Spring 2018

iQ: iSEE Quarterly

An update from the Institute for Sustainability, Energy, and Environment

What's new at iSEE ...

Leadership Roles Realigned

The Institute for Sustainability, Energy, and Environment (iSEE) has announced that Madhu Khanna, ACES Distinguished Professor of Agricultural and Consumer Economics, will be iSEE's new Associate Director for Research.

Baum Family Director Evan H. DeLucia, who had led the Institute's research initiatives, recently took on the Director role for the new, $115 million Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), a collaborative effort between iSEE, the Carl R. Woese Institute for Genomic Biology, and 17 partner institutions that was funded by the U.S. Department of Energy (DOE).

"Bringing CABBI into this campus, and our Institute, was a major boost to our University," DeLucia said, "but taking on a DOE Bioenergy Research Center means that iSEE needed to expand its footprint so that all of its research initiatives are supported."

DeLucia will concentrate his efforts on supporting all three parts of iSEE's mission — research, education and outreach, and campus sustainability — by securing external funding from granting agencies and philanthropy. Khanna, formerly the iSEE Associate Director for Education and Outreach, now takes on the research role.

"Madhu has done a wonderful job with our education and outreach efforts. Our Sustainability, Energy, and Environment Fellows Program, a campuswide minor, is has surpassed 90 students in its third year, and our annual iSEE Congress continues to grow, with registration topping 400 people last fall," DeLucia said. "I am confident in her abilities to bring similar successes to our research profile, as she has a prolific research portfolio."


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The new Associate Director for Education and Outreach will be English Professor Gillen D'Arcy Wood, the Langan Professorial Scholar of Environmental Humanities of English. Wood recently started the new undergraduate Certificate in Environmental Writing program through iSEE, the Department of English, and the School of Earth, Society, and Environment — and he will continue to lead that effort along with editing the new *Q Magazine*, a student environmental publication.

"We are excited to have Gillen on board," DeLucia said. "iSEE is even more interdisciplinary in its leadership with associate directors from three of the University's largest colleges (Agricultural, Consumer, and Environmental Sciences; Engineering; Liberal Arts and Sciences), and we will continue reaching campuswide in all aspects of our mission."

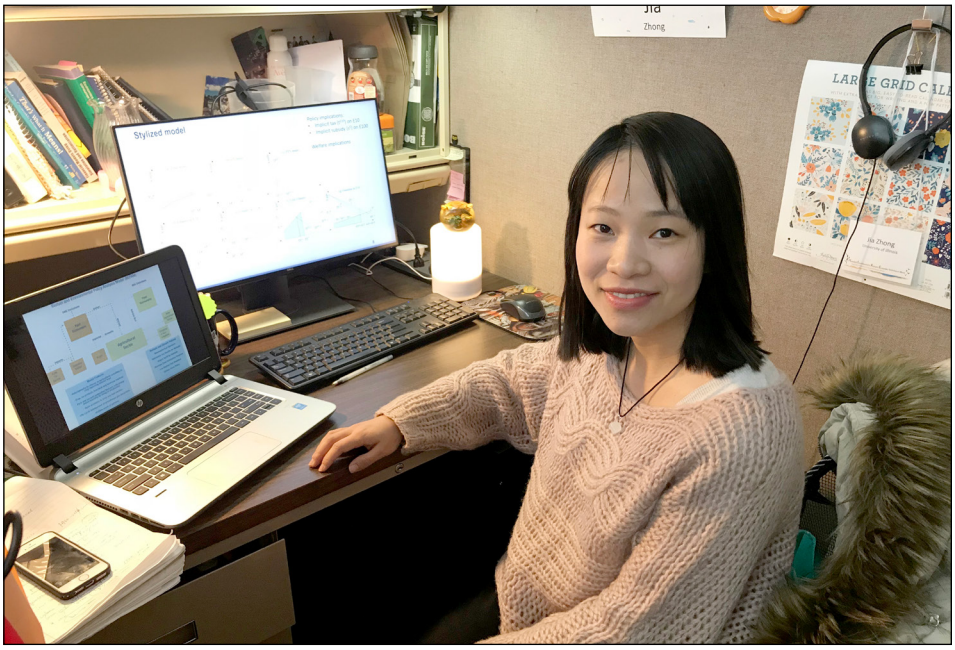
Ximing Cai, the Lovell Endowed Professor of Civil and Environmental Engineering, will remain the Associate Director for Campus Sustainability, a job he took on in Spring 2017. Cai's initiatives include a new Campus as a Living Lab research program that ties campus sustainability projects and programs to research — and future external grant opportunities.

In other news, Cai's predecessor, Chemistry Professor Ben McCall, recently was selected to be the first executive director of the University of Dayton's Hanley Sustainability Institute.

What's inside ...

What's new in research ...

In the Spotlight: Jia Zhong



Most people don't look to economics to solve issues in sustainability. However, Jia Zhong, a member of the Critical Infrastructure and Transportation project and a third-year Ph.D. student in the Department of Agricultural and Consumer Economics, does just that.

By building economic models from complex data sets, Zhong and her teammates can answer the "what-ifs" surrounding renewable energy and national transportation systems, allowing policy-makers to enact changes for a healthier society and environment.

Her specific "what-if" is about cars — in particular flexible-fuel vehicles (FFVs) that can run on multiple types of fuels (such as gasoline mixed with a higher content of ethanol) in a single tank. By studying these vehicles, she can see if increased usage could help improve a current government policy requiring a certain volume of renewable fuel to be mixed into petroleum-sourced fuel.

From an environmental standpoint, these cars are a great alternative to standard vehicles due to their lower emissions. In a perfect world, all people would adopt active transportation or use zero-emissions vehicles because it's the right thing to do. Zhong's work, however, is in finding more probable — and practical — solutions in an imperfect world. For sustainability economists, the best options for creating a better environment are ones that have the best chance of widespread adoption.

She poses a series of economic questions to begin teasing out the optimal conditions for FFVs to comply with government standards: Under what conditions would flex-fuel cars be economically attractive to consumers and compliant with government standards? How can blended fuel be priced to appeal to consumers? How can these cars be incentivized while being economically feasible? While it may sound tedious, challenges like these allow economists like to Zhong shine.

"Some of the main factors we are dealing with are fuel pricing and the potential welfare cost," she said, and the goal is to predict the conditions that would benefit the largest amount of people for the lowest amount of money.

To discover such conditions, Zhong jumps into economic simulation — a computer-generated alternate "world" where she can manipulate the circumstances that could make the "what ifs" of FFVs possible. To an untrained eye, the simulation looks like an indecipherable web of graphs, spreadsheets, and variables. But to an economist, it's a thrilling opportunity to construct a better future.

Yet at the end of the day, these simulations are just suggestions — not reality. Despite multitudes of tests and simulations, researchers will never be able to accurately predict some aspects of economics.

"Usually the No. 1 question we get is, 'What percentage can you be sure that this will run the way you predict?' We always try to supplement real-life data to make it as accurate as possible," Zhong said. "But what we suggest are just implications, not a direct output.

"That's just the nature of all research: There's always a difference between the laboratory and the real world. By being involved with policy, we're able to contribute our knowledge and make reasonable suggestions for a positive impact," she said. "I'd love to take what I've learned and return to China and work on environmental policy there," she said. "I have a responsibility to learn as much as I can with my education so that I can help make the world a better place."

Read the full Zhong profile.

More about the Critical Infrastructure and Transportation project.

Global Climate Change Scholars Convene, Begin Website Plans

During the Spring 2018 semester, the Institute moved ahead with plans to coalesce the Illinois Global Climate Change Scholars in the hopes of bringing together researchers across campus on teams that will pursue external funding opportunities.

In December, a Global Climate Change Council was formed to steer the next steps for the Scholars, and Natural Resources and Environmental Sciences Professor Angela Kent was elected Chair of the Council.

The scholars already have a listserv, and the Council will work with iSEE to get a Global Climate Change at Illinois website up and running this year. More soon!

What's new in research (continued) ...

New Grants to Extend iSEE Work

You've heard that "you are what you eat." But could what you are in return influence what's available to eat?

University of Illinois Animal Biology Professor Carla Cáceres, a co-Principal Investigator on iSEE's Stormwater and Mosquito Control project, will receive $800,000 over three years from the National Science Foundation to study potential feedback loops between the food web mosquito larvae are born into and the chemistry of their gut.

Through a study titled "Community Assembly Across Scales of Ecological Organization", her goal is to better understand the mechanics of the relationships between invertebrate hosts (such as mosquitoes) and their microbes in natural systems.

Cáceres will collaborate with several Illinois researchers and outside partners, including Stormwater and Mosquito Control project PI Brian Allan, an Associate Professor of Entomology; Allison Hansen, an Assistant Professor of Entomology; Zoi Rapti, an Associate Professor of Mathematics; and Ephantus Muturi, a Research Entomologist at the U.S. Department of Agriculture.

CÁCERES LOVELL YANG

More about the grant, and the iSEE seed-funded project on the iSEE website.

In Agroforestry for Food news:

• In March, the U.S. Department of Agriculture's National Institute of Food and Agriculture announced a grant for $460,000 to support research led by University of Illinois scientists Sarah Taylor Lovell, Andrew Margenot, and Alexandra Harmon-Threatt.

Lovell, an Associate Professor of Crop Sciences at Illinois, has been investigating the benefits of multifunctional woody polyculture — a mix of perennial trees and shrubs in the same planted area — for years. Polycultures have the potential not only to create habitat, regulate nutrient cycles, and hold soil and carbon, but also to provide harvestable and profitable edible products.

In 2014, iSEE seed-funded the planting of a 30-acre Agroforestry for Food (A4F) test plot with Lovell as the PI.

This grant follows a $495,000 USDA NIFA grant awarded to A4F Co-PI Wendy Yang and others in 2016.

• Earlier in the spring, Lovell, A4F team members, iSEE Baum Family Director Evan H. DeLucia, and others published a paper titled "Frontiers in Alley Cropping: Transformative Solutions for Temperate Agriculture" in *Global Change Biology*.

Alley cropping is an agroforestry practice in which trees are planted alongside or in between rows of grain crops in a main production field. In most modern applications, it takes the form of a single tree species comingled with a single grain species. While this arrangement offers many benefits — habitat creation, carbon sequestration, and diversification of farm products — Lovell's team argues that greater benefit could be realized by increasing the number of tree species included and leveraging them for food and fodder production.

More about the grant, the alley cropping paper and the seed-funded A4F project on the iSEE website.

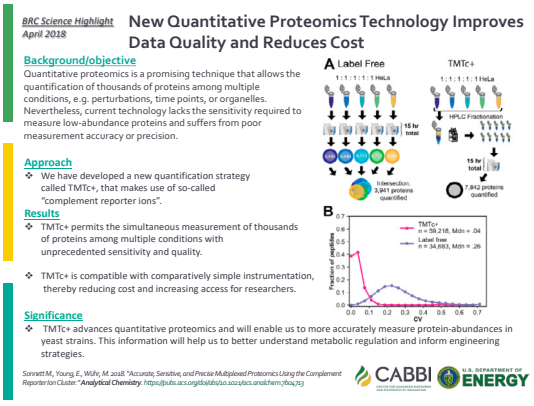
What's new at CABBI ...

Center Names New Deputy Theme Leaders, Publishes Paper

News from the Center for Advanced Bioenergy and Bioproducts Innovation, led by iSEE and the Carl R. Woese Institute for Genomic Biology (IGB):

• In May, CABBI added Deputy Theme Leaders from its partner institutions for Feedstock Production (Kankshita Swaminathan, Faculty Investigator at HudsonAlpha Institute of Biotechnology), Conversion (Joshua Rabinowitz, Professor of Chemistry and the Lewis-Sigler Institute for Integrative Genomics at Princeton University), and Sustainability (Andy VanLoocke, Assistant Professor of Agronomy at Iowa State University).

• The Center will convene a Strategic Advisory Board (SAB), a 14-member panel of Bioenergy Research Center representatives as well as academic, government, and industry experts in the bioenergy and bioproduct thematic areas. This group will meet annually to evaluate research progress and guide future scientific directions.



• CABBI recently published its first two Bioenergy Research Center Science Highlights and a few other pieces. Publications from CABBI researchers were in *Biotechnology and Bioengineering*, *Analytical Chemistry*, *Biotechnology Journal*, and *Metabolic Engineering*.

• The Center has begun planning its first annual retreat for early July in Urbana-Champaign.

Read the latest from the Center at cabbi.bio.

What's new in research (continued) ...

Seed-funding Sustainability: New Research to Use Campus as 'Living Lab'

In May, iSEE announced plans to seed fund the first two sustainability research projects in its Campus as a Living Lab program at the University of Illinois at Urbana-Champaign.

One study will examine possibilities for redirecting waste heat from industrial processes into usable energy through a thermochemical battery, and the other will test a no-waste system for turning food scraps into biofuel while simultaneously treating wastewater and creating natural agricultural fertilizers. Each project will receive $30,000 from iSEE to cover startup costs as the researchers prepare larger proposals through the Institute for substantial external funding of the research.

SINHA

ZHANG

Launched in February 2018, iSEE's Living Lab program is designed to link campus sustainability targets to national and global sustainability, energy, and environment challenges — turning campus into a test bed for solutions to real-world problems.

"Transforming university campuses into 'living laboratories' is a timely and important campaign," said Ximing Cai, iSEE's Associate Director for Campus Sustainability. "Sustainability isn't just happening 'out there;' it's a consideration every day right here on our campus. By using our own facilities and community as a miniature model of the world at large, we can learn things that will make this campus better, but also make the world better."

Thermochemical batteries project

Led by Sanjiv Sinha, a Professor of Mechanical Science and Engineering, along with others from his department and the Illinois Sustainable Technology Center (ISTC) are planning to harness heat energy currently going to waste (just being exhausted into the air) from industrial sources for other purposes like space heating. The team will create a battery pack capable of storing heat through a series of chemical reactions.

The team won't have to go far to test the prototype battery systems: "The Abbott Plant on campus has multiple waste heat loss points that could benefit from thermal storage," the collaborators wrote. "The proposed storage system needs to be designed for multiple scenarios, several of which arise in power plants.

"We plan to acquire and understand the existing waste heat loss data in terms of heat source temperatures, loss quantity, transients, and fluid flow rates associated with the losses. We will use the data to identify the components suited for thermal storage systems and explore designs that match the conditions at Abbott. Broadly, space heating is a large part of the campus' energy use. In the long term, thermal storage offers the possibility of unique improvements in efficient use and reduced costs for the entire campus."

Environment-Enhancing FEW Systems

In a seed-funded project led by Bioengineering Professor Yuanhui Zhang, researchers from across campus will test a processing system that can deliver not only renewable energy, but also clean water and some bonus organic fertilizers for agriculture. Their design is meant to find synergies between water, food, and energy — where one category's waste product could be another one's ingredients.

A process called hydrothermic liquefaction (HTL) sits at the heart of the project. Biowaste solids like campus food scraps or dried manures are exposed to high heat and pressure, replicating the geological process that created fossil fuels many millennia ago.

While the energy-rich molecules of the biowaste become biocrude oil, the other nutrient-rich parts can be used as fertilizers for food production. Meanwhile, the liquid parts of biowaste can be treated to become clean water. Algae will eat up all the pollutants and leave behind clean water, and they can also be "fed" with the leftover nutrients from the HTL step. At the end of their lifespan, the algae themselves serve as an input for HTL, making sure nothing goes to waste.

Zhang's team includes others from Bioengineering as well as from the Departments of Agricultural and Consumer Economics, Crop Sciences, Food Science and Human Nutrition, Chemical and Biomolecular Engineering, and ISTC. Making campus their living lab, the researchers will rely on the E2-Energy Demonstration Lab at the South Farm Swine Research Center, a Department of Crop Sciences greenhouse, HTL reactors built by the Department of Agricultural and Biological Engineering, and wastewater treatment operations at Urbana-Champaign Sanitary District.

Read more about the Campus as a Living Lab program.

Crops *in silico* Project Planning Third Annual Workshop

The Crops *in silico* research project, seed-funded by iSEE in 2015, is planning its third annual symposium and workshop this year.

The event, which helps to explore advancements in plant modeling while highlighting what can be gained from tools and lessons learned by computer scientists, will help the C*is* team coordinate research, training, and educational activities.

This year's event will take place July 31-Aug. 3. The first few days include a keynote and invited speakers, presentations and discussions. The final day will be a Hackathon, in which computer programmers, software developers, interface designers, and plant biologists will work side-by-side.

Read more about the research project.

Critical Conversation

On May 3-4, iSEE hosted academics, industry and agricultural leaders, nonprofits, and government and NGO representatives in downtown Chicago's University Club for a conversation on the nitrogen reduction challenge. This safe place for a frank, unattributed discussion, above, was a positive step toward exploring the issues in reducing runoff from agricultural land into streams, which has caused a major toxic zone in the Gulf of Mexico. Keynote speaker Jason Weller of Land O' Lakes, right, got the conversation started the evening of May 3, and three panel and breakout sessions continued the discussion the next day. The Critical Conversation was paid for by a generous donation from the Alvin H. Baum Family Fund, iSEE's founding benefactor. The Baum Fund is administered by Joel Friedman. Read more and watch the video of Weller's talk on the iSEE website.

Fifth Annual iSEE Congress: 'Sustainable Cities'

iSEE Congress 2018 will foster critical thinking on the strategies for meeting our growing urban transportation, housing, and food needs sustainably — and for making our cities more resilient to climate change.

Cities are the centers of economic activity but also large consumers of energy and water and sources of solid waste, air pollution, and greenhouse gas emissions across the world. They are hotbeds for poor air quality, congestion, and densified housing, and they are vulnerable to extreme damages to life and infrastructure due to severe weather events.

Cities with more green space, permeable surfaces, and disaster-resilient infrastructure emit fewer emissions, thereby benefiting human health and well-being and increasing resilience against extreme weather events.

Urban consumption patterns are being transformed with the emergence of ride sharing, e-commerce, smart phone enabled connectivity and demand for green infrastructure.

The conference, which will run Oct. 3-5 at the Illini Union, will feature three keynote addresses and a special panel discussion with mayors about sustainable urban planning.

Previous iSEE Congresses on other grand challenges facing society have been attended by hundreds of faculty, students, and others from across campus — and beyond — each year.

The schedule, other info, and the registration form are on the iSEE website.

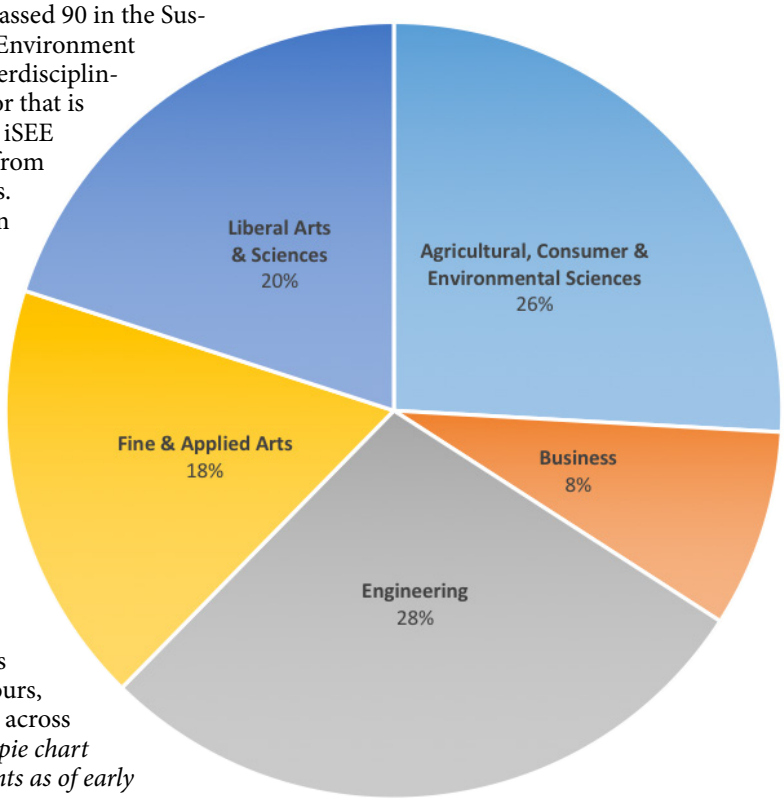
What's new in education ...

Campuswide Sustainability Minor Continues to Grow

Enrollment has surpassed 90 in the Sustainability, Energy, and Environment Fellows Program, an interdisciplinary undergraduate minor that is a collaboration between iSEE and six academic units from across the U of I campus.

More than two dozen Illinois students have now graduated with the minor, which began about three years ago — and enrollment in Spring 2018 was nearly at 30 students.

The minor, which features a capstone research project taught by iSEE Levenick Teaching Fellows Jeffery Roesler and Ken Paige among its required 16-18 credit hours, has shown broad appeal across the Illinois campus (*see pie chart for details about applicants as of early spring 2018*).



Read more about the SEE Fellows Program.

'Q Magazine' Website on Way

During the 2017-18 academic year, more than 85 students enrolled in courses within the new undergraduate Certificate in Environmental Writing (CEW), a collaboration between iSEE, the School for Earth, Society, and Environment, and the Department of English.

In Spring 2018, Professor Gillen D'Arcy Wood worked with more than a dozen students in the CEW capstone course, "Environmental Writing for Publication." The top articles from that and other CEW courses will be a part of the first *Q Magazine*, which will be published online this summer in an effort led by Wood, Student Editor Katherine Watson, and iSEE staff.

The *Q Magazine* website will be up and running soon at https://q.sustainability.illinois.edu; stay tuned!

Read more about the CEW.

What's new in outreach (continued) ...

Earth Month 2018

In April, iSEE helped facilitate and promote five climate-related lectures — including a packed house on April 6 at the Levis Faculty Center for acclaimed climate scholar Michael Mann, left, who delivered a Center for Advanced Study Miller-Comm Lecture titled 'A Return to the Madhouse: Climate Change Denial in the Age of Trump.' Earth Day featured a new iSEE event: Plogging (jogging through campus while picking up trash and plastic waste), inset. Read more about Earth Month and other annual events.

Illini Lights Out: 2nd Successful Year

For the second year in a row, Illini Lights Out is one of the most popular ways to make a difference on the University of Illinois' Urbana-Champaign campus.

During eight events in the 2017-18 school year, an average of 87 student volunteers per event turned off 36,301 lights this year to save almost $6,000 in energy costs — bringing the two-year total to 62,354 lights, 88.2 tons of carbon dioxide equivalent, and more than $9,300 in savings.

Congratulations to iSEE Campus Sustainability Interns Claire Kredens and Vince Spagnola on leading events with both record turnout and record energy savings.

And more good news: The Student Sustainability Committee (SSC) has granted iSEE $10,000 to grow and continue the Illini Lights Out program in 2018-19.

With both interns back for another year of organizing, we're looking forward to a bright future of student involvement and energy-savings on campus.

More on the Illini Lights Out program.

Carbon Units Sold to Fund Further Sustainability Efforts

As part of its ongoing dedication to reducing its environmental footprint, the University of Illinois at Urbana-Champaign has sold more than 37,000 Verified Carbon Units (VCUs) from 2017 as part of its continued participation in Second Nature's Carbon Credit and Purchasing Program (C2P2). Proceeds from this sale exceed $236,000.

Second Nature is a Boston-based nonprofit, and money raised through C2P2 has provided the spark for a number of major campus sustainability initiatives. The single largest investment to date was a contribution of $750,000 to help increase the campus Revolving Loan Fund (RLF), an internal funding source for utility conservation projects with payback periods of less than 10 years. The RLF has gone on to provide crucial financing for efforts ranging from major LED retrofits and retrocommissioning projects to supporting a new biomass boiler at the Energy Farm.

Other activities financed through these sales of carbon credits include the Certified Green Office Program, which has enrolled more than 50 offices and hundreds of staff in effecting change at a departmental level.

"Continued participation in the C2P2 program has been a major win for our ability to pursue new and cutting-edge methods to reduce our environmental impact," said Ximing Cai, iSEE's Associate Director for Campus Sustainability. "Resources for sustainability initiatives can sometimes be scarce, and having dedicated funding through this program is vital to our continued success as a campus."

More information on past carbon credit sales on the iSEE webpage.

U of I Earns National Recognition for Efforts

The University of Illinois at Urbana-Champaign was recognized both by Boston nonprofit Second Nature and by the Arbor Day Foundation in April for its sustainability and environmental efforts.

• Second Nature recognized the University of Illinois at Urbana-Champaign for advancing climate action in higher education with two "Marks of Distinction."

Illinois was honored for two financial planning-related efforts for campus sustainability:

1) a commitment to a revolving fund worth at least $1 million to support campus sustainability projects; and

2) participation 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 (*see the story on the U of I's latest sale above*).

MARKS OF DISTINCTION 2018
PRESIDENTS' CLIMATE LEADERSHIP COMMITMENTS
Making Our Mark - Leading With Distinction

TREE CAMPUS USA

• Illinois earned its third straight 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. The Arbor Day Foundation also awarded the U of I the Tree Campus USA designation in April 2016 and '17.

Read more about campus sustainability recognition on the iSEE website.

What's new with the Student Sustainability Committee (SSC) ...

New Micro Grants for Student Projects

The Student Sustainability Committee (SSC) recognizes that some student-led projects require funding quickly.

Therefore, SSC launched the Micro Grant initiative in late Spring 2018 to assist student-led projects that cost less than $500.

The Micro Grant aspires to:

- provide funding to project leaders within one month of an application submission;
- increase opportunities for students to use the Sustainable Campus Environment Fee;
- increase financial support for same-semester programming initiatives; and
- expand outreach by making funding more accessible to all student groups.

SSC received and funded two Micro Grants in April 2018. One was for $200 to support Eco-Olympics, increasing energy conservation awareness through digital signage. The other $500 grant was awarded to Design for America, co-sponsoring that group's Social Hack event, which explores sustainability in design thinking.

Get more updates and learn more about SSC.

Committee Awards $350,000 for Eight Sustainability Projects

In April, the Student Sustainability Committee voted to allocate more than $350,000 to eight projects ranging from sustainable programming to native plantings.

For example, undergraduate students will contribute more than 2,500 hours of labor to complete the first census at the Trelease Woods, a University-managed natural area (see photo above). Once complete, the area will join an international network called ForestGEO, provide a living lab for university courses, and expose students to carbon sequestration and forest management. This project received $69,467 from SSC.

Another highly student-driven project includes enhancing learning opportunities at the Southern Arboretum Woodlands (SAW). Using $40,000 from SSC, this project will transform the SAW into a campus and community resource through collective and ethical natural resource management.

Students will continue suppressing invasive plant species and establishing native plants.

For a full list of SSC-funded projects, visit the SSC website.