# Working Lands Soil & Water

An investment opportunity in a new, regenerative farming model.

WORKING LANDS
INVESTMENT PARTNERS, LLC

**Working Lands Soil & Water**

# A new regenerative farming model that results in a five-fold increase in crop yield and Carbon sequestration

The world is at a crossroads: we can continue racing toward climate-induced chaos, or we can sequester in our soil the billions of tons[1] of atmospheric CO2 required to slow and halt this destructive process. While many experts understand the potential to sequester Carbon in soil, current regenerative[2] farming models (e.g., farming principles and practices that increase biodiversity, enrich soil, improve watersheds and enhance ecosystem services) typically take a decade or more to restore soils devastated by decades of toxic chemicals, plowing and erosion. Very few farmers can survive financially during this long transition to healthy soil. Nor do most have the expertise to overcome severely compacted, worn-out soil that has low organic matter, poor rainwater permeability, and mineral and microbial deficiencies and imbalances — all of which must be restored to effectively sequester Carbon.

## The Model

Working Lands Soil & Water (WL/S&W) has developed a regenerative model that significantly increases soil fertility in less than two years,boosts crop yield quickly, and produces food with higher nutrient value for animals and humans. [3] The model also dramatically improves farm economics and sequesters more Carbon more quickly than any currently available methodology.

WL/S&W's mission is to commercialize and propagate a profitable, scalable regenerative farming model that:

- restores soil fertility and improves yield in less than two years,
- increases soil and food nutrient density and farmers' profits,
- sequesters much more Carbon per acre more quickly than current models,
- is practical and implementable by the average farmer.

The following four phases of our model are described in greater detail within this document:

**Phase 1:** Proof of Concept

**Phase 2:** Pre-commercial Vetting

**Phase 3:** Commercial Viability

**Phase 4:** Large-scale Deployment

## The Investment Proposition

- Investment in regenerative agriculture
- Qualified Opportunity Zone business
- Land ownership and management business model
- Significant market opportunity
- Climatic benefits, including Carbon sequestration

Investors in Working Lands Soil & Water will have an ownership interest in a new business that will utilize proven technology to improve soil quality, improve yields and reduce environmental Carbon five times (5X) faster than other methods. WL/S&W intends to acquire Opportunity Zone land through a separate investment partnership it will manage and operate under contract. The company will also contract with farm owners to improve soil quality under revenue partnership agreements.

The strategies and actions described within these phases create a soil building, Carbon sequestering engine that will sustain and recharge itself year after year.

TABLE OF CONTENTS

## Company Founders

Dan Spethmann

# Dan Spethmann

has more than 30 years' experience in natural resource management. Dan is co-founder of Working Lands Soil & Water and managing partner of Working Lands Investment Partners, LLC, specializing in the developing environmental markets, specifically performing project origination and execution. His projects focus on performing project origination and execution for stream and wetlands mitigation, including permitting, design and construction management.

Previously, Dan was manager of Investment Programs for New Forests, Inc., where he helped raise and place institutional and private capital into ecosystem markets. Prior to this, he led the non-timber resources development effort at Temple-Inland, Inc., where he developed stream and wetlands mitigation instruments, working forest conservation easements, and endangered species credit programs. Dan was founder of Strategic Controls Corporation, which provided supervisory control and data acquisition systems for the natural gas industry. Prior to this, he served as project manager at Moncon, Inc., where he provided controls systems for hydroelectric facilities, as well as the municipal water and wastewater industries.

Dan holds a Doctorate degree in Environmental Ethics from Georgetown University, a PhD in Natural Resources Economics from Stephen F. Austin State University, a M.S. in Forestry from the University of Wisconsin-Madison, and a B.S. in Biology from the University of Wisconsin-Stevens Point.

Ed Huling

# Ed Huling

is co- founder of Working Lands Soil & Water, a leader in regenerative farming and Carbon sequestration. Ed is an innovator and thought leader in developing regenerative farming methods to rebuild depleted soils, sequester Carbon, and grow fruits, vegetables and grass-finished meats with superior flavor and nutrient density.

Before co-founding WL/S&W, Ed built New Day Farms, a producer of high quality heirloom tomatoes, microgreens and other crops sold to Whole Foods Markets and other retailers. Whole Foods called Ed's heirloom tomatoes "a phenomenon" because they sold out so quickly.

Prior to founding New Day Farms, Ed founded and operated the Thyme Square Restaurant, an award- winning organic restaurant in Bethesda, MD, and earlier served as vice president of marketing for Organic Farms in Beltsville, MD, the nation's largest organic produce distributor at that time.

Ed majored in Environmental Science at Brandeis University, where he developed a passion for our natural world and a profound dedication to protecting it. He was the only undergraduate in the school's history to publish his original environmental research in the prestigious Science Magazine.

## Company Background and History

In 2006, Ed Huling left his position as a researcher at the U.S. Department of Agriculture's research station and greenhouses in Beltsville, MD to pursue the development of new farming methods to address the significant declines in food nutritional value revealed by his research. Ed founded New Day Farms and began careful testing in a large greenhouse environment in Northern Virginia. Over hundreds of trials, Ed mixed Virginia pasture soil with a host of different sources of trace minerals and beneficial microbial inoculants in search of the most nutrient dense soil with the highest possible organic matter in which to grow a variety of plants, including heirloom tomatoes, salad greens, kale, melons and more.

Ten years later, in 2016, Ed teamed up with Working Lands Investment Partners' managing partner, Dan Spethmann, to found Working Lands Soil & Water (WL/S&W), with the goal to further improve Ed's soil, reduce production costs, and create efficiencies of scale that would enable the commercialization of WL/S&W soil. From 2017 to 2018, WL/S&W achieved these goals by increasing organic matter and nutrient density, implementing significant cost reductions and production efficiencies and incorporating key elements of these nutrient dense soil-building methodologies into its high-yield, high nutrition field production system.

Dan's management and finance skills complement Ed's farming and food industry experience and inventiveness. Both bring a deep commitment to the natural world and to helping farmers transition from chemical farming to reverse climate change by improving fertility and sequestering Carbon in soil.

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# The Working Lands Soil Methodology

The cornerstones of our regenerative farming model are our proprietary organic nutrients and microbial inoculants, and our soil restoration methodology, which jumpstarts fertility in less than two years.

## Plant Density and Yield

Once we have restored substantially higher soil productive capacity, we then increase plant density and yield dramatically by planting multiple species of seasonally-adapted annual crops directly into continuous perennial pasture grasses — known as intercropping — using our proprietary planting and inoculation equipment. The crops actually thrive together because we plant cool season annual plants during the fall, winter and spring, when the perennial grasses are less active, so they easily co-exist. This way, we get continuous forage for our grazing animals[4] during both cold and hot periods.

## Animal Grazing and Plant Health

Throughout the year, our grazing animals harvest the grasses and the nutrient dense forage we have inter-planted. We manage our high-animal-density herds using advanced multi-paddock methods in which we move fences to carefully control the amount of time the cows have access to forage. This allows us to continually direct the herds to fresh, nutrient-dense forage and move them out of the fields at the right time. These grazing practices help maintain a high density of plants and further accelerate soil restoration and Carbon sequestration[5].

**Our regenerative model jumpstarts fertility in less than two years.**

**Figure 1.** High-animal-density herds using advanced multi-paddock management methods

## More Healthy Plants = More Carbon

The primary driver of Carbon sequestration in soil is Net Primary Productivity (NPP)[6]. NPP is the net amount of $CO_2$ taken in by vegetation in a particular area, and is an important element in the balance of Carbon exchange between the Earth and the atmosphere.

A subset of Net Primary Productivity is crop yield, which we will be measuring during our trials. The greater the amount of crop yield, the greater the amount of root mass and root exudates, which are the source of most soil Carbon.

Supported by our previously documented forage yield increase of 500%[7], we expect to boost our Carbon sequestration by a similar multiple of five times the one ton per acre that is sequestered by other regenerative models.

## Additional Steps to Sequestering More Carbon

We are also implementing a number of other microbial inoculations, mineral amendments and other practices[8] proven to increase the rate of Carbon sequestration, including:

- **Mycorrhizal fungi inoculant,** known to be instrumental in converting root exudates to soil Carbon that is resistant to breakdown.
- **Amending the soil with the element Manganese,** a plant nutrient that has also been shown to catalyze the formation of stable forms of soil Carbon.
- **Amending the soil with Iron,** another plant nutrient, which complexes with organic matter, preventing its consumption and oxidation by soil bacteria.
- **Amending the soil with the element Sulfur**, a key constituent of protein, which has also been shown to support autotrophic bacteria that convert $CO_2$ in the soil from the atmosphere or from root or microbial respiration into stable forms of Carbon.
- **The re-introduction of dung beetles** into the pasture to bury the tons of cattle dung deposited on pastures each year. This is a means of further boosting soil Carbon.
- **Our soil, crop and animal management practices** are designed to shift our soil from dominantly bacterial, which is typical for most depleted farm soils, to dominantly fungal. Fungi, including mycorrhizal fungi, typically consume less soil Carbon for their own metabolism than bacteria, and convert more of the Carbon to stable forms that stay in the soil long term.
- **There are other microbes and enzymes** that we will be experimenting with that have been proven to sequester Carbon from root exudates or $CO_2$ in the soil.
- **We will be growing annual and perennial legume plants as part of our mixed forage crops all year.** Nitrogen is an essential constituent of soil organic matter, so there must be a continuous source of Nitrogen added to the soil to raise soil organic matter and sequester Carbon. The most beneficial form of Nitrogen is an organic form fixed from the air by Nitrogen-fixing bacteria in association with certain plants that form symbiotic relationships with these bacteria (called legumes).

**Figure 2.** Legume root nodules, which contain the Nitrogen-fixing microbes that are key in soil health

**Figure 3.** Successful intercropping trials Fall 2018; Germinating Winter Wheat, Winter Peas, Hairy Vetch and Daikon Radish

## Soil Deficiencies

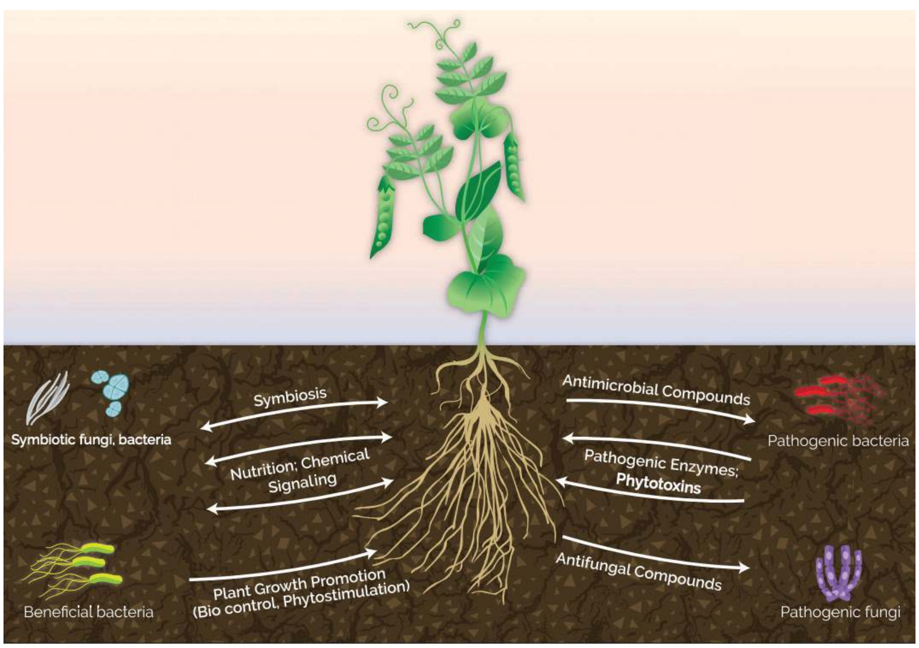
WL/S&W's Soil and Regenerative Model discussed above addresses a broad range of soil deficiencies caused by current industrial agriculture practices.

**Loss of soil organic matter (SOM).** Up to 90% of pre-agriculture organic matter has been lost via erosion and oxidation since agriculture began 10,000 years ago. This has led to profound negative consequences for soil productivity and ecosystem health.

**Why is SOM important?** SOM is instrumental for creating a soft, porous structure that plant roots and soil organisms can easily penetrate. It also allows heavier rains to soak in, and provides insulation to keep soil temperature steadier. Last but not least, the electromagnetic properties of organic matter enable it to hold onto positively and negatively charged mineral nutrients so they remain available for plant use and are not washed away by the rain. SOM is also related to Net Primary Productivity (NPP).

**Loss of soil microorganisms.** Centuries of plowing, decades of chemical fertilizers and toxic pesticides, and the replacement of perennial plants with monocrops have led to the loss of soil microorganisms. Also, microbes require enzymes to function properly, which require a great diversity of minerals to fuel. For the most part, mainstream agriculture has been mining these minerals, not restoring them.

**Why are microorganisms important?** Among other things, microorganisms help transform organic matter into plant-available nutrients and convert inert Nitrogen in the air into a plant-available form.




The benefits of soil microorganisms

**Up to 90% of pre-agriculture organic matter has been lost via erosion and oxidation since agriculture began 10,000 years ago.**

**Weathered soil.** Weathered soil means that agriculturally-crucial plant nutrients such as Calcium; Magnesium; Potassium; Copper; Zinc; Manganese, and others have been leached or mined out of the soil rock particles to a substantial degree, leaving a dominance of Aluminum, an anti-nutrient, plus Silicon and Iron.

**On what is soil productivity dependent?** Soil productivity depends heavily on the balance of essential minerals. Mineral imbalances are very common, and are one of the leading causes of low soil productivity. For instance, the lower the Calcium concentration is in soil, generally the higher the Aluminum concentration, which is harmful for soil productivity. As well, more Aluminum, which is toxic to humans and animals, gets absorbed by the plant.

**Soil productivity depends heavily on the balance of essential minerals. Mineral imbalances are very common, and are one of the leading causes of low soil productivity.**

It is generally more difficult to reduce an excessive concentration of a particular mineral element such as Sodium or Phosphorus than it is to add a mineral element to address a deficiency, although both are a challenge.

**Unbalanced pH:** Soil minerals essential for plant growth become available to plants within a limited pH range. At higher or lower pH levels, these elements stay chemically bound to other elements and, thus, are insoluble and unavailable to plants.

**What is optimal pH?** Optimal pH is higher for some elements than others, but all essential minerals are at least moderately available in a pH range from 6 to 8. Millions of acres of U.S. cropland have a pH outside of this range – mostly acidic – which is evidence of a deficiency of positively charged mineral cations such as Calcium, Magnesium, Potassium and others.

**Bacterial-Fungal Imbalance:** Fungi, including mycorrhizal fungi, are crucial for improving mineral availability in soil, for nutrient cycling, and for Carbon sequestration. However, centuries of tillage, ubiquitous annual monocrops, toxic chemicals, and other practices have steadily destroyed fungi and resulted in degraded soil productivity and the loss of Carbon sequestration in soil. **Most grassland and agriculture soils have bacteria-dominant food webs.**

Mycorrhizal fungi and plant roots

**Toxic Chemical Residues:** Herbicide and pesticide residues are pervasive in soils where they are applied. Although the concentrations of these chemicals are low, perhaps down to the parts-per-billion, they nevertheless affect productivity in multiple ways, including suppression of microbial activity and the locking up of certain soil minerals. This reduces their availability to plants, as well as suppresses pollinator populations and interferes in the reproduction of multiple species (including humans).

## Restoration Methods

There are numerous methods currently deployed to restore the soil deficiencies previously discussed. The matrix below presents the 10 restoration methods most commonly found on farms not engaged in industrial agriculture practices. Note: there are many important benefits of restored soil, but the primary two focused on for the purposes of this comparison are increased soil organic matter and enhanced Carbon sequestration.

### Approaches to Soil Restoration

| METHOD | NOTES | COST |
|---|---|---|
| **Raw manure or other raw organic material to soil surface** | Should be deposited by animals grazing. Can build excessive Phosphorus over time | Low per application if on-farm source is available. High cost over time for small benefit. |
| **Composted manure or other organic matter, or municipal sewage waste** | Relies on the application of typically tons of composted organic matter or municipal sludge | Compost is expensive; and may have to be applied annually unless soil functionality is restored and proper crop practices implemented<br><br>Municipal waste is “free” to the farmer. |
| **Biochar** | Labor intensive to produce | High |
| **Limestone + other mineral fertilizers to the land surface** | Often an important part of a soil restoration program. Should be incorporated for best effect. | Moderate |
| **Rock powders** | Rock powders are particularly important in regions of high weathering, like the Eastern U.S. But require robust soil microbiology to solubilize minerals. | Moderate |
| **Holistic Grazing** | Proper grazing increases plant diversity, grass productivity, and root exudates. | Modest net cost to launch program until higher grass productivity boosts income |
| **No-till cover cropping** | Plant annual cover crop after summer annual cash crop; uses special machine and sometimes herbicides to kill off cover crop, which is destructive of soil microbiology. | Moderately expensive because cover crop is not eaten by animals or otherwise monetized, unless it is a cash crop like grain. |
| **Soil inoculation** | Mycorrhizal fungi or other beneficial microbes are critical, but difficult to reestablish once killed off. | Can be expensive when multiple applications are required. |
| **Planting legumes** | Planting Legumes and inoculating the seed with Rhizobia to fix nitrogen from the air to boost soil nitrogen levels. | Legumes are not expensive, and replace purchased nitrogen fertilizer, so save money. |
| **Pasture Cropping** | And other types of intercropping boost plant growth, and soil-building roots and root exudates | Not expensive if fertility is good and forage crops can be fed to animals |

| TIME TO RESTORATION | INCREASE IN SOM | ENHANCED CARBON SEQUESTRATION |
|---|---|---|
| Decades | Very small amount converted to stable soil organic matter. Most oxidizes above ground. | Minor impact. Root exudates and mycorrhizal fungi drive sequestration, not surface applications |
| Decades | See above | See above |
| Years | Mixed | High |
| Several years, often several applications | No direct increase. If done properly, contributes to increased crop growth, which contributes to higher root exudates and soil carbon. | Ditto answer to the left. |
| Long with typical low soil biological activity; relatively rapid with robust soil microbiology | Indirect impact over time as plant growth and root exudates increase. | Positive over time by improving plant growth and exudates. |
| Years to decades | Low to Medium, depending on how rigorous the animal management is | See answer to the left. |
| Modest improvement in soil structure and soil nutrient availability within a couple of years. Long, slow build-up of soil organic matter, depending on entirety of farm practices. | Slow improvement in soil organic matter, dependent on entirety of regenerative practices. | See answer to left. |
| Typically years to reestablish, although comprehensive WL system achieves significant results even in year one. | Mycorrhiza are instrumental for carbon sequestration. | Mycorrhiza deliver results as soon as reestablished, particularly when there is good diversity of forage plants. |
| Can be planted year one, and contribute right away to organic nitrogen fixation, a key element for sequestering carbon. | Nitrogen is crucial for carbon sequestration. So legumes can make a big contribution | See answers to the left. |
| Can be implemented in year one as long as fertility is good | Pasture cropping will contribute significantly and directly to soil organic matter as long as mycorrhizal fungi have been reestablished, and soil fertility is good. | Pasture cropping is a key tool for boosting root exudates and carbon sequestration. |

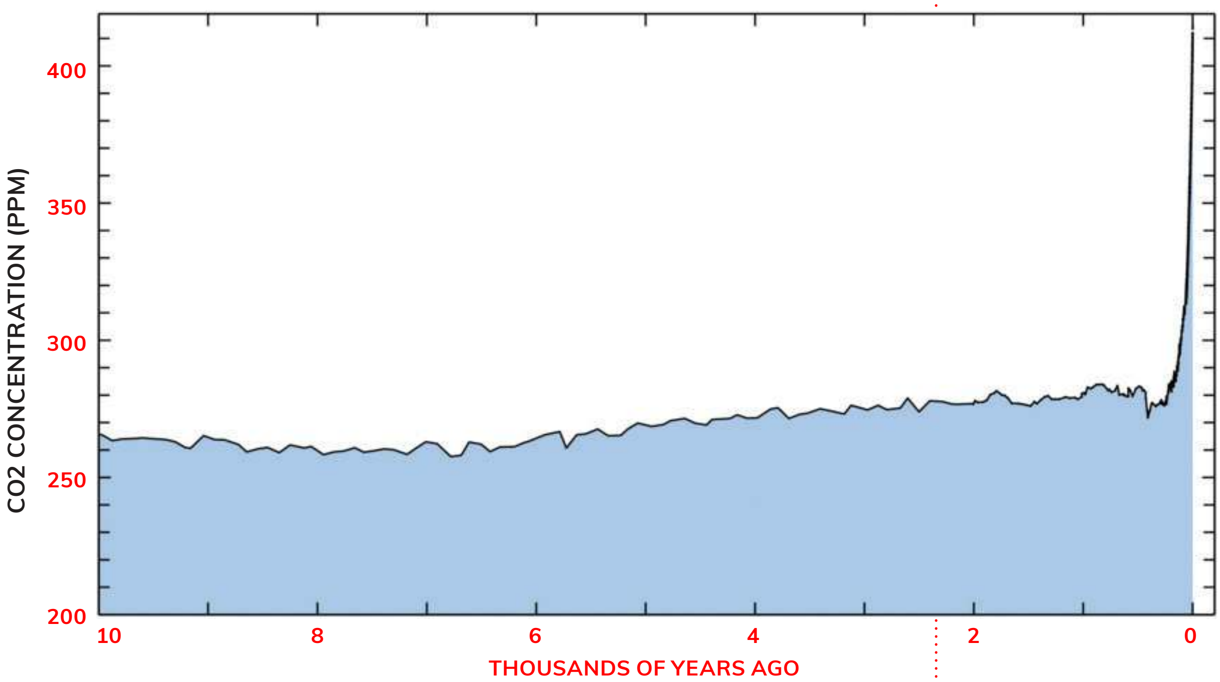
## Climate

The Earth's climate is changing. When averaged out over decades, the global mean temperature has risen to 0.8°C over preindustrial levels.[9] This change has already begun to affect ecosystems across the planet, and scientists continue to make connections between these changes and an increase in the emissions of greenhouse gases into the atmosphere from the burning of fossil fuels by humans, primarily Carbon Dioxide ($CO_2$).

Measured in Parts per Million (PPM), atmospheric $CO_2$ levels that measured at between 260 and 280 PPM in preindustrial times are currently climbing through 400 PPM.[10] To slow, if not stop, this increase in atmospheric $CO_2$, humans must reduce fossil fuel emissions and sequester (remove) huge quantities of $CO_2$ from the atmosphere. There is consensus that we should lower atmospheric Carbon to at least 350 PPM.

To slow, if not stop, this increase in atmospheric $CO_2$, humans must reduce fossil fuel emissions and sequester (remove) huge quantities of $CO_2$ from the atmosphere.

**September 23, 2019**
**Ice-core data before 1958. Mauna Loa data after 1958.**



## Soil Carbon and Carbon Sequestration

There is a growing body of knowledge on the mechanisms and capacity of soil to sequester atmospheric carbon dioxide. Besides the far-reaching implications of using our farms to solve the existential global warming crisis, soil Carbon is a core element of soil fertility. It is critical to soil structure, the availability of nutrients to plants, and the biological and physical health of the soil. So, when soil Carbon is low (≤2%), soil health is low, and when soil Carbon is high (≥4%), soil health is generally high.[11] Healthier soils photosynthesize more, which pulls more $CO_2$ from the atmosphere. Much of this carbon ends up stored in the soil. Soils in most parts of the world have soil Carbon levels below 2%. But we have tested Virginia clay soil as high as 7% Carbon, showing the potential for storing far more Carbon.

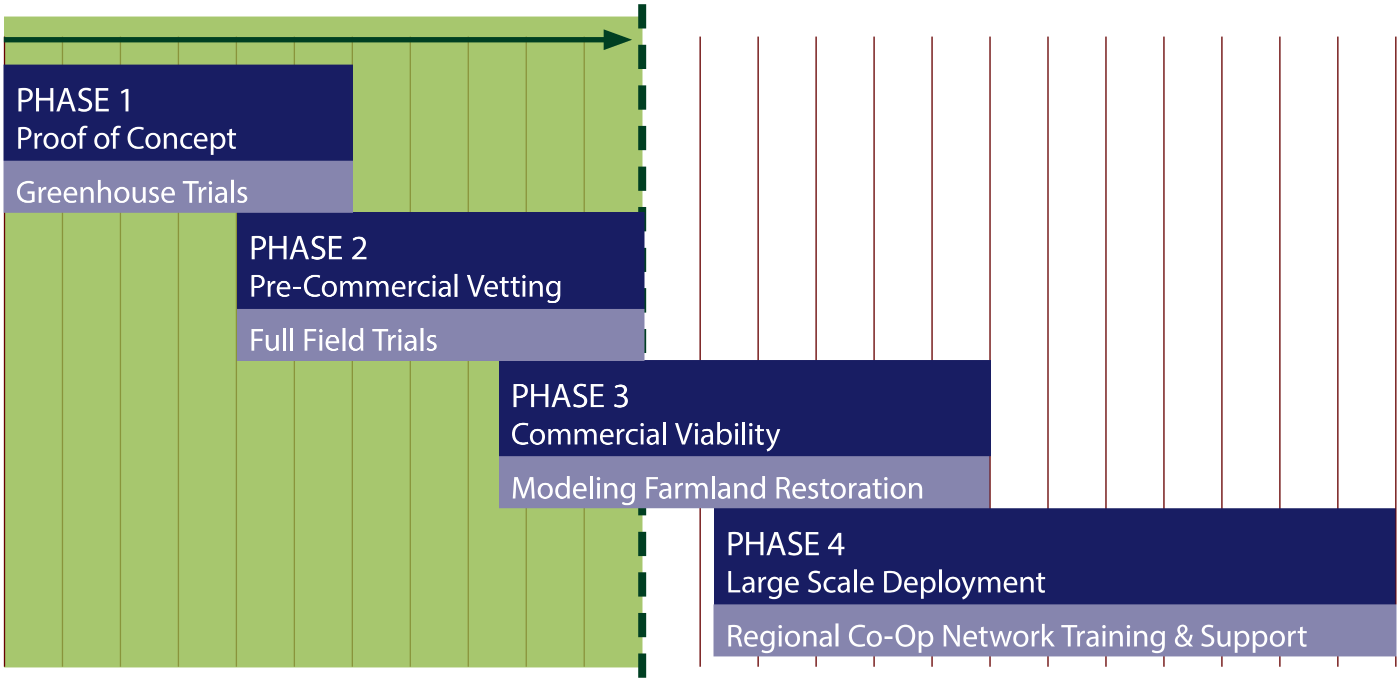
WLS&W projects that we will increase soil carbon from 2% to the benchmark of 7% in the top 12 inches of soil over a 20-year period. This five percent carbon increase in the top 12 inches amounts to 200,000 pounds of carbon during that period. Since carbon constitutes only about 26% of the weight of carbon dioxide, this means we will have pulled 760,000 pounds of carbon dioxide out of the atmosphere over every acre of the farm. For the entire 400 acre farm, 300 million pounds of atmospheric $CO_2$ will be sequestered in 20 years.

To put this in perspective, our farm will sequester the amount of carbon emitted by about 1,700 average cars every year.

**Healthier soils grow a greater number of healthy, more vigorous plants, which pull in more atmospheric $CO_2$, the majority of which ends up stored in the soil.**

# Where we are in the process

## Four Phases of the WL/S&W Timeline




### Phase 1: Proof of Concept

- The model for WL/S&W's soil was developed over 10 years of careful testing in a large greenhouse environment in Northern Virginia.
- The final soil formula is extremely rich in organic matter and key nutrients that are vital for animal and human health, and for high yield.

### Phase 2: Pre-Commercial Vetting

- Soil organic matter (Soil Organic Matter) was increased from 9% to 25%.
- Nutrient storage capacity (Cation Exchange Capacity) of the soil was increased from 30 to 46.
- Calcium, Magnesium, Phosphorus, and Potassium levels have been raised.
- Overall production costs were reduced from $300 to $60 per ton.
- 15 trials were conducted and provided preliminary proof of our high yields, multi-season intercropping success, and the viability of our custom planting machinery.

### Phase 3: Commercial Viability

- WL/S&W is currently transitioning from Phase 2 to Phase 3.
- Acquiring currently low-value, depleted farmland to restore to full productivity using our regenerative model.
- This model will drive a strong increase in operating income and margins, add CO2e credit revenue, and build capital appreciation resulting from improved farm profitability, soil rent and, ultimately, farm resale value.

**Figure 4.** Best-in-class heirloom tomatoes grown for Whole Foods in Phase 1

**Figure 5.** Highly-nutritious microgreens grown for Whole Foods in Phase 1

### Phase 4: Large Scale Deployment

- Will expand our WL/S&W regenerative agriculture program to farmers around the world through a network of regional co-ops that will train and support farmers.
- WL/S&W will help measure and document the Carbon being sequestered by all these farmers, and aggregate and sell the Carbon credits, passing the majority of this income back to the farmers.

## Phase 2 Investment

WL/S&W intends to acquire Opportunity Zone land through a separate investment partnership it will manage and operate under contract. The company will also contract with farm owners to improve soil quality under revenue partnership agreements.

WL/S&W will use funds from Opportunity Zone investors to acquire Herren Farm to develop as a working model for regenerative agricultural methods, and to train future employees to manage additional farm properties. Highlights of the farm include:

- A demonstration farm to document benefits of Intellectual Property
- Unique opportunity located in Culpeper County, Virginia (approximately 70 miles SW of Washington, DC) totaling 421 acres, with 400 acres considered productive grazing land
- Both a model and an investment (projected 8.42X and 36% IRR)
- Acreage allocated for research & development

### What is an Opportunity Zone?

Opportunity Zones (OZ) were created as part of the Tax Cuts and Jobs Act of 2017 to encourage investment in low-income community businesses. For investors, they provide:

- the ability to invest realized capital gains and defer taxes until 2026
- the ability to exclude gains on the Opportunity Zone investment if held at least 10 years.

There are more than 8,000 designated OZ scattered across the 50 states and U.S. territories, most of which are not proximate to urban centers.

**Figure 6.** WL/S&W generated 250% higher yield in the radishes on the left.

**There are more than 8,000 designated Opportunity Zones scattered across the 50 states and U.S. territories.**

# Phase 1 & 2 Results

## WL/S&W Phase 1 Results

The greenhouse soil formula developed over a decade of work is extremely rich in key nutrients that are vital for animal and human health and for high yield. This is evident in the table below, which compares nutrient values in Virginia pastureland with the soils developed in the greenhouse. The nutrient levels in the greenhouse-developed soils are several times higher than typical Virginia pasture soil.

| LAB ANALYSIS: GREENHOUSE SOIL | | | | | | |
|---|---|---|---|---|---|---|
| 9.2% | 150 | 83 | 622 | 597 | 4165 | 30.6 |
| 242% INCREASE | 127% INCREASE | 436% INCREASE | 464% INCREASE | 574% INCREASE | 734% INCREASE | 527% INCREASE |
| ORGANIC MATTER % RATE | NITROGEN LBS/ACRE | PHOSPHORUS PPM | POTASSIUM PPM | MAGNESIUM PPM | CALCIUM PPM | C.E.C. MEQ/100G |
| **LAB ANALYSIS: TYPICAL VIRGINIA PASTURE SOIL** | | | | | | |
| 3.8 % | 118 | 19 | 134 | 104 | 567 | 5.8 |

PPM is Parts per Million. C.E.C., or Cation Exchange Capacity, is the measure of nutrient-holding capacity of soil.

The table above demonstrates that the soil WL/S&W co-founder Ed Huling developed contains key nutrients, but what matters even more is whether the plants absorb the nutrients and provide them to the humans and animals who eat the plants. The plants grown in the greenhouse soils had very high nutrient levels, as analyzed by EMSL Labs, a USDA-approved lab located in New Jersey. Below is the nutritional panel on the microgreens (salad greens) grown in the greenhouse. The greens contain 24 essential vitamins and minerals, many at very high percentages, including Calcium, Iron, Magnesium, Chromium, Selenium, Manganese, and a series of vitamins including K, B6, A, E and others.

**Nutrition Facts**

Serving Size 1/2 bag (90.5g)
Servings Per Container 2
Calories 25

*Percent Daily Values are based on a 2000 calorie diet.

| Amount Per Serving | % Daily Values* | Amount Per Serving | % Daily Values* |
|---|---|---|---|
| **Total Fat** 0g | 0% | **Potassium** 280g | 8% |
| Saturated Fat 0g | 0% | **Total Carbohydrate** 4g | 1% |
| Trans Fat 0g | | Dietary Fiber 2g | 8% |
| **Cholesterol** 0mg | 0% | **Sugars** 0g | |
| **Sodium** 15mg | 1% | **Protein** 2g | 4% |

- Vitamin A 15%
- Vitamin E 10%
- Niacin 6%
- Pantothenic Acid 2%
- Zinc 4%
- Chromium 15%
- Vitamin C 10%
- Vitamin K 90%
- Vitamin B6 8%
- Phosporous 6%
- Selenium 20%
- Molybdenum 35%
- Calcium 8%
- Thiamin 15%
- Folate 15%
- Iodone 10%
- Copper 15%
- Chloride 4%
- Iron 120%
- Riboflavin 10%
- Biotin 2%
- Magnesium 15%
- Manganese 60%

## Phase 2 Results

As shown below, improvements continue to be made to WL/S&W's soil. In typical Virginia pasture soils, the percentage of organic matter (soil Carbon) is 3.8% (or often lower). By contrast, WL/S&W's organic matter is 6 times higher at 24.9%.

This soil analysis also shows that the content of key minerals is also substantially higher in WL/S&W's soil. These minerals are essential for nutrient density in forage, for supporting high crop yield, superior health of the plants grown in this soil, and the grazing animals that eat the forage. The soil analyses below were performed by Waypoint Analytical Lab in Virginia.

**LAB ANALYSIS: WORKING LAND SOIL**

| | | | | | | |
|---|---|---|---|---|---|---|
| 24.9% | 150 | 204 | 3972 | 973 | 5123 | 46.2 |
| 170% INCREASE | 0% INCREASE | 146% INCREASE | 539% INCREASE | 59% INCREASE | 23% INCREASE | 51% INCREASE |
| ORGANIC MATTER % RATE | NITROGEN LBS/ACRE | PHOSPHORUS PPM | POTASSIUM PPM | MAGNESIUM PPM | CALCIUM PPM | C.E.C. MEQ/100G |

**LAB ANALYSIS: GREENHOUSE SOIL**

| | | | | | | |
|---|---|---|---|---|---|---|
| 9.2% | 150 | 83 | 622 | 597 | 4165 | 30.6 |
| 242% INCREASE | 127% INCREASE | 436% INCREASE | 464% INCREASE | 574% INCREASE | 734% INCREASE | 527% INCREASE |
| ORGANIC MATTER % RATE | NITROGEN LBS/ACRE | PHOSPHORUS PPM | POTASSIUM PPM | MAGNESIUM PPM | CALCIUM PPM | C.E.C. MEQ/100G |

**LAB ANALYSIS: TYPICAL VIRGINIA PASTURE SOIL**

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.8 % | 118 | 19 | 134 | 104 | 567 | 5.8 |

PPM is Parts per Million. C.E.C., or Cation Exchange Capacity, is the measure of nutrient-holding capacity of soil.

# The 15 trials we conducted on farms

## in Virginia over the last 3 years provide preliminary proof of our high yields, multi-season inter-cropping success, and the viability of our custom planting machinery.

**Example 1A:**
**Successful inter-cropping trials in WL/S&W soil**

Summer 2017 – 2 weeks after planting

Sorghum Sudan Grass, Pearl Millet & Cowpea annuals inter-planted into perennial pasture grass

**Example 1B:**
**Successful inter-cropping trials in WL/S&W soil**

Summer 2017 – 5 weeks after planting

Sorghum Sudan Grass, Pearl Millet & Cowpea annuals inter-planted into perennial pasture grass. 45,000 pounds per acre of high-quality forage in just 5 weeks.

**Example 2:**
**Successful inter-cropping trials in WL/S&W soil**

Fall 2017

Winter Rye and Winter Pea inter-planted in rows into perennial pasture Grass.

**Example 3:**
**Successful inter-cropping trials in WL/S&W soil**

Spring 2018

Winter Rye and Peas interplanted in rows into perennial pasture grass

**Example 4A:**
**Successful inter-cropping trials in WL/S&W soil**

Spring 2018

Control Group - Winter Rye and Peas planted into regular pasture.

**Example 4B:**
**Successful inter-cropping trials in WL/S&W soil**

Spring 2018

Trial Group - Winter Rye and Peas planted into WL/S&W soil.

**Example 5A:**
**Successful inter-cropping trials in WL/S&W soil**

Fall 2018

Custom planting machinery interplanting Winter Rye, Hairy Vetch and Winter Pea into perennial pasture grass.

**Example 5B:**
**Successful inter-cropping trials in WL/S&W soil**

Fall 2018

Winter Rye, Hairy Vetch, Winter Pea, and Daikon Radish (shown) inter-planted into perennial pasture grass with custom planting machinery.

# Business Model

## The key elements of the WL/S&W business model are:

**Better farm economics due to much higher crop yields and revenue per acre.** We expect our forage crop yields will be at least five times normal Virginia pasture grass yields per acre, based on preliminary proof of concept trials that generated such yields.

**Higher animal feed conversion efficiency and weight gain per day.** We expect the cattle that feed on our high protein, high mineral density forages to convert a higher percentage of this forage to meat at a faster daily rate of gain than is typical for cattle feeding on normal, depleted pasture grass forage. There are a number of trace elements that are well documented to contribute to high feed conversion efficiency and weight gain per day. We will be including all of these trace minerals in our restoration process.

These feeding efficiencies are critical to level the playing field with industrial cattle producers who achieve rapid weight gains by feeding cattle corn and soybeans to the detriment of animal and human health, the soil, and Carbon sequestration. Our full field trials in 2020 are expected to confirm and quantify such accelerated weight gains.

**Higher product quality will earn a higher price per pound and higher margins.** Meat quality is largely determined by forage quality, including energy value, protein levels, and mineral density. Our production system is designed to maximize these quality factors, which will have a positive impact on meat quality and market value.

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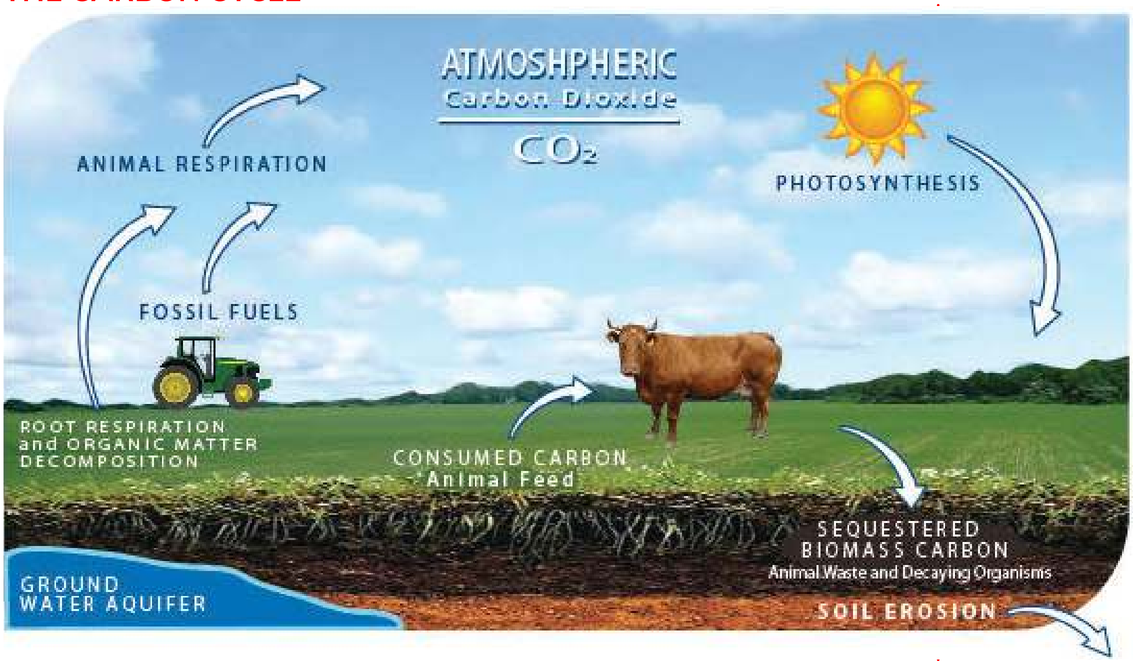
THE CARBON CYCLE



**Cost savings on pesticides and veterinarians.** Our forage trials over the past three years confirm that we need no herbicides, pesticides or fungicides. This represents a significant cost saving. We also expect that the animals feeding on these nutrient dense forages will have a high level of immune health, and thus will be free of the many possible diseases and ailments that affect many farm animals.

**Carbon credit revenue.** We expect significant additional revenue from CO2e (Carbon) Credits and other ecosystem services credits. Dan Spethmann, with his many years of experience monetizing Carbon sequestered in soil and other nutrient and ecosystem credits, will oversee our efforts to monetize these credits.

**Resilience.** We expect our resilience to climate-caused temperature and precipitation extremes to continuously improve as we restore higher and higher levels of soil Carbon, plant density and microbial diversity. Higher soil organic matter improves soil structure, which helps insulate the soil from higher air temperatures and results in a high percentage of rain flow being absorbed and stored in the soil. It is thus ready to supply needed water to plants during drought periods, which are expected to increase as climate disruption worsens.

**Financial Model:** On page 25 is a three-year comparison of the finances of a conventional Virginia beef farm with a representative three-year summary of the revenue and expenses for WL/S&W, and our farm model. Three different farm size net income scenarios are shown.

First-year net income is negative due to the first year investment in fertility, and because of lower startup crop yields. By the second year, yields are higher, costs are lower, and net income is positive. Actual numbers will depend on farm size, rate of expansion, and other variables. For example, first year acreage is likely to be less than later years, which would reduce first-year losses.

**Meat quality is largely determined by forage quality, including energy value, protein levels, and mineral density.**

## A Key WL/S&W Strategy for Optimizing Financial Returns

We discovered a powerful economic principle with greenhouse production that can just as profitably be applied in the field (though most farmers do not do so). That is, that every intervention that improves crop yield, leverages and increases the rate of financial return on every other intervention and increases the rate of return on investment of production assets, including land; buildings; fences; water lines; roads, and other infrastructure investments.

In contrast, most farmers go to great lengths to lower their costs to an absolute minimum, which often reduces their crop yield and revenue, making it more and more difficult to provide a return on their substantial investment in land, buildings, equipment and other infrastructure- all of which are fixed unless they are sold off. While not minimizing the importance of managing costs, our strategy is to continue investing in soil-building and cropping strategies that boost yields and revenue, which increase geometrically, along with Carbon sequestration, which is directly connected to plant yields and root mass and exudates.

This principle arose from our discovery that agricultural crop productivity on most farms is a tiny fraction of the potential that soil and sun and water can generate when soil nutrition and environmental conditions are optimal. So, for example, an investment in fertility, if effective, should produce a dramatic improvement in yield, as our fertility trials demonstrated.

Once baseline fertility is available to support higher crop yields, every additional annual forage planting can increase overall forage yields by 25-50%, with an equivalent increase in revenue without any additional investment in land or infrastructure.

Then, given high fertility, a powerful microbial inoculant that boosts plant growth might be added at the time of planting, for an additional 10% yield improvement, which further leverages prior investments in fertility, infrastructure, etc.

There are many such interventions that can be made once fertility is high, which is our primary goal. The point is, that a modest added investment that will boost yield costs much less and earns a much higher return on investment than buying more land, buildings, fences, etc., to get each additional 5, 10 or 20% increase in crop yield and revenue, providing the baseline fertility can support the extra yield, which our system provides for.

**Every intervention that improves crop yield, leverages and increases the rate of financial return on every other intervention and increases the rate of return on investment of production assets.**

## HIGHER NET INCOME FOR WORKING LANDS FARM MODEL

| CONVENTIONAL VIRGINIA BEEF FARM | YEAR 1 | YEAR 2 | YEAR 3 |
|---|---|---|---|
| Average Virginia forage yield per acre (lbs) | 5,000 | 5,000 | 5,000 |
| Yearly Cattle weight gain per acre (lbs) | 214 | 214 | 214 |
| **Value of yearly weight gain** | **$385** | **$385** | **$385** |

| WORKING LANDS FARM MODEL | YEAR 1 | YEAR 2 | YEAR 3 |
|---|---|---|---|
| Total annual forage yield per acre (lbs) | 15,000 | 19,000 | 22,500 |
| Yearly Cattle weight gain per acre (lbs) | 1,042 | 1,464 | 1,912 |
| Value of meat per pound (US$) | $1.80 | $1.90 | $2.00 |
| **Value of yearly weight gain** | **$1,875** | **$2,781** | **$3,825** |
| Value of Carbon and Nutrient Credits | | $200 | $200 |
| **Yearly Meat & Credit revenue per acre** | **$1,875** | **$2,981** | **$4,025** |
| Estimated Operation & Admin cost per acre | $2,503 | $1,856 | $1,436 |
| **Total acres in operation** | **500** | **500** | **500** |
| **Farm Net Income per Year** | **($245,696)** | **$322,911** | **$951,073** |
| **Total acres in operation** | **1000** | **1000** | **1000** |
| **Farm Net Income per Year** | **($591,393)** | **$645,822** | **$1,902,146** |
| **Total acres in operation** | **1500** | **1500** | **1500** |
| **Farm Net Income per Year** | **($737,089)** | **$1,118,734** | **$3,003,219** |

**ASSUMPTIONS:**

- 60% of conventional farm forage is consumed by animals vs. 75-85% at WL/S&W due to superior grazing practices
- Daily forage dry matter requirement is assumed to be 28 pounds for conventional farm vs. 27 pounds for WL/S&W due to enhanced feed conversion metabolism
- WL/S&W stocking rate assumed to be 90% of capacity to allow for drought

# End Notes


1 Sundquist, E., Burress, R., Faulkner, S., Gleason, R., Harden, J., Kharaka, Y., ... Waldrop, M. (2008). Carbon Sequestration to Mitigate Climate Change: Fact Sheet. Retrieved from https://pubs.usgs.gov/fs/2008/3097/pdf/CarbonFS.pdf

2 Here we intend on Regenerative farming and Conservation Agriculture to mean the same thing: system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services.

3 Huling, E., Spethmann, D., & Hoffmann, B. (2019). A New Regenerative Farming Model. Working-Lands Soil & Water. p. 25-26

4 Teague, R., & Apfelbaum, S. (2016). Increasing Soil Carbon Using Regenerative Agriculture and Adaptive MultiPaddock (AMP) Grazing: Overview of findings, research needs, and the 1 Million Metric Tons pilot. White House Office of Science and Technology Policy.

5 Savory, A., & Butterfield, J. (2018). Holistic Management: A New Framework for Decision Making (2nd ed.). Island Press.

6 Roxburgh, S. H., Berry, S. L., Buckley, T. N., Barnes, B., & Roderick, M. L. (2005). What is NPP? Inconsistent accounting of respiratory fluxes in the definition of net primary production. Functional Ecology, 19(3), 378–382. https://doi.org/10.1111/j.1365-2435.2005.00983.x

7 Huling, E., Spethmann, D., & Hoffmann, B. (2019). A New Regenerative Farming Model. Working-Lands Soil & Water.

8 Post, W. M., Amonette, J. E., Birdsey, R., Garten, C. T., Izaurralde, R. C., Jardine, P. M., ... Metting, F. B. (2009). Terrestrial biological carbon sequestration: Science for enhancement and implementation. In B. J. McPherson & E. T. Sundquist (Eds.), Geophysical Monograph Series (Vol. 183, pp. 73–88). Washington, D. C.: American Geophysical Union. https://www.nrs.fs.fed.us/pubs/jrnl/2009/nrs_2009_post_001.pdf

9 Climate change: An introduction. (2013, April 23). Retrieved September 27, 2019, from Campaign against Climate Change website: https://www.campaigncc.org/climate_change/introduction

10 ibid

11 The importance of carbon in the soil. (n.d.). Retrieved September 27, 2019, from Young Carbon Farmers website: https://www.futurefarmers.com.au/young-carbon-farmers/carbon-farming/importance-of-carbon-in-the-soil

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