

## Uncovering the Mysteries of Soil Carbon: The Significance to Our World

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### **Introduction:**

When we discuss ways to combat climate change, talk frequently centers on renewable energy sources and electric cars. However, the earth that sits beneath our feet is a potent and frequently disregarded weapon against growing carbon dioxide levels. Beneath the surface of the ground, soil carbon is a hidden treasure that is essential to agriculture, biodiversity, and the fight against climate change.

### **The Significance of Soil Carbon:**

Soil carbon, or soil organic carbon, is a vital constituent of soil health. It is made up of organic material that has broken down over time from leftover plant and animal waste. This carbon-rich substance increases soil fertility, retains more water, and fosters a wide variety of microbial life (Jagadesh et al., 2023, 2024). According to studies, soils around the world contain about three times as much carbon as the atmosphere and four times as much as all of the world's live plants and animals put together (Paustian et al., 2016). Because of this, soils are an essential carbon storage resource that have the capacity to absorb large volumes of carbon dioxide from the atmosphere.

### **Climate Change Mitigation:**

An important process that helps offset carbon emissions is soil carbon sequestration. When plants photosynthesize, they take in carbon dioxide from the atmosphere and transform it into organic matter through photosynthesis. This organic matter is then deposited into the soil when the plants shed their leaves, branches, and roots. Well-manicured soils function as a "carbon sink," storing this carbon for extended periods of time. Raising soil carbon levels can have a substantial impact on mitigating climate change. For example, a study estimated that improved soil management practices could sequester up to 1.85 gigatons of carbon dioxide annually (Lal, 2020). This is equivalent to the emissions from about 400 million cars in a year.

### **Regenerative agriculture and soil carbon:**



Using regenerative agricultural techniques is one of the best ways to raise soil carbon levels. Crop rotation, cover crops, and no-till farming are examples of practices that not only strengthen soil health but also increase carbon sequestration. For instance, regenerative techniques can raise soil organic carbon levels by 20–40% in just five to ten years, according to a study conducted by the Food and Agriculture Organization (FAO) (Clara et al., 2017). This helps to mitigate climate change while also enhancing soil fertility and structure.

### **The Function of Soil Microbes:**

Soil carbon encompasses more than just the carbon-rich substance itself; it also includes the unseen heroes that live beneath our feet, known as soil microbes. These microscopic creatures, which include fungi and bacteria, are essential for the cycling of nutrients and the breakdown of organic materials. As organic matter is broken down by soil bacteria, carbon dioxide is released as a by-product. To support long-term carbon storage, some of this carbon is nevertheless retained in the soil as stable organic molecules (Cotrufo et al., 2015).

### **Loss of Soil Carbon and the Need for Immediate Action:**

Soil carbon is important, but it's in danger. Globally, unsustainable land-use patterns like urbanization, intensive agriculture, and deforestation have resulted in large losses of soil carbon. According to estimates from the Intergovernmental Panel on Climate Change (IPCC), between 25% and 75% of soil carbon has been lost from agricultural soils worldwide (IPCC, 2019). This loss lowers soil fertility and resilience to floods and droughts in addition to contributing to climate change. It's a vicious cycle: as soil carbon sinks, soil health declines, which raises agricultural productivity and makes the land more susceptible to extreme weather events.

### **Conclusion:**

Soil carbon has enormous promise in the fight against climate change despite being frequently overlooked and misunderstood. We can unleash the power of this unsung hero under our feet by embracing regenerative farming methods, contributing to soil health programs, and putting soil carbon sequestration legislation into effect. Hence, no-till farming and soil mulching support the earth's inherent capacity to store carbon. Thus, we can create a healthier and more environmentally friendly future for future generations by collaborating with nature and improving our soils.

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