PRO-NATURA INTERNATIONAL
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AGROFORESTRY, SUPER VEGETABLE GARDENS AND BIOCHAR IN THE COCOA PLANTATIONS OF IVORY COAST

All of the achievements of Pro-Natura in the countries of the Global South have the same goal: working with local populations to promote sustainable agricultural development of village communities in order to increase their income while protecting biodiversity.
In Ivory Coast, our activities are conducted with people living on the edge of two national parks, Taï and Marahoué, in areas where population growth is accelerating forest clearance to exploit new fields within the Park.

The adventure of Pro-Natura in Ivory Coast began in 1999 when we joined the activities taken by the Ivorian Association *Vie et Forêt* (Life and Forest) on the outskirts of the Taï National Park (MAB - UNESCO), a major biodiversity reserve in West Africa. Alongside the construction of health posts, *Vie et Forêt* managed the domestication of a very important wild fruit tree, the Makoré, a multipurpose Sapotaceae also being researched as timber species. These mature trees and other agroforestry species currently represent a traditional food reserve and invaluable seed in times of food crisis or conflict.

Agroforestry, biodiversity and conservation of traditional knowledge

Agroforestry is a set of land management techniques involving the combination of multipurpose trees with cultivation or with livestock, or with both, in accordance with local traditions (for more information visit our website www.pronatura.org).

In 2002, Pro-Natura started, under the direction of Wilfrid Pineau, village workshops in agroforestry training for the reforestation west of Taï National Park in about twenty villages bordering Liberia with support from the French Ministry of Foreign Affairs and Ivorian development funds for professional training. Its geographical scope extends from the village of Paule-Oula south of the town of Taï, to the town of Zagné south of Guiglo.

During this period we produced an Agroforestry Guide for the Ivory Coast (electronic version available on request).

Pro-Natura International
33 Avenue Duquesne, 75007 Paris Tél. +33 680 61 09 36 Email pro-natura@wanadoo.fr - www.pronatura.org
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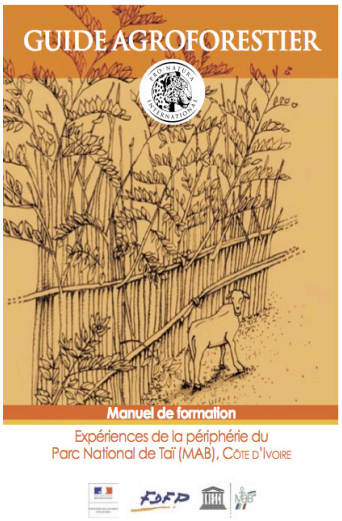
More than 3000 people were the beneficiaries of this operation in which about 20,000 native tree species have been planted, including the famous wild fruit tree, the Makoré. Around the Park Taï, Project Director Wilfrid Pineau reports that when an old woman dies or a Makoré is cut, a bit of traditional knowledge on the processing of kernels into cooking oil disappears.
In 2009, we expanded our work around the highly endangered National Park Marahoué in the centre of the Ivory Coast.



The collaboration with *Fondation Planet Action,* an initiative of the group Airbus / Astrium, demonstrated that one can easily spot agroforestry landscape units in satellite images and accurately track the evolution of plantations while measuring carbon storage in trees.
Besides its relevance in terms of diversification, food security and biodiversity conservation, agroforestry is well adapted to comply with loggers' obligations for replanting.
This reduces conflicts with local people by signing plans and contracts for reforestation agroforestry. Furthermore, legal and illegal logging that coincides with the explosion of new cash crops such as rubber requires that policy makers, nature conservation organisations, the agricultural sector and forest exploitation companies review their strategies to preserve some of Ivory Coast's remaining natural areas.

Political crisis, ethnic migration, disruption of rainfall, cocoa economy, unsustainable agriculture and the explosive spread of the Ebola virus are all issues closely linked to destruction of forests in Ivory Coast.

Key to the success of agroforestry systems: Super Vegetable Gardens and farm income-generating activities

The needs expressed by farmers receiving agroforestry training around Taï guided and led to an expansion of Pro-Natura's strategies for action. They incorporate various agricultural activities that rapidly generate income notably with sheep, goats and gardening. The Ivorian team of trainers in rural areas expanded the project in 2009 to the outskirts of the National Park Marahoué northwest of Abidjan for two years by integrating Super Vegetable Gardens in a professional youth rehabilitation project, in partnership with the Ivory Coast Platform of Services. 240 Ivorian farmers successfully experimented with biochar to increase their yields in vegetable production.

Installation of a biochar super vegetable garden next to the Marahoue National Parc

Super Vegetable Gardens provide both vegetables and short-term income to farmers who can then invest in their agroforestry systems. In parallel with the establishment of agroforestry systems coupled with income-generating activities (Super Vegetable Gardens, food crops, livestock), biochar should be integrated into the activities of development projects and the conservation of flora and wildlife. It is now emerging as a powerful new tool to increase long-term agricultural productivity, while protecting the forests.

Biochar to improve the productivity of cocoa and coffee plantations ecologically

Fifteen years working with farmers on the peripheries of the National Parks of Taï and Marahoué has confirmed that the ecological intensification of agriculture is now possible in Ivory Coast by recycling carbon from unused agricultural and forest residues to make biochar.

In the Ivory Coast, old cocoa and coffee plantations tend not to be renewed because of a threat of disease and soil exhaustion, and are gradually being replaced by the cultivation of rubber. In addition, "full sun" cocoa varieties are pushing farmers to cut down all other useful trees in cocoa plantations, which can no longer act as biodiversity reservoirs. New cocoa agroforestry systems must be created with useful trees giving a high canopy that lets in light and poses no sanitary risks to cocoa plants.

Biochar applied in the topsoil is not itself consumed by plants, rather it provides a habitat, similar to a sponge, for soil microorganisms, permanently restoring fertility. Crop yields are increased by 50% to 200% at the rate of 1 kg of biochar per m^2.

It's not just increased yields that biochar treated soils can deliver. Trials have shown that trees grown in soil with biochar applied at between 5% and 10% are significantly more disease resilient. Of particular relevance to the cocoa sector are trials that show biochar treated trees successfully fighting off incidences of the plant pathogen phytophthora. Monilia or black pod, a disease that has devastated whole swathes of cocoa growing regions is a species of phytophthora.

Biochar is particularly relevant for the coffee and cocoa sectors that generate abundant residues.

Key benefits of biochar on cocoa plantations

- Improved resistance to disease, and better survival rates, also for young cocoa trees in nurseries
- Increased yields
- Reduced inputs (fertilisers, pesticides)
- Improved physico-chemical properties of the soil (increased pH and Cation Exchange Capacity, better water retention)
- Improved soil biological activity
- Sequestered soil carbon: one tonne of buried biochar is equivalent to 2.7 tonnes less CO_2 in the atmosphere

Carbonizer Pyrochar-1 producing biochar

By converting agricultural residues into high quality biochar, key stakeholders in the coffee / cocoa sectors can conduct pilot projects to sustain this production in Ivory Coast as well as in Ghana. Extensions of the project call for using different sizes of carbonizers fed by other types of biomass. Biochar can actually be produced by carbonising coconut fibres, chips and sawmill residues, stalks and other unused agricultural residues.

This new opportunity for recovery of organic matter is also a source of employment in rural areas, and it is also to fight against climate change.

In addition to improving soil fertility permanently, biochar also acts as a sustainable carbon sink by sequestering carbon from atmospheric CO_2 (one tonne of biochar being equivalent to at least 2.7 tonnes of CO_2), thus mitigating long-term climate change.

Testing of the application of biochar on cocoa production conducted by the company Carbon Gold in Belize is showing very encouraging results on pod production, the biochar produced by making use of appropriately-sized cocoa waste.

Such innovative projects – agroforestry training, short-term income-generating agricultural activities and biochar production – are concrete examples of sustainable development.

In Belize, cacao trees with biochar on the left get productive well before those without on the right – both are 3 years old (Carbon Gold project)

Contact

Guy F. Reinaud, President: +33 6 80 61 09 36
guy.reinaud@pronatura.org

Wilfrid Pineau, Project Director: +590 6 90 75 91 91
wilfrid.pineau@wanadoo.fr