

Biochar in Water Stewardship

new tool for soil stewards and land managers

Biochar is charcoal special made to put in soil. This practice began 6000 years ago in the Amazon to create some of Earth's most fertile soils. Scientists in the 1960's showed these soils were human-made by adding charcoal. In 2008, this "new" idea was named "biochar," and rapidly spread worldwide in a revolution in soil fertility and carbon sequestration. Biochar benefits offer farmers, foresters and landscapers a powerful, natural tool to manage land, boost soil fertility and maintain water quality.

Charcoal, the black residue of burnt biomass, is well-known to filter and purify water. "Activated" charcoal is in home filters, municipal treatment plants and industrial pollution controls.

Carbon & Water are ancient partners to make living cells, and compose 85% of organisms. Their intimate interactions shape molecules, organisms and ecosystems. Their management are primary concerns of farmers, landscapers and gardeners.

Soil isn't inert mineral dirt, but complex media made by and for microbes. Soil supports living communities of microbes, plants and other life with multiple ecosystem services, including to absorb, hold and deliver water and nutrients to roots. A primary service of soil is filter, purify and regulate water.

Water Infiltration is biochar's first benefit. Biochar creates porous soil structure, with aggregation, aeration, and electric charge to attract and absorb water. Biochar supports an open soil surface, reduces crusts, to admit air and water, allows rain to soak in, rather than repel and bead off. More penetration means less erosion and runoff, more water stored as groundwater.

Water Movement improves with biochar. Typical sand drains quick, with minimal retention. Biochar slows movement 92%, creating more time and opportunity to absorb and retain water. Oppositely, clay impedes and slows water flow. Biochar opens clay to speed movement 300%, improve drainage, reduce waterlogging.

Water Holding Capacity is increased by biochar. Carbon and water share geometry and scale to nest together in close, intimate storage. Each gram of biochar can hold 8 grams of water. Biochar's empty micropore sponge absorbs water, then slowly release it to boost water retention, keep soil wetter, improve drought resistance, reduce irrigation demand. This water conservation is valuable in agriculture and landscaping.

Stormwater Run-off of landscapes, roadways, parking lots, and hardscapes benefits from biochar's boost to water penetration, reducing run-off and erosion. Biochar's high capacity ion adsorption effectively traps heavy metals, hydrocarbons and pollutants to curtail entry into streams, watersheds and groundwater.

Silt, the #1 non-point pollutant, is precious topsoil. Biochar improves soil particle aggregation and cohesion, proliferates microbes, to open soil surfaces and inner structure, reduce erosion, end dissolution of soil.

Farm Fertilizers, primary nonpoint pollutants, are reduced with biochar. First, biochar improves fertilizer efficiency by better delivery to plants, reducing amounts needed. Biochar captures and holds nutrients in soil, to lower leaching losses by 50 to 80%. Biochar buffers fertilizers to minimize disturbance to soil ecosystems.

Manure Management benefits right away from the micropore sponge for odor control, ammonia adsorption and methane reduction. Biochar stabilizes nutrients and microbes to improve digestion into a stable product.

Phosphorus & Nitrogen Traps made with biochar adsorb these key nutrients to capture farmland run-off and protect streams and lakes. Biochar has unique ability to adsorb negative ions, mostly nitrogen and phosphorus.

Agricultural Practices are changing rapidly to achieve sustainable soil health by boosting soil carbon, organic matter, trace elements, and microbes. Ingenuity is needed to integrate biochar into complex farm systems.

Carbon Sequestration is long-term removal of CO₂ from Earth's atmosphere—at least 100 years. Biochar is inert, unreactive, stable for over 1600 years. Microbes don't digest biochar, they live in it—and around it. Biochar is not an annual expense like fertilizer, but—like any infrastructure—investment in long-term fertility.

Water Stewardship extends beyond quantity and availability, to protect and restore quality and drinkability.