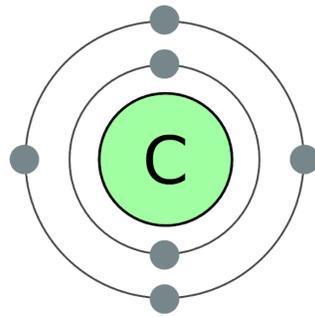


Soil Carbon Sequestration



The Importance of Carbon -

Carbon is the basis of nearly all life on Earth. Its unique molecular structure allows it to take many forms. Earth's atmosphere currently contains about **405 parts per million** (ppm) carbon in its gaseous state. For all of human history, the concentration of carbon in the atmosphere has held steady below 300 ppm. **Carbon has a cycle:** it moves between earth, air, and water rather rapidly. Many human activities impact this cycle. Soil disturbance, burning, and deforestation are examples of ways that humans push more carbon into its gaseous state while reducing the amount of carbon getting "fixed" into the soil.

Carbon as Currency -

Carbon is the backbone of all **sugars, carbohydrates, proteins, and fats** - all foods are made of carbon! Plants make all of these carbon-based goodies via photosynthesis and build their own structures (roots, stems, leaves, etc) out of them. Significantly, plants also leak out these energy-rich carbon foods into the soil (where they are called **exudates** or **photosynthate**) in order to attract bacteria and fungi, their symbiotic partners belowground! Plants trade these carbon compounds for other nutrients like nitrogen, phosphorus, magnesium, calcium, etc. Carbon is the currency that plants use to buy little microscopic shoppers (the bacteria and fungi) who search the soil for whatever the plant needs and then use their digestive powers to liberate those nutrients and return them to the plant. Teamwork!

Soil Carbon -

Soil microorganisms are fed by plants and they are essential for restoring soil carbon. These organisms produce sticky, carbon-based glues that bind soil mineral particles together with organic debris and condensed products of decomposition. In so doing, they form stable soil **aggregates** where carbon is abundant. One particular group of organisms, **mycorrhizal fungi**, produce a special glue called **glomalin**, which is very resistant to decay and an important way that carbon is locked within the soil profile.



How to Transform Your Yard Into a Carbon Sink

1. Reduce disturbance & keep it covered

Humans have many traditional/cultural activities that we think improve the soil: seasonal tillage, removing organic debris (e.g leaves, grass clippings, end-of-season plants), and cultivating to keep soil bare in places we haven't intentionally planted. Sadly, these activities do the opposite: they destroy soil **structure**, thereby reducing the soil's ability to function properly. Soil structure is built by microbes and the **aggregation** they create is essential for carbon storage. These human activities also destroy delicate soil fungi, our greatest allies in the race to lock carbon back belowground.

2. Keep living roots in the soil as long as possible

Plants do something amazing: **they photosynthesize!** Using sunlight energy, plants convert CO₂ from the air into sugars, carbohydrates, proteins, and fats. Foods! They use these foods to build their own structures and they also leak out a lot of these foods into the soil to feed bacteria and fungi. These carbon-based goodies (exudates or photosynthate) are **traded for micro-nutrients**, which plants cannot access without microbe partners. Because of this nutrient sharing, the root zone (**rhizosphere**) of plants is one of the most busy and bio-diverse places on Earth!

3. Embrace diversity

All plants produce different carbon-based foods and attract different microbes. In nature, diversity is key! A diversity of plant life supports a diverse microbial ecosystem with billions of different species of bacteria, fungi, and their predators like protozoa and nematodes. When the soil is well-fed by plants, **a thriving food web develops**. The living activity in the soil is responsible for clean water, healthy plants, toxin elimination, nutrient cycling & density, carbon restoration and more! So embrace those dandelions - they're breaking up soil compaction and feeding billions of microorganisms!



Resources -

Soil Carbon Restoration: Can Biology do the Job?

Jack Kittredge, Northeast Organic Farming Association/Massachusetts Chapter, Inc

https://www.nofamass.org/sites/default/files/2015_White_Paper_web.pdf

The Carbon Sequestering Garden: Gardening for the Planet While Growing the Best Food Possible

Allison Houghton, Northeast Organic Farming Association/Massachusetts Chapter, Inc

<https://www.nofamass.org/sites/default/files/The-Carbon-Sequestering-Garden.pdf>

Climate-Wise Landscaping: Practical Action for a Sustainable Future

Book by Sue Reed and Ginny Stibolt

Teaming with Microbes and Teaming with Fungi

Books by Jeff Lowenfels



Understanding and Enhancing Soil Biological Health: The Solution for Reversing Soil Degradation

Open Access *Sustainability* 2015 , 7, 988-1027

Check out our website: RenaissanceSoil.com for more resources and suggestions!