FMNR

Farmer Managed Natural Regeneration

World Vision

HAITI NATURAL RESOURCES TECHNICAL NOTES

Tony Rinaudo

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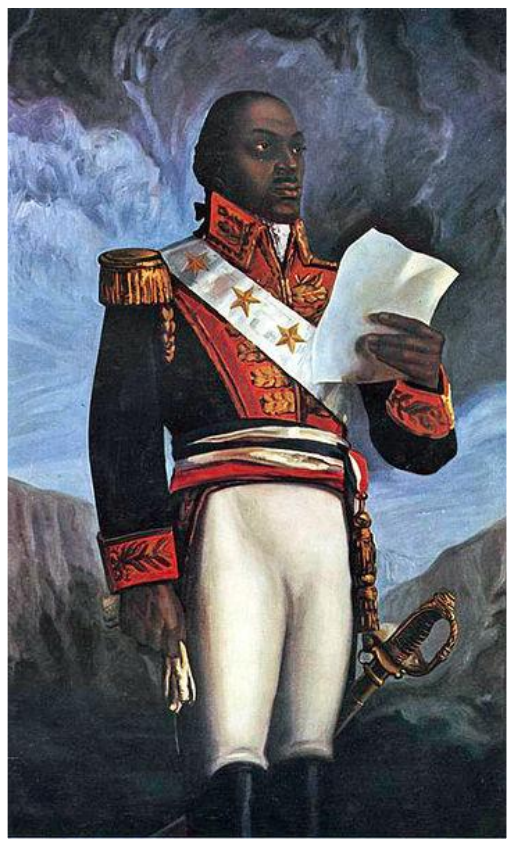
Introduction

« In overthrowing me you have cut down in Saint Domingue only the trunk of the tree of liberty; it will spring up again from the roots, for they are many and they are deep »

- Général Toussaint Louverture, (1802)



General Toussaint Louverture was the leader of the Haitian Revolution. His military genius and political acumen transformed an entire society of slaves into the independent black state of Haiti. The success of the Haitian Revolution shook the institution of slavery throughout the New World.

When the French imprisoned him he famously referred to the Haitian fight for independence with a metaphor, pointing to the tree of liberty's ability to spring up again from its roots after being cut down. Given his understanding of the tenacity of trees to grow from stumps, one wonders if the history of Haiti's forests would have been different had the French left him in power.

General Louverture knew the key principle that Farmer Managed Natural Regeneration is based on in 1802! Could this knowledge be revived and applied for creating a Haitian Regreening movement today?

Before leaving for my trip to Haiti last November, people around me would give me an incredulous look and say "Well, that's a challenge!" - I was not sure what to expect.

As I started to read background material and receive information from people who worked in the field, I could identify two streams of thought and experience.

The one says that reforestation in Haiti has failed. That over $100m has been spent on reforestation and there is little to show for it; that Haiti is one of the most deforested countries in the world with one of the highest deforestation rates. By the end of the 1980's, the level of nursery based tree production was around 10 million trees per year, but with a survival rate of between 30-40%. Top down methods were often used along with incentives, paying farmers with 'Food for Work' programs. Too rarely were farmers listened to, or their traditional knowledge acknowledged and built on, or their actual needs and decision making-drivers understood. Severe storms, conflict, dependence on charcoal, population pressure to clear more land and higher returns for annual crops have contributed to the current state of deforestation.

The other points to pockets of success where farmers have embraced the practice of agroforestry where planting and leaving trees on their farmland makes sense to them – usually economic, but also for soil conservation and other reasons. Where tree species such as mango, cocoa, coconut, citrus, tamarind, avocado provided a clear economic advantage, and in some cases where planting trees for soil conservation purposes made economic sense, the work prospered.

However, after few days spent on the island, having met local farmers and having presented Farmer Managed Natural Regeneration in a workshop I feel very encouraged. Throughout Haiti there are millions of tree stumps, roots and seeds in the soil with great capacity to regenerate. Through awareness building and creating an enabling environment, rapid, low cost and scalable reforestation is possible in Haiti. I have no doubt about the ability of World Vision Haiti staff to implement good Natural Resources Management projects or of the Haitian people to own and continue the work beyond the life of the project. I felt the participants to the FMNR workshop remained very engaged until the end. For me, this trip was a good investment and I believe it will bear fruit. So I am leaving with great hope to see a re-greening movement in Haiti which will transform the island and which will be an inspiration to the whole region.

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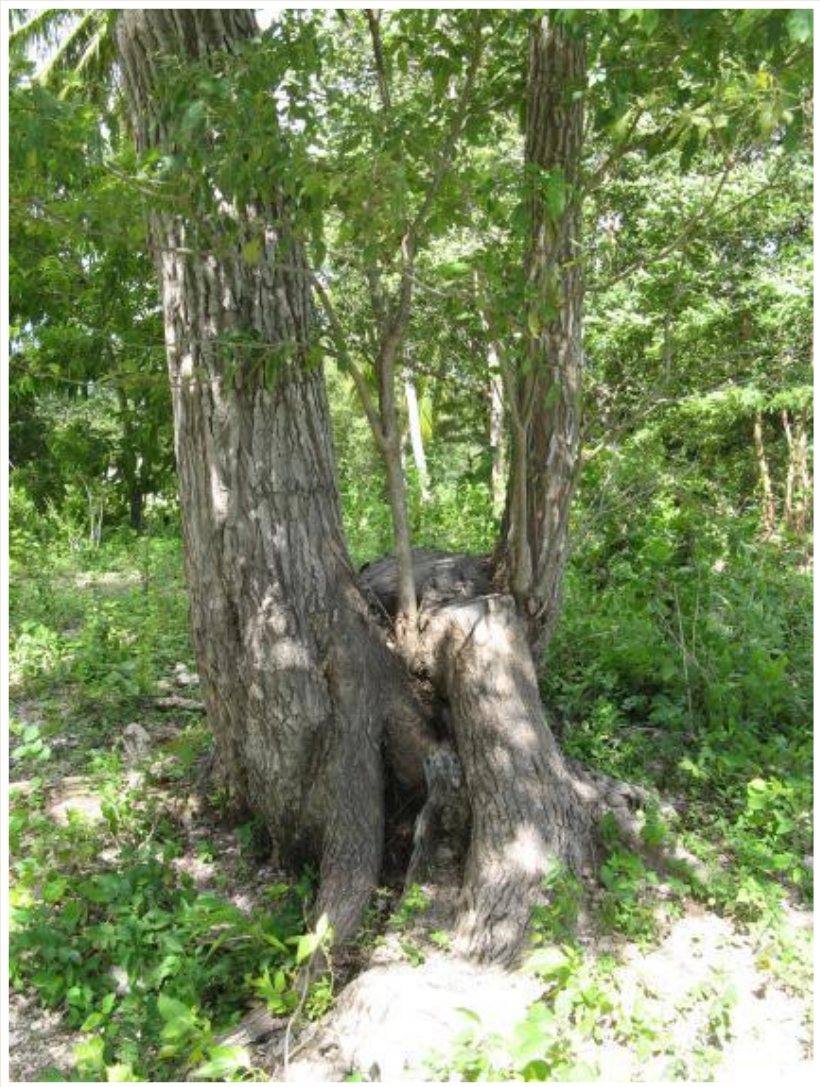

Vigorous re-growth of indigenous tree from tree stump, La Gonâve.

Field Visits

La Gonâve.

World Vision Australia funded watershed and Natural Resource Management (NRM) projects have brought about big changes in the target areas of La Gonâve. Farmers used to cut every tree for charcoal and to make way for crops, resulting in increased soil erosion, loss of soil fertility and reduction in water availability. Through the project interventions, attitudes and practices have changed significantly. Today people are much more selective on which trees they cut and they are planting more trees than they are cutting in order to protect water sheds, build soil fertility and for income generation.

Severe deforestation is evident in this aerial photograph of La Gonâve. Once densely forested, today La Gonâve suffers the consequences of deforestation – flooding, low soil fertility, soil erosion and consequent poor crop yields and seasonal drying up of previously permanent springs.

The WV watershed and NRM projects were very successful in awareness creation on the impact of forest destruction and in bringing about behaviour change. Without forest protection, soils quickly lost fertility, severe erosion occurred on the island's steep slopes and water shortages became the norm. Over 500,000 tree seedlings were supplied per year during the life of the NRM project with a very good average survival rate of 76%. What had been a very eroded and deforested landscape now has a good covering of trees. Of significance is the fact that work did not stop when project funding ended. Today, farmers continue to raise and plant new trees, and they allow regeneration of naturally self-seeding trees.

On La Gonâve, some farmers are already practicing FMNR to one degree or another. Normally, forest would be totally cleared in preparation for farming. Here, selected trees have been deliberately left and pruned.

Many farmers like Wilfrid Saint Germain are proud of their tree planting efforts.

Private agroforestry plot in near Nan Café village.

The lower altitudes of La Gonâve are covered in dense scrub made up primarily of prosopis juliflora (Annex VI) – a thorny, invasive species, along with some neem, leucaena and various indigenous species. While prosopis is commonly seen as an invasive weed, it has greatly reduced erosion and landslides, provided fuel wood and a steady income from charcoal production and fodder for the islands goat population. What could be seen as a problem plant actually has tremendous capacity to maintain a very large and sustainable charcoal, fodder, firewood and light pole industry, while maintaining a degree of environmental integrity and even providing a protective environment for fostering a succession of more valuable tree species.

Slopes at lower latitudes are covered predominantly by prosopis trees. Prosopis has high capacity to regrow (coppice) prolifically after cutting.

A combination of selective pruning and rotational harvesting of tree re-growth, controlled grazing and complimentary agricultural practices would bring about rapid forest regeneration and result in environmental restoration. Ultimately, this will enable greater wellbeing through improved food and water security and wealth creation. Timber and non-timber forest products have the potential to become major economic drivers of La Gonâve's economy.

After cutting prosopis trees for charcoal, individual trees are not managed and dozens of competing stems sprout from the one stump. Thinning excess stems and pruning side branches of remaining stems would result in faster, straighter growth of a more valuable wood product.

Prosopis juliflora has formed dense, almost impenetrable thickets which have not been systematically thinned or managed. Productivity of the trees and their end value is greatly compromised.

Above *Formerly dense impenetrable thickets of prosopis juliflora being managed through selective pruning in Kenya.*

Left *While pruned smaller stems can still be converted to charcoal, providing an immediate short term income, more valuable poles produced in the medium term (2-3 years) provide a higher return and strong incentive to manage prosopis through pruning.*

Beautiful furniture can be made from prosopis wood such as these examples from Argentina

Haiti has a strong tradition of carving and carpentry - there is no reason why some prosopis trees could not be grown to maturity to provide timber for a viable furniture industry.
The Island of La Gonâve is a major supplier of charcoal to the mainland and charcoal making is one of main income generation sources. Along with land clearing for agriculture, charcoal making has contributed to the decimation of the islands once dense forests.

For Haiti as a whole, some 720,000 metric tons of charcoal are used annually[1] at a value of $65 million and some 222,000 metric tons of firewood[2] are consumed. Haiti wide, some 150,000 people are employed in the charcoal industry. Much of the Haitian population is dependent on charcoal for cooking.

Demand for charcoal is not going to go away any time soon. Since charcoal is an economic product, and since there is a vigorous renewable resource in the form of prosopis, managing the prosopis stand in a coordinated way, according to silvicultural principles would provide a steady income while improving the environment.

More efficient charcoal making technologies and fuel efficient stoves which would greatly reduce waste and produce a superior product are available both in Haiti and abroad[3]. In addition, management of re-growth would ensure progressively greater benefits: short term from charcoal and fodder; medium term from sale of poles and long term, from value adding and sale of timber and timber products.

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[1] http://jonathanauch.com/charbon/
[2] http://www.hrdf.org/files/Substitution-of-Wood-Charcoal-by-Conversion-of-Cellulose-Products.pdf
[3]
- Fuel efficient stoves – 25-50% fuel saving: http://vimeo.com/17245955 and http://www.ashden.org/files/Haitiwinner.pdf
- Charcoal from the fields project, Haiti: http://d-lab.mit.edu/sites/default/files/Charcoal_BG.pdf
- Portable fuel efficient charcoal kiln, Cambodia: http://www.hcdconnect.org/stories/multipurpose-portable-charcoal-kiln-in-cambodia-for-fuelwood-utilization-efficiency/
- Available Charcoal Technologies, Kenya: http://www.undp.org/content/dam/kenya/docs/energy_and_environment/Charcoal_Production_kilns_study-1-.pdf

Central Plateau

In the Central Plateau a World Vision Area Development Program agroforestry project was visited. Even though seedlings were provided free, it was evident that communities and individuals were committed to planting and maintaining trees. They understood and appreciated the benefits. In fact, beneficiaries provided an in-kind contribution to establish and maintain tree nurseries and to plant, protect and manage the trees in their fields. Farmers planted a mix of species for fruit, timber and charcoal production on their land and at the sites visited, the trees were well managed. There is a need for greater testing and promotion of suitable agroforestry species because few farmers apply fertilizers and low soil fertility is a serious issue resulting in poor crop yields and contributing to malnutrition. (Annex III & IV).

There is a tradition of agroforestry in the region which can be built on. For example, many farmers practice a form of FMNR by regularly harvesting and managing regrowth of naturally occurring trees on farm borders. Particularly valuable trees such as mango and native mahogany were being managed on crop land. This traditional knowledge and practice provides a strong foundation for introducing a more intensive form of FMNR which could be rapidly and cheaply scaled up.

While many hills are severely deforested, there are good examples of intensive agroforestry as well

FMNR is not a new concept to Haiti. Awareness creation and mobilization of people can build on this existing knowledge and practice.

Indigenous mahogany growing on crop land. The farmer has deliberately left these trees and will harvest them when mature.

Left Bread fruit **Right** Naturally occurring trees on farm borders managed by farmers. The trees are regularly harvested and allowed to regrow

Cassia siamia planted on farm borders. Farmers are actively planting and protecting fruit, timber and charcoal trees. It is clear that they value trees and are prepared to invest their time and skill into this activity.

Observations and comments

- There already exists a good foundation for creating a re-greening movement in Haiti. Farmers linked to WV NRM projects visited, are valuing, planting and protecting trees and manage natural regeneration for fruit, wood, charcoal, soil fertility and watershed management. They are prepared to make the effort to ensure tree survival even after formal project closure.
- Farmer Managed Natural Regeneration (FMNR) (Annex I) is not a new concept in Haiti. Farmers are practicing FMNR in one form or another already. Thus a promotion campaign would not be introducing a new concept, but would be building on what is already known and helping to improve and expand on what is already being done.
- Ingredients necessary for a re-greening movement are already present: a large labour force, organizational structures (such as savings groups, women's groups, farmers groups, watershed management groups etc.), land ownership and/or traditional 'land use rights or access' through local arrangements (Annex VII), a large legal market for timber, firewood, charcoal and non-timber forest products and a vast reserve of tree stumps, roots and seeds in the soil with the capacity to grow rapidly if given the chance.

Recommendations

- Build the capacity of existing organizational structures in areas of leadership, group solidarity, goal setting, silvicultural practice, land management, value adding and marketing.
- Facilitate creation of local agreements among stakeholders on natural resource management.
- Host workshops and facilitate discussions, exchange visits and planning.
- Take a whole of landscape and all-stakeholder approach, i.e. plan to impact whole water catchments (peak to sea) and even districts. Natural resources are shared resources affecting and affected by all stakeholders, therefore, all stakeholders should be engaged and included.
- Emphasis needs to be placed on challenging entrenched, detrimental land management practices (burning, continuous grazing, clear felling all trees for agriculture and charcoal, and soil nutrient depletion resulting in clearing and cultivation of far more land than necessary to produce adequate food).
- Teach farmers practical/attainable ways to improve soil fertility. By increasing soil fertility, crop yields will increase and pressure to clear more forest for farming will decrease. Methods include agroforestry (Annex IV) using soil building species (e.g. leucaena, sesbania, glyricidia etc), targeted use of biochar mixed with compost/animal manure (Annex III) and use of legumes.
- Facilitate value chain development, value adding to raw products and market development of timber and non-timber forest products. Link income generation to natural resource management activities e.g. forest restoration and honey production (Annex II); mangrove planting and sea food harvest (Annex V); tree management and timber and furniture production).
- Build relationships with research organizations such as the World Agroforestry Centre[4] which can assist with technical advice.

[4] http://www.cgiar.org/cgiar-consortium/research-centers/world-agroforestry-centre/

Environmental stewardship and Child-focused Development.

That a healthy environment is crucial for truly sustainable development which incorporates poverty reduction and food security, should not be in question. In 1998 alone, environmental related calamities – landslides, floods, droughts, wildfires – claimed upwards of 32,000 lives, costing $92 billion and permanently or temporarily displacing some 300 million people worldwide5. Yet, development agencies and governments commonly fail to grasp the necessity of attaining a healthy environment in order to achieve sustainable development. Too often, a healthy environment is not treated as the essential requirement for supporting sustainable development and child wellbeing outcomes that it is.

Simply put[6]:

• Children's physical survival, especially from conception through 5 years of age, is heavily influenced by their natural environment.

• Children's physical and mental development is also significantly affected by their natural environment.

• The environment is the world's largest employer, and in developing countries the majority of caregivers derive their livelihood, and thus ability to provide for their children, from their environments.

• Food security, nutrition security, disease and immunity, disaster risk, mental health and prosperity are all influenced by the health of the environment – not just in developing countries but, increasingly, throughout the globe.

Almost total deforestation in Haiti has exacerbated the country's vulnerability to natural disasters. In 2004, flooding claimed 3,000 lives along Haiti's border with the Dominican Republic and, in September that year, Hurricane Jeanne killed 3,000 people as a result of flooding and mudslides. In contrast, in the Dominican Republic, which has retained much of its forest cover, the death toll from Jeanne was minimal. The island once known for its fertile soils is now characterized by low soil fertility and resultant low food crop yields. Springs which flowed all year now provide water only immediately after rains and streams fluctuate between raging torrents after rain and dry beds during the dry season. All these physical manifestations of land degradation have a direct impact on child wellbeing outcomes and hence they are legitimate targets of World Vision interventions.

Why is that child poor?

From a natural resource management perspective, that child is poor because her life support system, the environment, has been damaged. It cannot provide abundantly, as it was created to.

That child is poor because only 50% of the land is converting sunlight energy to usable energy for 30% of the year, while 75% of the rainfall runs off or evaporates (causing downstream flooding and contributing to local drought), 95% of the available biodiversity goes unused and 90% of the soils are infertile and biologically dead.

Fortunately, like God, the environment is very forgiving, and will give us a second chance – if we turn from our destructive ways and walk humbly with it.

Tony Rinaudo, *Why is that Child Poor* presentation.

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[5] Environmental refugees. Tim McGirk, Time, February 7, 2000.
[6] WVI NECI Core document "The Natural Environment in Development and Well-Being"

Annexes

Annex I: Farmer Managed Natural Regeneration

In many parts of the world, poverty, poor farming practices and fast-growing populations have turned once-productive farmlands and forests into virtual deserts. In parts of Niger Republic crops now fail three years in five.

Farmer Managed Natural Regeneration[7] (FMNR) is a low-cost, land-restoration technique used to combat poverty and hunger amongst poor subsistence farmers by increasing food and timber production, and resilience to climate extremes.

In practice, FMNR involves the systematic regrowth and management of trees and shrubs from felled tree stumps, sprouting root systems or seeds. The regrown trees and shrubs – integrated into both crops and grazing pastures – help restore soil structure and fertility, inhibit erosion and soil moisture evaporation, rehabilitate springs and the water table, and increase biodiversity. Some tree species also impart nutrients such as nitrogen into the soil.

As a result, FMNR can double crop yields, provide building timber and firewood, fodder and shade for livestock, wild foods for nutrition and medication, and increased incomes and living standards for farming families and their communities.

Across the Sahel region of Africa, FMNR is diversifying diets through a greater range of crops and the collection of wild foods. Because of the beneficial impact of trees on crops, through FMNR, Niger produces an extra 500,000 tons of grain annually, enough to feed 2.5 million people; and it has restored five million hectares of farmland. In northern Ghana, a burnt-out, barren landscape is now being recovered, with forest 1-3 meters tall in just two years – producing wood, livestock fodder and wild foods.

> Equally effective in restoring croplands, grazing lands and forests, FMNR is transforming landscapes and communities by providing more food and better nutrition for millions of people.

In Senegal, FMNR has transformed 50,000 hectares of farmland and doubled crop yields in just three years. In southern Ethiopia, a barren mountain has been reforested and the community is now reaping financial benefits through the sale of carbon credits.

With increased incomes, families become more resilient against drought and flood, are able to afford healthcare and send their kids to school. In fact the whole community benefits economically.

As FMNR is community-led and requires the involvement of regulators and governments to ensure land and tree ownership, communities are building their networking and negotiation skills. As well, they are developing new business structures.

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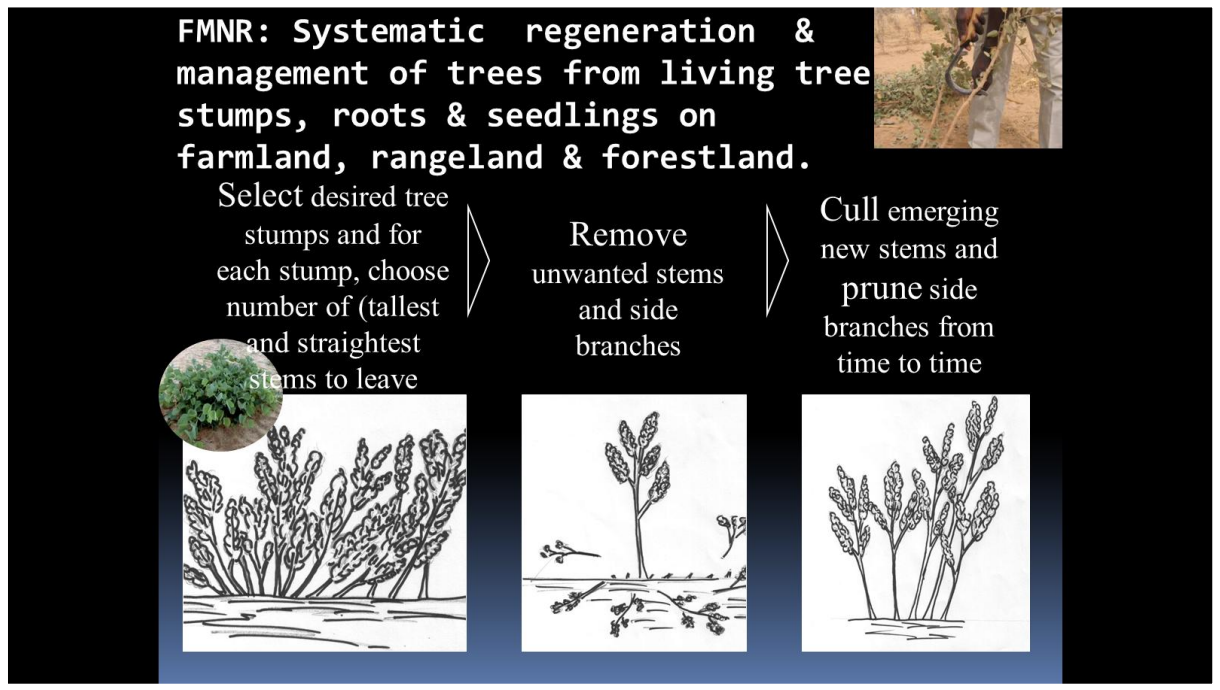
[7] • http://en.wikipedia.org/wiki/Farmer_Managed_Natural_Regeneration
• http://www.youtube.com/watch?v=E9DpptI4QGY



Annex II: Bee Keeping.

Beekeeping in Haiti is a growing but still underutilized industry and this was very evident in the project sites visited[8]. Despite their great potential to capitalize on the good reforestation work achieved to date, no bee hives were observed during the two week visit! Beyond the immediate benefit of pollinating agricultural crops, beekeeping creates a cottage industry where beekeepers can sell honey and secondary bee products like candles and waxes adding much needed income. Maintaining bee hives in forests and reforestation sites gives farmers a strong incentive for protecting the forests from fire, theft and livestock damage. Income from bees also reduces the poverty driven imperative to clear forests.

Annex III: Soil Fertility.

Infertile soil is a major issue in Haiti. It is estimated that Haiti loses around 10,000-15,000 hectares of once-fertile land to erosion every year. Crop yields in Haiti are 1/5 of those in neighbouring Dominican Republic, and 1/10th of those in the US. Soil infertility is also a major driver of deforestation. Farmers fell trees to supplement their meagre incomes and to feed their families and because of low crop yields, they clear forest and plant far more area than they would need to if soils were more fertile and crop yields were higher. The success of reforestation projects is therefore linked to raising soil fertility.

Few farmers in Haiti can afford inorganic fertilizers and even animal manure may be in short supply. After several years of cropping, soils lose their fertility. In the past, people merely carried out slash and burn agriculture, progressively clearing new forest areas to utilize the fertile soils until there was no forest left. More recently farmers in WV programs visited have begun restoring exhausted soils by replanting tree seedlings and by direct sowing tree seeds. They allow the soil to recover before clearing the trees and planting annual crops again. An ideal next transition would be to grow the forest and crops together instead of sequentially by graduating to a agroforestry farming system (Annex…). For a rapid response, infertile soils could be enriched by the practice of digging planting (zai) pits and filling them with animal manure and organic matter salted with biochar.

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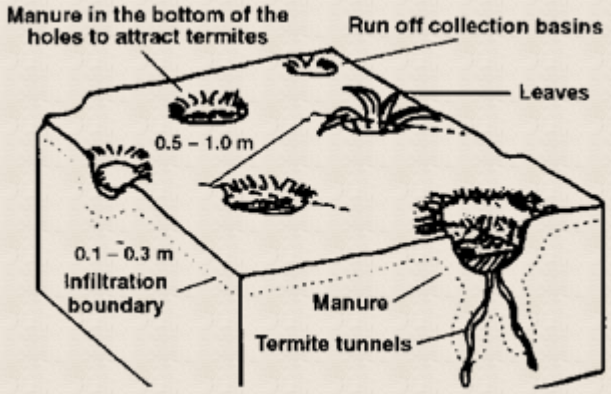
[8] • http://floridahaiti.org/?q=node/108509
• http://www.beesfordevelopment.org/uploads/BfDJ82%20Haiti014.pdf

Zai holes are a cultivation system from West Africa traditionally used on heavy clay soils to increase water infiltration. Dry manure or compost is placed in holes (approx. 30cm wide x 30cm deep) which are spaced according to the crop plants requirements (e.g. 1 x 1 meter spacing for millet in West Africa). Termites burrowing up to the organic matter turn it into rich humus, thereby increasing soil fertility, aeration and water infiltration. Even on more porous sandy soils, zai holes increase crop yields dramatically. The concentration of nutrients where the plant has exclusive access to them results in vigorous, healthy crop growth which quickly shades out weeds growing in less fertile soil between zai holes.

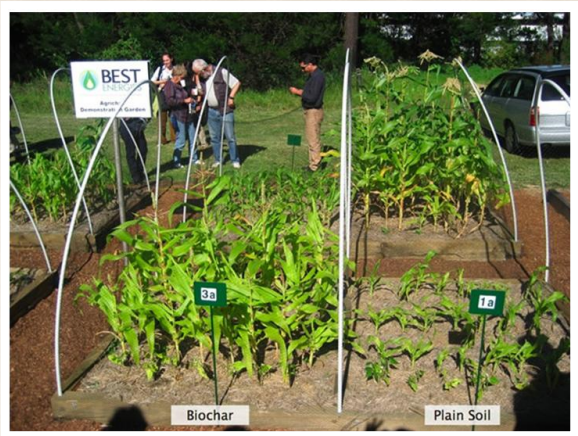


Above Diagrams of Zai holes. Termites attracted to the organic matter dig tunnels which help aerate the soil and enable more water to infiltrate deeper into the soil profile. Right Crops respond positively to the concentration of nutrients and moisture and weeds growing outside of the zai hole tend to be shaded by the rapidly growing crop plant.

In that rainfall levels in Haiti are higher than for the Sahel, a 30cm deep zai hole may not be necessary and may even cause waterlogging and stress on crop plants. Thus, experimentation with different depth holes is warranted. In Zimbabwe, farmers simply make a slightly deeper than usual planting hole – allowing enough room to place a small amount of compost in each hole before seed sowing.

Compost or manure can be made even more effective by adding biochar[9]. Biochar is defined simply as charcoal that is used for agricultural purposes. Biochar has many benefits. It increases crop yields, sometimes substantially if the soil is in poor condition. It helps to prevent fertilizer runoff and leeching, allowing the use of less fertilizers and diminishing pollution to the surrounding environment. And it retains moisture, helping plants through periods of drought more easily. Most importantly, it replenishes exhausted or marginal soils with organic carbon and fosters the growth of soil microbes essential for nutrient absorption, particularly mycorrhizal fungi. As a not-insignificant bonus, the biochar sequesters carbon and stores it in soil forever, thus helping to reduce the carbon in the atmosphere that contributes to climate change.

[9] www.biochar-international.org



Left This photo shows the positive impact of simply adding biochar to depleted soil. If biochar and compost were added an even greater benefit would be noted.

When used in fine granular form (less than 2 mm) and combined with animal dung, it can be applied to different soil types across a variety of climatic conditions. Thus the fine dust and tiny chips of charcoal which are too small to sell for fuel can be utilized and no new trees need be destroyed in order to produce biochar. The poorer the soils, the greater the impact of biochar.

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Biochar research shows measurable, replicable improvements in soil productivity:

- Enhances the soil biological activity (40% increase in mycorrhizal fungi)1
- Improves nutrient retention in soils (50% increase in Cation Exchange Capacity)2
- Improves the water retention capacity of soils (up to 18% increase)3
- In terms of carbon sequestration, 1 tonne of biochar is equivalent to 2.7 tonnes of CO2
- Increases the pH of acidic soils (1 point pH increase)4
- Increases soil organic matter5

Annex IV: Agroforestry[10]

Much progress in introducing agroforestry has been made through current and past WV Haiti programs. This foundation can be built on to bring additional benefits.

Agroforestry systems can be advantageous over conventional agricultural, and forest production methods. They can offer increased productivity, economic benefits, and more diversity in the ecological goods and services provided.[5]

Biodiversity in agroforestry systems is typically higher than in conventional agricultural systems. With two or more interacting plant species in a given land area, it creates a more complex habitat that can support a wider variety of birds, insects, and other animals. Depending upon the application, potential impacts of agroforestry can include:

- Reducing poverty through increased production of wood and other tree products for home consumption and sale
- Contributing to food security by restoring the soil fertility for food crops
- Cleaner water through reduced nutrient and soil runoff
- Countering global warming and the risk of hunger by increasing the number of drought-resistant trees and the subsequent production of fruits, nuts and edible oils
- Reducing deforestation and pressure on woodlands by providing farm-grown fuelwood
- Reducing or eliminating the need for toxic chemicals (insecticides, herbicides, etc.)
- Through more diverse farm outputs, improved human nutrition
- In situations where people have limited access to mainstream medicines, providing growing space for medicinal plants

[10] http://en.wikipedia.org/wiki/Agroforestry

Agroforestry practices may also realize a number of other associated environmental goals, such as:

- Carbon sequestration
- Odour, dust, and noise reduction
- Green space and visual aesthetics
- Enhancement or maintenance of wildlife habitat
- *Further information: Ecoscaping*

In the WV Haiti context there is a lot of scope for building on the good foundation already laid through

- promoting more intensive FMNR on farmland
- testing "fertilizer" trees[11] which increase soil organic matter and nitrogen content
- testing alternate high value timber and fruit species.

See also:

Taungya system.

- http://www.worldagroforestry.org/units/Library/Books/Book%2032/an%20introduction%20to%20agroforestry/html/6_taungya.htm?n=29

and the Honduran Quesungual agroforestry system

- http://www.fao.org/focus/e/honduras/agro-e.htm
- http://ciat.cgiar.org/wp-content/uploads/2012/12/qsmas1.pdf

Annex V: Mangroves and artificial reefs..

On the island of La Gonâve, it was surprising that fish was not on the restaurant menu. The reason – few were caught. This is in part at least due to the destruction of the island's mangrove forests. Mangrove forests transfer organic matter and energy from the land to the sea, forming the base of marine food webs. They are also home to a wide variety of marine and terrestrial life, and serve as nurseries for coral reefs and commercially important fish species. In addition, mangrove forests play a vital role in trapping sediments, thereby stabilizing coastlines and protecting coral reefs and seagrass meadows. Mangroves are the first line of defense against storm surges and fierce winds. Mangroves also provide timber for building boats and firewood.

Studies conducted in the Philippines indicate that one hectare of mangroves can yield 400 kilos of local fish and seafood annually, and help feed a further 400 kilos of fish and 75 kilos of seafood that mature elsewhere. Removal of one hectare of mangroves thus costs fisheries US$200 - US$700 per annum. Conversely, mangrove restoration can play a pivotal role in reducing poverty and improving child wellbeing outcomes.

Haiti has experienced severe mangrove destruction. This has had a significant negative impact on livelihoods and nutrition. Where WV program areas include coastal zones, promotion of mangrove planting and management should also be included in the activities. There are a number of successful mangrove[12] restoration programs in Haiti.

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[11] http://en.wikipedia.org/wiki/Fertilizer_tree

[12] • http://w3.shorecrest.org/~Lisa_Peck/MarineBio/syllabus/ch11_ecosystems/ecosystem_wp/2008/vince/prod.html
• http://www.linktv.org/video/5201/haiti-mangrove-protection

Even so, it could be argued that communities are very poor and cannot wait for mangrove forests to grow. By constructing artificial reefs using smaller pruned branches, short term benefits could be realized while waiting for mangroves to mature. An artificial reef[13] is any man-made object placed in the sea as a habitat for marine organisms. Sea life is drawn like a magnet to any large object in the otherwise featureless bottom sand. Almost anything will do, but objects that can withstand the corrosive effects of salt water are best. The objective of artificial reefs is to create hard structure habitat for mussels, Sea Bass, Blackfish, Porgy, lobster and many other species of marine life. Once fish and shellfish establish themselves in their new homes - and it doesn't take long - the reefs produce excellent catches of fish and provide underwater attractions for scuba divers.

Creating artificial reefs is not an entirely new idea to Haiti where some fishermen are known to lash logs together and float them out to deeper water in order to attract fish. If a well-planned FMNR program were to be adopted by communities on La Gonâve, smaller pruned branches from FMNR sites could be used to create artificial reefs –

- Forming the basis of a restored fishing industry
- Giving communities short term benefits (increased fish catch) while waiting for medium and long term benefits from planted mangroves which take time to establish.

An example of survival and ingenuity from Benin

Five hundred years ago, a small group of people outside of what is now Cotonou, Benin, avoided being captured for slavery by taking advantage of local religious customs. At the time, the powerful West-African Fon tribe was hunting and selling other native tribesman to the Portuguese. While there were few physical impediments protecting the ancestors of today's Ganvie village from outside attack, Fon religious practice forbade their raiders from advancing on any peoples dwelling on water, laying the groundwork for escape and establishment of the Ganvie Lake Village.

Today, Ganvie is a village of roughly 20,000 people that stands on stilts in the middle of Lake Nokoue. Ganvie has developed an intricate and prosperous culture within the constraints of life on the lake, relying on a complicated network of underwater fencing to corral and farm various fish populations. The lake was divided into farming plots which were distributed to villagers by the chief. Each plot was enclosed by reeds. The fish would hatch eggs within the reeds and when they developed, they would belong to that farm owner who would catch and sell his crop.

Palm tree fronds used as an artificial reef to attract fish, Ganvie village, Benin.

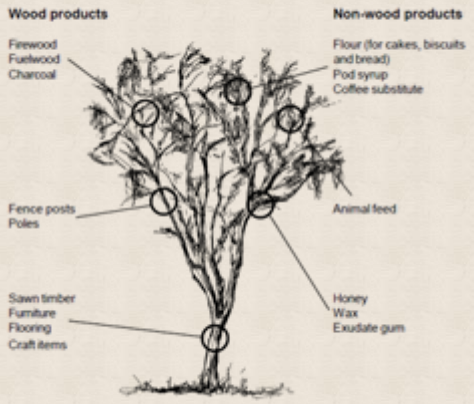
[13] • http://njscuba.net/reefs/
• http://en.wikipedia.org/wiki/Ganvie

Annex VI: Prosopis juliflora

Prosopis juliflora[14] is primarily used for charcoal and fodder on La Gonâve, yet if managed properly it could also provide timber, fodder, fibre, food, shade, shelter, medicine, tannin and dyestuffs, soil nitrogen and improved soil fertility. Working qualities are largely dictated by the quality of the wood itself. Prosopis that is clear and free from defects is easy to work with hand and machine tools, but irregular grain or knots can be challenging. It glues, turns and finishes well. Common uses of the wood include flooring, firewood, turned objects, cabinetry and furniture.

Livestock eat prosopis pods which may yield as high as 6-10 tons/hectare/year. The average yield per tree is about 10-50 kg pods/year[15] .

Prosopis is a major honey source in Bolivia, Jamaica, Pakistan, western Australia and elsewhere. In Sri Lanka, it is one of the most important species for bee forage due to its very copious nectar flow.



From 'Managing Prosopis juliflora, DFID[16].

Annex VII: land rights

Gaining land rights and tree user rights are important milestones that need to be achieved before farmers will adopt innovations like tree planting and FMNR in many countries. Farmers need to be confident that they will benefit from their labour and investment. However, Smucker et.al, 2000[17] suggest that in Haiti, peasant social relations (which effectively ensure user rights) are key to successful uptake of FMNR and should be given more attention than pursuing often costly and time consuming formal titles.

The findings suggest that (a) formal title is not necessarily more secure than informal arrangements, (b) informal arrangements based on traditional social capital resources assure affordable and flexible access to land for most people, and (c) perceived stability of access to land—via stability of personal and social relationships—is a more important determinant of technology adoption than mode of access. Empirical evidence from Haiti challenges the proposition that direct interventions to reform tenure—especially large-scale cadastral survey and titling—should be a priority for rural Haiti. Instead, more fundamental reforms must first be addressed. Furthermore, the evidence shows that peasant social relations support agricultural intensification even in the absence of formalized property rights and titles.

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[14] http://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1354
[15] http://www.feedipedia.org/node/554
[16] Land tenure and the adoption of agricultural technology in Haiti. Glenn R. Smucker, T. Anderson White, and Michael Bannister CAPRi WORKING PAPER NO. 6 October 2000

The emergence of successful watershed regimes was explained by two factors: significant economic gain from the action, and a critical mass of social capital derived from labor exchange practices and the existence of producer groups. Land title or tenure type was not the key factor (to land access), but rather the degree to which individuals were incorporated in a nexus of enduring and well adapted set of personal and social relations. Evidence suggests that farmers make investment decisions based on their perception of prospects for long-term access to a plot – regardless of its tenure status, including investments that actively enhance their prospects for long-term access. This suggests that perceived stability of access to land – via stability of personal and social relationships – is a more important determinant of technology adoption than mode of access.

About the author

Tony, or 'chief' as he is known in the Program Research & Advisory team, is involved in the development and promotion of agricultural-forestry-pastoral systems across a range of environments. Tony previously spent 18 years in Niger managing a long-term agricultural development program. The natural-regeneration reforestation methods Tony developed were adopted by farmers and contributed to over five million hectares of land being revegetated in Niger alone. Tony was also instrumental in introducing edible seeded Australian acacias into Nigerien farming systems and in their promotion as a human food.

Tony's specialist areas are de/reforestation, desertification, sustainable farming and food production. Tony is currently engaged primarily in promoting reforestation internationally and facilitating ongoing research and development of edible seeded Australian Acacias.

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