Newsletter – September 2021

Greening the Sahel with biochar

To fight against poverty and malnutrition while creating a gigantic carbon sink

In the Sahel, our experience shows that biochar is an effective way to tackle the causes and consequences of desertification. Pro-Natura proposes to intensify these efforts in particular by integrating biochar into the Great Green Wall. This would maximize carbon sequestration and greatly improve the standard of living of farmers, while ensuring a large share of self-financing through the sale of carbon credits.

Adding biochar in the sand of Sahara

Results five weeks later

Soil revitalization is the basis of the fight against food insecurity, malnutrition and climate change

In Africa, approximately two-thirds of the continent's area is classified as deserts or arid lands, with 75% degraded. In the Sahel, food insecurity and malnutrition are endemic and affect more than 20 million people. Recurrent droughts result in a considerable drop in agricultural production, and severe shortages of fodder lead to early transhumance and changes in the routes taken by livestock, which aggravate tensions between communities. Soil revitalisation is therefore a major social issue, but also an environmental issue, because without it the advance of the desert is inevitable.

For three decades, Pro-Natura has been developing agroforestry in Africa to reverse the vicious circle between poverty, loss of biodiversity, land degradation and climate change. For the past fifteen years, we have made biochar the pillar of our action to achieve these objectives, with very convincing results.

Biochar significantly improves soil quality while combatting global warming

Biochar

As plants grow, they take up CO_2, producing biomass that contains carbon. Rather than allowing some unused biomass to decompose and release this carbon, pyrolysis (heating at high temperature in the absence of oxygen) can be used to convert about half of the carbon in it to an inert solid form. The resulting product, called biochar, is used as a soil amendment; applied only once by mixing it with the soil, it makes it possible to sustainably improve the quality of soils while sequestering carbon in them. Unlike most inputs of organic matter from litter, compost, or manure, biochar is made up of inherently stable forms of carbon that are not broken down by soil microorganisms.

The agronomic benefits of biochar can be explained in particular by its very large number of micro-cells, which **allow it to absorb large quantities of water** which is then available to plants, particularly in sandy soils. This increased amount of water 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 to practically permanently store carbon initially captured by plants from the atmosphere.

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

Biochar would self-finance much of the Great Green Wall tree plantation and maximise carbon sequestration

The Great Green Wall initiative was relaunched at the One Planet Summit last January, where Emmanuel Macron announced that a budget of $14 billion over five years had been established. It is intended to prevent the advance of the desert in the Sudano-Sahelian zone, which crosses 11 African countries. The project is 8,000 km long and 15 km wide, from Senegal to Djibouti.

The very high cost of this project could be partially covered thanks to biochar. Indeed, the long-term carbon sequestration obtained with biochar makes it possible to generate high-quality carbon credits, the market value of which is very high (currently around € 100 per tonne of CO_2-equivalent). By producing biochar on a large scale, it is therefore possible to generate significant income that could finance a significant part of reforestation.

At the same time, the biochar produced could be used to improve soils in reforestation areas, allowing trees to grow faster and maximise their survival rate thanks to better quality soils. **The agronomic efficiency of biochar on trees is very significant:** the main meta-analysis by Thomas and Gale (2015) shows an average increase of 41% in tree biomass on a variety of temperate and tropical trees, with an impact much higher on tropical trees, where the increase can reach 300%. Thus, by integrating biochar into the Great Green Wall, we will create a gigantic carbon sink.

Moringa Oleifera without biochar

Moringa Oleifera with biochar

Demonstration done by Dr. Mohamed Bouchentouf in the Sahara on 2 trees planted at the same time

Biochar is also a means of financing integrated development programs in the Sahel, combining agroforestry, climate and energy

Agroforestry is an agricultural practice that combines trees and crops and / or livestock on the same plot, while respecting local traditions. This is a rational land use system that increases the total yield by a combination of agricultural crops, trees (mainly fruit trees) and / or livestock, in synergy on the same plot.

Among the nature-based solutions addressing climate change, agroforestry itself is a very effective practice, both sequestering carbon in trees, fighting deforestation and reducing poverty. Adding biochar increases soil fertility and increases sequestration effects. It is therefore a way to improve food security and farmers' income while fighting climate change.

To maximise the virtuous effects of biochar, pyrolysis machines can be coupled with a cogeneration system to produce renewable electricity from excess pyrolysis gases. Biochar can therefore also be a means of improving access to energy, especially in rural areas, in an ecological way by avoiding CO_2 emissions from fossil fuels. It is also a way to maximise the income from such a project; combined with those from carbon credits.

When applied in a more targeted way, biochar makes it possible to create *super vegetable gardens* in the Sahel. These are very productive whatever the season and which save water

To combat malnutrition, it is essential to empower farmers to produce vegetables for their own consumption and to enable them to generate income.

Super vegetable garden with biochar in Niger

Pro-Natura's *super vegetable garden* is both intensive and ecological. On a single hectare of Sahelian or desert soil, more than 100 tonnes of vegetables can be produced annually. With a cycle of between 3 and 5 weeks for vegetable crops, production provides essential nutrients to families and the possibility of selling surpluses.

For example, a 60 m^2 family super vegetable garden produces a total of around 1.5 tonnes of various vegetables per year. It is an innovative and ecological agronomic concept, integrating biochar. ***Super vegetable gardens*** **produce a balanced diet all year round**, in our experience saving approximately 80% water and time (two hours of work per day). Establishing agroforestry systems combined with *super vegetable gardens* and biochar is therefore a priority in the fight against poverty, rural exodus and climate change.

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