"
- Daniel Schneider, Professor of Urban + Regional Planning, "FAA 230: Sustainable Design of the Built Environment;"
- Andrew Stillwell, Assistant Professor of Electrical and Computer Engineering, "ECE 330: Green Electric Energy;"



- Chiara Vincenzi, Adjunct Instructor in Art + Design, "ARTS 321: Sustainable Fashion Development & Branding;" and
  - Andrew Wilson, Teaching Associate in Social Studies at Uni High, "World History."
- The Teaching Sustainability program consists of four elements to help the 2020-21 Fellows best incorporate sustainability into their courses:
- a retreat for developing lesson plans, held in Spring 2020 and available via teleconference for interested instructors from other U of I campuses;
  - summer feedback from iSEE and sustainability subject matter experts;
  - a fall progress check-in; and
  - a Spring 2021 debriefing, at which time the cohort will meet the newly named 2021-22 Fellows.
- iSEE is also building an online guide

of academic and personal resources for Fellows to use while building their syllabi. This should launch in Fall 2020.

#### Four New Courses Launched by 2019-20 Cohort of Fellows

In the meantime, the first cohort of Fellows reported in Fall 2019 (*photo above*) that four new courses had already reached students with a fifth still in development. The courses:

- "ARTD 451: Ethics of a Designer in a Global Economy," taught by Eric Benson and Nekita Thomas;
- "ESE 466: Climate Change, Law and Health," taught by Warren Lavey and Dr. Holly Rosencranz;
- "FSHN 499: Environmental Impacts of Food & Nutrition Systems," taught by Melissa Prescott; and
- "ARCH 576: Building Energy Use," taught by Yun Kyu Yi.



## ‘Sustainability Justice’ Attracts 400+ Participants; Water Event Delayed

In September 2019, more than 400 students, faculty, staff, and community members attended lectures, panels, and roundtables with a vibrant group of speakers at iSEE Congress 2019: “Sustainability Justice.” Over a few days at the Illini Union, attendees explored environmental justice, a keystone concept driving the broader sustainability project.

Simultaneously representing a field of scholarship, political agenda, and framework for understanding our fast-changing world, the marriage of social justice and sustainability has moved beyond its initial focus on the inequitable distribution of environmental burdens to incorporate a range of pressing social and ecological issues within a unifying framework that strives to realize sustainable justice for all. But as human rights advocates know, the concept of justice can be defined in multiple ways, and its implementation into policy, environmental law, ecological design and planning — not to mention global trade — faces great challenges.

Highlighted by keynote talks from Kim Wasserman (pictured above), Executive Director of Chicago’s Little Village Environmental Organization, and international human rights expert John Knox, Professor of Law at Wake Forest University and the former Special Rapporteur to the United Nations, the discussions were passionate, lively, challenging, and introduced a diversity of critical voices and perspectives.



### 2020 Congress Postponed

With the COVID-19 pandemic still likely to limit attendance, iSEE postponed its seventh annual Congress, “The Future of Water” (image above).

Original invited guests included Pacific Institute Co-Founder Peter Gleick, a leading scientist, innovator, and communicator on global water and climate issues, and *New York Times* environmental reporter Somini Sengupta.

iSEE and the Joint Area Centers (JACS), which are co-sponsoring the event, hope those keynote speakers and other invited speakers will be available for a rescheduled Congress in Spring 2021 if possible.

## iCAP Forums, Renowned Scientist Highlight Events

The official kickoff for the new Illinois Climate Action Plan (iCAP 2020; *more, pages 22-23*) took place in late October during Sustainability Week on the University of Illinois campus.

At the Campus Sustainability Celebration — attended by more than 100 students, faculty, staff, administrators, and community members — iSEE and the SWATeams put together five-year and longer-term goals and objectives for campus as it pursues carbon neutrality by 2050 or sooner.

Teams also made initial suggestions for potential strategies to reach these new targets (see picture at right), and all attendees were invited to offer suggestions.

Despite the COVID-19 pandemic forcing the closure of campus in Spring 2020, Earth Week still featured a major iCAP unveiling, during which students presented updated draft objectives to an online audience of more than 70 people



(*more, pages 22-23*).

By far the biggest success of Earth Week was another online event: the “zero-carbon” Charles David Keeling Lecture presented by iSEE and hosted on Zoom by the Department of Atmospheric Sciences.

Well-known climate expert Katharine Hayhoe (pictured below), a Professor of Political Science and Director of

the Climate Center at Texas Tech University, was already scheduled to deliver the Keeling Lecture online — hence its “zero carbon” advertising moniker.

But iSEE was thrilled when Illinois alumna Hayhoe’s talk, “Climate Science in a Fact-Free World,” attracted more than 265 people from campus and around the world to log in and listen.



# CAMPUS SUSTAINABILITY

## ILLINOIS CLIMATE ACTION PLAN 2020

# We've Got a Plan!

Illinois Climate Action Plan (iCAP) 2020 will be published in Fall 2020, in time for the annual Campus Sustainability Celebration in October.

During the past year, iSEE and Facilities & Services (F&S) sought input from across campus (*see examples in the graphic below*) and began drafting the document, which is the U of I's strategic plan for achieving carbon neutrality as soon as possible, by 2050 at the latest.

iCAP 2020 already features new ideas for reducing waste, curbing water and energy use, lowering carbon emissions, and promoting sustainability on campus.

Among the many proposed objectives are the following:

- fully divesting of fossil fuel companies;
- committing to a sustainable investing policy;
- incorporating the iCAP into the next campus Strategic Plan;
- achieving a Sustainability Tracking, Assessment & Rating System (STARS) Platinum ranking from the Association for the Advancement of Sustainability in Higher Education (AASHE);
- developing a coordinated urban biodiversity master plan with local cities;
- incorporating sustainability opportunities into career fairs;
- broadening sustainability education across the entire U of I curriculum;
- establishing a curricular environmental leadership program;
- developing a comprehensive and effective zero waste messaging campaign;
- developing a comprehensive energy planning document with details on being net zero by 2050;
- reaching 140,000 megawatt-hours per year of clean power;
- improving space use in campus buildings;
- establishing an electric vehicle task force;
- reducing driving on campus with a commuter program, a campus bike plan, and telecommuting policies;
- reducing water consumption;
- adding a resilient landscape strategy with more trees and pollinator areas;
- establishing a food literacy project;
- starting a green cleaning program; and
- creating a sustainable events program.

Draft objectives were completed in April and presented to campus via teleconference due to the COVID-19 pandemic. In June, the Sustainability Council, chaired by Chancellor Robert J. Jones, discussed the objectives, and later that month a fuller-text draft was released for public comment.

Once the text is finalized and the book is approved by the Chancellor, a few copies will be printed. But to be more sustainable, iSEE intends to publish it online at [sustainability.illinois.edu/icap/](https://sustainability.illinois.edu/icap/).

The primary writer for iCAP 2020 is iSEE Communications Specialist Jenna Kurtzweil; student Intern Donna Dimitrova is the book designer.

## Campus Engagement with the iCAP

Before the first draft of Illinois Climate Action Plan (iCAP) 2020 was complete, iSEE solicited input from the campus community — with an emphasis on students. Some examples:

- The **Campus Sustainability Celebration** in October, attended by more than 100 people (*more, page 21*).
- Four **Student Input Sessions** in Fall and early Spring, in which about 160 students offered ideas about iCAP objectives. Illinois Student Government and student

groups were actively involved.

- iSEE hosted an **iCAP Forum** during Earth Week on Zoom and Facebook Live, reaching 70-75 people with a presentation of draft objectives.
- iSEE Sustainability Programs Coordinator Meredith Moore and Academic Instructor/Advisor Eric Green led a dozen students in NRES 285, an **eight-week iCAP course**, in early Spring.
- Moore presented the iCAP draft objectives to about

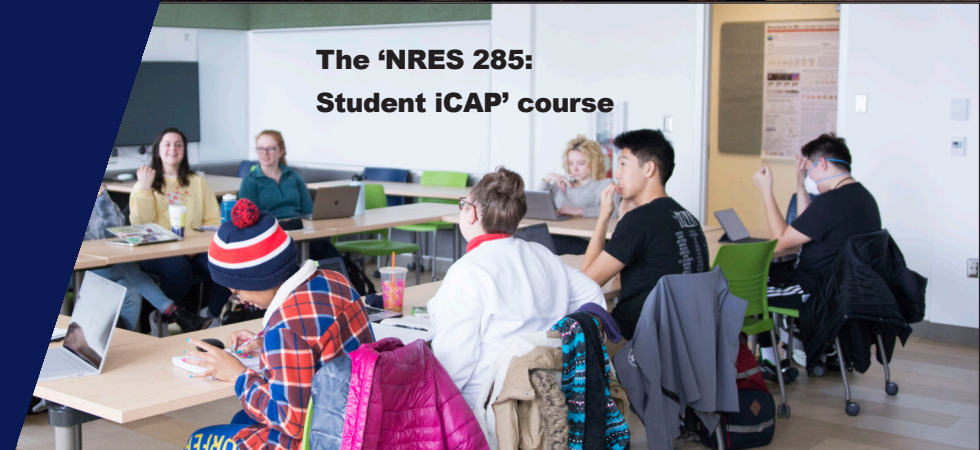


# iCAP 2020

## Illinois Climate Action Plan



December 2019  
Student Input Session



The 'NRES 285:  
Student iCAP' course



'iCAP: A Plan To Be Proud Of'  
promotional video

June 2020 Sustainability  
Council Meeting

## — Reaching out in 2019-20

20 members of the **Senate Committee on Campus Operations** in May.

- In June, when the 2020 draft text was released along with a **feedback form**, iSEE received more than two dozen written responses.
- The iCAP was written with **input from more than 100 people**, including

iSEE and Facilities & Services staff and interns, and students, staff, faculty, and administrators on the Sustainability Working Advisory Teams, the iCAP Working Group, and the Sustainability Council.

- Finally, **dozens of students** helped present the plan, write, contribute quotes, create a video, and even design the book. Thanks!



## Solar Farm 2.0 ... and Solar Farm 3.0?

In Fall 2019, the University of Illinois Board of Trustees approved construction of Solar Farm 2.0 — an expansion of more than 54 acres of solar panels.

Facilities & Services (F&S) and Prairieland Energy Inc. intend to increase campus on-site renewable energy generation to 25,000 megawatt-hours — meeting an objective in the Illinois Climate Action Plan (iCAP).

Construction was delayed by the COVID-19 pandemic but is expected to be completed in 2021. When added to the 21-acre original Solar Farm that began operations in December 2015, the completed array will give the University about 75 acres devoted to solar — making the campus “the third-largest user of on-site renewables for higher educa-

tion facilities in the United States,” F&S Executive Director Mohamed Attalla said.

Solar Farm 2.0 will include habitat for pollinators under the solar panels, and iSEE researchers are making efforts to attract funding to use the farm as a “living laboratory” for agrivoltaics (in which crop production and energy generation coexist).

In the meantime, iSEE and F&S have commissioned two studies to explore the feasibility of “Solar Farm 3.0,” which would involve a major purchase from an off-campus energy farm to increase the renewable portfolio for campus. And future studies might include the exploration of micro-nuclear reactors as a zero-carbon campus power source.

### Carbon Unit Sales Funding Current, Future Projects

In late 2019, iSEE completed a sale of the U of I campus’ Verified Carbon Units (a measure of carbon dioxide or equivalent greenhouse gases (GHG) kept out of the atmosphere). The units, accumulated during the second half of 2017, were sold as part of the Carbon Credit and Purchasing Program (C2P2) through Boston-based nonprofit Second Nature.

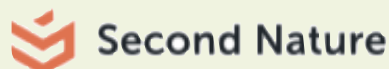
Proceeds totaled nearly \$202,000.

That amount, along with proceeds and matching funds from previous carbon sales, are being held at the campus level; the fund stood at more than \$1.06 million as of December 2019.

Funds from that account have been used, and are reserved for future use, toward campus sustainability and GHG reduction projects as determined by iSEE and Facilities & Services (F&S). Some concrete examples from the past year include:

- Hiring consultants to explore a major purchase of off-campus solar energy — what iSEE likes to term “Solar Farm 3.0” (*see story at left*).
- Helping F&S to hire a Zero Waste Coordinator for campus. Shantanu Pai, formerly a Sustainability Researcher at the Prairie Research Institute, is new to the job in 2020.

By selling its accumulated carbon credits, Illinois’ good work (mainly through efforts by F&S) to reduce GHG emissions will fund additional emission reductions and energy conservation projects on campus.



## iSEE Offers Guide for Individuals to Offset their Carbon Footprints

The University of Illinois at Urbana-Champaign is committed to becoming carbon neutral no later than 2050. To do so, the campus community must take ownership of that commitment — and faculty, students, and staff can do their part as individuals.

In November 2019, iSEE began offering a guide to helping campus community members make the choice to do their part.

One way is to purchase carbon offsets for travel or other actions that have measurable emissions.

Offsetting your carbon footprint is becoming easier to do — and at less than \$10 for a 2,000-mile flight, it is a cost-effective way for you to personally pay for your emissions impact even if your grant or government fund won’t cover offsets (many do not).

iSEE’s webpage offers a four-step guide to calculate the amount of carbon to offset — and to purchase high-standard offsets.

The COVID-19 pandemic drastically reduced faculty travel (and related emissions), one silver lining in an otherwise cloudy 2020. Said iSEE Baum Family Director Evan H. DeLucia: “Travel-related emissions had been increasing on our campus, and this reduction will directly affect the atmosphere as these emissions are not transferred elsewhere.”

However, DeLucia said, travel reductions as well as other emission reductions with an empty campus in

**HOW TO: OFFSET YOUR CARBON FOOTPRINT**

1. PAY CARBON OFFSET SURCHARGES WHEN PURCHASING TICKET
2. CALCULATE YOUR CARBON FOOTPRINT
3. PURCHASE OFFSETS THAT FUND VARIOUS PROJECTS
4. FILL OUT THE ISEE SURVEY TO REPORT YOUR OFFSET PURCHASE

[GO.ILLINOIS.EDU/OFFSETCARBON](http://GO.ILLINOIS.EDU/OFFSETCARBON) ISEE

Spring and Summer 2020, are only temporary. “We need to remain steadfast in our commitment to bring our campus to carbon neutrality once this health

crisis passes” — and perhaps the lessons learned about teleconferencing will help faculty make more eco-conscious decisions moving forward.

### Greener Campus Programs Re-Energized

In February, iSEE published the latest version of its Certified Green Office Program (CGOP), in which offices and units can take some simple steps to reduce resource use and emissions, and earn certification.

This program, which has helped more than 1,700 staff and faculty on campus conserve energy, reduce waste, and save money, will begin



re-certifying offices once the campus reopens for business as the COVID-19 pandemic abates.

Fall 2020 will see new guides for labs, Greek chapters, student organizations, and events. iSEE will start certifying those, too.

In the meantime, iSEE is sending monthly Greener Campus newsletters to interested parties.

## STUDENT PROGRAMS



# Students Who Help Quad Go Dark a Shining Beacon of Environmentalism

Under the leadership of the Student Sustainability Committee (SSC) — and especially senior Taylor Holin — the Illini Lights Out (ILO) program had unprecedented success in 2019-2020.

ILO, in which groups of students scour campus buildings on Friday evenings to turn off all unused lights for the weekend, started in Spring 2016 as a one-off event by an iSEE SWA-Team. It has gained popularity through the years — as well as funding from SSC.

Despite losing the final three ILO events of the spring after students left campus during the COVID-19 pandemic, the campaign achieved significant results. The Jan. 31 and Feb. 21 events averaged 100 participants and totaled 6,463 bulbs turned off for the weekend. This saved the campus 11,150 kilowatt-hours (kwh) of electricity (or 7.9 metric tons of CO<sub>2</sub> equivalent gases) — and \$1,762 on its power bill!

For the year, the totals were 38,668 bulbs, 66,702 kwh, 47.2 CO<sub>2</sub>e, and a record \$10,095 in savings!

Check out our totals over the first 3½ years in the graphic below.

### More iSEE Student Engagement Success

In addition to ILO successes, new and ongoing research projects (see pages 6-15), the Institute's educational and outreach programs (pages 16-21), and strong engagement during the Illinois Climate Action Plan 2020 drafting and approval process (pages 22-23), iSEE had other successes in making contact with students during the past year.

For instance, Sustainability Programs Coordinator Meredith Moore and other iSEE staffers reached thousands of undergraduates with sustainability messaging — and recycling help — during the annual Quad Day in Fall 2019. The result was more than 150 students signing on to receive iSEE's weekly sustainability e-newsletter.



153,091

Lights turned off through Spring 2020

190.8

Tons of carbon dioxide equivalent saved through Spring 2020

27,258

Dollars saved in energy bills through Spring 2020

## CAMPUS ACCOLADES

# University Remains a National Leader in Sustainability

The University of Illinois at Urbana-Champaign has been recognized with the following sustainability leadership achievements during the past year:

- Illinois was No. 20 out of 282 four-year higher education institutions in Sierra Club Magazine's "Cool Schools" contest in Fall 2019. The U of I ranked tops in the Big Ten Conference

(Michigan State University had the second-best ranking at 66th).

- The Urbana-Champaign campus won first place in the Fall 2019 International Laboratory Freezer Challenge, repeating as the top school in the Academia category for the second straight year. In 2019, 70 labs from 15 buildings participated in the program.

- The U of I was recertified as a Bee Campus USA for the second straight year in Fall 2019. The 53rd certified school — and the first in the Big Ten — it is now one of 99 campuses nationwide designated as pollinator-friendly.



- In October 2019, the University of Illinois at Urbana-Champaign earned its first Silver designation as a Bicycle Friendly University (BFU) from the League of American Bicyclists. The U of I, which has maintained bronze-level BFU certification since 2011 and is one of 208 colleges and universities recognized nationally, is now one of 94 with Silver level or better status.



- In November 2019, environmental nonprofit Second Nature awarded the campus "Marks of Distinction" for advancing climate action in higher education and 1) being "On Track" for 25% carbon reduction; 2) participating in the Billion Dollar Green Challenge; and 3) participating in Second Nature's Carbon Credit and Purchasing Program, which helps the University sell credit for the carbon it doesn't emit to an other entity — and reinvest those earnings in further carbon reductions.



- In March 2020, Illinois earned its fifth straight designation as an official Tree Campus USA by the Arbor Day Foundation for its commitment to effective urban forestry. To nurture the more than 20,000 trees on University land, campus maintains a tree advisory committee as well as a campus tree-care plan.

### Khanna, Cai, Wood Make News

All three of iSEE's Associate Directors were in the headlines during the past year ...

#### AAEA President Elect

Madhu Khanna, iSEE Associate Director for Research, was named president-elect of the Agricultural and Applied Economics Association (AAEA) effective July 28, 2020. Khanna is ACES Distinguished Professor in the Department of Agricultural and Consumer Economics, and her research focuses on the intersection of agricultural, energy, and environmental economics.



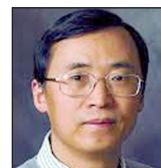
**KHANNA**

Khanna said she was honored to be elected by her peers to lead the AAEA. Her priorities include attracting a new generation of scholars from diverse fields, institutions and backgrounds; helping the AAEA be an effective advocate for federal research funding; and building a leadership training program for early and mid-career scholars, women, and minorities.

"AAEA plays a vital role in keeping us all connected, even more so in these challenging times, and I would like to see it become an even more effective voice for a broad range of societally relevant issues important to its membership," Khanna said.

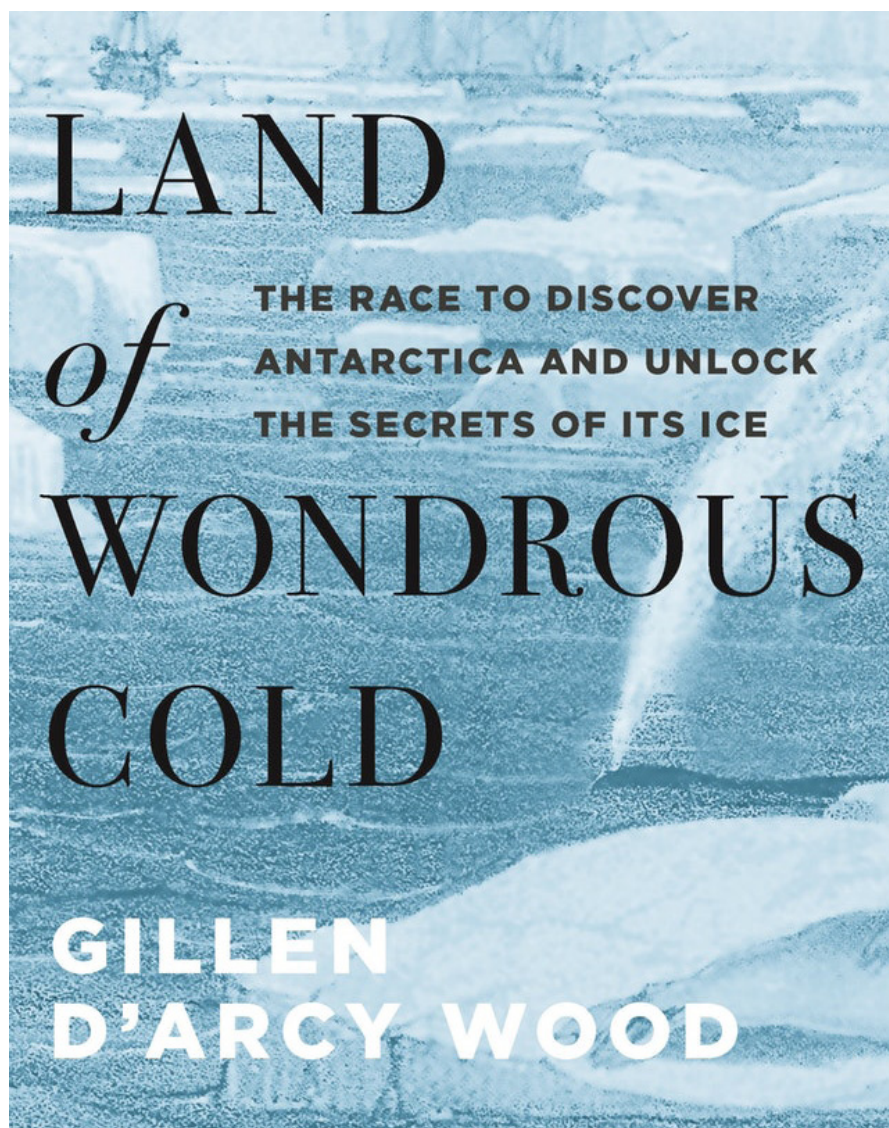
#### Latest AGU Fellow

In August, Ximing Cai, iSEE's Associate Director for Campus Sustainability, was named a 2019 Fellow of the American Geophysical Union (AGU). Cai was honored along with 61 other 2019 AGU Fellows at its Fall Meeting on Dec. 11 in San Francisco.



**CAI**

Cai's prolific research profile as a Lovell Endowed Professor of Civil & Environmental Engineering includes coupled human-natural system analysis with an emphasis on human interferences



in hydrological processes, water-energy-food system modeling especially in dry areas, and sustainable water resources management particularly in developing countries.

#### 'Land of Wondrous Cold'

In March, iSEE Associate Director for Education & Outreach Gillen D'Arcy Wood published his new book, "Land of Wondrous Cold: The Race to Discover Antarctica and Unlock the Secrets of its Ice."

Wood, a Professor of English and

Langan Professorial Scholar of Environmental Humanities, writes about the first explorations of Antarctica, interwoven with its geological history and framed by the current threat of climate change.

"The glaciation of Antarctica set the global thermostat for us and our evolution," Wood said. "It's crucial for the Earth we inhabit. We are, in an ecological sense, intimately tied to Antarctica."



**WOOD**

### iSEE Hires Academic Instructor/Advisor, DOE Grants Manager, Communications Specialists

In addition to bringing on Jeffrey Brawn, an endowed Chair of Natural Resources and Environmental Sciences, to run the Levenick Visiting Scholars program (see page 18), iSEE bolstered its reach on the research, instructional and communications front with four new hires in 2019-20 ...

#### Eric Green

Green first was hired as the Student Sustainability Committee (SSC) Coordinator earlier in 2019. But by November, iSEE had seen its need for instruction and academic advising grow as its curricular education program expands. And the Institute already had the best candidate in house.



**GREEN**

Green will teach courses in the campuswide honors minor SEE Fellows Program, and he will advise students in both the minor and the undergraduate Certificate in Environmental Writing (CEW).

With about 60 students currently enrolled in the minor and dozens more in the certificate, as well as dozens taking the SEE FP and CEW courses each semester, he'll help students in both programs schedule the courses they need to complete their requirements in time for graduation.

In 2020-21, Green will teach "ENVS 301: Tools for Sustainability" and "ENVS 492: Capstone," the introduction and final courses in the minor. In the meantime, he teamed with Sustainability Programs Coordinator Meredith Moore (see photo) in Spring 2020 to teach "NRES 285: Student iCAP," in which students explored aspects of the forthcoming Illinois Climate Action Plan (iCAP 2020). *Read more, page 16.*

Green also maintains and updates a list of sustainability-related courses students can choose during each registration period for upcoming semesters.

#### Anya Knecht

With two new U.S. Department of Energy grants landed in 2019 and 2020 (see pages 8-9), iSEE needed logistical support for the new research teams.

Knecht, who previously served as a Research Coordinator at the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), was hired in March 2020 to assist Principal Investigator D.K. Lee with his Next-Generation Feedstocks project, and PI Kaiyu Guan with his Smart Farms project.



**KNECHT**

Her insight into the workings of DOE projects will help both teams stay organized and equipped with the materials and hardware needed to carry out their research in the field, lab, and computer labs.

#### Jenna Kurtzweil

A 2019 University of Illinois graduate with experience as an iSEE Intern, Kurtzweil was hired as a Communications Specialist in September. She works to reach campus about the



Institute through written content, social media campaigns, and the weekly newsletter.

Her outstanding organizational skills and experience at iSEE and as one of the first Certificate in Environmental Writing graduates have proved invaluable as a natural mentor for the team's current crop of communications interns.

And her ability to adapt and augment her skills have proven useful as the lead communicator during the publicity campaign for iCAP 2020 — for which she also is the author.

"After a year as a Writing Intern here, I felt drawn to keep pursuing science writing and communication. I was excited for the opportunity to continue working for iSEE, and to sharpen that focus specifically into environmental communication," Kurtzweil said.



**KURTZWEIL**

#### Julie Wurth

In January, iSEE welcomed another communications team member. An Illinois alumna, Wurth is an accomplished writer and reporter, and came to iSEE from *The News-Gazette*, where she spent years on the University of Illinois beat at the local newspaper.

"The Institute's mission spoke to me. I wanted to lend whatever talents I could as a writer and journalist to help educate the public about these important issues," she said.

"I feel like I'm doing something positive to promote a more sustainable way of life and preserve our planet."

Wurth writes and edits content for the website, newsletter, social media, and scientific materials. Among her duties will be a lead role in communicating for CABBI.



**WURTH**

## STAYING IN TOUCH

# Keep up with iSEE

### OUR OFFICE

Phone: 217-333-4178

Mailing Address: 1101 W. Peabody, Suite 350  
(NSRC), MC-635 Urbana, IL 61801

### EMAIL

General: [sustainability@illinois.edu](mailto:sustainability@illinois.edu)

Educational Programs: [sustainability-education@illinois.edu](mailto:sustainability-education@illinois.edu); [see-fellows@illinois.edu](mailto:see-fellows@illinois.edu)

Campus Sustainability: [campus-sustainability@illinois.edu](mailto:campus-sustainability@illinois.edu)

Greener Campus: [iseegreenoffice@gmail.com](mailto:iseegreenoffice@gmail.com)

Illini Lights Out: [illinilights@gmail.com](mailto:illinilights@gmail.com)

Q Magazine editors: [qmagazineillinois@gmail.com](mailto:qmagazineillinois@gmail.com)

Center for Advanced Bioenergy and Bioproducts Innovation (CABBI): [cabbi-bio@illinois.edu](mailto:cabbi-bio@illinois.edu)

Contact info for iSEE directors, staff, and interns may be found at [sustainability.illinois.edu/about/contact/](http://sustainability.illinois.edu/about/contact/).

### WEBSITES

iSEE: [sustainability.illinois.edu](http://sustainability.illinois.edu)

Energy at Illinois: [energy.illinois.edu](http://energy.illinois.edu)

Water at Illinois: [water.illinois.edu](http://water.illinois.edu)

Global Climate Change at Illinois: [globalclimatechange.illinois.edu](http://globalclimatechange.illinois.edu)

CABBI: [cabbi.bio](http://cabbi.bio)

Leverhulme Centre for Climate Change

Mitigation (LC3M): [lc3m.org/research/theme-3/](http://lc3m.org/research/theme-3/)

Agroforestry for Food: [agroforestry4food.com](http://agroforestry4food.com)

Crops *in silico*: [cropsinsilico.org](http://cropsinsilico.org)

Sun Buckets: [sunbuckets.com](http://sunbuckets.com)

Q Magazine: [q.sustainability.illinois.edu](http://q.sustainability.illinois.edu)

iCAP Portal: [icap.sustainability.illinois.edu](http://icap.sustainability.illinois.edu)

### SOCIAL MEDIA

iSEE Facebook: [facebook.com/iSEEatUofI](https://facebook.com/iSEEatUofI)

Sustainability @ Illinois Facebook group: [facebook.com/groups/123074238038372](https://facebook.com/groups/123074238038372)

iSEE Twitter: [twitter.com/sustainILLINOIS](https://twitter.com/sustainILLINOIS)

CABBI Twitter: [twitter.com/CABBIbio](https://twitter.com/CABBIbio)

Agroforestry for Food Facebook:

[facebook.com/AgroforestryForFood](https://facebook.com/AgroforestryForFood)

iSEE YouTube: [bit.ly/iSEEyt](https://bit.ly/iSEEyt)

iSEE Instagram: [instagram.com/sustainillinois/](https://instagram.com/sustainillinois/)

Sun Buckets Facebook:

[facebook.com/Sun-Buckets](https://facebook.com/Sun-Buckets)

Agroforestry for Food Twitter:

[twitter.com/Agforestry4Food](https://twitter.com/Agforestry4Food)



## Campus Engagement 2019-20

Our Institute takes pride in engaging all University of Illinois students, faculty, staff, and community members. This is a rough estimate of people reached through iSEE efforts during the most recent academic year.

### RESEARCH

# 925

#### Centers, projects, scholars

- Principal Investigators/Faculty-level Researchers
- Seed Grant Recipients
- Water, Energy, Global Climate Change, etc., Scholars
- Postdocs/Lab & Field Technicians
- Graduate & Undergraduate Students
- Support Staff

### EDUCATION

# 206

#### Academics for students

- SEE Fellows Program (campuswide minor)
- Undergrad Certificate in Environmental Writing
- Levenick iSEE Teaching Sustainability Fellows (faculty grants program)
- Educational, Research & Campus Sustainability Program-related Courses

### SPONSORED EVENTS

# 1,100

#### Hosted campus and off-campus gatherings

- Congress
- Critical Conversation
- Research conferences, workshops
- Earth Month, Keeling, MillerComm Lectures
- Sustainability Celebration

### CAMPUS SUSTAINABILITY

# 7,350

#### Campus programs and organizations

- iCAP Forums
- Greener Campus (offices, labs/freezers, chapters, RSOs)
- Illini Lights Out
- Green Quad Day, All Employee Expo, other staff interactions
- iCAP teams
- Student groups



**University of Illinois  
at Urbana-Champaign**



**Office of the Vice  
Chancellor for Research  
and Innovation**