

A Case Study on Utilizing Cacao-based Agroforestry Systems to Replace Low Productivity Crops on Hillsides in Honduras

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Abstract

The purpose of this paper was to describe the methodology followed by the Honduran Agricultural Research Foundation (FHIA) when implementing an income generating project that improved the quality of life of 445 poor, rural producers (including 95 women) of the hillside and piedmont areas of the Honduran north coast and at the same time protected and maintained the natural resource base of the area. As a result of these programming efforts, a total of 2,450 rural family members now have increased their yearly incomes from an average of \$400 / hectare to approximately US\$2,500 per hectare utilizing perennial crops alone. Through the introduction of new cacao plantings coupled with other high-value commodities such as plantains, tropical fruits and fast-growing tropical woods, the risks inherent in hillside farming were spread out over more enterprises. These new plantings in most cases only took up about one-half of the land area for a family; therefore, they still had ample room to produce their own basic commodities for home consumption. In addition, thorough the introduction of high-value perennial crops and the removal or restriction of grazing to more appropriate areas, producers had very little need to continue using slash and burn practices. Finally, the improved environmental conditions on their lands have greatly reduced rain-caused erosion, improved air and water quality, protected remaining forests and provided for reforestation efforts. Important lessons learned were also described in order that other organizations might be able to replicate these positive results.

Key words: cacao, agroforestry, deforestation, income generation, sustainability

Introduction

Hillside farming efforts on the north coast of Honduras are not only major contributors of deforestation, soil erosion, and environmental degradation, but they also subject the families involved to a life time of poverty and an overall low-level of their quality of life. The slash and burn techniques used by these families contribute to more than 200,000 acres of deforestation each year (FHIA, 2007). These families on average have about one hectare of land that provides little more than a subsistence-level of living (US\$400 / hectare / year). Over the last several years, the Honduran Agricultural Research Foundation (FHIA) has been promoting cacao and other perennial crops combined with an agroforestry system as a means of addressing these problems. Anecdotal evidence points to positive outcomes and impacts that are raising income levels to more than \$2,500 per hectare while maintaining and preserving the environment. The project included 445 producers, 95 of them women, and involved a total of 2,450 family members.

While implementing this project, FHIA followed prescribed protocols documented by other project implementers and researchers (Pezeshki-Raad, Yoder, & Diamond, 1994; Hulme, 2006). Every effort was made to include as many stakeholders as possible (Lev and Acker, 1994). Participant input and feedback was solicited throughout the project (Chizari & Noorabadi, R. (1999). Gender issues were a central issue for the project implementers (Tuttle, Dooley, & Lindner, 2004). Quarterly, semi-annual and annual reports were completed during the project cycle. At the end of the project a complete evaluation was carried out (Diem, 2002).



Figure 1. Map of Honduras

Purpose and Objectives

The purpose of this paper is to describe FHIA efforts, outcomes achieved, and the lessons learned in working to bring about increased incomes and improved quality of life of poor, rural families of the hillside and piedmont areas of the Honduran north coast and at the same time protect and maintain the areas natural resource base (FHIA, 2008).

Methodology and/or Data sources

The methodology for this paper is a case study. A case study provides a systematic and logical process for looking at actual events, collecting and presenting data, analyzing the information and reporting the results. Case studies describe “real world” situations and can contribute to greater understanding of complex issues or problems. Although critics often point out that case studies offer no grounds for establishing reliability or generality of findings, they can serve as an excellent tool for exploring programs that have had positive outcomes (Soy, 1997).

The project described provided (1) significantly increased and sustainable economic incomes and employment for 445 families located in the project target areas, (2) diversified agricultural production and replaced low-productivity crops through the introduction of new, higher-value crops such as cacao combined with an agroforestry system that followed environmentally sustainable practices, and (3) diminished the impact of human activities (slash and burn and low-density cattle ranching).

All project activities and implementation strategies were based on the needs expressed by the communities and on FHIA’s previous experience in the target area. Local government and environmental leaders played a major role during the “socialization” stage of the project. This was the stage when local meetings were held with interested groups and individuals to explain the purpose, objectives, and goals of the project. The existing plantings generally included a subsistence agricultural system based on the practice of slash and burn prior to planting corn and beans, low-density cattle ranching, or cacao plantings abandoned because of Moniliasis disease. FHIA developed management practices incorporating shorter trees through pruning and varieties with some Moniliasis tolerance that permitted producers to remain in production and at profitable levels. At FHIA’s research facility in La Masica, the incidence of Moniliasis has remained under 10 percent (versus 80 to 100 percent without controls) for the last several years. It should be noted that these management and cultural practices along with newer more tolerant varieties required no chemical applications.

Component 1: Promotion, Organization and Community Support

Goals for each community were determined in conjunction with the community leaders and based on the actual situation. Lead producers (trainers) were identified based upon community input, demographic characteristics such as education level, farming practices, and a willingness to assume the responsibilities of a “lead producer”. They were given educational and promotional trips to the FHIA research centers for cacao (CEDEC) and for agroforestry (CADETH), the germoplasm bank at the Regional University Center for the Atlantic Littoral (CURLA), and agroforestry-based farms on the north coast. Their specialized training allowed them to expand the diffusion of the technology being promoted by this project to their relatives and neighbors. The approach fully embraced a train-the-trainer model.

Component 2: Nature and extent of female and male participation in project planning

Prior to the project beginning, FHIA made community visits to most of the potential sites. During these visits, a trained facilitator led and carried out detailed rapid rural assessments of the demographic characteristics of each corresponding community. Input was solicited from both female and male members. During the actual project, an estimated 1,275 female family members were encouraged to participate in the project by providing specific gender-based training materials concerning their role so that their family would fully benefit from the project. FHIA recognized that it was essential to include both women and men in all steps of the project from the initial planning stages on through the implementation of field activities as well as the post-harvest and processing, and marketing activities. While the male members of each family would certainly play a central role in the field-based activities, it was imperative that the women and children also participate.

Component 3: Technology Transfer

Efforts were concentrated on training and technical assistance for the establishment and management of high-income cropping systems based on environmentally-sustainable, cacao-based agroforestry models that are alternative options to the planting of basic grains (corn and beans) and low-altitude coffee (under 600-800 meters above sea level at Honduras latitudes). Emphasis in technology transfer was also provided to other themes related to the protection of natural resources. The communication strategies incorporated a combination of diffusion theory coupled with field days, classroom lectures, hands-on training exercises, and visits to successful producers with similar farming operations. Producers were expected to make in-kind contributions of their labor and infrastructure in return for the planting materials, training, and technical assistance. This strategy has been very successful with FHIA's other projects in the same geographical area.

Component 4: Planting Materials

For the establishment or rehabilitation of cropping systems based on cacao-agroforestry models on producers' farms, FHIA provided technical assistance and planting material based on climatic conditions, investment costs, transportation difficulties, and market potential and actual prices. Provision of planting materials was an indispensable, initial activity in order change from migratory agriculture to sustainable, higher-value, cropping systems. Nurseries and multiplication plots were set up in the target communities and managed by project beneficiaries for the continued production of planting material.

Among the promising crops identified by FHIA and which were supplied to participants were cacao, rambutan, coco, plantains, vegetables, and fast-growing and fine wood tree species along with yucca and maracuya. FHIA employed a Taungya system of interplanting with annual and perennial crops until the perennial crops were fully established which provided producers with immediate income as well as diversification of their sources of income and diet. As part of this effort, producers made in-kind contributions through their own physical labor, that of other family members, and through the use of their own farming equipment, implements, and draft animals.

A major effort was made to install cacao-based agroforestry systems adjacent to low-altitude coffee plantations to provide growers with a production system that was very similar to coffee but that was more suitable and profitable. (FHIA's experience has been that cacao produced at these altitudes has less incidence of Moniliasis in general). Moniliasis is caused by

the fungus *Moniliophthora roreri*. It thrives well in low altitude, humid areas. Coffee grows best above 1000 meters. Cacao can be grown from 0 to approximately 750 meters. Therefore, while the coffee mentioned may be considered low altitude, the cacao would not. Cacao grown below approximately 200-300 meters is particularly susceptible to Monilia because of the higher humidity. At an altitude of 400-700 meters there should be a lower incidence of Monilia because of the higher altitude and resulting lower humidity levels. Monilia only affects the cacao fruit and doesn't have any affect on other commodities including basic food grains used for consumption. Planting cacao also has the advantage of maintaining tree-plantation cultivation under improved circumstances in a populace resistant to change. The major change was the addition of sustainable cropping systems based on proven agroforestry production models. A illustrative listing can be seen in Table 1.

Table 1
Agroforestry Systems and Illustrative Estimated Incomes Over 20 Years

Agroforestry system	Estimated income (\$US/ha) by year								
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7 to 19	Year 20
Cacao (rehabilitated) (Cacao –traditional shade)	-	375	875	1,250	1,500	1,500	1,500	1,500	1,500
2. Cacao- plantain-fruit-trees with perimeter hard wood plantings	-	2,750	3,100	1,600	1,300	2,200	3,000	4,000	60,000
3. Cacao-plantain-hard wood species combined with additional perimeter hard wood plantings	-	2,750	3,100	1,600	1,100	1,600	2,000	2,700	120,000
4. Rambutan-plantain with perimeter hard wood plantings	-	4,500	4,800	3,300	3,450	5,000	6,600	8,250	60,000
5. Coconut-plantain with perimeter hard wood plantings	-	4,500	4,800	3,000	3,300	3,300	4,900	5,900	60,000

Component 5: Training

FHIA trained 20 Lead Producers in more than a dozen specific training events and 425 other producers in similar training courses, through the use of specific-theme modules which included workshops, field days, and theory-in-practice type courses (hands-on) using the FHIA research and demonstration centers at CEDEC and CADETH well as producers' farms in the target areas. All of these training events/activities were based on distinct, previously-established, agroforestry production systems; including how to produce organic compost fertilizers and how to manage the land using accepted practices for soil and natural resource conservation. Participants also received training related to business and farm management topics (see Table 2).

Table 2
Illustrative List of Training/Educational Materials

	Illustrative titles	Quantity
1	Soil Conservation Guide	900
2	Perimeter plantings of hard wood and fruit-trees species and inter-planting with cacao	900
3	Cacao production with non-traditional shade trees such as plantains, fruit trees, and hard woods	900
4	Control of <i>Moniliasis</i> in cacao plantings	400
5	Production practices for plantains	400
6	Establishment and management of forest nurseries	600
7	Cacao post-harvest and quality control guide	400
8	Business and farm management practices	900

FHIA concentrated on upgrading the skills of “lead” producers in order for them to assist and more widely disseminate the transfer of technology. However, it should be noted, that all participating producers, not only those designated as “lead” producers, received personalized training, farm visits, and in-class instruction which was supplemented by the “lead” producers. The lead producers, who were neighboring farmers, were able to assist and answer questions on a daily basis. The lead producers had direct contact with the field extension workers involved with the project.

As training aids for the participants, FHIA developed and distributed almost 5,000 training documents, production guides, and technical notes. The training documents, production guides, and technical notes were all developed by FHIA’s Communication Unit in cooperation with our cacao / agroforestry staff and with direct input from the “lead” producers. The literacy level of the producers involved was quite variable. The “lead” producers were all literate and the written material in their training session reflected this. FHIA also had, and continues to develop, other materials more appropriate for those unable to fully understand written materials; however the majority of the materials developed for this project were distributed to the “lead” producers (trainers), but were also available to all producers.

Component 6: Sustainability Issues

There were three main sustainability measurements for this project. Number one was related to increased income levels, employment, and quality of life. The participants quickly learn that the crops involved (primarily cacao and other high-valued perennials coupled with an agroforestry component) would provide them with an annual income approximately five to six times greater than what their traditional cropping system provided. New employment opportunities were also developed with the new cropping system. The two items would both lead to a higher quality of life for the participants. Secondly, the high-value diversified agricultural practices involved in this project promoted sustainable agronomic and environmental practices that became self-perpetuating. Thirdly, as a direct result of the increased income, employment opportunities, higher quality of life and the use of sustainable farming practices, the impact of human activities that previously contributed to natural disasters such as soil erosion, low water quality, and deforestation were greatly reduced.

Component 7: Environmental Improvements

Given the current environmental situation found in the region, it was of utmost importance to make sure that all project interventions minimized further risks and worked to improve the current environmental degradation found in the area. The cacao-based agroforestry system is a much more environmentally friendly system than the slash and burn, basic-grains, low altitude coffee, and livestock systems normally encountered in the region.

The slash and burn system not only destroys beneficial plant fauna and micro flora through soil exposure, but it also directly contributed to soil erosion, nutrient losses, and water quality problems. The cacao-based agroforestry system maintains an adequate shade and plant fauna life structure that minimized soil erosion and maintained and contributed to increased soil fertility, micro flora, and built a watershed that helped restrict and filter heavy runoff from rains, thus allowing for improved water quality. In addition, the cacao-agroforestry system greatly limited the need for chemical applications because diseases such as Moniliasis could be controlled primarily through “best management” practices. All of these practices combined reduced deforestation, limited the use of slash and burn systems and at the same time improved water quality, erosion control and soil nutrition along with increasing rural incomes and improving the overall quality of life of the region’s citizens.

Component 8: Gender Issues

The female members of each of the participating families made up an important part of the project. Each housewife and the older daughters were included in activities that address the issues of income generation, nutrition, and home health improvement. The lesson learned from other similar projects suggested that one of the best options was for the women to become full-participants in the establishment and management of plant nurseries (cacao, fruits, and wood species). This option allowed them to become active participants in the project and make a positive contribution toward the family’s income while at the same time incorporating the learn-by-doing philosophy. This option also allowed for plant material to be produced near the sites where it was planted, thus reducing the time, cost, and potential damage to the plant material normally encountered when moving young plants to distant sites.

Just as in the case of “lead” producers, “lead” women were identified during the orientation meetings. Based upon previous project experience, groups of 15-30 women were formed, along with their older daughters, in order to provide training related to nursery care (cacao and agroforestry) and in order to multiply plants for sale to other local producers along with maintaining their own plantings. This was of great benefit to the local communities as the participants no longer had to rely on outside traders to provide plant material and they also had additional source of income.

Another activity involving women and young girls concerned the local post-harvest handling of the cacao fruit. Although not all women participated, our past experience indicated that female family members were already involved in certain post-harvest activities with cacao such as fruit separation, extraction, fermentation, and drying. By providing additional training, we found that women took excellent care of the harvested cacao beans and that they were greatly appreciative of their opportunity to receive additional training and became enthusiastic participants in the value-added process that increased their incomes.

When handled by women, post-harvest activities don’t interfere with the cropping requirements of other crops and it doesn’t require the same labor associated with the harvesting of African palm or sugar cane.

In addition, through the production and sale of higher-value commodities, family nutritional requirements were easier to meet and allowed more family members to become active participants in productive activities.

Finally, it was usually the women and children in families that made a daily search for firewood. With the use of shade trees for the production of cacao as well as the growing of wood trees for sale and for firewood, family members were able to travel shorter distances and no longer contributed to the problem of uncontrolled deforestation.

The main risk came from the fact that family members must normally continue to travel greater distances to find adequate wood for cooking. There was also the cost element related to their labor and transportation. The collection of firewood is a major task for most families, especially women and children. Although the goal of this project was not to provide firewood, the agroforestry portion made a small contribution through pruning that was available for use by the families.

Component 9: Project Risks and Mitigation

All projects face some risks during the project implementation stage as well as after the project is completed and this project was no different. However, given FHIA's project experience, it was estimated that the greatest risk would come from natural phenomena such as hurricanes. However, it should be noted, that once the project was started, those small-scale producers participating immediately began to learn how to minimize the effects of natural disasters. Through improved hillside agroforestry farming techniques, coupled with the planting of perennial crops, they were able to see relatively quick results. Although there was also some risk with a project of this size, especially since not all of the individuals in a given community are not as dedicated as they should be, FHIA made every effort during the planning stages to select only those producers with the appropriate demographic characteristics (previous experience, commitment, family interest, appropriate land holdings, etc) to warrant their participation.

Results and Conclusions

Increase in income, employment, and quality of life

As a result of these programming efforts, rural families now have increased their yearly incomes to an average of approximately US\$2,500 per hectare utilizing perennial crops alone. The combination of cacao and other perennial crops such as rambutan and fine wood species for shade, rather than the traditional low-value cacao shade varieties has the potential to raise incomes to more than US\$100,000 over a 20 year period. Employment opportunities have also increased as there is a need for laborers during the implementation phase and then for crop production, harvesting, and marketing. Approximately 1,100 new jobs brought in an estimated \$941,000 of income.

Diversified high-value agriculture utilizing sustainable practices

Through the introduction of new cacao plantings coupled with other high-value commodities such as plantains, tropical fruits and fast-growing tropical woods, the risks inherent in hillside farming are spread out over more enterprises. The planting material distributed included 43,000 cacao, rambutan, coco and other fruit trees; 580 plantain corms; 170 pounds of vegetable seed; 35,000 fast-growing and fine wood species, and 80,000 other plants including

yucca and maracuya. These new plantings in most cases only took up about one-half of the land area for a family; therefore, they still had ample room to produce their own basic commodities for home consumption.

Diminished impact of human activities and natural disasters in fragile areas

The mixture of hillside cattle grazing and slash and burn land preparation for basic grains such as maize and beans creates an unsustainable environmental nightmare. Through the introduction of high-value perennial crops and the removal or restriction of grazing to more appropriate areas, producers have very little need to use slash and burn practices. In addition, the improved environmental conditions on their lands have greatly reduced rain-caused erosion, improved air and water quality, protected remaining forests and provided for reforestation efforts.

Lessons learned from this project

(1) one hectare was the minimum area necessary to maintain family interest and to make it economically important and to guarantee sufficient income; otherwise, farmers would soon return to planting basic grains; (2) it was essential to supply farmers with good quality planting material to establish the base planting since they did not have access to a ready supply nor cash to purchase it; (3) the training needed to include every step from the establishment of the original plots through all phases of production, post harvest, and marketing, and (4) all of the different types of agroforestry and fruit tree systems provided greater income than the traditional basic grain system and at the same time helped to protect the fragile environment condition of hillside systems.

Educational Importance, Implications and Application

There are several different combinations of perennial crops mixed with fine wood and fast growing word species that can serve as combinations along with cacao on fragile hillside areas. It is strongly recommended that FHIA's efforts be reviewed by others and replicated in other hillside areas of Honduras and Central America in general. The project methodology has been very successful in the north coast and piedmont areas of Honduras. However, poor, rural families in other areas may very well benefit from the same technology.

From an educational standpoint, the training programs, seminars, and one-on-one outreach efforts involved with implementing this type of project also need to be reviewed and perhaps replicated in other areas. While there is nothing magical in what FHIA has done, it seems that very few other programs in Honduras have come up with the combination of plant materials, research, technical expertise, training, and outreach. The long-term changes in behavior as a result of this program should be further examined to determine the exact role of each component.

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