



LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

2020 ANNUAL REPORT

IOWA STATE UNIVERSITY

Leopold Center for Sustainable Agriculture
209 Curtiss Hall, 513 Farm House Lane
Ames, IA 50011-1054
515-294-3711
www.leopold.iastate.edu

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On the cover

Oak savana and prairie at Whiterock Conservancy.

DIRECTOR'S MESSAGE

Dear Friends of the Leopold Center



Once again, I am happy to send you the annual report from the Leopold Center for Sustainable Agriculture. Another year of challenges and opportunities to summarize. We hope you find this report useful and informative.

And oh, what a year it has been for everyone across the state of Iowa. The Covid-19 pandemic, home confinement and quarantine time, dry weather for crops, low commodity prices, the derecho, strained supply lines, empty store shelves and an election. I don't need to rehash the details of 2020 events and I am sure each of you have your own stories to tell about the challenges, and perhaps, unfortunate tragedies that have occurred this past year. All we can hope for is that 2021 will be better and less stressful.

In this year's annual report, we continue to highlight some of our partner organizations. We hope you find these articles informative. We also note that this has been a year of change in leadership for some organizations including the upcoming retirement of Dr. Fred Kirschenmann. As always, Fred offers some insightful and interesting comments about his time at the Leopold Center. We have also included some perspective on Fred's contributions from Dr. Mark Honeyman, Associate Dean in the College of Agriculture and Life Sciences. Many of you know that Dr. Honeyman has a long working affiliation with Fred and the Leopold Center.

This year we also highlight our long-standing partnership with the Graduate Program in Sustainable Agriculture (GPSA) at Iowa State. Dr. J. Arbuckle, the current GPSA Chair, has provided an update and comments on the program and the opportunities it offers students interested in sustainable agriculture.

Also highlighted are some interesting research projects being carried out with funding and collaboration by the Leopold Center. In some cases, we have provided seed funding to relatively new faculty to help them get started in their research career on topics relevant to the Center's mission — a long-standing tradition. In other cases, we have chosen projects that show great potential in terms of discovery and usefulness. We don't have as much funding for research as we once did but we still try very hard to identify projects



that have the potential to make a difference in terms of Iowa's water and soil.

In closing, the Leopold Center continues to seek improvements in our agriculture and food systems. We look to the future for solutions, being always mindful of the past accomplishments of the Center and its collaborators. Our phones are still connected and the door to the Leopold Center remains open. I invite you to contact us or stop in.

Onward we go into 2021!

Mark Rasmussen

P.S. We wish to acknowledge Carol Brown for her assistance in preparation of this annual report. Many of you may know that Carol used to be at the Leopold Center. We are delighted that she was able to assist us in preparation of this year's report. Her willingness to help in this effort is greatly appreciated.

2020 FINANCIAL STATEMENT

ISU Foundation Accounts

Totals rounded to whole dollars

2019 Balance Carry Forward \$129,458

Income/Endowment Earnings

Restricted* \$3,357

Unrestricted.....\$214,760

Subtotal Current Income\$218,117

Expenses

Operations \$8,983

Restricted Expenses* \$1,055

Unrestricted Expenses\$366

Obligated Support - ISU\$55,839

Research Projects..... \$145,773

Organizational Support.....\$24,500

Subtotal Expenses.....\$236,515

2020 Balance \$111,060

**Restricted Accounts are funded by the Shivvers and the Spencer Family Endowment funds.*

2020 ADVISORY BOARD

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Leopold Center for Sustainable Agriculture Director Mark Rasmussen (left) and Chris Martin, Iowa State University professor of art and visual culture, with the new conference table made for LCSA from historic Leopold red oak. Photo: Chris Gannon, Iowa State University.

New Table From Historic Leopold Tree Arrives at Leopold Center

By Ann Y. Robinson



A new conference table has been delivered to its home in the office of the Leopold Center for Sustainable Agriculture at Iowa State University. The table may be new, but it has a notable past.

Made of lumber from a large red oak tree, its story began in the 1880s in Burlington. It was planted by Charles and Marie Starker, to celebrate the birth of their first grandchild, Aldo. Or, depending on which descendent tells the story today, possibly this particular piece of wood came from the tree planted to mark the arrival of one of Aldo's brothers, Carl or Frederic.

Aldo grew up to become famous for writing the 1949 conservation classic *A Sand County Almanac* and founding the field of wildlife management. Carl and Frederic eventually took over the family furniture-making business. Their trees grew tall and broad to provide wildlife habitat and shade for the two adjacent Leopold family homes where they grew up on the bluffs of the Mississippi River. When a windstorm felled two of the Leopold siblings' birth trees in 2013, the wood was salvaged by the Burlington city forester and volunteers and stored in an icehouse on the grounds.

Mark Rasmussen, Leopold Center director, learned of the wood when he was giving a presentation for the Leopold Landscape Alliance (LLA), which now owns the Leopold homes and the land on which they're located. Rasmussen

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had an idea, hatched with LLA President Steven Brower—use some of the wood to create something special for the center at Iowa State that hon-

ors Aldo Leopold's name and the land ethics he promoted.

Rasmussen shared the idea with Chris Martin, Iowa State professor of art and visual culture and sustainable environments. Martin, an artist and artisan with a reverence for the natural world, has long had deep respect for Leopold and his writings. He took Rasmussen up on the offer of a commission to work with the wood. The two met, and in 2015, they travelled to Burlington to acquire some of the historic wood and start imagining what they could do with it.

Initially, they waited. The lumber needed more time to dry, so it was stacked in the rafters of Rasmussen's garage.

Martin often says he's not a big fan of red oak. "Red oak in Iowa is ubiquitous, so it's usually not that exciting to work with," he said. "But this wood was different. Its age and time in the icehouse gave it some nice character, and its history linked to Leopold, all made the project especially interesting and meaningful."

Inspiring table

From the beginning, a table for the Leopold Center at Iowa State was part of the wood's intended future. As Martin created his simple, slightly fluted design for the table, it became a "passion project." The result was recently delivered to Rasmussen's office in Curtiss Hall on campus.

The table's polished top has the Leopold Center's logo in the center, and a plaque underneath attests to the table's heritage. Its unique legs and metal fittings are reminiscent of the brass brackets on surveying tripods from the early 1900s, something Aldo Leopold might have used in his work and travels.

By its fall, the tree attests the unity of the hodge-podge called history.

— from the essay, “Good Oak, February,” in *A Sand County Almanac* by Aldo Leopold

“It’s kind of inspiring to have it here,” Rasmussen said about the table. “I hope it will provide a tangible symbol of the center’s connection to the Leopold heritage for many years to come.”

Teaching sustainability

Before making the table, Martin used some of the oak as a special project for his wood design class. Students hand-crafted small, decorative boxes out of the wood while learning complex assembly techniques and working with power tools. Each box has an outline of an oak leaf and a quote from Aldo Leopold on its lid.

In the process, Martin had the students read “A Sand County Almanac” and consider how Aldo Leopold’s concepts of sustainability might apply today to their lives and careers.

The Leopold Center has used the boxes to share with special supporters. One of the students’ Leopold boxes now has a revered spot in the office of College of Agriculture and Life Sciences Endowed Dean Chair Dan Robison, a Leopold fan and once a forestry professor.

Wandering wood

Wood from the two Leopold birth trees has traveled far from the Leopold boys’ Burlington home. According to Brower, lumber from the downed trees has gone to a number of entities with links to the Leopold heritage and conservation mission, including the Midewin National Tallgrass Prairie Center, Joliet, Ill.; the Leopold Foundation, Baraboo, Wisc.; and Les Cheneaux Club near Mackinac Island, Mich., where the Leopold family vacationed in the summers.



*Storm-felled Leopold red oak tree being sawed into lumber by Nelson Leopold Smith, a grandson of Carl Leopold.
Photo: Leopold Landscape Alliance.*

Some has stayed closer to home to be crafted into tables and a bed for the historic Leopold homes. Other pieces have been used to create unique bowls, turned by Jim Spring, Frederic Leopold’s grandson, to support local conservation fundraisers.

“We still have a bit of the Leopold lumber left in Ames,” Rasmussen said. He and Martin intend to make good use of it.

This article is reprinted courtesy of “Wallaces Farmer” and the Iowa State University College of Agriculture and Life Sciences.



Aldo Leopold’s childhood home in Burlington, Iowa, in early 1900s, showing young red oak on the right. Photo: Leopold Landscape Alliance.

About the Leopold Landscape Alliance

Aldo Leopold’s birthplace and childhood homes in Burlington, Iowa are owned by the nonprofit Leopold Landscape Alliance. This reunites the original Starker-Leopold compound for education and researcher/writer/artist-in-residence programs. In addition to using the Leopold family homes for interpretation, the Alliance works on landscape scale conservation in the Iowa/Illinois Mississippi River region.

leopoldlandscape.org

My Leopold Center Journey



As I reflect on my 20 years with the Leopold Center, it has become increasingly clear to me that the mission and activities of the Center were a perfect fit for my senior years. The principles of life instilled in me growing up on our farm in North Dakota (1935–1950), then entering the academic world as a student, and ultimately as a teacher and administrator (1950–1976), and then returning to our farm to convert it to an organic, self-renewing, operation (1976–2000), were all life-changing. These life experiences led me to ponder what kind of relationship to Mother Earth, and to my fellow humans, could provide me with a most meaningful life?

And given that perspective, when I was first invited to consider becoming the second permanent director of the Leopold Center in 2000, I was deeply moved by the Center's vision, articulated so clearly by its founders, and also by the mission and activities that it was clearly engaged in—all of which seemed like a perfect fit for continuing my life's journey. Consequently, I accepted the invitation enthusiastically.

Of course, since the vision and mission of the Center was grounded in a culture of agriculture that challenged many of the assumptions of our dominant culture, it was marginalized by many. Aldo Leopold already understood, back in 1945, that important changes in the culture of agriculture were necessary because there were serious problems with certain aspects of modern agriculture. At one point Leopold acknowledged that while it was “inevitable that industrialization” would “spread to farm life” it had already “overshot the mark” because industrial agriculture was “humanly desolate and economically unstable” and that “someday this agriculture would die of its own too much,” because it would be “bad for farmers.” Of course, this alternative culture has a long history going back to Liberty Hyde Baily, Albert Howard, and other luminaries. However, it was certainly not taken seriously back in 1945, and, in fact, given our dominant form of agriculture, is still largely ignored today.

However, as David Montgomery's new study, “Growing A Revolution: Bringing Soil Back to Life, 2017” demonstrates, there are some farmers who are already making a transition to an alternative culture—often for economic reasons! The farmers in Montgomery's study discovered that the input-intensive, industrial agriculture, had such increased costs that they were losing money. So they began to transition to a more ecological system that regenerated their soil, making their farms more self-renewing, and therefore reduced their costs—and they are now making a profit.

This is the kind of revolution that the Leopold Center envisioned from its inception, and much of the research that the Center has funded from the beginning has verified that such an agriculture



is, in fact, possible and will ultimately become necessary. As Ernest Schusky pointed out in his 1989 book, *Culture and Agriculture An Ecological Introduction to Traditional and Modern Farming Systems*, our current, input-intensive agriculture—which he called the “neo-caloric era”—could not last much longer since all of the inputs are non-renewable, and so they will soon become depleted, and become too costly! As one example, farmers have already begun to be concerned about the increased cost of phosphorus, due largely to the fact that we only have four countries that still have rock phosphate reserves, and those reserves are predicted to be fully depleted within another 20 years, and so the costs are already increasing.

Additionally, there are other costs related to our modern culture of agriculture. It is now obvious, for example, that our modern input-intensive agriculture is causing serious water quality problems inflicting significant clean-up costs to make water available that is safe to drink.

All of this suggests that the kind of ecologically driven agriculture, which has been at the heart of the Leopold Center's work, will become increasingly important. Meanwhile, a modest number of farmers have begun to demonstrate that such self-renewing systems are possible—even here in Iowa! In fact, the Leopold Center's research has led to the adoption of cover crops, buffer strips, some more diverse cropping systems and crop–livestock integrations, and some farmers are already experiencing economic benefits as a result of ecological bottom lines.

From my perspective, all of this suggests that while the Leopold Center has been pushed aside by many in modern agriculture, it has demonstrated that its role is essential in

anticipating some of the changes we are likely to experience in our future—such as climate change, shortage of industrial inputs, and water pollution. Also key is the Leopold Center's responsibility to prepare farmers and the public to meet these challenges. I am confident that the Leopold Center, and the research it has sponsored, will become increasingly important to the future of food and agriculture.

All of this will require that we also adopt an ethical mandate, something that Aldo Leopold and the founders of the Leopold Center recognized. Leopold was adamant about the fact that to adopt a culture of agriculture grounded in ecological principles, would require a "land ethic" that "reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land." And he went on to point out that health, "is the capacity of the land for self-renewal."

These are some of the core principles that inspired the creation of the Leopold Center, and motivated me to enthusiastically devote the rest of my life to its mission. We owe it to future generations to leave them a world with clean water, healthy soils, a stable climate and nourishing food. The Leopold Center has a key role to play in that future.

— Fred Kirschenmann



At an LCSA Board of Directors meeting in 2009, Dennis Keeney, Jerry DeWitt and Fred Kirschenmann pause with Neil Hamilton, an original LCSA board member and director (ret) of the Drake University Ag Law Center. Keeney was the first Leopold Center director and DeWitt held the position after Kirschenmann.

Thoughts on Fred Kirschenmann

By Mark S. Honeyman

Fred Kirschenmann is a professor, author, speaker, philosopher, distinguished fellow, leader, visionary—all of these descriptors and more. But maybe, most importantly, Fred Kirschenmann is a farmer, a practitioner of agriculture.

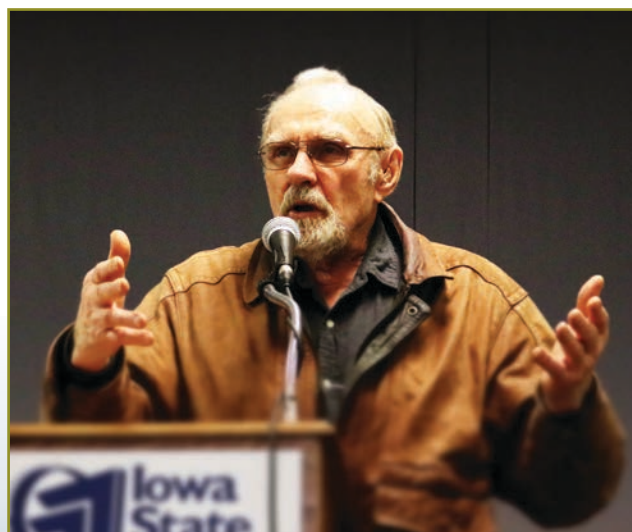
You can tell Fred is a farmer even without checking his credentials. For the last many years he had an office in Curtiss Hall on the Iowa State University campus and I would greet him often. You could tell he was a farmer by his hardened hands, weathered face and unassuming work clothes. After greeting each other, our conversations often centered on the weather and crops—like farmers always do. Fred's farm is in North Dakota, so in these brief encounters, North Dakota weather was always colder, drier, snowier or harsher than Iowa's. And the North Dakota crops were always more exotic and challenging than Iowa's "plain old" corn and soybeans. But like a farmer, Fred was happy to relate what he was seeing and in turn, listen to others' experiences. For me he was a familiar, refreshing reminder of the rural life, the farming life, on a bustling campus. And as we parted, there was often a tidbit of what he was thinking or writing or reading that would stick in my head and make me think.

Agriculture is defined as the science and art of cultivating plants and livestock. Over many decades, Fred honed his cultivation skills. He started and continued a large organic crop and livestock farm in North Dakota, and he kept his hands—and his heart—in it. The farm kept him literally grounded. His "science" was interpreting his experiences and knowledge to the scientific academics. His "art" was understanding the soil, land and weather, and relating to the people who knew and practiced this work. He noticed connections that were not obvious to many. His eyes were set

on the long view of agriculture, food and communities. In new and untried ways, he turned that focus outward to try to explain to the world, both those familiar with agriculture and the many who were not, these intricacies and interactions. He wrote and spoke on sustainability and resiliency for now and the future, whether it represented popular views or not. Here, too, he was honing cultivation skills of a different kind. He wanted to plant the seeds of thinking, discussion and debate on the deeper issues imbedded in food and land.

As Fred Kirschenmann retires as Distinguished Fellow of Iowa State University's Leopold Center for Sustainable Agriculture, I fully expect him to continue being a farmer and a cultivator of ideas that speak to us and keep making us think.

Mark Honeyman is an Associate Dean in the Iowa State University College of Agriculture and Life Sciences.



Iowa State University Creamery Basic Cheese Making Workshop



The Iowa State University Creamery held its first basic cheese making workshop on July 23 and 24, with significant financial support from the Leopold Center for Sustainable Agriculture. Although the workshop was originally intended to be held in-person, to allow participants hands-on experience of making a variety of cheeses, the pandemic necessitated the move to offer a virtual program. With event coordination help from the ISU Center for Industrial Research and Service (CIRAS) team, eight farms registered and participated in the workshop. The level of experience varied, ranging from dairy enthusiasts, to participants interested in starting cheese production, to current producers wanting to expand their knowledge.

The workshop was divided into several sections, with live classroom materials and recorded videos of various cheese-making steps scattered throughout the two days.

The classroom and discussion materials included:

- Stephanie Clark, Department of Food Science and Human Nutrition Professor, teaching about the chemistry of cheese making and the chemistry and microbiology of milk;
- Kate Ehlts, Iowa Sanitation Rating Officer, discussing regulatory requirements and services; and
- Dave Potter, Dairy Connection Inc. owner, teaching about selecting dairy cultures and other cheese supplies.

Because participants were unable to be in the micro-creamery to make cheese, each step of the process was recorded while the ISU Creamery staff produced the cheese. The recorded videos included in-depth steps and explanations on pasteurization, along with the following cheese varieties: chevre, cheddar, jack, and mozzarella. Although it would be preferred to have participants in the micro-creamery, physically completing each step of the process, this format has given the participants the opportunity to re-watch the recorded videos at any time that is convenient for them.

The ISU Creamery plans to host an annual cheesemaking workshop, to help dairy enthusiasts and entrepreneurs alike learn about making a variety of cheeses. There is hope that the 2021 workshop will be able to be in-person, so the participants can experience hands-on learning about the cheesemaking process. Thank you so much to the Leopold Center for Sustainable Agriculture for helping make the ISU Creamery's first cheesemaking workshop a success!



Stephanie Clark and Kate Ehlts display cheeses produced in the cheese making workshop, held virtually in July.

Livestock Odor, Nutrient Recycling and Crop Production Improvement Linked Through Biochar

Agricultural researchers continue to look for improvements in crop production as well as management of nutrients and manure. But can one additional element impact all three of these agronomic issues?

A diverse team of researchers comprised of agricultural engineers, agronomists and horticulturalists at Iowa State University (ISU) believe the answer lies with biochar.

“When we mix biochar with swine manure and apply it to the soil, our hypothesis is that it could improve soil quality, reduce nutrient movement and increase plant nutrient availability,” says Jacek Koziel, ISU Agricultural and Biosystems Engineering Professor. “Our research team is assessing the effect of biochar in two areas: nutrient leaching loss from the soil and the slow release of additional nutrients to plants.”

Manure management has been an issue since there has been domesticated livestock. Ongoing challenges include finding ways to reuse this nutrient-rich byproduct and keeping it out of the water supply. Koziel’s team is looking to find synergy in a manure–biochar mixture through a research project funded by the Leopold Center for Sustainable Agriculture.

Biochar is a charcoal-like material consisting of control-burned organic material. The end product is rich with carbon, which can have several soil benefits. Koziel’s team used two types of biochar in the project: biochar made from red oak and from corn stover. These were combined with swine manure in a two-part experiment: test tube-type columns of soil to measure nutrient leaching; and corn and soybean potted plants in the greenhouse to study nutrient availability.

“Both parts of the experiment showed that the biochar–manure mixture improved soil quality and plant nutrient

availability when compared to conventional manure application,” says Koziel. “We also found that the biochar–manure treatments influenced both soil carbon and nitrogen dynamics more diversely than conventional manure application.”

For Part 1 of the project, the team filled clear plastic tubes with soil and applied three biochar–manure mixtures to



the soil. The columns were leached with water several times over 30 days. In Part 2, three biochar–manure mixtures were applied to pots

of corn and soybeans growing in a greenhouse. The soil properties and nutrient availability were measured in each treatment and compared with the controls.

This project built on Koziel’s team work on mitigating manure odor. The researchers found when they applied biochar to the surface of swine manure in simulated pits, there was a reduction in ammonia and hydrogen sulfide levels and other compounds that contribute to manure odor. Some of these compounds could be hazardous to humans if high levels are inhaled or absorbed through the skin.

These positive results suggest that biochar could be used to solve both agronomic and environmental challenges and further improve the sustainability of animal and crop production. Koziel hopes the study will be expanded to a field-scale and for a longer term to ensure accurate positive implications on the plant and soil systems, he says.

Illuminating Pollutants in Iowa Surface Waters

Looking at the miles of rivers and streams in Iowa – more than 7,000 miles actually – it's sometimes easy to see how dirty the water is. But even the cleanest looking stream holds pollution the naked eye cannot see.

Iowa State University Chemistry Professor Jacob Petrich is exploring ways to detect water pollution that cannot be seen just by looking. He is exploring ways to detect optical brightening agents in the water to bring some pollutants to light.

"Optical brighteners or fluorescent whitening agents are synthetic compounds not found in nature," says Petrich. "These are additives in products such as laundry detergents to help make our clothes brighter. These compounds can make excellent markers for detecting leakage of wastewater into surface runoff."

Funded by the Leopold Center for Sustainable Agriculture (LCSA), Petrich's research project goal is finding whether these optical brighteners can be effective in locating sewage in streams and other waterbodies. His project components include detecting how long these compounds last before they break down and how much remains detectable when diluted in surface waters.

Detecting these synthetic compounds in rivers and streams assumes the chemicals aren't the only ones entering the waters. Other pollutants in the wastewater may exist with these compounds, so finding the brighteners visible through Petrich's spectrometry tests, one could conclude there are more pollutants in their company.

"There are many old and failing septic systems in rural Iowa and we need to have tools to find them," says Mark Rasmussen, LCSA Director. "Living on an acreage, I saw firsthand how these old systems can contribute to surface water pollution. When replacing our old septic system, I learned it was hooked directly into old field tiles and not properly into a leach field."

For people who work in this arena, Petrich's work could be significant. Margaret Jaynes is the Environmental Health Director for

Story County, Iowa. Among her many responsibilities, she oversees permits for rural septic system installation and replacement.

"This work is especially important because it identifies potential sources of untreated wastewater that carry human pathogens," says Jaynes. "While pollution from untreated sewage may not be as prominent as pollution from agriculture, sewage pollution carries this extra threat to public health."

Finding synthetic compounds and fluorescent whitening agents in waterbodies means there is leakage somewhere upstream from things such as septic systems, where these brighteners originated. This could lead to more tests to detect what other pollutants are present, such as chemicals involved in agricultural practices or industrial waste.

"As part of the research project, we're determining the optical properties of the brighteners and their rates of decomposition," Petrich says. "The goal is to find a set of light wavelengths that will detect the presence of one or more of the optical brighteners in surface water. Then we will explore how quickly they can be detected and the sensitivity of detection."

Petrich and his research team are collecting samples from two Story County rivers to use in their testing along with a control sample for comparison. The brighteners can be seen by measuring their fluorescence intensity through light wavelengths with Petrich's spectrometry equipment. And that could help Jaynes with her goals for improved water quality and public health.

"Optical brightener testing could be used to pinpoint failing septic systems that discharge from a tile or seep into streams," says Jaynes. "With this information, the county

sanitarian can require the property owner to upgrade their septic system."

If Petrich's research is successful, this could be another tool to use for water quality indicators and eventual improvement for environmental and industrial professionals like Jaynes.



Myth-Busting Saturated Riparian Forest Buffers

Saturated riparian buffers are a proven edge-of-field practice for effective treatment of nutrient-laden agricultural drainage water. However, the overwhelming majority of these cost-shareable practices in existence have been implemented in non-woody vegetation such as warm-season grasses.

Through a research project supported by the Leopold Center for Sustainable Agriculture, William Beck and Hilary Pierce are hoping to debunk this idea. Beck is an assistant professor in the Iowa State University (ISU) Forestry Department and Pierce is an ISU Extension program specialist.

“The federal Conservation Reserve Program (CRP) includes saturated riparian forest buffers — CP22S — as an approved cost-share practice,” says Beck. “But there is a preconceived notion that these buffers shouldn’t be placed in forested areas because tree roots could enter and clog the drain tiles.”

A saturated riparian buffer is a water quality improvement practice consisting of drainage tile from a crop field diverted through a control structure into a tile line that runs parallel to a river, stream or drainage ditch. Water leaving the field enters the buffer, saturating the soil along the waterbody. The excess nitrate in the tile flow is converted to nitrogen gas before the water seeps into the adjacent waterbody.

Beck and Pierce intend to demonstrate that these structures can be installed in forested areas near a stream without the perceived negative impacts. They established an appropriate long-term saturated riparian forest buffer research site along Walnut Creek in Story County, Iowa. The site is located near an existing saturated buffer planted with prairie and pollinator plants and grasses, which will make for good comparison. The saturated riparian forest buffer site has been designed and will be installed in the spring of 2021. The site will have pin oak, Shumard oak and swamp oak trees planted along the buffer.

“We’ll begin to monitor the groundwater after the forested buffer is established,” Beck says. “Several students worked on this project learning about siting and design. They will be helping with the monitoring. It’s a great hands-on educational experience.”

Another component of the research project will be to monitor willow tree roots in a drainage tile setting in the ISU Forestry Department greenhouse. Willow cuttings were established in large pots and the containers will be bisected and placed in drainable bins to witness the effects of water flow and how the roots interact with the drainage tile.

Between the on-site saturated riparian forest buffer and the greenhouse research, Beck and Pierce are optimistic that they can bust the myth of

clogged drainage tile by tree roots and change landowners’ mindset. Removing another barrier toward adoption will allow for more of these nutrient-reducing practices to be installed for improved water quality.



An ISU undergraduate student uses an electronic tile probe to locate/map on-site tiles, starting at the stream outlet. Location of existing tiles is a critical, and challenging, component of the overall SRFB design process.



An ISU undergraduate extracts a soil core for description. Soil core description is critical to ensure the site is appropriate for the SRFB practice.

Honors Project Highlights Benefits of Pasture-raised Cattle for Regenerative Agriculture

News articles about the negative impacts of livestock on the environment inspired Iowa State University animal science student Grace German to study the role of beef cattle in regenerative agriculture. The results became her Honors Program Senior Capstone Project and led to a new video, now posted on the LCSA website.

Digging into the science behind cattle production, German's conclusion was significantly different than the news stories that prompted her project. Her voice narrates the 6-minute video, which features a poster summarizing findings compiled during her research. These include points on methane, soils, pastures, integrating enterprises and the modern meat consumer. In the background, she speaks to "the rest of the story," particularly the benefits of cattle raised on pasture.

"It's not cows – it's how they're managed," she says. "Cattle are an asset to regenerative agriculture systems as their emissions are more than compensated for by the carbon sequestered in the soil of a well-managed grazing system. Further, their contributions to soil health and biodiversity cannot be overlooked."

Find German's video and poster, at: www.leopold.iastate.edu/benefits-grazing-beef-cattle.

"This project has given me opportunities to take my education outside of the classroom, and to share the unique findings with farmers, ranchers, and consumers," says German. "I'm optimistic about the opportunities beef producers have to continue their family legacies while protecting and even improve their natural resources."

Her adviser on the project was LCSA Director Mark Rasmussen, a professor in the Department of Animal Science at Iowa State.

"I appreciate Grace's great work on this project," says Rasmussen. "She had hoped to spend the summer of 2020 learning and working as an intern at Whiteoak Pastures in Georgia, a farm that has done a full life-cycle analysis of their cattle operation. The coronavirus ruined that opportunity for her, but I know she will find other ways to pursue her scholarship in the future."

German's project reflects real-world experience, gained on her family's farm near Holstein, Iowa, where they raise grass-fed beef and sell other livestock products. They can be found online, at www.thankfulharvest.com.

As German graduates, her near-term plans are continue working in the Midwest, focusing on direct-to-consumer marketing and sustainability initiatives for animal agriculture.



Graduate Program in Sustainable Agriculture Training the Next Generation of Sustainable Agriculturalists

The interdisciplinary Graduate Program in Sustainable Agriculture (GPSA) at Iowa State University integrates knowledge and problem-solving skills from diverse disciplines including agronomy, ecology, the social sciences, community and regional planning, and ethics. The program was the first sustainable agriculture graduate program in the United States when it was established in 2001. It provides masters' and Ph.D. program training and facilitates interdisciplinary research focused on cornerstone sustainability issues including soil health, food security, environmental quality, and community development.

By emphasizing scientific principles and analytical thinking, the GPSA prepares students to address agricultural sustainability challenges in Iowa, across the country and the world. By bringing together 80 faculty from more than 20 departments spanning the Colleges of Agriculture and Life Sciences, Design, Engineering, Human Sciences, Liberal Arts and Sciences, and Veterinary Medicine, the program promotes innovative research that reflects ISU's commitment to public service and excellence in scholarship. These graduates are doing impactful work in an incredibly diverse array of jobs in academia, government agencies, the private sector, and non-governmental organizations.

"The Leopold Center has provided indispensable resources that we have invested in our amazing students," says J. Arbuckle, chair of the GPSA. "Our students and the great work they are doing since graduating represents the long-term impacts of the LCSA/GPSA partnership."

The Leopold Center supported the GPSA even before its inception and has been a primary contributor to the program's success over the years. Grants funded by LCSA supported innovative research by GPSA faculty and research assistantships for scores of students working on groundbreaking projects such as the prairie strips project.

In recent years, LCSA has contributed funding for first-year fellowships for highly qualified students. This support has helped GPSA faculty leverage funds from other sources to create more assistantship opportunities so faculty can recruit talented graduate students to work on sustainable

agriculture research. Since the 2017-18 academic year, funds from LCSA have supported 12 one-quarter-time, first-year graduate fellowships. These fellowships have allowed faculty to recruit students they may not have been able to fully fund otherwise.

"The Leopold Center has been the GPSA's strongest and most valued partner over the program's 20 years," says Mary Wiedenhoef, GPSA Director of Graduate Studies. "We look forward to many more years of this impactful relationship."

Several recent graduates who benefitted from fellowships and/or worked on LCSA grant-funded projects include:

- **Andrea Basche**, Ph.D. in Sustainable Agriculture and Agronomy; now Assistant Professor in the Department of Agronomy and Horticulture at the University of Nebraska – Lincoln.
- **Ranae Dietzel**, Ph.D. in Sustainable Agriculture and Agronomy; now co-proprietor of Lost Lake Farm and Agronomy Data Scientist for Syngenta.
- **Lydia English**, M.S. in Sustainable Agriculture and Agronomy; now Strategic Initiatives Coordinator for Practical Farmers of Iowa.
- **Hanna Poffenbarger**, Ph.D. in Soil Science, Minor in Sustainable Agriculture; now Assistant Professor of Soil Nutrient Management, Department of Plant and Soil Sciences, University of Kentucky.
- **Gabrielle Roesch-McNally**, Ph.D. in Sustainable Agriculture and Sociology; now Women for the Land Director for American Farmland Trust.
- **Diego Thompson**, M.S. and Ph.D. in Sustainable Agriculture and Sociology; now Assistant Professor of Sociology at Mississippi State University.

These are only a few examples of the many students who have gone through the GPSA program and are now working toward more sustainable food and agricultural systems across the non-profit, government, private, and academic sectors.



2,4-D Herbicide Degradation in Iowa Fields

Developed in the 1940s, the broadleaf herbicide that contains the chemical 2,4-D has been used in crop fields across the Midwest. It continues to be a popular product and its usage has increased over the years. But there is still much to learn about the fate of this herbicide in the environment.

Dr. Betsy Swanner, associate professor in the Department of Geological and Atmospheric Sciences at Iowa State University, worked with visiting scholar Dr. Hui Tong on how this chemical affects the environment. Tong observed that an iron (II)-oxidizing bacteria had the capability to degrade 2,4-D herbicide. These particular bacteria were isolated by a student in Swanner's lab.

Through funding from the Leopold Center for Sustainable Agriculture, Tong and Swanner conducted experiments and analysis to further this finding. They believed that the mechanism of degradation was actually chemical, not biological. Prior studies had shown degradation of 2,4-D in the presence of iron (III)-reducing bacteria when they produced iron (II), which formed a reactive phase on the surface of iron (III) materials, catalyzing 2,4-D degradation.

They subsequently found a number of shallow streams near Ames, Iowa, where mats of iron-oxidizing bacteria were growing. They targeted these areas to investigate how 2,4-D might be naturally diminished in Iowa's watersheds where there is an abundance of agricultural land. The potential biodegradation will be beneficial to human and animal health. This process helps mitigate 2,4-D contamination in the surface waters that might be used for watering livestock, recreation and drinking.

The research project has received subsequent funding from the Center for Health Effects of Environmental Contamination (CHEEC) at the University of Iowa. Zackry Stevenson, a microbiology Ph.D. student at ISU, will be continuing this study.

Dr. Tong was a visiting scholar at ISU from 2018-2020. He holds appointments from the National-Regional Joint Engineering Research Center for Soil Pollution Control and Remediation in South China, Guangdong Key Laboratory of Integrated Agro-environmental Pollution Control and Management, and the Guangdong Institute of Eco-environmental Science & Technology at the Guangdong Academy of Sciences in Guangzhou, China.



A drainage channel in Ames with a rusty biofilm of iron (II)-oxidizing bacteria. Research funded by LCSA aims to determine if such features are hotspots for degradation of the herbicide 2,4-D.

Whiterock Conservancy: A Destination to Explore Eco-Tourism and Regenerative Agriculture

By Chris Freland, Executive Director



reetings from Whiterock Conservancy!

Imagine a place where you can lose yourself in nature and experience all that wilderness has to offer. Even before 2020's pandemic, a word I often referred to wanderlust. Mer-

riam-Webster defines wanderlust as a strong longing for or impulse toward wandering. If you are longing for a safe place to escape and learn, Whiterock Conservancy is ready to fill that need! Located an hour northwest of Des Moines, Whiterock straddles the Middle Raccoon River near Coon Rapids, Iowa. Our 5,500-acre non-profit private land trust offers endless opportunities to wander.

Whether you visit for a day, a weekend, or a week, Whiterock has something for you. Its unique natural lands management program, 40-mile interpretive trail system, and overnight accommodations provide a myriad of eco-tourism, recreational and educational options. Our 12 stocked fishing ponds are free to the public and we also offer easy access to the Middle Raccoon River.

Whiterock's marked trails allow you to immerse yourself in the heart of oak savanna, observing native sandstone bluffs, prairies, and wetlands. As you wander, you are sure to experience some of the multitude of the native creatures that make Whiterock home. Our trail systems include designated mountain bike and equestrian trails, as well as multi-use trails for hiking and limited ATV or 4-passenger UTV use. All trails are pet friendly.

We offer accommodations for overnight stays to suit nearly every vacation rental style. They range from private rooms with bath, a family-sized log home or farmhouse, cottage, and a primitive cabin. Campers can choose rustic tent sites or an RV campground with electrical hook-ups and equestrian enthusiasts enjoy horse accommodating camping. Seasonally, services include canoe, kayak, and mountain bike rentals, as well as UTV rentals. On-site firewood sales allow guests to relax at a campfire with friends or family.

As we expand future self-guided learning, we are excited about the potential for digital libraries focused on visitors' experiences and the key places

to explore at Whiterock. We equally are looking at ways to expand interpretive signage on our trails. We will enlarge our footprint in these areas as digital access and technology evolve.

Fulfilling our mission of restoring and responsibly using the land, Whiterock is heavily invested in preserving its natural resources, oak savanna restoration through controlled burns, and a variety of regenerative agricultural practices. Current agricultural practices include cover crops, no-till farming, small grain harvests, strips and block prairie habitat, precision technologies to maximize land use, and both rotational and flash grazing of cattle.

All practices are evaluated based on improving soil health while adhering to economic benefits, being good stewards of the land and serving as a demonstration site for others. This includes many partnerships with tenants, universities, agricultural, natural resources, and conservation organizations. As we look to the future, we are continually evaluating our role in being innovative and responsible with the land entrusted to us.

My adventure as Executive Director began in October of 2020. Growing up in Stanley, in scenic Northeast Iowa, I quickly learned the complex relationship between agriculture, conservation, and the environment. A graduate of Iowa State University, my extensive background in agriculture, health care, and non-profit management has provided me with many of the skills necessary for success at Whiterock.

Most recently I served as Executive Director for the Iowa Beef Industry Council, where I helped establish public/private partnerships with individuals, organizations, and universities. I am pleased to reconnect with the Leopold Center, which has held a seat on Whiterock's Board of Directors since Whiterock's inception in 2004. I am excited to expand the quality and quantity of experiences for visitors and partners into the future. Connect

with us on Facebook and Instagram and visit our website.

We look forward to having you wander with us, stay with us, and invest in all the rich experiences we offer. Come to us as a wanderer and leave as a friend!



Whiterock Conservancy Executive Director Chris Freland with furry companion, Captain.
Photo: Carroll Times Herald





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