

Welcome

2016 KBS LTER All-Scientist Meeting
September 16, 2016

State of the Project

Where we are, where we're headed, opportunities

Phil Robertson

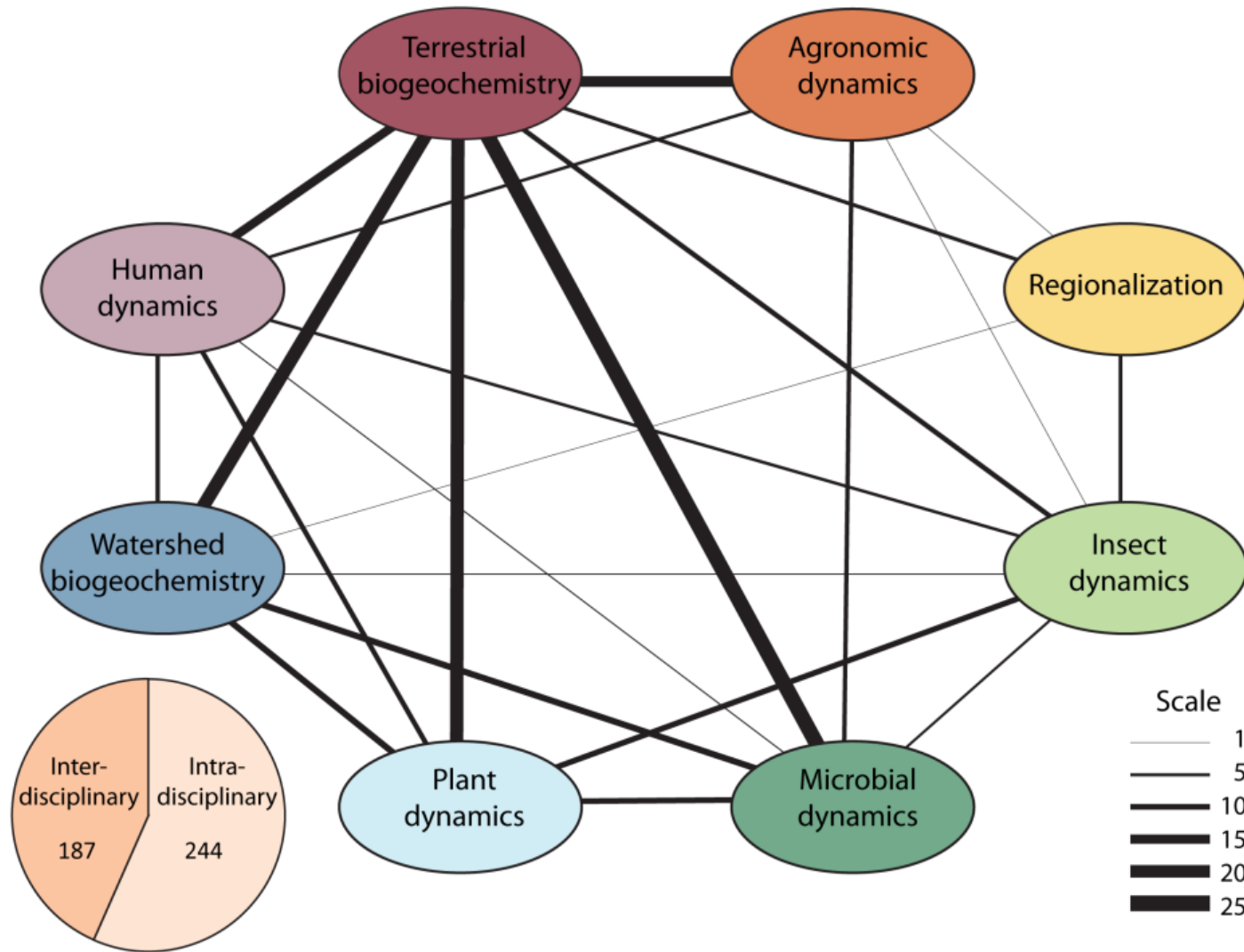


AgBioResearch
MICHIGAN STATE UNIVERSITY



KBS LTER
Kellogg Biological Station
Long-term Ecological Research

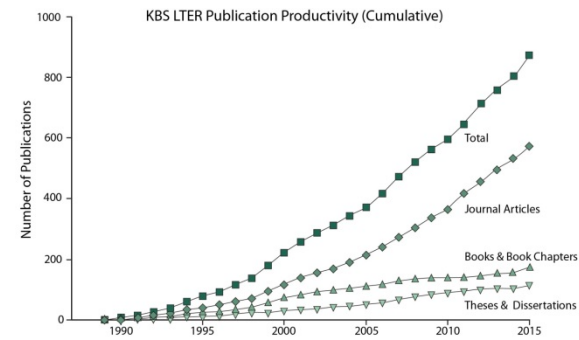
KBS LTER Cross-disciplinary (Cross-laboratory) Publications



Based on co-authorship analysis; n=431 publications 1999-2013

Long-term Ecological Research in Agricultural Landscapes

- 29th year (from 1988)
 - PI group currently includes Phil Robertson, Steve Hamilton, Kay Gross, Doug Landis, Tom Schmidt, Sieg Snapp, Scott Swinton
 - 30th year begins a new funding cycle (more later)
 - 50 co-investigators; 8 other universities besides MSU
 - 58 externally funded projects working on site in 2016
 - 5-7 dissertations per year; 70 pubs in 2015 (lter.kbs.msu.edu)
 - Growing data catalog, well-used (workshop tomorrow)
- 2015 National All Scientist Meeting big success!
- 2015 Publication of our site synthesis volume!

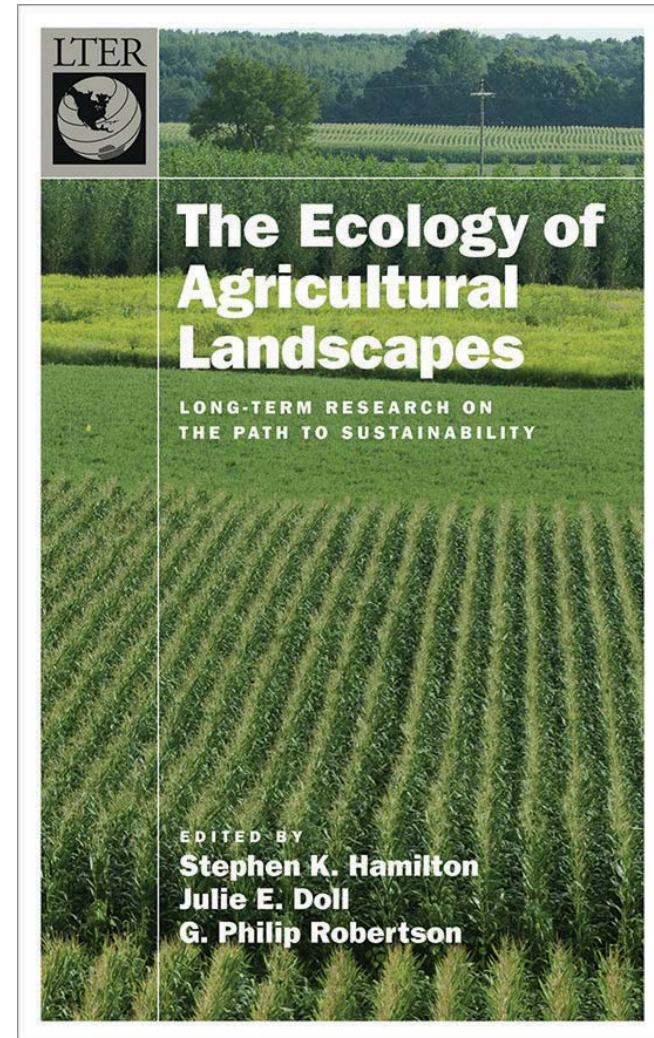


The Ecology of Agricultural Ecosystems: Long-term Research on the Path to Sustainability

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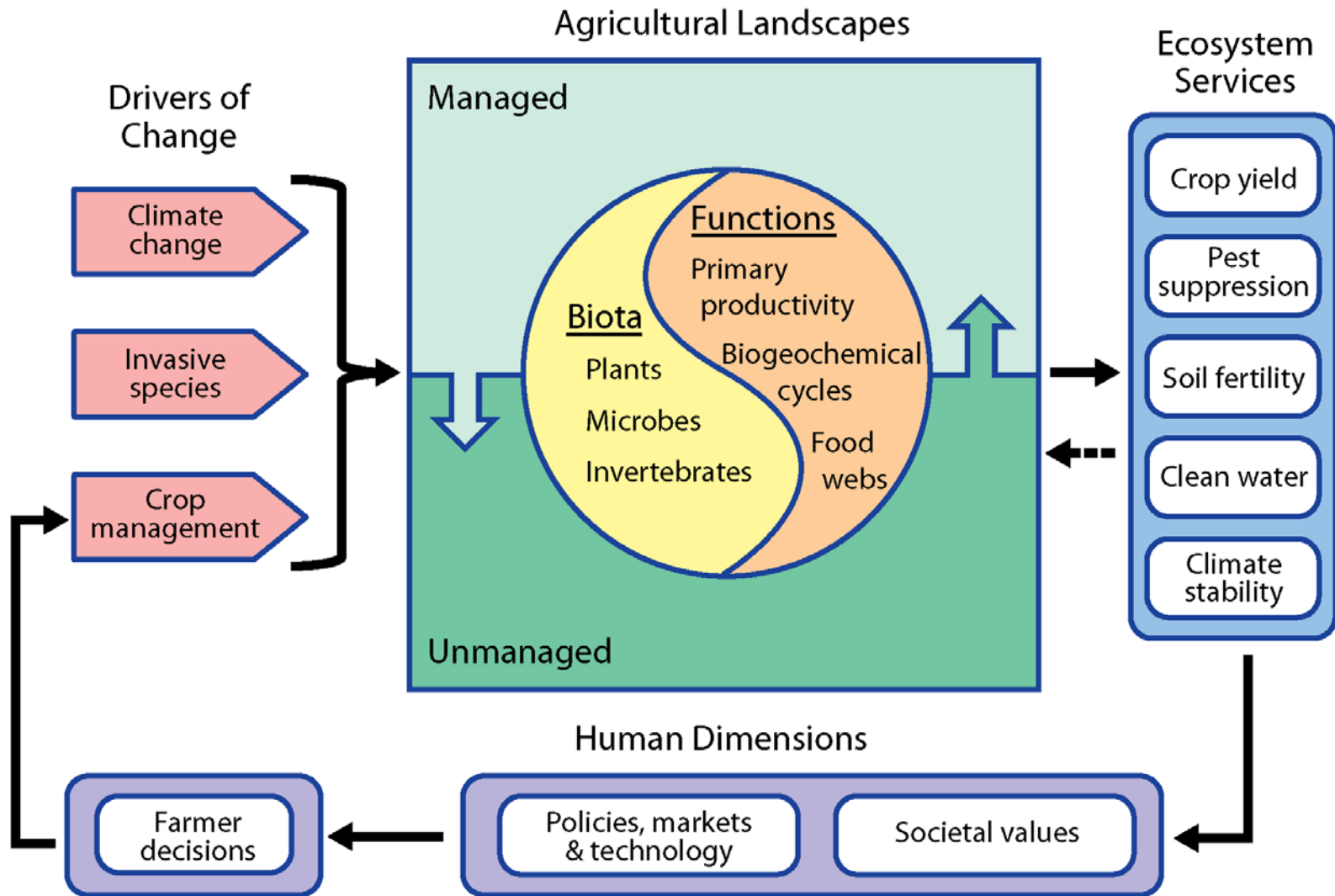
Chapters available (legally) at
lter.kbs.msu.edu/synthesisbookchapters/



Long-term Ecological Research in Agricultural Landscapes

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- 2016 Proposal Funded (!)
 - PI Transitions: Steve Hamilton (Director), Sarah Evans, Doug Landis, Jen Lau, Scott Swinton, Sandy Marquart-Pyatt, Phil Robertson
 - *Long-term Stability of Ecosystem Services*

The Long-term Stability of Ecosystem Service Delivery



KBS LTER Original Overarching Question

To what extent can we manage agricultural systems with biology rather than chemistry?

– while maintaining / enhancing ecosystem services...

- High yields*
- Environmental performance*

Long-term Ecological Research in Agricultural Landscapes

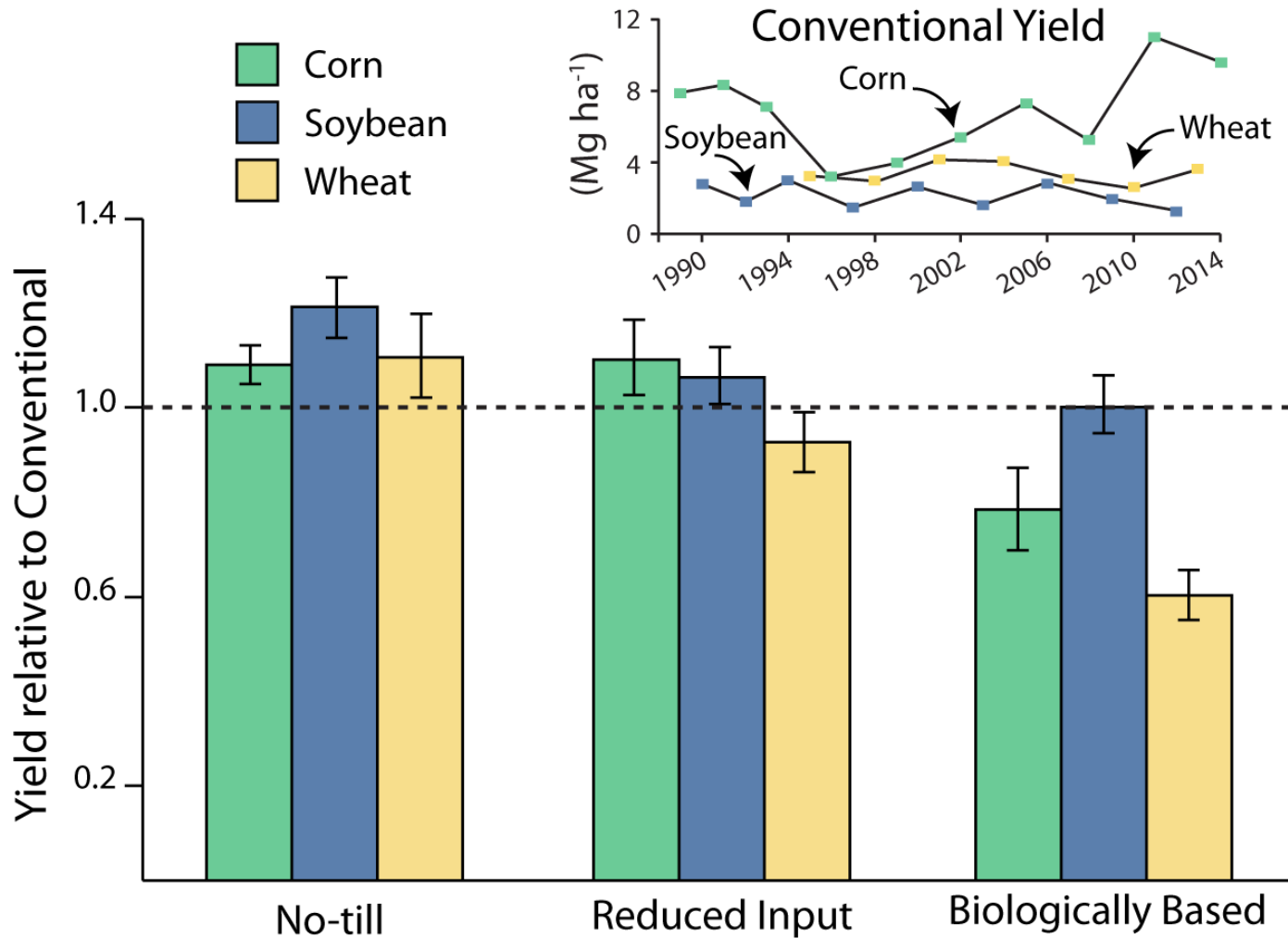
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 - *Long-term Stability of Ecosystem Services*
 - Kudos for our accomplishments: “...has had a strong influence on our understanding of how agroecosystems function, as well as management strategies for human-dominated ecosystems. In addition, this work has made significant contributions to basic knowledge....”

KBS LTER Main Cropping System Experiment (MCSE)

Ecosystem Type	Management Intensity
<i>Annual Grain Crops (Corn - Soybean - Wheat)</i>	
Conventional tillage	High
No-till	
Low-input with legume cover	
Organic with legume cover	
<i>Perennial Biomass Crops</i>	
Alfalfa	
Hybrid poplars	
<i>Unmanaged Communities</i>	
Early successional old field	
Mid successional old field	
Late successional forest	Low



KBS LTER Relative Yields (1989–2015)



A complex question that requires diverse knowledge.....

Insect predator-prey relationships that control pest populations



Microbe-soil-plant interactions that control soil nutrient availability



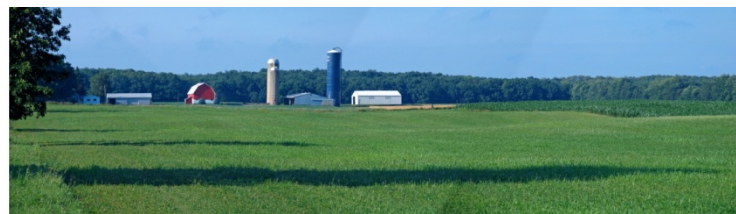
Competition among weeds and crops for limiting resources



The loss of nutrients to groundwater, surface waters, and to the atmosphere



The valuation of ecosystem services provided by agriculture



Main Cropping System Experiment (MCSE) Site Layout

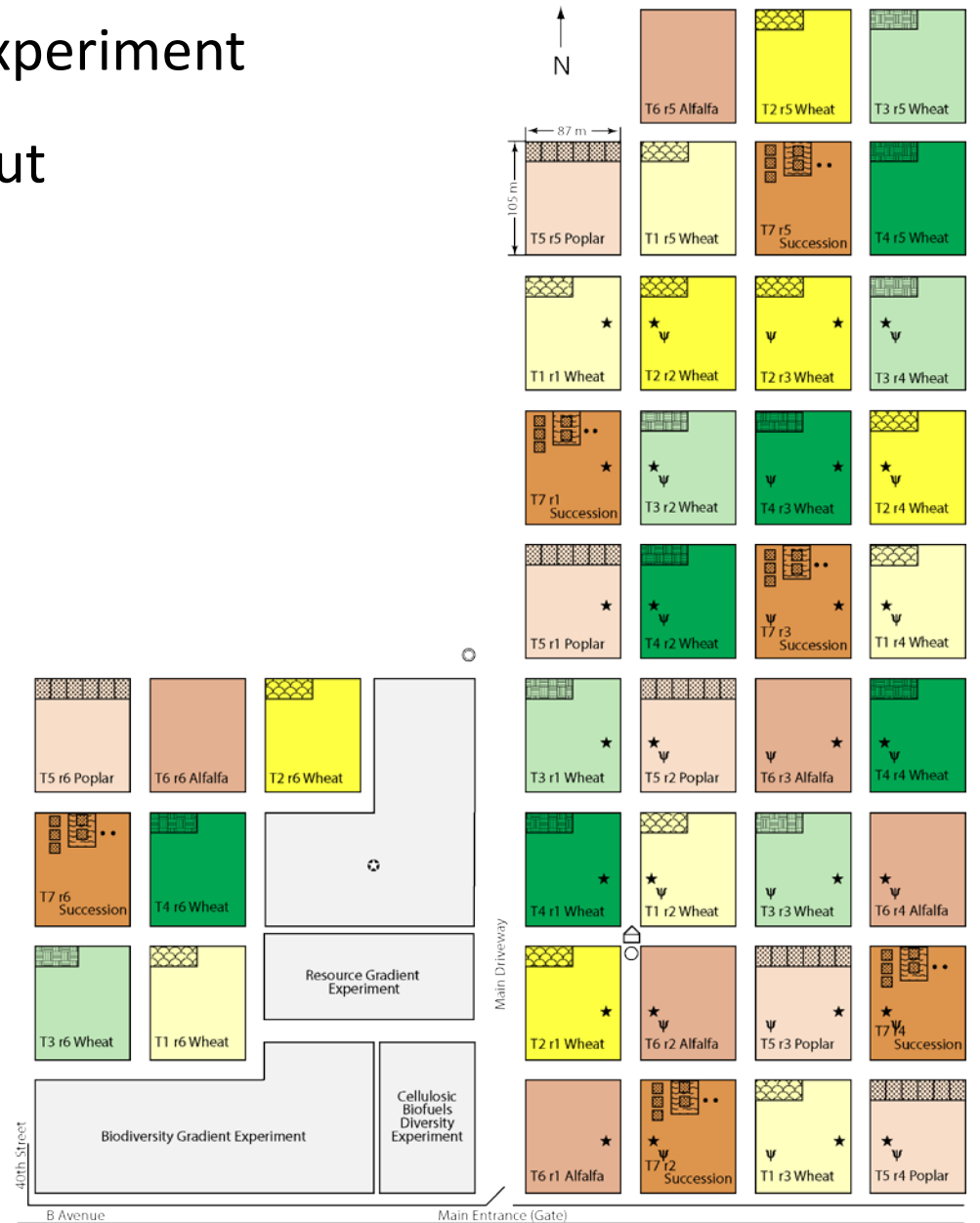
Main Cropping System Experiment

Treatment Key

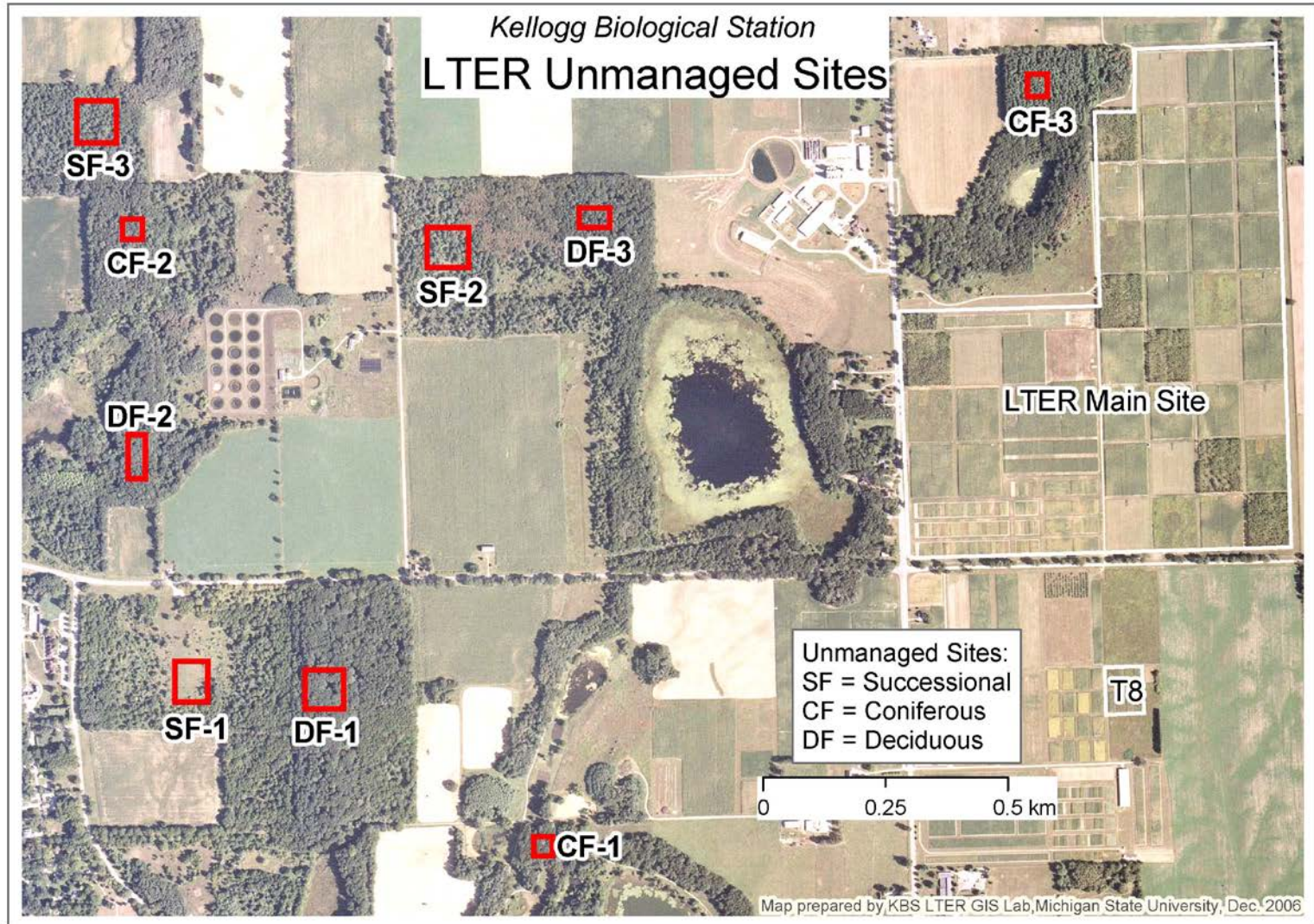
- T1 Conventional corn/soybean/**wheat**
 - T2 No-till corn/soybean/**wheat**
 - T3 Reduced Input corn/soybean/**wheat** with cover crop
 - T4 Biologically Based corn/soybean/**wheat** with cover crop
 - T5 Poplar
 - T6 Alfalfa (Wheat in 2016, back to alfalfa in 2017)
 - T7 Early Successional community
 - T8 Mown Grassland (never tilled) community
- r = replicate number

Microplot Treatment Key

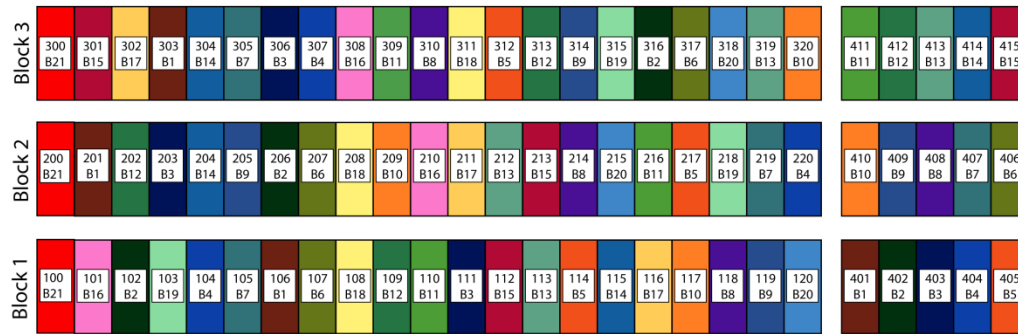
- Nitrogen fertilized
- Tillage (T7)
- Herbicide-free
- Nitrogen fertilized and weed-free



Main Cropping System Experiment (MCSE) Unmanaged Sites



Biodiversity Experiment



Block 4

Treatment	Description	System
B1	F _{fall}	A
B2	F _{spring}	A
B3	C _{cov2} - S - W _{cov2}	B
B4	S - W _{cov2} - C _{cov2}	B
B5	W _{cov2} - C _{cov2} - S	B
B6	C _{cov1} - S - W _{cov1}	C
B7	S - W _{cov1} - C _{cov1}	C
B8	W _{cov1} - C _{cov1} - S	C
B9	C - S - W	D
B10	S - W - C	D
B11	W - C - S	D
B12	C - S	E
B13	S - C	E
B14	W - S	E
B15	C _{cov1}	F
B16	S _{cov1}	F
B17	W _{cov1}	F
B18	C	G
B19	S	G
B20	W	G
B21	T	H

Description Key

F = Fallow
 S = Soybean
 C = Corn
 W = Wheat
 T = Tilled and cultivated
 cov1 = 1-species cover (legume)
 cov2 = 2-species cover (legume + small grain)

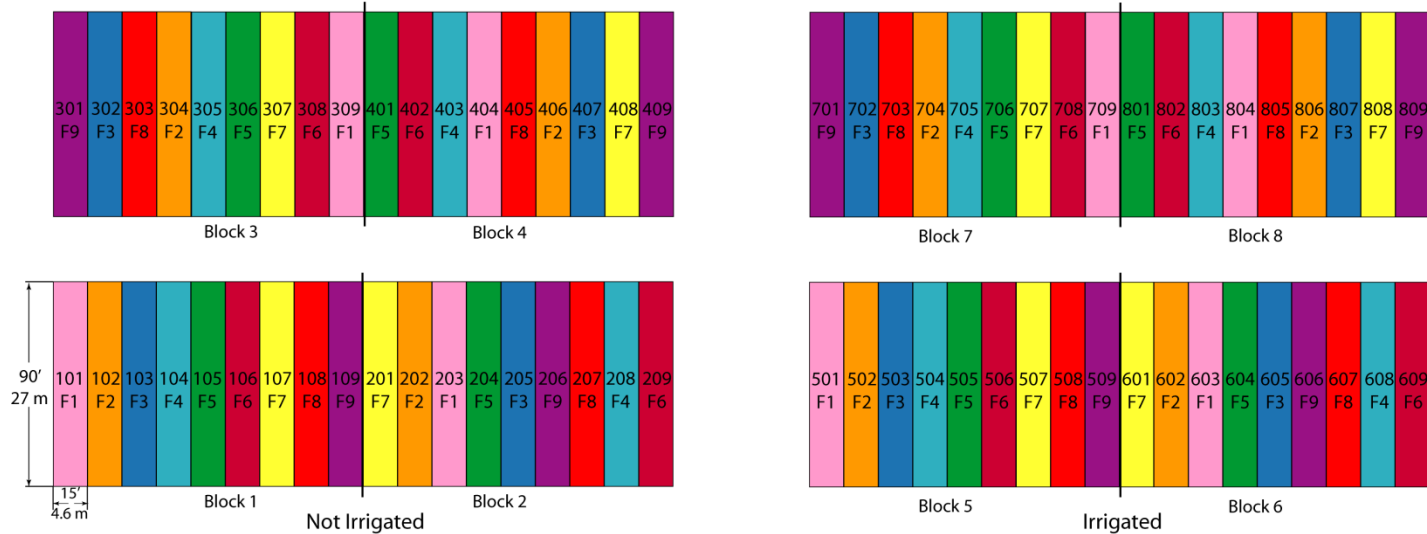
Location within main LTER site



System Key	Trt	Total Species	Species/year
A	B1-2	20+	10-12
B	B3-5	6	1-3
C	B6-8	5	1-2
D	B9-11	3	1
E	B12-14	2	1
F	B15-17	2	2
G	B18-20	1	1
H	B21	0	0

All treatments established May 2000.
 Each plot is 30' X 90' (9.1m x 27.4m)

Resource Gradient Experiment: Nitrogen x Water



Nitrogen Amounts in Corn Crop Years

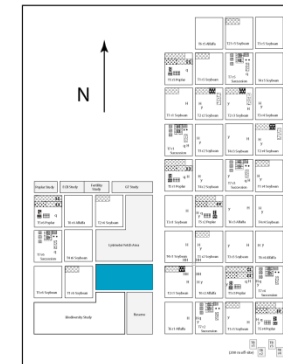
Treatment	F1	F2	F3	F4	F5	F6	F7	F8	F9
N(lb/a)	0	30	60	90	120	150	180	220	260
N(kg/ha)	0	34	67	101	135	168	202	246	291

Nitrogen Amounts in Winter Wheat Years

Treatment	F1	F2	F3	F4	F5	F6	F7	F8	F9
N(lb/a)	0	20	40	60	80	100	120	140	160
N(kg/ha)	0	23	45	67	90	112	135	157	180

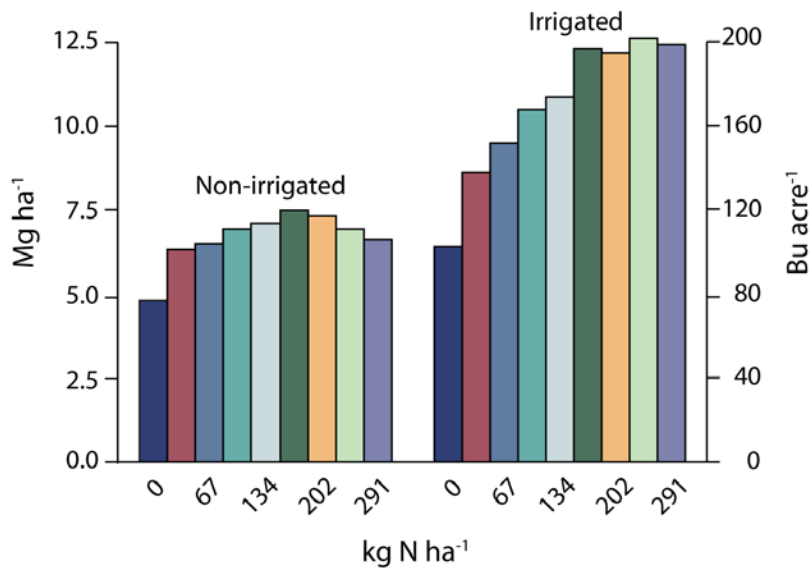
All treatments established May 2005
Each plot is 15' x 90' (4.6 x 27.4 m)

Location within main LTER site

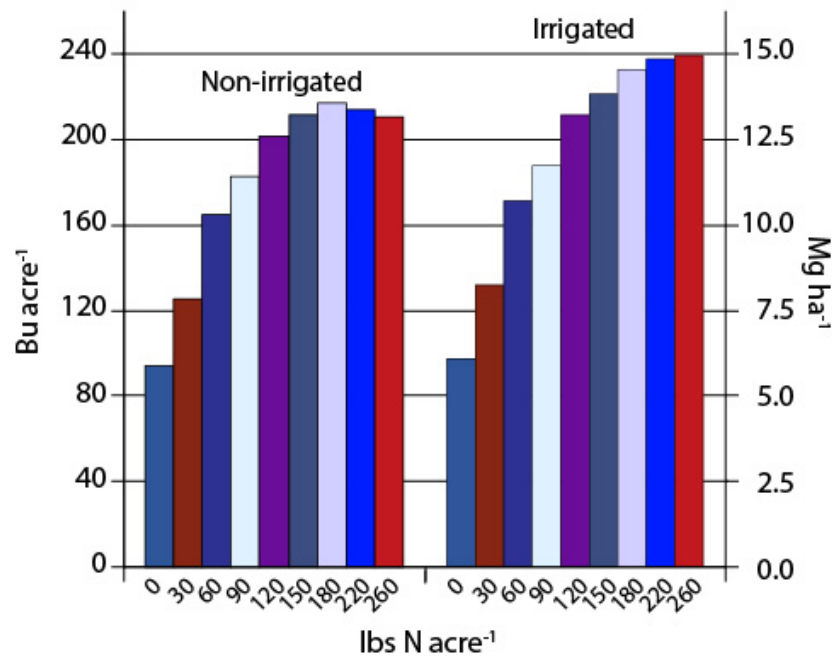


KBS corn yields at different N rates

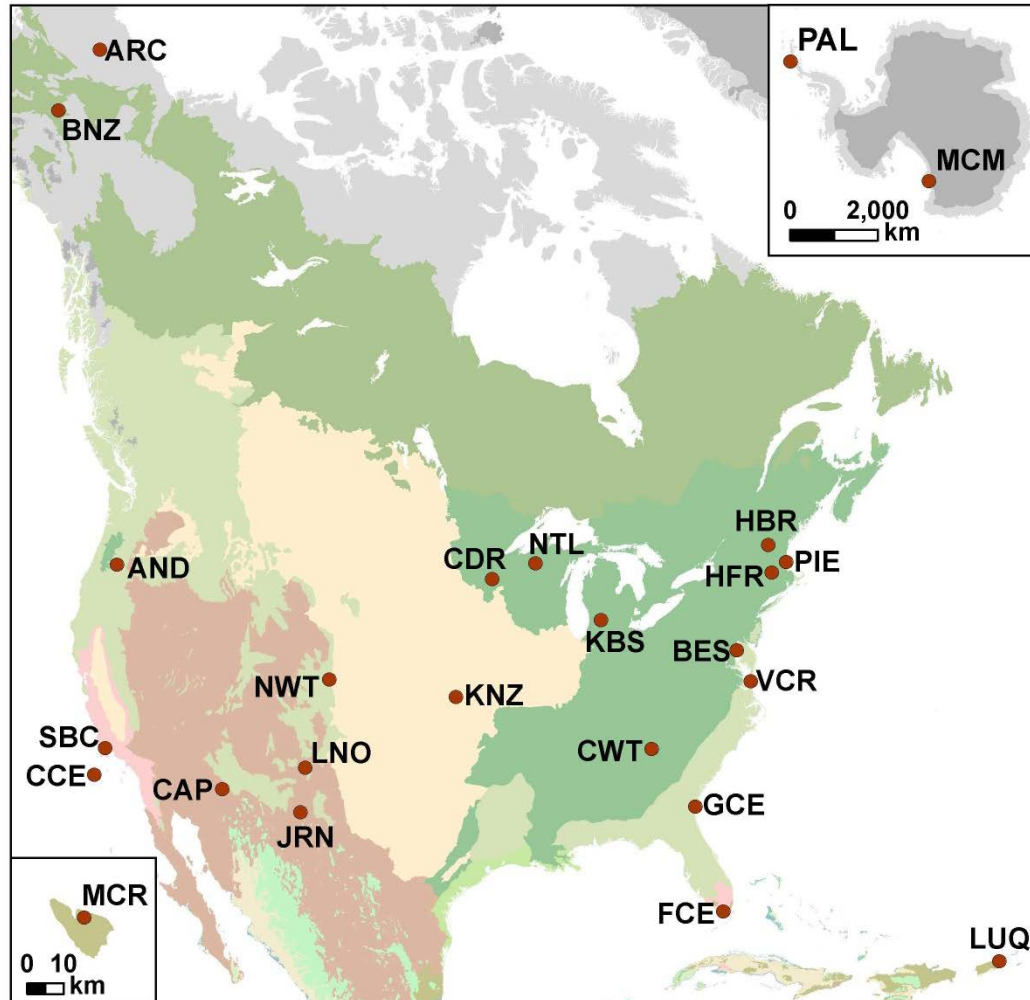
2008 N-rate Corn Yields



2011 N-rate Corn Yields



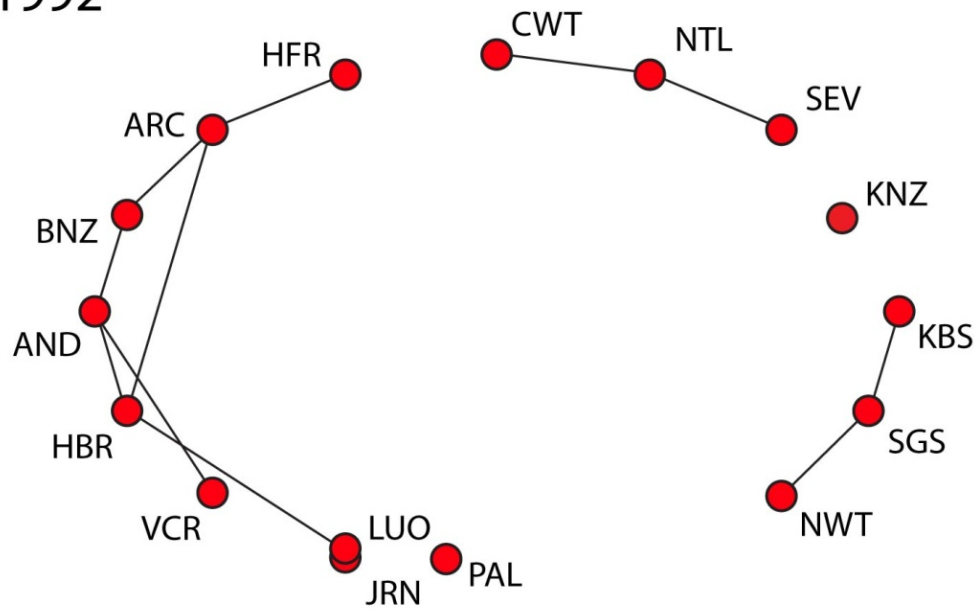
The LTER Network 2016



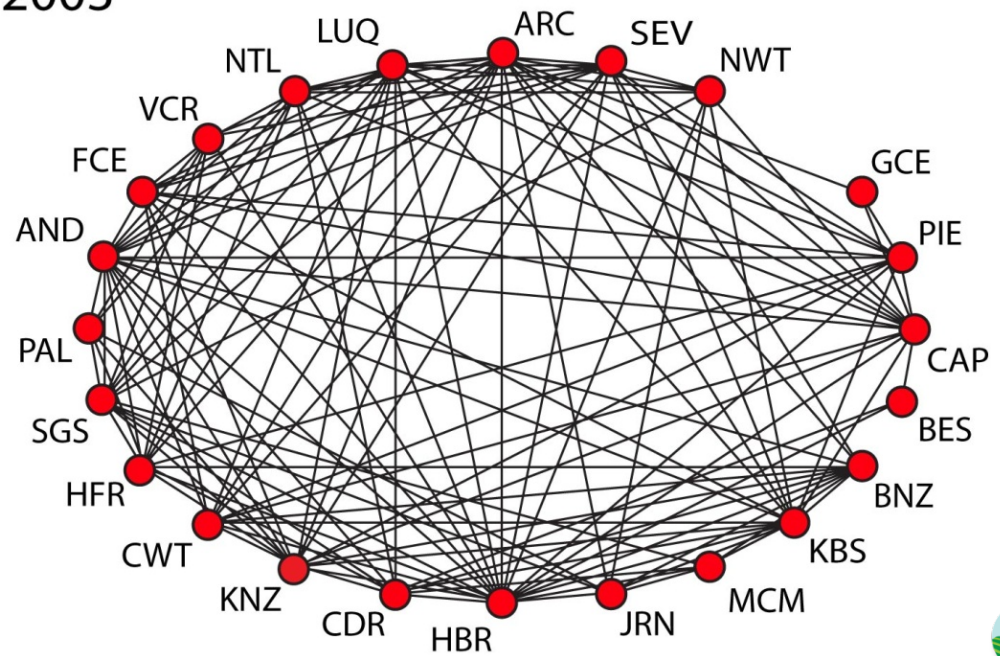
LTERR Network

Cross-site Publications

1992



2003





KBS LTER

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KELLOGG BIOLOGICAL STATION LONG-TERM ECOLOGICAL RESEARCH (LTER) PROGRAM IS PART OF A NATIONAL NETWORK OF LTER SITES ESTABLISHED BY THE NATIONAL SCIENCE FOUNDATION

WELCOME TO THE 2016 ALL SCIENTIST MEETING AND INVESTIGATORS FIELD TOUR

KBS LTER research aims to understand the ecology of Midwest cropping systems and agricultural landscapes. We study interactions among plants, microbes, insects, management, and the environment to learn how agriculture can provide both high yields and environmental outcomes that benefit society. [Learn More >>](#)

RECENT POSTS

SEPTEMBER 14, 2016 | Michigan was pretty cool after all: Reflections from an undergraduate researcher

SEPTEMBER 7, 2016 | My summer at Kellogg Biological Station: Reflections from an undergraduate researcher

SEPTEMBER 1, 2016 | Learning about the environment from the soil up: Reflections from an undergraduate researcher

25 YEARS OF KBS LTER!

[2015 KBS LTER SYMPOSIUM](#)

[KBS LTER SYNTHESIS BOOK](#)

[BIOSCIENCE ARTICLE: FARMING FOR ECOSYSTEM SERVICES](#)

RESEARCH HIGHLIGHTS

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[SOIL MICROBES](#)

[CLEAN WATER](#)

[SOIL CARBON](#)



Key LTER staff you should know (and thank)

- Neville Millar: LTER Science Coordinator
- Julie Doll: LTER Outreach and Education Coordinator
- Stacey VanderWulp: LTER Project Manager
- Sven Bohm: LTER Information Manager
- Joe Simmons: LTER Agronomic Manager
- Justin Mezo: LTER/GLBRC agronomy
- Kevin Kahmark: LTER/GLBRC greenhouse gas analyses
- Cathy McMinn: LTER sampling and analytical work
- And many seasonal and student research assistants!