Tools and Topics for Implementing Healthy Soil Agriculture

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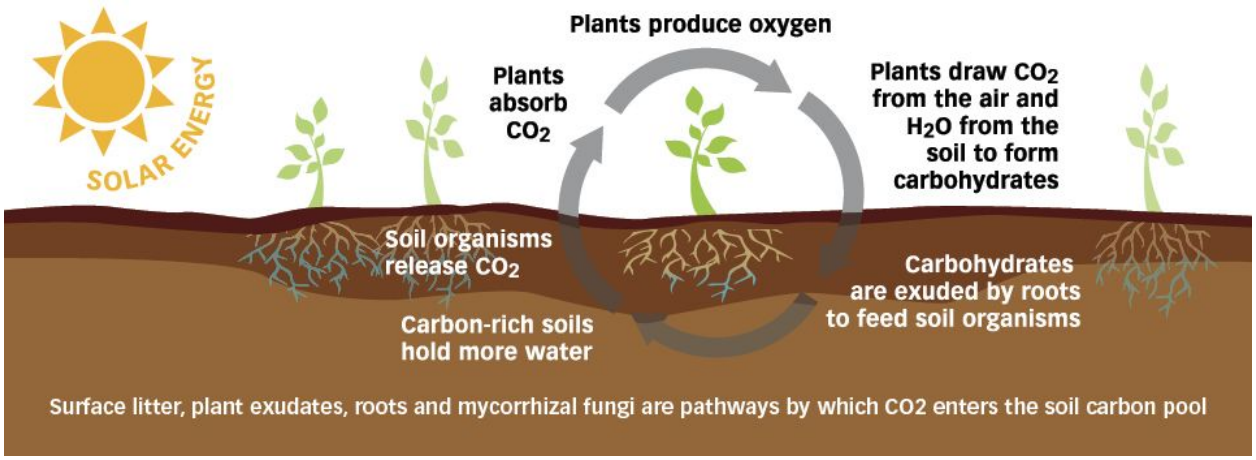
Introduction

Climate change is a real and scary situation that we unfortunately face now, and will continue to face in the future. Fortunately, there are many exciting initiatives that are designed to slow or help reverse our climate problem. One of them is regenerative agriculture, or healthy soils. In an overly simplistic view of this concept, plants take in sunlight and carbon dioxide (CO2 - a greenhouse gas) and give off oxygen (O2) while producing food. 60% of the food that a plant produces is stored underground in the roots while the top 40% is what we have typically viewed as valuable. The lower 60% feeds many organisms and animals that intern produce nutrients the plants need to thrive. Leveraging this process reduces or eliminates the need for synthetic fertilizer. Furthermore, as plants die they leave behind carbon, and carbon rich soil is very water efficient, reducing the need for irrigation. Plants also aid in reducing erosion and toxic run-off. This is not a new man made technology, it is the way nature has evolved over millions of years, "regenerative by design".



Source: Community Environmental Council cecsb.org

A recently released report titled Completing the Picture: How the Circular Economy Tackles Climate Change, makes the case that shifting to renewable energy and energy efficiency in buildings and transport can meet only about 55 percent of greenhouse gas reductions needed. The other 45 percent must come from redesigning and rethinking how we manage land and other resources, and how we produce everything from cars to cauliflower. In short: the world will need to embrace a circular economy.

What follows is *not* an exhaustive how-to on what steps should be taken to implement a healthy soil strategy on your farm. It is more a practitioner's observation on tools that would aid in accelerating healthy soil practices. This paper makes a few basic assumptions:

- Bare soil is bad, planted soil is good - bare soil erodes, is not reducing our climate problem, is not producing nutrients and evaporates the moisture it contains. Planted soil reduces greenhouse gasses, produces food and nutrients, reduces erosion and efficiently uses water.
- No Till - 60% of the food produced by the plant is destroyed by tilling when the root systems are broken up. It also brings the nutrient poor soil to the top, sending the carbon rich soil to the bottom. Because the soil is broken up, it erodes quicker, and because the top soil is nutrient poor, farms apply synthetic fertilizer to create a more nutrient rich environment for plant growth.
- Spread Manure - this paper has a livestock perspective and as such, it assumes the farm is producing manure. Manure, (a.k.a. Black gold), is a great resource for adding carbon and nutrients to the soil and it should be considered to accelerate the benefits of healthy soil practices.

Too many experiments and not enough time

Once involved in healthy soils, one of the first realizations is that it takes a growing season to see results. Much of the information available on the internet may seem general in nature but it is very specific to a region (i.e. what works in the Southwest may not work in the Northeast). As a result, implementing these practices is trial and error for most. There are just too many things to try to find the best fit for your operation. What follows is a list of tools & topics that would be helpful to accelerate healthy soil benefits.

TOOL: Wiki
One tool that would be helpful is a Wikipedia for Healthy Soil that was a known source for best practices. The magic of Wikipedia is that its content is built and edited by the crowd (practitioners). It has been proven over the years to be a high quality source of information built by volunteers and is practically free from the miopic perspective of one author. It is the crowd that creates and edits the document where the outcome tends to be very high quality because all contributors have a vested interest in the outcome.

Fact checking should always be a concern when using freely available reference material to make decisions. The success of Wikipedia in large part is a result of the community owning the content and as such is continuously responsible for its accuracy.

> *Wikipedia articles are very easy to edit. Anyone can click the "edit" link and edit an article. Obtaining formal peer review for edits is not necessary since the review is a*

communal function here and everyone who reads an article and corrects it is a reviewer. Essentially, Wikipedia is self-correcting – over time, articles improve from a multitude of contributions. There is an entire infrastructure for people seeking comments, or other opinions on editorial matters, and as a result, Wikipedia has got "consensus-seeking" down to a fine art. We prefer (in most cases) that people just go in and make changes they deem necessary; the community is by and large quick to respond to dubious edits (if any) and either revert or question them. This is very efficient; our efforts seem more constructive than those on similar projects - https://en.wikipedia.org/wiki/Wikipedia:Why_Wikipedia_is_so_great

TOOL: Bulletin Board System (BBS), The Wiki is not enough. Practitioners need a place to interact and solve problems among their peers. As mentioned earlier, a practice that works in the Southwest may not in the Northeast and so practitioners need a place to interact, support and problem solve. Slashdot.org and Github.com are great examples of users helping users providing high quality practical information. This content is also provided by the crowd, where it is being peer reviewed among contributors.

TOOL: Science and Data Collection
The science behind global warming, carbon sequestration, and regenerative agriculture is complex and is best understood by our global science community. The one thing they could use is more data which farms can readily provide.. Tools are needed for both data recording and analytics to help each farm customize their practices for optimal benefit, while reporting back to the scientific community [of what works where so they can understand why]. Scientist can help by providing easy to use , freely available test methods for measuring success in the fields, both economically and ecologically.
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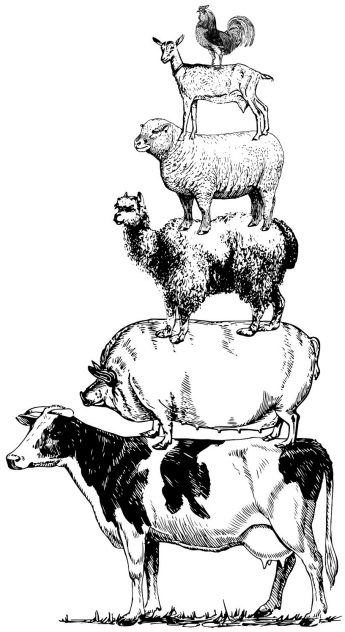

Source: onpasture.com

TOPIC: Grazers

Most successful agricultural operations are multifaceted , that is to say , the organization is involved in several aspects of farming (eg. livestock and vegetables). Livestock/Grazers are a very effective way to maintain pasture while reducing feed costs**.** Multi-species grazing is when different animals are brought to the pasture at different times to eat what is growing. In a scenario where grass grows rapidly in the spring, cattle may be brought in because they eat long grass. The cows produce a lot of manure, so pigs are brought in because they like to root and spread things around. Next, chickens are introduced for insect and parasite control. Other species are added and subtracted based on a farm's particular situation. Because a pasture typically does not grow one type of plant, multiple grazer types are needed to utilize the feed. This can get complicated because plant types grow at different rates and different animals prefer the plant in different stages in its lifecycle. Because the information is regional, this would be a great application for a BBS. Users with different experiences could contribute successes and failures to the benefit of the community at large. Because the community is utilizing their pasture more efficiently, the number of animals it can support increases, creating a mutualistic relationship which also benefits the environment.

Classification of plant species, nutritional value for different types of grazers, and growing statistics by region would be invaluable to a multi-species grazing practice. As one might imagine, this could be a monumental task. The power of the crowd could distribute the workload is such a way that each individual's workload is very light however, the overall benefit would be huge. SETI@home is a great example of how a massive problem can be broken down into small manageable chunks.

TOPIC: Slow Food, Sustainable Fashion and Agriculture

The slow food movement brought an awareness of local freshness, taste, and nutrition to the public consumer. In the same way, clothes made from natural materials in a regenerative, climate friendly way will similarly be in high demand. This dovetails nicely with healthy soil initiatives allowing our land to produce not just healthy food, but healthy clothes as well. As synthetic, petroleum based fibers such as nylon, acrylic, and polyester are under increased pressure to reduce their greenhouse impact, it is easy to see how the demand for natural fibers will easily out match the natural fiber supply. All signs point to high demand for locally grown, climate friendly meat , dairy, and fiber in the next few years. However, pasture raised livestock has not been in high demand throughout the industrial age and as a result, our capacity for grazing livestock is not sufficient. A discussion needs to be held about the best way to ramp up not just the capacity but the markets available to producers.

TOPIC: Specialty vs. Commodity

One side effect of the industrialization of agriculture is there has been a shift from a specialty to commodity mindset. Commodity is typically understood as the lowest acceptable quality of a specific product. For example, corn targeted for syrup does not need to be the same quality as sweet corn sold by the ear. Having a commodity perspective allows products to be produced at scale with consistent and repeatable results. Specialty is something very different. It is typically high quality containing unique feature sets rarely found. Wine is a great example of this. The slow food movement has demonstrated that consumers are willing to pay for high quality , specialty products. Producing agricultural products with climate friendly practices will be a discriminator in the next few years.

> *The rise of the global middle class, with roughly 3 billion new entrants between now and 2030, will lead to an explosion of demand for stuff. Most of that growth will come from the developing world. Tomorrow's middle class won't just be buying more goods, they'll also be eating higher on the food chain — more meat and dairy products, for example, along with a rise in processed and packaged foods. - GreenBiz*

The reason why this topic is important in a healthy soil discussion is that there will be lots of pressure on our industrial farm infrastructure to feed the world, while existing farming practices are having a negative impact on the environment. Large farms don't have the ability to retool their practices quickly, giving smaller farms an advantage. Under these multiple pressures, small farm organizations will be required to meet the local needs in the U.S. These smaller specialty farms should be incentivized to implement healthy soil practices in mass because it is valued by their local community and good for the environment. The U.S. consumer has had their fill of commodity goods and will desire high quality, feature rich, climate friendly food and clothing, and will assign status and lifestyle choices to local food and clothes.

Small farms taken as a whole can have a significant impact on community and the environment.

TOPIC: Infrastructure

Much of the infrastructure to support small scale , local farming has gone away. In a specialty market, sometimes raw material are best sold “farm fresh”. Fruits and vegetables are a great example. Clothing made from natural fiber does however require value-ad processing. In an age of commodity and synthetics, the value proposition has not been there for natural fiber clothing. It is a different time. For many of the reasons covered above, natural fiber, climate friendly clothing will finally have the value proposition. Unfortunately, we have allowed our infrastructure to deteriorate Some of the areas that need development are:

- Natural Fiber Textile Factories (different from synthetics)
- Technology R&D for Natural Fiber
- Fiber Collection and Fusion Centers
- Small Lot Transportation & Logistics
- Climate Friendly Farming Platforms and Tools
- Test methods for measuring success

For this approach to be viable, public/private investment must be made. As we look forward to the climate benefits of renewable energy, buildings and transportation, successes in large part due to public/private investment, we need to plan and anticipate the multitude of benefits that climate friendly agriculture will bring by small local farms.

Lack of infrastructure for natural fiber is a major concern including, harvesting, preparation, transportation, and value-ad processing. To develop healthy soils at scale, we will need grazing livestock to maintain the soils in an eco-friendly, cost effective way. As a result, the government should reinvest in our infrastructure. Providing incentives such as tax credits to motivate the entrepreneurial farmer to build the infrastructure where they see the need and benefit to the community and environment.

Conclusion

The need is clear, but what is unclear is the speed in which this change will happen. The climate problem is accelerating at an alarming rate and the solutions will need to keep pace. Small farms’ ability to adopt climate friendly practices while producing high quality products need to be viewed as a community asset and climate solution provider. Awareness is key. If the U.S. is to be a leader in this area, public and private funds need to be made available to build out the tools and infrastructure and incentivize small farms to participate. Among the ingenious solutions being proposed to combat climate change, mobilizing small farms to implement

healthy soil practices is the low hanging fruit. The biggest obstacle is the scope of problem that will require adequate support to be successful.

> **T*om Chi X-Googler:*** *“I started with the question: How do we really address the large-scale issues related to climate? Having a background in physics and electrical engineering, my first hope was that we could just go and make some kind of machine — one that sucks carbon out of the air and cleans water. But, as I looked into it more, it turned out that the best machines I could find were actually trees and soils, and the processes that happen in oceans and wetlands.”*