

Global warming is the direst challenge to our species survival. Its causes are rooted largely in the way we produce food. This installation comments on the current state of agriculture. In industrial systems, we suck out all the nutrients from the soil, drown it in chemicals and release captured carbon, never stopping to replenish the land. The chicken wire caging the soil represents how industrial agriculture is inhibiting soil performing its natural job; sequestering carbon. We do not see the result of the industrial system on the soil, for it is concealed under a cloak of genetically engineered greens. By taking this soil out of the ground and elevating it, I seek to expose and exalt the soils crucial role in the reversal of global warming.

Soil in regenerative agricultural systems is teeming with life, captured carbon, and nutrients that, in turn, increase the nutritive quality of what is growing within it. By putting myself in the soil, I hope to ask the viewer to question his or her own assumptions about the connection between human health and soil health, as well uplift the serene beauty of soil that often goes unrecognized.

Regenerative agriculture is both financially and ecologically is the least costly and only existing climate change mitigation process; however the necessary level of urgency and political willingness to employ these methods is not seen. My work aims to bring Soil to the fore and demystify its astounding ability to create real change, solve real problems and improve the quality of all of our lives.

Olivia

Introduction

I have always had deep-rooted ties with the world of food and agriculture. I grew up listening to conversations at dinner parties centered on the topics of “how small scale farming will be affected as industrial agriculture grows increasingly robust,” and “how GMO’s are penetrating the supermarkets at a disturbing speed.” Sitting quietly at the end of the table, listening intently to these discussions, I was slowly drawn into this world, and an inherent need to advocate for it was created.

This past summer I had the opportunity to experience this world on a first hand basis, working at a small local farm on the island of Martha’s Vineyard. I was put right to work weeding several long rows of shiso and purple and green basil. There, surrounded by a few fenced in fields, a beautiful sunflower garden, rows of herbs and flowers and a spacy enclosure housing 25 rabbits, I felt the soil with my hands, I smelled the untarnished air, and I witnessed the beauty and elegance of crop rotation and its ability to cycle nutrients back into the earth through photosynthesis.

This system later reappeared through concept of carbon farming, a system of taking carbon dioxide out of the air and storing it in the ground. This concept’s concreteness, clarity and potential in today’s carbon plagued world excited me more than what I thought normal, so I decided to try to make this concept a reality.

From this, a business proposal for Blue Bottle Coffee was born, in which I outlined the potential for Blue Bottles farms to implement carbon farming, and tackled the question; *could something so mundane as soil and photosynthesis be a viable solution to global climate change?*

Abstract

Implementing regenerative agriculture in the farms Blue Bottle sources coffee from will result in an array of social, environmental and financial benefits, and the action will be the catalyst for a roaring movement towards a more sustainable, healthy planet. To achieve this, I propose a partnership between Blue Bottle Coffee and Terra Genesis International. The knowledge and experience Terra Genesis International has with assessing and transforming landscapes, including coffee plantations, will dramatically lessen the chance of mistake and will efficiently and purposefully achieve this regenerative transformation. Through this partnership, Blue Bottle could pave the path of regenerative agriculture’s place in today’s market system and set a glowing precedent that companies strive to meet.

Global Warming & Agriculture’s Hefty Impact

In today’s world of rapid expansion, we have a pressing problem: global warming. The release of green house gases (GHG’s), primarily carbon dioxide (*CO2*), into our atmosphere, is the chief cause of global warming. The increasing temperature of our atmosphere affects all of us in all sectors, so it is all of our responsibility to take action against it. Because most GHG have a half-life of over 100 years, GHG emissions will have to drop by 75 to 80 % in the period from 2020 to 2050 in order to limit global warming to two degrees Fahrenheit.¹ However, GOG emissions are predicted to rise 35 % by 2030 in response to the spread of industrial farming,

population growth, and changing diets.² This will greatly prolong the recovery of our planet, so we must act quickly to challenge this statistic.

The weight of global warming rests heavily on the shoulders of the agriculture sector, with 50 to 60 % of emissions attributed to the food system. Out of this, 11 to 15 % of GHG's are produced on the farm; 15 to 20 % of emissions are attributed to waste, processing, packaging and transporting food; and 15 to 18 percent are due to land use changes, such as deforestation.³ Therefore it should be the goal of every farmer and food-related company to work toward reducing the statistic. Beginning in 2030, there will be a 2 percent drag on yield every decade due to excess *CO2* in the air.⁴ Rise in temperatures will also increase the exposure of crops and livestock to diseases and pests. This will, in turn, increase production and handling losses.⁵ Therefore global warming will directly affect the quality and production of the coffee beans that Blue Bottle buys, and result in added hardships for the farmers. In other words, the cost of doing nothing will ultimately result in an overall reduction of profit.

Recent and future rises in GHG emissions are mainly occurring in developing countries, causing over 70 % of agricultural emissions worldwide.⁶ With Blue Bottle sourcing their beans heavily from these developing countries, you are positioned perfectly to have influence right in the heart of the problem. They have the opportunity to set a precedent of regenerative farming practices that, hopefully, will inspire and induce other local farmers to adopt a better system of farming. Industrial, non-regenerative systems are rapidly infiltrating these countries as they develop, but Blue Bottle could be the catalyst for a roaring movement towards a more sustainable, healthy planet.

Regenerative agriculture; Soil is the solution

It is established that global warming is a problem that we must find a solution for, and that we must act with urgency. The standard approach to this problem has been people and businesses adopting “organic” or “sustainable.” It is thought that if companies use sustainable packaging, recycle or compost, - they have benefited the environment, which is true. However, the use and mindset generated around the word *sustainable* is intrinsically flawed. *Sustainability* is defined by the Oxford Dictionary as “conserving an ecological balance by avoiding depletion of natural resources.”⁷ We have reached a level of global warming that has surpassed an ecological balance; therefore if we sustain our current practices, lifestyle, and mindset, conserving only what we have, we *will* deplete natural resources. In order to ensure prosperity and well-being for the earth, and those in it, we must restore what has been depleted. Therefore, sustainable is not enough. We must regenerate.

As stated by the United Nations in a report of trade and environment review in 2013, “We will not resolve the climate crisis if the global food system is not urgently and dramatically transformed. The place to start is with the soil.”⁸ During the 20th century, cultivated soils have lost 30 to 75 % of their organic matter, and soils under pastures and prairies have lost 50 % of their organic matter, due to damaging farming practices such as the use of fertilizers; and pesticides, especially nitrogen fertilizer, overgrazing, burning, plowing and tilling, and the constant use of land for production without putting nutrients back in.⁹

The destruction of soil organic matter is directly related to the release of *CO2* into our atmosphere because when soil is tilled, the bank of carbon that is created through photosynthesis is disrupted, and the carbon is exposed to the air. The carbon atom pairs with oxygen atoms creating *CO2*, the molecule that is now plaguing our air.¹⁰ Therefore, dead soil, and badly

managed soil becomes net emitter of carbon rather than a tool for carbon sequestration.¹¹ With between 150 and 200 billion tons of soil organic matter lost, 200 to 300 billion tons of *CO2* has been released to the atmosphere.¹² This amount is equivalent to 25 to 40 % of the current excess *CO2* in the air.¹³ Therefore, to reverse climate change, we must put those 200 to 300 billion tons of *CO2* back into the soil.

Carbon farming, or *regenerative agriculture*, is an umbrella term for agriculture that, among other things, focuses on sequestering *CO2* from the atmosphere and restoring it to its original place in the soil. Through photosynthesis, plants take *CO2* out of the atmosphere, expel the oxygen, and use the carbon to build up sugars. Some of these sugars build up plant mass, however, 40 % of the sugars are expelled through the roots and are leached into the soil where they feed surrounding microbes. In return, the microbes provide the plants with nutrients and minerals.¹⁴ When the carbon rich microbes die, they create carbon rich humus. This carbon is very stable, being only partially decomposed due to its anaerobic surroundings. Carbon that is stored in the ground creates a carbon bank that, without disturbance, can stay in the ground for thousands of years.¹⁵ Therefore, the key to the success of the cycle, therefore, is directly related to the amount of microbial activity in the soil. When pesticides are sprayed on soil, they kill microbes; and the natural sequestration of carbon is inhibited. Part of regenerative agriculture's overall goal involves building up soil organic matter and microbial activity in order to maximize carbon sequestration from soil respiration and photosynthesis.

With the right farming methods, the carbon sequestration rate can be expedited, and release of soil carbon avoided. The continuous, widespread use of regenerative practices would offset of 24 to 30 % of current global annual GHG emissions.¹⁶ According to the UN report, “if the right policies and incentives were in place worldwide, soil organic matter contents could be restored to pre-industrial agricultural levels within a period of 50 years.”¹⁷

Regenerative Agriculture; Farming Practices

As stated in the key messages section of the UN report, we need to transform our farming practices “from a linear to a holistic approach in agricultural management, which recognizes that a farmer is not only a producer of agricultural goods, but also a manager of an agro-ecological system.”¹⁸ Regenerative agriculture focuses on looking at the whole agro-ecological system, accounting for each action’s impact on this system. As stated by Ethan Roland, expert in biochemistry, permaculture and landscape design, and advocate of regenerative practices, “Truly regenerative agriculture responds to the place, to the human, to the ecosystem, and to the cultural context of the place, creating resilience and interconnection with the land.”¹⁹

In order to grow coffee, or any crop, in a regenerative way, it is essential that you reconnect with the specific ecosystem that that crop naturally grows in, and base your farming practices off of this structure. Mr. Roland goes to explain that in a regenerative system you “mimic abundant natural ecosystems... and grow the coffee in accordance to the essence of how it was originally grown and developed.”²⁰ From there, a resilient, low or no input regenerative system can be designed.

Tierra Genesis International, Ethan’s company, has worked with implementing regenerative practices on coffee plantations in the past. From this, and his knowledge of regenerative

agriculture in general, specific agricultural practices that are regenerative, and that could be practiced in coffee plantations include the following;

- **Diversified cropping systems and intercropping:** Intercropping coffee in a poly culture (i.e. coffee is grown in harmony with other allying crops such as sugar cane, coconut palms, cinnamon, and others) produces a greater economic resilience for farmers and their communities by maximizing other income opportunities and using land to its fullest potential. For example, when weeds grow, in a regenerative system, instead of suppressing them, they are designed out and replaced with plants that grow in similar ecological patterns; plants that will also provide extra income for farmers. By using a diverse mix of perennial and annual crops grown together, including legume, and carbon fixing cover crops, carbon sequestration is promoted, soil erosion is avoided, and profit is made.
- **Integration between crop and animal production:** The use of ruminants to build soil carbon is a popular regenerative farming technique. Plant roots tend to have an equal mass above and below the surface. Therefore, roots of the plants, when grazed by ruminants, shed a corresponding mass to what was grazed. The carbon rich roots detach creating carbon rich soil.²¹ *Overgrazing* is a risk associated with the use of ruminants. However, by mimicking natural herd patterns, and rotating the animals en masse through condensed portions of land, overgrazing can be avoided and broken landscapes restored. Ruminants can also be used to control weeds and fertilize the soil with their manure.
- **Keyline farming:** Keyline farming is a form of tilling that does not disrupt carbon banks and release *CO2* into the atmosphere. Keyline farming aims to grow crops in relation to the contour of the land, and therefore maximize the capture of rainfall flowing across the land. Water management can also be enhanced through the use of pond systems that catch and store water in the landscape, resulting in the potential for the landscape to totally rehydrate and become drought proof. Keyline farming is a form of tilling that does not disrupt carbon banks and release *CO2* into the atmosphere. It can “transform arid landscapes to green... through working with the harmonic patterns of the land.”²² Using a non inversion Keyline plow, that cuts sharp lines through the soil, the earth is aerated, water is allowed to sink down, and the further growth of plant roots is achieved, creating more topsoil.
- **Living soils:** Promoting living soils emphasizes the health of the soil food web, maximizing the biological activity in the soil. Through the addition of manure, compost and *compost tea*, dead soil can be reactivated, and better assist in the sequestration of carbon.²³
- **Biochar:** Biochar is activated charcoal that acts as a home for the biology of the soil. It can be used as either a replacement for soil, or as a supplement. Similar to compost, but more efficient, biochar sequesters carbon, translates it into a stable form, and stores it for thousands of years. According to Craig Sams, founder of Carbon Gold Ltd., a renowned

biochar company, “Biochar could sustainably contribute 1 billion metric tones a year to reduction in atmospheric carbon dioxide.”²⁴

Regenerative agriculture combines the knowledge of science with the experience of local farmers and uses this information to design an agricultural model, using a combination of the practices outlined above, tailored to the specific landscape and climate.

Benefits of Regenerative Agriculture

Regenerative agriculture provides a number of public goods and services through working with the ecosystem and the community as a whole. The improvement of the soil creates a “virtuous cycle of higher productivity of the plants and greater availability of organic matter,” thus increasing the yield.²⁵ The increase in diversity through using polycultures instead of monocultures, and the increase in soil carbon levels improves soil structure, soil fertility and soil life. This, in turn, increases the water holding and retention ability of the soil, avoiding runoff and soil erosion. This also increases plants resistance to extreme weather, be that of droughts or flooding.²⁶ In addition to this, the increase in soil biological activity would protect plants against pests and diseases.²⁷

Apart from the numerous social, ecological and environmental benefits, a purely financial case can be made for farms to switch to regenerative methods. It has been noted that farms that switched saw a 20 to 60 % annual growth in revenue.²⁸ Regenerative agriculture sets up the land, crop, and community for long-term success, and is therefore less expensive than other farming methods because of the stability and antifragility that the land, crop and community gain. According to Ethan, the money put into making farms regenerative converts into “living capital that has social benefits, and leads to an overall financial gain.”²⁹

As said by Patrick Holden, the founding director of the Sustainable Food Trust, and a key member in the Soil Association, “the greatest challenge of this generation is to reverse global warming, and feed the growing population.” Through the widespread use of regenerative practices more than 100 % of the current annual *CO2* emissions could be sequestered, all while producing high yielding food in a way that provides countless other benefits.³⁰ However, in order to achieve this, we must start to transition.

Blue Bottle and Regenerative Agriculture

Coffee is one of the few perennial crops that is also a commodity. If Blue Bottle were to shift their agricultural practices, demonstrating large scale regenerative coffee production, while still making equal or greater profits, it could have an enormous impact on how the coffee market and supply chain operates, prompting other coffee companies to adopt this method of farming.

In order for Blue Bottle to implement regenerative agriculture in farms they source from, it is essential to involve those who have a deep understanding of biology and agriculture from a scientific lens. Those who understand the science of agriculture are able to predict the outcomes of using specific agricultural methods. This will help limit the possibility of mistakes if the farms are redesigned or adapt to a regenerative system.

The company Terra Genesis International is a consulting firm that works with businesses assessing their supply chain, and assisting in its transformation to become regenerative. The founder, Ethan Roland, created the company in order to shift one billion dollars worth of purchasing power into global regeneration.

As Roland briefly outlined for me, if Blue Bottle Coffee and Terra Genesis International were to collaborate to work towards Blue Bottle becoming regenerative, the steps taken would be as followed:

- **Step 1:** An initial understanding of the essence of Blue Bottle Coffee and specific goals they want to achieve.
- **Step 2:** Conducting an initial supply chain assessment. This involves looking at where all of the ingredients are coming from and what their circumstances are, identifying the potential to condense the ingredients, (can the company buy their sugar from where they grow their coffee...etc.), outlining opportunities for regeneration within the supply chain, and for working with existing suppliers to evolve and develop how they practice agriculture to embrace regenerative practices.
- **Step 3:** Creating a regenerative agriculture strategy plan. This plan would include research about the coffee in each specific climate. Then farms from each climate would be chosen to act as a test for that climate and represent other farms of the area. Each farm would undergo assessment with participation from the farmers, exploring what they know, what they do, and how they can incorporate regenerative techniques. The strategy plan would outline possibilities of how to make the farm, or a section of the farm, regenerative. Carefully creating, and laying out the design of the regenerative system on paper is the most important step of creating a regenerative system, and it also ensures its success. It would take roughly 18 months for the farm to see the regeneration beginning. When they are suitably regenerative and running, these farms would act as models to which less enthusiastic farmers could be brought to, to better illustrate what their farms could look like. It is essential that there is maximum collaboration with the farmer, ensuring the regenerative goals for the farm are in line with the goals of the farmer, and of the community. This will ensure utmost success and enthusiasm.

Tools and Education

In order to gauge the success of the transformed farms, tools able to measure the amount of carbon sequestered, and that can compare year-to-year sequestration rate to assess progress must be used. There are a few options, some more complicated and accurate than others. They are as listed:

- **Draeger Tube:** Using a cylinder vacuum to catch the amount of *CO2* released by the soil in a certain area, through soil respiration and decomposition, soil biodiversity and life can be measured. This is an indicator of the rate and efficiency of photosynthesis.³¹

- Winrock International: Winrock International has created a manual that outlines steps to measure soil carbon. It involves the collection of soil and its analysis in a laboratory to determine carbon content.³²

Education and training on how to use this equipment would be required, and would happen ideally through on site collaboration with the farmers.

The Consumer and Advertising

If Blue Bottle were to become regenerative, apart from improving lives and communities, contributing to the reversal of global warming, and producing largely self sufficient, high yielding, resilient, profitable farms, they would have the opportunity to educate the consumer to create awareness around regenerative agriculture as a viable solution to global warming. Being such a well regarded company, Blue Bottle could have a large impact over how quickly and efficiently regenerative methods are adopted by other companies, and in turn, how quickly and efficiently global warming is reversed.

The agricultural movement towards becoming regenerative is inevitable, it is just a question of when and whom. If Blue Bottle were to place themselves on the frontline of this movement, their leadership and commitment would set the brand apart from other companies. Blue Bottle could become a glowing validation of what good can be done, and what power businesses, with passion and desire to make change, have to actually make that change.

Conclusion

Regenerative agriculture is the market solution that we have been looking for. Through growing improved products, creating positive demand, and inspiring others, all while operating with the principles of our economy, Blue Bottle can make tangible, timely, achievable improvements to our planet *and* generate profit.

Although regenerative agriculture is both financially and ecologically one of the least costly climate change mitigation methods, as stated in the UN report, "...we neither see the necessary level of urgency nor the political willingness for (this) drastic change."³³ In order to reverse global warming, we must take the matter in to our own hands; working with and bringing together companies that have a commitment to moving in a regenerative direction, potentially Blue Bottle Coffee, and through redesigning their supply chain, collaborating with farmers and communities, and committing to upholding standards of regeneration from the planting of the seed, to the presenting of the product, create real change, solve real problems, and improve the quality of all of our lives.

¹ UNCTAD. *Trade and Environment Review 2013- Wake Up Before It Is Too Late*. Rep. N.p.: United Nations, n.d. Print. pg 2

² UN pg 3

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- ⁵ UN pg 5
- ⁶ UN pg 3
- ⁷ "Definition of Sustainable in English:." *Sustainable: Definition of Sustainable in Oxford Dictionary (American English) (US)*. N.p., n.d. Web. 18 Nov. 2015. <http://www.oxforddictionaries.com/us/definition/american_english/sustainable>
- ⁸ Un pg 20
- ⁹ Un pg 21
- ¹⁰ Bland, Alastair. "Ground:Level." *Made Local Magazine*. N.p., May-June 2015. Web. 18 Nov. 2015. <<http://madelocalmagazine.com/2015/05/groundlevel/>>.
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- ¹² UN pg 21
- ¹³ UN pg 21
- ¹⁴ Pollan, Michael. "Keynote: The Great Challenge: Farming, Food and Climate Change." *YouTube*. YouTube, 13 Nov. 2014. Web. 18 Nov. 2015. <<https://www.youtube.com/watch?v=eSjHN8zefak>>.
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- ¹⁶ UN 21
- ¹⁷ UN pg 21
- ¹⁸ UN Key messages
- ¹⁹ "Regenerative Agriculture." Telephone interview. 8 Nov. 2015.
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- ²⁵ UN pg 21
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- ²⁸ "Regenerative Agriculture." Telephone interview. 8 Nov. 2015.
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³¹ USDA. "USDA - Soil Quality Test Kit Guide." (n.d.): n. pag. Aug. 1999. Web.

³² Walker, Sarah M. "Standard Operating Procedures for Terrestrial Carbon Measurement." *Winrock SOPs for Terrestrial Carbon Measurement* (n.d.): n. pag. *Winrock International*. 2012. Web. 18 Nov. 2015.

³³ UN pg 7

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