A Dystopian Story: The War on Soil Erosion

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In a century from now you walk across the barren landscape, carefully dodging wind-blown stones and rusted cars. The sun beats down on the world, illuminating soil so eroded that it can no longer sustain life. In this dystopian world, you are witnessing the end of humanity; and as the last agriculturist on earth, you can do little but watch. Now, set down your book. Such a reality sounds distant. However, this world may be closer than we realize. Land overuse, deforestation and overgrazing are the signs of a silent war. A war, it seems, that we are fighting against ourselves. Your dystopian book may have started as a love story between a farmer and his land. Eventually, however, something began to erode their relationship, breaking their bonds and leaving behind something as meaningless as dirt. This is the plight agriculturists are facing today. Soil erosion is defined as the wearing away or degradation of the top layer of soil, and it has become a global issue recently as much of the topsoil currently managed has been worn away. Across land considered agricultural the war against soil erosion is raging. Despite this, few warriors have seen success, and many more are hesitant to join the battle. The story of agriculture is in its most desperate chapter—and the weapons currently in use have no effect on this formidable foe. Luckily, there is a new weapon being introduced into the battle, one that has already been proven to be effective against the enemies in the mirror—and it is called Regenerative Agriculture. Soil erosion has become a worldwide issue in recent years, and acres of arable land have been lost. Additionally, soil erosion has impacted product quality and has released tons of organic carbon into the atmosphere as carbon dioxide. Because of this, it is necessary to adopt sustainable land management practices to mitigate soil loss and its climate effects across agricultural systems. With proper cropland management, agriculturists can reverse

the impact soil erosion has—however education must be implemented to do so. Pick your book back up because something's about to change.

The Issue: Accelerated Soil Erosion (ASE)

Let's turn to your book's glossary. The terms "Soil degradation" and "Accelerated erosion" have some confusing connotations behind them, and defining these is often difficult. Mr. Jeff Goats, the Wyoming state USDA-NRCS soil scientist whose job it is to improve soil health on operations across the state, defines accelerated soil erosion (or ASE) as "humans or animals disturbing topsoil . . . that leads to soil loss and quality degradation across the A Horizon" (Goats). This definition warrants some explanation while emphasizing the human impact. Topsoil, or the primary layer of soil (also known as the A Horizon) is essential in sustaining all plant life and supplying a unique biosphere for a variety of microorganisms. Many of these microorganisms play vital roles in improving soil vitality and climate health. Soil health is often difficult to measure, as a variety of components must be calculated to gain a full understanding of the health of any ecosystem. Organic carbon, however, is often used as a preliminary means of measurement for eroded soils. Soil Organic Carbon (SOC) is essential to the health of plants and microorganisms found in the biosphere, and it is almost exclusively captured through a process known as Atmospheric Carbon Sequestration (or ACS). In ACS, plants capture atmospheric carbon and trade it at their roots with mycorrhizal fungi for fixated nitrogen, a symbiotic relationship that gives back to the soil—one that has been made impossible through tillage and overgrazing as constant sequestration is needed for healthy microorganisms and systems. ASE is a man-made war that needs to be fought—and won—right now.

While the vocabulary around ASE is sometimes unclear, the causes are easily understood and can be remedied. ASE is mainly caused by various human and animal activities that disrupt

the topsoil. These activities act as ruthless warriors fighting against our soil's health. In the state of Wyoming, two Goliaths loom over the battlefield: Overgrazing and tillage. According to Dr. Jinfeng Chang and a team of environmental research scientists at the International Institute for Applied Systems Analysis, "[R]egions with overgrazing have a decreased productivity and either small soil carbon gains or carbon losses . . . in contrast, regions with sparsely grazed grasslands provided an important climate cooling service" (Chang, J. et al. 2021). Proper management is essential if agricultural systems are to aim not only to be renewable in terms of soil health, but also climate friendly through capturing atmospheric carbon dioxide and ensuring a net zero carbon footprint, proper grazing management must be implemented. Methods do exist that can graze the same number of cattle, for example, without having any (or even having a positive) effect on forage health and ACS, however these practices are not intensively used in the state. The other ruthless warrior we have fought against is known as tillage. Tillage has long been considered synonymous with idyllic pastoral scenes, however "The magnitude of [soil] depletion is exacerbated by ploughing . . . and other drastic disturbances. Most soils may lose one-half to two-thirds of their SOC [soil organic carbon] pool within 5 years", Dr. Rattan Lal, head of the Waterman College of Food, Agricultural, and Environmental Sciences at the University of Ohio explains. He was talking about the process through which soil carbon, when exposed to the atmosphere, binds with oxygen and floats away as carbon dioxide. This loss has been so exponential that "Each year, world soils release about 4% of their pool (60 Pg) into the atmosphere, which is 10 time the fossil fuel combustion." (Lal, R. 2009). Not only is this harmful to the global climate through adding to carbon dioxide emissions, but it is also detrimental to soil health as SOC is essential in supporting soil fertility and microorganism health.

This war has been waging for centuries. The fight against soil erosion is not new, however it wasn't until recently that it became desperate. According to research from the Max Planck Institute for Biogeochemistry, humans began accelerating soil erosion over four thousand years ago (Jenny, J. 2019). While this information has prompted many to disregard the issue, Dr. Melissa Ho, plant physiologist and senior vice president of the World Wildlife Fund claims that "half of the topsoil on the planet has been lost in the last 150 years" (Ho, M. 2018). The rapid rate of erosion found in recent years can be attributed to a global shift that began the rapid industrialization in agriculture nearly two centuries ago. This focus on productivity over land stewardship has led to an increase in ASE and related global issues. Topsoil is essential for all life systems, and its loss is detrimental to global markets, and the environment. The loss of fertile topsoil has forced farmers and ranchers to increase chemical fertilizer application at great cost to these agriculturists. Also, erosive events have been linked to various detrimental losses including the desertification of arable land, a decrease in soil-protecting biodiversity, and pollution from erosive runoff. Soil erosion has also been linked to effects on crop health and yield and has decreased forage output from America's rangelands. This lack of love has led to an impact on productivity worldwide, as estimates project a 23% loss in arable land shortly after the year 2025 (Bakker et al, 2007). This loss of arable land has led many producers to manage natural grasslands. However, this has been proven detrimental to the global climate by adding to carbon dioxide emissions. Additionally, current industrial agricultural practices wear away topsoil much quicker than it can regenerate. Unfortunately, little is being done to alleviate these effects even at a statewide level.

The Remedy: Regenerative Agriculture (RA)

Let’s flip to the chapter where we start winning and allow me to introduce our mysterious weapon: regenerative agriculture. Available in a variety of makes and models, this weapon is revolutionizing the war on soil erosion. And commonly defined as a set of practices aimed towards improving soil health, it is a weapon that agriculturists are beginning to invest in. But to use it, we first must understand the science behind our battle. There are a few causes behind accelerated soil erosion; the most common are various animal and human activities that disrupt the topsoil. These agents act as ruthless warriors fighting against our soil’s health. As they are constantly shifting and evolving, these warriors require an adaptable weapon to defeat. Regenerative agricultural (RA) practices vary from region to region and even from farmer to farmer. However, each can be perfectly suited for the damage being caused. Protect your soil with rotational grazing, a type of herd management in which herds are kept close-knit and move often in order to mimic wild ungulate herds and the important elements that make these herd’s grazing patterns beneficial for soil health while avoiding overgrazing (Goats, J. 2023); load your weapon with the ammunition of biodiversity aimed towards improving overall soil health through Organic Carbon sequestration and nitrogen capture (Rhodes, C. J. 2017), suit up for battle with holistic watershed planning, as improper management has caused irreparable damage to the structure, microorganisms, and macronutrients found in healthy soil and has polluted waterways with agricultural runoff (Sprinkle, J. 2023), and fight back with the use of cover crops, a method of regenerative agriculture traditionally reserved for crop production that is gaining traction as a grazable type of soil protection that decreases flood and drought damage and promotes carbon sequestration. With these methods and more, agriculturists are taking aim and fighting against soil erosion.

The Application: Education

Our fight is far from over; and many ranchers seem to be fighting a losing battle. Despite the many benefits found in the implementation of regenerative agricultural practices, many are hesitant to begin. I recently spoke with the USDA-appointed Wyoming state soil scientist, Mr. Jeff Goats, on the importance of using regenerative agriculture on pastures and ranches statewide. He said that these practices are the only hope we have to prevent that dystopian future. Unfortunately, few ranchers and farmers use soil-minded practices on their operations—indeed, only 22% of cattle operations in the state intensively use rotational grazing patterns, or similar sustainable management, even in areas that are highly susceptible to erosion. Mr. Goats said that this sparse use of sustainable practices is due to a lack of education. Across the state there is a gap in what ranchers need to know about soil erosion on their land, and what education is provided (Goats, J. 2023). So, ladies and gentlemen, I urge every one of you to help close this gap. Education is the only tool strong enough to properly build up regenerative agriculture. Join me in fighting the good fight against soil erosion, because the future of our industry—the largest in the state—is at stake. Educate yourselves and those you know on the affects soil erosion has on agriculturists' livelihoods and use the weapon of regenerative agriculture on your own land. Our fight is far from over, and we need all the warriors we can get.

Conclusion

In a century from now, you walk across the soft grass, carefully dodging flower beds and vegetable gardens. The sun glimmers through the leaves, carefully illuminating a land brimming with life—all thanks to the soil beneath. In this world, you are witnessing humanity thrive, and as one of many agriculturists, you did anything but stand by and watch. Your book may be nearing its end, but the battle is just beginning. Ladies and gentlemen, I urge every one of you to

rekindle your love, grab your weapons, fight the good fight, and pick your books back up, because without you, nothing will ever change.

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