SINK CARBON IN YOUR GARDEN

Build Soil Health While Addressing Climate Change

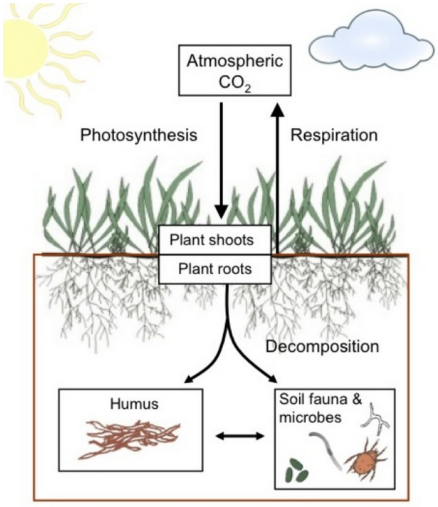
Harness the power of plants to move carbon out of the atmosphere and into the ground, one garden at a time...

Life on earth is based on carbon. It cycles continuously between major planetary pools: the atmosphere, bodies of water, and life forms of all kinds--both living and dead. Planetary forces strive to keep it in balance between these pools; but agricultural practices over millennia, and the more recent burning of fossil fuels, have allowed increasing amounts of carbon to flow into the atmosphere as carbon dioxide--one of the greenhouse gases contributing to our current climate crisis.

Plants have the ability to restore this imbalance. Using energy from the sun, plants sip carbon from the air, use water to turn it into food for life forms, and release oxygen. We call this gift from the plant world photosynthesis. More plants of many different species--growing for longer periods of time--allow more photosynthesis to take place and more carbon to move out of the atmosphere into life forms.

Life forms eat the carbon-rich food produced by photosynthesis. As they live, excrete, and die, the carbon in their bodies cycles into organic matter. Organic matter is dead and decaying life forms. It is what allows soil to hold water and grow plants that are healthy and disease resistant--AND store carbon. Organic matter in soil is cycled and protected by a community of organisms that need food, air, and water to live. Use "Soil Health Practices" (see page 3) to give these soil organisms what they need to build more and more organic matter--and to store more and more carbon--while improving water-holding capacity and fertility in your garden.

Organic matter in the soil contains carbon in many forms. It may be in living soil organisms and plants; dead creatures of all kinds; "very dead" dark, complex humus compounds that resist further decomposition; or in-between in more fluid forms. When soil is rich in carbon--and contains enough air and water--soil organisms can thrive and do the work of building more carbon-rich organic matter. Increasing organic matter does many good things. It improves soil fertility because organic matter is a storehouse of plant-available nutrients; it increases water-holding capacity by making soil sponge-like; and it keeps carbon in the ground, helping to stabilize the climate. **We need more plants, of all sizes, growing for longer periods of time,** to increase the amount of carbon captured by photosynthesis; and **we need to support soil organisms to cycle more of that carbon into soil**. Much of the planet is devoted to private yards. Using "Soil Health Practices" (see page 3) to support soil organisms and to make our gardens diverse and multi-layered--and beautiful!--will increase organic matter in our yards and begin to solve the climate crisis.



When carbon is captured by a plant, some is used to build the plant's body, and some becomes carbon-rich food that seeps out through roots to feed microorganisms like bacteria, fungi, amoebae, nematodes, and protozoa. These soil organisms return the favor by mining nutrients for the plant. They are microscopic in size and massive in numbers, and each one has important roles fostering the breathtaking complexity that is a working ecosystem. They cycle nutrients in the root zone where plants can access them as needed and they keep these nutrients from being lost to leaching. They decompose waste, purify and store water, and break down pollutants. They need air and water and the food excreted by plant roots to do their essential work.

As these soil organisms digest the carbon-rich food received from a plant, they excrete it into slimes and glues that build soil structure and make soil dark, crumbly, and rich with aggregates. Aggregates are stable clumps of soil that resist erosion. When aggregates of many sizes are bound together by soil organisms and root hairs, they form a porous, spongy structure with lots of spaces for air and water. This soil carbon sponge is ideal habitat for soil organisms. It is the underground setting for the alchemy that transforms carbon into the "very dead" complex humus compounds that keep it in the ground over the long term, eventually becoming fossil fuels like coal and oil. "Soil Health Practices" offer ways to garden with the health of soil organisms in mind, giving them what they need to cycle more and more carbon, water, and nutrients to build soil fertility and to help stabilize our climate.

Soil Health Practices

Use these practices to support soil life to extend the growing season; improve water. carbon, and nutrient cycles; and increase the amount of the earth's surface that supports soil fertility--one garden at a time! Avoid practices and conditions that are stressful for soil life--chemical inputs, monoculture, unnecessary tilling of soil, and bare ground--and build diversity.

- **FEED soil life by keeping the ground covered and living roots in the ground for as much of the year as possible.** Avoid bare soil. Maintain a multi-layered canopy of living plants to protect the soil surface from pounding rain, wind, and heat. This will maximize the volume of space and the amount of time available for photosynthesis while preventing erosion and loss of organic matter. To provide overwintering habitat for species, leave dried leaves on the ground and dry herbaceous stems standing until species have hatched in spring.
- **Preserve AIR space for soil life.** Minimize tilling and soil disturbance to avoid damaging the soil's fragile air spaces and to prevent bringing weed seeds to the surface. Reserve tilling for highly compacted soil.
- **Conserve WATER for soil life.** Capture rainwater, and shape garden beds to avoid runoff; this will allow water to "slow, spread, and sink" into the ground.
- **RECYCLE everything!** Conserve carbon, nutrients, and organic matter by sheet mulching, composting, spreading spent plants on the surface as mulch, and leaving roots of annual plants in the ground..
- **Eliminate all synthetic fertilizers, pesticides, herbicides, and fungicides,** as well as chlorinated water. Synthetic chemicals and chlorine are harmful to soil life.

BIODIVERSITY is essential for ecosystem health. Cultivate different species and sizes of plants and avoid monoculture. A diverse stand of plants provides food and habitat for many different soil critters, insects, birds, reptiles, and other life forms who will eat, poop, and die in your garden, effectively conserving and recycling nutrients; and a diverse population of critters ensures that all ecosystem services--like decomposing waste, pollination, and countless others--are sufficiently handled so that the overall system can thrive. Choose **native plants**; they support many more creatures than do non-native plants due to co-evolution over millennia, and because they are well-adapted to our environment. **Biodiversity prevents the need for chemical inputs because it helps conserve nutrients and keep pest populations low**.

IN A NUTSHELL--SUPPORT SOIL LIFE

Keep the ground covered and living roots in the ground for as much of the year as possible. Avoid bare soil. Tolerate a "messier garden" to provide winter shelter for species.

Preserve air space in the soil by minimizing disturbance.

Conserve water by harvesting rainwater & preventing runoff.

Conserve carbon & nutrients by recycling spent plants into compost or mulch.

Encourage biodiversity. Grow a variety of plants--especially natives. Avoid monoculture. Use only organic soil amendments. Avoid all synthetic inputs.

Learn from people who have been doing this for centuries.

Every piece of land is unique. Get to know yours.

Resources

- The Soil Story, Kiss the Ground: https://www.youtube.com/watch?v=nvAoZ14cP7Q
- Fisher, Adrian Ayres, "Carbon Gardening, A Natural Climate Solution that Can Help Reduce CO2 Emissions While Restoring Biodiversity": https://www.ecolandscaping.org/02/developing-healthy-landscapes/climate-change/carbon-gardening/
- Kittredge, Jack, "Soil Carbon Restoration: Can Biology Do the Job": https://www.nofamass.org/wp-content/uploads/2020/12/2015_White_Paper_web.pdf
- Pershouse, Didi, "Soil Health Principles": https://www.didipershouse.com/soil-health-principles.html

- Written by Dorothea Sotiros. Questions or comments? Email: <dsotiros@gmail.com>

2018/rev. 2023 & 2024