

Sustainable Agronomy for Flood Recovery and Resiliency

**Paul J. Jasa, Extension Engineer
University of Nebraska**

Residue, Soil Biology, & Systems Approach

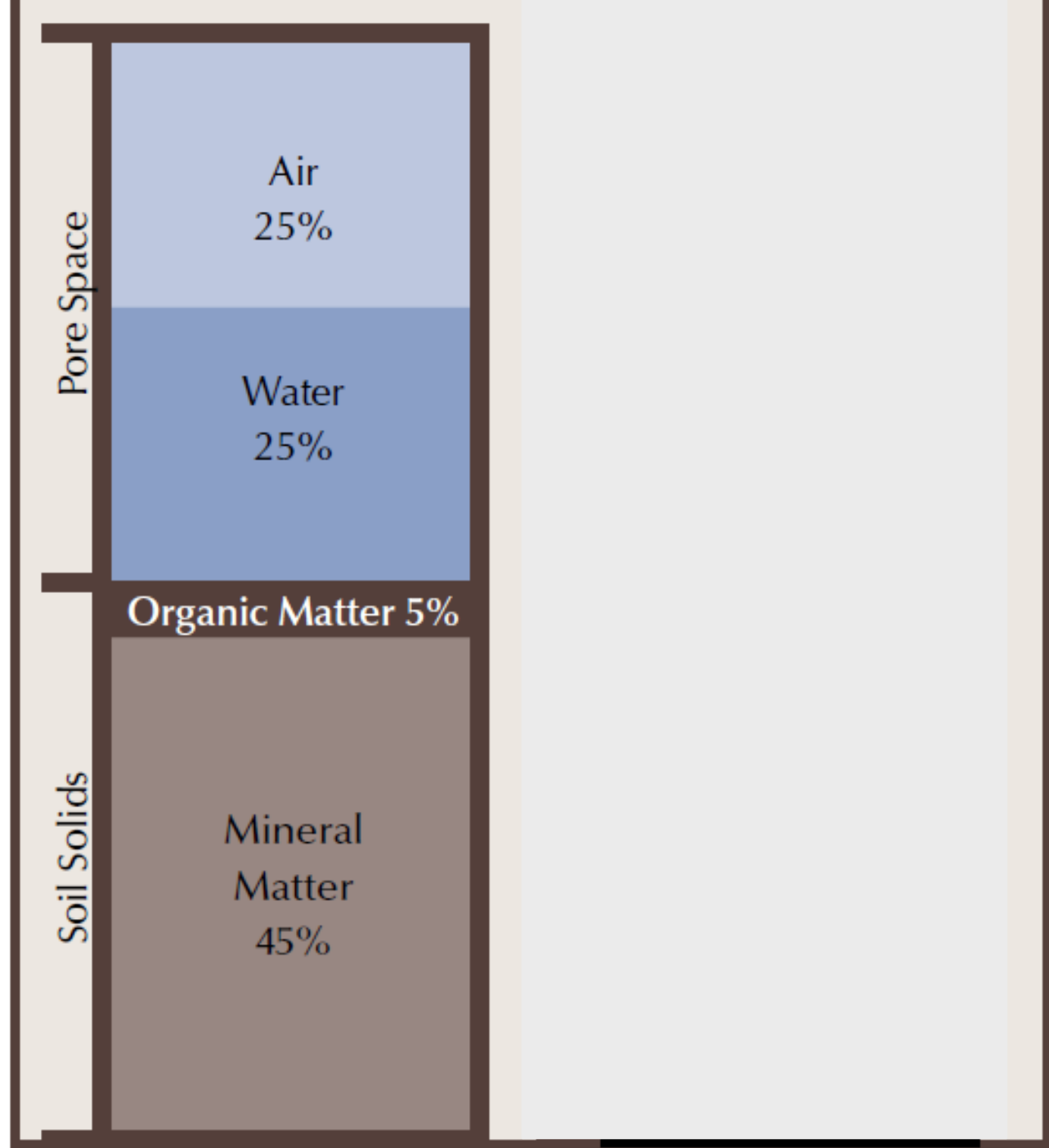
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This is how a long term no-till soil looks

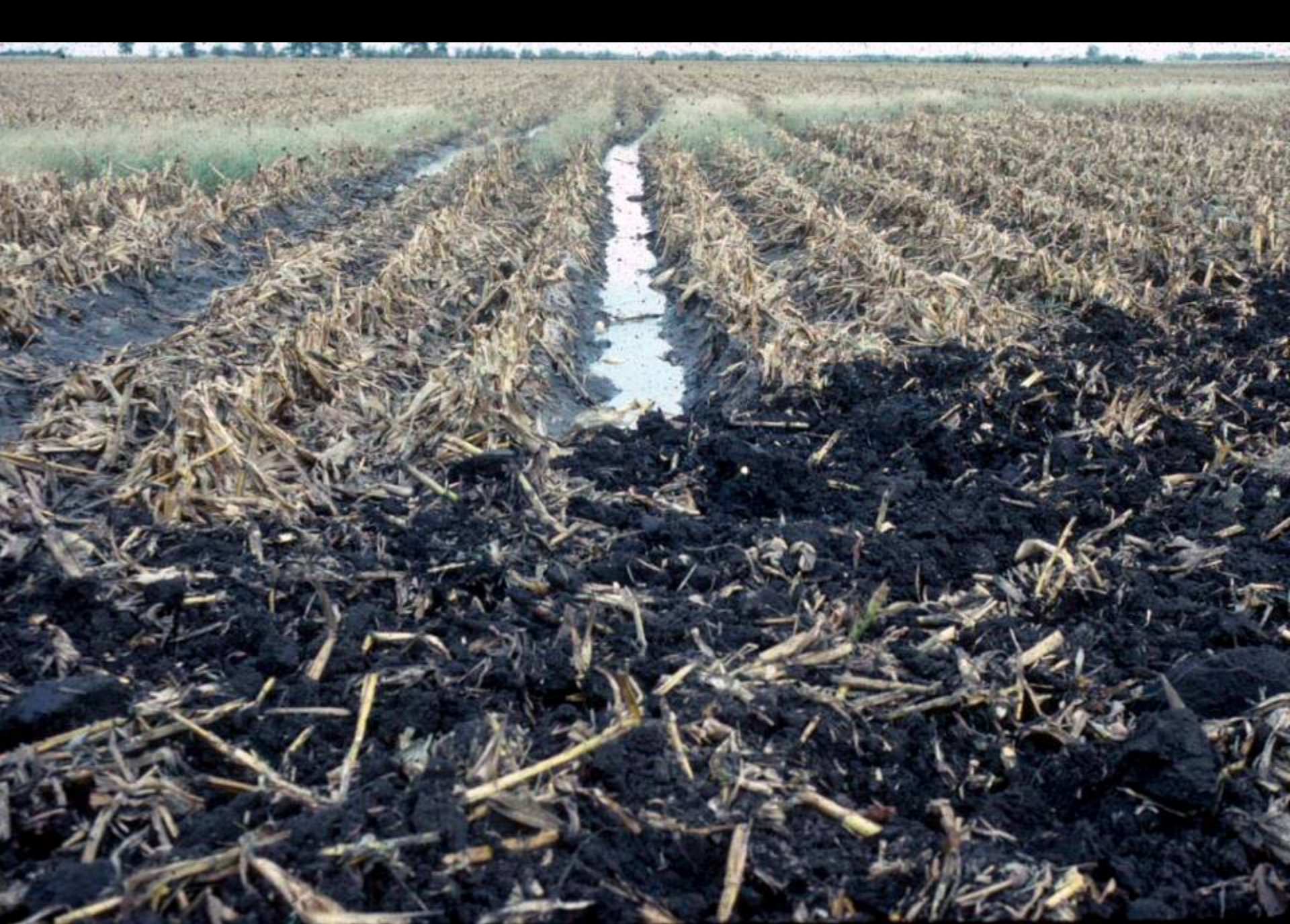


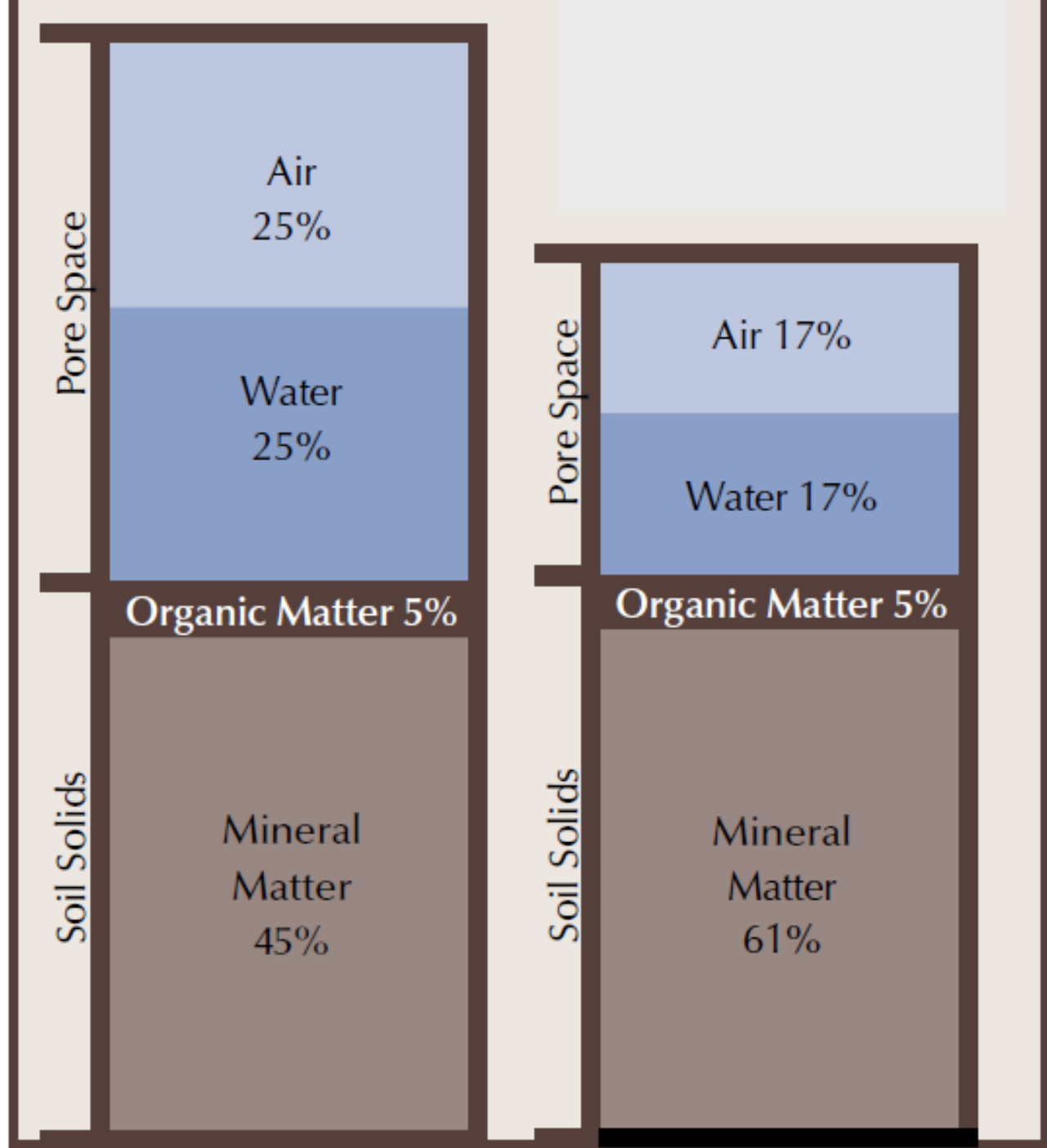
(Derpsch, 2005)



















NASA photo



A photograph of a soil profile. The top layer is dark brown, moist, and has a crumbly, granular texture. Below this is a lighter brown, more structured layer with visible vertical roots and some horizontal layering. The bottom of the profile is a very light tan color. Sparse green and brown grass is visible at the top edge of the soil.

Native Soil Structure

Conservation Agriculture & Soil Health Principles

- **Minimal soil disturbance**
- **Keep the soil covered**
- **Diversity of plants**
- **Living roots in the soil**
- **Integrate livestock**







2008-2011 Yields, bu/A

	<u>Corn</u>	<u>Soybeans</u>
No-till	216.9	52.0
NT w/CC	204.9	51.9
DD w/CC	204.2	49.1
Disk-Disk	204.5	49.4
Chisel-D	203.3	50.7
Plow-D-D	204.2	49.8



2015 Yields, bu/A

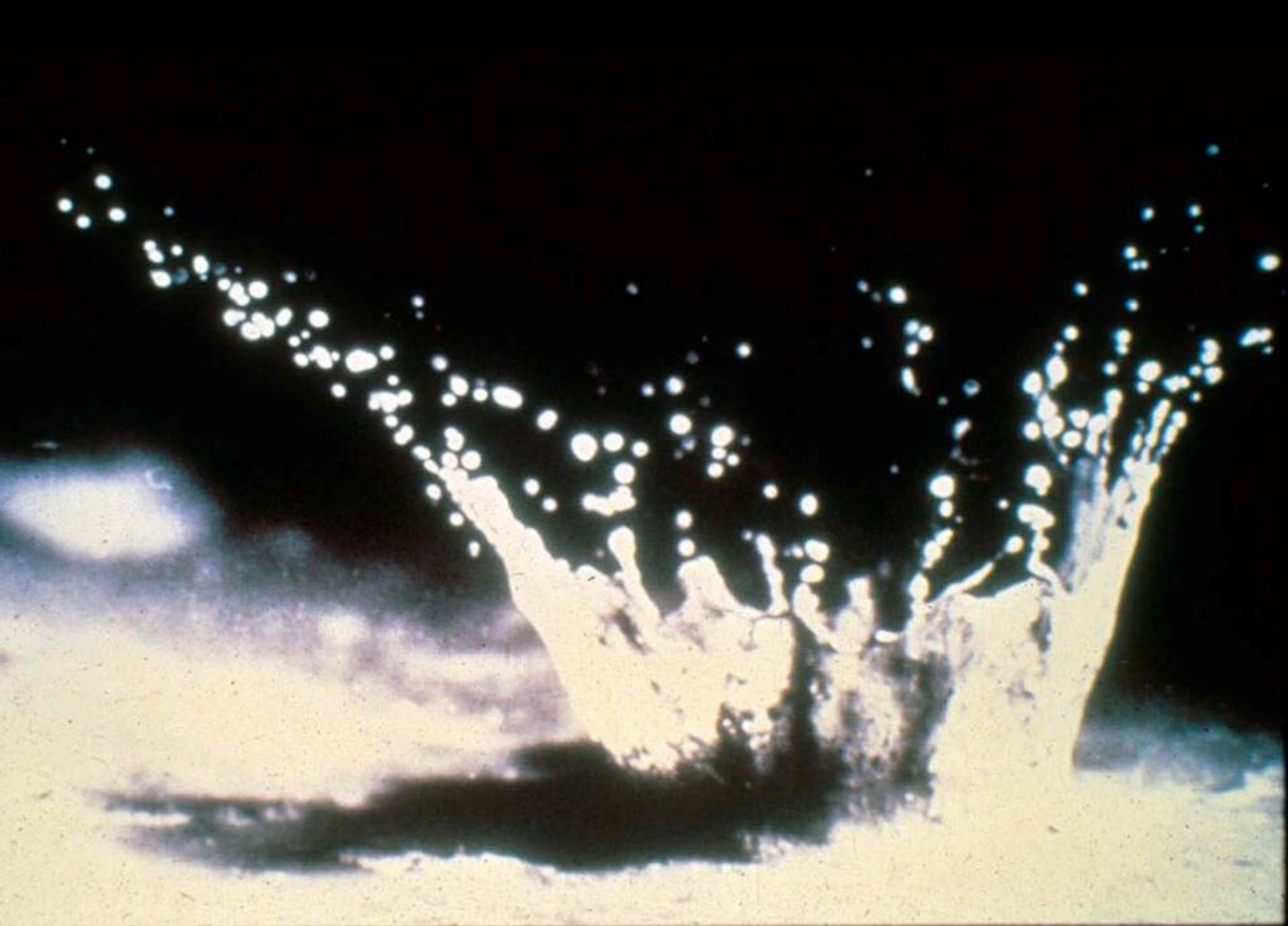
	<u>Corn</u>	<u>Soybeans</u>
No-till	223.4	60.0
NT w/CC	207.0	58.4
DD w/CC	203.7	55.1
Disk-Disk	206.7	55.3
Chisel-D	182.6	53.5
Plow-D-D	186.5	56.7

2018 Yields, bu/A

	<u>Corn</u>	<u>Soybeans</u>
No-till	224.7	49.2
NT w/CC	232.8	48.2
DD w/CC	208.6	49.2
Disk-Disk	215.5	44.7
Chisel-D	216.6	47.7
Plow-D-D	207.4	50.9















**SW Nebraska - 6 inch rain June 12-13
Crusting, runoff, & terraces overtopped**



**Adjoining field - 6 inch rain June 12-13
Established no-till, little runoff**





Tilled Yield

210 bu/A

No-till Yield

237 bu/A




Rogers Memorial Farm 2009







The background of the slide is a photograph of a vast, green agricultural field. The crops are tall and dense, filling the lower two-thirds of the frame. In the distance, the field meets a flat horizon under a pale, clear sky. The overall scene is bright and natural, suggesting a healthy and productive farming environment.

Increase biological diversity
Put new crops in the rotation
Put forages in the rotation
Use cover crops



FOOD ISSUES

It's the Soil Biology, Stupid!

Domain	Phylum	Class	Order	Family	Genus	Species	Compost Treated	Control	Desert	Total Count	Microbial Resilience	Nitrogen Cycle	Carbon Cycle
Archaea	Thaumarchaeota	Unclassified (Thaumarchaeota)	Nitrososporiales	Nitrososporiaceae	Nitrososporium	Nitrososporium maritimus	3,882	7,901	951	12,734			
	Acidobacteria	Acidobacteria (class)	Acidobacteriales	Acidobacteriaceae	Acidobacterium	Acidobacterium capsulatum	2,631	3,534	1,147	7,312			
		Solibacteres unclassified	Solibacteriales unclassified	Acidobacteriaceae	Acidobacterium	Acidobacterium sp. MP5ACTXB	1,418	1,639	254	3,311			
					Candidatus Solibacter	Candidatus Solibacter usitatus	17,913	22,435	9,691	50,039			Fe
					Candidatus Koribacter	Candidatus Koribacter versatilis	7,496	10,138	1,921	19,555			
					Acidothermus	Acidothermus cellulositicus	3,150	2,421	522	6,133			
					Arcanobacterium	Arcanobacterium haemolyticum	355	108	45	508			
					Cellulomonas	Cellulomonas flavescens	2,226	1,255	19	3,499			
					Corynebacterium	Corynebacterium glutamicum	767	681	3	1,286			
					Dermacoccus	Dermacoccus sp. Ellis185	684	424	9	1,117			
				Frankiaceae	Frankia	Frankia sp. Cc3	2,895	2,157	229	5,281	7/5		
						Frankia sp. EAN10ec	2,299	1,796	258	4,353	+		
						Frankia sp. EUN2f	1,140	622	70	2,040	+		
						Frankia sp. Eul3c	1,445	1,434	241	3,120	+		
						Frankia symbiont of Datisca glomerata	781	595	53	1,429	+		
				Geodermatophilaceae	Geodermatophilus	Geodermatophilus obscurus	12,050	7,959	349	20,358			Mo
				Kineococcaceae	Gordonia	Gordonia bronchialis	1,006	588	30	1,624			
					Janibacter	Janibacter sp. HTCC2648	2,792	1,921	70	4,783			
					Janibacter	Janibacter dentrificans	809	427	5	1,371			
					Kineococcus	Kineococcus radiotolerans	4,486	2,799	92	7,377			
				Microbacteriaceae	Clavibacter	Clavibacter michiganensis	4,739	2,342	30	7,081			
					Lathonia	Lathonia xyl	4,601	1,679	46	6,326			
					Arthrobacter	Arthrobacter arilaezeis	1,042	377	31	1,450			
					Arthrobacter	Arthrobacter aureus	4,268	2,304	133	6,705			
				Micrococcaceae	Arthrobacter	Arthrobacter chlorophenolicus	2,399	1,114	62	3,575			
					Arthrobacter	Arthrobacter nitroguajacolicus	18	2	-	20			Co
					Arthrobacter	Arthrobacter sp. F824	4,837	2,635	160	7,632			
					Kocuria	Kocuria rhizophila	1,528	752	23	2,303			
					Micrococcus	Micrococcus luteus	1,440	563	24	2,027			
					Rothia	Rothia dentocariosa	1,373	817	14	2,154			
					Rothia	Rothia dentocariosa	498	205	4	707			

MARCH 25, 2018

LA CHEFS

##BIOLOGY, ##CLIMATE, ##FOOD, ##REGENERATIVE, ##SOIL

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“In soil/natural ecosystems, microorganisms including bacteria and fungi exist in a very large number and **play a very crucial role in maintaining major biogeochemical cycles, plant nutrition, plant health, soil fertility, soil structure, and degrading organic pollutants and remediation of toxic metals.** Therefore, microorganisms are key players in important ecological processes, such as carbon, nitrogen, phosphorus, and sulfur biogeochemical cycle, and directly influence all lines on Earth. It is noted

Micrococcaceae	Arthrobacter	Arthrobacter amicus	4,268	2,304	133	5,705		
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	Penibacterium	Penibacterium salmoninarum	1,573	647	14	2,454		
	Rothia	Rothia dentocariosa	498	205	9	712		

“In soil/natural ecosystems, microorganisms including bacteria and fungi exist in a very large number and **play a very crucial role in maintaining major biogeochemical cycles, plant nutrition, plant health, soil fertility, soil structure, and degrading organic pollutants and remediation of toxic metals.** Therefore, microorganisms are key players in important ecological processes, such as carbon, nitrogen, phosphorous, and sulfur biogeochemical cycle, and directly influence all lives on Earth. It is noted that 1 gram of soil/sediment may contain 10 to the 9th

learning more about what soil microbes do individually as well as collectively (in quorems), soil scientists are better understanding the huge role soil microbes play especially in nutrient cycling, carbon/nitrogen/phosphorus utilization, carbon sequestration, methane mitigation, soil fertility, and plant nutrient density.

Current research has shown microbes help build soil organic matter [SOM] through decomposition and the carbon pathway (Liang et al 2017), that is root exudates . Roots exude carbon that feed microbes, and soil organic matter is, in part, formed by microbes eating one another, pooping and dying, that is microbial waste and necromass. Thus carbon capture and utilization is driven by soil microbes (Kallenbach et al 2016). The more plant diversity above ground, the more microbial diversity







Proper crop rotation is key









Photos from Liz Haney's post







**Tilled “dormant” with 5+ days of 100°F June heat
No-till soil was cooler and yielded 35 bu/A more**







30° C



25° C



56° C



51° C



24° C

























Flood Recovery for cropland

Cover Crops for Soil Health

Paul Jasa, Extension Engineer, University of Nebraska–Lincoln

As the Missouri River's water recedes from fields, producers may need to do some field repairs, dealing with sedimentation, eroded or scoured areas, deposited debris, and still standing water. As harvest of their remaining 2011 crop nears, this work may not seem pressing. However, establishing a cover crop as soon as possible on these fields will aid in recovering and rebuilding the soil.

Cover Crop Benefits

Cover crops can be used for a variety of purposes including protecting the soil, improving soil structure, fixing nitrogen, feeding soil biological life, and managing soil moisture. Fields that were flooded in summer 2011 need cover crops for all of these reasons since a crop wasn't grown in them this year. A key soil quality concept is that there should be something green and growing during as much of the year as possible. This is important to protect

Grasses provide the longest lasting residue cover because they have a higher carbon to nitrogen ratio in their biomass compared to non-grass species. In addition, they improve snow catch in the winter and reduce wind erosion in the spring compared to bare soil. Taller brassicas and broadleaves like rape, canola, Ethiopian cabbage, and sunflowers will also stand nicely to reduce wind erosion and catch snowfall, but they provide less residue.

With the saturated soil conditions during flooding, most of the residual nitrates in the soil were lost to either denitrification or leaching. A cover crop will scavenge any remaining residual nitrates for its growth, reducing further losses. However, if there are no residual nitrates, cover crop growth may be slow, with non-legumes showing nitrogen deficiencies. Some producers apply some nitrogen fertilizer to encourage cover crop growth which is later recovered as the cover crop residue breaks down. Producers should use legume cover crops to fix some nitrogen for the next

sedimentation, eroded or scoured areas, deposited debris, and still standing water. As harvest of their remaining 2011 crop nears, this work may not seem pressing. However, establishing a cover crop as soon as possible on these fields will aid in recovering and rebuilding the soil.

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Rod Zessin Prevented Planting acres drilled August 19th



11.10.2010 23:05



Missouri River Bottoms – Flooded 2011



Flood Recovery for cropland

Flooded Soil Syndrome

John Sawyer, Professor and Extension Soil Fertility Specialist

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Department of Agronomy, Iowa State University

Fallow Syndrome is a condition where crops planted the year after an extended period with no plant growth exhibit reduced early growth and yield. On corn plants the syndrome exhibits classic phosphorus (P) deficiency symptoms, including slow-stunted early growth, purple coloration, and poorly developed roots. This effect is called Fallow Syndrome because it is observed in soils where, for moisture conservation, the land has been idled for a year and kept fallow with no crop or weed growth. This allows accumulation of moisture in the soil for the next cycle of crop production.

A similar syndrome can be observed after extensive flooding due to the lack of plant growth in submerged areas. This is sometimes called “Flooded Soil Syndrome.” This

beneficial fungi form important relationships with plant roots, particularly related to uptake of P and other nutrients with limited mobility in the soil. The AM fungi require a host plant, that is, active roots in the soil. They cannot be propagated in soil alone. In the year following flooding, AM colonization potential and activity are reduced. However, as the season and plant growth progress, AM root colonization can increase to levels similar to that in non-flooded soil. In addition to the AM issue, soil fluctuating anaerobic (flooded) to aerobic (non-flooded) conditions can reduce plant available P. In combination, reduced AM fungal populations and low plant available P reduce early season crop P uptake.

Another possible reason relates to increased strength of P retention by soil constituents. Reduced crop-availability of

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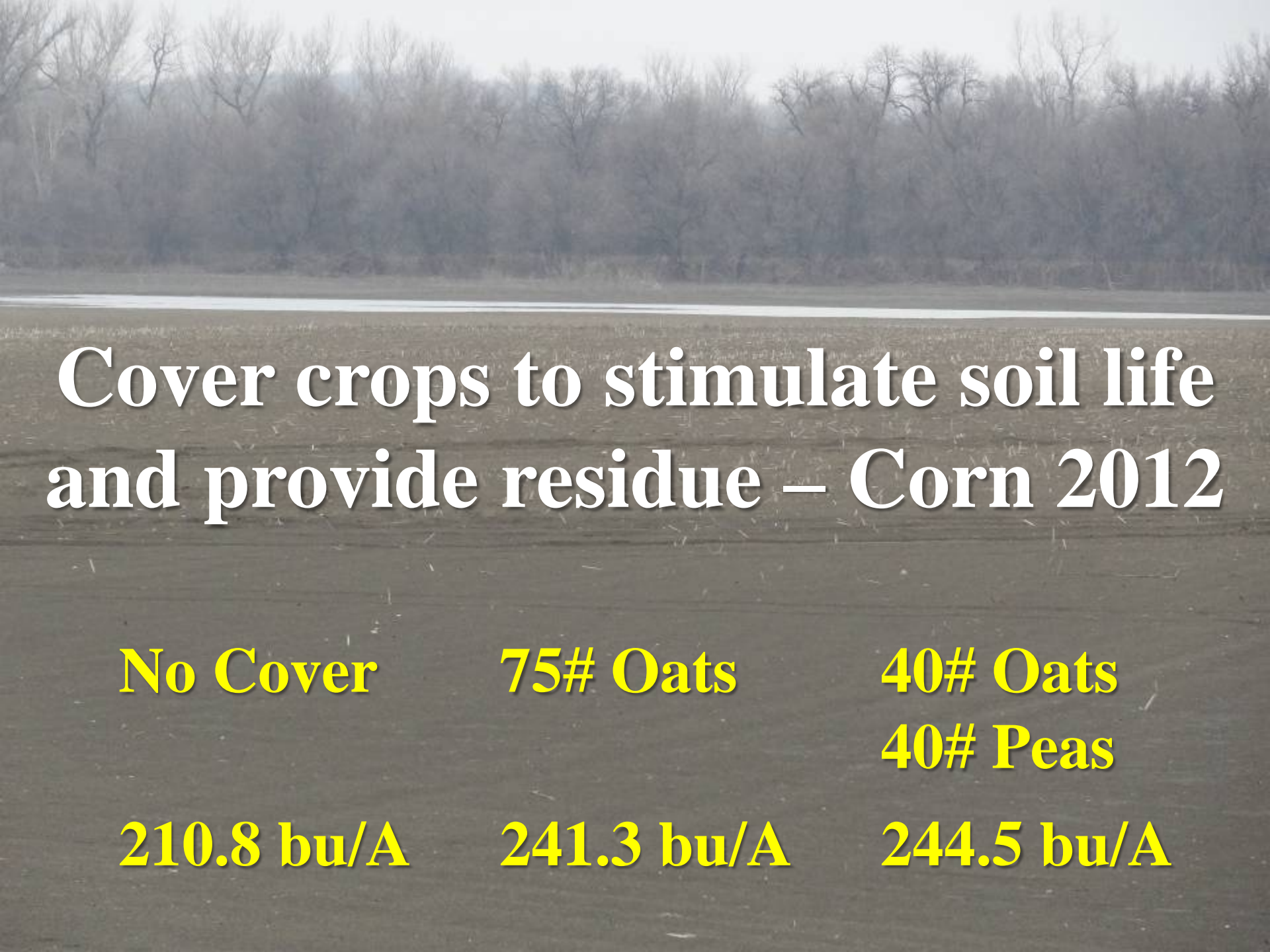
A similar syndrome can be observed after extensive flooding due to the lack of plant growth in submerged areas. This is sometimes called “Flooded Soil Syndrome.” This

Ferrie: Combat Fallow Syndrome In Corn, Prevent Plant Acres

JULY 9, 2019 11:45 AM

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Cover crops to stimulate soil life and provide residue – Corn 2012

No Cover

210.8 bu/A

75# Oats

241.3 bu/A

40# Oats

40# Peas

244.5 bu/A







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Acknowledgements

Numerous Cooperating Farmers

Many International Hosts

University of Nebraska Rogers Memorial Farm

