AGROFORESTRY AND SUSTAINABLE RESOURCE CONSERVATION IN HAITI: A CASE STUDY

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OVERVIEW

Soil erosion and deforestation are endemic in Haiti due to centuries of agricultural exploitation, first under the colonial plantation system—intensive monocropping of export commodities such as cotton, indigo, tobacco, sugarcane, and coffee—and later by the widespread harvest of timber for export markets and the expansion of peasant subsistence agriculture on marginal sloping land. A growing urban population and an increasing demand for charcoal and fuel wood have further stressed the environment. While rural Haiti has provided most of the nation's revenue in the form of agriculture and natural resources, this wealth has systematically been siphoned from rural areas to the capital with little returning to the countryside in the form of infrastructure or development. Furthermore, political and socioeconomic instability has been a tremendous obstacle to sustainable resource management and foreign investment in conservation projects and research. As a result rural populations themselves have played the most active role in combating erosion with traditional agroforestry technologies, yet the rate of degradation is too great for these efforts to be truly sustainable. Millions of dollars have been spent by donor aid agencies on large-scale agroforestry initiatives over the last several decades to address the dire state of Haiti's environment, yet many of these projects have ended with little to show. Projects involving local farmers, *gwoupman peyizan* (peasants' groups), and indigenous knowledge have been more successful and offer the greatest potential for effective conservation of Haiti's natural resources.

Deforestation and hillside erosion near Kenscoff, Ouest region

source: http://www.haiticulture.ch/HaitiMap.html

NATURAL RESOURCE DEGRADATION IN HAITI

The Republic of Haiti comprises the western third (27,750 km^2) of the island of Hispaniola in the Caribbean's Greater Antilles, lying in the tropics between 18 and 23° N. The island boasts the highest mountains the Caribbean, as described by its original Taino name *Ayiti kiskeya* ("land of mountains") and aptly noted in the Haitian proverb: *Dèyè mon, lot mon* ("Behind the mountains, there are more mountains"). Sixty-three percent of all land in Haiti slopes more than 20 percent and more than a third of the country lies above 400 meters (Pellek, 1992; White and Jickling, 1995; Smith, 2001), with peaks in the south up to 2700 m and 2100 m in the central region (Zimmerman, 1986). While only 20 percent of land is considered arable, 50 percent is under agricultural production (FAO). Forested land was estimated in 1940 at approximately 30 percent of Haiti's total area, and dropped to 10 percent by 1970. Current estimates lie between 1.4 and 2 percent (Michel, 2001). Intensive production is limited mostly to the fertile Artibonite Valley, yet the majority of rural population has access only to the hillsides for subsistence agriculture of maize, beans, cassava, and fruit. As a result, most hillsides are visibly eroded, and according to USAID, a third of all land is severely degraded (White and Jickling, 1995). Gully erosion is endemic, particularly along rural footpaths and roads (Wahab *et al*., 1986), seriously compromising both soil fertility and infrastructure. In one research site in the Sud-Ouest region, 60 percent of soils were eroded to the B horizon and 20 percent to the C horizon (Paskett and Philoctete, 1990). In many areas, unconsolidated marl or basalt bedrock is visible at the surface. Indeed, Haitians sometimes comment, "The mountains have grown old. You can see their bones poking through their skin" (Smith, 2001).

Gully erosion along a footpath, near Séguin, Sud-Est region

With the intense rainfall of the two growing seasons (April to July and September to November), precious topsoil is lost downhill, silting up rivers below. In semi-arid areas of the country, excessive silting has reduced river flow by 80 percent since the mid-1960s, threatening drinking water sources and hydroelectric power production at the Peligre and Saut Mathurine plants. Heavy sedimentation in the fertile floodplains has also reduced drainage and increased salinity of the soil and groundwater (Zimmerman, 1986).

Some Haitian soils particularly susceptible to erosion

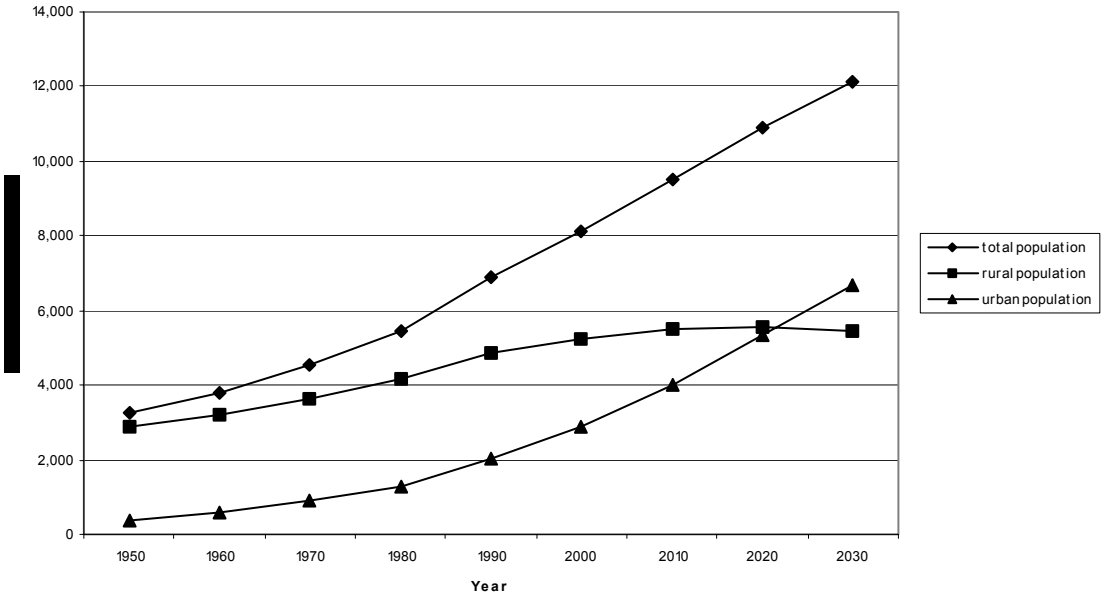
Soil Series	USDA Soil Taxonomy	Slope
Formond clay loam	Typic Dystropept, fine clayey, mixed, isohyperthermic	5 to 12 %
Forteresse siltly clay	Typic Eutrorthox, clayey, oxidic, isohyperthermic	8 to 15 %
Macaya silty clay loam	Typic Haplorthox, clayey, mixed, isohyperthermic	25 to 65 %
Platon-Soulette silty clay	Tropeptic Eutrorthox, clayey, oxidic, isohyperthermic	15 to 25 %
Toro silty clay	Lithic Calcistolls, clayey, mixed, isohyperthermic	25 to 50 %
Toro-Deaty silty clays	Lithic and Typic Calciustolls, clayey, mixed, isohyperhermic	25 to 50 %
Titon-Cavalier silty clays	Plinthic and Typic Paleudults, clayey, mixed, isohyperthermic	25 to 50 %

source: Wahab *et al*., 1987

While Haiti remains the only nation in the Western Hemisphere whose majority subsist as small farmers (White and Jickling, 1995), Haiti's urban population is expected to surpass the rural population by 2025. Currently, a quarter of the country's population of 8.1 million is concentrated in the capital Port-au-Prince. With the population growing at a rate of 2.1 percent, this trend towards urban migration will further exhaust natural resources as the needs of the urban population are met. Charcoal and firewood provide

85 to 90 percent of Haiti's energy for home and industrial use, with rural firewood consumption estimated at 500 kg per person per year. Similarly, 62 percent of Port-au-Prince's population relies solely on charcoal for cooking and heating, amounting to roughly 0.44 kg per person per day (Michel, 2001). Charcoal production has doubled over the last two decades, from 13.1 million metric tons per year to 26.4 in 2002 (FAOSTAT). Declining soil fertility and falling commodity prices have led many rural Haitians to intensify charcoal production as a means of guaranteeing cash income. The semi-arid Nord-Ouest peninsula, for example, produces about fifty percent of the charcoal used in Port-au-Prince (Pellek, 1990). With an annual deforestation rate of 5.7 percent, Haiti's remaining 880 km^2 of forested land is gravely threatened (World Bank, 2000).

Haiti's population: total, urban, and rural (source: FAOSTAT)



BACKGROUND CONTEXT

The rapid deforestation of Haiti began during the colonial period, and was intensified when coffee was introduced in 1730. Upland forests were cleared and fifty years later, a quarter of the colony's land was under coffee. The system of plantation monoculture and clean-cultivation between rows of coffee, indigo, tobacco, and sugarcane exhausted soil nutrients and led to rapid erosion (Paskett and Philoctete, 1990). Following the revolution of 1804, the government was forced to export timber throughout the 19th century to pay off a 90 million franc indemnity to France. No longer under colonial rule, land remained unequally distributed nevertheless, and peasants were granted access only to the marginal slopes between 200 and 600 m, above the fertile plains and below the zones of coffee production. These hillside soils were particularly susceptible to erosion when cleared for farming.

A lack of capital and land tenure continues to constrain sustainable resource management. Average per capita income in 2001 was $480, more than seven times less than the average for Latin America and the Caribbean (World Bank), yet mean income for the majority of the (mostly rural) population is estimated at less than $100 per year (Smith, 2001). Land parcels are subdivided with inheritance, and after generations of such division, the intensively cropped, meager-sized parcels can scarcely produce enough to feed a family. The last agricultural survey was conducted in 1971 and found that 59 percent of all agricultural parcels were less than a hectare and that 88 percent of farm families owned less than three hectares (White and Jickling, 1995). Current estimates claim that most peasants own less than a quarter hectare (Smith, 2001). In an effort to increase production, many families lease or sharecrop additional fields. As there is no space for traditional fallowing, soil fertility is compromised, and farmers are generally unwilling to invest capital or labor into improving land they do not own themselves.

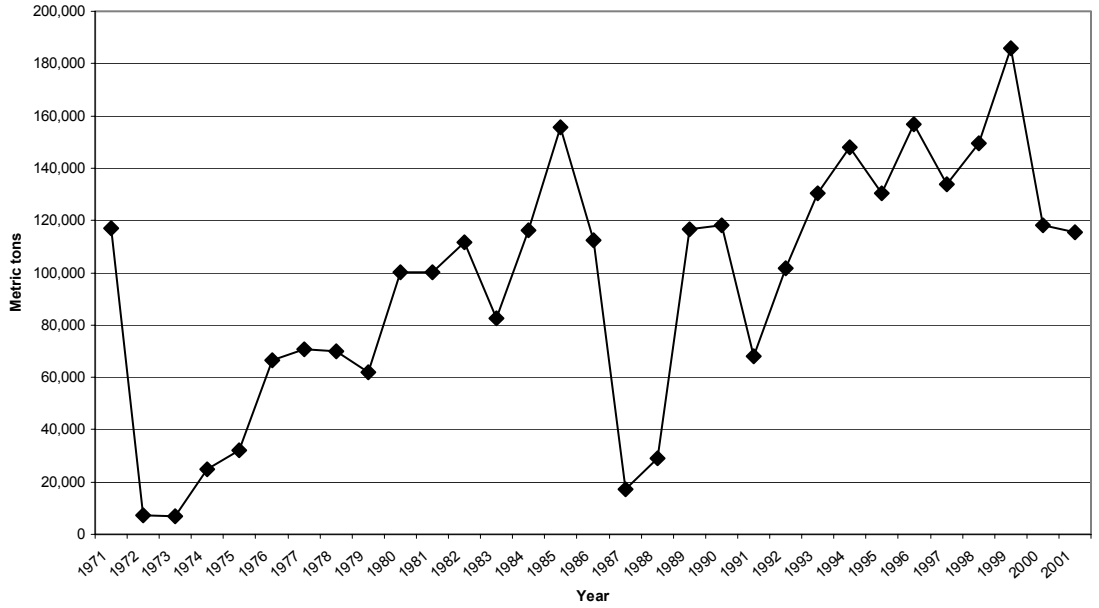
The precarious state of Haiti's natural resources are by and large a tragic legacy of pre- and post-colonial exploitation, exacerbated not only by the irresponsible mismanagement of the nation's wealth by a string of opportunistic dictators, but also by crippling debt burdens and the persistent (and repeatedly enacted) threat of military intervention by the US and European governments. Currently, the inadequacy of the government to manage Haiti's natural resources is largely due to a lack of infrastructure and investment in a country whose political climate remains as precarious as its environment. The poorest country in the Western hemisphere, Haiti suffers from high rates of illiteracy (49 percent), and only 13 percent of the population has access to potable water, 6 percent to electricity (World Bank, 2002; Smith, 2001). The nation's external debt (outstanding and disbursed) has nearly tripled over the last two decades, amounting to $1.25 billion in 2001. Popularly-elected president Jean-Bertrand Aristide's 1994 return to power by the US military and delivery of $2.1 billion in aid following the 1991 coup was contingent on the implementation of a structural adjustment program mandated by the World Trade Organization and international lending institutions, requiring regular debt service, maintenance of low wages, privatization of state enterprise, as well as the lifting of agricultural subsidies and price supports (Smith, 2001). While coffee and sugarcane traditionally provided the nations' primary export revenues, the economy is now dominated by clothing and footwear assembly plants which provide 80 to 90 percent of the nation's exports (FAO, 2001). A 2002 trade agreement with the Dominican Republic has led to the displacement of many small farms in the newly established free-trade zone along the fertile plain of the Nord-Est region on the Dominican border (James, 2002).

Food production in Haiti over the last two decades

	Year				
	1982	**1987**	**1992**	**1997**	**2002**
	----------Production (metric tons)----------				
Cereals	390,900	461,806	451,796	490,000	363,000
Roots and Tubers	740,000	755,000	794,043	727,000	755,000
Pulses	85,900	100,711	106,523	88,000	70,500
Vegetables&Melons	292,060	309,350	235,760	213,825	198,870
Fruits	1,027,040	1,077,782	889,305	908,360	968,800
Sugar Cane	3,000,000	1,800,000	1,429,280	1,100,000	1,008,100
Coffee, Green	32,250	30,088	27,355	27,000	28,000

source: FAOSTAT

Total food aid to Haiti (source: FAOSTAT)



Agricultural imports and food aid have increased since 1994 with the lowering of import tariffs as required by structural adjustment; and the resulting influx of cheap food imports has pushed market prices below competitive levels. Food security remains tenuous at best, however, as the persistent devaluation of the Haitian *gourde* on the international market has severely reduced the purchasing power of consumers. All of these factors, in conjunction with environmental constraints such as drought, declining soil fertility, and hurricanes, have led to a decline in food production and exports—per capita food production has dropped 20 percent in the last decade (FAO, 2001), and resources are continually depleted.

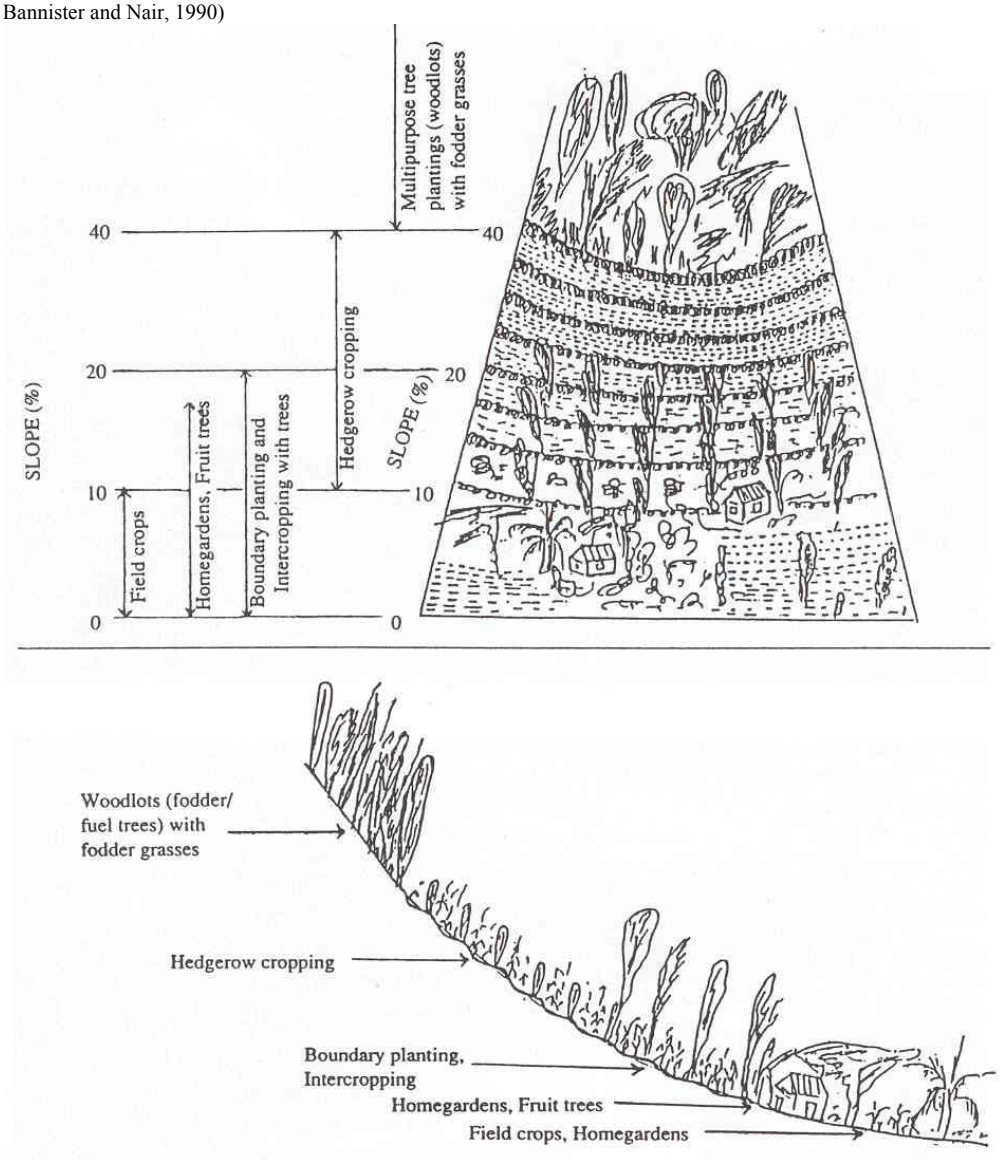
AGROFORESTRY AS A SUSTAINABLE SOLUTION

Clearly, the uncertainty of food security in Haiti is intrinsically linked to the continued degradation of the environment and the numerous climatic, socio-economic, and political factors that threaten the country's natural resource base. Over the years, a plethora of governmental and non-governmental agroforestry initiatives have been tested on national, regional, and local levels to address these concerns. Yet it is important to note that small farmers in Haiti have long practiced various forms of agroforestry. Home courtyard gardens incorporate multistoried food and tree crop species such as coffee, cassava, plantain, castor bean, mango, avocado, and citrus. Live fences are planted to protect fields and home gardens. Between fields, woody perennial species are often used to demarcate boundaries. In an indigenous silvopastoral system in Haiti's more arid zones, animals are grazed on wooded rangeland. Multipurpose trees have always been central to Haitian agriculture, providing food, fodder, medicine, shade, or wood for the population (White and Jickling, 1995). The rare indigenous oil palm, *Attalea crassispatha* (*ti koko* or *kowos etranje* in Creole), for example, provides a fatty nut meat eaten raw or used as a

cooking oil. Its large woody bracts are often used as pig troughs, and its trunk used for rough but durable and insect-resistant lumber. Grain is stored at a height of 6 meters, balanced in sacks hung on a pole passed through the trunk (Timyan and Reep, 1994).

Many resource conservation initiatives have promoted agroforestry techniques as a means of reducing soil erosion and improving soil fertility. On the most basic level, reforestation projects have focused on the planting of cash crop tree species. The most extensive of these, the Pan American Development Foundation (PADF)'s Pwoje Pyebwa, funded by USAID's Agroforestry Outreach Project, provided over 200,000 farmers with nearly 48 million free seedlings between 1981 and 1991. A shift from exotic species to native high-value and fruit species at the request of the local population, as well as improved seedling quality and planting training saw an increase from 30 to 50 percent survival (Bannister and Josiah, 1993; White and Jickling, 1995).

Agroforestry incorporated into the hillside agriculture in Haiti
(source: Bannister and Nair, 1990)



Perhaps the most widely promoted agroforestry technique used by development projects in Haiti is alley cropping with contour hedgerows of leguminous nitrogen-fixing shrub species such as *Leucaena leucocephala*. Shrubs are periodically coppiced and prunings are scattered as mulch on the interrows, releasing nutrients for uptake by the crop, and contributing organic matter (OM) to the soil. Higher levels of OM help to slow erosion due to runoff by increasing soil porosity and infiltration, as well as enhance soil fertility. The mulch cover also maintains soil moisture during dry periods. The wide range of agroecological conditions—due to changes in elevations and resulting differences in temperature and rainfall—make it difficult to generalize on the success of a particular species. Recent scientific research has evaluated the germination, seed size, and establishment several species of shrub for use in alley cropping in various agroecological zones across Haiti (Shannon *et al*., 1997) as well the rate of nutrient mineralization at different elevations (Isaac *et al*., 2000, 2003). By 1992, about 1.4 million meters of hedgerows had been established throughout Haiti, estimated to have saved 350,000 metric tons of soil (Pellek, 1992).

Hillside contour hedgerows and trees, near Kenscoff, Ouest region

Hedgerows must be spaced more closely as the slope of the land increases in order to slow erosion and improve soil fertility. As a result, some farmers have been resistant to adopt them due to the amount of space required on their otherwise small tracts. If hedgerows are not trimmed back frequently enough, they may become weedy or suffer insect damage—*Sesbania grandiflora*, which has performed poorly in Haiti on degraded soils in high-drought areas, is particularly prone to infestation (Pellek, 1992). Often farmers practice the hedgerow intercropping in a manner different than that advocated by extension workers. For example, Proje Pyebwa *animateurs* (extensionists) suggested

coppicing hedgerows at the same time, using green branches as mulch, and woody branches as in-fill between trees. Farmers, however, would prune the hedgerow species as needed, using the leaves as animal fodder and the branches as fuel wood (Bannister and Josiah, 1993).

Some agroforestry initiatives in Haiti in the last two decades

Project name	Sponsor	Size, location, population served	Agroforestry methods
Targetted Watershed Management Project	USAID	80, 000 ha in Grande Anse, to the south and west of Pic Macaya 20,000 farmers via four Haitian NGOs and the University of Florida, 1986-1991	Contour hedgerow alley cropping, correct plant densities
Proje Pyebwa (PADF)	USAID Agroforestry Outreach Project	$30 million for Haitian forests, 1987-1991, worked with local NGOs and *animateurs*	Fruit and timber trees planted on farmland; contour hedgerows
Projet Forestation National	World Bank, Government of Haiti	$5 million for Institution building and management of state lands, 1983-1989	
Local *gwoupman peyizan* initiatives	CARITAS	20,000 to 50,000 seedlings per season produced in a nursery, each farmer receives up to 100	Intercropping, , contour hedgerows, home gardens

Sources: Paskett and Phioctete, 1990; Pellek, 1990; Zimmerman, 1986

An economic comparison of traditional farming methods, indigenous agroforestry, and project-sponsored agroforestry in Maissade (Centre) and Maniche (Sud) found that agroforestry provided a much greater economic return in Maissade, where soils are more fertile and productive. Net returns increased 100 percent with the use of traditional (boundary planting and dispersed food crops intercropped with timber) or project agroforestry (fast-growing boundary timber) techniques. *Leucaena* hedgerows ntegrated with traditional residue barriers were the most profitable. Overall, fluctuations in crop prices had a greater effect on economic returns than the price of trees or assumptions about planting density. A cost-benefit analysis found no difference between agroforestry and traditional techniques. Because personal discount rates increased with economic and political insecurity, an all too common occurrence in Haiti, many farmers focus their labor and investment on short-term, annual cropping systems rather than on the long-term benefits of an agroforestry system when land and labor are limited.

LESSONS LEARNED AND RECOMMENDATIONS FOR THE FUTURE

The strong-arm approach taken by foreign aid agencies over the years has left many Haitians bitter and suspicious towards intervention in the name of development. The USAID-led eradication of the indigenous Creole pig to preempt an outbreak of African swine fever in the early 1980s had disastrous social and economic consequences on the livelihoods of the rural population (Smith, 2001). Similarly, *équipement du territoire* (landscape infrastructure) initiatives sponsored by development agencies throughout the 1970s and 80s relied on the Haitian government to force rural participation or used food or cash payments as incentive to construct capital-intensive soil conservation

technologies. This approach largely failed because farmers were not included in the planning process, often infringed on land rights, provided little economic gain, and ignored traditional conservation technologies and knowledge (Bannister and Josiah, 1993; White and Jickling, 1995). Many of the "mechanical structures" incorporating stone have failed due to high rates of infiltration and percolation of rainwater. While stronger than vegetative barriers, construction and maintenance are expensive and labor intensive, and the structure itself provides no actual income to farmers (Pellek, 1992). The dilapidated remains of many concrete and rock walls throughout Haiti stand as testament to the unsustainable nature of this approach.

In the 1970s, a philosophy of confronting the "root causes" of poverty informed the actions of community development advocates, leading peasants to question their systematic socioeconomic subjugation by the wealthy elite. Religious relief groups such as the Peace and Justice Commission, CARITAS, and the Mennonite Central Committee (MCC) worked with rural communities to train *animateurs* and *animatrices* to educate peasants' groups, *gwoupman peyizan* (GPs) in sustainable agriculture, water and sanitation, health, income generation, and women's rights. As GPs blossomed throughout the 1980s and provided the bulwark of support for Aristide's popular movement, rural Haiti was empowered to take charge of its own development. The GPs organize traditional work groups (*kòve*) to implement many of these projects (Smith, 2001). Perhaps the most successful conservation initiatives were those carried out by GPs sponsored by relief agencies. A network of animateurs serves as the interface between the GPs and the project or technical service. An animateur may work with three or four GPs, consulting with farmers and explaining the particular technique. In the CARITAS project, local seeding nurseries capable of producing 20,000 to 50,000 seedlings per season were established and staffed by GP members. The program also included credit for seeds, legal aid to secure farmers' land tenure, construction of granaries, and agronomic and agroforestry consultation (Zimmerman, 1986).

While much of Haiti's natural resource degradation is symptomatic of the nation's inability to extricate itself from a paralyzing debt burden and the repercussions of neo-liberal economic policy, *in situ* appropriate technology initiatives can at least help to alleviate some of this pressure. The most readily adopted agroforestry or soil conservation techniques are those that incorporate indigenous practices such as the *ramp pay* (conour residue barrier), *kleonaj* (wattling placed in ravines to catch soil for crop production), and *sakle an woulo* (weeds hoed into pre-planting contour ridges). Government and non-governmental organizations can be most effective by investing heavily in this grassroots participatory approach, relying on farmer knowledge and input. Only by incorporating farmers into the decision-making process can we hope for these solutions to be durable. As agroforestry techniques are passed along from animateurs to GPs and integrated into traditional farming systems and tested on-farm, rural farmers will gain a sense of proprietorship over the technologies, ensuring at least a minimum standard of resource conservation in rural Haiti.

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