Soil Health: A Global Perspective

Brian Dougherty
2018 Nuffield Scholar
1briandougherty@gmail.com
Phone: (563) 239-7070
Twitter: @NEIowaAgEng

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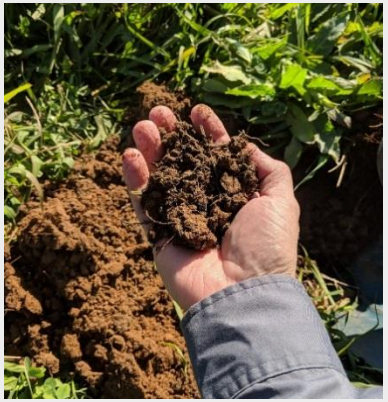
The intersection of soil health, nutrient management, and water quality issues





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Overview

What factors drive soil health efforts in other countries?

How does the U.S. compare?

Where are we headed?

NUFFIELD INTERNATIONAL FARMING SCHOLARS

Argentina & Chile

It's still the "Wild West"

- Political and economic instability (high inflation, cash transactions)
- Essentially no government support for production agriculture
- Soil health efforts driven by ***short-term profit***

Argentina: Best runoff comparison ever!

Australia

Soil health focus is tied to water scarcity and salinity issues

- Minimal government support for production agriculture
- Soil CRC: 10-yr research project with $167 million funding
- Soil health efforts driven by ***long term profit***

Canada – SE Ontario

Farmers are working hard to improve water quality in Lake Erie:

- No-till
- Cover crops
- Intercropping

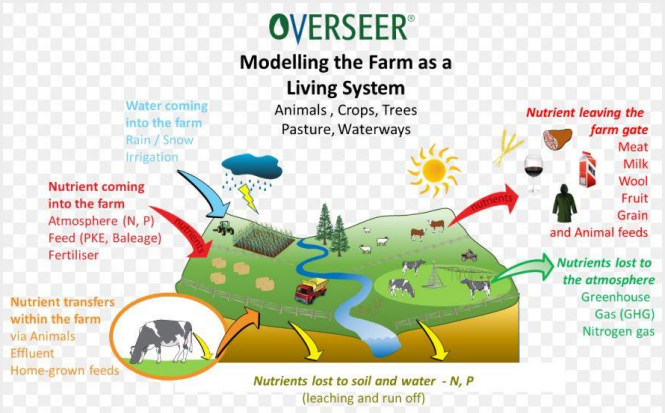
Canada – SE Ontario

Soil health efforts driven by ***water quality concerns***

New Zealand

Heavily regulated compared to the U.S. – focus on water quality

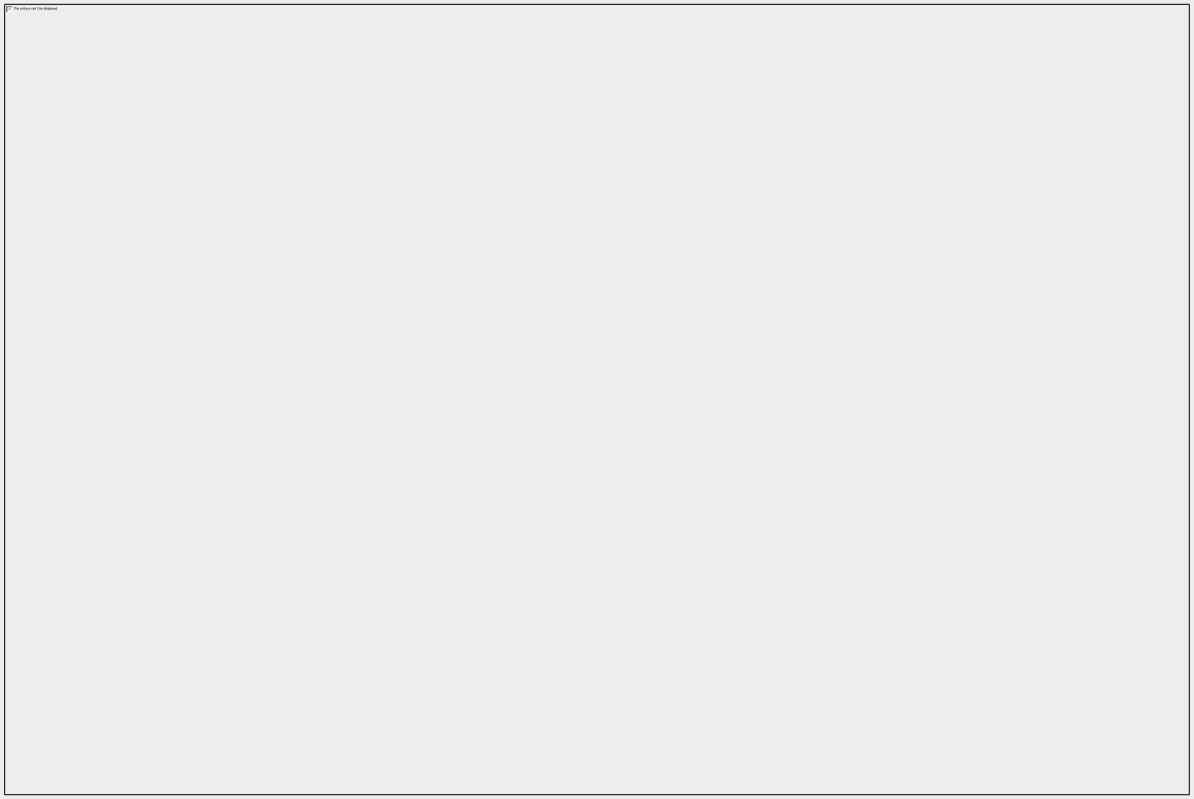
- Noticeable fear of regulation and among farmers
- Farmers are losing their 'social license to operate'
- Minimal government support for agriculture - export dependent
- Soil health efforts driven by ***regulations*** and ***public pressure***



EU Countries: France, UK, Ireland, Netherlands

Problems related to poor soil management

- Excessive tillage = poor soil cover and water infiltration = erosion
- Europeans have had thousands of years of practice!!



EU Countries: France, UK, Ireland, Netherlands

- Massive government support for production agriculture
  - "Greening" scheme payments for cover crops, permanent grassland, habitat plantings, diversified rotations, etc. etc.
- Laundry list of regulations to go with the payments
  - Requirements for field buffers, set-aside acreage, cover crop regulations, manure restrictions, production quotas, etc. etc.
- This is all subject to change: Common Agricultural Policy is expensive and Brexit has created chaos
- Lots of technology used to deal with excess manure nutrients
- Soil health efforts driven by ***regulations*** and ***government support***

How the U.S. is different

Farmers here have it easy with soil and water quality regulations

- Reasonable (generous?) government support for agriculture
- Fewer environmental safeguards relative to other advanced countries
- Soil health and water quality efforts are mostly ***voluntary***
- Requirements are flexible with minimal enforcement

How we are all the same

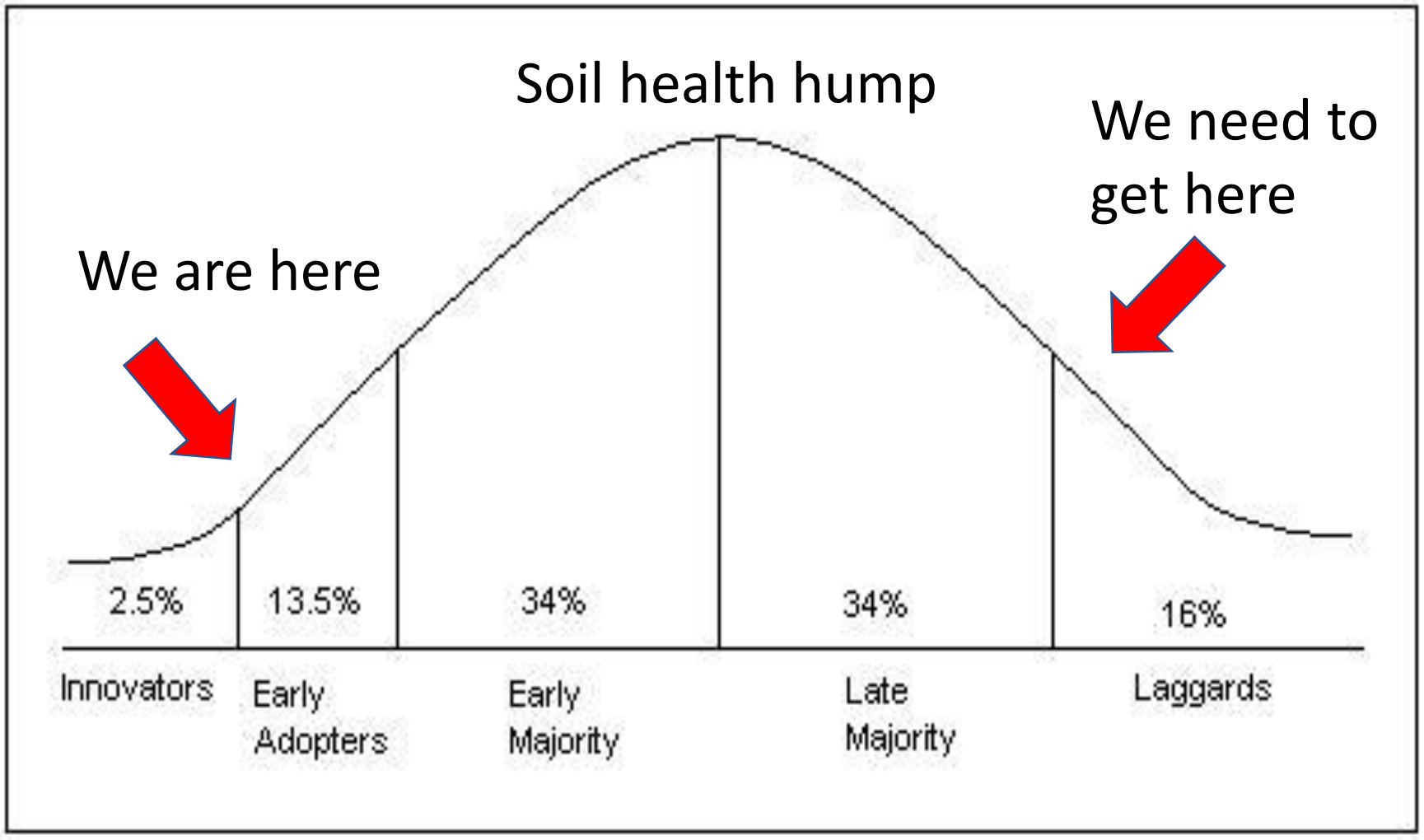
- Farmers are getting old
- Kids can't afford to or don't want to farm
- Small towns are dying
- Mostly conventional chemically-based agriculture
- We use technology to improve yield and mask soil degradation
- We try to convince ourselves that we are 'leaving the land better than we found it'
- Farmers realize the current production model is broken

The exception

Farms using **regenerative, biologically based practices** were **thriving**, young people had **opportunity** and were **excited**, and farmers were having **fun** again

But it's too much work and we can't 'feed the world' that way!!??

Where are we headed?



Will we get over the soil health hump?

We will ***because there is no other logical alternative***

Our future is bleak if we continue with current rates of soil degradation

T ✖ 5 tons/acre

How will we get there?

By combining the old with the new to capture more free sunlight, air, and water

The old - basic soil health principles:

- Keep it covered
- Don’t disturb it
- Always grow something
- Add diversity

The new - technology and innovation:

- Better planters
- Better soil health tests
- Better understanding of nutrient cycling

How will we get there?

Cover crops

Agroforestry

Relay/intercropping

Side-dress manure

How will we get there?

Better soil health tests

Analysis	Result	Guideline	Interpretation	Comments
Total Bacteria (ug/g)	333	175	High	Total bacterial biomass is above the optimum range in this sample.
Total Fungi (ug/g)	82	50	Normal	Total fungal biomass is within the optimal range in this sample.
Active Bacteria (ug/g)	18.47	5.00	High	Only aerobically active bacteria aid plant growth by breaking down simple carbon compounds and providing nutrients to the plant. Aerobic bacterial activity is above the optimal range in this sample indicating that the bacterial biomass will continue to increase.
Active Fungi (ug/g)	1.7	1.0	Normal	Aerobically active fungi decompose complex carbon compounds, aid soil structure and retain nutrients in the soil making them available for plant uptake. Aerobic fungal activity is within the optimum range in this sample.
Hyphal Diameter (um)	2.60	2.60	Normal	Fungal hyphae extend from the plant root-fungal interface into the surrounding soil. Larger diameter hyphae can access greater amounts of water and nutrients.In this sample the hyphal diameter is above the optimal level.
Tot Fungi/Tot Bact	0.25	0.20	Normal	Plants earlier along the successional line, such as grasses and brassicas, require a more bacterial dominated soil. Plants further along the successional line, such as shrubs and trees, require more fungal dominated soils.In this sample the bacteria to fungi ratio is within the optimal range.
Active/Total Fungi	0.02	0.25	Very Low	Higher levels of fungal activity will increase beneficial fungal populations. A low ratio may mean the soil has a higher proportion of anaerobic, potentilly detrimental, fungi.In this sample the ratio of active to total fungi is below the optimal range.
Active/Total Bact	0.06	0.25	Low	Higher levels of bacterialll activity will increase beneficial bacterial populations. A low ratio may mean the soil has a higher proportion of anaerobic, potentilly detrimental, bacteria.In this sample the ratio of active to total bacteria is below the optimal range.
Act. Fungi/Act. Bact	< 0.1	0.75	Very Low	Bacterial activity predominates in this sample.
Ciliates (No/g)	< 1	50	Very Low	Protozoa play an important role in mineralising nutrients into plant available forms. They also regulate bacterial populations and help supress disease by competing with or feeding on pathogens. Ciliates are the largest protozoa and feed on other protozoa and bacteria.In this sample the population of ciliate protozoa is below the optimal range.
Flagellates (No/g)	15975	10000	Normal	Protozoa play an important role in mineralising nutrients into plant available forms. They also regulate bacterial populations and help supress disease by competing with or feeding on pathogens. Flagellates are the smallest protozoa and feed primarily on bacteria.In this sample the population of flagellate protozoa is in the optimal range.
Amoebae (No/g)	9787	10000	Slightly Low	Protozoa play an important role in mineralising nutrients into plant available forms. They also regulate bacterial populations and help supress disease by competing with or feeding on pathogens. Amoebal protozoa live at the root surface and feed on bacterial populations.In this sample the population of amoebal protozoa is below the optimal range.

Holistic grazing

Perennial grains

Other ‘crazy’ ideas

How will we get there?

Experimentation

How will we get there?

1. Innovators and early adopters:
   - Will be more resilient and profitable
   - Will expand and replace poor managers
2. We will eventually change the farm bill to ***enable maximum production*** by supporting soil health rather than ***subsidize maximum production***

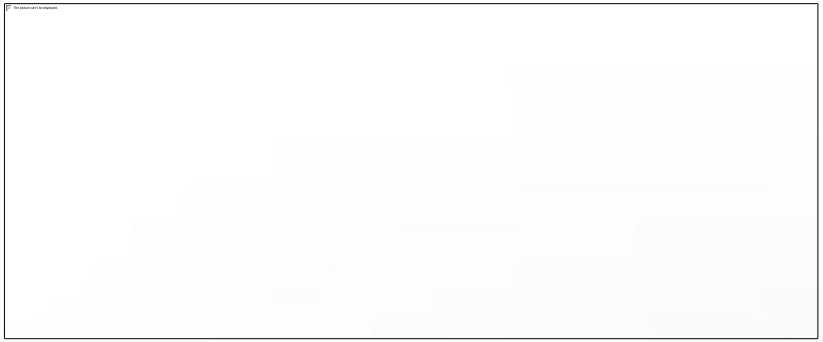
*"*Americans can always be counted on to do the right thing - after they have tried everything else" – Winston Churchill

Recommendations

Get on the soil health train or get run over!!

- ✓ Learn to mimic nature on your farm
- ✓ Feed the soil – this is a paradigm shift
- ✓ Be an early adopter – try new ideas and learn from each other
- ✓ Have fun with it!

Recommendations



Thank you!

Questions or comments?