4.

LAND & WATER

PROTECTING OUR RESOURCES ON CAMPUS AND BEYOND

As a micro-urban hub, robust research institute, agricultural living laboratory, and land-grant university, the Urbana campus is a microcosm for land and water management in the Midwest and globally. On both local and large scales, these resources are indispensable for sustaining growing populations. However, they are increasingly threatened by human development, biodiversity loss, and climate change. As our student body expands, we must be energetic stewards of the environmental resources for which we are responsible.

Our campus has an urgent responsibility to sustainably manage everything from the water we drink to the crops we harvest to the pollinators we rely on for survival. Strategies to address these and other concerns include implementing green infrastructure, designing resilient landscapes, and restoring our ecosystems. As part of the university's carbon neutrality goal, we must also increase the amount of carbon sequestered by our soil and vegetation.

Because our approach to environmental stewardship is linked with sustainable community development, the Land & Water objectives (e.g., rainwater management plans) may involve the Resilience SWATeam. A particular issue of interest to both the university and community is sustaining Boneyard Creek, the three-mile waterway flowing through campus and draining from Urbana and Champaign. The Boneyard Creek Master Plan[96] was published in 2008 to strategize planning and maintenance efforts. Every year, Boneyard Creek Community Day unites local residents to clean up litter and promote appreciation for the landmark. Boneyard Creek is also a site for ongoing research into flooding patterns and water quality.

Notable achievements in sustainable land and water management from 2015 to 2019 include:

» In December 2019, the Resilient Grounds Strategy Advisory Committee, charged by Facilities and Services (F&S) Executive Director Mohamed Attalla and chaired by professor of landscape architecture William Sullivan, completed a strategic vision for improving campus landscape resilience. The Resilient Landscape Strategy identified key challenges (see Objective #4.2) and developed solutions to ensure that campus landscapes are designed and maintained in a fashion commensurate with our global profile.

» In March 2020, the university earned its fifth annual designation as an official Tree Campus USA[97] by the Arbor Day Foundation for its commitment to effective urban forestry. The standards for this designation include maintaining a Campus Tree Advisory Committee, establishing a Campus Tree Care Plan,[98] dedicating annual stewardship, offering student-focused service-learning projects, and performing an Arbor Day observance.

» An online Tree Campus inventory[99] was updated to document the campus's 16,493 trees. The database also tracks relevant annual metrics including total greenhouse gas (GHG) sequestration (3,207,559.17 lbs CO_2), water saved (17,400,271.91 gal), and energy saved (2,023,115.73 kWh). Through efforts to implement iCAP 2015 objectives, the total agroforestry acreage on campus increased to 102.8 acres as of FY19.[100]

» In October 2018, the university became the first in the Big Ten to achieve Bee Campus USA certification.[101] The initiative was spearheaded by a group of students in the Sustainability Living Learning Community (SLLC) based in Lincoln Avenue Residence Hall. The students coordinated the extensive development of the Bee Campus USA application, funded by F&S Sustainability, in conjunction with the Department of Entomology, the Department of Natural Resources & Environmental Sciences (NRES), U of I Extension, and F&S. This designation recognizes our myriad efforts to foster a pollinator-friendly campus. Other examples include the citizen-science initiatives I-Pollinate[102] and BeeSpotter,[103] the Pollinatarium,[104] several pollinator-focused classes, and many student organizations related to pollinators.

» The Integrated Pest Management (IPM) program for the F&S Grounds department was formally established as a policy in

96 https://bit.ly/2XbkcDI

97 https://www.arborday.org/programs/treecampususa/

98 https://bit.ly/CampusTreeCarePlan

99 https://illinoisedu.treekeepersoftware.com

100 https://bit.ly/3301bBV

101 https://bit.ly/3jOmBh5

102 https://ipollinate.illinois.edu/

103 https://beespotter.org/

104 https://pollinatarium.illinois.edu/

conjunction with the Bee Campus USA application process. IPM for Grounds reduces pesticide use outdoors on campus to reduce weeds and other potential plant issues by identifying acceptable pest levels and incorporating preventive cultural practices, monitoring, mechanical controls, biological controls, and restrictions. The Water Station at F&S also provides certified environmentally friendly IPM in campus buildings to reduce pests indoors. All F&S employees who apply pesticides go through rigorous training and education to become State Licensed Public Pesticide Operators or Applicators.

» In early 2019, the Student Sustainability Committee (SSC) funded work to begin nitrate-nitrogen monitoring in the Embarras River south of campus. This project aligned with a previous iCAP goal to reduce nitrate fertilizer losses from our farms by 50%. An undergraduate class installed initial monitoring equipment in fall 2019.

» In summer 2019, ACES farm staff began working to obtain specialized equipment to streamline cover crop seed planting during the fall corn and soybean harvest. Adding a living cover during the winter substantially reduces nitrogen and phosphorus losses.

» The Red Oak Rain Garden (RORG)[105] has been a treasured installment on campus since 2006. During Campus Sustainability Week 2019, the RORG team unveiled plans for a three-tiered renovation project. Due to COVID-19 delays, Phase 3 (installing a north-south bridge) is expected to be completed by spring 2021. The campus's oldest rain garden captures and uses stormwater runoff while also serving as an aesthetically pleasing landmark. Recently, the Champaign County Design and Conservation Foundation and U of I Extension received a grant from the Illinois Clean Energy Community Foundation for the RORG.

» In spring 2020, iSEE began a small-scale composting program in the National Soybean Research Center (NSRC) with funding from the SSC. This project will implement an on-site compost tumbler to collect and sustainably dispose of food waste, coffee grounds, and shredded office paper. The next step is to construct a pollinator garden on the west side of NSRC, which will be fertilized in part by the tumbler. In addition to reducing food waste, this project will serve as an example for other units and provide an educational opportunity for students, staff, and faculty members. The goal is to expand this program across campus and provide increased opportunities for student participation. The SSC previously funded Department of Anthropology Assistant Professor Jessica Brinkworth to begin Bokashi composting and develop a carbon garden for her lab to engage and train undergraduates in carbon reduction measures.

A major Land & Water success story is the reduction in our campuswide potable (i.e., drinkable) water consumption. FY19 metrics reported a 37% decrease in annual potable water usage from the FY08 baseline.[106] We plan to continue this pattern over the next five years through a combination of innovative technology and water management strategies, minimizing excess potable water consumption both indoors and outdoors — everywhere from bathroom faucets to irrigation systems. (See Objective #4.1 for additional discussion of this target.)

In addition to the potable water consumed on campus, we hope to improve the quality of water flowing downstream, away from campus. Implementing agricultural conservation practices significantly reduces nutrient loss from our landscapes and mitigates environmental consequences. The South Farms water impacts can be greatly improved by implementing best management practices (BMP) for nutrient loss reductions. This includes cover crops as well as other conservation strategies. The statewide Illinois Nutrient Loss Reduction Strategy[107] was developed in collaboration with staff and faculty members to reduce nutrient loss, particularly nitrate-nitrogen, and lower nitrous oxide emissions from our waterways. (See Objective #4.4.)

While we can implement local and statewide measures to prevent nitrate runoff, the impact of nutrient loss on water health is not limited to Champaign County, Illinois, or even the contiguous United States. Excess nitrogen from South Farms soil can travel uninterrupted from the Embarras River to the Mississippi River system, ultimately ending up in the Gulf of Mexico. Once there, pollutants feed into a low-oxygen, high-mortality marine sector known as the "dead zone." Here in Urbana-Champaign, we can do our part by mitigating excess fertilizer that travels across county and state lines.

In keeping with this document's holistic approach to sustainability issues, water conservation should also be prioritized at the cultural level. For example, one of our overarching goals is to shift public perception away from the notion of "stormwater" as disposable and toward a culture that values "rainwater" for its plethora of practical benefits. Initiatives to educate the community and promote sites like the Red Oak Rain Garden will aid in developing a sustainability-minded culture that both celebrates and responsibly manages the world around us.

105 https://redoakraingarden.org/about/

106 https://bit.ly/2Xlnfcz

107 https://bit.ly/304UXVo

> *"More students should care about sustainability because we are a part of the youth! The Earth we have right now is the one we will always have! In order for us to flourish in our future lives and careers, the Earth needs to flourish as well. I'm most excited to see how the university will work to make their dorm buildings and dining halls more sustainable."*
>
> *— Samantha Roberson '22*

4.1 Reduce Water Consumption
4.2 Implement Resilient Landscape Strategy
  4.2.1 Increase Number of Trees
  4.2.2 Increase Pollinator-Friendly Areas
  4.2.3 Double Green Infrastructure Installations
4.3 Cover Crops on South Farms
4.4 Monitor Soil Health

Land & Water Objectives

The following Land & Water objectives were developed by the SWATeams, iCAP Working Group, campus community, and Sustainability Council to guide the university's actions toward sustainable land and water management.

The 321-acre Illinois Energy Farm is a living laboratory for agricultural sustainability research.

4.1 [F&S] Reduce potable water consumption to 721,500 kgal/year by FY24, which is a reduction of 45% from the FY08 baseline.

Potable water refers to water that is safe to drink, a scarce commodity in developing regions and an increasingly precious resource worldwide. On campus, we are implementing infrastructure to conserve potable water used for non-drinking purposes (e.g., sinks, faucets, toilet fixtures, plumbing, cooling, and irrigation). In FY19, campus used 823,049 kgal of water (Figure 17).

As of FY19, we have reduced potable water consumption by 37% from the FY08 baseline (Figure 18).[108] To reduce consumption by another 8% by FY24, we will focus on the two largest sources of excess water usage: campus buildings and agricultural irrigation.

108 https://bit.ly/2Xlnfcz

WATER CONSUMPTION IN CAMPUS BUILDINGS

Restrooms in campus facilities are a common source of water inefficiency, as many plumbing fixtures are not up-to-date with current conservation technology. Previous sustainability projects have addressed this by updating campus facilities with low-flow fixtures. As of FY19, there are approximately 1,100 lavatories that must be converted to low-flow, about 500 urinals that use one gallon per flush (GPF) rather than 0.5 GPF or 0.125 GPF, and approximately 1,100 toilets that use three or more GPF. The most efficient flush rates are as low as one GPF in newer campus facilities. Though retrofitting existing fixtures is difficult, we will continuously research water reuse techniques and require low-flow fixtures for all new construction. The Building Maintenance team at F&S is compiling an inventory of buildings that lack low-flow fixtures in restrooms; upon its completion, we will identify the buildings with the most fixtures to retrofit and seek funding to implement these improvements.

Total Campus Potable Water Use (kgal)

TRACKED BY FISCAL YEAR

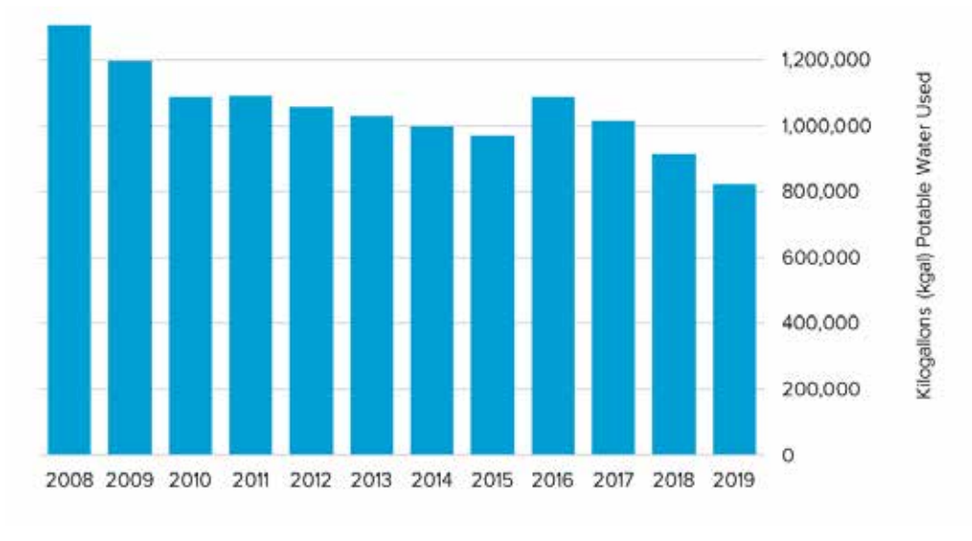

Figure 17: Total Campus Potable Water Use (kgal)

Percent Reduction in Potable Water Consumption

TRACKED BY FISCAL YEAR

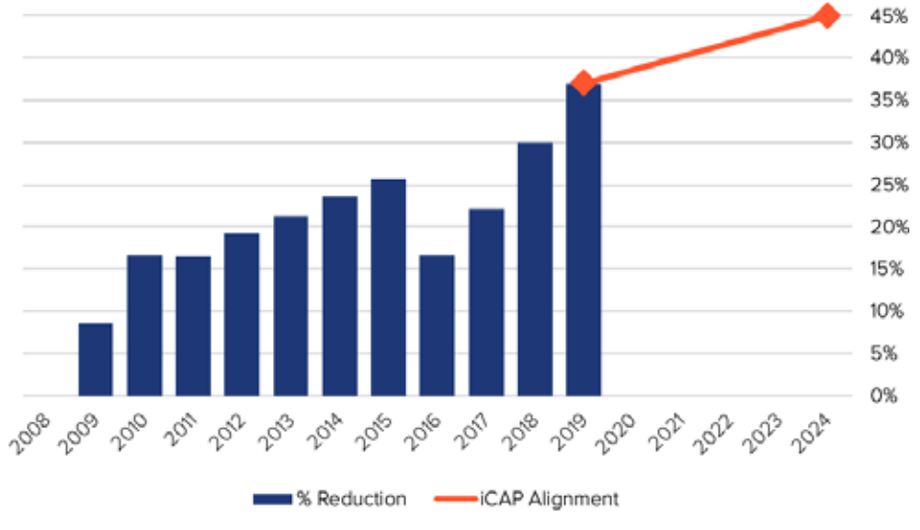

Figure 18: Percent Reduction in Potable Water Consumption

Housing has contributed greatly to water use reduction in dining facilities by transitioning to trayless dining. Simply removing trays in dining halls saves 516 gallons of water per day and 110,940 gallons annually. Their recent adoption of the Grind2Energy system will also contribute to a notable reduction in water consumption.

In research labs, it is not uncommon for equipment to use a "once-through" cooling system — as its name implies, the (often potable) water used for cooling has a brief lifespan, passing through the machines just once before being discharged as wastewater. This process is needlessly wasteful. After identifying which equipment relies on once-through cooling systems, we will explore ways that these processes can be redesigned to incorporate more sustainable practices.

In addition to upgrading our facilities, we will communicate water conservation best practices to building occupants: students, staff, faculty members, and facilities staff. Communicating water consumption will bring awareness to the rate and volume at which campus buildings consume water, and will encourage individuals to make decisions supportive of the iCAP objectives.

AGRICULTURAL WATER USAGE

Agricultural research is central to the university's mission. Even though a small fraction of the 3,300 acres devoted to crop cultivation requires irrigation, water use volumes are staggering. For example, a 40-acre field irrigated with 10 inches of water over the course of a year will require over 10 million gallons annually. To achieve a 45% potable water use reduction, irrigated university-owned land must be transitioned from municipal water sources to reclaimed water sources or wells.

4.2 [F&S] Implement the Resilient Landscape Strategy recommendations by FY24.

Campus landscapes are our habitats: the places where we work, relax, and engage with others. Campus landscapes sustain us. They clean our air, beautify our surroundings, sequester carbon, and provide us with motivation and inspiration. Campus landscapes are as essential to our health and well-being as any brick-and-mortar infrastructure, and yet we often act as if the spaces between the buildings don't matter. With proper design and direction, campus landscapes can become multi-functional spaces that support teaching and research, promote the well-being of our campus community, and contribute to our economic success by drawing new students and donors to our doors.

We have an obligation to steward and maintain our landscapes in sustainable ways, to reflect upon the past and envision a healthier, more resilient future. Our campus landscapes must be future-focused and able to withstand the challenges of tomorrow: climate change, large storm events, and heavy use by tens of thousands of individuals.

The Resilient Landscape Strategy is organized around five key challenges: lack of a landscape master plan, an unclear decision-making structure, lack of resilient rainwater management, an inadequately resourced Grounds Department, and inconsistent funding for landscape improvements.

Increased visibility of greenery has positive impacts on students' attention, stress, and mental wellness. The Resilient Landscape Strategy has already begun to address campus landscape health and its ability to motivate and sustain our community. In order for everyone to enjoy nature's restorative qualities, the university will increase the amount and visibility of natural landscapes so that they can be enjoyed from anywhere on campus. For example: efforts to integrate greenery and natural lighting into existing space could result in construction of an indoor "sunroom," which would serve as a positive environment for studying, working, reflecting, and hosting mental health workshops. As we add more indoor green rooms on campus, an online inventory of these locations will be made publicly available.

Additionally, identifying a walking path with plants on north and central campus would provide opportunities to self-tour and learn about native species.

LANDSCAPE MASTER PLAN

While the 2017 Campus Master Plan provides an overall vision for a sustainable campus, the plan prioritizes buildings over landscapes. There is no cohesive vision for resilient campus landscapes and limited guidelines for ensuring landscapes' long-term success. F&S is developing a Landscape Master Plan including a shared vision for the overall campus landscape and specific design guidelines. This will include establishing a steering committee, hiring an external landscape architecture firm, and initiating extensive public and stakeholder engagement. The Landscape Master Plan is scheduled to be completed by fall 2021.

DECISION-MAKING STRUCTURE

The University Landscape Architect's (ULA) authority over campus landscapes is compromised by an unclear reporting structure and an uninformed appeals process. This often leads to disjointed designs and unsustainable development. F&S is working to establish a Campus Landscapes department, clarify the ULA's role, and provide appropriate resources for informed decision-making.

In addition, there must be a landscape design appeals process outside of the standard capital programs variance process. Landscape and site projects that the ULA determines do not align with the Landscape Master Plan must adhere to this process to win approval. The landscape design appeals committee will include faculty members, students, administrative staff, and representation from the Native American community in keeping with the campus commitment to collaborate with Native Nations. [109]

RAINWATER MANAGEMENT PLAN

Campus rainwater management conditions and standards are out of date, leading to flooding and creating opportunities for pollutants to contaminate local waterways. Rainwater is whisked away instead of being protected and used as a resource.

109 See page 13 of the Resilient Landscape Strategy, https://bit.ly/3fiuXdk

The October 2019 Campus Sustainability Week featured a student-led Quad Tree Walk, which spread awareness of our trees' diversity and value.

To remedy this, we will require best management practices for rainwater in core campus and agricultural areas and adhere to a comprehensive rainwater management plan.

We will also increase opportunities for education and engagement for Grounds employees, the Illinois community, and students. We will initiate a recurring student competition for resilient landscape designs and fund implementation of winning submissions.

RESOURCES FOR F&S GROUNDS DEPARTMENT

Campus landscapes and open spaces have been marginalized and simplified, leading to an overall loss of aesthetic value. Staff levels, equipment, and facilities are insufficient to maintain a high degree of resiliency. To improve our landscapes' aesthetic and environmental functionality, we must increase the F&S Grounds staffing complement, including additional Grounds workers; reinstate the Grounds Gardener, Horticulturist, and Tree Assistant positions; and hire an ecologist. We must also train Grounds employees, both at F&S and for all units with Grounds staff, and provide units with appropriate equipment and facilities.

FUNDING FOR LANDSCAPE IMPROVEMENTS

While campus landscape improvements are frequently funded as part of capital building projects, site improvements are often the first to be cut when budgets are tight. We need a way to protect capital project funding for landscape improvements and ensure adequate funding beyond capital projects. Currently, little direct funding and donor support is expressly allocated to landscape improvements. We intend to earmark capital project funding for landscapes, develop a rainwater management fee, secure annual funding for landscape improvements, and prioritize efforts to seek donor funding.

4.2.1 [F&S] Increase the number of trees on campus by 1,500 by FY24 and by 3,000 by FY30.

Campus has 16,493 trees as calculated by our online Tree Campus inventory.[110] We aim to increase this number by FY24, planting 1,500 trees in the next five years and another 1,500 by FY30. Additional trees will not only boost aesthetic appeal, but will aid in greenhouse gas sequestration, water management, and financial savings. We also work to maintain the 10-20-30 diversity rule: urban forests should have no more than 10% of any single species, 20% of any single genus, and 30% of any single family. The Morton Arboretum has championed a further reduction to 5:10:15. In the 2019 Campus Tree Care Plan,[111] inventory analysis showed that the university's tree diversity is 8.1:14:19.6. Thus, we currently meet the 10:20:30 rule, and we are committed to the stronger 5:10:15 goal. As of 2019, 187 species, 74 genera, and 38 families are represented on the Illinois campus.

A critical step to increasing trees' abundance and visibility is maintaining annual Tree Campus USA recertification. In addition to anchoring the logistical and financial framework needed to foster a tree-friendly environment, the program's five standards provide a pathway toward increased visibility and public awareness of our arboreal assets. The standards also include key goals for improving our urban forest, such as "[initiating] a service learning project to calculate the tree canopy coverage."

An Adopt-a-Pathway program currently exists but has not been strongly promoted. In the coming five years, we aim to relaunch the program to encourage individuals to spend more time outdoors and enjoy the natural environment. University departments, clubs, and organizations will have the opportunity to "adopt" sections of campus walking paths and take on the responsibilities of litter removal, plant watering and weeding, and maintaining overall aesthetic appeal.

4.2.2 [F&S] Increase the number of ground-level pollinator-friendly landscaping areas on campus by 50% from the FY19 baseline by April 2024.

As of FY19, campus supports 26 ground-level pollinator-friendly landscaping areas. These

110 Statistics collected on June 24, 2020.

111 https://bit.ly/CampusTreeCarePlan

are documented on the Pollinator Supportive Landscape Map,[112] which is updated each spring prior to Earth Month celebrations.[113] By April 2024, we plan to increase this number by 50%, resulting in at least 39 ground-level pollinator-supportive areas. Green roofs on campus buildings support pollinators as well.

MAINTAIN BEE CAMPUS USA STATUS

By maintaining Bee Campus USA status, we will foster a pollinator-friendly environment (which is not exclusive to bees). These efforts will also support sustainable food production, native plant propagation, awareness of pollinator-friendly best practices, and viable habitat creation for creatures dependent on pollinators for survival — including humans!

ENHANCING LOW-MOW ZONES

In 2010, F&S established low-mow zones[114] to support pollinators and decrease maintenance costs. Cutting low-mow zones intermittently lessens seed production from weeds and non-native plants, an essential process for preserving native perennial biodiversity and minimizing invasive species. Currently, we have 81.8 acres of low-mow land and 5.7 acres of prairie plantings on university property. We intend to convert a portion of the low-mow acreage into prairie or meadow with a focus on pollinator support and native plantings.

STUDENT INVOLVEMENT

Student participation is necessary to increase pollinator-friendly areas on campus. In addition to the students involved with Bee Campus USA, there are several Registered Student Organizations (RSO) dedicated to this effort.

Red Bison is one RSO that works on ecosystem restoration projects. They currently help manage two active restoration sites on campus: the Florida and Orchard Prairie,[115] which is a 2.8-acre tallgrass prairie, and the South Arboretum Woods (SAW), which is becoming a mixture of prairie, oak savanna, and oak-hickory woodland. Pollinators, especially migrating monarchs, frequent these sites.

Additionally, From the Ground Up is an RSO that focuses on student-led sustainability projects. In fall 2019, From the Ground Up received approval to work on 3.9 acres of a previously designated low-mow zone near Orchard Downs Housing Facility. The RSO plans to transform this plot into a pollinator-friendly native Illinois flower garden. From the Ground Up also started the Foreign Languages Building Garden Renovation Project in early 2020 with support from the Student Sustainability Committee to plant native wildflowers, pollinator-supportive plants, and possibly bird and bee habitats. This group raises awareness of modern threats to pollinator populations and has recently added an education component to their mission. Members will teach lessons and facilitate conversations about sustainability and landscape health in Champaign and Urbana public schools.

112 https://bit.ly/PollinatorPocketMap

113 An interactive version is available through Google Maps: https://bit.ly/2BH9spo

114 https://bit.ly/iCAP_LowMow

115 https://bit.ly/33570lU

4.2.3. [F&S] Double the number of on-campus green infrastructure installations from 24 to 48 by FY24.

Green infrastructure refers to "stormwater management practices that protect, restore, or mimic the natural water cycle."[116] These are biologically based treatment areas that clean stormwater and reduce erosion caused by runoff. Campus currently has 24 green infrastructure installations including permeable pavement, green roofs, rain barrels, and bioswales (vegetation-filled trenches for runoff capture and filtration).

In addition to maintaining our current projects' quality, we aim to double campus green infrastructure areas by FY24. Ideally, new installations will be evenly distributed to double all existing efforts. Below are examples of how we will supplement existing installations.

GREEN ROOFS

Campus currently has nine green roofs on buildings including Krannert Center for the Performing Arts, the Business Instructional Facility, and the Art and Design Building. Green roofs are valuable for reducing runoff and lessening heat's impact on heating, ventilation, and air-conditioning (HVAC) systems. We could augment these benefits by planting pollinator-supportive native landscapes on green roofs. Additionally, future buildings and major remodels (e.g., renovations to Illinois Street Residence Hall) will be undertaken with the potential for green roofs in mind.

CISTERNS AND RAIN BARRELS

Many residential properties in our community use rain barrels for rainwater management. Rain barrels act as green infrastructure by seamlessly integrating natural rainfall into small-scale irrigation sites. At the larger scale, campus can increase the use of underground cisterns to collect rainwater which could potentially be used for campus irrigation systems. Increasing the use of rain barrels and cisterns in university-owned spaces (and subsequently phasing out sprinklers) will bolster our water conservation efforts. These systems capture rainwater for reuse, thus reducing the volume of runoff and associated pollution that often follow heavy rain. This will shrink the volume of potable water unnecessarily dispensed for irrigation, allowing for that valuable resource to be conserved.

Smaller-scale rain barrels can be installed at pollinator pockets on campus. Currently, this is being implemented at the Idea Garden and in conjunction with the pollinator gardens near Davenport Hall.

4.3 [ACES] Use cover crops in at least 20% of South Farms acreage by FY24.

South Farms is located south of the Florida Avenue campus border, encompassing approx-

116 National Green Infrastructure Certification Program (NGICP), https://bit.ly/2P5Q6go

imately 3,343 acres operated by departments in the College of ACES. Crop Sciences (which includes the 321-acre Energy Farm) and Animal Sciences are responsible for the largest land areas (roughly 50% and 45% respectively), while the remainder is allocated to Agricultural & Biological Engineering (ABE), the College of Veterinary Medicine, aquaculture research, and forestry.

This large land parcel should be cultivated as efficiently as possible with respect to the environment, the economy, and scientific research. A proven avenue for advancing these goals is planting cover crops, quick-to-cultivate plants (e.g., rye) that reduce soil erosion and add nutrients back into the soil. Currently, all South Farms cover crop use is in service of research projects, totaling less than 20 acres. Moving forward, we plan to increase this total to approximately 668 acres by planting cover crops on 20% of the South Farms. This target represents an ambitious yet achievable goal, balancing the capabilities of South Farms personnel with the benefits of university support. All ACES departments will be encouraged to participate.

This initiative goes hand in hand with ongoing ACES efforts to incorporate agricultural conservation practices (e.g., soil erosion monitoring) on university-operated farmland. In 2018, the Agriculture, Land Use, Food, and Sequestration (ALUFS) SWATeam submitted a recommendation to the iCAP Working Group (iWG) stating that a comprehensive, cooperative management plan for all non-research agricultural land on the South Farms should be developed to promote sustainable practices and implement best management practices. Efforts to develop this plan will continue over the next five years.

One of the most significant considerations for this objective is obtaining and maintaining the necessary equipment. Several methods can be used to plant cover crops, all of which require either refurbishing old equipment (e.g., grain drills owned by Crop Sciences and Animal Sciences) or buying new equipment. For example, should campus pursue interseeding, a method implemented in late summer wherein cover crops are seeded while primary crops are in mid-growth, we would likely invest in a high-clearance sprayer (i.e., a piece of machinery used for fertilizer and other nutrient application) retrofitted with an air seeder to distribute seeds in tandem with the sprayer.

To best serve our scientists and research faculty members, cover crop use should be coordinated with soil and water health tracking and monitoring.

4.4 [ACES] Monitor soil health by collecting soil analyses for all South Farms land parcels by FY24.

As we take steps like planting cover crops to improve farm sustainability and resiliency, we must take an adaptive approach to soil quality monitoring. This ensures that we are making informed decisions and implementing productive solutions.

As is the case for many iCAP objectives, data analysis begins with data collection. Our key metric is the number of land parcels for which we are able to obtain soil measurements. Two options for achieving this objective are outlined here:

COLLECT SOIL SAMPLES USING LABCORE

Many university researchers take soil samples from the South Farms on a regular basis. Therefore, the most efficient method for compiling soil data into LabCore — a farm data collection, archiving, and geographic information system (GIS) platform — involves soliciting information from these individuals. If scientists are able to provide georeferenced points for their sample sites, that information can be used to create comprehensive maps to augment standard USDA Soil Survey data. This also allows the tracking of organic matter in the soil, which is pivotal to carbon sequestration. In addition to providing a real-time aerial overview of soil health across the South Farms, implementing a GIS platform allows geographical tracking of activities that might influence soil health. Over time, novel correlations can be developed to link soil health with carbon reductions.

Equally important to collecting soil samples is creating a publicly accessible information hub where scientists can both contribute and retrieve free, non-proprietary data. Ideally,

In the coming years, we intend to secure annual funding for landscape improvement projects.

a benefit of using LabCore is an expedited process and minimized need for arduous field research to manually obtain soil samples.

TILE DRAINAGE WITH SOIL ANALYTICS CAPABILITIES

A second method for collecting soil health data and conducting subsequent analyses is installing a tile drainage system with a soil analytics component.

Certain Energy Farm plots currently possess such tile systems, which monitor nitrate loss and collect aggregated soil nutrient information. We propose to replicate some of these strategies at diverse South Farms locations (e.g., distributed in conventionally tilled or no-till fields; with or without cover crops; annual or perennial crops, etc.) to compare nutrient loss based on management style. The tiles would be located on the edges of their respective farms, so that nutrient loss out of South Farms boundaries (and into critical waterways) can be closely monitored. This approach aligns with previous iCAP goals and facilitates quantification of land management changes and the impact of changing rainfall patterns over time.

The strategies implemented to achieve this objective will build a strong foundation for the campus's Nutrient Loss Reduction Strategy, our long-term plan to optimize nutrients regularly applied to crops in order to prevent chemical runoff into U.S. waterways. The interconnectedness of statewide, national, and global land and water systems is proof that public, private, and university-operated agricultural units must act as one to address widespread soil and water health concerns.

As a leader in the development of novel agricultural management and technological approaches, the university is poised to provide a "pilot program" in our nutrient loss reduction efforts and provide a model for sustainable land management that other academic and agricultural communities can apply to their own practices.

Conclusion

Humanity is intimately linked to the land and water that surround us. We are each affected by our access to these resources on a daily basis — strolling through the Main Quad on a sunny day, propping an umbrella open on a rainy walk to class, or sipping water from a drinking fountain. The most effective step toward enacting big-picture land and water management strategies is connecting with individuals on scales as small as the actions listed above, and nurturing curiosity about how land and water factor into the everyday.

As a land-grant university, the Urbana campus is situated on more than 5,000 contiguous acres. While we are fortunate to occupy this expansive space, we must keep in mind that the land and water we possess is finite.

The university's size and wealth of resources pose unique challenges. For example, given the threat of climate change, assessing flood risks in the campus and community will be prioritized (see the Resilience chapter for further discussion). Challenges also afford exciting opportunities to enact progressive environmental change on both individual and institutional scales. This is a great responsibility, and one we do not take lightly. Through innovative infrastructure, adaptive strategy implementation, and data-driven land use practices, we will strive to become a pillar of ethical land and water management in the coming decades.

We will strive to become a pillar of ethical land and water management in the coming decades.