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Regenerative Agriculture: Future of Sustainable Food Production

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Abstract

The loss of the world's fertile soil and biodiversity, along with the loss of indigenous seeds and knowledge, pose a mortal threat to our future survival. According to soil scientists, if current rates of soil destruction (*i.e.* decarbonization, erosion, desertification, chemical pollution) occurs continuously, then we will not only suffer serious damage to public health due to a qualitatively degraded food supply characterized by diminished nutrition but also we will literally no longer have enough arable topsoil to feed ourselves within 50 years. Without protecting and regenerating the soil, it will be impossible to feed the world. Thus, adoption of regenerative agriculture should be done to regenerate and revitalize the soil and the environment. Regenerative agriculture leads to healthy soil, capable of producing high quality, nutrient dense food while simultaneously improving, rather than degrading land, and ultimately leading to productive farms and healthy communities and economies.

Introduction

Today's agricultural practices like cultivation of crops and livestock as well as deforestation to make room for more farmland are responsible for an estimated one quarter of global greenhouse gas emissions, according to the Environmental Protection Agency. The 2020's herald a pivotal chance to deliver on our great climate, environment and development challenges, and the scale and pace of change will require truly transformative thinking. We will need to move beyond efficiency and doing less harm and base strategies on new goals that ensure business success also meets the needs of people and the planet. It's time to step up a gear or three on our journey toward a sustainable future. Thus, shifting from conventional agriculture to regenerative agriculture requires a fundamental shift in the goals of our agriculture system, from one focused exclusively on maximizing yield and efficiency to one that pursues economic and social outcomes alongside sustainable productivity. The comparison between conventional agriculture and regenerative agriculture on soil carbon is shown in figure 1.

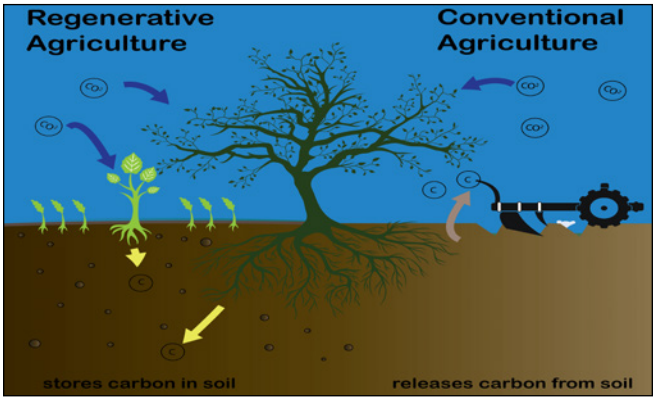

Figure 1: Comparison between Conventional and Regenerative agriculture

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Although regenerative agriculture has no universal definition, the term is often used to describe practices aimed at promoting soil health by restoring soil's organic carbon. One major goal of regenerative practices is to use some of the carbon that plants have absorbed from the atmosphere to help restore soil carbon. Other goals of regenerative agriculture are economic resiliency in farming communities, maintain soil health, water management, maintain above ground bio-diversity (Figure 2).

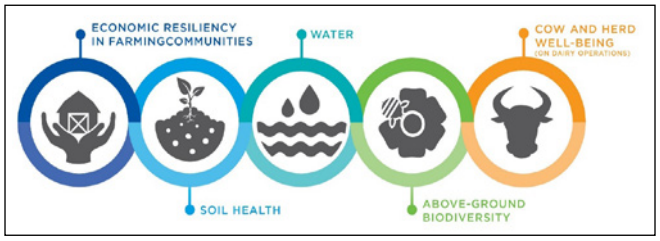

Figure 2: Goals of Regenerative Agriculture

Principles of Regenerative Agriculture

Certainly, the word "regenerative" appears to be becoming a sustainability buzzword within companies but "regenerative agriculture" is itself a distinct movement in agriculture. Central to regenerative agriculture is the building of soil health and the many positive knock-on effects that this can bring to our farming systems and landscapes. This includes better water management and nutrient recycling, improved yields, soil resilience and carbon sequestration. These are all appealing features. For some, it's the latter benefit; the opportunity to increase soil organic carbon, which is causing a particular stir in some companies, given the increasing pace of climate change. Principles of regenerative agriculture principles can pull carbon from the air and store it underground to fuel a vast array of life. Also, keeping the soil protected from erosion under an armor of living plants and crop residue can help suppress pests by promoting natural competition to reduce the need for synthetic pesticides. Regenerative agriculture works best when the farming or ranching operation is viewed as an ecosystem. There are six core principles of regenerative agriculture that we use as the basis for our work. Figure 3 shows six core principles and practices found in regenerative agriculture.

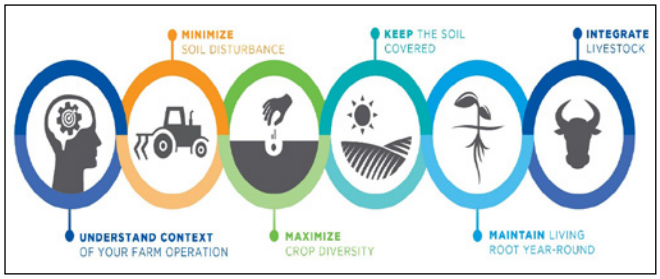

Figure 3: Six core principles of Regenerative Agriculture

Role of Regenerative Agriculture on Soil Health

The regenerative farming approach focuses on restoring soils that have been degraded by the industrial, agricultural system. Its methods promote healthier ecosystems by rebuilding soil organic matter through holistic farming and grazing techniques. There is also growing evidence that a healthy soil microbiome full of necessary bacteria, fungi, and nematodes is more likely to produce nutrient-dense food, promoting better human health. Regenerative farming practices boost soil health through a variety of techniques:

Integrating Livestock

As animals move, their hooves break up the soil, compacting inedible plants and allowing nutrients and sunlight to new plants essentially speeding up the building of soil organic matter, with crushed leaves and stalks creating a natural mulch. This better equips the soil for germinating seeds. And the livestock's excrement adds nutrients to the ground, further improving water retention.

Cover Crops and Crop Rotation

One of the key principles of regenerative agriculture techniques is to keep the soil covered at all times. This can be achieved through both plant residues and cover crops, which protect the soil from wind and water erosion, lower the temperature of the soil, and feed the microorganisms within it. Left exposed to the elements, soil will erode and the nutrients necessary for successful plant growth will either dry out or quiteliterally wash away. At the same time, planting the same plants in the same location can lead to a buildup of some nutrients and a lack of others. But by rotating crops and deploying cover crops strategically, farms and gardens can infuse soils with more and more (and more diverse) soil organic matter, oftenwhile avoiding disease and pest problems naturally.

No-till

One tea spoon of healthy soil has more living organisms than there are people on Earth vitally important building structure and overall soil health. Mechanical, physical, and chemical (synthetic fertilizer, herbicide, pesticide, and fungicide) disturbances all have a negative on the soil microbiome, putting soil nutrient cycling and environmental resilience at risk. Limiting the disturbance of the soil maintains the soil structure and prevents erosion. By adopting low- or no-till practices, farmers minimize physical disturbance of the soil, and over time increase levels of soil organic matter, creating healthier, more resilient environments for plants to thrive, as well as keeping more and more carbon where it belongs.

Crop Diversity

Regenerative systems are also likely to support much more diverse production and enable innovation in feed crops. Where major feed staples such as row crops

are sown, cover crops and other regenerative practices can keep the nutrients in the soil, enabling resilient productivity. Regenerative practices build soil health and thus increase resilience of the farming systems to changing weather patterns. Every farmers practicing regenerative agriculture will adapt it to his or her individual crop type, soil type, and property needs. What's important, proponents say, is that measures are being taken to build soil organic matter and add to the overall system's biodiversity.

Role of Regenerative Agriculture on Carbon Sequestration

Industrial agricultural techniques like deep tilling, mono-cropping and an over-use of chemical fertilizers and pesticides, have diminished our soil's natural ability to sequester carbon from the atmosphere. This means that the CO_2 that would normally be drawn down into a healthy, carbon-pumped soil, is now staying in the atmosphere and contributing to global warming. Switching to regenerative practices will restore soil health and function, reboot plant activity aka photosynthesis, and enable nature to re-balance our currently out-of-whack carbon levels. Regenerative agriculture is a system of farming and grazing practices that can reverse climate change by building healthy, biologically-diverse and mineral-rich soils, all the while sequestering carbon from the atmosphere. Global soils contain 2 to 3 times more carbon than the atmosphere. It is estimated that at least 50% of the carbon in the earth's soils has been released into the atmosphere over the past few centuries, partly due to destructive agricultural practices. Moving forward, regenerative farming practices presents an amazing opportunity to restore both carbon balance and the climate. This is because agriculture is the one sector that has the ability to transform from emitting CO_2, to sequestering CO_2. Sequestering carbon is the key to halting the warming of our planet. This kind of farming system improves our health by increasing the nutritional value of our food, the health of our planet by regenerating our soils and increasing the ability for soil to sequester carbon from the atmosphere, and the livelihoods of the farmers by providing better yielding crops in the long term.

How Farmers are Putting Regenerative Agriculture into Practice

Some traditional farmers have been incorporating regenerative agricultural practices like reduced tillage, crop rotations, and cover cropping for years. By adopting regenerative agriculture practices, soils also often measure an increase in carbon compared to nearby farms. When specific technologies applied in a well-structured cropping sequence reduce the farmer's dependence on external inputs, management is less determined by externalities over which the farm family has little control. The farmer can implement these practices partly by substituting knowledge or new information for what was previously purchased to grow the crop. The self-reliance that can be developed by the limited resource farmer can lead to greater food and income security.

Governments and bilateral/ international assistance agencies can help farmers achieve this self-reliance by developing a broader range of regenerative, organic, or other alternative resource-efficient technologies. Strategies can be designed at the national level that encourages local autonomy and self-reliance, although these are quite a departure from most development approaches in vogue today. Food production for local and national consumption needs to have priority in a total development strategy. Governments can encourage production of basic food commodities through import and export policies, realistic price supports, and by incentives for farmers to increase production. International and bilateral programs also need to support this decision. Thus, the government's policies can promote a degree of self-reliance at the national level, and can foster the same objective at the local level. Technology that improves soil fertility and pest control using internal resources needs to be developed and tested on the farm. This could build toward increased local stability of production and eventually greater national security in the basic food supply. The use of internal inputs for agricultural production reduces costs for transportation, eases complications of a poorly developed infrastructure, and increases self-reliance in each region.

Conclusion

Regenerative farming systems improve both the production potential of the soil and the environment in which the farm operates. By reducing or eliminating use of chemical pesticides and external sources of fertilizer, non-chemical methods could help increase the biological potential of the soil environment. Implementation of some practices described above could help countries to become more self-reliant in food supply through a rational use of natural resources. Tomorrow's development strategies will be characterized by a range of options for farmers, and by a more efficient use of scarce production resources in agriculture. Regenerative practices have the potential to deliver wide ranging benefits including the restoration of soil health, water quality and biodiversity, sustainable food production and of risk throughout agricultural supply chains. Such systems can serve the needs of national agricultural sector planners, who in many countries are concerned with increased self-reliance in farming inputs and in production of basic food commodities. This includes a realistic focus on training of local development specialists, increased research on food crops under limited resource conditions, and providing information, incentives, and appropriate technologies for operators of both large and small farms. Well-conceived national plans include varied food

production strategies and options for farmers with different resource levels.

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