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Innovation towards Sustainable Development
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GREENING THE SAHARA WITH BIOCHAR WHILE FIGHTING CLIMATE CHANGE

Between 9000 and 4000 BCE, North Africa and the Sahara were covered with savannas and forests and blessed with an abundance of rainfall. Like their Mediterranean neighbours, flourishing local communities raised sheep and goats and ancient rock paintings depict them fishing in lakes and rivers. Around 3500 BCE the climate began to dry, perhaps because of overgrazing. Over time one of the planet's biggest life supporting systems became the world's biggest and hottest desert, the Sahara.

Today intensive industrial agriculture and overgrazing have degraded more than two billion hectares of our planet's agricultural land. Climate change is speeding up global desertification. This birth story of the Sahara may be a cautionary tale.

Indeed many of the world's deserts started as forests that were cut or burned to clear the land and then ruined by overgrazing.

Encroaching desertification, along with growing concern over global food security, have combined to inspire numerous attempts to "green" the Sahara. Of these, one of the most renowned is the 80 million Euros *Sahara Forest Project*, a scheme to build in Qatar 20 hectares of vegetable greenhouses along with a 10 MW Solar plant to desalinate seawater.

Pro-Natura International (Pro-Natura) has a very different approach. With roots firmly planted 27 years ago in the tropical soil of Brazil, our "New Oasis" projects have created, in collaboration with the social company JTS Concept, lush and verdant Super Vegetable Gardens in the desert areas of Algeria, Mauritania, Burkina Fasso, Chad and Senegal. Pro-Natura has also initiated similar projects in the more humid climates of Haiti and Brazil.



The start of a Super Vegetable Garden



A Super Vegetable Garden in the South of Algeria with Dr. Mohamed Bouchentouf, Project Director at Pro-Natura International

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A New Oasis unlike the others

Each “New Oasis” project is launched with a tent, or makeshift shelter using cloths made of dromedary or goat hairs. Once the site is identified and agreed upon, the families or communities involved build this shelter where green tea with dates can be enjoyed in restful shade, a place where tools are left overnight.

This first phase represents the core value of what we have learned over decades. The success or failure of our projects is based on our ability to generate and maintain community participation and support.

While the shelter is being built additional teams are created. One group will use fronds and desert plant branches to build fences designed to minimize the effect of wind and sand and protect the growing food from hungry animals. If biochar¹, produced from unused agricultural residues, is not readily available, a group of women may take charcoal and break it down into a fine powder by pounding it. A composting site will be chosen, and often a nursery will be created to grow local species of trees.

In our 40 + agro-forestry schools, Pro-Natura has pioneered various ecological techniques. The Non-Mist Propagation Box allows us to dramatically increase the growth of often-endangered species of trees whose seeds germinate with difficulty and to domesticate wild fruit varieties. Cuttings and other techniques of propagation (layering for example) are helping trees grow much faster and fructify twice as fast, compared to trees grown from seeds. Once these cuttings are the right height they will be transplanted generally along the protective fences, using biochar, animal dung and compost. In the final phase of the Super Vegetable Gardens the land is prepared for the many vegetables, including varieties of cabbage and zucchinis.

The production of the Super Vegetable Gardens is continuous whatever the season

The result of 15 years of research and 30 years of field experience, the Super Vegetable Gardens (SVG), is a mode of intensive and ecological cultivation that yield more than 100 tonnes of vegetables per year from a single hectare of desert soil.

The SVG’s production is constant, irrespective of seasons and with a crop every 5 weeks for short cycle vegetables, it provides local families with a nutritious diet and possibly a surplus to sell.



Local technique for preparing biochar in Tchad



Adding biochar to the soil in the South of Algeria

¹ Vegetable carbon, initially from charcoal, and now from carbonized unused agricultural residues.



With biochar and other innovative eco-techniques, there is 80% plus reduction in water consumption

and only 2 hours of labour per day is required.

Dr. Mohamed Bouchentouf, Pro-Natura's chief agronomist for desert areas explains: "Once we have marked the land using alignment cords, long trenches 1.20 meter wide, 12.5 metres long and 40 cm deep are dug and we cover them with a special plastic lining supplied in JTS Concept's kits. Imagine a giant, rectangular flowerpot... this limits the work to a well-defined space and results in subsoil enrichment and pest control, as well as controlling water and wind erosion. The lining also leads to deeper rooting and better lateral growth of plants".

"Once the trenches are ready", the Algerian-born agronomist continues, "they're filled with a mixture of biochar (generally one kilo per square meter), compost (when available) and animal dung. This combination of organic fertilizers and amendments is essential to regenerate soil fertility in often sterile soils and contributes to healthy plant growth". "Once the beds are prepared, non-GMO seeds, are chosen according to local climate and eating habits are sown instead of planted. Finally, we cover the trenches with special "crop veils". "These veils", he continues, "have many functions. While decreasing water evaporation by at least two thirds, they increase the photosynthesis period by limiting the time when the stomata (foliar cells of the plant indispensable for photosynthesis) remain closed during the hottest hours of the day. Furthermore, they create a barrier to flying insects, attenuate the early morning cold and form a protection against sand storms as well as any heavy rains".

Pro-Natura's main contribution for Saharan Africa to the JTS Concept innovations is the introduction and use of biochar

Pro-Natura's strongest contribution to the groundbreaking work of JTS Concept in North Africa has been the introduction and use of biochar, a natural soil amendment that can double or even triple food production per hectare.

Soil fertilization using biochar is an ancient practice employed more than 7,000 years ago by pre-Columbian Amazonian Indians.

Today biochar is generating great enthusiasm across the scientific community (Cornell University is spearheading its study) with over 500 published studies of its effects. Green Guru James Lovelock, father of the Gaia Hypothesis, calls it "humanity's best chance to survive".

Others have hailed it as the catalyst of the "Third Green Revolution".



Maintenance of a Biochar Super Vegetable Garden in Tchad



Pyro-6F machine producing biochar in a continuous way



The biggest reason behind this acclaim is that biochar also acts as a “carbon sink”. Sequestering carbon (one tonne of biochar is equivalent to 2.7 tonnes of CO₂), it mitigates long-term climate change. A scientific publication in Nature Communications calculated that 11% of annual CO₂ emissions could be offset by the large-scale use of biochar in agriculture. This system may well be the only realistic geo-engineering scheme available.

While the original Amazonian “Terra Preta” (in Portuguese) was created by mixing forest wood charcoal powder with animal waste, biochar is produced exclusively from renewable biomass (unused agricultural or forestry residues like rice, coffee or cocoa husks, invasive plants, etc.). Pro-Natura developed a prize winning pyrolysis machine (First Prize for technological innovation from the Altran Foundation), called the Pyro-6F that can turn every day 12 tons of rice husks or similar “waste” biomass into 5 tons of high-quality black biochar powder.

A new paradigm for agro-investments

We are witnessing a global land rush triggered by the 2008 food crisis, growing water and topsoil shortages and the EU's legislation mandating that by 2015, 10% of all transport fuel must come from plant-based biofuels.

Sixty countries have been targeted. According to some estimates, more than 200 million hectares of land have been acquired in the last few years. Seventy million hectares of these are located in 27 African countries. Private companies, pension funds and a dozen countries’ sovereign funds continue to compete for huge chunks of countries like Liberia which is already 67% owned by foreign agri-food investors. Predictably, this leads to mass evictions, civil unrest, environmental and social degradation and, in the case of Madagascar, to the fall of a government.

There is a different, and ultimately more strategic and sustainable, agro-investment paradigm. Pro-Natura and many UN Agencies believe that biochar, Super Vegetable Gardens and similar approaches from agro-ecology, permaculture and agro-forestry, implemented in a socially responsible context, could triple food production in the developing world.

When that shift happens, our biochar Super Vegetable Gardens will flower in arid regions ranging from the Gulf to the Gobi Desert! ■

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Planting trees with biochar in the Algerian desert



First vegetables after 5 weeks

