

2021-22 ANNUAL REPORT



W.K. Kellogg
Biological Station
MICHIGAN STATE UNIVERSITY



MOVING A LEGACY FORWARD



DEAR FRIENDS AND NEIGHBORS,

It's been a busy year at Kellogg Biological Station. We're excited to have welcomed four new faculty members over the past several months; I encourage you to learn more about them in this report. We hope to add another two faculty positions in the coming years, including a John A. Hannah Distinguished Professor.

Integral to welcoming these new researchers are our indefatigable staff members, who are essential to day-to-day operations at the Station. We could not conduct research, keep open the doors of the Manor House and Sanctuary, complete needed renovations such as those recently done at our historic Boat House, or maintain our grounds and buildings without their dedication to their work.



We continue to seek out new partnerships that further our research, education and outreach activities. One such collaboration is the creation of the MiSTRIPS program—an extension of an Iowa State University-based program that supports the adoption of the conservation practice known as prairie strips. MiSTRIPS offers programming and networking opportunities that connect area stakeholders with research in sustainable agriculture.

Finally, in these pages you can read about some of the fascinating research published over the past year by KBS scientists. Whether they are modeling the behavior of microbial communities, tracking antibiotic resistance in soil, or exploring how land management practices can help mitigate the effects of climate change, these studies—undertaken locally—have global impacts.

I hope you enjoy reading some of the year's highlights, and I look forward to seeing you at the Station.

With gratitude—
Fredric Janzen
KBS Director

THANK YOU

FOR YOUR GENEROSITY TO KBS IN 2021-22

Each year, contributions to KBS are made in memory or in honor of people whose lives have made lasting impacts. These gifts have been recognized in this list.

In memory of:

1. Mrs. Dorothy Ashley
2. Judy Geary
3. Barbara Hoag
4. Ms. Valerie Morel
5. Claudia Ploehn
6. Kathy Stansbury
7. Mrs. Tracy White

In honor of:

8. Stu Bassett
9. Dr. David G. Dvorak
10. Lisa Dvorak
11. Karol Peterson
12. Karen Wenk

BECAUSE OF YOUR SUPPORT:



The Bird Sanctuary's Paved Path received a fresh coat of asphalt, greatly improving accessibility for visitors.



The H. Wilson Cunningham and Jane A. Carstairs KBS Research Equipment and Instrumentation Fund was created to help defray equipment-related research costs.

\$10,000 and above

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NEW FACES IN THE FIELD

RECENT RESIDENT FACULTY HIRES EXPAND THE REACH OF KBS RESEARCH.

Over the past year, KBS has welcomed several new faculty members. They represent a continuation of the leading-edge science for which KBS is known, as well as an expansion of perspectives poised to enrich KBS research, education, and outreach activities.

Kadeem Gilbert joined KBS in August 2021 as an assistant professor in MSU's Department of Plant Biology. He earned his Ph.D. in biology from Harvard University.



KADEEM GILBERT

His research interests center on plants and their interactions with nearby animals or microbes that have physical contact with their leaf surfaces—how plants change the micro-environmental conditions of those surfaces to then affect what is able to live there.

“I also have a particular interest in carnivorous plants, especially the tropical pitcher plants of Southeast Asia,” Gilbert said.

Alisha A. Shah joined KBS in early 2022 as an assistant professor in the Department of Integrative Biology. She earned her Ph.D. in zoology from Colorado State University.



ALISHA A. SHAH

Her research focuses on the thermal physiology of organisms—how temperature impacts animals' adaptations to their environments. Specifically, Shah studies how temperature affects the physiological characteristics of aquatic insects and frogs.

“With my research,” Shah said, “I hope to not only learn more

about why animals live where they live, but also how they will respond to changing global temperatures.”

Anne M. Bronikowski also joined KBS and the Department of Integrative Biology in 2022 as a professor. She earned her Ph.D. from the University of Chicago.



ANNE M. BRONIKOWSKI

Her research focuses on life-history evolution: the way that life-history strategies affect outcomes in areas like lifespan and aging in reptiles and primates.

“Among species,” Bronikowski said, “I focus on specific traits, such as rate of aging, asking questions like ‘have cold-blooded tetrapods evolved slower aging than warm-blooded?’”

The newest resident faculty member is **Christine Sprunger**, an assistant professor of soil health in the Department of Plant, Soil and Microbial Sciences. She earned her Ph.D. from Michigan State University and did graduate work at KBS.



CHRISTINE SPRUNGER

Sprunger's research is focused on understanding how agricultural practices influence soil and rhizosphere processes for enhanced agronomic performance and ecological function.

“Much of my work falls within the intersection of agriculture and the environment,” she said, “so I am deeply invested in understanding how global climate change impacts crop productivity and ecosystem function within agroecosystems.”

We're thrilled to have Kadeem, Alisha, Anne and Christine at KBS and eager to see where their research takes them.

FORGING PARTNERSHIPS

SUSTAINABLE AGRICULTURE FOR POLLINATORS AND PEOPLE.

One of our most urgent challenges is squaring the need to produce enough food for a global population with the need to address the loss of biodiversity that results from converting land for agricultural use. KBS researchers, through regional and national partnerships, are working to contribute to a solution through the implementation and study of prairie strips.



SAMPLING INVERTEBRATES IN A PRAIRIE STRIP AT THE KBS LTER.

Prairie strips are a conservation practice that protects soil and water while providing habitat for wildlife. Ribbons of native prairie forbs and grasses are planted at intervals among row crops in agricultural fields. Active prairie strip studies are underway at KBS, visible from North 40th Street, through the KBS Long-term Ecological Research—LTER—and

Long-term Agroecosystem Research—LTAR—programs, the latter of which received full funding in 2021. Both programs are National Science Foundation-supported networks that together are comprised of 46 sites throughout the United States and beyond.

In late 2021, KBS formed a new regional partnership when it joined the Science-based Trials of Row-crops Integrated with Prairie Strips, or STRIPS, program. Since it was established at Iowa State University in 2007, the program has documented prairie strips' contributions to climate regulation, soil and water protection, and enhancement of biodiversity. Working with farmers and land owners, STRIPS has helped to devote more

than 112,000 acres of cropland to providing essential habitat for pollinators and other wildlife.

At KBS, the LTER and LTAR programs are collaborating with the STRIPS team to increase the adoption of prairie strips on agricultural landscapes across the Midwest. Through the development of the MiSTRIPS program, the KBS team is working alongside seven other contributing states to deliver programming and networking opportunities in an effort to increase the scale and adoption of prairie strips on area farms.



THE FIRST MISTRIPS EVENT WAS HELD AT HASENICK BROTHERS FARM IN AUGUST 2021.

“Within LTAR we have an exciting place to understand the mechanism of how aspirational agriculture can work, but to really work, it has to have a positive impact for our stakeholders,” said Nick Haddad, director of the KBS LTER and co-principal investigator of the MiSTRIPS program. “MiSTRIPS is a program that allows us to connect LTAR research to our stakeholders.”

“The sustainability of our agricultural systems impacts us all, but sustainability will be hard to achieve if we are not working toward a unified goal and on a larger scale,” said Fahimeh Baziari, MiSTRIPS project coordinator. “MiSTRIPS gives us an opportunity to coordinate with multiple stakeholders to increase conservation practices at the landscape level.”



TINY COMMUNITIES, OUTSIZED INFLUENCE

Microscopic communities make up the foundation for all ecosystems and are essential our well-being, yet their interactions and relationships aren't well-understood.

With that in mind, a community of scientists from Michigan State University and the University of California, Los Angeles, are designing a multifaceted approach to investigating one of the most complex and abundant communities on Earth. The research team includes KBS faculty members and MSU Foundation Professors Elena Litchman and Christopher Klausmeier.

The project is funded with a NSF "10 Big Ideas" grant.

"In any ecological community you have members interacting with each other; they can compete for resources, or they can benefit each other by providing each other with resources," said Litchman. **"We are taking principles from the community ecology of other systems and applying them to microbial communities."**

New research conducted at KBS has showed that dead bacteria can spread antibiotic resistance in soil after their demise, through a process called horizontal gene transfer. The study was led by Heather Kittredge, a former graduate student in the Evans Lab who now is a post-doctoral researcher at the University of Connecticut. KBS faculty member Sarah Evans also contributed to the project.

In the study, the team collected soil samples from sites around KBS, sterilized the soil and added living cells of the soil bacteria *Pseudomonas stutzeri* along with DNA from antibiotic-resistant forms of *P. stutzeri*. They then observed how often the living cells incorporated the DNA under different conditions.

They found that live bacteria could integrate the DNA even when it was present at low concentrations.

"Overall, this work demonstrates that dead bacteria... are an overlooked path to antibiotic resistance," wrote the team.



UNDETERRED BY DEATH



SOWING THE SEEDS OF A CAREER

In 2019, Sarah Johnson joined KBS for a summer through the Undergraduate Research Assistantship, or URA, program. Together with her mentor, former KBS graduate student Meredith Zettlemoyer, she developed a study that culminated in the publication of her research earlier this year.

“[Zettlemoyer] and I wanted to incorporate my interests with her ongoing study investigating potential causes of local prairie plant losses from Kalamazoo County. We studied if small mammals, like mice or voles, could play a role in the population declines through their consumption of seeds.”

Said Zettlemoyer, **“Sarah’s project is a great example of how an undergraduate project at KBS can blossom into an independent research experience. She took the lead on every aspect of this project, from design to writing, and it was so rewarding to watch her grow as a scientist.”**

Nature-based solutions like storing carbon in trees and soil are key climate change mitigation strategies, as is bioenergy coupled with geologic carbon storage. Research from KBS faculty member and MSU Distinguished Professor Phil Robertson reveals that integrating these approaches is more efficient than expected from analyses of each alone.

Land management—such as reforestation or using agricultural practices like no-till farming—has long been known for its potential to curb emissions. Bioenergy uses plant-based fuels to run cars on ethanol or electricity, and during its production the carbon dioxide it releases can be geologically sequestered belowground.

“Using only land management or bioenergy in an either-or scenario turns out to be shortsighted,” said Robertson. **“When we combine them, we find potential carbon dioxide storage capacity levels that neither approach alone can attain.”**



A ONE-TWO PUNCH FOR CLIMATE CHANGE MITIGATION



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DIRECTOR'S ADVISORY BOARD



DAB MEMBERS AND OTHERS TOUR RESEARCH PLOTS AT LUX ARBOR RESERVE.

The Director's Advisory Board does important work for KBS. Its charges include giving input on public programming, advocating for KBS in the community, and connecting with friends and alumni of the Station.

We're grateful for the support and guidance provided by the Board collectively and its members individually.

2021-22 Director's Advisory Board members:

David Dvorak, Becky Eldridge, Betsi English, Mike Gallagher, B. William Maxey, Carole Mendez, Sarah Sandell, Steve Sutherland, Christopher Tracy, and William Uggen.