

Carbon-Negative Biochar Production for Use in Soil

Fertility, Food & Fuel for 21st Century Green Communities

“Carbon-negative” is a new word for processes that remove carbon from Earth’s atmosphere by converting it to stable solids. In 2008, leading climate scientists identified 350 parts per million (ppm) carbon dioxide (CO₂) in earth’s atmosphere as a maximum safe level. Beyond that, many global warming effects accelerate, such as melting polar ice caps. CO₂ is already 390 ppm and still rising, so we are already 40 ppm over the safe limit.

Therefore, *Carbon neutral* isn’t enough to avoid the oncoming climate calamity. *Zero net emissions* won’t restore balance to the planet’s already overloaded thermal engine that drives climate and weather. To have a stable, sustainable future, humanity must be **carbon-negative**. We must rapidly implement ways to *remove greenhouses gases from the atmosphere*—first and foremost, carbon.

“Biochar” is a new word for charcoal made from biomass for the purpose of adding to soils to stimulate physical and biological fertility, and sequester carbon. Properly charred, this form of reduced carbon remains stable in soil for centuries, and likely millennia.

In 1992, Dutch soil scientist Wim Sombroek first proposed sequestering carbon as char in soils. The first international conference was in Australia in 2007; the second in Newcastle, England last September. In June 2009, European Union adopted standards for production and use of **biochar** in agriculture. The first North American Biochar Conference August 9-12, 2009 at University of Colorado at Boulder features an address by the USDA Secretary. In October, a Copenhagen climate negotiations, a Pacific Island nation endangered by sea level rise from global ice melt will propose priority recognition of **biochar** as strategy to sequester carbon.

In essence, **carbon-negative** strategy is simple: let nature do it. Plants by photosynthesis combine carbon dioxide (CO₂) with water to create carbohydrates, and build their bodies from this cellulose fiber. When plant biomass is burned without oxygen, up to half the carbon is converted to charcoal—carbon in its most reduced, inert, least reactive form. If that charred carbon is put in soil, it remains there for centuries, likely for millennia, safely sequestered. And in soil, **biochar** nurses a remarkable transformation that greatly improves physical structure, tilth, nutrient storage capacity, and biological activity. This sustainable fertility allows farmers to reduce fertilizer use and grow nutrient-dense foods.

Biochar production also produces renewable energy. “**Pyrolysis**” of biomass distills out volatile chemicals that are captured to reprocess into biofuels and chemicals, while 30-50% of the carbon remains as biochar. This gasification technology can be adapted to optimize yield for hydrogen, syngas, bio-oil, wood vinegar, or other by-products from various feedstocks. Even if the biofuels are burned, if biochar is put in soil, this energy strategy is net **carbon-negative**.

In 2008, Dr. James Hansen, America’s leading climate scientist, evaluated scientific data on **carbon-negative biochar** strategy to calculate potential impacts on atmosphere and climate. Dr. Hansen’s paper published in August 2008 states:

“Carbon sequestration in soil has significant potential. Biochar, produced in pyrolysis of crop residues, forestry wastes and animal manures, can restore soil fertility while storing carbon for centuries to millennia. Biochar helps soil retain nutrients and fertilizers, reducing emissions of greenhouse gases such as N₂O. Replacing slash-and-burn agriculture with slash-and-char, using agriculture and forestry wastes for biochar production can provide CO₂ drawdown of ~8 ppm or more in half a century.”

Dr. Hansen agrees **biochar** can sequester enough carbon to begin to mitigate climate change in half a century.

Carbon-negative biochar is our most effective natural strategy to sequester carbon, produce renewable energy, cut fertilizer use, reduce fossil fuels, reverse global warming, and address other key challenges. At its heart, this strategy transforms our use of fire from *complete combustion* to ash, to controlled combustion by *pyrolysis* and *gasification* to yield energy, charcoal, biofuel, and chemicals. **Carbon-negative** strategy with **biochar** isn’t an option or alternative, but essential and critical to assure a sustainable human future based on ecological restoration.

Time is urgent to address our climate, energy and economic crises, and turn human society in sustainable directions. So we are spreading this plan to put **biochar** in soil in our gardens, farms, homes, and communities, and teaching the methods. The public and public officials must quickly learn about this new **carbon-negative** concept, and support efforts to explore this new **biochar** strategy and to implement biofuel technology in farms, forestry, homes, businesses, and communities.