# Understanding Tropical Soils: Part 2

by Dexter B. Dombro

This article is continued from Understanding Tropical Soils: Part 1.

Now that we know the two most serious handicaps faced by tropical foresters, the low cation exchange capacity (CEC) and the acidic pH of the soil, the question is what can we do about it? The answer, surprisingly, can be found in the past. Spanish and Portuguese conquistadors noted that some indigenous communities in the Amazon had highly productive, multi-year food cultivations. This phenomenon continued into the present, at which point some scientists started to wonder why certain Amazon River basin communities had dark, productive soils. The term *Terra Preta* or black soil was coined from Brazilian Portuguese to describe this phenomenon. Archaeologists and others conducted excavations near indigenous Amazon communities, and discovered that the native people in pre-conquest South America had mixed charcoal and clay pottery shards into the soil they were cultivating. Since then, similar observations have been made in Africa and Asia at ancient sites.

*Typical sandy and acidic tropical soil in the Orinoco River basin of Colombia*

*Dark, nutrient rich soil is the goal when applying biochar and organic material.*

Very quickly scientists realized that those ancestors had known something we have forgotten. Charcoal in the soil can act as a retention agent, stopping nutrients, microfauna and fertilizers from being leached from tropical soils during heavy rainfalls. It allows organic material in the soil to build up, thereby providing plants and trees with a much better and more productive natural environment in which to grow. Clay has a similar retaining capacity, which would explain the use of the broken pottery shards. Obviously, the charcoal from fires and broken pottery were added to the soil as a means of creating *Terra Preta* in ancient times, thereby boosting food production and the quality of cultivations in pre-conquest indigenous communities. This led scientists and modern agriculturists to ask the obvious question: how can modern planters benefit from this knowledge? The list of benefits, as it turns out, is amazing and can be applied anywhere in the world, not just in the tropics.

1. Charcoal when embedded in the soil has a half-life of 1,000 years. Why is this important, you ask? Simply put, this means that charcoal obtained from organic matter and woody biomass can be sequestered in the soil for centuries, making it an extremely effective and potent way of capturing and storing atmospheric carbon on a very long term basis. Done on a worldwide basis this could be an important tool in the struggle against climate change.
2. The charcoal can't be placed in the soil on its own. It first needs to be charged with an organic fertilizer, like compost, cow manure or cow urine (urea). Charcoal is negative and on its own would attract all the nutrients in the soil, taking them away from the plants and trees. However, once charged, it becomes a potent agent for retaining and holding nutrients, organic material and therefore microfauna in the soil. A new term has been adopted to describe charged charcoal for agricultural use: **biochar**.

*Biochar is charcoal that has been charged using compost, cow urine or cow manure.*

*Note the dark discoloration of the surface soil, which is being leached by tropical rains if there is no retention.*

3. The process of making biochar also results in the production of wood ashes. Those ashes, when added to the soil at the same time turn out to be full of essential elements required by trees, such as boron (Chemical: B), phosphorus (P) and potassium (K). But perhaps more importantly, wood ashes are almost 10 times more alkaline than lime, meaning that in controlled applications they can reduce or neutralize soil acidity, thereby greatly enhancing agricultural productivity and the range of species that can be cultivated.

4. On the economic side of the equation, biochar can be produced using local resources. In India rice husks are charred, charged with cow urine and then added to the soil. Virtually any organic material can be charred and processed. This means that poor farmers, tree planters and communities in developing countries can not only enhance and improve their own soils, but also fertilize them with local resources, thereby eliminating high and environmentally unfriendly transportation costs for expensive chemical fertilizers and limes that kill the microfauna, leaving dead soil behind.

*Soil with a lot of clay can also retain nutrients and slow down soil filtration or lixiviation.*

*The goal is to plant in improved tropical soil!*

Needless to say, this is all very exciting, but still faces some technical challenges. For example, how can biochar be produced on a large scale? How can it be added to existing tree cultivations? Where does the required biomass come from? The answer to these and other questions can be found in the approach being taken by ***Amazonia Reforestation*** and ***CO2 Tropical Trees*** at their La Pedregoza and El Encierro plantations in Vichada, Colombia. Let's examine some of the solutions being developed in Part 3 of this series of articles.