Biochar - A Multitude of Benefits

What is Biochar?

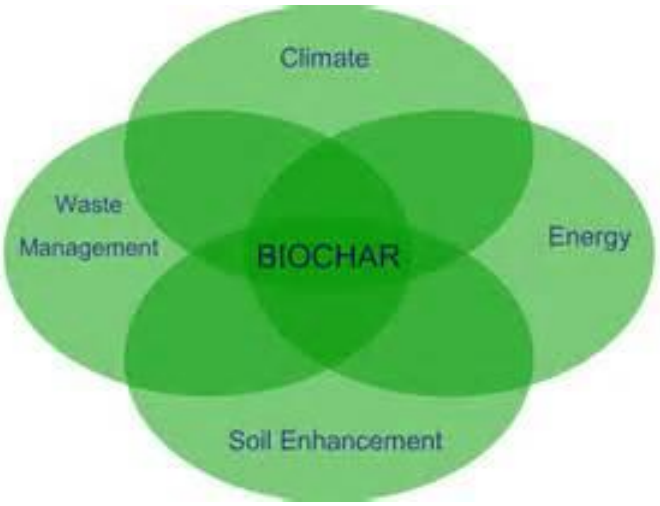
Biochar is a valuable soil amendment. Like most charcoal, biochar is made from biomass via *pyrolysis.* Biochar is under investigation as an approach to carbon sequestration to produce negative carbon dioxide emissions. Biochar thus has the potential to help mitigate climate change via carbon sequestration.

Biochar is a fine-grained charcoal high in organic carbon and largely resistant to decomposition. It is produced from pyrolysis of plant and waste feedstocks. As a soil amendment, biochar creates a recalcitrant soil carbon pool that is carbon-negative, serving as a net withdrawal of atmospheric carbon dioxide stored in highly recalcitrant soil carbon stocks. The enhanced nutrient retention capacity of biochar-amended soil not only reduces the total fertilizer requirements but also the climate and environmental impact of croplands.

The pyrolysis of biomass into biochar and energy creates four primary benefits.

1) Improvement of the productivity of soil to achieve higher yields.
2) Creation of a bioenergy as a substitute for fossil fuels.
3) Sequestration of carbon in the soil that will reduce atmospheric carbon dioxide.
4) Management of waste.

This 2,000 year-old practice converts agricultural waste into a soil enhancer that can hold carbon, boost food security, and increase soil biodiversity, and discourage deforestation. The process creates a fine-grained, highly porous charcoal that helps soils retain nutrients and water.

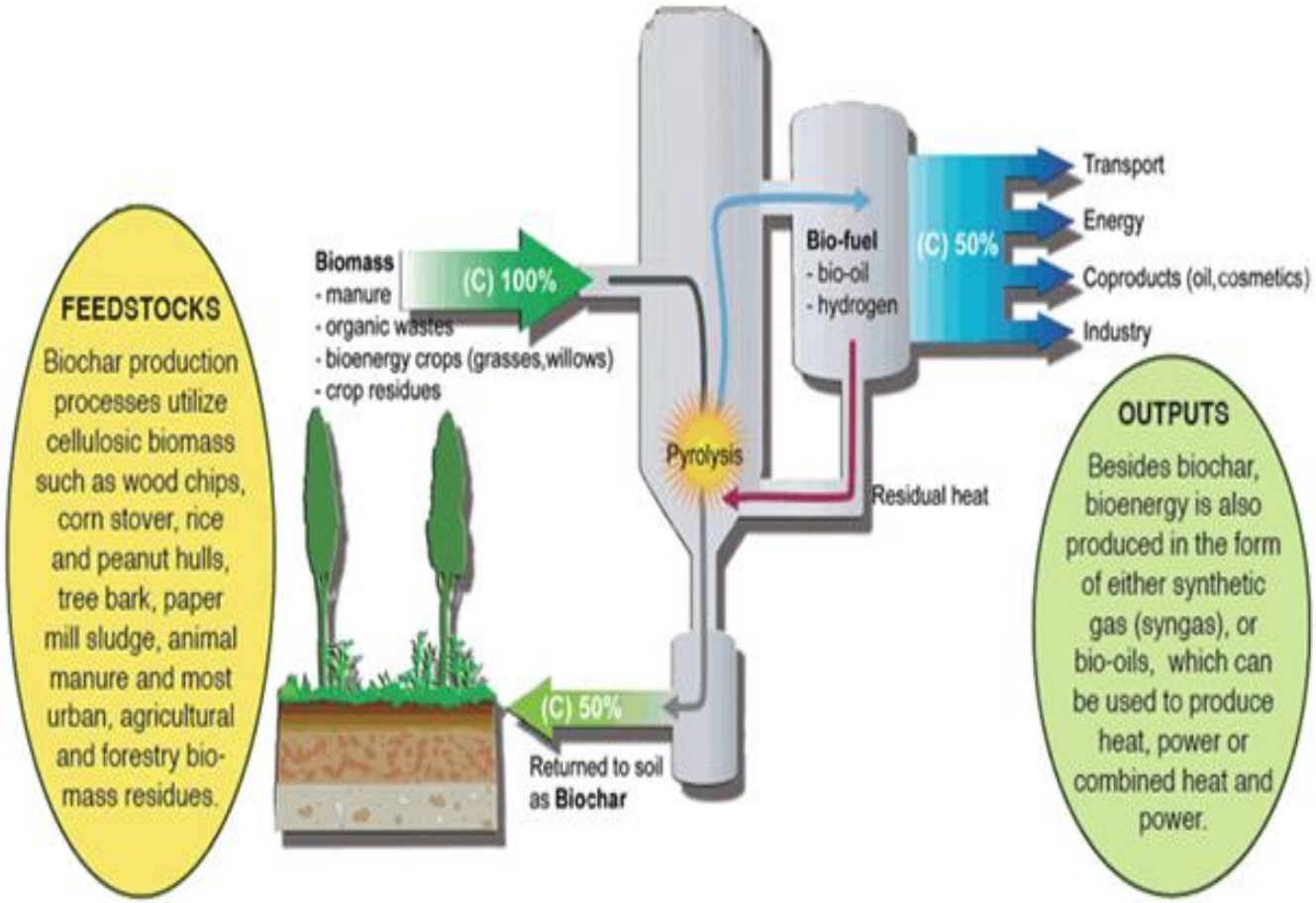


Caracterización energética del Marabú

Forest biomass marabú (Dichrostachys cinerea) is a wild shrub, that covers a large number of hectares in Cuba and that could become an important source of renewable energy; as biomass was subjected to physical chemical characterization, using specifications techniques of the European Committee for Standardization (CEN), and the main points of the pyrolysis process was identified by thermo-gravimetric analysis to evaluate the feasibility of its use as energy source.The study helped to show that this biomass has suitable characteristics for using as an energy source, a heating value > 19100 kJkg-1, 3,4% of ash and a melting temperature of 1460oC and also low in chlorine and sulfur - The thermo-gravimetric analysis pointed out two areas of well-defined pyrolysis reaction: the active zone, dominated by the decomposition of hemi-cellulose and cellulose, and the passive one, marked by the lignin decomposition; actually it occurs in a wide range of temperature, lower rate of degradation and overlapping decomposition of the other components. It was also shown a weight loss of 60% for the former.

Biochar is found in soils around the world as a result of vegetation fires and historic soil management practices. Intensive study of biochar-rich dark earths in the Amazon (terra preta), has led to a wider appreciation of biochar's unique properties as a soil enhancer.
Biochar can be an important tool to increase food security and cropland diversity in areas with severely depleted soils, scarce organic resources, and inadequate water and chemical fertilizer supplies. Biochar also improves water quality and quantity by increasing soil retention of nutrients and agrochemicals for plant and crop utilization. More nutrients stay in the soil instead of leaching into groundwater and causing pollution.

Charcoal or biochar when used in this context, is made by the pyrolysis of biomass (pyro means fire and lysis mean decomposition). Biochar is produced from thermal decomposition of organic material under a limited supply of oxygen and at relatively low temperatures. Pyrolysis is a form of baking biomass in the absence of air to drive off volatile gasses, leaving carbon behind. So it produces bioenergy in the form of gas and oil, along with the biochar. This energy can be recoverable and used as a renewable fuel.



Slow pyrolysis produces biochar and bioenergy.

Pyrolysis is a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen).

Biochar has the potential to help mitigate climate change via carbon sequestration.[2][3][4] Independently, biochar can increase soil fertility of acidic soils (low pH soils), increase agricultural productivity, and provide protection against some foliar and soil-borne diseases.[5] Furthermore, biochar reduces pressure on forests.[6] Biochar is a stable solid, rich in carbon, and can endure in soil for thousands of years.[1]

Biochar can improve water quality, reduce soil emissions of greenhouse gases, reduce nutrient leaching, reduce soil acidity, and reduce irrigation and fertilizer requirements.[35]

Pre-Columbian Amazonians are believed to have used biochar to enhance soil productivity. They produced it by smoldering agricultural waste (i.e., covering burning biomass with soil)[7] in pits or trenches.[8] European settlers called it *terra preta de Indio*.[9] Following observations and experiments, a research team working in French Guiana hypothesized that the Amazonian earthworm *Pontoscolex corethrurus* was the main agent of fine powdering and incorporation of charcoal debris to the mineral soil.