

34th Annual
**NATIONAL
NO-TILLAGE
CONFERENCE**

January 6-9, 2026 • St. Louis, Mo.

Testing for Soil Health Without Breaking the Bank

Kris Nichols



A Nation that Destroys its Soil, Destroys Itself.

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Soil Scientist

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KRISSYSTEMS.net

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Regenerative Alberta Living Lab

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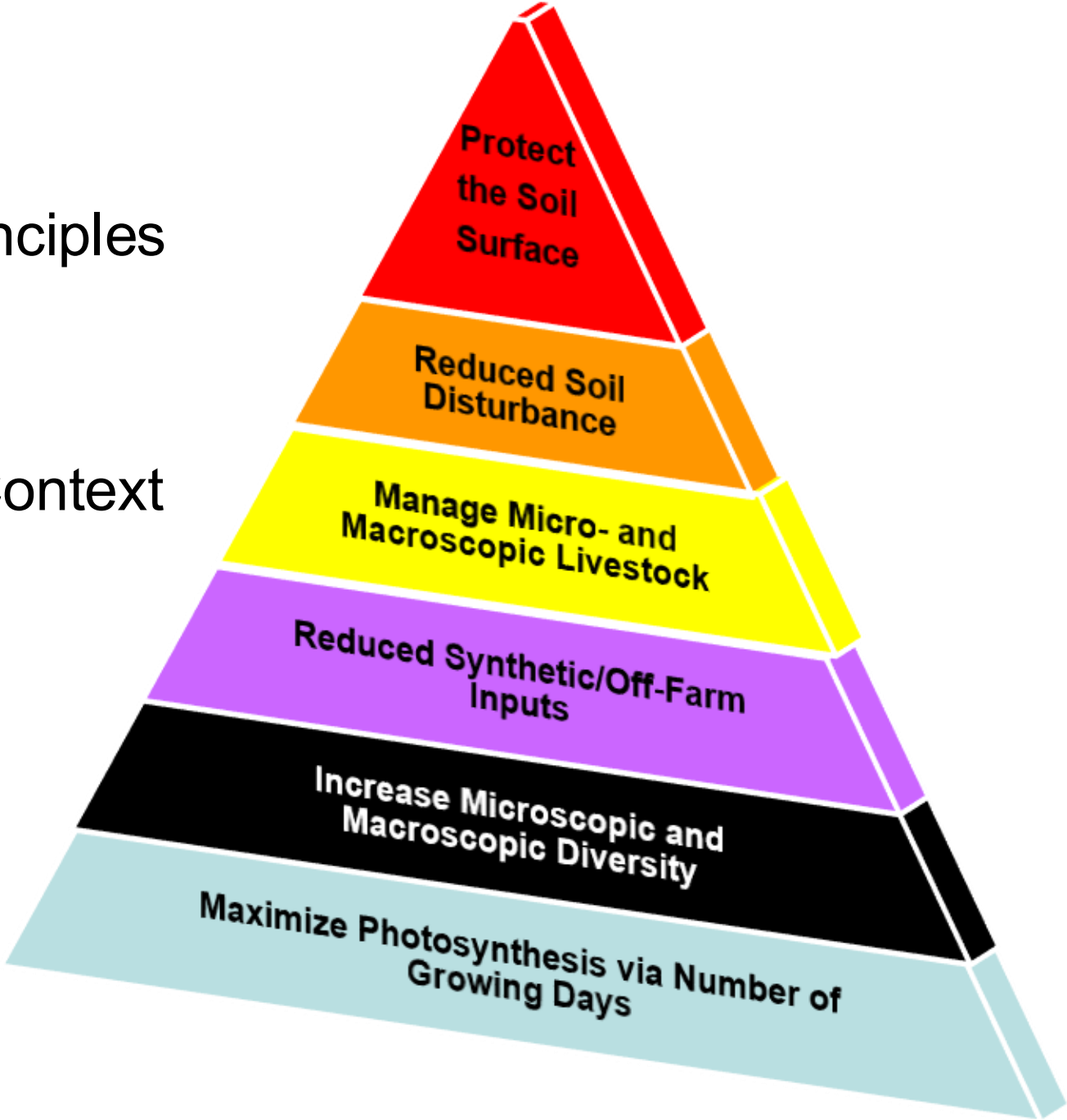
Agriculture et Agroalimentaire Canada

Agriculture and Agri-Food Canada

Canada

Soil Health Principles

Carbon Flow Context



Lab Analysis

Holistic Picture of Carbon Dynamics + Soil Health

Bulk Density

Gravel Content

Texture

Aggregate Stability

pH

Carbon (TC & TOC) + Organic Matter
(% combustion)

Root Depth

Soil Colour

Nitrogen (Total)

EC

Compaction

Infiltration

Metagenomics

Nitrogen (Available) P available K available
- Water Extraction and Weak Acid Extraction

Micro Nutrients (Ca, Mg, Na, SO₄-S, Zn, Fe,
Mn, Cu, B, Cl)

Spectral Data - Hyperspectral/NIR

Soil Moisture

Soil Temperature



Resources | Regenerative Alberta Living Lab (regenlivinglab.org)

Soil Tests



Experiments, tests, and activities that Dr. Kris Nichols has used to demonstrate soil health principles for a variety of audiences, and which you are invited to use on your own farm.

[How Much Soil is Available to Grow Food?](#)

A simple demonstration using an apple to illustrate how much soil is available on the earth to grow food

[Demonstrating Soil Porosity with a Sponge](#)

Using sponges to represent soil aggregation, porosity, and water movement in soil

[Scum Test](#)

A simple way to observe aggregate stability and glomalin presence in soil

[Measuring Mycorrhizal Colonization](#)

A method for measuring the amount of arbuscular mycorrhizal fungi within plant roots

[Soil Texture Analysis](#)

A simple way of determining soil type or texture from a soil sample

[Winogradsky Columns](#)

[Healthy Soil Pie](#)

Creating a physical pie chart to demonstrate the volume composition of typical soil

[Soil Clod Test](#)

A test to observe soil structure stability

[Measuring Aggregate Stability](#)

A method for measuring the amount of stable aggregates against flowing water or aggregates that survive wet-dry cycles

[Soil Sample Processing](#)

A method for preparing a soil sample for analysis

[Topographical Impacts on Wind and Water Erosion](#)

A small-scale test for measuring the impact of a topographical change, like the addition of riprap, on erosion





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The Andersons

Yetter
FARM EQUIPMENT
SINCE 1930

GO Seed
Semences, Semilla, Saad
Novel solutions for growing concerns.

40 YEARS TOTAL FARM MARKETING
BY STEWART-PETERSON

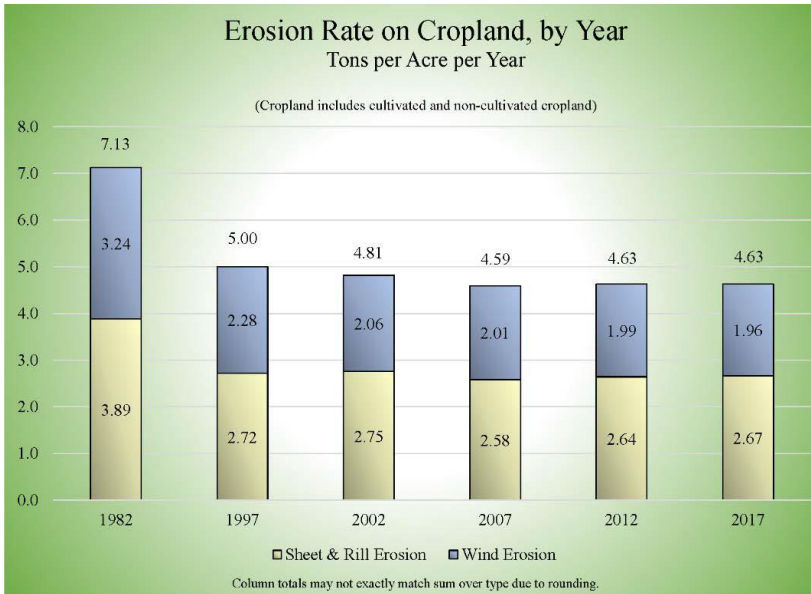
BioTill Cover Crops
Our Roots Run Deep
CopperheadAg PRODUCTS

HUMA
TITAN
VULCAN
EQUIPMENT

MidWest Bio-Tech, Inc.
Martin Till

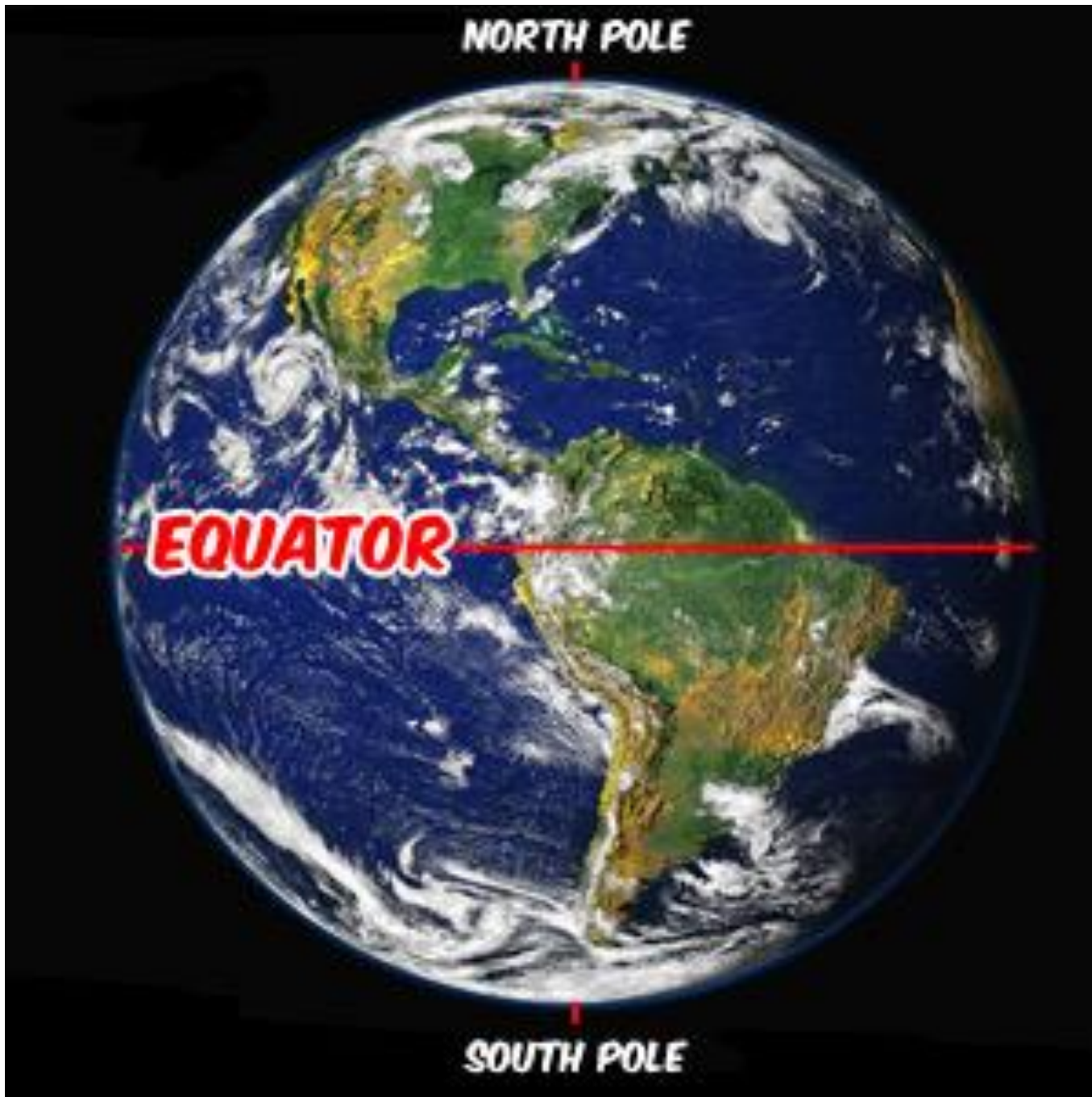
HORIZON
HORSCH
Ag Leader

Erosion



Country	Mean Erosion Rate (t ha ⁻¹ yr ⁻¹)	Arable Land (ha)	Soil Loss (t yr ⁻¹)	# railcars (100 t per car)	Length of Train (0.017 km per car)	Number of Times Circling Earth (40,075 km)
USA	11.44	148,600,000	1,700,000,000	17,000,000	289,000	7.21





US ships out 1.7 billion tonnes of topsoil per year requiring a train circle the Earth more than 7 times.

Hendricks, MN 2022



BUSINESS

Study: Midwest topsoil 'being eroded 100 times faster than it's forming'

An eye-popping new report argues that soil erosion in the Midwest is happening at a far faster clip than previously estimated.

By Christopher Vondracek (<https://www.startribune.com/christopher-vondracek/9173241/>) Star Tribune

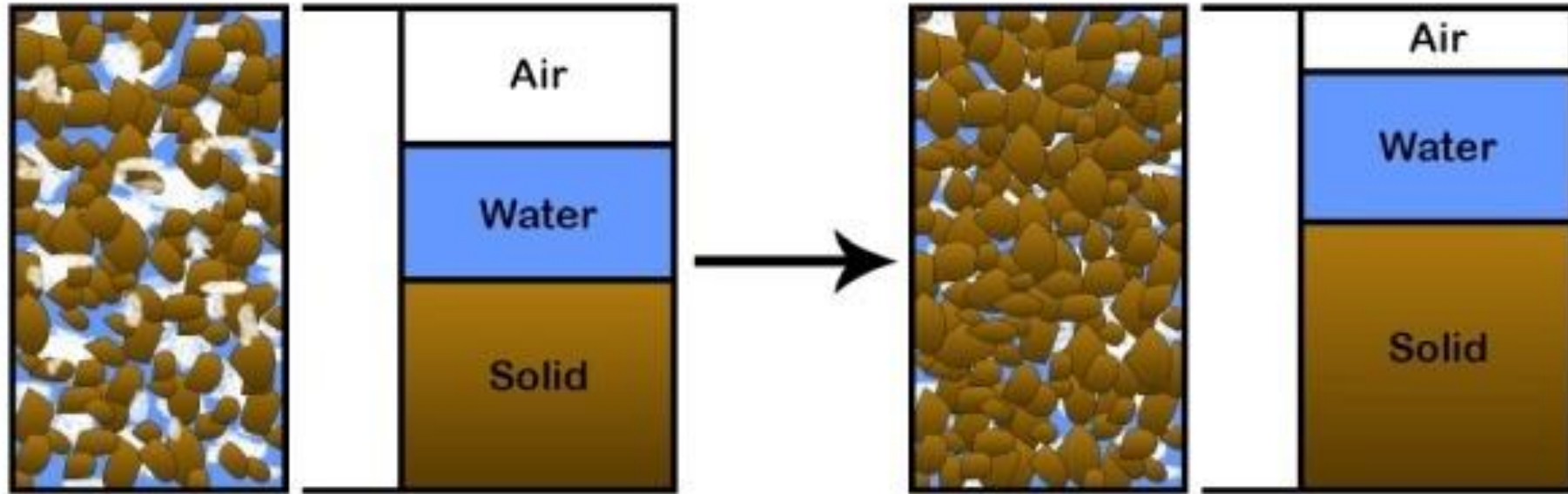
DECEMBER 28, 2022 — 12:31PM

Farmers might not know it — but something is stealing the land from under their feet.

It's erosion.

Test	Method	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity		
			Very Low	Low	Medium	Optimum	Very High	%sat	meq	
Soil pH	1:1	7.3						13.4 meq/100g		
Buffer pH								%Saturation		
Phosphorus (P)	M3	204 ppm	[Green bar]					K	6.2	0.8
Potassium (K)	M3	324 ppm	[Green bar]					Ca	79.1	10.6
Calcium (Ca)	M3	2119 ppm	[Green bar]					Mg	13.6	1.8
Magnesium (Mg)	M3	218 ppm	[Green bar]					H	0.0	0.0
Sulfur (S)	M3	14 ppm	[Yellow bar]					Na	1.1	0.1
Boron (B)	M3	1.4 ppm	[Green bar]					K/Mg Ratio: 0.46 [Red]		
Copper (Cu)	M3	4.1 ppm	[Green bar]					Ca/Mg Ratio: 5.82 [Green]		
Iron (Fe)	M3	100 ppm	[Yellow bar]							
Manganese (Mn)	M3	231 ppm	[Green bar]							
Zinc (Zn)	M3	11.4 ppm	[Green bar]							
Sodium (Na)	M3	34 ppm	[Grey bar]							
Soluble Salts										
Organic Matter	LOI	3.6% ENR 116	[Grey bar]							
Nitrate Nitrogen										

Soil Porosity



Healthy Soil

Unhealthy Soil

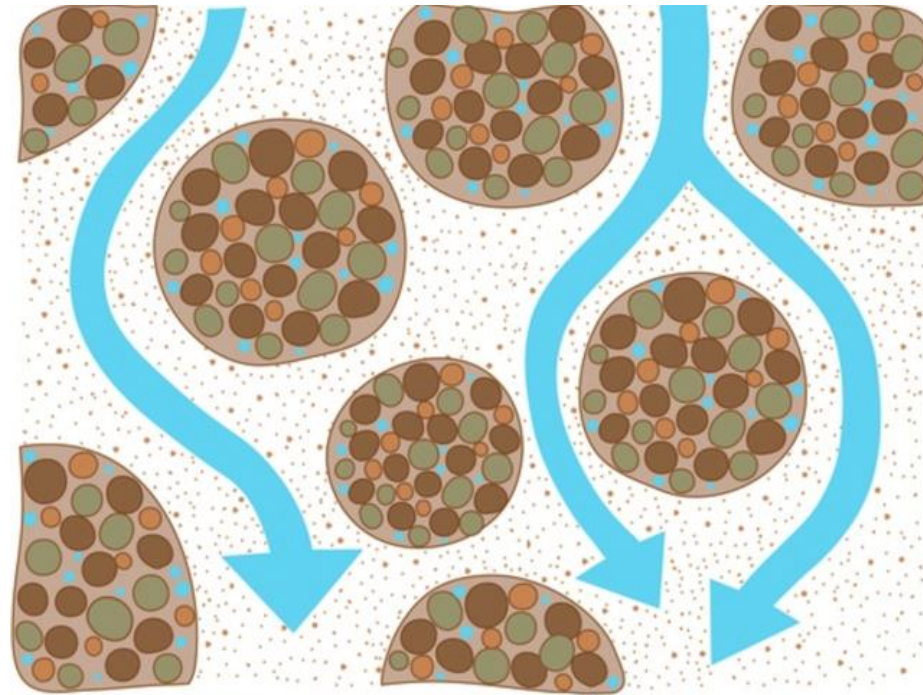
45% greater porosity increases infiltration by 167% for the first inch and 650% for the second inch - Karlen et al., 1998

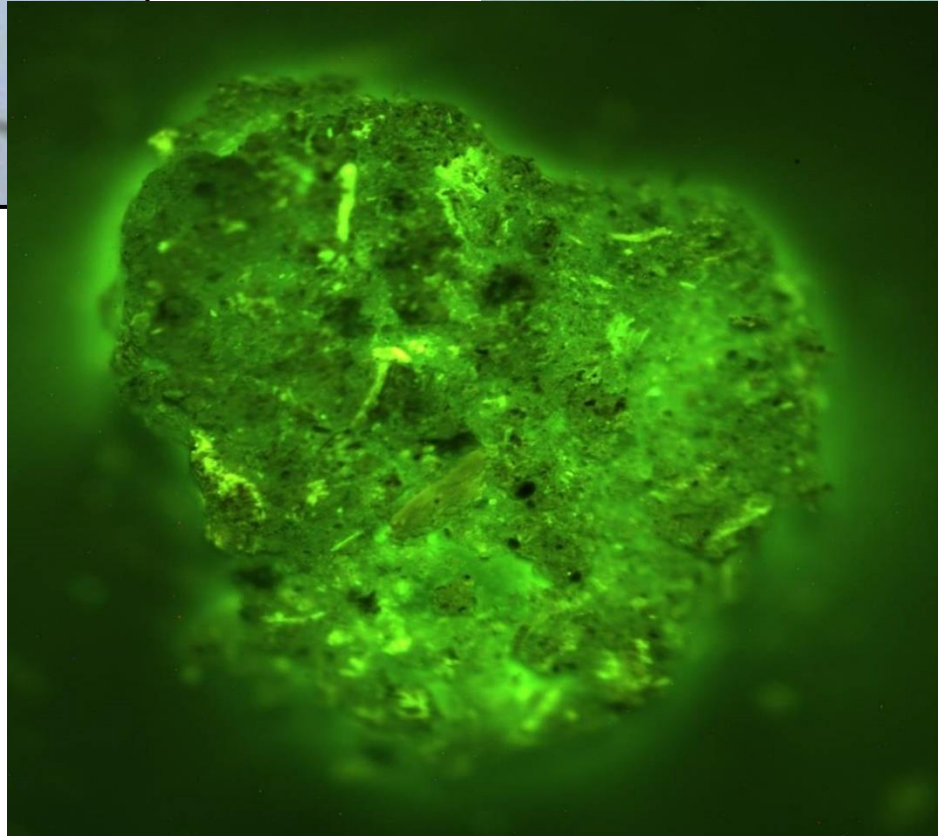
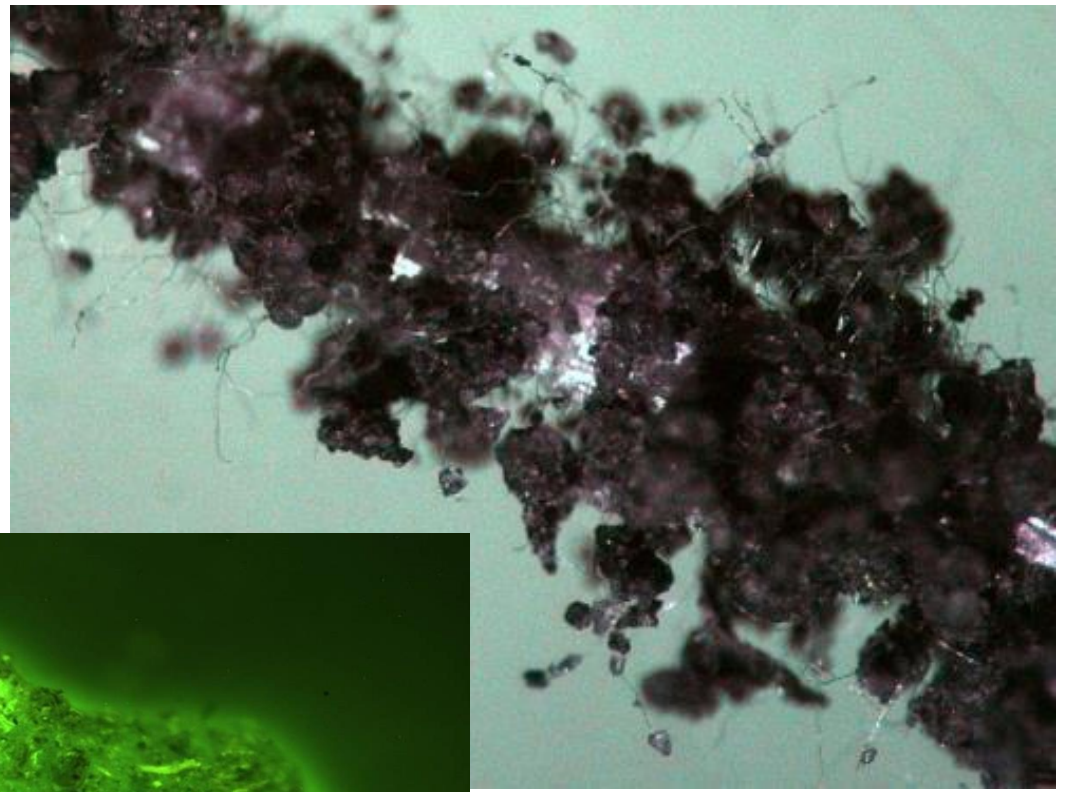
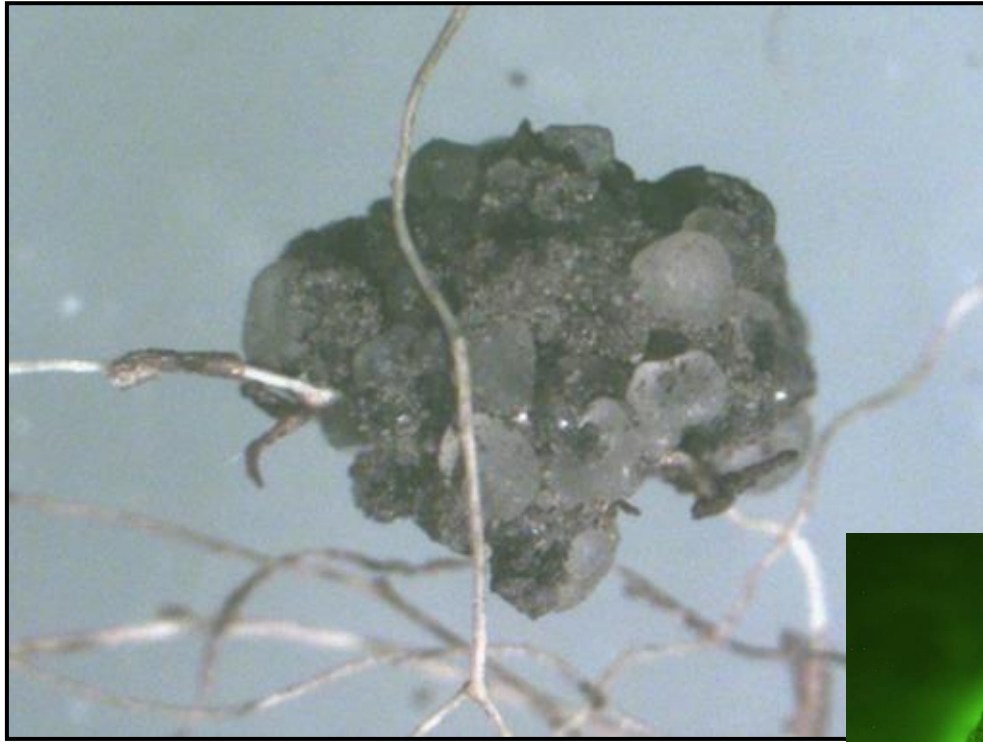


Soil Aggregation and Porosity

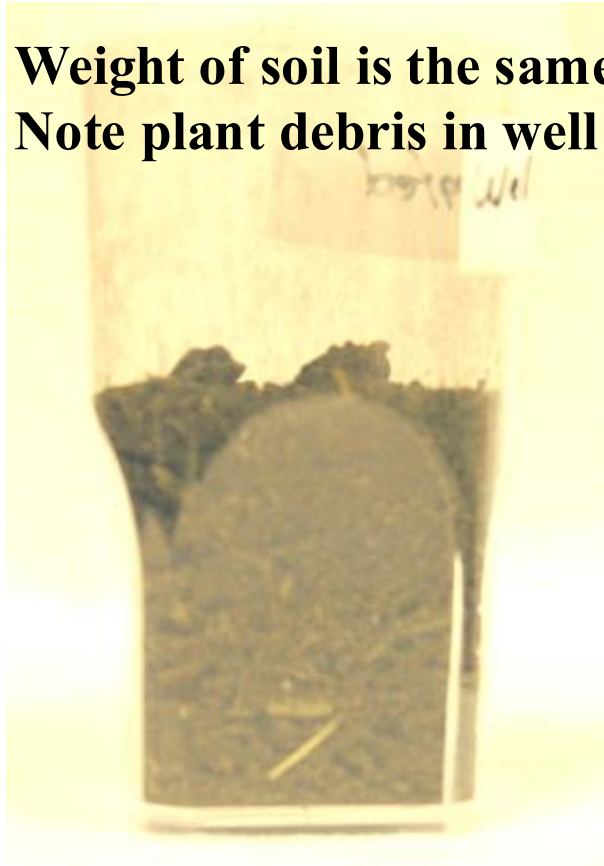


1-2 mm
Aggregates





**Weight of soil is the same but volume is different.
Note plant debris in well aggregated sample.**

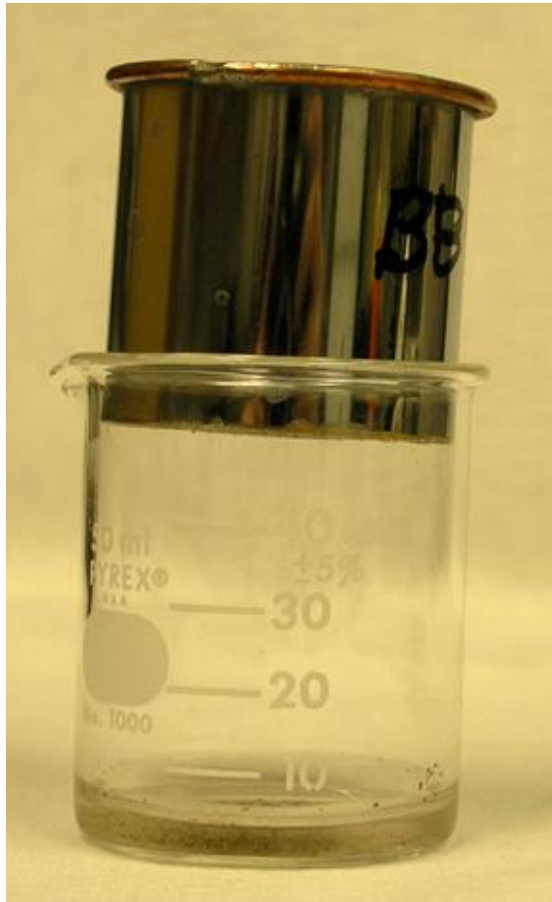


Well Aggregated Soil



Not Well Aggregated Soil





Well Aggregated Soil



Not Well Aggregated Soil





Well Aggregated Soil



Not Well Aggregated Soil





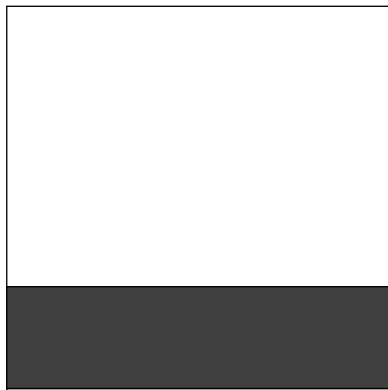
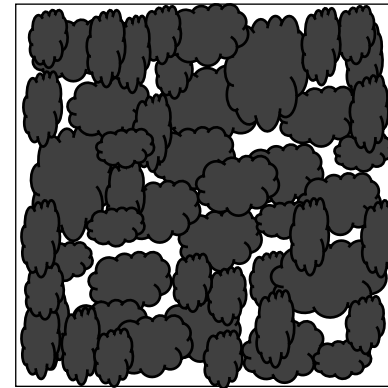
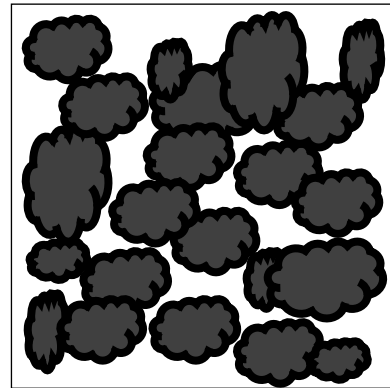
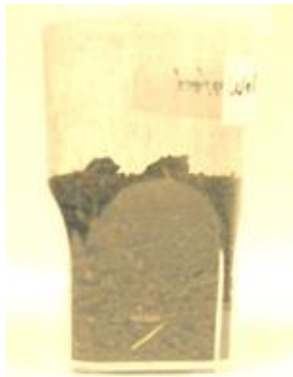
Well Aggregated Soil



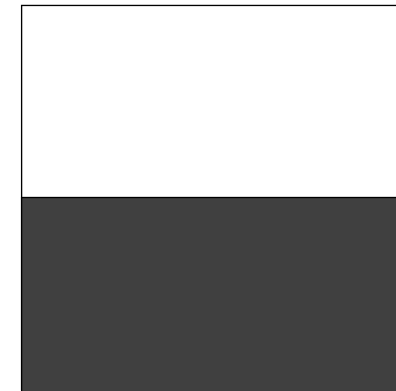
Not Well Aggregated Soil



Organic Matter vs Percent TOC vs Carbon Stocks

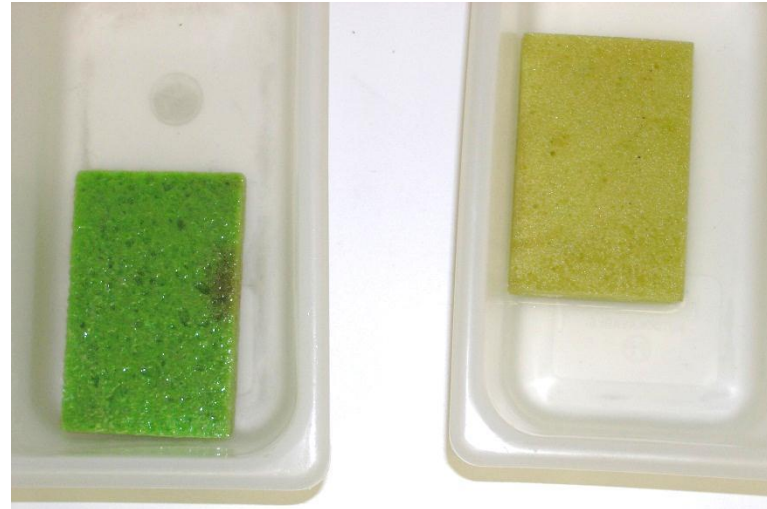


%OM	Bulk Density (g/cm ³)	% Carbon in SOM	% TOC	Stock TOC (t/acre)	Stock CO ₂ eq	Porosity estimate
7.1	0.66	58	4.12	16.47	60.38	75
8.6	1.42	58	4.99	42.92	157.36	46
12.2	0.73	58	7.08	31.30	114.76	72

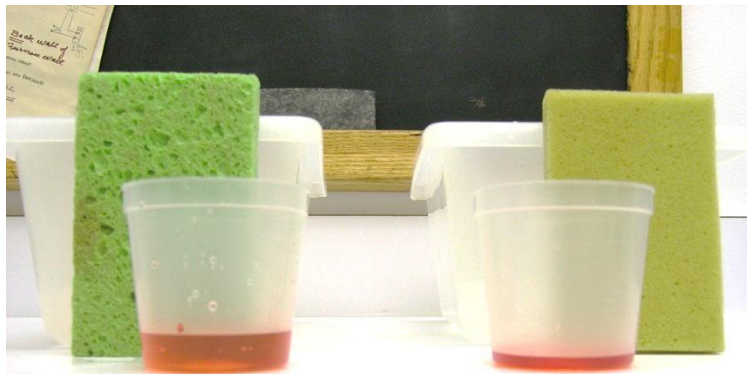


Sponge and Bucket

Infiltration, Water Holding Capacity, and Porosity



Sponge with more porosity is saturated first



Gravitational water or water which flows out of pores

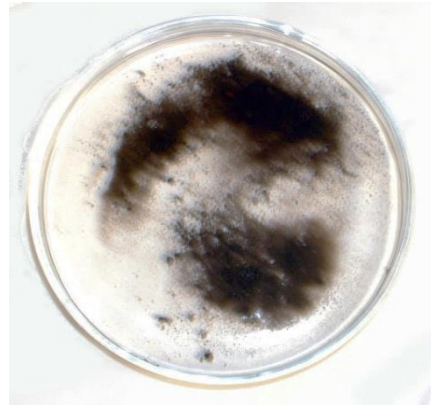


Pore space holds more water

AGGREGATE STABILITY



Dry Aggregates (above) with Water (below)



WSA = 14%

CT, SW-F



WSA = 47%

NT, SW-WW-SF



WSA = 93%

Moderately-grazed pasture

Slake Test/clod test/ aggregate stability test



Slake Test/clod test/ aggregate stability test



Slake Test/clod test/ aggregate stability test





Soil Clod or Slake Test

**Above shows how to
put the jars and screens
together. On the right
shows soil filtering
through the screen from
the CT, corn sample as
soon as the clod is
placed on the screen.**

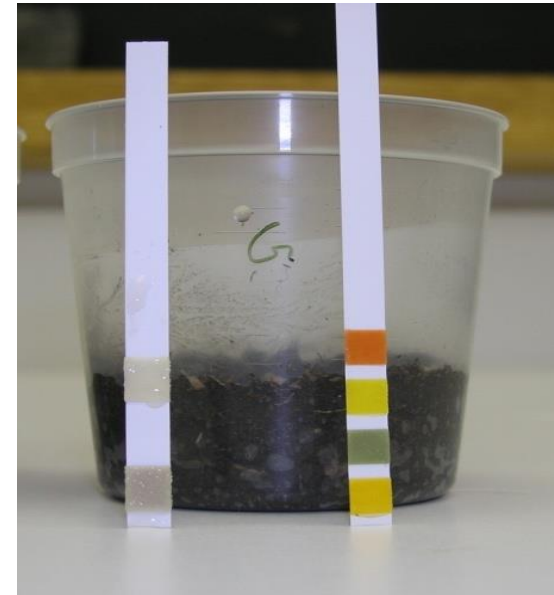
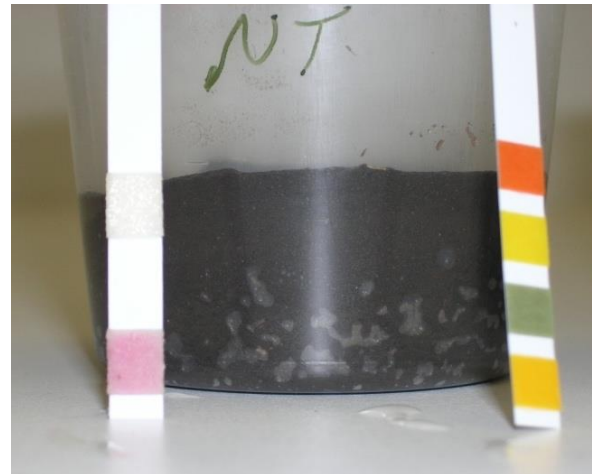
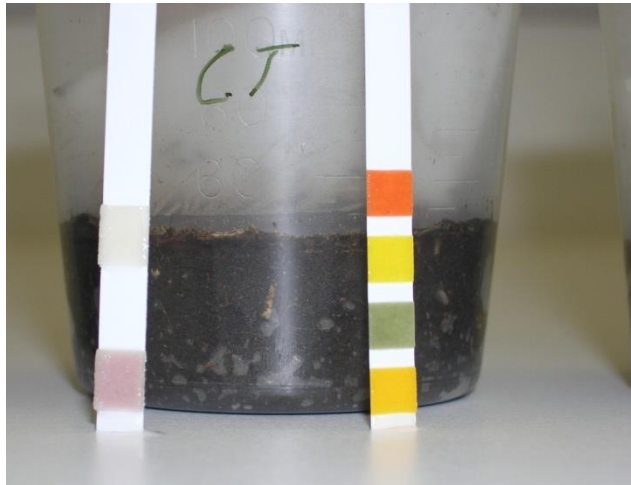
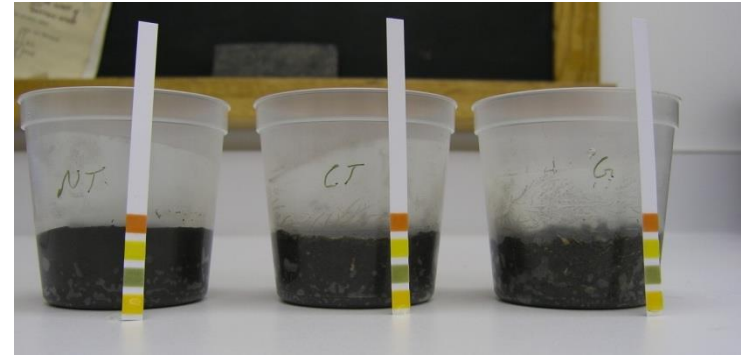
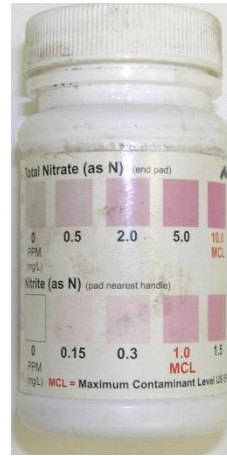
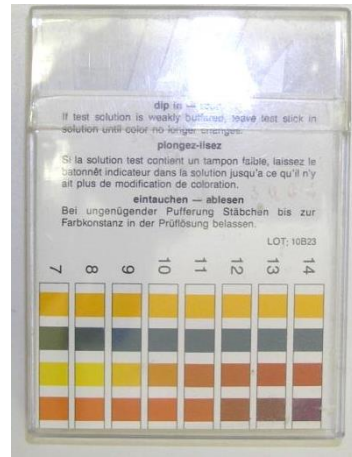




To the left, the swirling of the jars containing soil clods from NT, SW-F; CT-corn; and a grazed grassland (from left to right) is depicted.

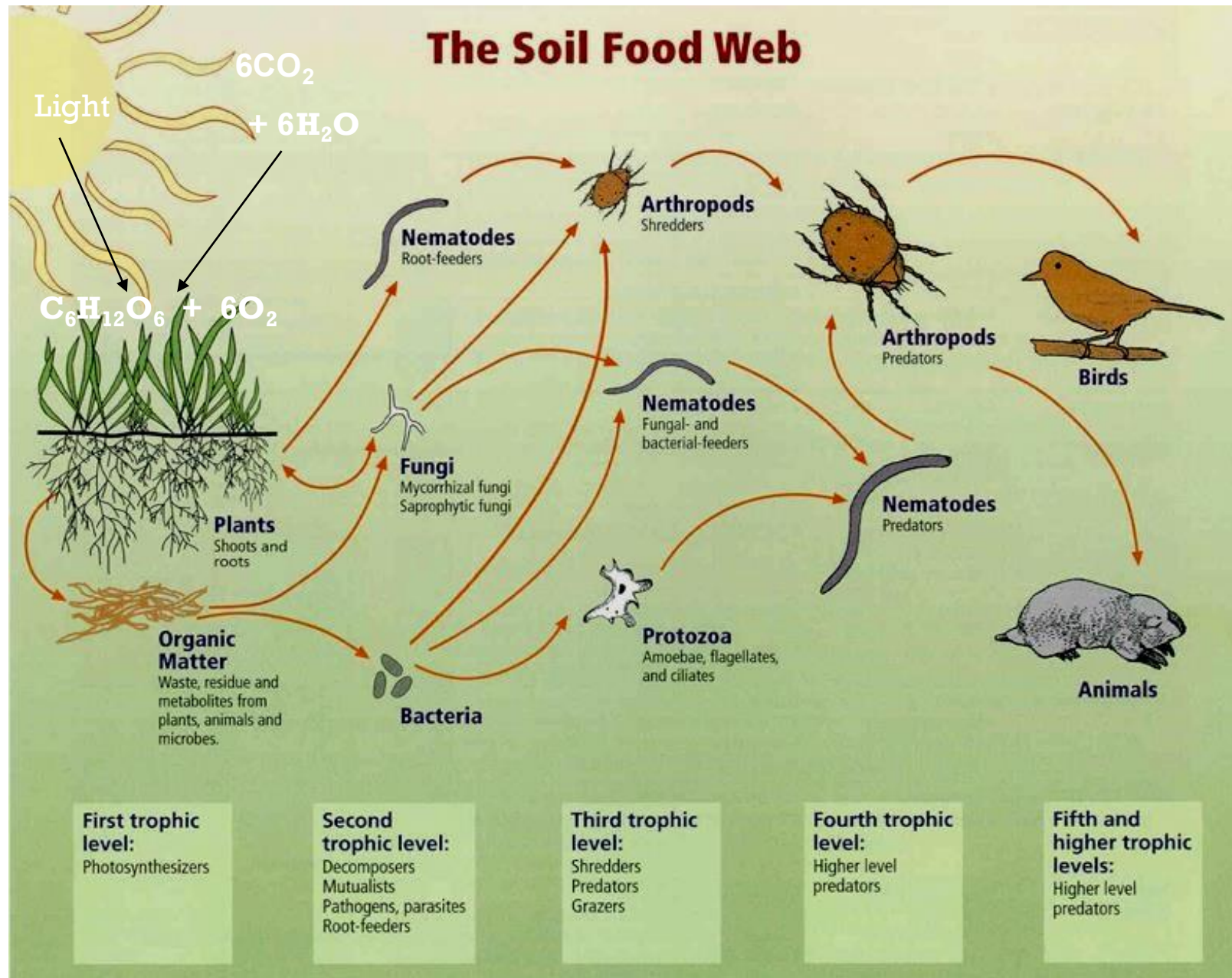
To the right is the amount of soil which filters through the screen after gently swirling the jar about four times.





Soil pH and Soil Nitrates

Root of the Problem is the Root of the Solution



Soil Your Undies



It really boils down to this: that all life is interrelated.
We are all caught in an inescapable network of
mutuality, tied into a single garment of destiny.
Whatever affects one destiny, affects all indirectly.

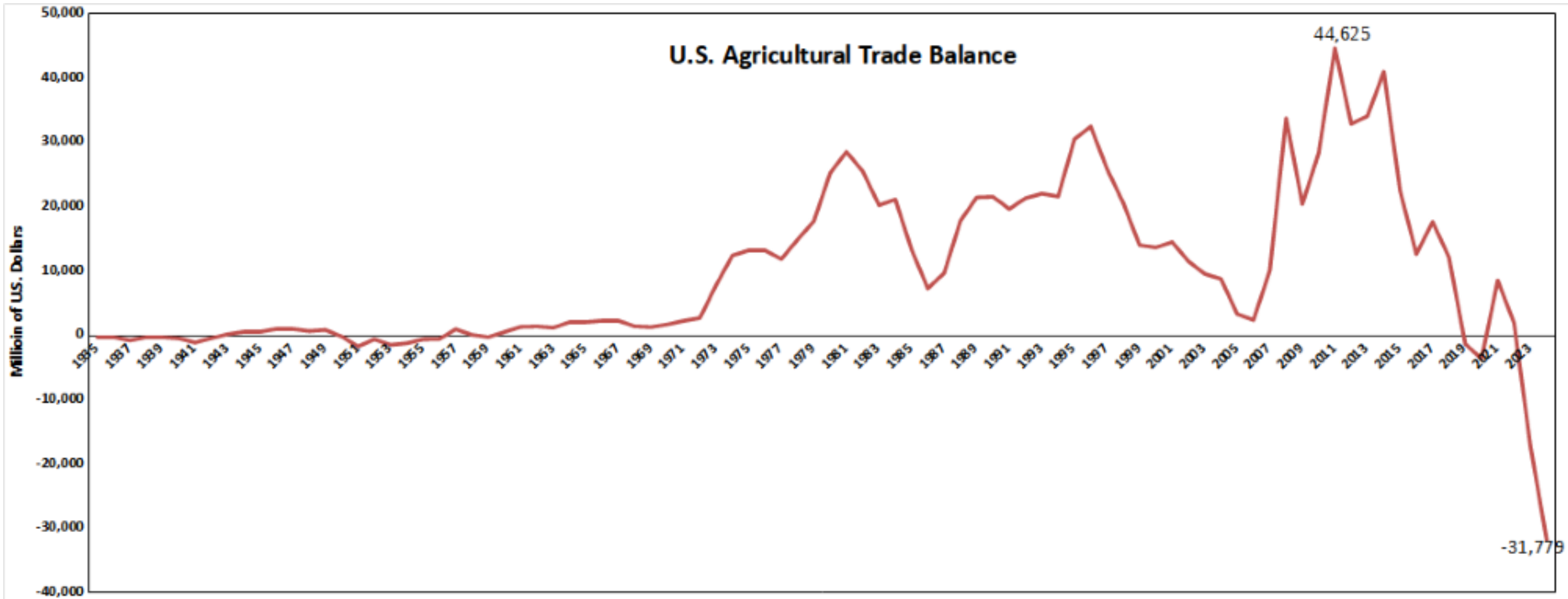
Martin Luther King Jr., Christmas Eve Sermon, 1967

Questions, Comments, Criticisms, Concerns



February 22, 2025 - Alberta, Canada





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