Newsletter – June 2022

Combining Agroforestry and Biochar

The Best Nature-Based Solution to Mitigate the Climate Crisis

In Africa, Pro-Natura's pioneering approach combines agroforestry with biochar

Agroforestry is a set of land management practices involving the combination of multipurpose trees with crops and/or livestock, in accordance with local traditions. Agroforestry systems have been naturally established and managed by rural communities for millennia.

Other innovative agroforestry systems are adapted to large-scale crops such as sugar cane, oil palm or rubber, to respond to environmental and economic issues, reducing pollution and inputs.

Pro-Natura agroforestry training centre in Ivory Coast

Biochar benefits the climate, trees and associated crops, and therefore local populations

Biochar

As plants grow, they absorb atmospheric CO_2, producing biomass that contains carbon. Rather than allowing some unused biomass to decompose and release this carbon back into the atmosphere, pyrolysis (heating at high temperature in the absence of oxygen) converts about half of the carbon present into an inert solid form. The resulting product, called biochar, is used as a soil amendment; its application, by mixing it with the soil, improves the quality of soils sustainably while sequestering carbon in them. Unlike most inputs of organic matter from litter, compost, or manure, biochar is composed of inherently stable forms of carbon that are not broken down by soil micro-organisms.

The agronomic benefits of biochar derive from its very large number of micro-cells, **allowing it to absorb large quantities of water** which is then available to plants, particularly in sandy soils. This increased water retention is essential for agriculture in climates with long dry seasons and erratic rainfall, as the soil can store water for longer periods of time. As a result, the carbon in biochar is stored in the soil for centuries, helping to restore fertility and mitigate climate change. Over the past fifteen years, a large number of scientific publications have demonstrated the agronomic benefits of biochar.

On the climate front, the 2018 IPCC special report (www.ipcc.ch/report/sr15) cites biochar as a very promising technology for **large-scale carbon sequestration to combat climate change**, since it allows the long-term storage of carbon initially captured by plants from the atmosphere.

Pro-Natura was a pioneer of biochar in Africa, particularly in the Sahel, producing biochar from agricultural waste and by providing proof, through numerous projects, of the very high efficiency of this product on soils that were originally acidic and nutrient-poor.

The effect of biochar on tree growth is very significant: the main meta-analysis by Thomas and Gale (2015) shows an **average increase of 41% in tree biomass** across a variety of temperate and tropical trees, **with a much higher impact on tropical trees, where the increase can reach 300%**

Moringa Oleifera without biochar

Moringa Oleifera with biochar

Biochar has also a positive impact on associated crops

Our experience across different climates has shown that just one application, between 5 to 10 tonnes per hectare, can increase crop productivity by 50% to 200%. A single application provides and maintains long-lasting soil fertility benefits, as well as enhancing carbon sequestration.

Rice without vs rice with biochar (Senegal)

Beyond carbon sequestration, biochar offers numerous other benefits:

- **Soil fertility:** Biochar can improve soil fertility, stimulating plant growth, which then absorbs more CO_2 in a positive feedback loop. It enhances the soil's biological activity, increases the pH of acidic soils, improves nutrient and water retention in soils, and increases organic matter.

- **Reduced emissions from feedstocks:** Converting agricultural and forestry waste into biochar can limit CO_2 and methane emissions otherwise generated by natural decomposition or burning of the waste.
- **Reduced fertilizer inputs:** Biochar can reduce the need for chemical fertilizers, resulting in reduced emissions of greenhouse gases from fertilizer manufacture, transport and use.
- **Reduced emissions from agricultural soils:** Biochar can reduce emissions of nitrous oxide (N_2O) and methane (CH_4), two potent greenhouse gases released by cultivated soils.

As an animal feed additive, biochar rapidly improves animal health, feed efficiency and soil organic matter

Health benefits include a rapid decrease in the incidence of diarrhoea, the eradication of allergies, the improvement of feed intake, and calmer animals. On feed efficiency, by passing through the digestive system, biochar becomes charged with plant nutriments, thus reducing leaching or gaseous emissions.

It also reduces CH_4 emissions: feeding biochar to livestock at rates of 1% of the daily feed intake reduces CH_4 emissions by 12% (Leng et al., 2012).

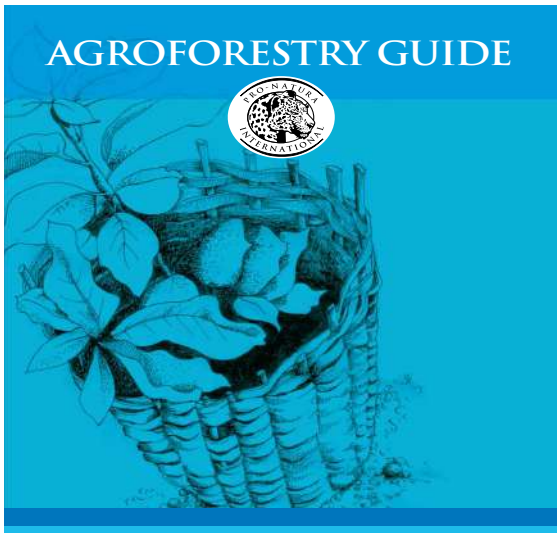
It also avoids the contamination of soil from antibiotics and other pharmaceutical products, pesticides and other toxic substances in animal manure.

Agroforestry with biochar contributes significantly to REDD+ (Reducing Emissions from Deforestation and Forest Degradation)

Pro-Natura has developed a **multi-dimensional computer model** that measures carbon sequestration in trees and soil, as well as the reduced emissions linked to renewable electricity co-generation with biochar production.

The model also helps optimise the income of local farming communities by advising them on climate-smart farming with the optimum mix of crops and trees.

One of the aims is to **massively scale up restoration of degraded and destroyed ecosystems** as a proven measure to fight the climate crisis and enhance food security, water supply and biodiversity.



Can be downloaded from www.pronatura.org

Biochar being applied on a coffee tree in Cameroon

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