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## SOIL IS LIFE

# Input from a Small Farmer to the VT Climate Caucus & Soil Health PES Working Groups

# 5/31/21

## INTRODUCTION

My wife, Kerry Gawalt, and I have been farming in the Upper Valley since 1996. Cedar Mountain Farm is a micro dairy of 20 Jersey milking cows and a CSA market garden. We are also partners in Cobb Hill cheese. We have been producing award winning raw milk cheeses for 20 years. Our farm is located at Cobb Hill co-housing in Hartland, VT., a 23 household ecovillage dedicated to sustainable living, forestry and farming.

We practice management intensive grazing and silvopasture on 40 acres and make hay on 15 acres. Our 1 ½ acre no-till market garden is horse-and-human powered. Two high tunnels allow us to extend the growing season. We plant a diverse rotation of vegetables and cover crops. Farm-made compost is applied annually on the hay fields and garden.

Ever since our time as apprentices on a biodynamic farm 30 years ago, our focus has been on soil health. We continue to take strides toward becoming a regenerative farm ecosystem. Although we are just one small farm, if organic regenerative practices are to be adopted widely it will be a grassroots movement of forward-thinking land managers who will be the catalysts. We hope our farm can serve as a working model, a training ground, and inspire others to adopt healthy soil practices.

## THE PROBLEM

With the onset of the Covid pandemic we now understand just how vulnerable our global food supply chains are in the face of disruption. Farmers everywhere are on the frontline of climate change. The northeast is 20% wetter since 1970. Climate scientists predict it will be 20% wetter again by 2050. Our crops and cattle are under stressors of extreme heat, drought & precipitation events. We see new pests and plant diseases. Bats and swallows go missing from the sky. We experience unpredictable growing seasons. The USDA has reclassified our region from Zone 3 to 4.

In the middle of the country in the spring of 2019 the Mississippi, Arkansas and Missouri Rivers all flooded. 20 million acres went unplanted. $20 billion was lost in profits. That same summer 2.5 million acres of forest burned in Alaska. Georgia and North Carolina suffered drought and record-breaking heat. Worldwide it was the hottest year in the history of humanity. In 2019 climate catastrophes round the planet dominated the news cycle.

At current rates of soil degradation, groundwater depletion and salinization, the Central Valley of California---where 40% of US produce is produced---will be a desert in ten years. Globally 30% of all arable land has been abandoned over the last 40 years. 25 million acres are abandoned each year. The FAO predicts that at current rates of worldwide soil loss---we have sixty harvest left. Dust storms have returned to the high plains. The last three years have witnessed scenes all too reminiscent of the Dust Bowl of 1935. California now burns out of control during the “rainy season”. In 2019 the Amazon Basin and Australia experienced unprecedented wildfire holocausts. In polar zones glaciers calve and permafrost melts at unprecedented rates.

Famine due to failure of Ukraine wheat played a major role in the uprisings of the Arab Spring that led to the Syrian Civil War. How many years before we face multiple breadbasket failures around the world? Social scientists tell us that civil order turns to rioting after seven missed meals.

The UN predicts as many as 700 million climate refugees will be on the move by 2050. People of the global south who have contributed the least and suffered the worst from what Bill McKibben calls “The iron law of climate change.” Our response must be to receive these people and offer them full and fair opportunity to contribute to our society. The farmers among them should be given access to land. Many of the Central American people currently attempting to cross the US southern border are farmers fleeing 6 years of continuous climate change-driven drought.

The process of land degradation was set in motion 10,000 years ago when we made the transition from hunter-gathers to agriculturalists. Since then, humans have degraded half of the terrestrial land surface. 1/3 of all atmospheric carbon released since 1750 has come from land degradation. Entire soil types are going extinct. We have removed grazing animals from the land and placed them in confinement. We grow corn for ethanol and export hog and cattle feed instead of feeding our own nation. Soil once 10 feet deep swiftly erodes away.

Not only our soil----our water is in trouble too. Eutrophication from unchecked urban run-off, sewage, detergents & pharmaceuticals, along with farm run-off of nitrogen and phosphorous from large confinement dairies, have created annual algal blooms in Lake Champlain.

Vermont dairy farms produce the same amount of milk now as they did in 1970. Back then we had 5000 dairy farms. Today we have 600. Each year 83,000 acres are planted to corn in VT. If all that corn was under-sown in cover crop it could sequester the carbon equivalent of removing 51,920 cars off VT roads.

Bare soil is 10x more prone to erosion than under cover crop. 10-100x more prone than soil under pasture. 1000-10,000x more prone to erosion than soil under forest.

Original prairie soils have 10% soil organic matter or more. Ag soils in the US are typically lower than 1%. VT dairies trend around 3%. In 2020 we heard glowing reports from UVM researchers that VT soils were in excellent condition because 30 dairy farms in the Champlain basin had an average SOM at 3-4%----but in our region that SOM level is the minimal threshold at which soil can function biologically. Below 3% it is so depleted it actually requires chemical inputs to produce acceptable yields. The Green Revolution seemed like a miracle because of the initial positive response plants growing in depleted soils have to soluble chemical fertilizers. An estimated 35% of the original “corn belt” soils are gone. In the US an average of 4 tons of topsoil is still being lost from every Ag acre every year. That’s 4 pick-up trucks leaving every acre. The overall economic loss is valued at $37 billion.

Degraded soils require chemical fertilizers and pesticides to prop them up. These products are re-purposed munitions and toxic agents from the world wars of the 20th century. These biocides kill the soil microbiology and make crops dependent upon synthetic intervention.

Cover crops and no-till are an improvement. But planted in mono-crops they lack biodiversity. Conventional no-till relies on GMO seed & Glyphosate---which is classified a human carcinogen by the EU, along with the dangerous cocktail of pollinator-killing Nicotinoids mixed with chemical fertilizers and pesticides. Sick soil grows sick plants & animals. And makes for sick people.

Our current farming practices are largely degenerative. And most of our incentives are misplaced. We need a “Just Transition” to shift our farms and forests over to regenerative land management.

Healthy soil can sequester 3-10 tons of carbon per acre. It is estimated that if all 8.3 billion acres of rangeland and 3.8 billion acres of cropland on the planet were converted to regenerative land management we could sequester enough carbon to bring CO2 in the atmosphere back down to 350/ppm in just 5 years.

Every person owes their existence to soil. The human gut biome depends on the health of the soil biome. Just as the microorganisms in soil provide metabolites to plants. The microorganisms in our gut provide nutrition to our cells. Access to Healthcare regularly polls as among the top concerns of Vermonters. If every citizen were dedicated to creating soil through the promotion of regenerative land management we could sequester all the carbon we need to cool the environment, restore biodiversity, provide meaningful employment and feed everyone nutrient dense food. There is your universal health care!

We now understand how vulnerable our health care system is in the face of disruption. Health care should begin with healthy nutrient dense food. We need to teach our children how to grow, harvest, and prepare healthy food. We need to ensure that all households in our region, regardless of income, have access to locally grown food from regenerative farms.

## CONTEXT IS EVERYTHING

There is an emergent trend in the Regenerative Ag community to add a sixth principle to the original five. The new first principal is “Context”---the recognition that each farm organism is unique and that this must be reflected in the application of the soil health principles in order for them to be effective. Context will need to be central to any PES program if it is to be sensible and equitable. For instance, if we consider the physical context of a farm, each will have a distinct soil type and land use history. A farm with sandy loam will likely start out at a lower base level of SOM (soil organic matter) compared to a farm with silt loam, and even if the sandy loam farmer surpasses the silt loam farmer in implementing regenerative practices, the soil SOM may not reflect this, as it could take many years to bring up the SOM in that sandy context. Conversely, a silt loam farmer implementing regenerative practices may quickly reach a plateau in which high SOM levels are stable but no longer seeing dramatic yearly increase. In either case, we would still want to reward these farmers for the continued implementation of regenerative practices on their respective farms.

Although we need to continue to fine tune our ability to gather data on SOM & SOC (soil organic carbon), our purposes for doing so should be more on measuring results in order to refine adaptive practices and less focused on measuring for carbon credit markets. Our only real wealth as a civilization is our soils. Farmers should not have to wait for the free market to reward them for doing the right thing. The state has a fiduciary responsibility to protect and restore our soil resources by providing a base income to land managers who can regenerate soil while producing food, fuel, fiber, building materials, and medicine. In this era of ecological collapse, regenerative land managers are our frontline essential workers.

We typically think of farmers and forest managers in terms of the output of their operations---yields of corn or so many board feet harvested. But to squarely address abrupt climate change, we need to match expectations for production with management aimed at restoration of the carbon cycle. Restoration of the carbon cycle leads to restoration of hydrologic cycles, which is critical to landscape function and climate change mitigation.

Going forward, we need all policy makers and land managers to understand that biology is the driver of soil health and carbon sequestration. There are three general types of SOM; the labile or “active carbon”, the stable humus, and long term occluded carbon. All three are the product of continual carbon inputs into the soil. Each one leads to the next. Photosynthesis is the primary source of soil carbon. 30-70% of the liquid carbon sugars produced by plants pass through plant roots to feed the soil microbiology. Plants enter into mutualistic symbiotic relationship with bacteria and fungi, who deliver nutrients and metabolites in exchange. Recent findings from studies in Australia demonstrate that 70% of humus is composed of microbial necro-mass. We used to say; “Feed the soil to feed the plants”---but now we can say; “Feed the soil to feed the biology which in turn will feed the plants and sequester carbon”.

When crops are spoon fed NPK at the outset of the growing season they have no need to exchange nutrients with bacteria and fungi. This method ultimately starves the soil microbes and leads to loss of soil carbon. A recent report from the University of Colorado demonstrated that, in a downward spiral, the US corn crop uses 1/3 of the annual nitrogen application to make up for lost soil carbon from the previous season. It is also estimated that only 1/3 of the total nitrogen applied ever reaches the plants, the rest is lost through leaching or volatization. Volatized nitrous oxide is 25% more potent a GHG than Co2.

In natural systems continual carbon inputs continuously come in through living roots, animal activity, and deposition of plant residue. In a cropping system the farmer is removing carbon in the form of produce. Through cover cropping, adaptive grazing, mulching & composting, the farmer can restore and augment the carbon bank.

## LOOK BACK TO SEE AHEAD

A starting point for “context” as our first soil health principle is to consider what was here before humans altered it (in our context that would mean before European settlement, as the Indigenous people were practicing what we now refer to as Agroecology). We need to to take the soil health of the ancient old growth forests as a measure for soil health in our region. Here in Vermont that means understanding the ecology of ancient old growth forests.

For any generation it can be difficult to imagine that the world of the past was so radically different than the present. Here in Vermont, with our rolling farm fields and forested mountains, the land appears to be healthy. Because the northeast region has the built-in resilience of abundant precipitation and a temperate climate, the land has recovered to such a degree that, unless you study the land use history, it is not manifestly evident that European settlement brought about near ecological collapse.

Contrary to popular myth, New England was not a place of poor, thin and rocky soils. The Western Abenaki evolved their culture under the bowers of a rich and varied tapestry of old growth forests with deep layers of duff and humus rich subsoils. The highly diverse forest adapted to every type of parent rock and topography, from mountain top to lowland coastal swamp. Indigenous people utilized land management techniques such as prescribed burning to encourage mast and fruit trees & shrubs---which only increased the abundance of wildlife.

The diverse deciduous and evergreen forests that blanketed the hills and basins of our region were a species of super-organism and the keystone species that bound them together were the mychorryzal fungi. These trees could live 400-500 years and were enormous---with red oaks and hard maples at 150 feet and white pines reaching 200 feet or more. Hardwoods could have boles 9 feet in diameter. Deep soil carbon accrued through centuries in a forest system that only ever tended to experience localized and relatively minor disturbance such as fire or windstorms. For all the tons of carbon held in the trunks and branches---the real long term stable carbon was built up over centuries in this substrata of deep humus. That legacy is the carbon bank we are still farming on.

50% of the carbon stored in a forest is held by the top 1% of the biggest trees. New findings show that, although it is not as rapid as in young trees, sequestration is greatest from the growth period of 50 years to 150 years of age and is continuous after that. The soil biome of an old growth forest is so robust that an estimated 60% of the carbon is stored below the ground. There are innumerable benefits accruing to old forests in terms of healthy landscape function and biodiversity---not to mention the aesthetics. These are places that can begin to heal your soul if you let them.

Beginning in 2010, for the first time in over one-hundred years, Vermont is again losing forest to the tune of 11,000 acres a year. Unchecked development, clear cutting and fragmentation all threaten the health of woodlands. 70% of our forest is in family ownership. We need to understand this land as a system and incentivize woodland owners to manage for long term health and adaptability. We can sustain a local harvest while managing for enhanced complexity. Although managing for old growth characteristics while continuing to harvest timber reduces yield on average to 60% of what it would be from a typical selective commercial cutting, the real world benefits of carbon sequestration, infiltration and retention of water, and restoration of biodiversity, far outweigh the loss.

Forest ecologists estimate that if you let a New England farm field go fallow, it takes natural succession about 120 years to re-establish a healthy soil biome. It is estimated that fully one half of Vermont’s soils have eroded away since the 18th century.

The good news is, that with the tools and methods of organic regenerative practices, such as composting, cover cropping and adaptive grazing, we can restore soil organic matter in our agricultural fields 10x faster than the natural process of forest succession.

The bad news is, the practices that can yield those kinds of results are not yet widely adopted. For instance, under conventional commodity management, we take a 60 acre field that was once old growth forest---a varied tapestry of complex 3-dimensional crowns, understory and forest floor with soil organic matter estimated at 9%-12% or more---and we remove that entire highly evolved perennial food web and reduce it to bare ground. Next we plant a patented GMO annual feed corn seed treated with fungicide, apply pelleted chemical fertilizers and inject raw liquid manure, spray with glyphostae and atrazine, harvest the biomass for silage and then put in a rye cover crop for 5 months over the winter before discing in with a 150 hp tractor---and we call that “regenerative”. We can and must do so much better than that.

Field trials demonstrate that organic farmers using the tools of cover cropping, mulching, and reduced tillage, can increase SOM and restore biodiversity. 1/4 of terrestrial life lives in soil. When soil biodiversity is restored, all trophic layers reap the benefits. Conventional no-till at best sustains SOM and when practiced on fields with drain tiles it has been shown to increase soluble phosphorous run-off because of improved infiltration.

## BEYOND EMISSIONS REDUCTIONS

To meet our binding greenhouse gas emission reduction targets as established under the passage of the VT Global Warming Solutions Act, to clean up our rivers and lakes, and renew our agricultural economy, we need to elevate healthy soil as an essential ingredient to solve the climate and ecological crisis. Simply reducing GHG emissions won’t be enough to halt climate change. We need to maximize the sequestration capacity of our farms and forests. More importantly, we need to focus on habitat restoration, maximizing landscape function, and restoring biodiversity.

When it comes to land management it makes little sense to simply focus on GHG reductions. In this time of societal reckoning and reparations, we need to come to terms with how degraded our environment has become, and accept our responsibility as a civil society to repair it. For instance, we could go around capturing all the methane escaping from manure pits on the large dairy farms, convert it into electricity in a bio-digester and call that smart and renewable energy---or we could ask ourselves, does it really make sense to keep thousands of dairy cows locked up in confinement and expend untold fossil fuel calories to raise their forage and deliver it to them in the barn when we could graze those cows and have them fertilize our fields, diversify our farms, and sequester carbon through adaptive land management?

Mega-projects like cap& burn and methane digesters for electric generation, are false solutions to the climate crisis. These infrastructure projects have a tremendous carbon footprint all their own, especially regards the use of concrete. It is reported that VT dairy industry received $28 million in aid over the last decade, and I'll wager most of that went to water quality improvement projects. But NRCS projects on the large farm scale also tend to be energy-intensive, heavy on concrete infrastructure. Their goal is to ask how can we mitigate the environmental damage of large farms. How to keep manure separate from water---keep soluble nutrients leaching from fields.

Aren't we asking the wrong set of questions? Is it it in the best interest of the public and our soils to keep finding ways to prop up large farms and thereby support the trend of consolidation? No matter how we green wash them and nip around the edges to make them less polluting, large confinement dairies will never be the path forward to a resilient regenerative re-localized agriculture. And despite what the hired consultants and industry lobbyists tell us, they continue to be places of misery for cows and workers, detrimental to soil health and water quality----and all while still leading producers into greater debt. Milk is a commodity that will no longer pay in the northeast. The agricultural sector can best respond to the GWSA by incentivizing land managers to convert all of our Ag & forest acres to smaller diversified operations practicing organic regenerative farm & forest management.

Right now in Vermont it is the mid-size farms presenting us with the greatest moment of opportunity and peril. We hear so many stories of aging dairy farmers with no succession plans. In areas where these farms are within reach of the Large Farm Operations they often get bought out, but where not, there is the risk of a sale that leads to fragmentation and development and permanent loss of arable land.

As an insider of the industry, I have great respect for all farmers simply for surviving and am sure that the LFO dairy farmers who are taking up no-till, winter rye cover cropping, manure injection etc., truly believe in the environmental merit of these practices. In some cases they've made great strides. But is it a commensurate response to the depth of the climate and ecological crisis we face? The bottom line on calling a practice "regenerative" is it has to build soil. Without applying all the principles of soil health results will be less than satisfactory.

Small diversified and intensively managed farms will have the flexibility and resilience to withstand the shocks and disruptions that are coming our way. According to the FAO, small farmers (25 acres or less) are still providing 70% of the world's food. Ultimately context is about developing our powers of observation. It is easier to do this on one hundred acres than on one thousand.

To sequester carbon farmers can mimic the action of the old growth forest and feed the soil microbiome by keeping living roots in the ground as much of the year as possible, amend the soil with compost and mulches, and integrate livestock into farming systems. Just as in an old growth forest, we need continual carbon inputs to keep the cycle operative. Soil ecosystems underpin all life on terrestrial earth, Carbon is the key and the great gift. But for life to continue---the gift must always move.

PES should take into account that carbon farming is a long term proposition. Land managers willing and able to practice regenerative principles and practices will require a steady guaranteed income. Every farm will experience ebbs and flows in sequestration, but there is not a farm in Vermont that can’t build more soil organic matter. It is this cumulative effect that is exponentially important and why payment should be equitable across the board for all land managers participating in soil health management.

## SOIL HEALTH MANAGEMENT SYSTEMS

In 1972, under pressure from a burgeoning environmental movement, the Nixon administration passed the Clean Air and Clean Water Protection Acts. Although this was a landmark victory for the environment, it was also a clear case of putting the cart before the horse: until we pass a Healthy Soil Protection and Restoration Act, we cannot have clean air and water---it is not possible without healthy soil.

We need progressive soil health policy reflective of a radical shift in societal priorities---where soil is recognized as “basic infrastructure”. We need to ensure that those who can produce food, medicine, fuel, fiber, and building materials, while regenerating soil are guaranteed a living wage the same way we do for other essential service providers.

We can begin a phased transition for agriculture and forestry by implementing Soil Health Management Systems. This is a model that was first successfully developed by NRCS agents and farmers in North Dakota. Here in Vermont, we could begin by using Nutrient Management Plans as a model. State, federal agents, and independent consultants can assist land managers in developing soil health plans. The aim is for long term adoption of practices with commensurate long term financial incentives and technical assistance. Field agents can do yearly site visits and regular follow ups to monitor and assist in the implementation of practices.

At Cedar Mountain Farm we have a successful track record of working with federal and state funded programs. For instance, it was through a collaboration with the Vermont Housing and Conservation Board in tandem with the Upper Valley Land Trust that Kerry and I could purchase an affordable unit and have access to arable land at Cobb Hill. We also participated in the Farm Viability program which over the course of a year, helped us to determine our actual cost of production for pricing our milk and cheese products. Later we engaged with the NRCS-EQUIP program, completing a series of projects over a ten year contract that included infrastructure for intensive management grazing, enhanced irrigation capacity for our market garden, covered manure storage facility and compost stacking pad, and more.

Having ourselves been the beneficiaries of successful collaboration with these partners, we see great potential for improving and enhancing their capacity to promote healthy soil practices more broadly in our region.

The strategy is to build out on already existing programs such as; NRCS-EQUIP, VT Environmental Stewardship Program, Vermont Housing and Conservation Board, UVM Extension, Farm to Plate, Farm to School, NGO advocates such as Nofa-Vt, Rural-Vt and the regional land trusts-----in order to coordinate and amplify the collective impact of all these efforts exponentially.

Higher yields and enhanced resilience can be achieved through adopting practices such as; cover cropping, crop rotations, composting, mulching, perennial crops and agroforestry, adaptive multi-species grazing, and organic reduced tillage and no-till practices adaptable to market gardens, row crops, and livestock operations.

The six basic principles of soil health developed by the NRCS provide a rubric for the adoption of healthy soil practices.

Each land manager would have a “team” of experts to help implement and troubleshoot. This team could coordinate with the Farm Viability Program to strive for successful outcomes at every level. Site characteristics and social context will be taken into account to ensure an equitable and *just* transition toward organic regenerative management.

All practices should be seen as comprising a synergy of effects to restore the totality of landscape functions of the farm or forest ecosystem. Incentives will no longer be granted piecemeal for specific practices---rather participants are aided to develop comprehensive plans.

Soil Health Management Systems would allow for the land manager to apply for assistance on a variety of practices *under a single contract.* This would increase enrollment and voluntary compliance with any new regulations regarding soil protection along the line of Required Agricultural Practices. Incentives are a favorable approach over regulations. Successful pilot projects and farmer-to-farmer training are proven methods for accelerating the adoption of healthy soils practices among the legacy farming community.

It is not practical to measure carbon sequestration, water quality and other enhanced functions on every farm every year. Therefore UVM should continue to conduct trials and monitor pilot farms to establish median averages resulting from the implementation of soil health plans. Farmers will be expected to document practices.

Many public forests already have conservation management plans which will be useful for developing criteria for ecological management in the forestry sector. Let’s unite with the President and call for the establishment of 30% forever wild forest lands in the state by 2030. As we move to create a localvore movement for wood products, and expect more biomass projects for heat and energy to come on line, let’s ensure that ecological forestry management be a required practice of Current Use.

Let’s ask lawmakers to ensure that payments for ecological services are aimed not only at incentives for the adoption of practices---but to sustain them over the long haul---and to equally reward those who are already practicing them. Let’s ensure that payment for ecological services is not restricted to cleaner water and carbon sequestration. We need a holistic measure of the ecological and economic benefits farmers contribute to society. We need to take into account all of the landscape functions of a farm or forest and how restoring these contributes to the health of the bioregion.

Not only do local organic regenerative farms sequester carbon and restore habitat, they also reduce the overall carbon footprint associated with food production by eliminating chemical inputs, reducing tractor use, and reducing transportation through local distribution.

## RESTORE THE WATER CYCLE

Forests under management for old growth characteristics can provide a local sustainable supply of forest products while acting as carbon sinks. Agroforestry practices; including silviculture, silvopasture, alley cropping, native species hedgerows, and riparian buffer zones, can all enhance soil and water quality.

The benefits of organic regenerative agriculture go far beyond carbon sequestration. At least of equal importance is the restoration of the water cycle. At 90%-----water vapor is the most prevalent greenhouse gas. As the planet warms more water is held as vapor---this is what drive hydrologic disasters such as monster hurricanes and tornadoes, droughts, floods, and wild fires. One gram of soil carbon can hold 8 grams of water. A healthy soil carbon sponge restores the hydrologic cycle which in turn, restores the small rain cycles. Mitigating extremes by maximizing photosynthesis.

Healthy soil practices are applicable in suburban and urban settings, too. Cities, towns and villages may implement healthy soil plans by creating more green spaces, community gardens and food parks. Water infiltration can be improved by establishing riparian buffers and replacement of asphalt and concrete with permeable surfaces. Urban grey water and run-off can be filtered through living filtration systems. Property managers and homeowners who practice regenerative yard care have an important role. On-farm and municipal composting can put us on track toward a circular economy and a zero-waste society.

As the pace of climate change crosses tipping points and accelerates, Vermont is experiencing more prolonged “flash” droughts and extreme precipitation events that cause catastrophic flooding. If it had rained 8”-11” inches in a 12 hour period back in 1750 as it did during Tropical Storm Irene, the old growth forests of our region would have infiltrated that water with ease---no catastrophic flooding of our waterways. With every increase of 1% organic matter in the top six inches of soil it will hold an additional 20,000-27,000 gallons of water per acre. Each additional 1% will also make an additional 20 lbs of mineralized nitrogen available to crops. Restoration of soil organic matter can provide resiliency in the face of weather extremes *and* increase yields.

We farmers used to think that humus formation was solely the product of decomposition. We now understand that photosynthesis grows soil through a mutualistic symbiotic relationship with microscopic soil flora and fauna. 30-70% of the liquid carbon sugars manufactured in plants are delivered to the microbes living in the rhizosphere in the form of exudates. Countless billions of fungi and bacteria thrive in this environment and deliver nutrients, metabolites, minerals and water to plant roots in exchange for carbon. This is how long term stable carbon is formed.

## JUST TRANSITION

The problem is, our current economic system does not reward small diversified farmers whose focus is building soil health. Nor for that matter, does it reward large commodity producers whose focus is on yields and mechanical efficiency. All farmers are hurting. The purveyors of agricultural inputs and machinery are the only ones reaping record profits in this game.

Despite the well-deserved hype about Vermont’s burgeoning local food movement---those of who us who have been on the ground building the local food system for decades are engaged in a labor of love. Most of us pay our employees more than we pay ourselves---but still can’t pay a living wage. It’s hard to find a dairy farmer who does not have operating and long term debt. Many of us have a family member with an off-farm income. Prior to Obamacare, most went without health insurance, and you’ll find many aging farmers with no retirement or succession plan. This is a hard sell for attracting new and young farmers.

To attain healthy soils, agriculture can operate within the free market, but we need built-in safety nets to ensure that land managers who can produce food, fiber, medicine, and building materials while regenerating soil receive just compensation for their good stewardship of Ag and forest lands.

Roughly 80% of Vermont farmland is dairy based. These soils have been systematically degraded through conventional management. But they also represent our greatest opportunity for regeneration and subsequent drawdown. In the process we can also bring resiliency back into our food system and restore vital ecological functions to our landscapes while returning economic vitality back to our farms. By offering incentives and training through the implementation of Soil Health Management Systems, the 83,000 acres currently devoted to corn can be transitioned to produce a wide diversity of crops, including grain and legumes for human consumption, fruits, vegetables, perennial crops and intermittent grazing. Much of the 265,000 acres currently devoted to hay and haylage could have grazing ruminants re-introduced, along with rotations of swine and poultry---and Agroforestry plantings to enhance productivity, landscape function, and biodiversity. Even if we halved milk production in VT we could still amply meet the needs of our own population---especially if we develop our own “Vermont Brand” for fluid milk and dairy products--- and have surplus product for regional sale. That would leave about 40,000 acres of prime ag soils and 130,000 acres of hay and pasture land available for intensive diversified farming. It’s not a matter of getting rid of dairy---it’s a matter of adding back in everything else. This kind of farming is management-intensive but that can translate into an era of opportunity for our future farmers.

This transition must happen as swiftly as possible in order to stave off the worst effects of abrupt climate change and loss of biodiversity and to have any hope of habitat restoration and a livable planet for the next generation.

A regenerative farm renaissance could boost Vermont’s tourism industry. Imagine our hills and valleys graced with a tapestry of organic regenerative diversified farms and regional food hubs. Tourists could travel hub-to-hub in electric buses charged by on-farm renewables to experience the specialty products of each region. We could become the “Napa Valley” of the organic regenerative movement. New and young farmers would flock here to attend Ag schools and intern on our farms, dairy plants & abbatoirs. At the same time we could create opportunities to resettle climate refugees from the global south by offering access to land for farming and good-paying jobs in the growing food service sector. We could establish "new commons" through partnership between government, NGO's and land owners, to grant access to farm land to climate refugees, young and new farmers, people of color, women farmers, and others historically excluded from access to land.

But for any of this to happen we need to elevate healthy soil as the essential ingredient to solving the climate and ecological crisis. Soil is such a critical resource that we can no longer leave its management unregulated. Ownership or leasehold or any other form of land tenure can no longer mean free license to degenerate or destroy soil. Government must protect this resource and offer transformational incentives for the adoption and maintenance of soil health management systems.

The roots of all social injustice are bound up with the exploitation of land water and air. The colonial-capitalist system that historically and currently inflicts so much cruelty upon poor, indigenous, people of color, and small farmers everywhere, is the same system that exploits and degrades the natural world. Reparations to one without the other will be meaningless. Progressive soil health policy can be a first step to reestablishing the commons and recognizing the rights of all living beings.

Climate scientists the world over have declared that this transition to organic regenerative land management and habitat restoration must begin now in order to stave off the worst effects of abrupt climate change and loss of biodiversity. Soil health protection and restoration is our last best chance to pass on a livable planet to the next generation. The first step for the legislature is to define healthy soil and enshrine the healthy soil principles into statutory language. This would provide True North to all farmers, agencies and advocates. Vermonters can lead the way.

## HOW TO PAY FOR PES?

We can’t count on philanthropy and especially not the free market to fix our broken Ag systems.

I am in the camp of considering a society truly civilized when every person is guaranteed as basic human rights access to food, clothing, housing, healthcare, education & meaningful work.

I was heartened to hear that universal basic income was being discussed in VT House Appropriations this session. I believe this will unleash the creativity and entrepreneurial spirit of our citizenry.

In the context of soil health policy I am advocating that farmers and forest land managers be offered a base income in exchange for the adoption of Soil Health Management Systems. This would be a simplified way of compensating for ecological services. It would rely on mean averages for measurement on comparable pilot operations. It would also ensure that small farmers don't get left behind by carbon trading schemes. We would implement soil health management systems instead of offering incentives for adoption of singular practices---focusing on context as the way to develop intelligent strategies for land restoration rather than relying on formulas or recipes (as do conventional methods that rely on chemical inputs).

Industrial agriculture in the US is already fully subsidized to the tune of $4.2 billion paid out in 2019 to farmers through RMA programs (Risk Management Assessment AKA---crop insurance).

The USDA says there are currently 2 million farms in the US. They have a loose definition of a "farm", for instance it only has to generate $1000/year income to qualify & owning 5 horses can constitute a farm. So probably in our equation a lot of those wouldn't qualify (VT has a more stringent definition for its 7000 farms but does include things like Christmas tree farms and bedding plant nurseries). Even at the 2 million farm figure, with the average US farm at 444 acres and the average crop insurance pay/acre at $224---that means if the RMA payments were distributed evenly as base income every farm in the country could be supported to adopt regenerative practices. The problem is the way RMAs gets paid out:

Corn $2.6 billion---60% of annual RMA payments

Soy $1.1 billion---25%

Corn and soy are grown for animal feed + high fructose corn syrup & biofuel. 40% of corn goes to ethanol, 30% goes to livestock feed and junk food, 30% is sold to China so their growing middle class can eat more meat.

Crop insurance takes as its measure the farm's previous history of yields. It incentivizes over-production. It discourages soil building practices that might have a negative impact on maximum yields.

1/3 of annual synthetic nitrogen applications go to cover for the loss of soil fertility (SOM) from the previous year.

The majority of the 4.2 billion spent on crop insurance in 2019 was for delayed planting payments due to the extreme flooding events (climate-driven) along the Missouri River.

Reforming crop insurance is critical to saving soil in the US. One idea being floated by ATTRA is Whole Farm Insurance---where the farm's previous history of total revenue is the baseline for compensation instead of yields.

Another source of revenue (discussed in a recent Nofa-Vt white paper on farm resiliency) is to increase taxation fees on chemical fertilizers. This taxation could operate similar to tax placed on the sale of tobacco products, with revenue accrued devoted to technical assistance to aid farmers in a just transition to healthy soil practices.

Payments to farmers could be direct or a combination direct payments for adoption of SHMS along with programs to create equity in the market, such as; price parity for local farm products, regional supply management of milk and other commodities, and whole farm revenue insurance.

We cannot expect farmers with annual operating debt and long term debt to be innovators and risk-takers. Dairy farmers invest enormous amounts of capital in equipment, infrastructure, inputs, and labor. They have seen profit margins flat-lined going on 50 years---while all these operating costs have sky-rocketed.

To those who say we cannot afford to subsidize land managers just so they’ll do the right thing, consider the following; the annual budget for the US Department of Defense in 2020 was $746 billion (that means the daily budget of the Pentagon averaged out at $2 billion). In 2019 Amazon CEO Jeff Bezos had a net worth of $200 billion, while the average farm income for that year in the US was *negative* $1200. In 2020 US corporations avoided paying $90 billion through offshore tax havens and the BP oil & gas company made $180.4 billion in profit. What do we truly value in this society? Does a resilient and healthy agriculture have a part to play in our national security?

Universal base income for regenerative land managers may sound far out---(sort of like abolishing slavery did to many in 1850)---but conversion to renewable energy without also undertaking massive land restoration won't be enough to save life on earth as we know it from the ravages of abrupt climate change.

We protect what we love.

Ecocide will become illegal in our lifetimes. I believe it.

Thank you.

Stephen Leslie

Cedar Mountain farm

Cobb Hill Cheese

Author at Chelsea Green Publishing

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## MAIN TALKING POINTS

\*To meet our binding greenhouse gas emission reduction targets as established under the passage of the VT Global Warming Solutions Act, to clean up our rivers and lakes, and renew our agricultural economy, we need to elevate healthy soil as an essential ingredient to solve the climate and ecological crisis. Simply reducing GHG emissions won’t be enough to halt climate change. We need to maximize the sequestration capacity of our farms and forests.

\*Until we pass a Healthy Soil Protection and Restoration Act, we cannot have clean air and water---it is not possible without healthy soil.

\*The state has a fiduciary responsibility to protect and restore our soil resources by providing a base income to land managers who can regenerate soil while producing food, fuel, fiber, building materials, and medicine.

\*We need progressive soil health policy reflective of a radical shift in societal priorities---where soil is recognized as “basic infrastructure”. We need to ensure that those who can produce food, medicine, fuel, fiber, and building materials, while regenerating soil are guaranteed a living wage the same way we do for other essential service providers.

\*There is an emergent trend in the Regenerative Ag community to add a sixth principle to the original five. The new first principal is “Context”---the recognition that each farm organism is unique and that this must be reflected in the application of the soil health principles in order for them to be effective. Context will need to be central to any PES program if it is to be sensible and equitable.

\*To squarely address abrupt climate change, we need to match expectations for production with management aimed at restoration of the carbon cycle. Restoration of the carbon cycle leads to restoration of hydrologic cycles, which is critical to landscape function and climate change mitigation.

\*We need all policy makers and land managers to understand that biology is the driver of soil health and carbon sequestration.

\*We need to to take the soil health of the ancient old growth forests as a measure for soil health in our region. That legacy is the soil carbon bank we are still farming on.

\*We can begin a phased transition for agriculture and forestry by implementing Soil Health Management Systems. Using Nutrient Management Plans as a model. State, federal agents, and independent consultants can assist land managers in developing soil health plans. The aim is for long term adoption of practices with commensurate long term financial incentives and technical assistance. Field agents can do yearly site visits and regular follow ups to monitor and assist in the implementation of practices.

\* Higher yields and enhanced resilience can be achieved through adopting practices such as; cover cropping, crop rotations, composting, mulching, perennial crops and agroforestry, adaptive multi-species grazing, and organic reduced tillage and no-till practices adaptable to market gardens, row crops, and livestock operations.

\*All practices should be seen as comprising a synergy of effects to restore the totality of landscape functions of the farm or forest ecosystem. Incentives will no longer be granted piecemeal for specific practices---rather participants are aided to develop comprehensive plans.

\*Soil Health Management Systems would allow for the land manager to apply for assistance on a variety of practices *under a single contract.*

\*It is not practical to measure carbon sequestration, water quality and other enhanced functions on every farm every year. Therefore UVM should continue to conduct trials and monitor pilot farms to establish median averages resulting from the implementation of soil health plans. Farmers will be expected to document practices.

\*PES should take into account that carbon farming is a long term proposition. Land managers willing and able to practice regenerative principles and practices will require a steady guaranteed income. Every farm will experience ebbs and flows in sequestration, but there is not a farm in Vermont that can’t build more soil organic matter. It is this cumulative effect that is exponentially important and why payment should be equitable across the board for all land managers participating in soil health management.

\*Let’s ask lawmakers to ensure that payments for ecological services are aimed not only at incentives for the adoption of practices---but to sustain them over the long haul---and to equally reward those who are already practicing them.

\*Let’s ensure that payment for ecological services is not restricted to cleaner water and carbon sequestration. We need a holistic measure of the ecological and economic benefits farmers contribute to society. We need to take into account all of the landscape functions of a farm or forest and how restoring these contributes to the health of the bioregion.

\*Establish "new commons" through partnerships between government, NGO's and land owners, to grant access to farm land to climate refugees, young and new farmers, people of color, women farmers, and others historically excluded from access to land.

\*Forests under management for old growth characteristics can provide a local sustainable supply of forest products while acting as carbon sinks. Agroforestry practices; including silviculture, silvopasture, alley cropping, native species hedgerows, and riparian buffer zones, can all enhance soil and water quality.

\*Establish of 30% forever wild forest lands in the state by 2030. As we move to create a localvore movement for wood products, and expect more biomass projects for heat and energy to come on line, let’s ensure that ecological forestry management be a required practice of Current Use.

\*To attain healthy soils, agriculture can operate within the free market, but we need built-in safety nets to ensure that land managers who can produce food, fiber, medicine, and building materials while regenerating soil receive just compensation for their good stewardship of Ag and forest lands.

\*Soil is such a critical resource that we can no longer leave its management unregulated. Ownership or leasehold or any other form of land tenure can no longer mean free license to degenerate or destroy soil. Government must protect this resource and offer transformational incentives for the adoption and maintenance of soil health management systems.

\*Farmers and forest land managers should be offered a base income in exchange for the adoption of Soil Health Management Systems. This would be a simplified way of compensating for ecological services. It would rely on mean averages for measurement on comparable pilot operations. It would also ensure that small farmers don't get left behind by carbon trading schemes. We would implement soil health management systems instead of offering incentives for adoption of singular practices---focusing on context as the way to develop intelligent strategies for land restoration rather than relying on formulas or recipes (as do conventional methods that rely on chemical inputs).

\*Reforming crop insurance is critical to saving soil in the US. Redistribute these subsidies to PES.

\*Universal base income for regenerative land managers may sound far out---(sort of like abolishing slavery did to many in 1850)---but conversion to renewable energy without also undertaking massive land restoration won't be enough to save life on earth as we know it from the ravages of abrupt climate change.