Community-Based Forestry in Haiti: Overcoming Extreme Erosion and Poverty

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Abstract. Haiti is a mountainous country which is 98% deforested, and consequently suffers from floods, erosion, and desertification. The HAS Haiti Timber Re-Introduction Project (HTRIP) began in 2006 to enable Haitians to re-create productive forests in order to improve their environment and health. HTRIP is not a research project, but rather a trial in applied, community-based, sustainable agroforestry. HTRIP assists Haitians in growing commercially valuable timber tree species on marginal hillside lands, encouraging soil conservation practices and agroforestry. HTRIP provides the trees and the technical expertise while the farmer provides the land and labor. Nursery and planting activities are monitored and guided by HTRIP staff. This paper describes the methodology used in 2006, plans for 2007, and project sustainability. In 2006, over 1,300 trees were planted, with the participation of more than 175 Haitians, 150 of whom will be prepared to plant on their own lands in 2007.

Keywords: Community-Based Forestry, Haiti, Agroforestry, Soil Conservation

INTRODUCTION

Haiti is often characterized as an environmental and humanitarian disaster. Seventy-six percent of Haitians live on less than $2 a day, and it is the poorest country in the Western Hemisphere (Sletten and Egset 2004). By 2005, 98% of Haiti had been deforested due to logging for timber, slash-and-burn agriculture, and the cutting of trees to fill the great demand for charcoal. A UN report from 1949 stated that Haiti's natural resources were so depleted that it could not support its population and recommended, "flood control, reforestation, and both anti-erosion and soil-conservation measures" (Friedmann 1955). In 2006, Haiti's situation is even more severe. Recently, Haiti has been used as an example of a country that has lost all of its natural forest cover (Woodwell 2002) and has severely impoverished water resources (Pearce 2002). Most of the land's topsoil has washed into the sea, choking coral reefs and marine life. Haiti's mountains have eroded to bedrock and its aquifers are drying up. The habitat loss for wildlife is severe. Twenty three of Haiti's native bird species are on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species due to habitat destruction (IUCN 2004).

These environmental problems now have a direct, negative impact on the economic status, health, and quality of life of the Haitian people. Furthermore, members of mountain communities, which are isolated by elevation, lack of transportation, and the poor condition of roads, suffer most acutely from the impacts of environmental degradation. These Haitians, who practice horticulture on the steep, rocky slopes of the mountains, experience significantly higher rates of malnutrition and other diseases than the residents of the valley floor (Hôpital Albert Schweitzer Haiti, unpublished data). This project resulted from a partnership between Hôpital Albert Schweitzer (HAS) Haiti, interested members of the American forest industry, and other private donors. Hôpital Albert Schweitzer, in rural Deschapelles, Haiti, was founded by Dr. Larimer and Gwen Mellon in 1956. In addition to hospital services, a Community Health program brings care to people in the mountains and remote parts of its 1,580 square kilometer (610 sq mile) service area, through fourteen outlying health centers operated by HAS and its partners.

The HAS Haiti Timber Re-Introduction Project represents a proactive approach to healthcare, dealing directly with the poverty and environmental degradation that contribute to many of the health problems that HAS treats. This is not a new concept for HAS, which has a long history of Community Development projects, but it is the largest project that has been undertaken focusing solely on forestry. Economic factors drove the deforestation of Haiti, and it will be impossible for reforestation to succeed there without close consideration of the economic situation. Many Haitians have no other means to survive but to travel long distances to find trees to cut down and make charcoal, which they then sell for fuel. Any tree that is not guarded is in danger of being harvested for this purpose, even if it is on private property or in a protected area. It would be impossible to reforest a large area in Haiti without maintaining a constant surveillance system. In addition to being socio-economically insensitive, due to the low yields that can be derived from the poor soil such a project would not be economically sustainable.

Instead of planting trees and then trying to protect them from people, HTRIP puts the trees in the people's hands- or, more literally, on their land. The majority of land in Haiti is divided into small plots. HTRIP employs a joint-venture strategy, in which landholders supply land and labor

in exchange for seedlings, which was successfully utilized by the Pan-American Development Fund (PADF) in Haiti (Murray and Bannister 2004). In this way, HTRIP works directly with individual landowners, who have a personal stake in the survival of the trees. As members of the local social-political system, the landowners are much better able to protect their trees from premature harvest. Meanwhile, the shortage of wood for timber and fuel is reduced, and the economic status of the landowners is improved. Therefore, HTRIP employs a socio-economically sustainable strategy to provide the basis for forestry that is sustainable in both the environmental and human aspects.

Many groups have been working on reforestation in Haiti for many years, but the work has resulted in almost no published works. Most efforts have been small-scale and involve the cultivation of fruit trees. The exception to both these statements is the work of PADF in Haiti from 1981-2000; Besides Murray and Bannister (2004), Timyan conducted growth trials of timber species (2001), and authored *Bwa yo: Important Trees of Haiti* (1996). Part of the motivation for writing a paper at this early point in the progress of HTRIP is to help fill this literature gap.

ENVIRONMENTAL CONDITIONS AND SPECIES COMPOSITION

The project is located in Haiti's mid-to-upper Artibonite Valley, which receives roughly 1000 millimeters (40 inches) of rain per year, with a dry period from November to March. On the sloping land that HTRIP targets for planting, water availability is further limited by fast run-off. Humidity has not been recorded in the area, but it generally changes from humid to dry in direct relation to the rainy season. Temperatures usually range between 24° and 28° C (75-82° F), but can reach as high as 38° C (100° F). The soils in the region are very calcareous due to their limestone parent material, and low in nitrogen and phosphorous. The mountain soils are highly eroded, with a minimal amount of organic topsoil. It is a common agricultural practice to burn off crop residues each year, which volatilizes nutrients and further destabilizes the soil.

Livestock presents a significant challenge to reforestation in Haiti. Many Haitian families own chickens, pigs, goats, and a horse or burro, and these animals are rarely kept in enclosures. During the rainy season when crops are growing, farmers will often tie their larger livestock down to keep them from destroying crops, but during the dry season after the harvest, the animals are allowed to range for food. This practice leads to the livestock causing major damage to young trees, some of the only live plant material within their reach during the dry season. Unless farmers can be convinced to keep their livestock tied up year-round, which would require them to grow and provide other forage for their livestock, the young trees require protection in the form of a fence.

Considering the economic circumstances of rural Haitians, their short life expectancies, and the degraded condition of the mountain soil, HTRIP chose to begin reforestation with hardy, fast-growing tree species. Three timber species were used in 2006; one native species (*Cedrela odorata*, Spanish Cedar), one naturalized species (*Eucalyptus camadulensis)*, and one species that had not been previously introduced to Haiti (*Paulownia* sp., Empress Tree). *Paulownia* is a fast-growing commercial species which re-sprouts after harvesting for up to eight generations. In addition, one *Citrus* tree and one nitrogen-fixing (leguminous) tree were planted for every three timber trees. The leguminous species will provide fuel wood and its leaves will be used to

make green compost to improve the soil for the surrounding vegetation. Native species *Enterlobium cyclocarpum* and *Lysiloma sabicu* were the primary nitrogen-fixing species used. Lime and grapefruit varieties of *Citrus* were used to provide nutritional benefits and a potential cash crop to the landowner. Sterile *Paulownia* root-stock was brought to Haiti from the US wrapped in damp packing material and plastic, and kept refrigerated until planting (up to two months). The rest of the species were propagated from seed in Haiti.

In preliminary tests in May 2005, 100 rooted cuttings of *Paulownia* were planted in various locations in the Artibonite Valley. A few reached heights of over two and a half meters by January 2006, though the average height was one meter. However, many of the young trees experienced die-back during the dry season and subsequently resumed growth from a lateral branch or root sprouts in April 2006. To investigate the potential of coppicing to encourage growth and reduce die-back, a subsample of 30 trees was coppiced in May 2006. Within one month they equaled the height of the non-coppiced *Paulownia* in the same location, and displayed superior growth structure. Their performance in their first full growing season after coppicing, to be measured in 2007, will help us gauge the capacity of this species to grow successfully in Haiti.

PLANNING PROCESS: IDENTIFYING INTERESTED COMMUNITIES

Recruiting and Scoping. Agronome Cleophat, the Haitian program coordinator, spoke at churches and meetings to spread the word about the project in most communities within a 15 kilometer (9.3 mile) radius of Deschapelles. The major towns in the area include Verettes, Petite Riviere, and Liancourt. Once HTRIP identified interested community leaders, staff visited them to determine if the location was appropriate for the project. HTRIP required 1024 square meters (11,022 sq ft) for the plot- enough space for 100 trees planted in a three meter (9.8 ft) grid and one meter of walking space between the trees and the perimeter fence. The land also needed to represent our target for reforestation: eroded and sloped. HTRIP sought the sites least suitable for traditional farming to better demonstrate the benefits that trees can provide to Haiti's degraded lands. Location in relation to roads and homes was also an important consideration. The plot needed to be adjacent to a community or on a main thoroughfare between communities, to be in plain sight of all community members and passers-by, and easily accessible for educational programming. HTRIP selected ten locations for planting in 2006.

Figure 1. HTRIP staff meets with community members at a future planting site.

Agreements. HTRIP signed a contract with each participating landowner, stating that while HTRIP provides the trees, tools, expertise, and money for food for the work days, the landowner will recruit volunteers from the community to labor on the work days. The materials used for a barbed wire fence around the perimeter were a conditional gift: for each year that the landowner continued to participate in the HTRIP program and follow our directions for the management of the plot, one tenth of the cost of the fence would be forgiven as

debt. Should the landowner chose to stop following HTRIP's guidelines, they would have to start making the annual payment on their debt from that year until the tenth year after planting. This small debt burden (just over $100 US total) provided the landowner with a financial motivation to stay committed to the HTRIP program.

SITE PREPARATION

Sites were prepared through the creation of contour canals to catch and slow the flow of water and earth from the plot during torrential tropical rains. The lines for these canals were plotted using a 'Level A' tool and stakes, and the canals were created using picks, shovels, and sometimes sledgehammers and rock bars. The downhill sides of the canals were reinforced with rocks. On average, four 35 meter long canals were created on each site. This work took 1-3 days per site to complete, depending on the slope and rockiness of the plot. HTRIP staff delivered fence posts of *Haematoxylum campechianum* (Logwood) to the sites prior to planting, and community members began to dig the post holes and set the posts with 3.0 meter (9.8 feet) spacing prior to the planting day. Site preparation was completed prior to the onset of the rainy season, when food was otherwise scarce and there were few demands on the community's time.

SITE PLANTING

HTRIP timed planting to coincide with the beginning of the rainy season, which occurred in May. On the day of planting, HTRIP staff and volunteers from the community would meet early in the morning with all the materials needed to finish the planting and fencing of the plot. One group would begin on the fence, checking that the posts were firmly set in the ground. Then they would string four-strands of barbed wire around the posts, and finally line the fence with locally available 'living fence' material, usually *Euphorbia lactea,* a cactus, or *Bursera simaruba,* a tree.

Another group would lay out small flags to mark the locations for planting the seedlings. There were 100 flags total, each with a code to represent one of the five tree species planted at each site. HTRIP followed a pattern of planting with *Paulownia* and *Eucalyptus* placed around the edge of the plot where they would receive the most sunlight, *Cedrela* within them, and *Citrus* in the center of the plot. The leguminous trees were evenly distributed throughout the plot to enrich the soil.

Figure 2. Volunteers digging a row of holes just below a contour canal.

Rows of flags were first placed just below each of the contour canals, where water would be most plentiful, and then in between the canals until all 100 flags were placed. In most cases these canal lines did not run parallel to the borders of the plot, and they did not run in straight lines, so an exact grid pattern was modified in order to optimize water capture. The planting pattern was also adjusted to accommodate any immobile obstacles in the plot, such as bedrock.

Volunteers dug 45 cm (18 in) deep holes at the flagged locations and added composted manure pre-mixed with soil for nutrient enrichment.

Planting was done primarily by volunteers but was carefully supervised to ensure that the seedlings were handled correctly and planted to a proper depth. The bare-root *Paulownia* stocks were planted by specially trained staff and the landowner. A stake was placed next to each *Paulownia* that was planted so that the young shoots would be easy to locate. If it had not rained in the past few days, staff brought water to the site in buckets for an initial watering.

When the work was done, HTRIP staff shared a meal, prepared on-site by volunteers, with the community members. This follows the Haitian tradition of working as a volunteer on someone else's land in exchange for a shared meal when the work was finished. HTRIP provided the landowner with funds in advance to buy the ingredients for the meal. Before departing, HTRIP staff made a list of the people that attended that day and presented the landowner with a binder containing their copy of the signed contract and other papers relevant to the project, including a list of the species that were planted on site.

ON-SITE FOLLOW-UP

A map was made of each site showing the GPS coordinates and elevation of the corners, the general layout of the trees, contour canals, and any other landmarks in the site. The map will assist follow-up monitoring of survival and growth rates. A copy of the map was provided to the landowner for their record. Initial photographs were taken for photomonitoring.

The sites were re-visited one month after planting to monitor initial survival and to re-plant any initial mortalities. If the *Paulownia* stock had not sent a sprout above the ground at that time, it was dug up and replaced, in order to give the demonstration plots a stronger start. However, some of the stock had sprouted below-ground and was just slow in growing to the surface. These individuals were replanted in a more controlled setting on HAS Plantation (described in the next section), to give them a second chance of surviving.

PLANTATION AT HAS

Following the planting of ten demonstration plots, a plantation for conducting growth trials, producing propagative materials, and testing silvicultural practices was established on HAS property. Forty members of the Organization for the Development of Deschapelles (ODD) offered to help HTRIP staff with the planting, in return for a meal and the gift of a few hand tools. *Paulownia*, *Cedrela*, and *Simarouba glauca*, a native timber species that is being considered for use in 2007, were planted in separate blocks, interspersed with nitrogen-fixing *Lysiloma sabicu*. In total, 300 trees were planted on HAS property. A local farmer will farm the land and maintain the trees. Any income that may be derived from this plantation will be used to offset HTRIP expenses.

INITIAL RESULTS AND DISCUSSION

One hundred young trees were planted in each of ten demonstration plots, and 300 were planted at the HAS plantation, bringing the total number of trees planted by HTRIP in 2006 to 1,300. After one month, the demonstration sites suffered an average rate of 17% mortality (standard deviation 8%). Two-tailed t-tests showed no significant differences in mortality among species, although *Paulownia* showed an overall mortality rate of 27%, while the others ranged from 9% to 19%. The rains during the time of planting and afterward were less than average, and probably severely stressed the young plants. Although it is impossible to control the weather,

HTRIP staff prepared the seedlings for adverse growing conditions by hardening them off prior to planting. This was impossible to do for *Paulownia*, however, because the rooted cuttings had to be kept dormant using refrigeration. HTRIP plans to examine the feasibility of pre-sprouting the rooted cuttings to reduce *Paulownia* planting mortality.

In addition to tree planting and survival rates, another important measure of success for this project is the number of community members that are involved. Ten to 25 community members (men, women, and children) volunteered their labor during the days of site preparation and planting in each of the ten communities, and an additional 40 participated in the HAS plantation. A conservative estimate of the number of individuals who participated is 175. Fifteen to 20 people in each community are now participating in monthly education sessions, being trained to plant trees on their own land in 2007.

NEXT STEPS: THE SECOND SEASON PLAN

Monthly education sessions began in July 2006, after planting was completed. These sessions take place in each of the ten communities and are conducted by a Haitian HTRIP extension agent. The curriculum was designed for farmers with little or no formal education, and lessons are conducted in Creole, the common language of Haiti (as opposed to French, the official language). Since the majority of farmers are illiterate, educational materials utilize drawings instead of words. Each session begins with a walk-through of the demonstration plot to spur discussion, and a more formal one-hour classroom phase follows. Session topics include tree types, tree care and maintenance, seed collection and storage, nursery preparation and management, phytosanitation, soil conservation, soil organic matter, and agroforestry.

The extension agent will oversee the construction of a simple nursery in each community and assist each student to grow 100-200 seedlings for him/herself in the nursery for planting in 2007. A local community member will be responsible for managing the nursery. One outstanding student in each community will be selected by the extension agent to assist them in coordinating the work of the community members for the 2007 season and in ensuring the quality of the plantings. HTRIP staff will also identify ten more communities for participation in 2007 and establish demonstration plots. The new demonstration plots will be on sites that are more remote and at higher elevations in the watershed, to reach out to the most disadvantaged communities and to bring ecosystem benefits to a larger number of downstream residents.

The performance of the species in the demonstration plots and HAS plantation will be monitored, and the results will impact the choice of species for planting in 2007. The species HTRIP uses will be open to revision, if more suitable species can be found.

CONCLUSIONS: MULTI-LEVEL SUSTAINABILITY THROUGH AGROFORESTRY, CONSERVATION, AND COOPERATION

Beginning with a socio-economically sustainable base, HTRIP seeks to be sustainable on a number of levels. On an individual plot scale, sustainability is achieved through agroforestry. On a species-level scale, sustainability is sought through conservation, and finally, on a geo-political scale, through cooperation with other groups.

The sustainable agroforestry component of HTRIP will be more fully developed in the future. While the young trees are small, farmers will continue to grow the crop of their choice in the plot. When the trees grow tall enough to begin to shade the crops, they will be thinned, allowing the remaining trees to grow taller and larger while temporarily increasing the amount of sunlight the plot receives. In 5-7 years, the understory will become so shaded as to require a change in crop type. At that point, HTRIP will assist the farmers in making the transition to coffee, chocolate, animal forage, or another shade-tolerant crop. These crops will then be maintained through sustainable harvesting and replanting of the tree component.

The wildlife of Haiti has been dramatically impacted by loss of habitat. Avifauna may particularly benefit from increased agroforestry. Incorporating trees into the agricultural landscape improves the structure of the habitat and encourages a more diverse assemblage of birds to use the site (Robbins et al. 1992, Petit et al. 1995). Trees can provide nectar and fruit as well as attract the insects that some birds rely on. HTRIP is developing partnerships with Pittsburgh's National Aviary and the Audubon Society of Haiti to find ways to maximize the value of the plantings for both the avifaunal and human components. The restoration of Haiti's rare, native timber species, such as Lignum Vitae (*Guaiacum officinale)* and Mahogany *(Swietenia mahogani),* is an ultimate goal of HTRIP, but the current, degraded soil conditions will not support these species. HTRIP staff plans to try incorporating these species into the second rotation of trees, and believes that the goals of restoring native bird and tree diversity can be complimentary.

HTRIP strives to be attuned to the efforts of other peer organizations in the Artibonite Valley, Haiti, and ultimately Hispaniola and the Caribbean. On the local level, HTRIP has established a cooperative relationship with the Mennonite Central Committee (MCC), one of the goals of which is to create an open forum for all the forestry groups in the Artibonite Valley. These groups are primarily Haitian-run community-based organizations. Through this forum, HTRIP and MCC hope to foster stronger coordination between these groups to allow more effective resource use. This will include documenting primary activities, mapping areas of geographical influence, and facilitate long-term planning for forestry across the whole area. Strengthened communication between groups will also allow for knowledge transfer and increased collaboration. Through HAS, HTRIP is connected to a Haiti-wide network of non-governmental forestry groups, universities and government agencies, and it is also staying abreast of The Nature Conservancy's upcoming expansion from the neighboring Dominican Republic into Haiti.

Given the number of groups interested in reforesting Haiti, the strong awareness and interest among Haitians themselves, and improved transportation and telecommunication networks, HTRIP expects to see progress towards this goal. By enabling individuals and communities to work together to grow and plant their own trees for their own benefit, it should be possible for forestry to be an economically, socially, and politically sustainable industry for Haiti.

LITERATURE CITED

FRIEDMANN, J.R.P. 1955. Developmental Planning in Haiti: A Critique of the U.N. Report. *Economic Development and Cultural Change* 4(1):39-54.

IUCN 2004. *2004 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on 20 April 2006.

MURRAY, G.F. and M.E. BANNISTER. 2004. Peasants, agroforesters, and anthropologists: A 20-year venture in income-generating trees and hedgerows in Haiti. *Agroforestry Systems* 61(15):383-397.

PEARCE, F. 2002. Water, water everywhere but many countries don't make the most of it. *New Scientist* 176(2373):14.

PETIT, D. R., J. F. LYNCH, R. L. HUTTO, J. G. BLAKE, and R. B. WAIDE. 1995. Habitat Use and Conservation in the Neotropics. Pp. 145-197 *in* Ecology and Management of Neotropical Migratory Birds, A Synthesis and Review of Critical Issues (T. E. Martin and D. M. Finch, eds). Oxford University Press, New York.

ROBBINS, C. S., B. A. DOWELL. D. K. DAWSON, J. A. COLON, R. ESTRADA, A. SUTTON, T. SUTTON, and D. WEYER. 1992. Comparison of Nerotropical migrant landbird populations wintering in tropical forests, isolated forest fragments, and agricultural habitats. Pp. 207-220 *in* Ecology and conservation of Neotropical migrant landbirds (J. M. Hagan, III and D. W. Johnston, eds). Smithsonian Institution Press, Washington, DC.

SLETTEN, P and W. EGSET. 2004. Poverty in Haiti. FAFO-Paper 2004:31. Website: <http://www.fafo.no/pub/rapp/755/755.pdf>

TIMYAN, J. 1996. *Bwa yo: Important Trees of Haiti*. South-East Consortium for International Development, Washington, D.C.

TIMYAN, J. 2001. 10-Year statistical analyses of tree improvement in Haiti and trial management recommendations. Report submitted to Pan American Development Foundation, Port-au-Prince, Haiti.

WOODWELL, G. 2002. The functional integrity of normally forested landscapes: A proposal for an index of environmental capital. *Proceedings of the National Academy of Sciences of the United States of America* 99(21):13600-13605.