

# Proceedings of the 5<sup>th</sup> Annual Nitrogen: Minnesota's Grand Challenge & Compelling Opportunity Conference

**5th Annual  
NITROGEN:  
MINNESOTA'S GRAND  
CHALLENGE & COMPELLING  
OPPORTUNITY CONFERENCE**



**Tuesday,  
February 5, 2019**

**Verizon Wireless Center,  
Mankato, MN**

 UNIVERSITY OF MINNESOTA | EXTENSION

**5TH ANNUAL  
NITROGEN: MINNESOTA'S GRAND CHALLENGE  
& COMPELLING OPPORTUNITY CONFERENCE**

**Sessions 9:05 a.m.-3:40 p.m.**

**■ GENERAL SESSION**

8:15 a.m.	<i>Registration</i>	
9:00 a.m.	<i>Welcome</i> Tom Rothman	University of Minnesota
9:05 a.m.	<i>Lessons Learned in 2018, Opportunities for 2019</i> Brad Carlson Dave Nicolai Brandon Fast	University of Minnesota Extension University of Minnesota Extension Minnesota Corn Research & Promotion Council
9:55 a.m.	<i>An Industry Perspective on Nitrogen: Beginning with 4R Nutrient Stewardship</i> Dr. Tai Maaz	International Plant Nutrition Institute
10:50 a.m.	<i>Break</i>	
11:05 a.m.	<i>NUE and Potential Environmental Outcomes Associated with N Application Timing</i> Dr. Carrie Laboski	University of Wisconsin-Madison
12:00	<i>Lunch</i>	

**■ BREAKOUT SESSION #1**

1:00 p.m.	<i>Managing Corn for High Yield and Environmental Stewardship While Controlling Costs</i> Dr. Jeff Coulter	University of Minnesota
1:55 p.m.	<i>N loss from Midwest cropping systems: What can we do about it?</i> Dr. Dan Jaynes	USDA ARS, Ames, IA
2:50 p.m.	<i>Urea Fertilizer Do's and Don'ts</i> Dr. Fabián Fernández	University of Minnesota

**■ BREAKOUT SESSION #2**

1:00 p.m.	<i>Improving Nitrogen Mineralization Predictions</i> Dr. Jason Clark	South Dakota State University
1:55 p.m.	<i>Soil Health and Implications for Nitrogen Management</i> Dr. Anna Cates	University of Minnesota
2:50 p.m.	<i>Nitrogen Management with Manure</i> Dr. Melissa Wilson	University of Minnesota
3:40 p.m.	<i>Adjourn</i>	

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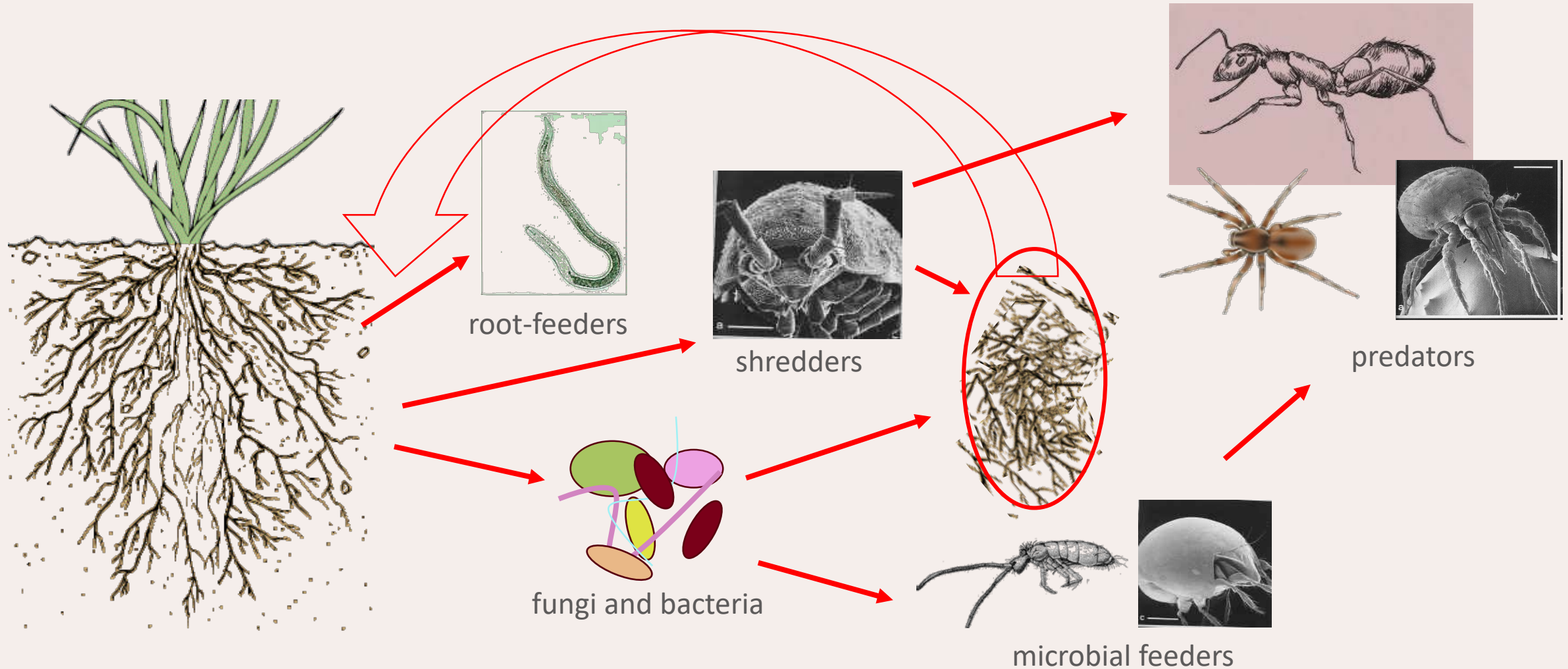
The Minnesota Office for Soil Health is a collaborative of the Minnesota Board of Water and Soil Resources and the University of Minnesota Water Resources Center

Photo courtesy USDA NRCS

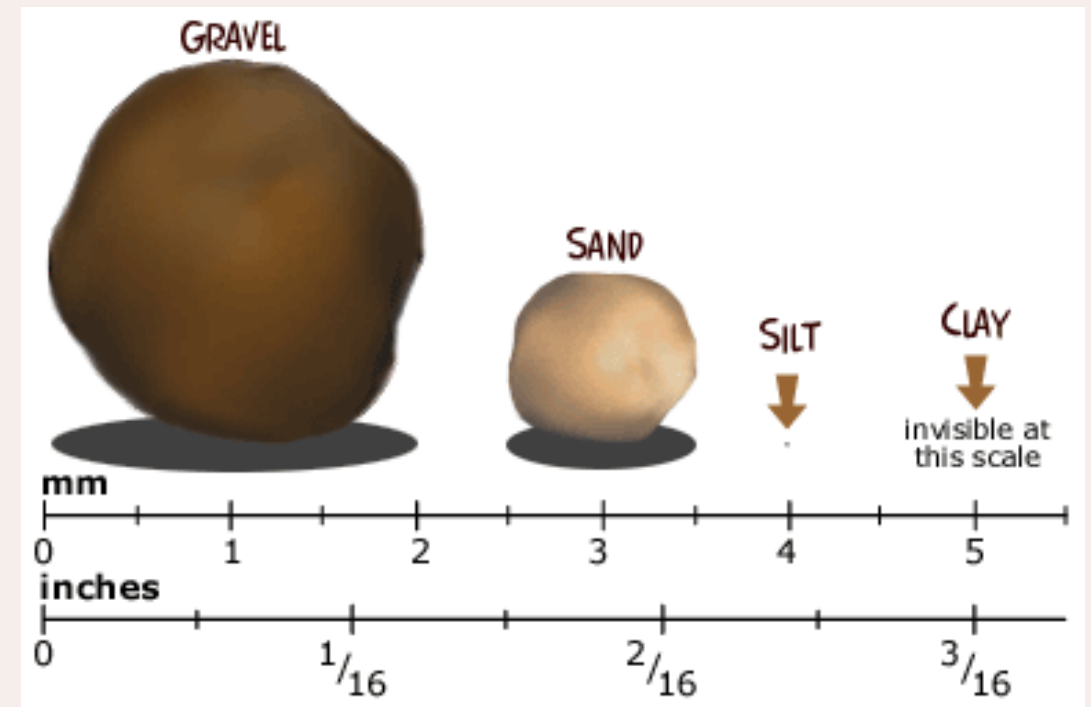
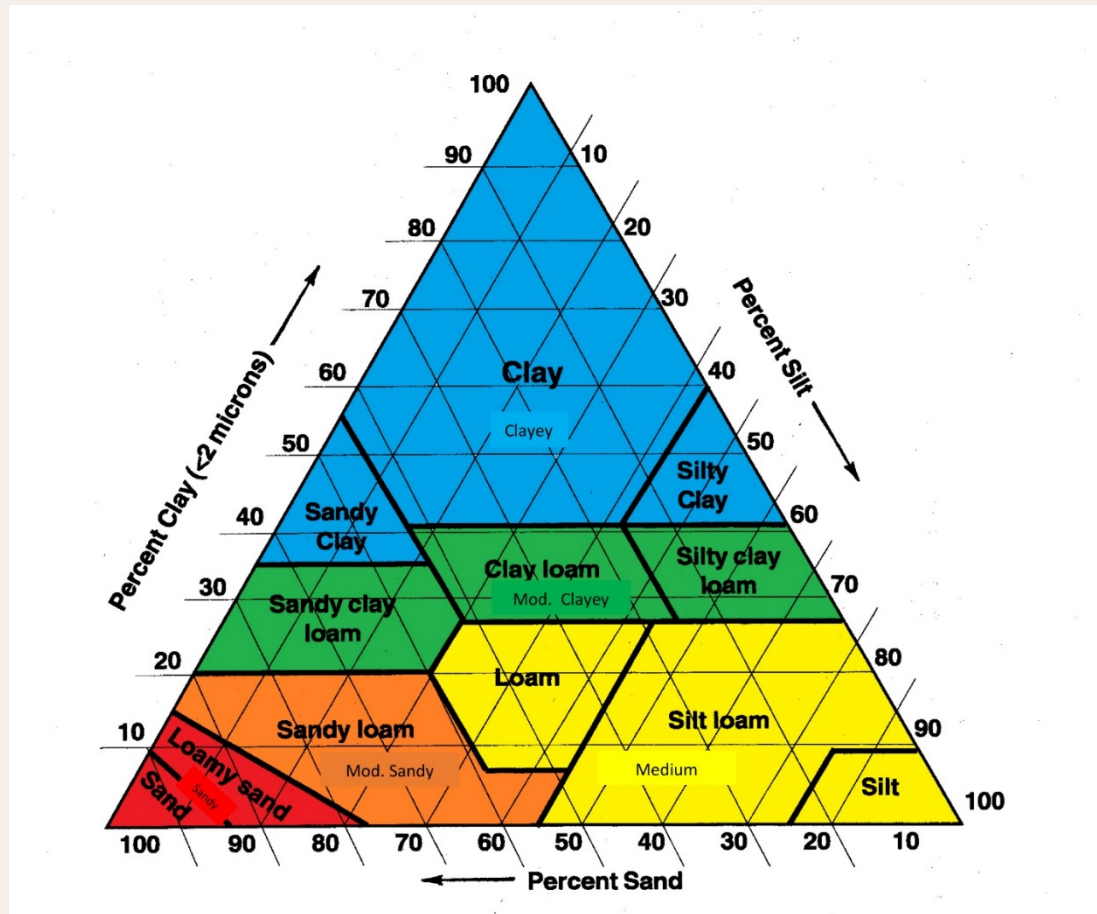
**[www.wrc.umn.edu/mosh](http://www.wrc.umn.edu/mosh)** Anna Cates, [catesa@umn.edu](mailto:catesa@umn.edu), 612-625-3135 @MNSoil



# Decomposition food web = soil C

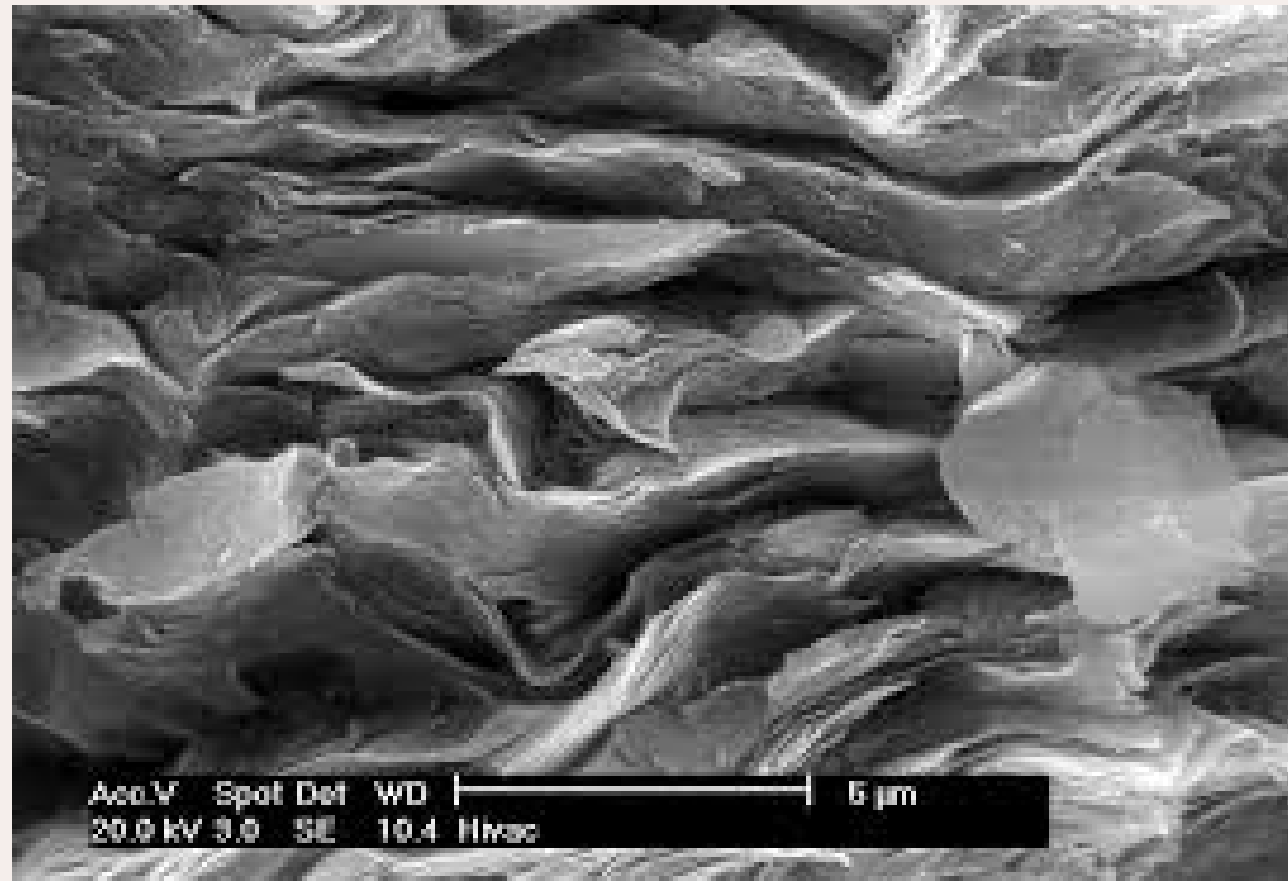


# Soil texture determines habitat



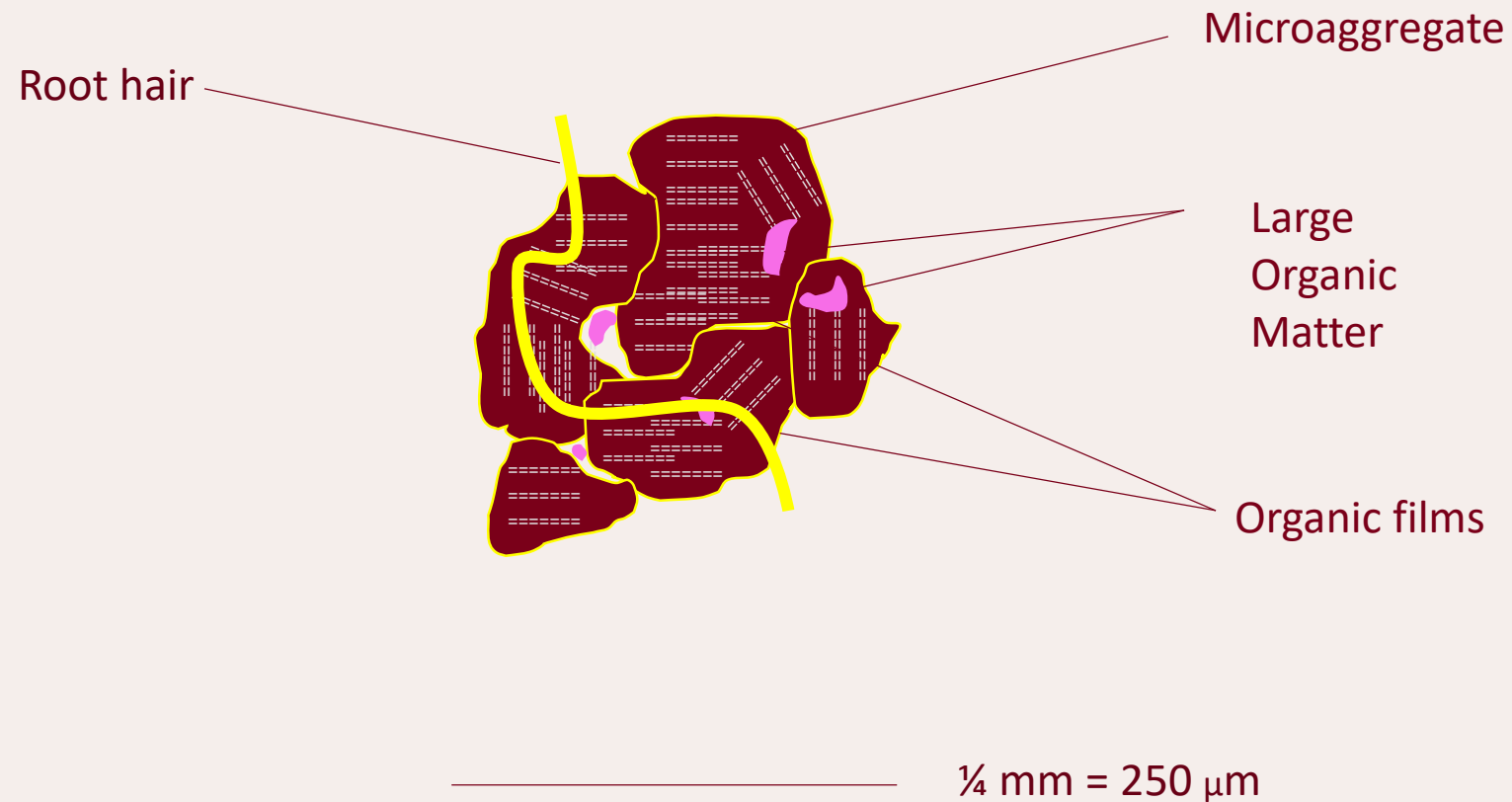


# Clay surface area holds carbon

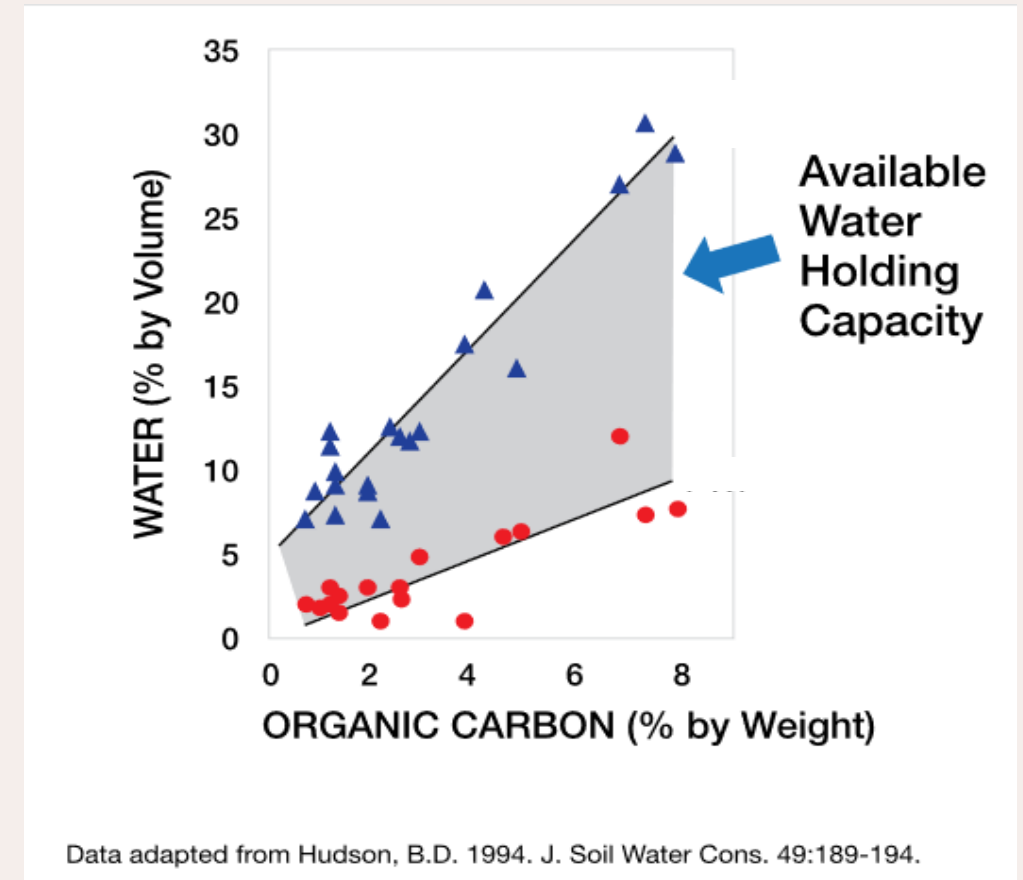
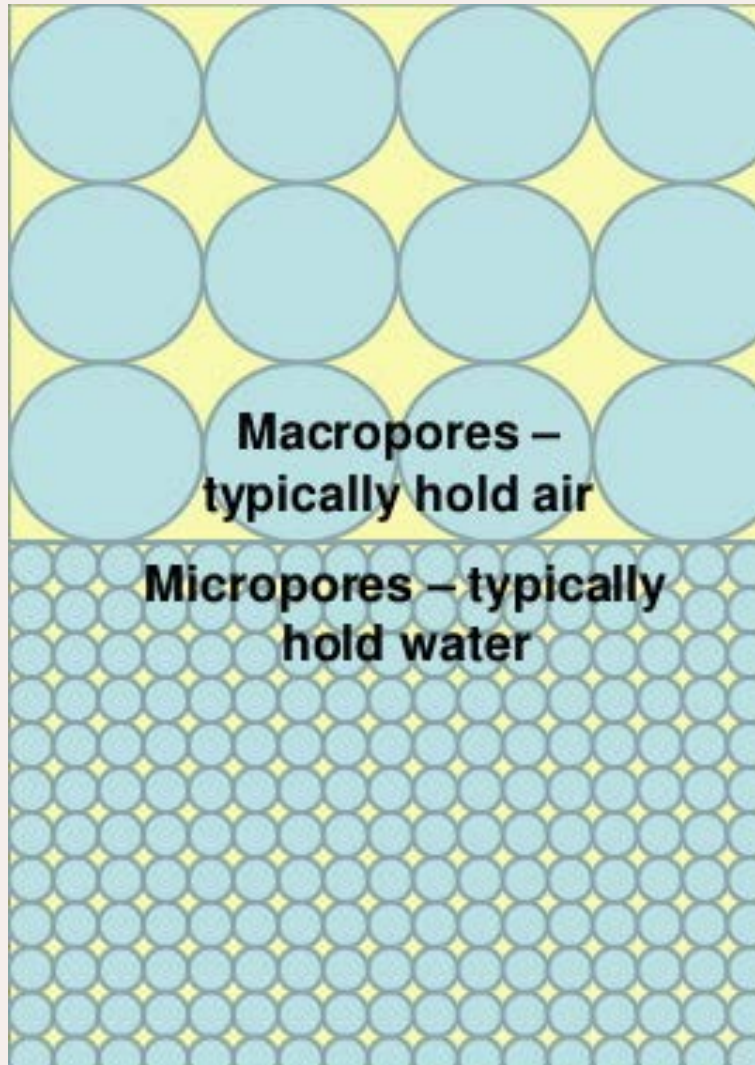




# Carbon-coated clay builds aggregates



# Soil aggregation increases available soil water



Soil Health Institute's Action Plan





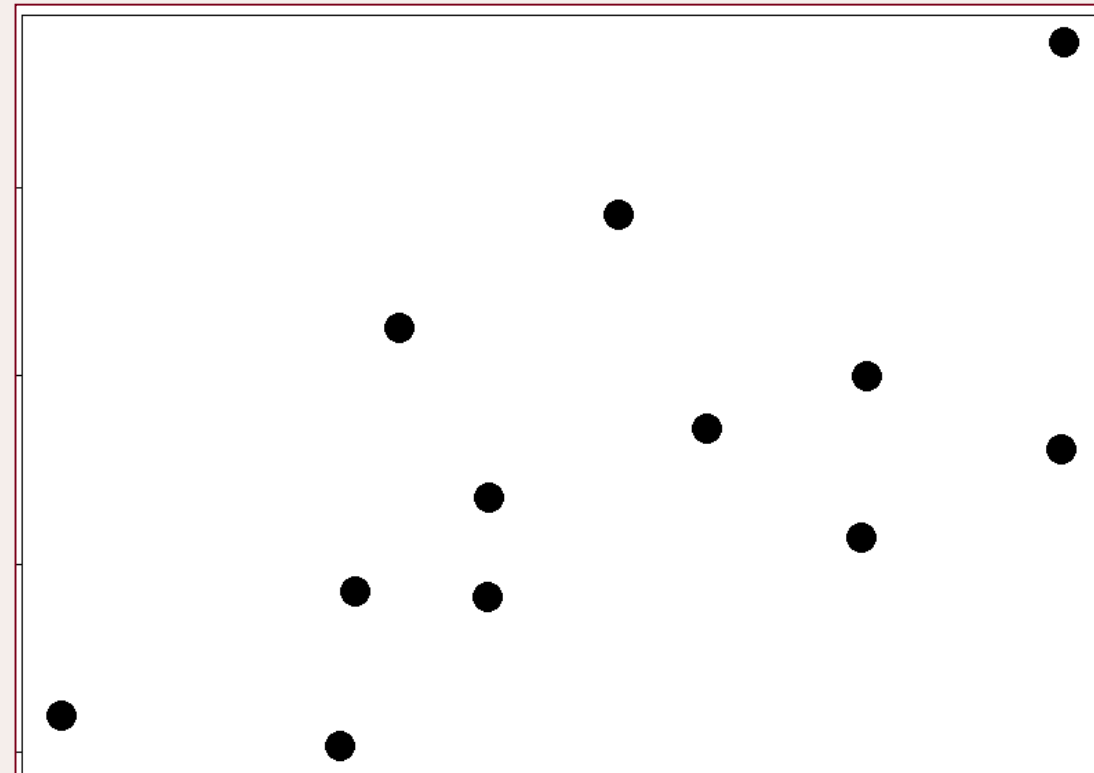




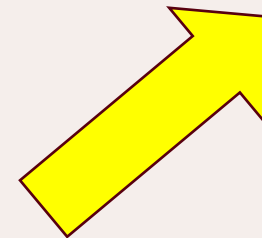
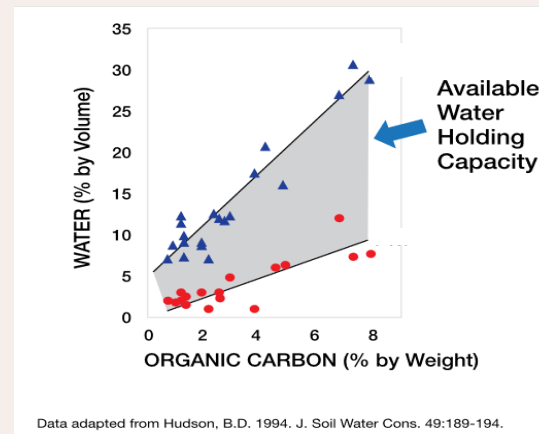
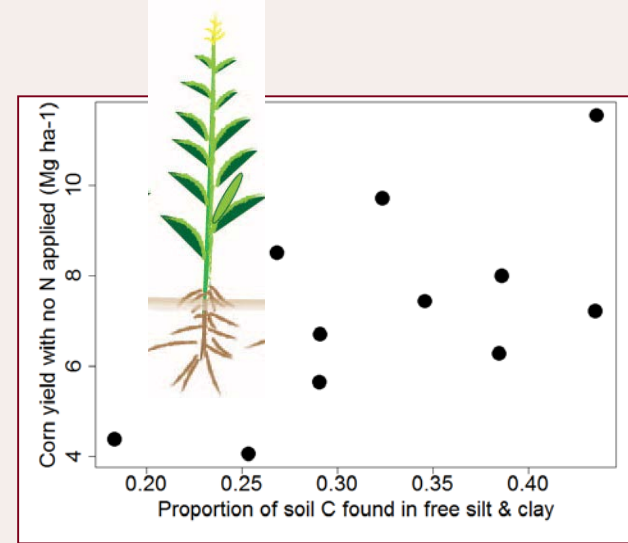
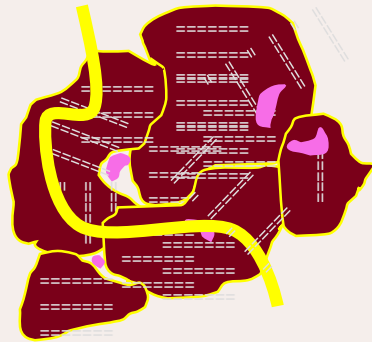
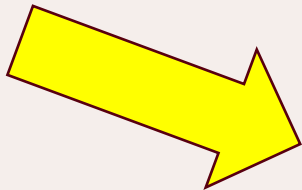
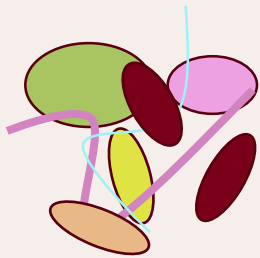
# Yield increases with clay-associated C



Corn Yield

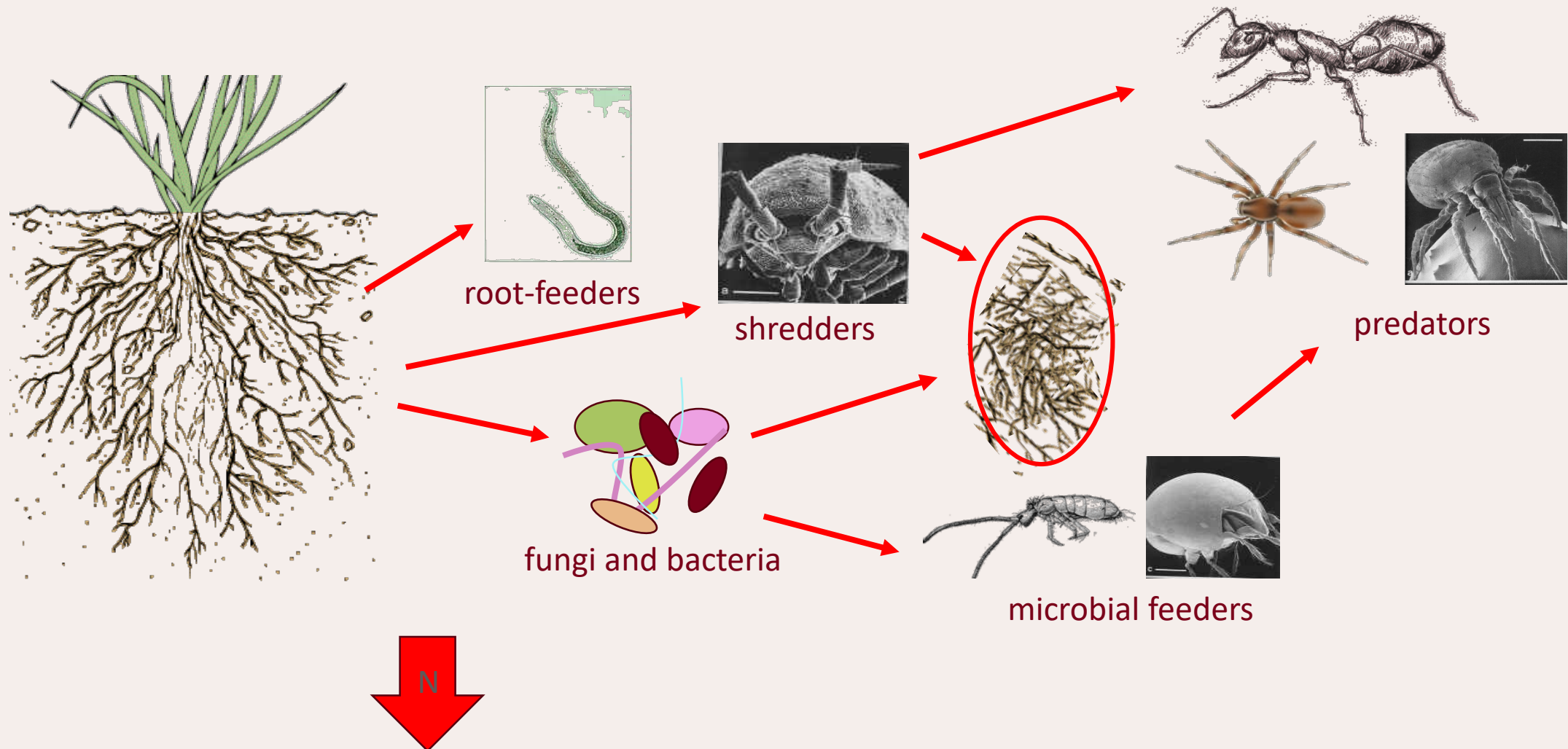


% of Soil C associated with clay

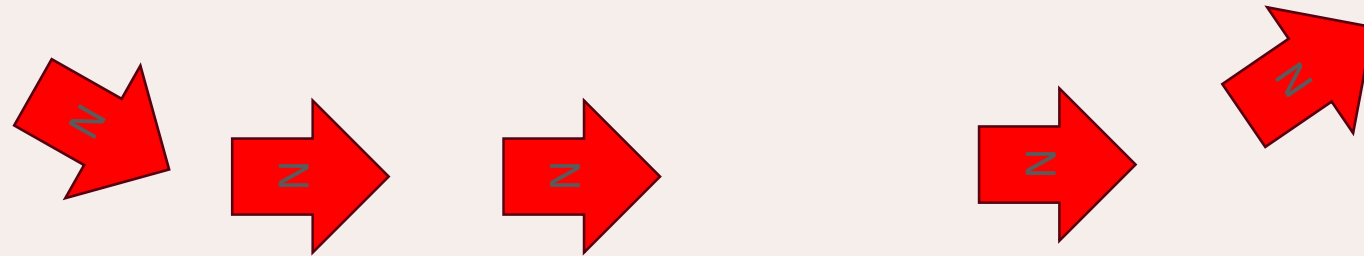
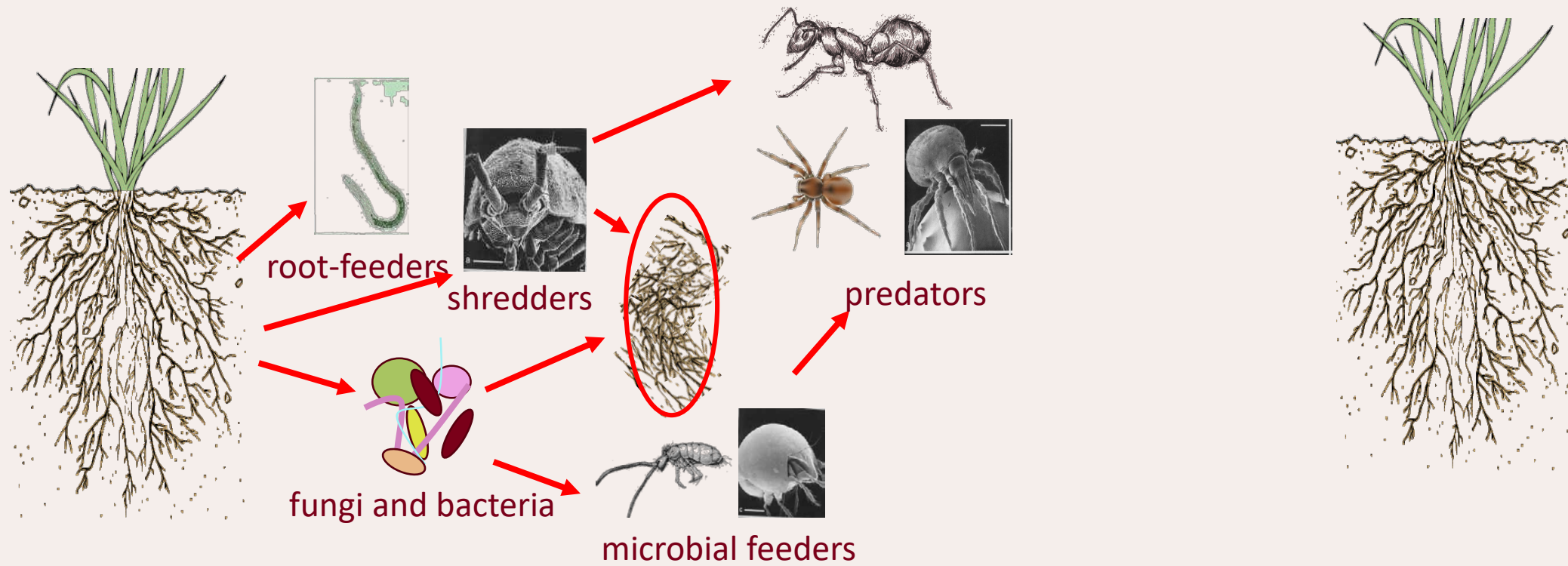




# Decomposition food web releases nutrients

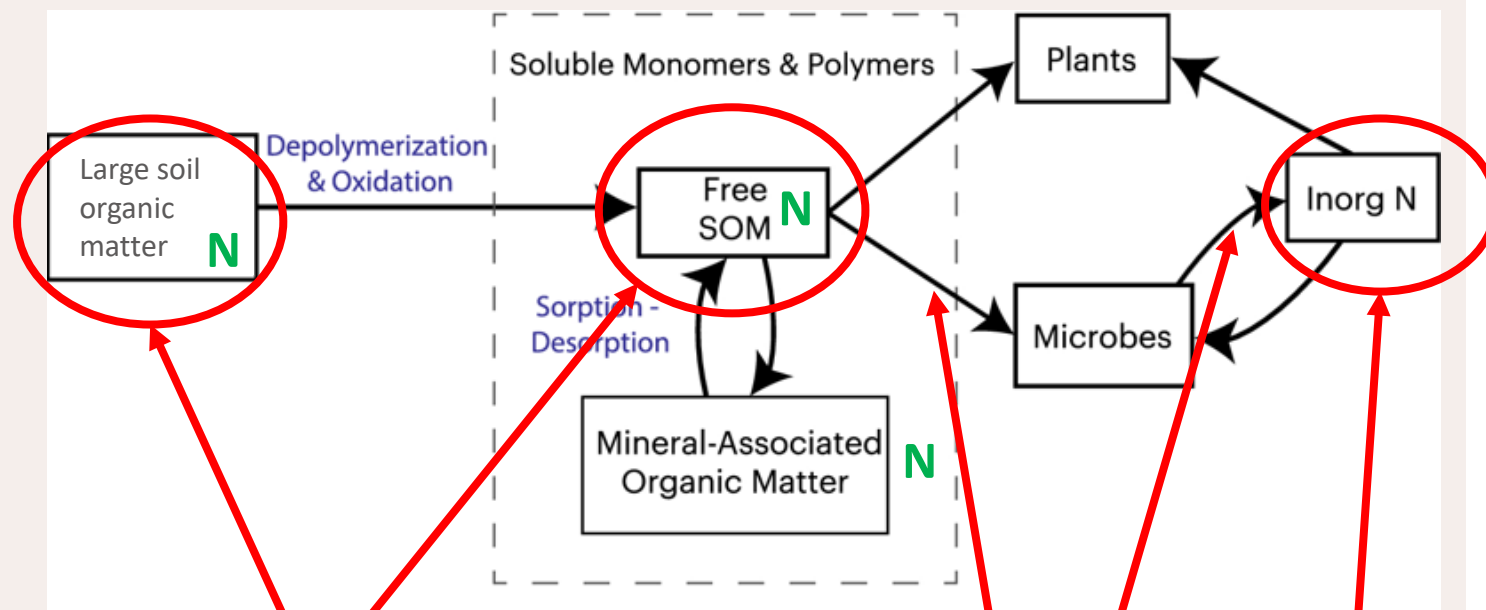


# Decomposition food web releases nutrients





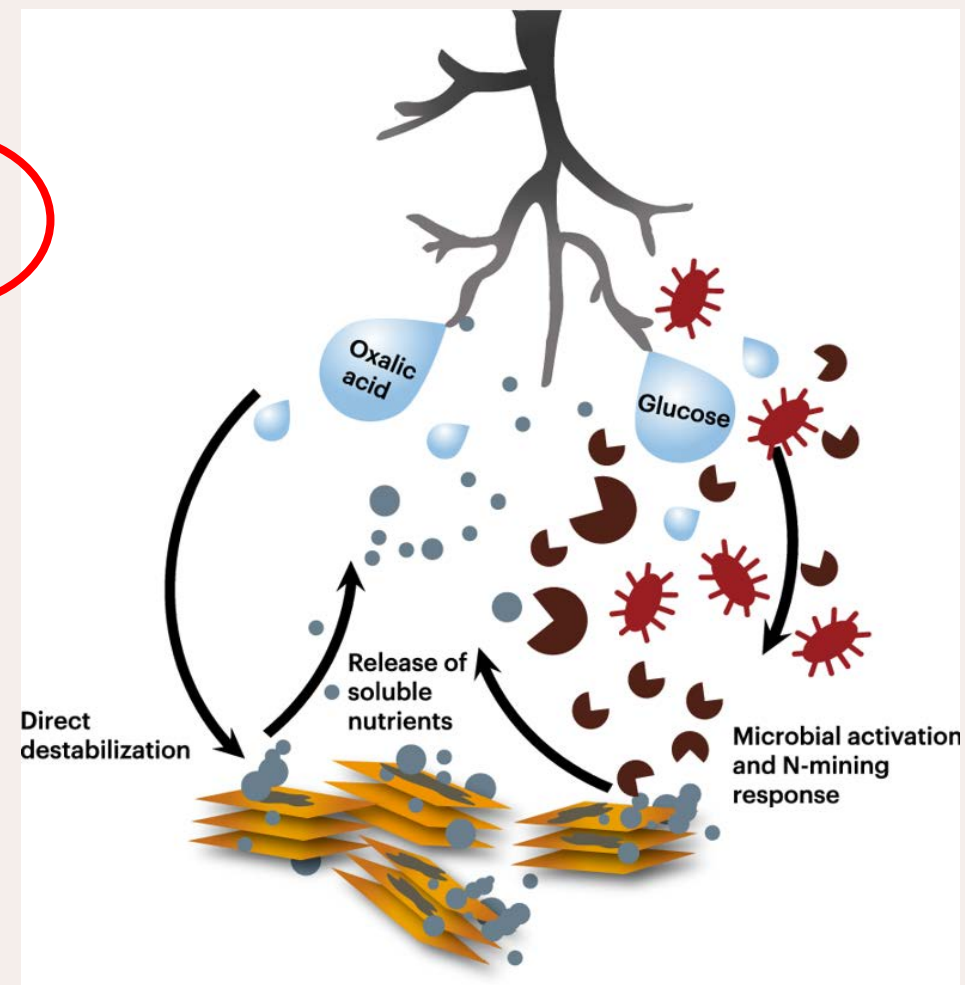
# Soil nitrogen pools: “plant-available”



Organic N, protein N

Nitrate,  
ammonia

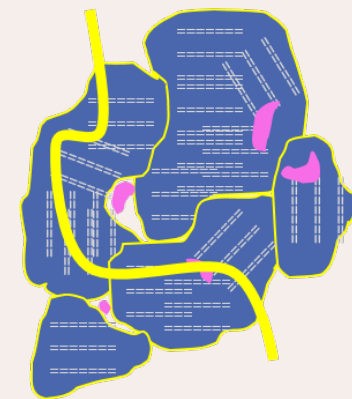
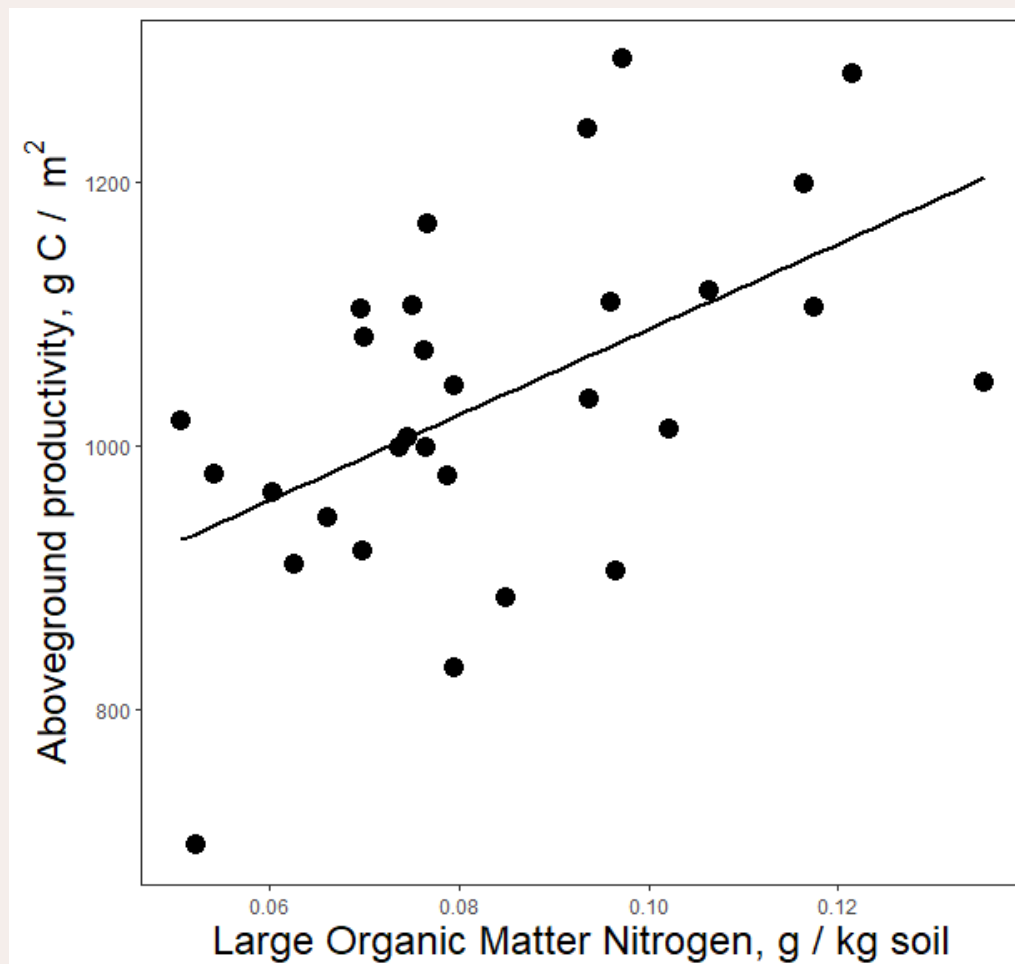
Potentially available N=  
Rate of processing organic N



Jilling et al. 2018



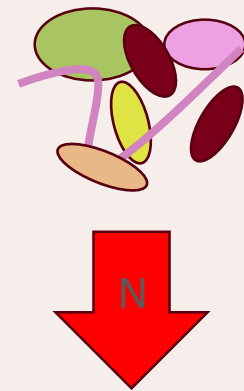
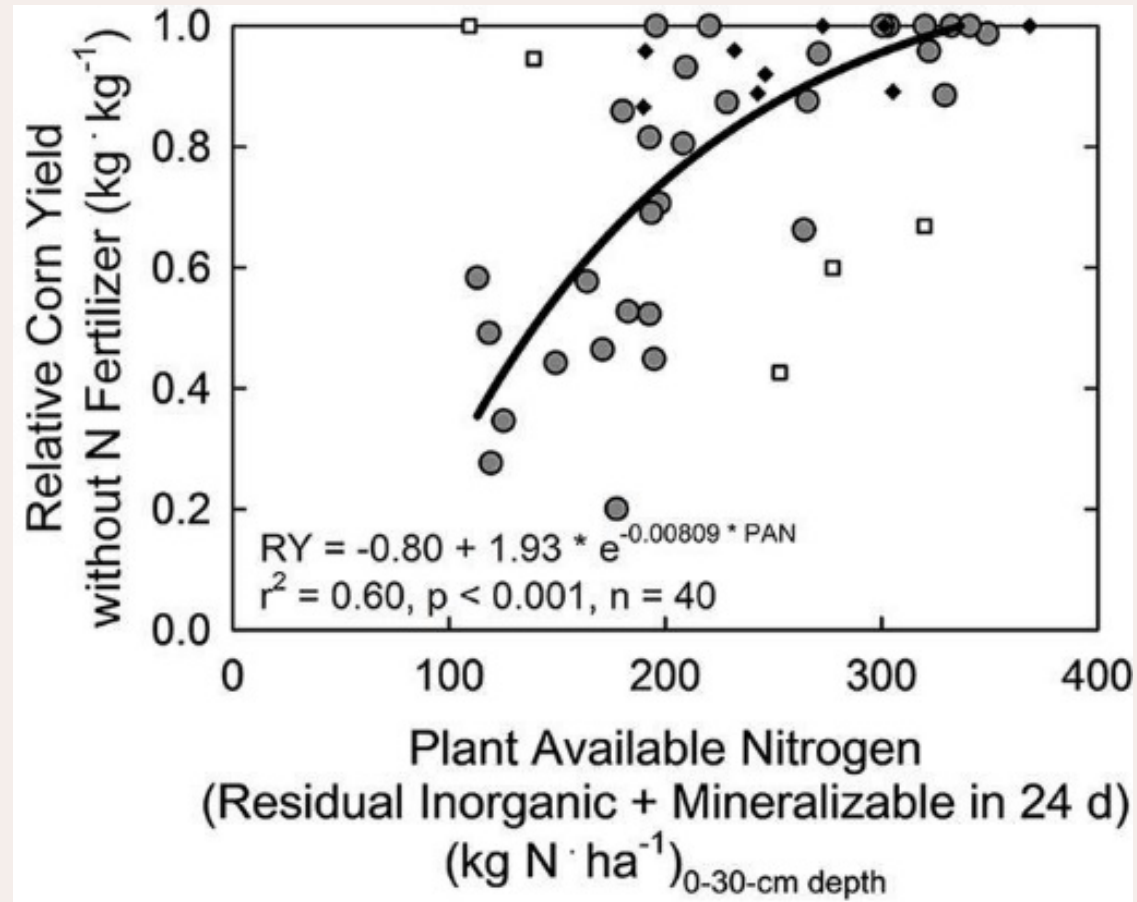
# Yield increases with large organic N



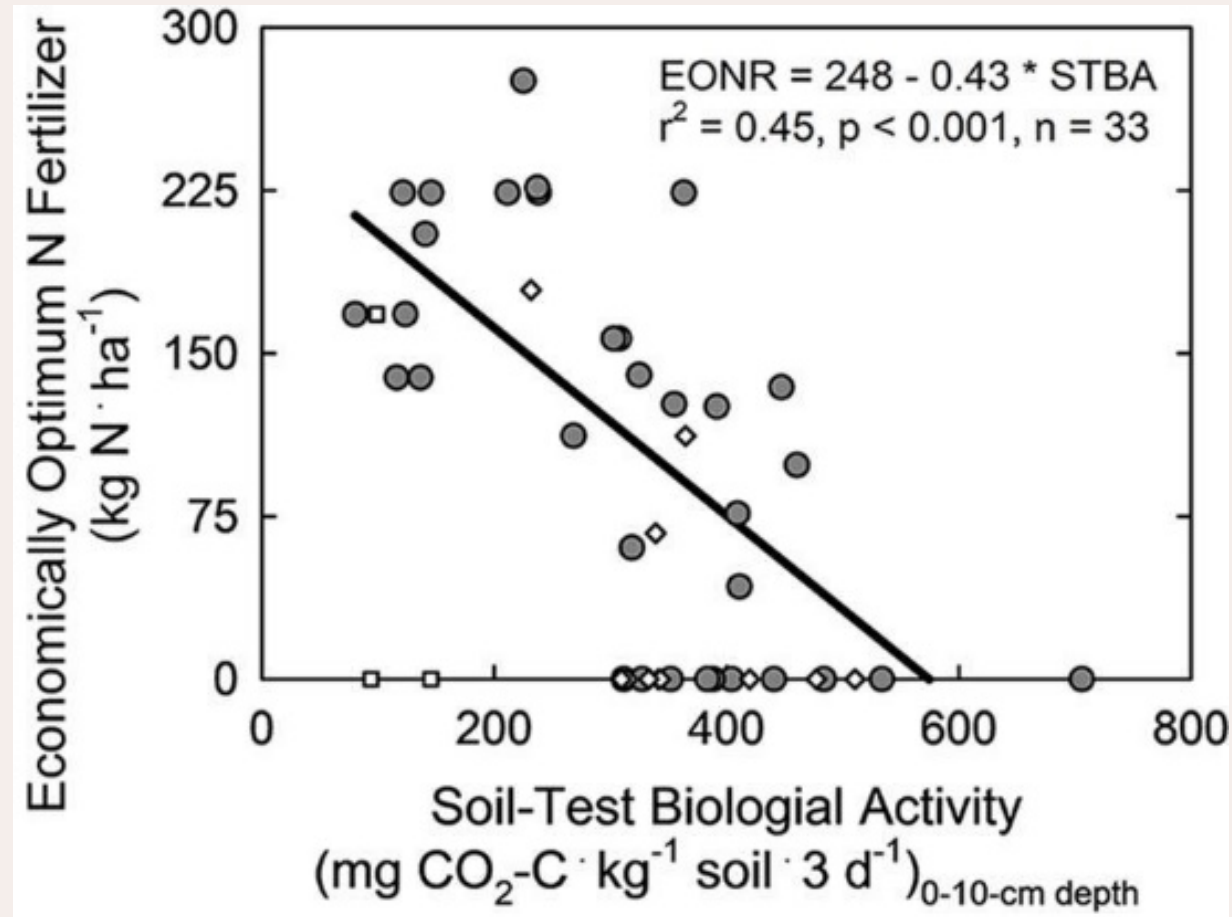
Cates et al., unpublished



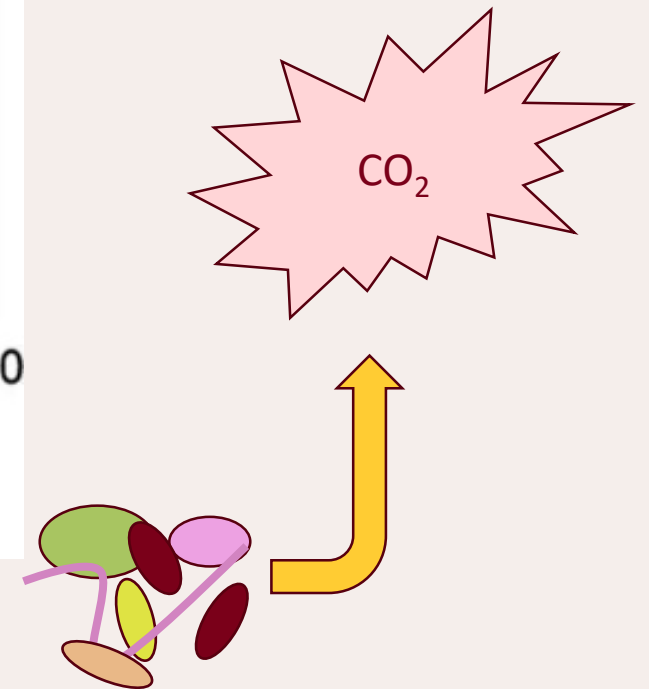
# Yield increases with plant-available N



# Fertilizer needs decreases with active C



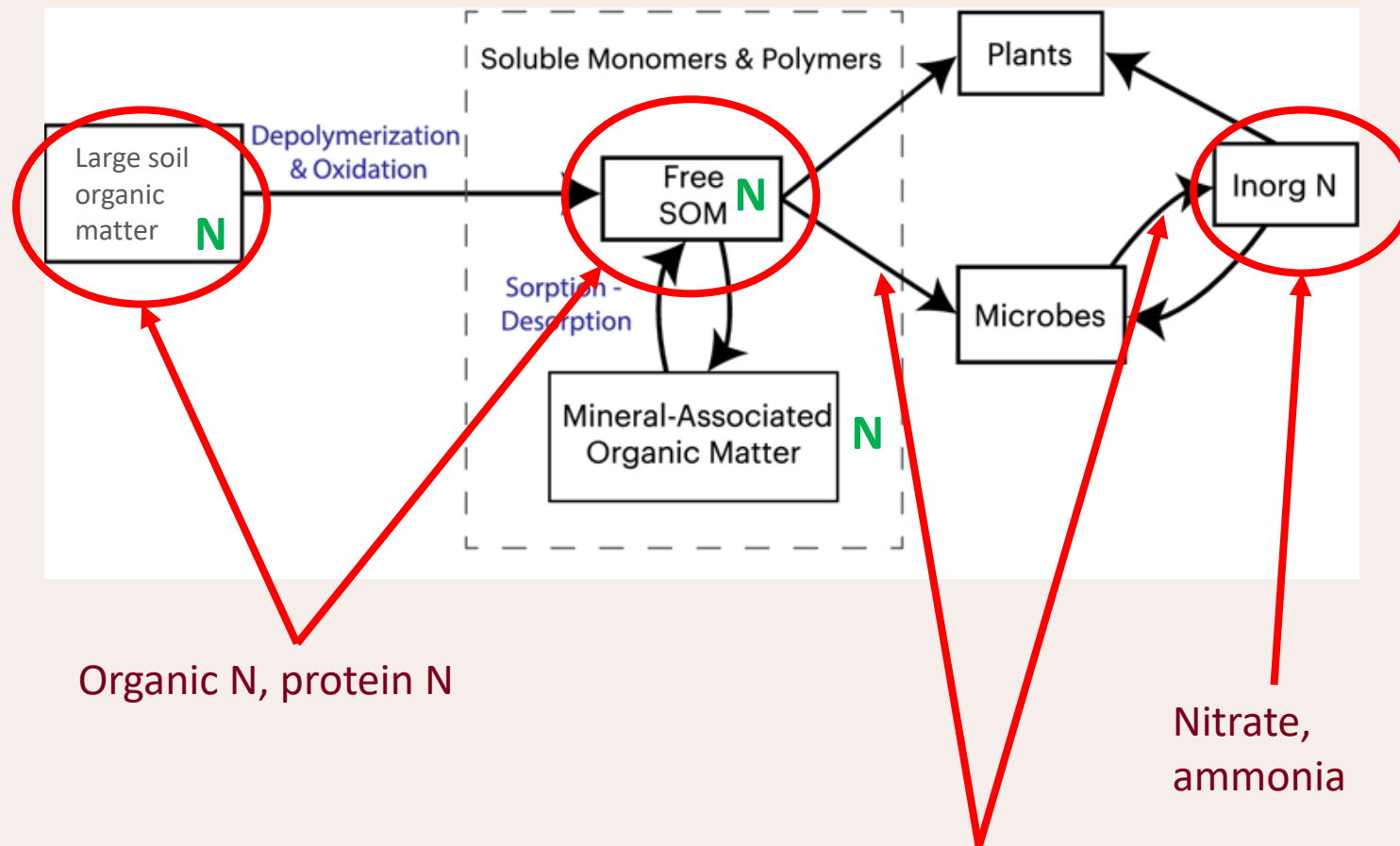
Franzleubbers 2018







# Soil nitrogen pools: “plant-available”



Organic N, protein N

Potentially available N =  
Rate of processing organic N

Nitrate,  
ammonia

# Soil Health Principles



# Soil Health Principles

- Keep the ground covered



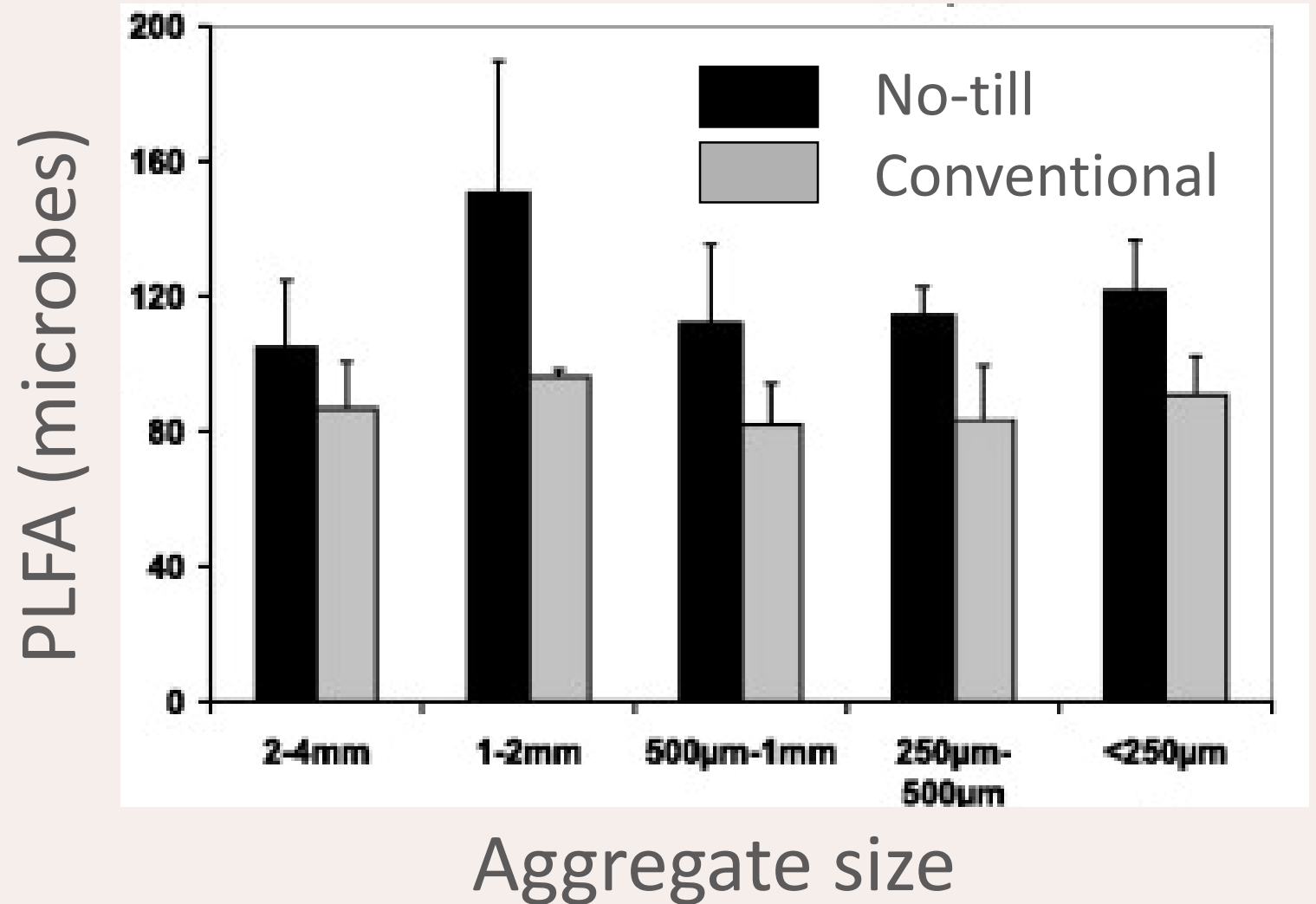
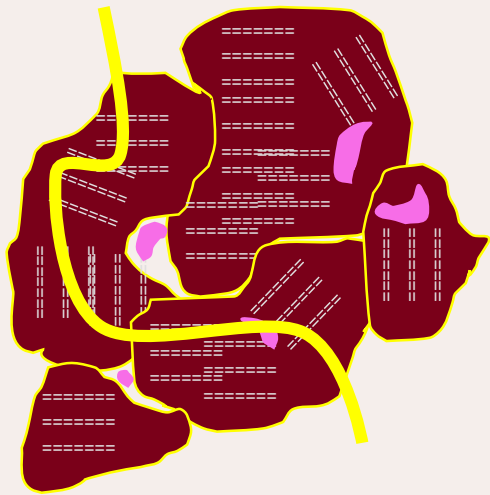


# Soil Health Principles

- Minimize disturbance



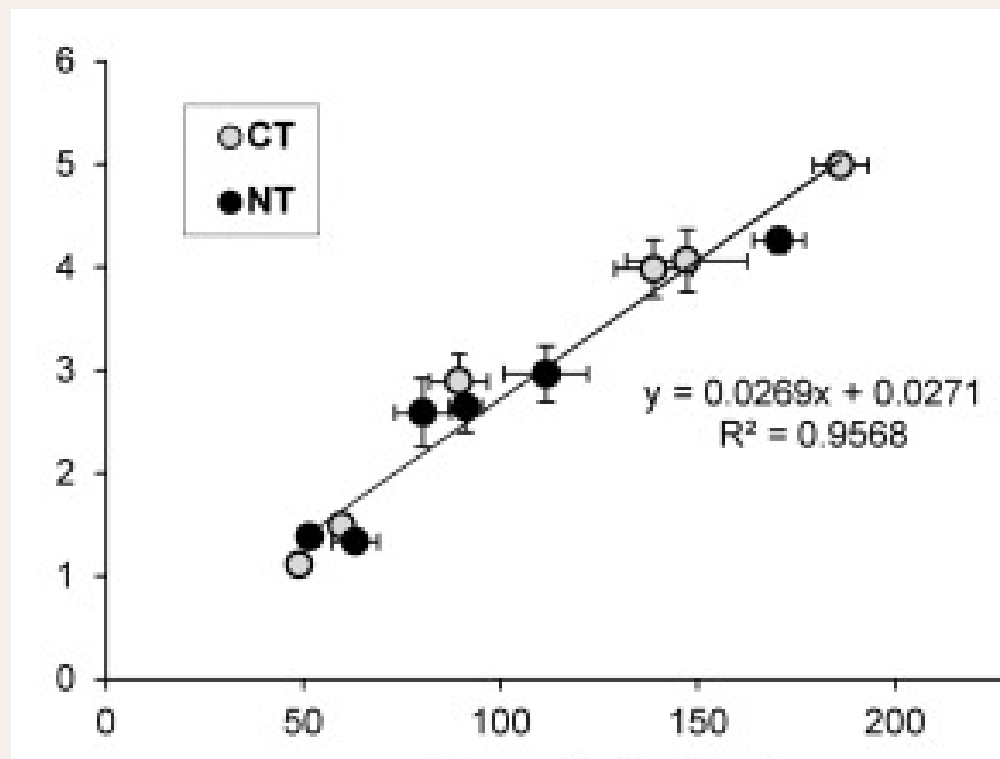
# No-till increases aggregates and microbes





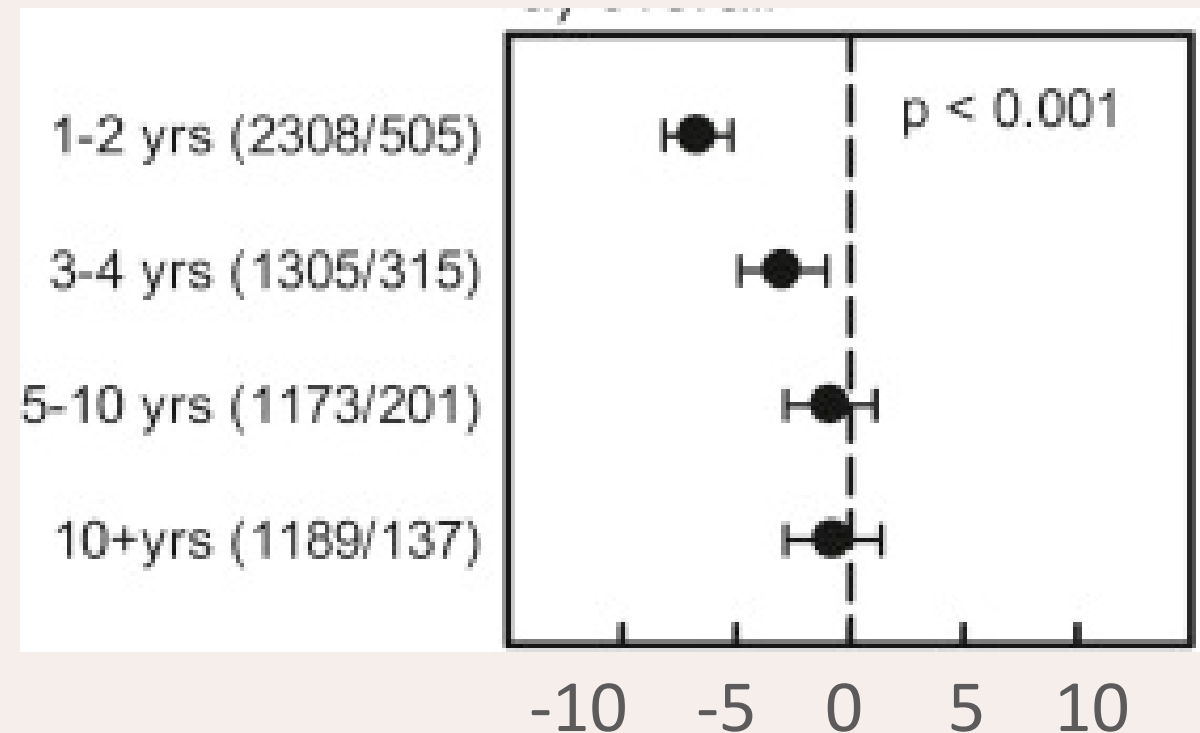
# No-till may reduce N supply (at first!)

Wheat Yield (ton/ha)



Nitrogen Supply (kg/ha)

Giambalvo et al. 2018



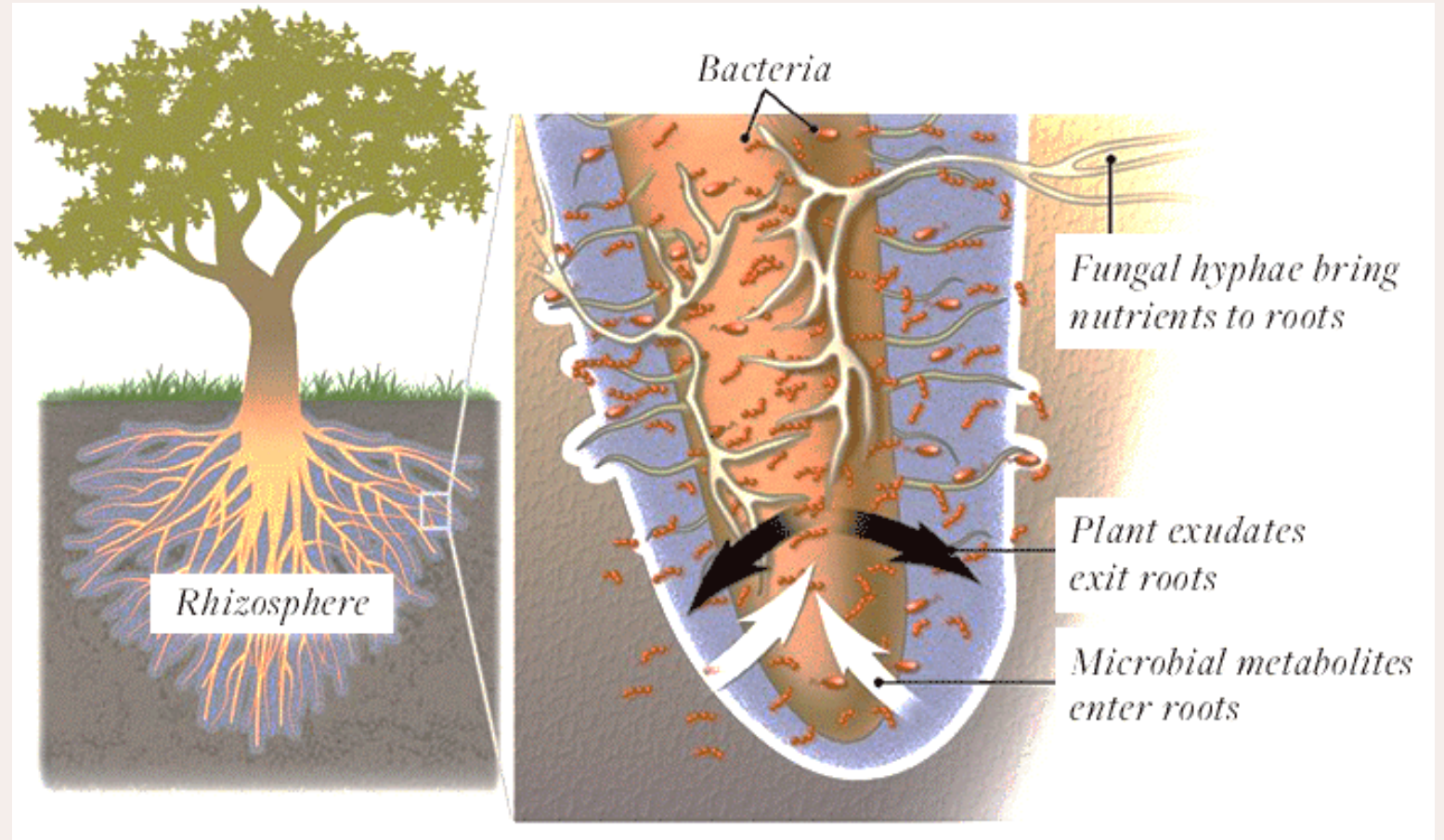
No-till effect on yield (%)

Pittelkow et al. 2015



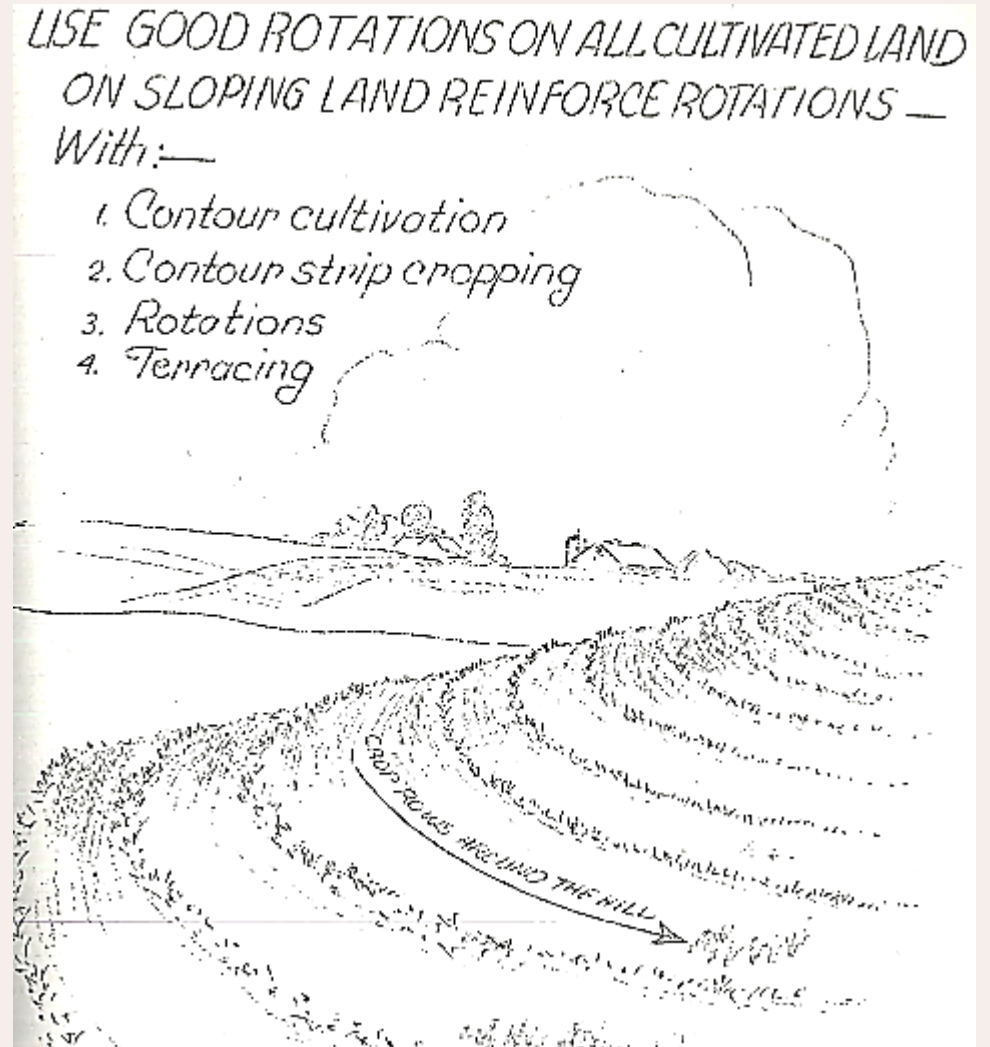
# Soil Health Principles

- Keep living roots in the ground



# Soil Health Principles

- Diversify aboveground



"Save the Soil", a 1935 Special Circular from UW-Extension by O.R. Zeasman and J.W. Clark



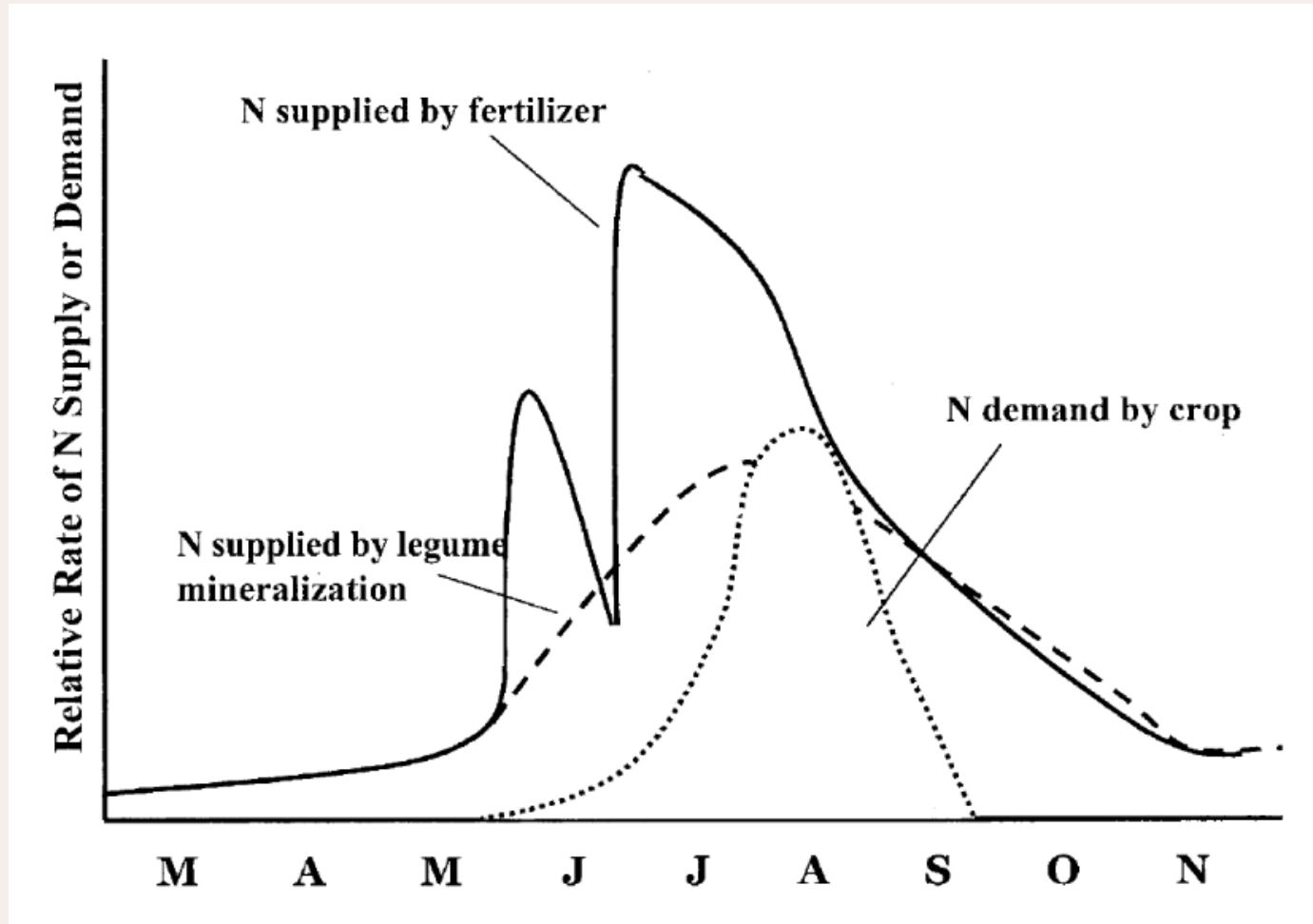
# Cover crops provide more living roots



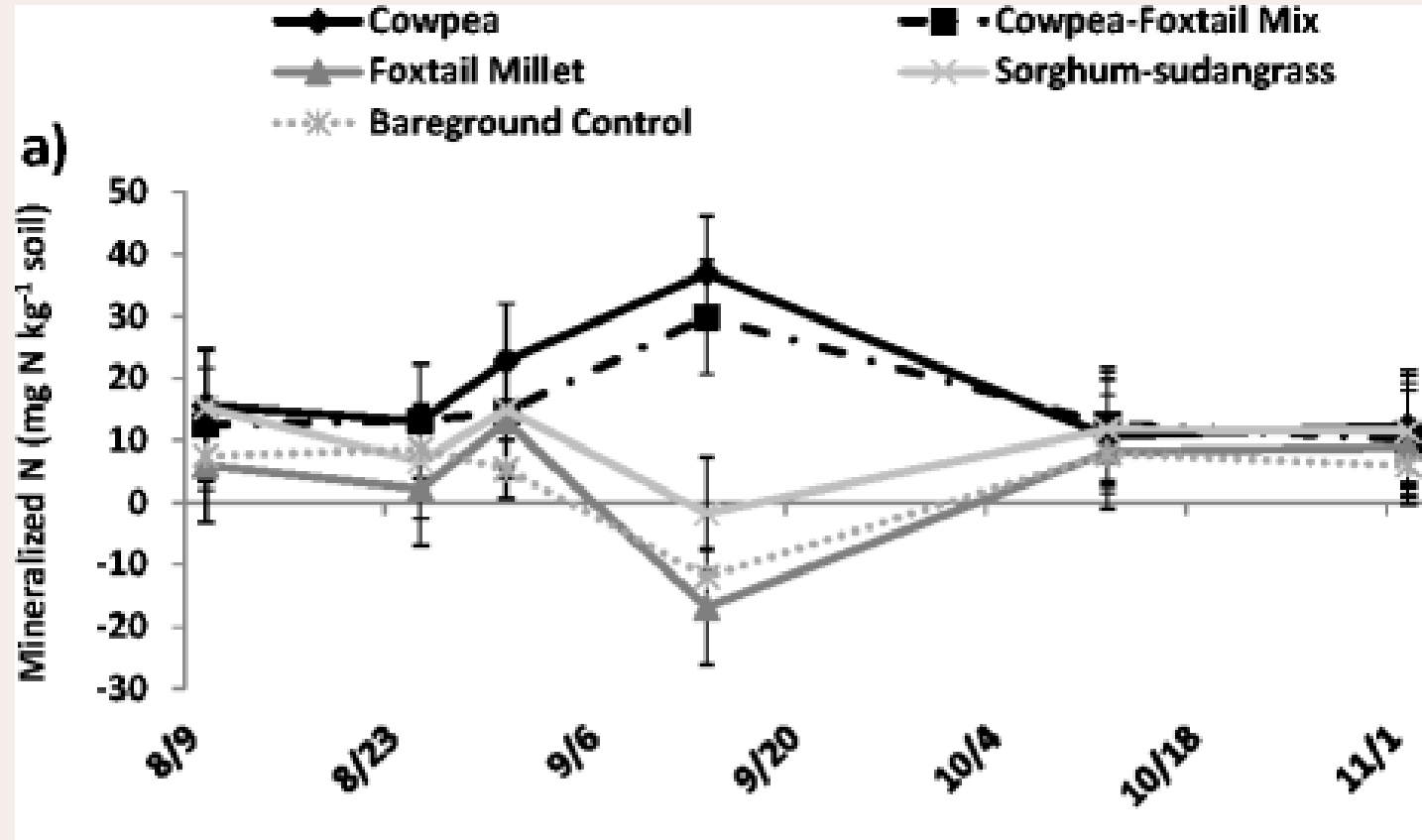
IA Soybean Association



# Legume cover crops can slowly release N

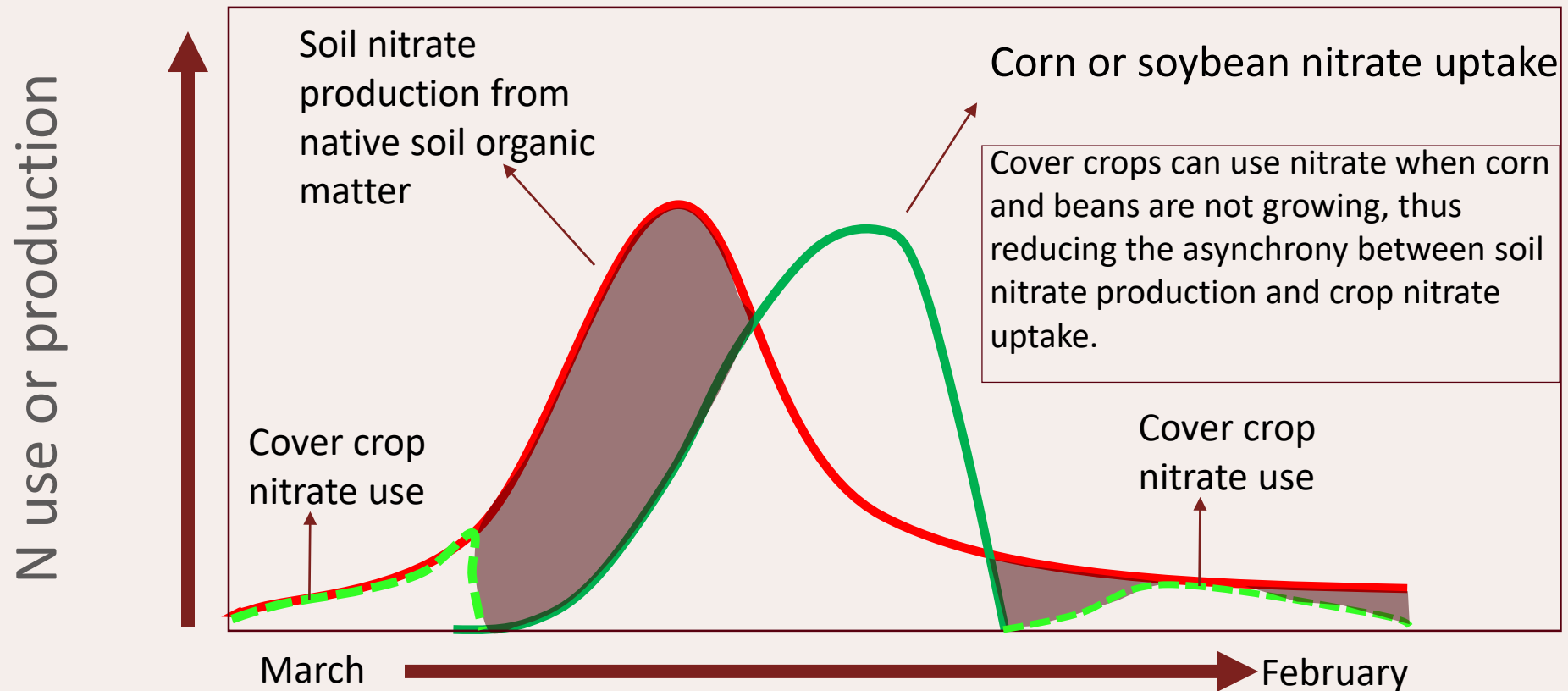


# Cover crops mineralize N at different rates



O'Connell et al. 2015

# Cover crops reduce nitrate leaching



*In the shaded areas, the soil produces nitrate, but there is no crop to use it.  
As a result, some nitrate is lost to waterways.*

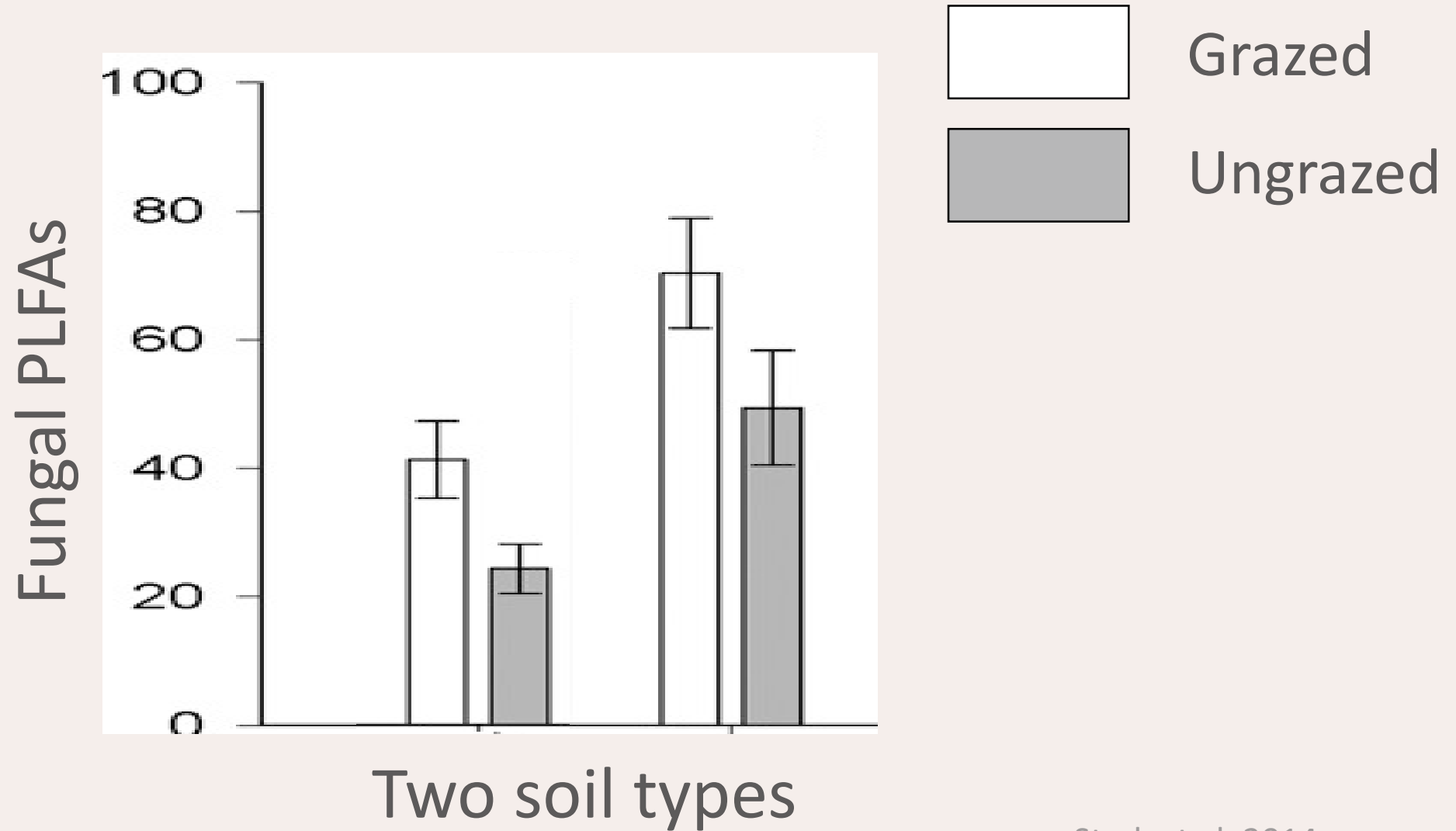


# Soil Health Principles

- Integrate livestock



# Grazing increases fungi





# Soil health principles work together

- Keep the soil covered
- Minimize disturbance
- Increase crop diversity
- Keep living roots in the ground
- Integrate livestock







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**[www.wrc.umn.edu/mosh](http://www.wrc.umn.edu/mosh)** Anna Cates, [catesa@umn.edu](mailto:catesa@umn.edu), 612-625-3135 @MNSoil