



LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

2019 ANNUAL REPORT

Leopold Center for Sustainable Agriculture
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IOWA STATE UNIVERSITY

DIRECTOR'S MESSAGE

To Friends of the Leopold Center:

I am delighted to introduce this annual report from the Leopold Center for Sustainable Agriculture. We hope you find this annual report useful and informative.



This year we want to emphasize and take note of our partner organizations. It has been a priority for us to maintain and nurture these partnerships and we have worked with our partners in many different ways. Direct funding support, seed investment funding, service on boards, meeting and speaker support, and general consultation and advice are just some of the ways we have worked with these partners. This year we have included reports from some of these organizations so you may better know their activities. We hope you will find these reports informative. We are always on the lookout for new partners, but we will continue to provide support to our long-time partners as well.

This year we have also highlighted some of the research projects and new initiatives supported by the Leopold Center and its partners. We are especially excited with new projects conducted by students in our undergraduate scholarship program.

We have also included research results from Jim Russell, professor emeritus, Iowa State University Department of Animal Science, that details the complex interactions between cattle grazing, soil organic carbon and enteric methane production. Cattle, grazing and climate change has been prominently featured this past year in social media. Unfortunately, much of the information has been suspect, based on faulty logic and devoid of sound data and proper analysis. Dr. Russell's research—funded for many years by the Leopold Center—serves to counter the misinformation and demonstrate that long-term studies are needed to fully understand complex interrelationships.

I'd like to end my message with a statement that you may have heard the last few months on Iowa Public Radio. "For over 30 years, the Leopold Center has supported research leading to cleaner water, better conservation of natural resources and greater agricultural vitality." This message is a reminder that we remain proud of the work that has been accomplished—and will continue to be accomplished—with our collaborators and partners.

Even though the Center has been tested in recent times by adverse events, we continue to pursue the Center's mission as we can with the help and encouragement of many friends and supporters. We continue to seek ways to overcome key knowledge barriers that impact food and agriculture. We continue to look to the future while always being mindful of the foundation laid by the Center's past accomplishments. The door to the Leopold Center in Curtiss Hall is always open for visitors and I invite you to stop by.

Mark Rasmussen

P.S. Thanks to Ann Staudt at Iowa Learning Farms for her assistance in preparation of this report.

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2019 FINANCIALS

ISU FOUNDATION ACCOUNTS

2018 Balance Carry Forward	\$97,598
Income/Endowment Earnings	
Restricted*	\$3,321
Unrestricted	\$212,657
Subtotal Current Income	\$215,978
Expenses	
Operations	\$7,214
Restricted Expenses*	\$5,025
Unrestricted Expenses	\$628
Obligated Support – ISU	\$56,789
Research Projects	\$92,562
Organizational Support	\$21,900
Subtotal Expenses	\$184,118
2019 Balance	\$129,458

**Restricted accounts are funded by the Shivers and the Spencer Family Endowment Funds.*

Thanks to Kim Vo, Accountant, College of Agriculture and Life Sciences, for preparation of this report.

LEOPOLD CENTER HAPPENINGS

TAGTOW PRESENTS ANNUAL SHIVVERS LECTURE

The Shivvers Lecture series has brought guests to Iowa State to speak about agriculture, food, natural resource conservation and sustainability for many years. The lecture series is named in the honor of John Shivvers, who was a prominent farmer near Knoxville, Iowa. Members of the Shivvers family continue to support the lecture series and attend this annual event.

Our 2019 Shivvers Lecture was presented by Angie Tagtow, founder and chief strategist for Äkta Strategies. Angie has had an inspiring career, including key roles at USDA, a career which has included connecting the dots between sustainable agriculture and human health. In her lecture, she shared numerous experiences from her own career, which ultimately led her to conclusions of how we need to redesign our food and agriculture systems. Her lecture was well attended in the Memorial Union Campanile Room. Her lecture is still available at:

<https://iastate.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=3d7bcf77-ca7c-44dc-a287-aa1d012d248f>



Our 2020 Shivvers Lecture will be presented on March 27, 2020 in the ISU Memorial Union by Timothy A. Wise. Professor Wise is a senior researcher at the Small Planet Institute and is also a senior research fellow at Tufts University's Global Development and Environment Institute. In 2019, he published an informative book, *Feeding Tomorrow: Agribusiness, Family Farms, and the Battle for the Future of Food.* In this new book Professor Wise addresses the many challenges that the future of food will face, including climate change. He also provides critical information about how input-intensive industrial agriculture, in many parts of the world, is no longer serving people's needs, and that increasingly small-scale farmers are feeding the world by rebuilding soils, and creating self-renewing, and vibrant, food and agriculture systems.

FORMER CENTER STAFF MEMBER RETIRES

Blue Maas, former secretary at the Leopold Center, retired from ISU in February 2020. Although her last months were not spent working at the Leopold Center due to the defunding, we wish to note her dedication and thank her for her service to the Leopold Center. We wish her well in her retirement.

FARMER RESEARCHER PAUL MUGGE SELECTED FOR SPENCER AWARD

Ann Robinson, Communications Specialist, College of Agriculture and Life Sciences

Sutherland farmer Paul Mugge has been selected as the 2019 winner of the Spencer Award, presented by the Leopold Center for Sustainable Agriculture at Iowa State University.

A 1974 Iowa State graduate in engineering, Mugge left a fledgling career with Boeing in Seattle, to return to Iowa and take over his family's 300-acre farm when his father retired. He now raises organic corn, soybeans, small grains and alfalfa.

The Spencer Award is one of the most prestigious awards of its kind. Administered by the Leopold Center, it recognizes farmers, researchers and teachers who have contributed significantly to the environmental and economic stability of the Iowa farming community. The award presentation is planned for the 2020 Iowa Water Conference, April 8-9, in Ames.

"We are pleased to honor Paul as a farmer and an exemplary on-farm researcher," said Leopold Center Director Mark Rasmussen. "He has done so much to study and demonstrate the efficacy of environmentally sound farming practices, and he has provided important leadership, including serving on the Leopold Center board from 1996 to 2009. He is an inspiring and deserving recipient."

Mugge said he adopted organic farming field by field, transitioning completely by 2003. Involvement with other farmers through Practical Farmers of Iowa gave him support and encouragement to begin farming organically. At the time, he said, "Things looked really bad for farming," but he managed to endure and now benefits from significant premiums for his organic crops.

There's just something

therapeutic

about going out there
and walking through a prairie...

Mugge received PFI's Master Researcher award in 2013, which recognized his participation in 65 trials to field-test practices including ridge-tilling, the late-spring soil nitrate test, small grain production, hoop-house production, weed management and prairie strips. Mugge has also hosted more than 20 field days to share information with others to help promote sustainable agriculture. Recently, he also was named recipient of PFI's 2020 Sustainable Agriculture Achievement Award.



**PAUL MUGGE HOSTING A
PRAIRIE & HABITAT FIELD DAY**

He said he is especially excited about the prairie strips he's planted. Over time, he thinks the strips may help control weed populations by supporting seed-eating insects and birds, but "Even if we don't see that bottom-line change, it's beautiful. There's just something therapeutic about going out there and walking through a prairie, even a reconstructed prairie."

In a letter supporting Mugge's Spencer Award nomination, PFI Director Sally Worley said, "Paul has a long-term vision for the farm where profit and stewardship are mutually inclusive... Paul's farm is a wonderful example of what is possible on Iowa's landscape."

Mugge credits Iowa State for giving him a broad-based education and encouraging an interest in international issues that has taken him on agricultural and mission trips to India, Puerto Rico, Haiti, Mexico, Russia and Uganda. Closer to home, he recently visited Montana with a group studying the impacts of climate change on grizzlies and huckleberries, which are important to the bear's diet. Mugge said his environmental interests originated with his progressive father and have been influenced by the words of Nez Perce Chief Joseph and authors like Garrett Hardin, Aldo Leopold and David Montgomery. Paul Mugge and his wife Karen have three children and seven grandchildren, who all live relatively close and sometimes help on the farm. His local activities include substitute teaching and active involvement in his faith community.

The Spencer Award honors Norman and Margaretha Spencer, who farmed in Woodbury County for 40 years. Graduates of Iowa State, the Spencer family maintained an active relationship with the university and several professors who encouraged them to conduct research on sustainable practices and family farming. The Spencer family established the award in 2001 through an endowment that provides a \$1,000 cash prize for each winner. Learn more about the award and the Spencer family at www.leopold.iastate.edu/spencer-award.

NEW SUSTAINABILITY SCHOLARSHIPS AWARDED TO IOWA UNDERGRADUATES

Ann Robinson, Communications Specialist, College of Agriculture and Life Sciences

Proposals from five undergraduates representing Iowa State University, Drake University, Grinnell College and the University of Northern Iowa were awarded funding in the first round of a new scholarship program supported by the Leopold Center for Sustainable Agriculture and the College of Agriculture and Life Sciences at Iowa State University.

The scholarships will be used for projects that help students conduct experimental research, travel and present at conferences, promote effective fungicide seed treatments, raise poultry at an on-campus farm, and support environmental awareness efforts.

The scholarship program is made possible by private donor funds supporting the Leopold Center for Sustainable Agriculture. Additional support for the scholarships is being provided by the ISU College of Agriculture and Life Sciences for eligible juniors and seniors enrolled in the college's 25 majors, thanks to funding from private donors.

"The Leopold Center and Iowa State's College of Agriculture and Life Sciences are excited to be able to help support these impressive and diverse projects by students in undergraduate programs here and across Iowa," said Mark Rasmussen, director of the Leopold Center for Sustainable Agriculture. "Their proposals exemplify our goal to expand opportunities for undergraduates to experience learning activities that nurture their understanding of how to apply sustainability to real-world situations."

The second round of the sustainability scholarship program sponsored by the Leopold Center for Sustainable Agriculture at Iowa State University has recently closed. Juniors and seniors at Iowa four-year colleges and universities may apply for up to \$1,000 to support planned learning and participation experiences related to agriculture, food, natural resources or related topics. Applicants are required to work with a faculty mentor at the student's educational institution.

THE STUDENTS AND THEIR PROJECTS

- **Kavita Jain**, a biology major at Iowa State University, is receiving support for research on the role of social buffering in bees within agricultural landscapes. Jain will work with graduate student Kate Borchardt, in ecology, evolution and organismal biology, and faculty mentor Amy Toth, associate professor of ecology, evolution and organismal biology.
- **Maia Lawson**, a double major in microbiology and genetics at Iowa State, is receiving support for research to further study the effectiveness of fungicide seed treatments at combatting soybean sudden death syndrome. The students plan to use the information to help farmers choose the most effective fungicide seed treatment so they can reduce costs and avoid unnecessary pesticide use. Lawson will work with faculty advisor Daren Mueller, associate professor of plant pathology and microbiology, and Yuba Kandel, manager of Mueller's lab.
- **Autumn Ellisor**, an environmental science major at Drake University, is receiving support to research remnant-dependent prairie moths at Chichaqua Bottoms Greenbelt in Polk County, Iowa. Ellisor will work with faculty mentor Keith Summerville, professor of environmental science and sustainability.
- **Thomas Hexter**, a math and anthropology major at Grinnell College, is receiving funds for a chicken coop to be managed by student residents of the Grinnell College Farm House. Hexter will work with faculty mentor Jonathan Andelson, professor of anthropology and director of the Center for Prairie Studies at Grinnell.
- **Faith Luce**, an earth and environmental sciences major at the University of Northern Iowa, is receiving funds for a collaborative project with other students to promote educational videos about a local watershed and use the videos to raise awareness in preparation for the 50th anniversary of Earth Day in 2020. Luce will work with faculty mentor Chad Heinzl, an associate professor of earth and environmental sciences.

WHITEROCK CONSERVANCY: AN IOWA PHENOMENON!

Dan Gudahl, Executive Director, Whiterock Conservancy

Aldo Leopold stated, *"To keep every cog and wheel is the first precaution of intelligent tinkering."*

Growing up on a small farm in southern Minnesota, I recall that I spent a lot of time wondering if I had been born too late. I often tried to imagine what things were like when the area now called Blue Earth County was untouched by human impact. Finding an arrowhead in a plowed field, hearing a story about tiled land that used to be full of waterfowl or a fence row hedge, now removed, that was perfect habitat for pheasants made me wonder about missed magnificence. A photo that sticks in my mind was from our local newspaper. Like most local papers, they published old articles and photos from 25, 50 or 100 years ago. This particular photo was of a small group of men with shotguns. Next to these men the picture showed a large pile of dead crows with the proud hunters standing around it. The crows were piled up like ear corn that had been dumped out of a wagon. The pile was about 6 feet high...a mound of dead crows that had been proudly collected and piled for all to see. Of course, this was done for a reason. The crows it seemed were too numerous to tolerate and were raiding farmers' crops and corn fields and affecting livelihoods. So many crows in one place either dead or alive is something that I have never seen with my own eyes. Perhaps I have seen 20 or 30 gathered together (a flock of crows is called a murder). Just imagine at the turn of the century hunters could hunt, kill and pile crows into a small hill. This must mean for us today that some of the cogs and wheels have been tinkered with and not for the better, at least for the crows.

After 30 years working in international development, I came to Iowa three years ago to become the executive director of Whiterock Conservancy. I took the job in part because of my admiration for the Leopold Center which I had been following throughout my career. I knew Fred Kirschenmann through his environmental advocacy work. Fred happened to be on the board of directors for Whiterock Conservancy. I thought certainly if Fred and the Leopold Center are involved with Whiterock Conservancy, it must be a great place to work. I also thought that perhaps Whiterock will provide a place to be able to think about what we as human beings are doing correctly and incorrectly when it comes to nature and our environment. I also admired the research supported by the Leopold Center, especially the research that helps us to realize that we might not have all the answers yet and that try as we might, nature is hard to beat!

Whiterock Conservancy provides a place where one can consider the roles humans play in intelligent tinkering. It is a 5,500 acre not-for-profit organization founded in 2004 as a result of a generous gift from the Garst family. Whiterock is located near Coon Rapids, Iowa with land in Guthrie, Greene and Carroll Counties. Whiterock is actively managed to improve the condition of the savannas, rolling pastures, native and restored prairies, wetlands, riverside bluffs and fishing ponds. Whiterock is restoring one of the largest areas of oak savanna left in Iowa. Our diverse habitats are home to hundreds of species of birds, mammals, and other wildlife. Whiterock also integrates regenerative agriculture and rotational grazing of livestock in its operation. There are 40 miles of trail and 7 miles of river to enjoy, and a variety of campsites and farmhouses available for rent.



ROTATIONAL GRAZING SYSTEM AT WHITEROCK CONSERVANCY

Whiterock Conservancy strives to continue the Garst legacy of innovative farming by demonstrating sustainable farming practices and providing farmers and non-farmers information on the benefits and costs of these practices. Visitors to Whiterock can see these practices on the ground and can learn more by requesting a staff-led tour of the property.

In order to provide opportunities for the public to experience and learn from this landscape, Whiterock Conservancy maintains a state-of-the-art backcountry soft trail system that serves the needs of walkers, hikers, runners, mountain bikers, equestrians and those with mobility limitations through the use of off road vehicles. Visitors can get close to nature, view sustainable agriculture practices and explore the history of the area.

As part of our mission to engage the public in learning about sustainable agriculture and the natural landscape, we are proud to steward the historic Garst Farm, the cradle of hybrid seed corn and the host for Soviet Premier Nikita Khrushchev during his historic 1959 visit to the United States.

Because of our non-profit registration status, Whiterock has had three "membership organizations" as part of the board of directors since its inception: the Iowa Natural Heritage Foundation, the Iowa Department of Natural Resources, and the Leopold Center. The Leopold Center, with its goals of promoting cleaner water, conservation of natural resources and greater agricultural vitality, is a natural fit to support Whiterock's mission of providing a place where people, the environment and agriculture can be sustained and can interact. Fred Kirschenmann has been the Leopold Center representative on the Whiterock board of directors since Whiterock was founded in 2004. His guidance and enthusiasm for looking at the future of agriculture differently than conventional agriculture has helped show Whiterock how they can best maintain a robust environment for wildlife, healthy soil and clean water, while not removing agriculture or livestock from the land base.

Whiterock Conservancy welcomes all Leopold Center supporters to come and visit Whiterock and enjoy these natural surroundings that we try our best to steward for future generations. We would also welcome more crows... if they care to stop by.

CONSERVATION EDUCATION FOR IOWANS OF ALL AGES

Jacqueline Comito, Program Director, Iowa Learning Farms and Water Rocks!

Conservation Learning Group (CLG), a think tank dedicated to addressing conservation and environmental challenges, was established as a part of Iowa State University Extension and Outreach in July 2018. The Conservation Learning Group is a collaborative team striving to advance training, outreach, and research across land uses and production systems to increase overall sustainability of agricultural and natural systems for generations to come.

The CLG umbrella includes two highly successful programs, Iowa Learning Farms and Water Rocks!, and incorporates inputs and knowledge from a broad range of research studies and programs spanning multiple topics. The Conservation Learning Group, through Iowa Learning Farms and Water Rocks!, continues to partner with the Leopold Center for Sustainable Agriculture. Center Director Mark Rasmussen is a part of the CLG leadership team, along with representatives from agricultural and biosystems engineering, social science, agronomy, crop science, soil science, wildlife management, water resource management and conservation.

BUILDING A CULTURE OF CONSERVATION

Iowa Learning Farms celebrated its 15th anniversary in 2019! What began in 2004 as a five-year research project has grown to become Iowa's go-to outreach program for accurate information on conservation and water quality practices. One reason for the continued success has been the partnership with the Leopold Center for Sustainable Agriculture. Since 2004, the Center's \$235,610 investment has leveraged over \$8.2 million for Iowa Learning Farms.



Has Iowa Learning Farms been successful in building a culture of conservation? The answer is a resounding “Yes!”. Here are some of the highlights from ILF’s 15-year report:

- Expanded our network of conservation-focused farmers across the state from 31 in 2005 to 88 in 2019.
- Held 265 conservation field days/workshops with 13,621 total attendees, 87% of whom are farmers or landowners.
- Amplified the conversation to include all Iowans with the Conservation Station trailers, participating in 1,286 events with 185,535 attendees.
- Farmers who attended an ILF field day are innovators in cover crop adoption: 58% planted a cover crop in 2018, covering 38% of their reported row-crop acres.
- The more field days farmers attended, the more conservation practices they implemented on their farms.
- Farmers attending ILF field days are spreading the conservation message. Two-thirds of the farmer respondents indicated that they had successfully influenced other farmers about conservation practices. These farmers are extending ILF’s influence to 58% more farmers than attended an ILF event over the years.

For more information:
www.iowalearningfarms.org

INCREASING IOWA’S ENVIRONMENTAL LITERACY

Water Rocks!, Iowa’s award-winning statewide youth education campaign about all things water, launched in 2012. The Water Rocks! team produces fun, memorable ways to help youth learn about water including K-12 classroom presentations, all-school musical assemblies, light-hearted educational videos, music videos, Conservation Station trailers, a web-based computer game, teacher training workshops, and college student internships.



Funding from the Leopold Center for Sustainable Agriculture has been key to helping build this program. Since 2013, the Center’s \$182,500 investment has leveraged over \$1.5 million for Water Rocks!.

During the 2018-19 school year, the Water Rocks! team delivered its high-energy, high-impact programming at 197 schools and 13 youth outdoor classrooms, reaching 32,800 students. Since program inception, the Water Rocks! team has engaged with over 130,000 students and will likely surpass the 150,000 mark by the end of this spring semester.

Water Rocks! is making an impact:

- **Classroom presentations:** Prior to the Water Rocks! presentation, only 41% of 4th-6th grade students could tell us what a watershed is. After the activities, 97% of the students answered correctly.
- **All-school assemblies:** Prior to the Water Rocks! assembly, only 35% of the student helpers could say what a watershed is and how water could be polluted. Afterwards, 96% of these students knew what a watershed was and could also successfully list key pollutants and key ways of cleaning water. In the beginning, only 10% of the students understood that they lived in a watershed—afterwards, 99% knew that they did!
- **Teachers:** 99% of teachers would recommend the Water Rocks! program to other teachers.

For more information:
www.waterrocks.org

There are currently over 100 Water Rocks! videos on YouTube and TeacherTube, with 376,000 combined views.

We have held 13 Water Rocks! Summit professional development workshops collectively reaching 263 teachers, 62 extension and environmental educators, and 14 high school student attendees from across Iowa and the Midwest. These interactive workshops include presentations by experts and the Water Rocks! team demonstrating how to use the original hands-on learning materials they developed for the classroom.

PARTNERING FOR SUCCESS

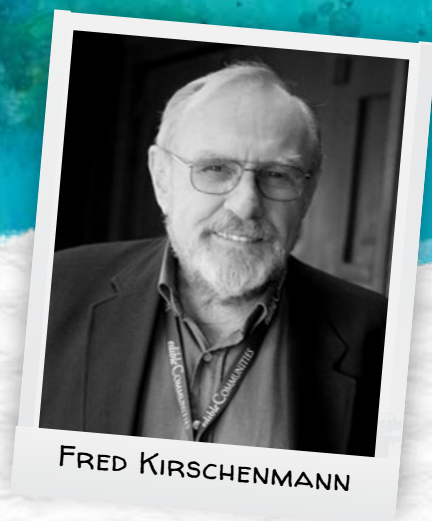
Iowa Learning Farms is a partnership among the Leopold Center for Sustainable Agriculture, Iowa Department of Agriculture and Land Stewardship, Iowa Department of Natural Resources (USEPA Section 319), Natural Resources Conservation Service, Iowa State University Extension and Outreach, Conservation Districts of Iowa, Iowa Farm Bureau, and Practical Farmers of Iowa.

Water Rocks! partners include the Leopold Center for Sustainable Agriculture, Iowa Department of Natural Resources (USEPA Section 319), Iowa State University Extension and Outreach, and personal gifts of support.



STONE BARNS CENTER FOR FOOD AND AGRICULTURE

Fred Kirschenmann, Distinguished Fellow, Leopold Center



As I think everyone on the Leopold Center Advisory Board of Directors knows, I now devote half of my career to work with the Leopold Center and half for the Stone Barns Center for Food and Agriculture in New York. This combination has been a truly inspiring part of my career. What I have learned from the Leopold Center's research and development over the past 30 years applies directly to the "regenerative" food and agriculture designs being developed on-the-ground by the Stone Barns Center and its collaborative Blue Hill Restaurant which operates on site.

Jack Algieri, the farm manager at Stone Barns who manages the 400 acre farming operation, and Dan Barber, the chef, who designs and manages the food system for his restaurant, have, over the past 20 years, developed an incredible working relationship that is grounded in the foundation of managing for healthy, self-renewing soil. As the farm manager, Jack now knows that the basis for a self-renewing farming system that requires no external inputs and constantly "brings soil back to life" is to manage for soil health. And as the chef, Dan has discovered that the most effective way to serve great tasting, health-promoting food in his restaurant is by serving "whole food, produced on the kind of healthy soil that Jack manages." As Dan puts it, "With this kind of whole food produced on healthy soil, we chefs don't need to manipulate food with external inputs to achieve good taste, we simply allow the natural flavors to express themselves."

As it turns out, much of what I learned through the research of the Leopold Center, and my experience on my own farm in North Dakota, now provides both Jack and Dan with valuable, foundational information on "how to bring soil back to life." So, the combination of working with the Leopold Center and the Stone Barns Center enables me to do work in a career that I could not imagine any better!

For more information:
www.stonebarnscenter.org

LEOPOLD LANDSCAPE ALLIANCE

Steve Brower, Leopold Landscape Alliance

Wow, Iowa Leopold Week in March is just around the corner! This makes us reflect on the good things that have happened to the Leopold Landscape Alliance (LLA) in 2019. The Alliance is a conservation non-profit and the owner of the Aldo Leopold Boyhood Homes in Burlington, Iowa. LLA board members include Steve Brower, Estella Leopold, Dave Riley, Jerry Rigdon, and Cliff Reif.

We started the year with several Leopold programs to conservation groups in the region, usually focusing on "Aldo Leopold and the Roots of the Land Ethic" to explain the importance of his childhood on the development of his values. We completed 10 programs like this during the year.

March started off with our annual reading of "A Sand County Almanac" at the childhood home on Clay St. Then to cap the Leopold March Celebrations we held our first conference: Leopold and Agriculture: Resilience and Sustainability in the Working Landscape. The program included 13 speakers from five states, with Mark Rasmussen speaking and helping facilitate the schedule. The weekend also included tours and an open house.

Throughout the year, work continued on various outreach programs. The LLA Native Land Management program helped several private landowners with restoration advice and actual boots-on-the-ground with the help of our volunteers. The sites included a prairie, savanna, streamside wetlands and dense oak forest.

The Leopold Exchange Program also took the "Roots" presentation out to Minnesota and Kansas colleges and NGOs as an introduction to the Leopold resources in Burlington. In exchange they brought some of their students and staff to visit Leopold's home so they could absorb more of Leopold's experience and walk in his footsteps. Previous visitors have commented about the significance of having a "moment with Aldo" in his home or old tramping sites.

The highlight of the year was the purchase of the Starker-Leopold House in June. This large Victorian, perched on the bluff above the Mississippi River, is Aldo's birthplace and teenage home sitting adjacent to the Leopold boyhood home. Reuniting the original Leopold compound for interpretation of Aldo's early education in nature creates a unique opportunity to study an Iowa conservation hero. A generous matching grant from Resource Enhancement and Protection Program's Historical Resource Development Program helped us purchase the Starker-Leopold House. The house will be open to the public with limited hours, starting in April, and our fundraising continues with private donations and other matching grants.

For more information:
www.leopoldalliance.org

We are beginning 2020 with mortgages to pay off, but high spirits. Our second conference will be held March 21, 2020 with the theme Leopold and Habitat Restoration for Future Generations, or Why Children Will Always Need Wild Lands. Look for the conference schedule and registration info on the LLA website at www.leopoldalliance.org.

Don't forget that we have a Researcher/Writer/Artist-in-Residence Program where Leopold fans can stay at the Leopold House to continue their work. For further information, contact Steve Brower, brower406@aol.com or 319-759-5062.

Stop by to see us when you are in Southeast Iowa—we have a lot to show you. Keep track of our progress on our website and follow us on Facebook at Leopold Landscape Alliance.



STARKER-LEOPOLD HOUSE
BURLINGTON, IA

THE H.A. WALLACE CHAIR AND THE LEOPOLD CENTER


Matt Liebman, Professor, Department of Agronomy

The Henry A. Wallace Endowed Chair for Sustainable Agriculture was established in 1997 with gifts from the Wallace Genetic Foundation and the W.K. Kellogg Foundation. Wallace was the founder of Pioneer Hi-Bred, a U.S. Secretary of Agriculture (1933-1940), a U.S. Vice-President (1941-1945), and a U.S. Secretary of Commerce (1945-1946). He was an Iowan, an ardent conservationist, a fervent supporter of rural communities, and a progressive leader in the fight to alleviate global hunger and poverty. The Wallace Chair was established as a faculty position at Iowa State University to ensure his ideas would be shared with future generations. More specifically, holders of the Wallace Chair are expected to:

- Provide leadership for the development and implementation of major educational and research programs concerning the sustainability of current and future agricultural practices;
- Explore new structures and relationships among the environmental community, consumers, agricultural producers, universities, and industry and governmental bodies;
- Enhance Iowa State University's ability to influence, support, and lead toward timely and appropriate changes for rural society, and better position the university to serve tomorrow's agriculture; and
- Develop educational materials and programs and report research findings to the scientific community, the citizens of Iowa, and the nation.

In addition to the representatives of the Wallace Genetic Foundation and the W.K. Kellogg Foundation, signatories to the memorandum of understanding creating the Wallace Chair included Iowa State University's President, the President of the ISU Foundation, the Dean of the College of Agriculture and Life Sciences, and the Director of the Leopold Center for Sustainable Agriculture. The Leopold Center was obligated to provide \$20,000 annually to support the activities of the Wallace Chair. The Wallace Chair was expected to "work with other sustainable agriculture programs in Iowa, including the Leopold Center, the Practical Farmers of Iowa, soil and water conservation districts, and other private and public entities as he or she sees fit on programs of mutual interest."

Dr. Lorna Michael Butler was the first person selected for the Wallace Chair and held the position from 2000 until her retirement in 2007. Her work focused on Iowa food systems and rural development, sustainability, and resilience in Africa.



Dr. Matt Liebman was selected for the position following Dr. Butler's departure. Liebman is a professor of agronomy and a fellow of the American Society of Agronomy. His research, teaching, and outreach activities focus on ways to improve environmental quality and agricultural productivity while reducing dependence on agrichemicals and fossil fuels. His specific interests include diversified cropping systems, weed ecology and management and the use of native prairie species for biofuel production and soil, water, and wildlife conservation. Funding from the Leopold Center has helped him support graduate students and conduct research.

Liebman was an original member of the group that started the STRIPS project (Science-based Trials of Row-crops Integrated with Prairie Strips), which was first funded by the Leopold Center in 2004. He and his students continue to be a part of the project, which now works with 66 collaborators on 81 fields across 6 states, with 621 acres of prairie strips planted to protect soil, water and wildlife on 5,557 acres of associated cropland. Results of the STRIPS project have been shared with soil and water conservation districts throughout Iowa. As of 2020, prairie strips are eligible for cost-sharing through the federal Conservation Reserve Program. The STRIPS team pioneered much of the research on prairie strips and helped develop the new USDA policy.

Liebman also serves as leader of the Marsden Farm cropping systems project. Established with Leopold Center support in 2001 and continued with funding from the U.S. Department of Agriculture, this project investigates how cropping system diversification and crop-livestock integration affect productivity, profitability, and environmental quality. Three systems have been compared within the experiment: a 2-year corn/soybean rotation, a 3-year corn/soybean/oat + red clover rotation, and a 4-year corn/soybean/oat + alfalfa/alfalfa rotation. Results of this long-term study indicate that diversification of conventional corn-soybean systems with small grains and forage legumes, coupled with integration of those systems with livestock, can allow for large reductions in the use of mineral fertilizers and herbicides and lead to less environmental damage, equivalent profitability, improved soil quality and higher crop productivity. The experiment has been featured by numerous state- and national-level media and is the source of 30 scientific publications.



GRAZING SYSTEM EFFECTS ON SOIL ORGANIC CARBON AND METHANE EMISSIONS IN SOUTHERN IOWA PASTURES

Jim Russell, Professor Emeritus, Department of Animal Science

RESEARCH REPORT

Previous research from locations in North America and Europe has shown that grasslands have the capacity to sequester nearly 1,100 tons of CO₂-carbon per acre annually as soil organic carbon (SOC). Grazing may result in annual accumulations or losses of SOC

as high as 670 tons/acre/year depending on previous land use, grazing intensity, soil texture, soil fertility, precipitation, and forage species. Rate of SOC accumulation in long-term grasslands may be limited as SOC approaches saturation levels. In comparison to ungrazed areas, SOC mass in cool season grass pastures on clay soils increased when grazed at low intensities but decreased at greater grazing intensities. However, there has been speculation that grazing management systems with short-term high stocking densities like mob or strip stocking would increase carbon sequestration as SOC.

Because methane has 25 to 30 times the global warming potential of carbon dioxide, enteric methane emissions from grazing cattle may offset 12 to 82% of carbon sequestration in pastures. Enteric methane emissions per unit of dry matter intake have been reduced by use of forage species or grazing management practices like rotational stocking that increase dry matter digestibility and/or reduce neutral detergent fiber concentration of forage selected by grazing cattle. However, because such management practices may also increase forage intake, these practices may cause no change or may even increase total daily enteric methane emissions. Therefore, the objective of this project was to quantify the effects of different stocking management systems on SOC quantities and enteric methane emissions from cool season grass pastures grazed by beef cows.

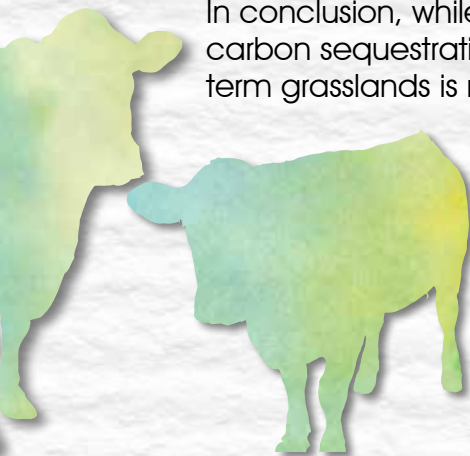
From 2012 to 2014, six 10-acre long-established pastures, containing tall fescue, reed canarygrass, smooth brome grass, orchardgrass, and small amounts of red clover and birdsfoot trefoil, were each grazed by eight August-calving Angus cows from May through October by either continuous, rotational, or strip stocking. Pastures stocked by rotational or strip stocking were each divided into 10 paddocks. Cows in the rotationally stocked pastures were offered live forage dry matter across each paddock at daily allowances of 4.0 to 6.0% of cow body weight as nutrient requirements increased from pregnancy into lactation assuming 50% forage removal with each rotation. In contrast, cows in strip stocked pastures were offered live forage dry matter in strips at 2.0 to 3.0% of cow body weight in strips that were moved daily, thereby allowing greater forage removal and less grazing selectivity. As a result of these management systems, while each paddock in the rotationally stocked pastures was stocked for 3 to 4 times per year with 4.4 day mean stocking periods and 34.0 mean day recovery periods, each paddock in the strip stocked pastures was grazed 1 to 2 times per year with 9.7 day mean stocking periods and 91.8 day mean recovery periods.



Soil organic carbon was measured in soil samples taken to a depth of 3 inches along transects at distances of 10 to 600 feet from the primary water troughs which were in position for 23 years of continuously stocked pastures and secondary water troughs in paddocks established at the start of the experiment in rotationally and strip-stocked pastures. Despite the large differences in the pattern of forage removal between stocking systems, SOC mass across the sampled areas did not change over the 29 months of this experiment in any of the stocking systems. As these pastures had been grazed pastures for at least 56 years prior to this experiment, SOC levels may have reached saturation resulting in this lack of change in SOC mass between management systems. Although total SOC masses did not differ between treatments, SOC mass decreased within 100 feet of the newly placed water troughs in rotationally stocked pastures, but increased at distances greater than 100 feet from the water trough as a result of the loss of forage growth near the water trough and greater forage growth away from the water trough. In contrast, total SOC mass increased within 50 feet of the water trough with concentration of manure nutrients, total SOC mass decreased at distances that were greater than 100 feet in strip stocked pastures but soil bulk density at these longer distances decreased.

Methane emissions were measured in two cows per pasture given a sulfur hexafluoride bolus as a marker gas and equipped with a collection halter for one week in June and August in 2013 and 2014. There was no difference in daily methane emissions between cows grazing continuously and rotationally stocked pastures. This lack of difference likely resulted from no difference in the concentrations of digestible dry matter or neutral detergent fiber in the live forage in the upper half of the sward which is the forage normally selected by grazing cattle. Furthermore, the daily forage allowance for cows in pastures grazing each of these stocking systems was high enough to allow cows to selectively graze this live forage. Daily methane emissions from cows grazing by strip stocking were 23% lower than those in continuously or rotationally stocked pastures in June. However, overall there were no significant differences in daily methane emissions between cows in the three stocking systems. As there were no differences in the concentrations of digestible dry matter or neutral detergent fiber in the live forage in the upper half of the sward between stocking systems in June, the difference in daily methane emissions between systems was likely the result of lower forage intake by cows in the strip stocked pastures during this period. In contrast, lower concentrations of digestible dry matter and higher concentrations of neutral detergent fiber in the live forage of the upper half of the sward in strip stocked pastures compared to continuously or rotationally stocked pastures likely increased methane emissions per unit of dry matter in August. However, the lower forage intake of cows in the strip stocked pastures likely resulted in no difference in daily methane emissions across the stocking systems.

In conclusion, while management practices like fertilization or irrigation may influence carbon sequestration as SOC in grasslands, SOC accumulation over a 3-year period in long-term grasslands is not affected by stocking system. As grazing management practices that improve forage digestibility also increase forage intake, these practices may reduce methane production per unit of forage dry matter intake, but not alter total daily methane emissions. This result implies that genetic selection of cattle that maintain or increase calf production with reduced feed intake through improved feed efficiency may be used to reduce total methane emissions by grazing cattle.



NUGGETS OF HISTORY UNDER OUR FEET

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Twelve thousand years ago, western Iowa was a very different place. The last of the Pleistocene ice sheets were receding, and the melting water created the Missouri River channel. The prevailing winds from the west blew particles of fine glacial debris into huge dunes and rolling hills, the loess deposits of western Iowa. University of Iowa botanist and naturalist Bohumil Shimek publishing in the 1890s first recognized that the hills and bluffs of western Iowa were formed by the winds as the glaciers were receding. As the newly deglaciated prairie grasslands advanced, they created a fertile prairie landscape which today is known as the Loess Hills.

The wind-blown loess contained a significant amount of calcium carbonate (up to 15% in some soils), in the form of the mineral calcite. This is easily confirmed by dripping dilute hydrochloric acid on a soil sample and watching the effervescence (bubbles and foam) that appears. This reaction results when carbon dioxide is released from the calcite minerals in the soil upon dissolution by the acid.

Another characteristic of loess is that it was deposited in thick layers (over 90 feet) in areas immediately adjacent to the Missouri River flood plain with shallower depths further east. The soils of the region consist predominantly of the Moody, Crofton and Nora series in some counties and the Ida and Monona series in others. These soils are calcareous due to calcium carbonate in the glacial parent material. While considerable work has been conducted on the organic carbon fraction in soils, due to its importance in soil fertility, the inorganic component (i.e. carbonate) has received much less attention.

These soils have another interesting characteristic in that they contain calcium carbonate nodules (loess dolls or lime concretions) at various depths in the soil profile. These nodules can range in size from small pebbles to the size of a golf ball. These nodules obviously did not blow in with the wind but were formed in place after the loess was deposited.

Our investigations show that loess nodules from western Iowa consist primarily of calcite as well as smaller portions of other calcium carbonate minerals including aragonite. Also present is a magnesium-containing variant, dolomite.

We are interested in these nodules because carbonate minerals form one of the largest reservoirs of carbon on the planet. Large-scale carbonate mineral formation draws down atmospheric carbon dioxide concentrations. Carbonate minerals are stable reservoirs of atmospheric carbon on time scales of hundreds, thousands, and even millions of years. The post-glacial formation of carbonate nodules in loess could have played a role in the long-term balance between atmospheric carbon and climate. Furthermore, if formation pathways are better understood, loess soils might offer a possibility for more contemporary carbon sequestration.

A major focus of our study is to understand the biological and chemical processes that result in carbonate nodule formation including the carbon source used in their formation. Our recent carbon-14 dating results suggest the nodules are a few thousand years old, much younger than the glacial landscape. Other isotopes of carbon—carbon-12 and carbon-13—indicate that the nodules may be formed from original soil calcite that dissolved and re-precipitated. We are also looking for evidence of biological processes, such as growth of nodules around plant roots.

Once we understand some of the basics about how carbonate nodules formed, we can begin to ask further questions: Is it possible to stimulate nodule growth today? Are there land management practices that dissolve, maintain, or grow the nodules? How much soil carbon is stored in this inorganic form in Iowa's soils?

Next time you're in the Loess Hills, take a moment to look for carbonate nodules, which are often visible in roadcuts or slopes (see photos at right). They may well represent both new and old possibilities for storing soil carbon.



**CALCIUM CARBONATE NODULES
FROM LOESS SOILS**



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