LTAR Newsletter January 2025

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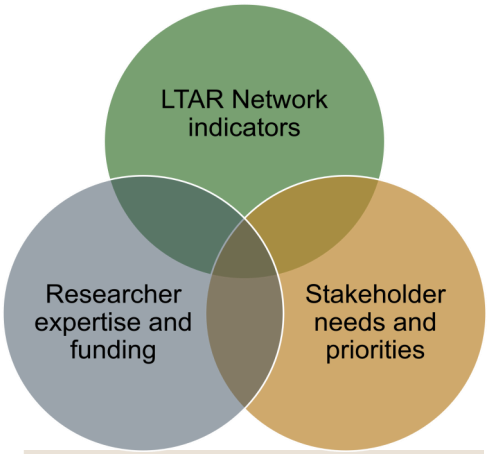
Kellogg Biological Station
Long-Term Agroecosystem Research

A note from the director — roadmap for research at the KBS LTAR

Phil Robertson

Long term research starts with an overarching question that can only be informed by long-term observations and experiments. KBS LTAR is no exception – together with stakeholders, we aim to inform the development of row crop systems for the future: to paraphrase our Stakeholder Advisory Board, to bridge the gap between agricultural systems of today and those needed by the next generations. Along the way are answers to questions that will have more immediate application.

In workshops over the past year we have identified six broad themes that can effectively frame our efforts: crop diversification, nutrient cycling and livestock integration, tillage management, precision inputs and conservation, and soil health. Underpinning all is system integration—how overall systems interact to provide key ecosystem services: resilient and profitable yields, clean water, healthy soils, biodiversity conservation, climate (greenhouse gas) mitigation, and social well-being. By addressing questions generated by researchers, stakeholders, and indicators measured across the LTAR Network, results from the Aspirational Cropping System Experiment will inform practices that will make a difference both near and long term.



KBS LTAR research is guided by three groups and impact will be greatest at the overlap.

An artist's LTAR perspective: Appreciation of the patchwork

"Quilt" wood-block print rendition of KBS LTAR plots by KBS LTER artist in residence, Trevor Grabill.

Kalamazoo printmaker Trevor Grabill captured the beauty of the patchworked LTAR experimental plots during their time as Artist in Residence at KBS. Trevor sat on a hill overlooking the Aspirational Cropping Systems Experiment when they first sketched "Quilt". Working from this sketch, Trevor made the print by hand-carving wooden stamps of various sizes, adding ink, and then using a small press to layer colors and textures. The residency is supported by the KBS Long-Term Ecological Research program. For more information visit lter.kbs.msu.edu/get-involved/artists-in-residence/

ASP corn harvest in one of the scale-up fields

Lisa Hargest and Christine Sprunger sample soils

Agronomy and Economics

Brook Wilke

The 2024 season started warm and wet, in contrast to the cool and dry conditions of 2023. Conditions shifted to a drought in August/September, leading to overall lower-than-average precipitation for the 2024 growing season. Highlights for the 2024 growing season include:

- A mild winter/wet spring led to slug outbreaks and severe damage to ASP soybeans, necessitating replant.
- Intense rainfall on May 8th caused substantial erosion and compaction in BAU fields. This led to poor stands in BAU corn, while ASP crops were unaffected.
- More Growing Degree Days (GDD) in spring accelerated crop phenological stages and shortened grain fill periods for winter wheat and canola.
- Corn and soybeans had high yields in both systems, but late summer drought reduced grain size and yield.
- Perennial forages were harvested 3 times. The first cutting included a significant proportion of volunteer winter canola. This led to high yields but lower feed quality.
- ASP soybean and ASP canola fields were negatively impacted by wildlife, particularly deer and groundhogs.

Overall, the ASP cropping system was ~10% less profitable than the BAU system at the plot scale (see table) and profit margins diverged further in the scale-up fields.

2024 SUMMARY	Business-As-Usual (BAU)		Aspirational (ASP)	
Crop	**Yield**	**Profit**	**Yield**	**Profit**
Corn	216.4 Bu/A	$287.88/A	226.2 Bu/A	$379.72/A
Soybeans	77.5 Bu/A	$473.43/A	59.8 Bu/A	$228.71/A
Wheat Grain			*95.4 Bu/A*	*$226.24/A*
Wheat Straw			*1.0 Tons/A*	*$67.70/A*
Cover Crop Forage			*1.7 Tons/A*	*$57.79/A*
ASP Wheat Total				$351.72/A
ASP Winter Canola			2,351 lbs/A	$287.85/A
ASP Forage			6.2 Tons/A	$467.30/A
Whole System		**$380.66/A**		**$343.06 A**

On-Farm Climate Research

Monica Jean

A newly funded Agricultural Climate Resiliency project "Ensuring the success of Michigan farms in the face of climate change" led by PI Dr. Christine Sprunger seeks to understand how climate change and extreme weather events impact crop yields, soil health, greenhouse gases, and the economic well-being of farmers across Michigan. Researchers will explore how regenerative agriculture practices affect soil health and yield stability, as well impacts on climate adaptation and mitigation. This effort is led by a team of Extension Educators and faculty from across Michigan State University.

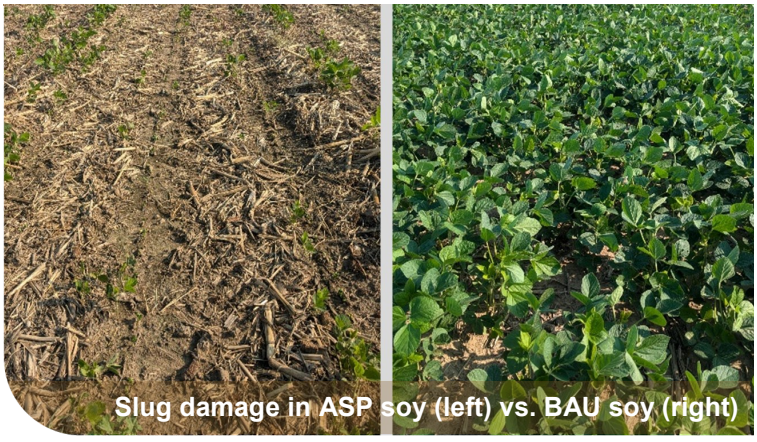
Farmer partner, Darin Labar, works with MSU researchers to study the soil health of his field.

In fall 2024, the research team enrolled 91 farmers and sampled soil on 187 fields across 39 counties. Farmers will receive a comprehensive soil health report and contribute to state efforts of creating a regional soil health database.

In 2025, a subset of 25 farmers will be selected to further participate in the two-year study, which will include collecting soil and greenhouse gas samples throughout the growing season. The project includes interviews and opportunities to network with other farmers, commodity groups, and researchers.

The LTAR is excited by this project because it will allow us to see how practices in our plot- and field-scale experiments function across the many soil types and weather regimes in Michigan. Furthermore, we hope that on-farm collaborations will stimulate new ideas for the next version of the LTAR Aspirational cropping system, which will be updated in 2026.

Annabelle McCarthy studies butterflies in prairie strips



Slug damage in ASP soy (left) vs. BAU soy (right)

Prairie for Pollinators and Pocketbooks

Annabelle McCarthy and Rachel Drobnak

One conservation practice gaining traction in Michigan is prairie strips which involve converting up to 10% of crop fields to a mixture of perennial grasses, flowers, and forbs. Compared to other conservation practices, prairie strips require minimal management and provide multiple environmental benefits.

In her studies, MSU PhD student Alice Dykstra found that prairie strips support a high abundance and species richness of pollinator bees and butterflies. Prairie strips were beneficial regardless of their position in the field or the surrounding crop type.

MSU MS student Annabelle McCarthy is researching how prairie strips affect butterfly survival and reproduction compared to habitat in the surrounding landscape. She found that butterflies laid the greatest number of eggs in prairie strips, and that predation of the eggs was also lower in prairie strips. From a predation perspective, prairie strips could act as a refuge for butterfly populations.

MSU PhD student Rachel Drobnak worked with a team of scientists, economists, and Extension educators to develop an adjustable partial budget tool to help farmers navigate the costs and savings associated with prairie strips. The tool predicts that prairie strips could save farmers money if planted in areas where crops yield below 50% of the statewide average.

Prairie strips are a novel part of the LTAR Aspirational Cropping System Experiment at both the plot and field scales.

New Long-Term Pest Monitoring

DeShae Dillard and Hannah Burrack

In 2024 KBS LTAR investigators initiated a long-term pest monitoring program. Efforts focused on three objectives: 1) monitoring established and emerging pest arthropods in row crops, 2) enhancing pest management and agronomic outcomes, and 3) broader integration with ongoing research. Key pests include slugs in soybean and cabbage, and seedpod weevil and lygus bugs in canola (Table 1).

Increased slug pressure in Aspirational (ASP) soybean—compared to business-as-usual (BAU) soybean—caused substantial defoliation by early June, necessitating replanting (Top Image). Slugs are a known pest in no-till systems with high plant residue, but populations vary seasonally among crops. For instance, populations may build-up in ASP corn with minimal damage until soybeans are planted the next year. Other crops in the ASP system may also experience slug damage; we will continue monitoring.

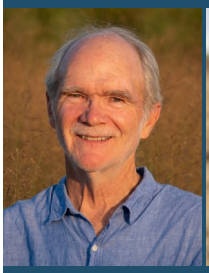
Knowledge of effective canola management in Michigan is limited. The Canola Council of Canada established economic thresholds for canola pests; however, these were developed for spring canola and may not be relevant to the winter canola in Michigan. Both cabbage seedpod weevil and lygus bug reached this threshold; Michigan canola may benefit from a regionally-adapted management program.

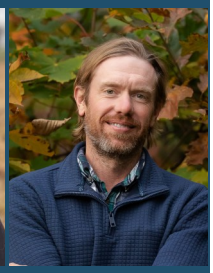
Table 1. Pests found in LTAR Experiment plots, May-Oct. 2024

Crop	Pests
Corn (ASP & BAU)	Fall Armyworm (P), Corn Earworm (P), European Corn Borer (P), Slugs (S), Corn Aphid (DO)
Soybeans (ASP & BAU)	Slugs (S), Soybean Aphid (DO), Spider Mite (DO), Japanese Beetle (SN), Bean Leaf Beetle (SN), Green Cloverworm (SN), Soybean Looper (SN)
Wheat (ASP)	Slugs (S)
Winter Canola (ASP)	Slugs (S), Diamondback Moth (SN), Cabbage Seedpod Weevil (SN), Lygus Bug (SN)
Four different methods used for monitoring— P: Pheromone trap May-Sept; S: Shingle; DO: Direct Observation, SN: Sweep Net	

OUR TEAM

Leadership





Phil Robertson Tayler Ulbrich Brook Wilke

Scientific Steering Committee

Bruno Basso, Hannah Burrack, Sarah Evans, Nick Haddad, Sasha Kravchenko, Doug Landis, Sandy Marquart-Pyatt, Christine Sprunger

Systems Integration Team

Dean Baas, Jennifer Blesh, Tim Boring, Kim Cassida, Marc Hasenick, Manni Singh

Stakeholder Advisory Board (2024)

Laura Campbell (Chair), Adam Reimer (Vice-Chair), Christine Charles, Julie Doll, Colleen Forestieri, Randy Heinze, Cade Klein, Henry Miller, Mark Mills, Emily O'Halloran, Kristin Poley, Sherman Reed, Melissa Shaw, Jason Stegink, Ben Wickerham, Lisa Woodke

Upcoming Events

June 10: Food-Grade Grains Field Day
partnership with MiAA and MSU Extension

September 4: LTAR Field Day
partnership with MSU Extension

Contact Us

Email Kbs.ltar@msu.edu to get involved or be included in our list-serv.

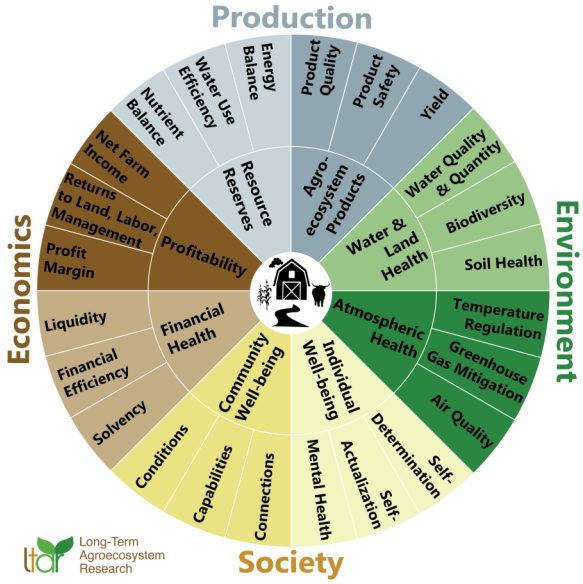
Website: ltar.kbs.msu.edu

Photo Credits: Brook Wilke, DeShae Dillard, Garret Morgan

LTAR Network Indicator Framework

Brook Wilke and Sheri Spiegal

Agricultural systems are expected to produce a steady supply of food and fiber while ensuring environmental quality and well-being into the future. Farmers and scientists are working together to test a diversity of management strategies that may help achieve these lofty goals, but a common way to identify and communicate which strategies are working best is needed. The LTAR Network, under the direction of Dr. Teferi Tsegaye, created an Indicator framework that provides a robust definition of what we care about from agroecosystems, as well as a platform to measure changes in those characteristics at research stations and on farms. Four domains (Production, Environment, Society and Economics) provide a foundation for evaluating farms, including multiple indicators within each domain (see figure). KBS LTAR is using this framework to build a set of metrics to evaluate the performance of the ACSE, and inform measurement decisions for on-farm research.



Concepts for indicators and metrics have evolved since 2018, first at national LTAR Network meetings and later with a formalized consensus process in the LTAR Indicators Working Group. The system is intended to eventually explore indicators at multiple scales (e.g., nation, region, landscape, farm/ranch, field). The LTAR Network is currently focusing on the farm/ranch scale to connect and standardize LTAR Common Experiment measurements, as well as to provide tools for other scientists and producers working at these scales.

Staff Appreciation

The KBS LTAR functions with the help of many, and we are deeply grateful. This year we give a special thanks to Kevin Kahmark and David Weed. David has been with KBS for 24 years, and Kevin 16 years. In 2024 they worked for months to install 96 lysimeters on the ACSE, as well as an eddy covariance tower. These instruments will help us measure ground water quality and greenhouse gas exchange for years to come.

David Weed (left) and Kevin Kahmark (right) installing lysimeters in the ACSE.

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