**Why soil microbiome matters**

Gabe Brown is a farmer from North Dakota. Few years ago he gave a Ted talk where he said:

<https://youtu.be/QfTZ0rnowcc>

"Our soil resource agriculture has been challenged. How do we feed 9 billion people by the year 2050?

Today's current production model we can't do that. It is a model in which one kills the soil. It's a model of monoculture production practices.

No matter where you go around this great state there's fields of wheat, fields of corn, fields of soybeans, and many other crops.

It's one of livestock which are now in confinement whether it be poultry housed in poultry houses, or beef cattle in a feedlot for example.

However these practices have come at a cost.

They have caused the loss of biodiversity.

Healthy native rangeland has hundreds of different species of plants and animals and insects. Monoculture agriculture has few.

This lack of biodiversity has led to the destruction of our soil resource.

I'll share some proof with you and the statistics provided by North Dakota State University.

In Walsh county North Dakota back in 1960 the topsoil was 34" deep. In 2014 that topsoil was only 15" deep.

a stunning 56% loss.

The organic matter level on that same soil had gone from over 8% to less than 3% today.

Look at the ramifications of that.

The soil on your left was a soil that had not been tilled and had not seen monoculture production practices that's the same soil 17 years later. On the right after 17 years of production model of tillage and monocultures.

It also destroys the pore spaces in the soil

Those pore spaces are critical for life in the soil, are critical for water infiltration–because if we don't have soil aggregates we cannot infiltrate water.

I took this photo in a field less than 10 miles from where you're seated today that shows a half of an inch of rainfall can no longer be infiltrated into the soil profile. If we can't infiltrate water then what happens?

We resort to things such as tile drainage and you're seeing this all over the central United States today.

What happens when we put tile drainage in and we do not have the soil aggregates to hold our soils in place?

That soil ends up in the watershed and unfortunately along with it goes all the nutrients that may have been applied to those fields.

That lack of biodiversity also leads to lower nutrient cycling. If we don't have adequate nutrient cycling we're going to have to add more and more synthetic fertilizers.

Those synthetic fertilizers come at a cost; cost of fossil fuel usage and they also spur the decline of the soil biology.

We need to understand how soil functions.

How soil functions is due to that biology because the plants get their nutrients via the biology.

High synthetic fertilizer use also aids in the propagation of weeds.

Most weeds love nitrogen. The more synthetic fertilizer we apply, the more weeds we get.

If we have increased weed pressure what do we have to do?

Spray herbicides.

Now unfortunately many of those herbicides are chelates.

What is a chelate?

A chelate binds metals so any of the metals such as magnesium, manganese, iron, zinc, copper then become unavailable to the plants.

If the plant cannot uptake these micronutrients it's more prone to disease.

Because plants cannot ward off diseases on their own?

We need to spray fungicides. Fungicides then are detrimental to what?

Soil biology.

Because plants are not healthy enough to ward off pests?

We then need to spray pesticides on the crops which are meant for human consumption.

Because we spray pesticides we have a decline in what?

The very predator insects which would take care of the pest which we are spraying.

We also have a decline in pollinators.

You can hardly pick up a paper or a magazine today without reading about the plight of our pollinators.

These pollinators are critical in our crop production.

The current production model is all about killing whether it be; weeds, a fungus, a pasture, diversity, or our profit.

Take a look at these projections just put out by North Dakota State University. They're 2016 projections for some of the major crops in our state.

Every one of them projects a negative return.

What impact does that have on the quality of life of those producing that crop?

Take it a step further what impact does it have on our schools?

Drive around this state of ours and you're going to see a lot of small towns that have fewer and fewer children attending the schools.

What effect does that have on our businesses? and then in our communities?

What effect does the current production model have on our health?

The nutrient densities of the foods that we produce have declined anywhere from 15% to 65% in the last 50 years.

This has had many negative consequences.

The United States spends more on health care than any other developed country in the world, yet we lead the world in the incidences of ADD, ADHD, cancer, osteoporosis, Alzheimers, autoimmune diseases, and the list goes on and on.

This is not acceptable.

It cannot continue, but the good news is there's another way.

It's nature's Way.

Look at how nature functions.

In nature there's no mechanical tillage–yet in our production model we're tilling the soil.

In nature there's always armor on the soil surface protecting that soil from wind erosion, water erosion, evaporation–yet in our production model the fields lay exposed.

Nature cycles water very efficiently, it's able to infiltrate into the soil profile. Then due to the large amount of organic matter, it's held there for such a time that it's needed by plants.

By destroying our soil resource, we can no longer infiltrate the water and store it for when it's needed.

Nature has living plant root networks; there's things growing at all times throughout the growing season.

Not that way with production agriculture.

So often we hear about the production model that we have today as the conventional model.

I would argue that nature's Way is the conventional model because it's been around for ions of time.

Think of it this way; what did this land look like 400 years ago? You had a lot of diversity.

There was a diversity of plant species, forbes, grasses, legumes, trees.

Then also you had a diversity of animals and insects and all these work together to build a healthy ecosystem. There's five principles that we must follow in order to follow nature's model. they are:

**#1. Least amount of mechanical disturbance possible.**

On my own ranch we have been 100% zero till since 1994. We have not tilled the soil at all.

**#2.** **Armor on the soil surface.**

We always have the soil covered.

That's a picture of one of our Fields following seeding. That field is no longer prone to wind erosion or water erosion because we're keeping armor on the surface.

**#3.** **Diversity**

My son teaches rangeland management at the local community college. He brought his students out to one of our paddocks. They counted over 140 different species of grasses, forbs and legumes. Why don't we have that in production agriculture today?

On our operation we're trying to mimic it

These are just some of the cash crops that we grow on our operation. We don't just grow one crash crap we grow many along with that we do not grow cash crops as monocultures.

We keep a tremendous amount of diversity feeding soil biology. We also have orchards on our operation.

These orchards–besides providing us with the fruit–we're able to have livestock growing underneath them thus stacking enterprises. We have five acres of vegetable production but it's not monoculture. In between each of the cornrows is rows of peas, beans, squash, zucchini, carrots, pumpkins, in a variety of other species so that we get the benefit of diversity.

**#4. Living root in the ground as long as possible.**

You don't have to drive very far around this state to see that there are monocultures growing for only a short period of time and then the land lays idle.

These are just some of the cover crop species which we planted on our operation.

This past year we actually planted over 70 different species from the time the snow melts in the spring until the snow stays in early winter. We have a variety of species growing on our land to feed soil health. We're optimizing solar energy collection because how the system works is we take sunlight through photosynthesis. It makes carbon that is transferred down to the roots where it's leaked out. That's what all the biology feeds on. We need that biology in order to get the nutrients to the plant, to nourish animals and people. For you see, if we have healthy soil we're going to have clean air, clean water, healthy plants, healthy animals, and healthy people. We have to focus on feeding biology along with this. Then we're able to feed all of the wildlife that's on our operation and we also feed a myriad of different insects.

Insects tend to get a bad rap.

We like a wide variety of insects including all the predator insects which take care of the pests. We want to address our problems through biological means, not through chemical means.

Dr Jonathan Lundgren, one of the world's foremost entomologists, told me that for every insect species that's a pest there's 1700 that are beneficial so why in production agriculture do we aim at just killing that pest when we should aim at providing habitat for all those beneficials. The one reason producers have a pest problem is because of lack of diversity we need to think biologically the ecosystem is animal impact on our operation we run a herd of 350 beef cows we also grass finished that beef because we know it's healthier both for us and for the animals we have a flock of sheep and raise grass finished lamb we have pastured pork we have broilers which are out on pasture and we have a flock of 750 laying hens which are also out on pasture.

We also have bees those bees besides pollinating our crop provide us with honey here's what we've done on our operation when we started in 1993 on the left we had very shallow topsoil 1.7% organic matter we could only infiltrate a half of an inch of rainfall per hour.

We then went no till. We started to diversify the cash crop rotation we noticed and improvement in soil health from there we started to add cover crops–another improvement in soil health–organic matter levels increased, our infiltration improved. We then started integrating all of these livestock species on top of it, another marked increase in the health of our soil ecosystem.

Now in 2013 we actually have a plot of land which is now over 11% organic matter the same soils that in 1993 could only infiltrate a half of an inch of rainfall per hour can now infiltrate over 15 in of rainfall per hour we've done this without the use of any synthetic fertilizers pesticides or fungicides.

Doing it by following the principles of nature has led to a ranch that is profitable every year regardless of price. We do this without taking part in any government subsidies of any kind whether it be crop insurance, equip, CSP, or any other form of government payment thus we are not a burden to society.

The stacking of enterprises has allowed us to produce many more nutrient-dense calories of food at a lower cost as compared to the current production model. Yes, we can feed the world and we can do it in a way that regenerates our resources thus healing farms, families and communities."

"drought is not a weather issue, it's a management issue."

-Dr. Elaine Ingham

Widely recognized as the world's foremost soil biologist

With drought conditions spreading at an unprecedented rate the implications of what we're doing to our soil microbiome extend so much further than just the farmyard.

It is a keystone ecosystem and as such affects every ecosystem built upon it.

NOAA’s National Centers for Environmental Information (NCEI) tracks U.S. weather and climate events that have great economic and societal impacts (www.ncdc.noaa.gov/billions).

Since 1980, the U.S. has sustained 258 weather and climate disasters where the overall damage costs reached or exceeded $1 billion (including adjustments based on the Consumer Price Index, as of January 2020). Among these, 26 droughts cost the nation at least $249 billion, with an average cost of more than $9.6 billion incurred during each event. Only hurricanes were more costly. The cumulative cost for all 258 events exceeds $1.75 trillion.

Considering how detrimental it is, we should probably change the way we manage the soil.

<https://www.psu.edu/news/story/soil-tillage-reduces-availability-longevity-vitamin-ergothioneine-crops/>