

2007

# Action-Oriented Sustainable Agriculture Education: Attitudes Towards Nutrition and Agricultural Practices in Guaimaca, Honduras

Sarah Lynne Potenza  
*The University of Montana*

Let us know how access to this document benefits you.

Follow this and additional works at: <https://scholarworks.umt.edu/etd>

---

## Recommended Citation

Potenza, Sarah Lynne, "Action-Oriented Sustainable Agriculture Education: Attitudes Towards Nutrition and Agricultural Practices in Guaimaca, Honduras" (2007). *Graduate Student Theses, Dissertations, & Professional Papers*. 1231.  
<https://scholarworks.umt.edu/etd/1231>

This Professional Paper is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact [scholarworks@mail.lib.umt.edu](mailto:scholarworks@mail.lib.umt.edu).

ACTION-ORIENTED SUSTAINABLE AGRICULTURE EDUCATION: ATTITUDES  
TOWARDS NUTRITION AND AGRICULTURAL PRACTICES IN GUAIMACA,  
HONDURAS

By

Sarah Lynne Potenza

Bachelor of Arts, University of California, Santa Cruz 1999

Professional Paper

Presented in partial fulfillment of the requirements  
for the degree of

Masters of Science  
in Resource Conservation,  
International Conservation and Development

The University of Montana  
Missoula, MT

Spring 2007

Approved by:

Dr. David A. Strobel, Dean  
Graduate School

Dr. Stephen Siebert  
Department of Forest Management

Dr. Jill Belsky  
Department of Society and Conservation

Dr. Neva Hassanein  
Department of Environmental Studies

## ABSTRACT

Potenza, Sarah, M.S., May 2007

Resource Conservation

Chair: Dr. Stephen Siebert

Agricultural policies and global economic forces negatively affect many small-scale farmers in developing countries, resulting in widespread micronutrient malnutrition and environmental degradation. This study explores the connections between these issues, and the efficacy of using participatory education on sustainable agriculture to address them at a local level. Specifically, it evaluates an action-oriented education and sustainable agriculture program in Honduras, from the perspective of the participants and my own participation, as a means to improve agricultural practices and rural nutrition among subsistence farmers.

As in many developing countries, access to land, poor soil conditions, steep hillsides, adverse climatic conditions, and limited seed supplies affect the ability of Honduran subsistence farmers to produce enough food to supply their families' dietary needs. In addition, limited access to affordable healthy foods compounds problems of rural malnutrition and nutrient deficiencies. A supplemental educational program was initiated at a Catholic boarding school for high school girls in Guaimaca, Honduras, to address these issues. The project worked with young women and their families to design a pilot organic farm and garden to teach girls how to use sustainable agriculture practices in order to increase both crop and dietary diversity. The project also utilized education to reinforce fieldwork with classes on nutrition, cooking, agronomy, and environmental science. I conducted a series of mixed-method participant surveys to assess the effectiveness of the project from the perspective of the participants. The data collection methods utilized included semistructured and unstructured interviews, participatory questionnaires, and participant observation. The results suggest that participants adopted lessons on sustainable agriculture and nutrition, and ultimately expanded the program from a school farm project to household and community agriculture projects.

## ACKNOWLEDGEMENTS

I would like to thank *las Hermanas de Guaimaca*, the Sisters of Guaimaca, for their unflagging support of my work in their town. Not only did they care for me as part of their family, but they renewed my faith in the honor and dedication of people to work for justice and positive change. They are an inspiration. *¡Muchos gracias, hermanas!*

I spent a year in Guaimaca, Honduras, and was met with kindness and friendship from all that I met. To my students at the *Internado*, thank-you. I miss you all. I am grateful to all the families of the students that opened their doors to this project. Additionally, I would like to thank Mario and Emilio, organic farmers, friends, and advisers, Maria Elena and Manuel, my neighbors and helpers; Ricardo, co-teacher and friend; and so many more. Each helped probably without realizing how much your support and friendship meant to me.

Sara, Ben, Christina, and all of my fellow volunteers in Guaimaca, thank you for being there with me through parts of the journey. Your friendship helped me get through the rough and tough days. Chad, thank-you for your patience in those hot days in the sun, and for getting the rototiller to work. Without you, I would not have seen Honduras beyond Guaimaca. Thank-you for all of our adventures.

To Dr. Stephen Siebert and Dr. Jill Belsky, thank-you for guiding me through these years in Missoula. Your example has been inspiring. Steve, thank you for your advice in developing the project, and insightful editing of this paper.

Finally, thank you to my family. You led me to Honduras through your own work and dedication. Thank you for supporting me in all these years of school, moving, and traveling. I love you.

## PREFACE

From September 2005 to October 2006 I lived and worked in Guaimaca, Honduras on a project which focused on connecting sustainable agriculture and environmental education with rural nutrition and improved agricultural techniques. For me, the road to Guaimaca began as an undergraduate at the University of California, Santa Cruz, in a class by Dr. Steve Gliessman, Agroecology and Sustainable Food Systems. My interest in organic farming and sustainable agriculture continued upon graduation when I worked on organic farms in New Zealand, and later became the Sustainable Agriculture (SA) Program Coordinator at the Ecological Farming Association in Watsonville, CA. As the SA program coordinator, I facilitated the incorporation of sustainable and/or organic agriculture techniques on conventional farms. I was aware of the difficulties in altering large-scale farming systems in the U.S. to become more agroecological, and of the importance in doing so for long-term solutions to failing agricultural productivity and environmental damage. I also realized that even when a farm is losing productivity, change might be too big of a gamble for many farmers without the aid of education and encouragement. Education is often a key component to farmers' ability or willingness to risk changing a traditional farming system to incorporate sustainable agriculture principles.

During this time, I visited the town of Guaimaca while on a trip to Honduras and Costa Rica. In Guaimaca, I met a small-scale organic coffee grower named Mario Gonzalez, and remember asking him why he decided to become organically certified. I was surprised to hear the first reason he mentioned was that the International Monetary Fund

had offered Honduras debt-forgiveness on loans for ecological protection. Nation-state relations with international lending organizations can impact rural farmers, and these farmers are often aware of the impacts, even if they live in remote rural villages without electricity. At the University of Montana, I continued to explore how global trade relations affect local economic conditions, agricultural production, and dietary well being in developing countries.

On my first visit to Guaimaca, I met the Sisters of the Dominican Order, a group of Catholic nuns working on low-cost health care and female education issues. I was immediately impressed with their involvement with local farmers and the connections they made between rural food production and nutrition. For my graduate work, I contacted the Sisters, and discussed returning to Guaimaca for a year to start a project with them that focused on these issues. The Sisters asked me to start a pilot organic diversified farm project with their female students, which later expanded to rural mountain garden sites throughout the Guaimaca area.

## TABLE OF CONTENTS

|  |      |
|--|------|
| LIST OF FIGURES.....   | viii |
| CHAPTER 1. INTRODUCTION .....  | 1    |
| 1.1 Soul Sisters and the Guaimaca Garden Project.....                    | 1    |
| 1.2 Connections.....   | 8    |
| 1.3 Hidden Hunger.....   | 8    |
| 1.4 Changing Rural Food Systems.....                                     | 10   |
| 1.5 Alternative Development Paradigm.....                                | 12   |
| 1.6 Participatory Action-oriented Education.....                         | 14   |
| CHAPTER 2. HONDURAS COUNTRY SPECIFICS.....                               | 17   |
| 2.1 Honduras Country Background and Demographics.....                    | 17   |
| 2.2 Honduran Economic Trends.....  | 18   |
| 2.3 Agriculture in Honduras.....   | 22   |
| 2.4 The Catholic Church in Honduras.....                                 | 24   |
| CHAPTER 3. RESEARCH SITE.....  | 27   |
| 3.1 Guaimaca, Honduras.....  | 27   |
| 3.2 School Farm Site.....  | 29   |
| CHAPTER 4. RESEARCH METHODS.....   | 31   |
| 4.1 Program Structure: Action-oriented education.....                    | 31   |
| 4.2 Research Methods.....  | 35   |
| CHAPTER 5. RESULTS.....  | 40   |
| 5.1 Semistructured Student Participant Interviews and Questionnaire..... | 40   |

|  |    |
|--|----|
| Section 1: En su casa/ At your house.....                        | 40 |
| Section 2: Agricultura en Honduras/ Agriculture in Honduras..... | 42 |
| Section 3: La programa de la huerta/ The farm program.....       | 43 |
| Section 4: Nutrición/ Nutrition.....                             | 45 |
| Section 5: Evaluación/ Evaluation.....                           | 49 |
| Section 6. Beneficios de proyecto/ Project Benefits.....         | 53 |
| Section 7. Estructura de la clase/ The class structure.....      | 55 |
| 5.2 Household Questionnaire.....                                 | 56 |
| First Family/ Household Questionnaire, August 2006.....          | 56 |
| Second Family/Household Questionnaire, September 2006.....       | 57 |
| CHAPTER 6. DISCUSSION AND CONCLUSION.....                        | 60 |
| 6.1 Discussion.....  | 60 |
| 6.1.1 Using Compost.....   | 60 |
| 6.1.2 Seed Saving.....   | 62 |
| 6.1.3 Healthy Habits.....  | 63 |
| 6.1.4 Participatory Action-oriented Education.....               | 65 |
| 6.1.5 Lessons learned.....                                       | 66 |
| 6.1.6 Future for Guaimaca Garden Project.....                    | 70 |
| 6.2 Conclusion.....  | 72 |
| REFERENCES.....  | 76 |
| APPENCICES.....  | 85 |

## LIST OF FIGURES

|  |    |
|--|----|
| Figure 1. Changing local food systems.....   | 11 |
| Figure 2. Map of Honduras.....   | 17 |
| Figure 3. Relief diagram of Guaimaca from parade float.....  | 27 |
| Figure 4. Crop diversity per household.....  | 41 |
| Figure 5. Farming Activity.....  | 41 |
| Figure 6. Perceived barriers to diversified agriculture in Honduras.....   | 43 |
| Figure 7. Requirements for more diversified agriculture in Honduras.....   | 43 |
| Figure 8. Newly acquired skills resulting from project participation.....  | 44 |
| Figure 9. Project participants reported intention to use learned behavior / skills from<br>project in the future ..... | 45 |
| Figure 10. Student perception of why the garden project emphasized diversified<br>farming .....                        | 49 |
| Figure 11. Household seed requests.....  | 57 |

## CHAPTER 1. INTRODUCTION

### 1.1 Soul Sisters and the Guaimaca Garden Project

From September 2005 to October 2006, I lived in Guaimaca, Honduras and established a pilot diversified agriculture and education program. I worked through a Catholic boarding school administered by three Columbian Sisters. I met Sister Maria Ceballas in Guaimaca in 2002, and was impressed by her awareness of the connections between local environmental degradation and public health, as well as her interests in organic food and farming. I approached her about starting a diversified organic farm in Guaimaca as a demonstration farm and to supply the *Internado* (the boarding school for girls) with fresh food. Upon my arrival in Guaimaca, Sister Carmen Rivera, the director of the *Internado*, asked me to teach a class to the girls on sustainable agriculture and education, with the hope of addressing the issues of environmental awareness, nutrition, and improved farming practices.

“The agriculture project was initially pursued as a culture-sensitive approach to education. The girls of the *Internado* are coming from rural areas and we want to keep them connected to their roots. We cannot promise them a future outside of their rural area at this time, but if they can go back and use their education to start diversified family gardens and/or small businesses where they can sell vegetables this would be a positive change.” (Ceballas, pers. comm, 2006)

The Sisters in Guaimaca are of the Dominican Order, whose mission statement embraces a concern for social justice and peace. Their order is particularly concerned with working on issues of education, access to health care, justice, peace and solidarity for the marginalized poor. They currently have missions working on HIV/AIDS in Zambia, leprosy in Cameroon, and peace and justice in Guatemala, just to name a few. “The Sisters are the more numerous section of the Dominican Order [they outnumber their

male counterparts], and more sensitive to the needs of people, especially the poor and oppressed, and often more active in promoting human rights” (Father Damian Byrne, Master of Dominican Order, 1990).

Two of the Sisters in Guaimaca are nurse practitioners, and the third is an educator. The Sisters are very busy: since moving to Guaimaca six years ago they have started a low-cost medical clinic, an organic coffee cooperative, an organic soybean nutrition program for mothers and children, a women’s sewing cooperative, a boarding school for girls, and most recently, a 300-acre organic farm. According to Sister Maria Ceballas (pers. comm, 2005), the ‘vision for the mission’ came in response to an appeal made in 2000 by Pope John Paul II to religious members from the North and South to work together for the people as one church, not as the North American Church and the Latin American Church, or as rich and poor.

The religious Sisters started providing health care services in Guaimaca in 2001 by opening a low-cost medical clinic, but quickly identified that “the greatest illness was poverty, misery, and ignorance at many different levels” (Ceballas, pers. comm, 2006). Therefore, while continuing to provide health care, they began to work with single women and youth by teaching them skills that would enable them to provide for their families and escape from the cycle of poverty, domestic abuse, and illiteracy.

The educational system in Honduras has left many women completely uneducated because they cannot afford public school (pers, obsv, 2005). School is ‘free’, but

uniforms are required, and are one of the main restrictions for the most impoverished to become literate. If a family must choose between children, boys are educated before girls. In addition, the social/gender system in Honduras is similar to many other Central American countries. Women live with the constraints enforced by religion, politics, class, and gender. According to the Sisters (pers. comm, 2005), machismo behavior by men is culturally acceptable, which often translates into domestic abuse, high birth rates, and single, unsupported mothers at a very young age.

The Sisters of Guaimaca started a women's cooperative, which works with a group of young, illiterate, impoverished and abused mothers. It is the Sisters' belief that the limitations of women's roles in society will change when women move from passive participants to active agents in their lives. Financial independence and the ability to provide an education and a better future for their children are keys to this change and empowerment. The first step the Sisters took towards this was creating a sewing center where women learned to make and sell school uniforms. The sewing center provides valuable training and an independent source of income for single mothers. It also provides economical uniforms not only to their children, but also to all the children of Guaimaca. The work of the sewing center, and the women trained there, will enable the most impoverished of the next generation to become literate, and offer them the possibility of changing their economic condition. The second step Dominican Sisters took towards altering the social/ gender system was making education accessible to rural girls, so the next generation would have a better head start.

Guaimaca is the seat of the municipality, and has the only secondary school in the area. There are no secondary schools in the surrounding mountain villages. Though school is compulsory through 6<sup>th</sup> grade, only 30% of children continue to secondary school, the equivalent of US high school, and only 8% continue to university level (US Library of Congress, 1993).

In 2005, the Sisters finished constructing the *Internado*, or boarding school, whose roster of students is based on wealth and gender. The nuns invite the poorest girls from the most under-served rural mountain villages to attend the program in Guaimaca, which enabled these girls to complete high school. Now in its second full year of operation, the *Internado* is a residence in Guaimaca for about 40 girls, ages 11-17 from mountain villages up to 5 hours away. The *Internado* provides free room and board and is the only chance any of these young women have to continue education beyond the 6<sup>th</sup> grade.

Although the Sisters themselves are Colombian, they are sponsored by the Diocese of Fall River, Massachusetts. The Sisters host volunteers in Guaimaca for one or two year positions as nurses, doctors, teachers, farmers, and administrators. The volunteers come from a wide range of backgrounds, countries, and faiths, and have a diverse range of skills. Though I am not Catholic, the nuns invited me to work with them at their school to help develop an agriculture-based curriculum.

The project I designed was one component of the *Internado*'s supplemental education program, with the idea that the students would return to their villages and bring with them

the hands-on ability to provide their families with a healthier diet, healthier environment, and more marketable farm skills which can be passed on to the next generation of Hondurans.

I developed a yearlong curriculum based on direct action-oriented learning in the farm garden, reinforced with classes on nutrition, cooking, agronomy, and environmental studies. As the program progressed, the students began taking over more responsibility for the management of the school farm project. After nine months of classes and practice, the young women independently decided to expand the program to their own villages where they returned weekly, to start family gardens. I assisted this part of the project by making trips with them to meet their parents and relatives, and to advise them on ways to grow a wide range of vegetables organically. Once the program expanded to include the families and relatives of the young women, the class focus shifted to include workshops for adults on topics such as composting, vegetable production, and seed saving. We divided the village garden sites into different regional zones, which I visited on a rotational basis with the girls to discuss diversified farming with their families and to help establish gardens.

According to Sister Rivera, the vision for the project grew from a pilot site to an integrated community-wide project:

“Now, the garden is small, but in the future, as the number of students grows, we would like to expand the garden to make it bigger, to make it into a *huerta mixta* (an integrated mixed farm). The information of the villages can come to the school farm, and the information of the school farm can go to the villages. The school farm can be a model ‘mixed farm’: one that has fruit, vegetables, grains, a fish farm [tilapia], worm

composting, chickens, and more. For the villages, we want to start other projects in relation to family gardens. For example, now in Los Leones [a mountain village near Guaimaca], they are building a large chicken coop to cultivate chickens not only for the villages, which are very poor, but also for the *Internado*. In the following year, both the *Internado* and the family can eat the eggs and chickens. In Ojo de Agua [a mountain village near Guaimaca] they cannot bring their products here to sell, because it is too far. But, they have tilapia, and beautiful crops, and so we are organizing how to bring their tilapia and produce here in one of the trucks for the *Internado* and the markets in town. (pers. comm, 2006) ”

Sister Rivera envisions the Guaimaca garden project creating a connection between the mountain villages and town that otherwise would not be possible. She also encourages the students to become their communities’ teachers, and disseminate the information from our classes to their villages.

This paper first examines the global factors of influence that affect local socio-economic conditions, and in turn local diet and agricultural practices in developing countries. It then examines the Guaimaca garden project from the perspective of the participants to assess the effectiveness of the participatory action-oriented education style of the program, and how the project affected participants’ view of diversified sustainable agriculture and nutrition.

## 1.2 Connections

Before further discussing the project I was part of in Honduras, it is important to understand why there was a need for such a project in the first place. Why are subsistence farmers increasingly unable to meet their families’ dietary needs? Is it because of local problems in soil and land quality, or are forces on a global or national

scale affecting their well being? As Blaikie (1985) discussed in his seminal work on the political economy of soil erosion in developing countries, an initial analysis of soil erosion may indicate that the problem is place-based: too many peasant farmers on steep hillsides using improper agricultural techniques cause soil erosion. However, upon further investigation, the origin of soil erosion may be found in another place altogether, where there are no indications of a problem: the productive and fertile valley floor that was appropriated for an intensive fruit plantation, thus displacing the peasants to the fragile hillsides. The spatial scale of analysis often must be directed beyond the local problem to include the larger landscape, where perhaps there is no visual environmental degradation, but from which marginalization, displacement, and the resulting ecological and economic instability stem.

Similarly, in Honduras, issues of food security, nutrition, and agricultural practices are more complex than an initial place-based analysis may indicate. It is first necessary to consider global trade and nation-state policies to understand how local food systems and farming have been impacted.

The situation in Honduras is not unique; throughout the developing nations, small scale and/or subsistence farmers, the sections of society frequently with the lowest levels of education, often have difficulties succeeding in the face of changes resulting from neoliberal trade policies (Korzeniewicz and Smith, 2000). For the purpose of this study, I will briefly examine connections between global economic policy, agricultural practices, and malnutrition in developing countries, and in particular, how integration into the

international market led to export-oriented agriculture in Honduras. This in turn affected agricultural practices and food availability on a local level. I will then consider an alternative development paradigm, sustainable agriculture, and the value of participatory action-oriented education in adopting new agricultural methods. These conditions are first considered through a global lens, and then focused specifically on Honduran conditions, where this study took place.

### 1.3 Hidden Hunger

Malnutrition resulting from micronutrient deficiencies, or 'hidden hunger', affects more than 3 billion people (or half the world population), mostly women and children living in developing countries (Welch and Graham, 2005). Humans require at least 50 nutrients regularly and in adequate amounts in order to be healthy and productive, a few of the more common ones include iron, iodine, vitamins A, D, B<sub>2</sub> and B<sub>12</sub>, folate, and zinc (Welch and Graham, 2004; Welch and Graham, 2005; Ramakrishnan, 2002; Viteri and Gonzalez, 2002). Particular debilities resulting from micronutrient malnutrition include stunted growth, wasting, impaired cognitive development and functioning, immune responses, and reproductive health (Adelekan, 2003). In many countries, micronutrient deficiency exceeds protein-energy malnutrition (Ali and Tsou, 1997). For example, in Central American countries, where the traditional subsistence food system is corn and beans, protein and caloric intakes are generally at acceptable levels, but still there are high incident rates of stunting, anemia, and infant mortality, indicating inadequate micronutrient availability (Graham et al., 2007).

Locally produced foods are increasingly being replaced by imported processed foods, which while inexpensive, are low in nutritional value and high in calories and carbohydrates (Sobal, 1999, as cited in Welch and Graham, 2005). Consequently, diseases generally associated with the overfed (heart disease, diabetes, obesity, etc) are found in alarming rates in developing countries. This condition is known as 'nutrition transition' (Clugston and Smith, 2002; Lajolo, 2002; Welch and Graham, 2005). In Honduras, the diet consists largely of carbohydrates in the form of tortillas, rice, beans, plantains and sweetened drinks. There is an extremely high incidence of type 2 diabetes resulting from this diet (Herman-Rivera and Thomas, 1999).

One possible avenue for remediation of micronutrient malnutrition is through bio-fortification of food products, such as by engineering iodine into salt, vitamin A into rice, or iron into grains. Much attention has been directed towards this option over the past two decades (see Graham et al., 2007; Khush, 2001; Welch and Graham, 2005). However, a growing consensus among nutritionists is that this approach is unsustainable (Roos, et al., 2002). Identifying appropriate foods for fortifying, cost, availability, accessibility, and local acceptance of fortified foods by vulnerable populations present prohibitive problems (Ali and Tsou, 1997; Roos, et al., 2002). A holistic alternative would be to integrate more micronutrient-rich foods such as vegetables and fruits into daily diets. Some consider this the only sustainable method of eliminating micronutrient deficiencies, and that the role of home gardening in supplying family nutrition requirements needs more attention (Ali and Tsou, 1997; Khan and Begum, 2002; Taher, et al., 2002; Tontisirin, et al., 2002).

#### 1.4 Changing rural food systems

Food security is of growing concern throughout the world. Globalization and neoliberal trade policies promised prosperity to developing nations. Many contend that instead global trade has increased economic disparities between the rich and poor, and that the poor are increasingly harmed by global trade (Winters, McCullough, and McKay, 2004). The effects of globalized trade relations can be variable and difficult to assess, and some economists argue that the evidence is inconclusive as to how these policies affect poverty (Easterly, 2001). However, neoliberal trade relations are reshaping local conditions worldwide, and are not creating a uniform social and environmental landscape (Roberts and Thanos, 2003). Nowhere is this more apparent than in Latin America, which suffers the highest levels of inequality in the world (Korzeniewicz and Smith, 2000).

World Bank / International Monetary Fund (IMF) structural adjustment programs have encouraged trade liberalization through such loan conditionalities as the privatization of social services, deregulation, placing emphases on regional comparative advantages in such areas as labor and agriculture, or the consolidation of a country's agricultural base from native foods to a few select crops destined for export markets (Peters, 2004). As traditional crops were replaced with cereals during the green revolution or other commercial foods during the current economic revolution, micronutrient availability in foods for the poor has decreased (Welch and Graham, 1999). While some sectors have been stimulated by structural adjustments, the economic benefits have not been evenly distributed (Korzeniewicz and Smith, 2000). In fact, some analysts have found that these

policies have created a significant worsening of income distribution in developing countries (Berry, 1997, as cited in Korzeniewicz and Smith, 2000; Peters, 2004; Portes, 1997).

Although agriculture remains the largest global employer, rural economies suffer under the terms of international trade policies (figure 1): real food prices drop, leading to a loss of local agricultural capacity, while dependence on imported processed foods increases (Scialabba, 2003). Small-scale farmers are unable to purchase inputs such as seeds, chemical inputs, and irrigations systems, and so are unable to access the conventional food production model and sell their produce (Scialabba, 2003). The result of these policies is reduced availability of affordable and healthy food, food insecurity, and increased micronutrient deficiency (Scialabba, 2003; Welch and Graham, 1999).

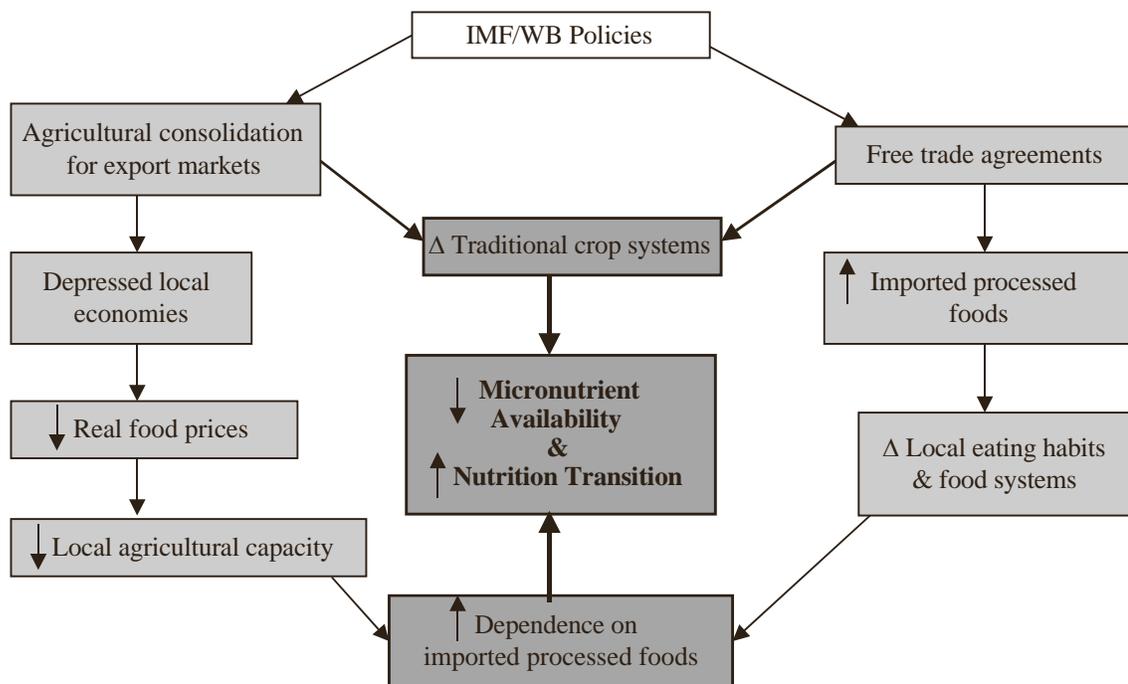


Figure 1. Changing local food systems schematic, showing the relationship between international policy structures and local nutrient availability

Industrialized agriculture on a global scale affects not only international markets, but also local markets by replacing traditional foods and local fruits and vegetables with imported processed foods of little nutritional value.

### 1.5 Alternative Development Paradigm

Modern agricultural practices, from the green revolution to current genetic modification of crops, have dramatically increased agricultural productivity, especially in cereals, for those that are able to access these technologies (Scialabba and Hattam, 2002). However, conventional or industrialized agriculture can also adversely affect natural and dietary biodiversity, result in soil and water degradation, and compromise ecosystem functions (Scialabba, 2003; Scialabba and Hattam, 2002). Furthermore, while modern technologies such as improved varieties and chemical inputs helped increase yields among some farmers, they do not address environmental instability, and many farmers lack the financial resources to purchase them (Arrellanes and Lee, 2003). Sustainable agriculture (SA) is an alternative agricultural paradigm that recognizes the connection between agriculture and biodiversity and in doing so, connects food and livelihood needs with natural system protection (Scialabba and Williamson, 2004).

Perspectives on what SA means can vary, but broadly, it is defined as agricultural techniques that are environmentally sound, economically viable, and socially responsible (EFA, 1990). SA often incorporates organic methods, minimizes the use of external chemical inputs, focuses on soil fertility management, integrated pest management, water

conservation, and farm diversity (EFA, 1990). In essence, SA considers the farm system as part of the natural ecosystem, and incorporates agroecological principles to perpetuate farm productivity, whether on household garden or farm scale.

The Food and Agriculture Organization (FAO) of the United Nations has emphasized SA throughout developing countries as a means to combat poverty and malnutrition in rural communities in recent years. FAO studies have examined the efficacy of using SA / organic agriculture methods to reach the poorest sectors, which are often bypassed by conventional agriculture development; explored connections between dietary diversity and natural diversity in farming systems; and potential ways to increase food security through SA (Muller, 2006; Scialabba and Hattam, 2002; Scialabba, 2003; Scialabba and Williamson, 2004; Toledo and Burlingame, 2006; Zanolli, et al., 2007). These studies offer evidence of the growing attention focused on sustainable agriculture. Increasingly, SA is seen as a potential means to reduce poverty, increase economic viability, improve biological and dietary diversity, and promote environmental protection (Perz, 2004; Toledo and Burlingame, 2006).

Sustainable agriculture may provide a means for rural communities to gain access to international niche markets, defend their rights to resources, and pursue self-determination by forming powerful institutions able to collaborate with international NGOs and connect with distant consumers (Holt-Giménez, 2006). SA could also be a way for small-scale farmers to organize into cooperatives and gain certification as organic, sustainable, fair trade, environmentally friendly, or any of the other certifications

that garner consumer premiums in foreign markets (Hattam, 2002). Finally, the point I find most interesting for the purpose of this study, SA could be a means for subsistence farmers to stabilize income and improve nutrition through agricultural diversification (Holt-Giménez, 2006).

My experiences working with farmers in US through the Ecological Farming Association taught me the difficulties many farmers face in making production changes. Many farmers may be poised on the edge of economic ruin from decreasing farm productivity, but afraid to change their traditional farming practices. It is my belief that education is a key component to enable farmers to risk changing their livelihoods and incorporate sustainable agricultural practices into their farm system.

### 1.6 Participatory Action-oriented Education

Participatory action-oriented learning can be a powerful SA training tool. In recent years, the World Bank and Food and Agriculture Organization (FAO) of the United Nations have shown demonstrated success with participatory education programs for farmers. They have promoted farmer field schools (FFS) as intensive participatory learning programs, which rely on interactive learning and field experimentation (Feder, et al., 2004). An important aspect of FFS is that participants are encouraged to teach others, and to become agricultural trainers (Godtland, et al., 2004). FFS seeks to ‘send farmers back to school’ as a means to influence their agricultural choices (Feder, et al., 2004).

In the United States, many schools are working with students to connect food and farming issues from a young age. Started at the University of California, Santa Cruz in 1978, Life Lab uses school gardens as a ‘living laboratory’ for action-oriented learning about environmental and earth sciences, farming, and nutrition, and the program is found in more than 1400 schools today (Life Lab, 2006). Similarly, farm-to-school programs work with school-age children, particularly low-income youth to improve health, nutrition, and community food systems (Vallianatos, et al., 2004). Typically, these programs connect schools with local agriculture, create school gardens where students participate in growing their own food, and incorporate classes on nutrition and diet into the school curriculum (Rimkus, et al., 2004). There is potential to blend aspects of the FFS and these US participatory learning programs to the site-specific conditions found in developing countries in order to work with students to connect nutrition and farming practices from a young age.

Multi-disciplinary education is a proven means of alleviating environmental degradation and encouraging adoption of ecological or sustainable agriculture methods (Scialabba and Williamson, 2004). When education focuses on women, it can positively affect nearly every aspect of development, from raising agricultural productivity to improving environmental management (World Bank, 1996). Specifically, environmental education has the potential to foster more sustainable resource management, natural resource conservation, and environmental health (Bekalo and Bangay, 2002; Pyrovetsi and Daoutopoulos, 1999; Sarkar and Bhattacharya, 2004). Integrating nutrition programs and sustainable agriculture into a single program has the potential to reduce hunger, improve

nutrition, and increase agricultural productivity in rural communities (Ruel and Levin, 2000; Sanchez and Swaminathan, 2005).

This study worked with a group of female students, and later their families, to create a pilot organic garden using sustainable agriculture principles to increase their ability to produce diversified crops in Guaimaca, Honduras. I stressed connections between food, farming, and nutrition, and used participatory action-oriented education to reinforce fieldwork. Class topics included nutrition, cooking, agronomy, and environmental sciences and were generally conducted in the field, using the garden as our laboratory for experiments, investigations, mapping, role-playing, and more. The girls grew the food they ate at their school as all harvest went to the school kitchen. Eventually, the girls in the Guaimaca garden project became their communities' teachers, and disseminated the information on organic and/ or sustainable agriculture to their villages where they started diversified household gardens. I later used a series of mixed method participant surveys to assess the effectiveness of the project from the perspective of the participants, including the young women, their families, and the Sisters of Guaimaca.

## CHAPTER 2. HONDURAS COUNTRY SPECIFICS

Chapter 2 narrows the focus of this study from an international scale of analysis to the nation-state conditions in Honduras. It discusses the country's demographics, economic trends, agriculture, and religious setting, and lays the foundation for why this project was initiated.

### 2.1 Honduras Country Background and Demographics



Figure 2. Map of Honduras

Honduras is located in Central America, with coastlines on both the Pacific Ocean and Caribbean Sea, and is about the size of Tennessee (figure 2). Its land is comprised mostly of steep mountains, with a narrow coastal plain known as the Mosquito Coast. Only 15% of the land in

Honduras is arable, but agriculture

remains one of the largest economic sectors for the country; consequently, the majority of the farming occurs on 'sub-optimal' hillsides (CIA, 2007).

The population of Honduras numbers about 6 million, with 41% under the age of 15 (CIA, 2007). The majority of the population is Mestizo (90%), with small populations of Mayan Indian, Garifuna, and whites. As with most of Latin America, there is a strong

Roman Catholic presence in Honduras, and nearly 97% of the population belongs to this church. There is, however, a growing evangelical Protestant movement (CIA, 2007).

A former Spanish colony, Honduras gained independence in 1821. Since independence, it has experienced nearly 300 insurgencies, internal rebellions, civil wars, and changes in government, more than half of which occurred during the 20<sup>th</sup> Century (USAID, 2005). In 1982, the first civilian-elected president ended nearly 20 years of military dictatorship. Since the 1980's, Honduras has held democratic presidential elections, but remains plagued by government corruption, debt, and food insecurity (USAID, 2005). It is one of the poorest and least developed countries in Latin America and the Caribbean, with an estimated 22% of the general population and 53% of children malnourished, half of which are severely malnourished (David, et al., 2004; UN World Food Programme, 2005).

## 2.2 Honduran Economic Trends

To understand contemporary economic trends in Honduras, one must return to 1998, the year Hurricane Mitch struck and irrevocably changed the country. The worst hurricane in 200 years, Mitch hit Honduras the hardest of all the countries in its path. Of the 16,000 total dead or missing people resulting from Mitch, more than half were in Honduras alone (IADB, 2007). Approximately 1.5 million Hondurans, or nearly one third of the population, became homeless, and 70-80% of nation's infrastructure and 70% of all crops were destroyed (NOAA, 2006; USGS, 2005). Entire villages washed away and one third of the capital, Tegucigalpa, was damaged (NOAA, 2006). The flooding and erosion that

resulted from the storm removed 600 times more topsoil in a few days than the annual average (Haigh, et al., 2004). Landslides permanently altered entire watersheds, rerouting rivers and streams so that areas that were once fertile become barren (Haigh, et al., 2004). As the mother of one of this project's students said:

“I had a vegetable garden before Hurricane Mitch, with a wide variety of crops, but Mitch flooded the river, scouring the river bottom, and deposited the sand and gravel on our fields, and ruined their productivity. Since then, I have not been able to grow anything.” (pers. comm, 2006)

The effects of Hurricane Mitch continue in Honduras to this day, and it is estimated that national development was set back at least 20 years (Mejia, 2002). In the wake of the storm, Honduras became the focus of a massive influx of foreign aid and development projects.

Prior to Hurricane Mitch, Honduras was experiencing moderate economic growth. The storm dramatically changed its economic future. Honduras sustained over \$4 billion of damage from Mitch (NOAA, 2006). To put this in perspective, Gross Domestic Product (GDP) for Honduras in 2003 was \$6.5 billion. Hardest hit by the storm was the agricultural sector, which was responsible for the majority of the country's exports (CIA, 2007). Honduras' trade deficit has grown from \$445 million in 1999, to \$506 million in 2000, to \$690 in 2001 (NTE Report, 2002). Creditors offered Honduras financing arrangements to try to restore the economy to pre-Mitch levels. As Honduras' debt grew and ability to repay shrank, the International Monetary Fund (IMF) and World Bank

(WB) indicated the country might be eligible for debt-relief under its Highly Indebted Poor Countries (HIPC) Initiative (USGS, 2004).

In order to qualify for inclusion in the HIPC initiative, the IMF-WB created a Poverty Reduction Strategy (PRS) for Honduras. If Honduras was able to make satisfactory progress towards poverty reduction, it would qualify for debt relief. According to the PRS, some of the indicators of success in the program include privatization of services (such as water and electricity), increased energy capabilities (most of Honduras' electrical capabilities are hydroelectric), and expanded free trade enterprises and exports under the Central American Free Trade Agreement (CAFTA) (IMF and IDA, 2004).

In early 2005, the WB's International Development Association (IDA) and the IMF agreed that Honduras had satisfactorily met the requirements to qualify for the HIPC Debt Initiative. Resources made available for debt relief provided under the HIPC Initiative were allocated to fund key 'pro-poor' growth programs outlined under the PRS. According to the IMF/ WB, Honduras made significant progress in implementing the PRS as seen in the decline of extreme poverty to 44.6% in 2004 from 49% in 2000 (Stillwell and Martin, 2005). Overall poverty decline was more modest, at only a 2-point reduction to 64% during the same timeframe. In addition, infrastructure coverage indicators, such as electricity, have improved (Stillwell and Martin, 2005). On April 5, 2005, Honduras became the 16<sup>th</sup> country to reach its completion point (when debtors commit irrevocably to debt relief) under the framework of the HIPC Debt Initiative.

Despite international funding, development projects, and relief work, Honduras remains the second poorest country in Central America, with nearly 30 percent of the population unemployed, one quarter of the country malnourished, and per capita income at around \$800 (UN World Food Programme, 2005; Stillwell and Martin, 2005). Latin America has one of the most unequal distributions of income in the world, and within this region, Honduras ranks as one of the most unequal, with the wealthiest 20 percent of the population accruing 60.2 percent of the income and the poorest 20 percent of the population accruing only 2.4 percent (Nathan Associates Inc, 2006).

The Honduran government is counting on expanded trade through Central American Free Trade Agreement (CAFTA) and debt-forgiveness from the World Bank/ IMF to stimulate its economy (CIA, 2007). The World Bank/ IMF offered Honduras debt relief in exchange for incorporating neoliberal policies such as privatization of services, consolidation of agricultural commodities to emphasize regional comparative advantages in coffee, bananas, and citrus, and expanded free trade through CAFTA. Honduras had little choice but to accept the terms of the agreement. Unfortunately, while international neoliberal trade policies may stimulate certain sectors of the economy on a national level, many smallholders are unable to produce the high-end agricultural products needed to enter into the global market, and have no alternative markets in which to sell other produce (Scialabba, 2003).

### 2.3 Agriculture in Honduras

Agriculture was historically Honduras' largest economic sector, although after Hurricane Mitch, it fell to third place behind services and light industry, which are less vulnerable to natural disasters (CIA, 2007). In terms of scale and output, coffee, citrus, and bananas are the top agricultural products for export, but, among traditional non-industrialized (i.e., not exported) crops, beans and maize are the most economically important crops (CIA, 2007; Graham, et al., 2007). Beans and maize are grown primarily for home consumption, with excess sold on local markets (Graham, et al., 2007). If the most economically important non-industrialized (and not exported) crops are grown primarily for subsistence, this suggests how weak the national market is in locally produced foods.

Honduras has had an export-oriented economy since the colonial era (Roberts and Thanos, 2003). Like many colonial countries, Honduras suffered under hundreds of years of dependency capitalism, the dominant socio-economic pattern throughout Latin America (Walker, 2003). In the late 1800's, bananas transformed the country into a 'banana republic', whose economy was externally oriented and government controlled by a few national and/or international elites (Soluri, 2005; Walker, 2003). Honduras has an agricultural history of plantation farming which benefits the few, based initially on bananas, which then expanded in the past century to include coffee and citrus (Soluri, 2005).

While agriculture remains in the top three of Honduras' economic sectors, agricultural yields are low compared to neighboring countries (US Library of Congress, 1993). In

general, farmers have expanded production rather than improve techniques (US Library of Congress, 1993). Since only 15% of Honduras is arable land (CIA, 2007), and the landscape is a series of steep hillsides and mountains, flat bottomland is at a premium for agricultural use. Consequently, wealthy, large-scale, commercial farmers occupy the country's few valleys, while poor small-scale farmers have been pushed into suboptimal hillsides. The Honduran government, Dole Food Company and Chiquita Brands International, own 60% percent of Honduras' cultivatable land (US Library of Congress, 1993). As Stonich (1989, as cited in Nuemann, 1992) found, the expansion of agro-industrial production in Honduras after World War II created changes in land use patterns and concentrated productive land into large-scale industrial farms. This situation compelled poor farmers onto infertile soil and steep hillsides, and because of insufficient and/or unsuitable land for long term fallow periods, resulted in the use of environmentally damaging farming techniques such as shortened rotations of 'slash and burn' farming (CIA, 2007).

Traditionally, most small-scale Honduran farmers grow corn and beans, the basis of their diets, and perhaps coffee, but cultivate few vegetables. Farming is not easy in Honduras; it seems that each year farmers exert more effort for fewer returns. This may be a familiar story regarding farming worldwide, however, Honduran farmers face particular disadvantages, including a long dry season, steep terrain, nutrient deficient soils, and poor marketing and transportation. One reason that there are so many small-scale corn and bean farmers in Honduras is that these crops are relatively easy to grow: they respond well to chemical inputs such as pesticides and fertilizers, and the local varieties are hardy

and drought-resistant (pers. obs. & comm, 2006). Different skills and knowledge are required to cultivate a more diverse farm or garden and at present, many Hondurans struggle just to produce corn and beans. Farm diversification and improved productivity will require farmers to employ new agricultural practices, including incorporating annual and perennial intercrops, compost, improved soil management, and other low-input sustainable agriculture principles. As Sister Maria Ceballas, from the research site and project founder stated:

“For me, the most important benefit [of the project] is to demonstrate to the community around us that family gardens are possible for self-maintenance. If people had the knowledge and the means, most people have access to a little bit of land to use for a garden. We have demonstrated that growing commonly used vegetables such as onions, beets, cabbage, peppers, and so on, grow well, and can be grown organically. Another benefit is educating [the students] in the sense of diversifying agriculture, because this is the biggest problem with agriculture in Honduras – the lack of diversity.” (pers. comm, 2006)

#### 2.4 The Catholic Church in Honduras

The Guaimaca garden project worked with girls attending a Catholic boarding school and was funded by the Sisters of the Dominican Order, a Catholic group. The Catholic Church has played an important role in Honduras since the colonial era, and it continues to have a strong influence today, as 97% of the population is Catholic (CIA, 2007). Beginning in the 1960's, the Church's authoritarian role has weakened, and been largely replaced with the doctrine of liberation theology. Most recently, Honduras has seen the integration of ecotheology with liberation theology in parts of the country.

Latin American liberation theology developed during the 1960's social movements. It focused on clergy members and lay people working with the poor to fight against social injustice and the underlying structure of oppression from the ground up (Boff and Boff, 1994). Today, the ecotheology movement is incorporating aspects of liberation theology with environmental justice. Environmental justice seeks to redress the disproportionate environmental risks or 'burdens' that are borne by poor or disempowered communities. Ecotheology grew out the awareness of the link between the destruction of the environment and social, economic, and political injustice (Abraham, 1994).

Since the 1960's, the Catholic Church has played an important role in working with subsistence farmers, peasants, and workers to organize for social change in Honduras. They have had the on-and-off support of the Roman Catholic Church, at times encouraged to organize peasant reform, at other times labeled radical and communist, largely following movements in world politics such as the Cold War (US Library of Congress, 1993).

For the past fifteen years, Catholic priests and nuns in Honduras have played a major role in organizing a people's resistance movement aimed at environmental justice. Father Andres Tamayo, of Olancho province (the border of which is a few kilometers from the project site), leads an environmental movement with growing national support. A series of confrontations over uncontrolled logging and illegal construction of a dam in Olancho province led to the assassination of multiple village leaders and local activists between 1995 and 2000 and became a rallying point for the movement. In 2003, Tamayo led

more than 40,000 subsistence farmers, workers, and citizens on a 7-day march from the capital of Olancho, Juticalpa, to the national capital Tegucigalpa, over 100 miles away. The March for Life (*Marcha por la Vida*) demanded that the Honduran government halt illegal logging, protect biodiversity, and assure environmental justice. The Roman Church has once again withdrawn support for Honduras' activist religious members saying that they are causing civil unrest (Medina Murillo, 2004). The priests have received death threats, but the movement continues to gain momentum (Medina Murillo, 2004).

From his rural parish in the town of Salama, Tamayo has built a nationwide movement and become one of Honduras' leading environmentalists. On April 17, 2005, the Goldman Environmental Prize, regarded as the "Nobel for the environment", was awarded to Tamayo for the work he is doing in Honduras. The Group of Eight (Britain, Canada, France, Germany, Italy, Japan, Russia and United States) asked Tamayo to address them regarding these problems in July 2005. He was the only Central American invited to make a presentation at the meeting (Mejia, 2005). Tamayo and his environmental movement have brought national and international attention to environmental justice and the need for environmental protection in Honduras.

## CHAPTER 3. RESEARCH SITE

### 3.1 Guaimaca, Honduras



Figure 3. Students' depiction of Guaimaca in a valley, picture from a float at the town fair

Guaimaca is a town of a few thousand people about two hours north of the Honduran capital, Tegucigalpa. It is a market town in a narrow valley, surrounded by steep mountains and mountain villages (figure 3). Land use in and around Guaimaca focuses on agro-industrial tomato production, cattle pasture, and traditional corn and

bean crop rotations on small-scale family plots, sometimes combined with small-scale coffee production. Above the valley floor, pine forest is the dominant vegetation, and logging is a major industry in the area. Unfortunately, the majority of the logging is illegal, and does not benefit the local community beyond employment at the local sawmill, the second largest in Honduras (Environmental Investigation Agency, 2005). There are pronounced dry and wet seasons in Honduras. In Guaimaca, the dry season is generally from November/December to May, and is a time of hardship for many, with limited water supply and food.

Land use and ownership in Guaimaca reflect national patterns; smallholders generally only have plots high in the mountains, while the valuable valley land is used for large-scale agro-industrial tomato production for international markets. Conventional tomatoes

are a relatively high-input crop, requiring high levels of fertilizer, pesticides, and fungicides. As in other tomato-growing regions, Guaimaca faces associated problems of groundwater contamination and worker safety (pers obsv, 2006, Drinkwater, et al., 1995).

For Sister Ceballas,

“The health aspects of this project are huge, [it] being organic. It is so reassuring to know we are eating safe, organic products, given the fact that in Honduras, pesticide use is poorly regulated in agriculture (pers comm, 2006)”.

According to the medical staff at the clinic in Guaimaca, air pollution and water quality are serious threats to public health (Lara, pers. comm, 2006). During the dry season, the majority of children seen by the clinic have respiratory problems (Ceballas, pers. comm, 2006)). Smoke from the lumber mill and from the seasonal, countrywide land burning for pastures and farming combined with dry dusty roads leave many people suffering from bronchial afflictions.

During the peaks of the dry and wet seasons, the city water supply, which comes from the mountains, does not operate due to either too much water, or not enough water. When I arrived in Guaimaca, in October 2005, the town did not have water for more than two months because it was the wet season, and the heavy rains and resulting high level of sedimentation shut down the water supply. Then in the following spring, during the dry season, a lack of rainfall forced the city to turn off the water again. City officials sporadically opened the water pipes in certain neighborhoods for a few hours, and people left their taps open all week long, so they would not miss the chance to fill up their *pilas*, a concrete water basin found in every Honduran yard, when it came. During these times, people used the town river for their needs. However, the river that flows through town is

milky blue-green color, choked with algae and trash. Cars and buses are washed in the water hole just upstream from town, animals are grazed along the banks, farms along both sides are sources of agricultural runoff, clothes are washed in its waters daily, and outhouses are situated along its banks, all of which makes the water highly unsuitable for drinking. For up to 6 months of the year, the river is the only water available to the majority of people who cannot afford to buy purified water.

Environmental quality in Guaimaca is severely affected by a range of air and water contaminants, some of which could be ameliorated through raising awareness and targeted education. With more than 40% of the population in Honduras under the age of 15, the next generation's land management decisions and level of environmental awareness will greatly affect the environmental health of Honduras.

### 3.2 School Farm Site

The site of the school farm is an empty lot in one of the neighborhoods of Guaimaca, about 1/3 of an acre. This site was available because it is owned by the Sisters, and has a strong fence around the perimeter with barbed wire and a padlocked gate. It was also directly behind my house so I could keep an eye on it. We considered other fields that were much larger and that local farmers said we could use for the project, but ultimately we rejected their offers because the fields were unfenced. In the mountains, people generally only make lightweight fences to keep out livestock, but in town, it is necessary to keep thieves out as well. Locals repeatedly told me that if we grew vegetables (rather than just corn and beans) in an unfenced area, people would steal all of them before we

could harvest them ourselves. This was actually one of the most common reasons given why people in town (though not in the mountain villages) did not grow more of their own vegetables. Unless they were able to protect the field with an armed guard at night, then it was not worth the effort to grow vegetables due to theft. One farmer and friend told me that he had to sit in his field with a shotgun each night during harvest season, and that more than once he was forced to use the gun against trespassers and thieves. Since we were not willing to take those actions, we restricted our work to an area that was securely fenced, despite its small size and poor soil.

The site was previously used as the town fair grounds. The soil was terribly compacted hard clay that we had to chip away at with hoes. Sometimes the hoes would bounce off the ground rather than dig in. It was like a rock. In the beginning, the Sisters wanted me to give up because they saw how hard it was to work the soil and thought we would never produce anything for all of our hard work. However, over the year I was there, the field changed dramatically. We continuously applied compost, and slowly the soil composition and fertility changed and we were able to produce a continuous rotation of diversified vegetables. By the time I left, we had transformed the site into a beautiful diversified field, with rows of rotating organic vegetables, young fruit trees, drip irrigation, a water tank, successive compost piles, flowers, benches for our classroom, and were able to feed the *Internado* and community fresh healthy vegetables.

## CHAPTER 4. RESEARCH METHODS

### 4.1 Program Structure: Action-oriented education

The program objective was to establish an action-oriented sustainable agriculture education project, with the goal of positively affecting agricultural practices and nutrition by teaching the students the skills to return to their villages and create diversified gardens. The program was two-fold: academic and applied, and each session with the girls included both of these aspects. Each lesson was action-oriented, as outdoor education is often more effective when learning by doing. Action-oriented education is a participatory education model, and uses experiments, investigations, drawing, play-acting and more to demonstrate lecture topics.

For example, we had series of classes on insects. In one class, we diagrammed the anatomy of an insect, and then broke into groups of two students. Each group captured an insect from the field, and then used their insect anatomy diagram to identify the captured insect's parts. They drew a picture of the insect and labeled its anatomy in the drawing. In a follow-up class, we discussed the difference between pests and beneficial insects. We then broke into small groups. Each group caught as many insects as possible and when we regrouped to examine their finds, we decided which insects were 'friends or foes', and what role each played in a farm or garden. This class topic taught the students that not all insects are 'pests', which came as a surprise to them. They learned that in fact many insects benefit a farm system by eating other insects. This then lead into a discussion of pesticides, pest control methods, and healthy ecosystem functioning.

In another class, we used the garden to demonstrate a timeline of the history of the Earth. We marked a line in the garden that was 300 feet long to represent the history of the earth, and then walked the line and marked with flags some of the major events in the earth's history. In the three hundred feet, it was only in the last foot that human ancestors appeared on the timeline, and it was in the last inch that Columbus discovered the Americas. This visually displayed history put into perspective how many years humans have been on the planet in comparison to other life forms and earth processes, and the impact humans have had on the rest of the planet in the 'last inch' of its history. We talked about the changes to species diversity and environmental quality that have occurred in the last 100 years alone, and discussed some reasons why these may have occurred. We also discussed ways we could each practice environmental protection. Some of the suggestions made by the students included planting more trees, being careful with trash, and restricting seasonal burning of the land.

Classes focused on a range of areas, including ecology, interdependence, organic agriculture, nutrition, and earth processes. In the earth processes section of the program, we experimented with soil types in the garden. We discussed soil classification, particle size, water holding capacity and composition, and how these affect soil fertility. Then we conducted an experiment to identify what type of soil we had in our site. In the nutrition section, we played games that demonstrated the basic food groups, and how to combine foods for good nutrition; had cooking classes that used crops we were growing in easy nutritious recipes. We also made homemade organic pesticides from local ingredients such as hot peppers and garlic, compost from local materials, and much more. I relied on

the work of Jaffe and Appel (1990) in developing much of the program curriculum (see Appendix 1), as well as nutritional information from the US Department of Agriculture's Food Pyramid Program (USDA, 2003), workshops taught by the local extensions agent from COHDEFOR, the Honduran natural resources and forestry agency, and my own experiences. As the program progressed and some of the foundations of sustainable agriculture had been taught, and as the farm became more productive, the classes expanded to include field trips to local conservation areas, and workshops for the community, taught by the girls and myself.

Though each day varied, the applied section of the class was generally structured around groups of two to four students working together on various aspects of the sustainable farm production, including making compost, hand preparation of rows, seeding, transplanting, watering, weeding, and organic and integrated pest management. I tried to ensure that they rotated through the different jobs, and learned about each aspect of the farm. As the year progressed, I saw changes in how they approached this section of the class, until finally they were able to explain to me what each job entailed, what their first steps should be, and how to proceed as a team.

There were between 30 and 40 girls at the *Internado* (numbers fluctuated slightly over the year), and they were divided into groups of about ten per group. Each group met with me once a week at the school farm, where we held class and then worked in the garden.

Along with my class, Sister Rivera, the director of the *Internado*, organized three other 'supplemental' classes (these were in addition to their public school classes) for girls:

computers, sewing, and English. Each group rotated through the four classes Tuesday through Friday. They went home for the weekends and returned Monday morning in time for their regular classes at the public high school. Towards the end of the year that I spent in Guaimaca, Sister Rivera changed the structure of the program. She held regular meetings with the teachers and students and, through group discussions, decided that to allow some girls to excel in one subject, and others to drop subjects that they did not enjoy, the girls would choose one supplemental class to attend all four days. They chose more or less evenly between the classes, and each group was still composed of about ten girls that met with their chosen class throughout the school week.

It was during this second phase that the girls approached Sister Rivera about expanding the project to their home villages. We hoped that after completing the program, the girls would one day be able to return to their villages with skills and experience to improve the nutrition and the economic condition of their families. To our surprise, they decided not to wait until they returned after high school, but instead took the project back to their villages when they returned each weekend. Thus began the second phase of the project: rural vegetable gardens.

Each student was invited to participate in the expansion of the project. All except two (who did not have land available) joined the project. The 'garden group' of ten girls, the core group at that point, and I went to the villages and met with parents and relatives interested in the project. We required the families to fence the area they wanted to use so that chickens and animals could not destroy it, and that they start a compost pile (with the

help of their daughter). Once the families met these requirements, we put together a satchel of seeds (I found a nursery in the US that agreed to donate all of their end-of-season seeds to the project each year) with each family receiving seeds based on their survey responses (see Appendix 2), and then began visiting their villages. Once the program expanded to include the families and relatives of the young women, the class focus shifted to include adult workshops on composting, vegetable production, and seed saving.

#### 4.2 Research Methods

To assess the effectiveness of the participatory action-oriented learning method, and specifically whether the project achieved its objectives of teaching organic diversified agricultural techniques and basic nutrition, I used a mixed-method data collection approach, which combined semistructured and unstructured interviews, written questionnaires, and observation. This approach is useful when data comes from various sources, as with this project (Axinn and Pearce, 2006). Data sources included the study participants (the students, their family members, and the Sisters) and my notes and observations. In addition, mixed methods can provide information from one source that is not fully explained by other methods or sources, reduce error by generating replicated information from multiple sources, and reduce the potential for bias in approach by using multiple methods (Axinn, Fricke, and Thornton, 1991; Edin, 1998; both cited in Axinn and Pearce, 2006). I conducted a series of questionnaires and interviews with project participants including all the young women of the school, members of their communities, and the Sisters who funded the project. Where responses lent themselves, I transformed

data into quantitative categorical variables that were coded and then statistically analyzed. In other cases, where data were not numeric, content analysis was conducted on the text (Axinn and Pearce, 2006). All data collection was in Spanish, and then translated to English.

The first survey, conducted in June 2006, focused on all of the young women involved in the program (Appendix 3). I initially surveyed 100% of the participants (n=36) through a written-response questionnaire. I divided the questionnaire into sections with easier questions first, regarding concrete aspects of their lives, such as “What do you grow at your house? Do you help your family in their farming activities?”, etc. The next sections of the questionnaire were more difficult and thought provoking, which I later realized were more suited for a semistructured interview in which I could explain the questions as needed. The responses to these questions were short and mostly unsatisfactory. Because I conducted a follow-up interview with similar questions, I analyze only the first section of the questionnaire in this paper to corroborate the interviews.

The Sisters suggested that oral interviews would elicit richer responses since the girls viewed the survey as ‘homework’ and because, as Sister Rivera said, “the culture is better at expressing themselves through conversation” (Rivera, pers. comm, 2006).

Consequently, I conducted a follow-up oral interview with 59% of the participants (n=20; total student participants at this time was 34, as two girls had left the program). The Sisters and I created a list of participants to be interviewed based on age, with the idea that the oldest girls would have greater maturity. Average participant age was 14.5 years,

with a range from 11 to 17. I explained the reason for the interviews to each student, and told them their participation was voluntary. One hundred percent of those asked to be interviewed agreed to the process, which took about 30 minutes to complete. One focus of the questionnaire and interview was to understand the girls' background and agricultural history so I would have a baseline assessment of their previous experience and challenges. A second focus was to assess what the girls had learned through their participation in the program, and the third focus was to assess the project's effectiveness, perceived benefits, and areas needing improvement (see Appendix 4).

The student interviews were semistructured. This method utilizes a set of predetermined questions and topics, but allows the interviewer to probe beyond the structured questions (Berg, 2007). Though I speak Spanish, for these interviews I worked with a local Guaimacan young woman as an interpreter to be certain that there was no miscommunication and so that I would have time to record answers during the interviews.

I conducted short surveys in August 2006 and a third in October 2006 of all families (n=32) that became involved in the project because of their daughters, nieces, or sisters. The families all live in very remote mountain villages up to five hours away from Guaimaca. Transportation is very difficult to these areas, and during the wet season, it can be impassable by truck or bus. These factors, combined with the class schedule, made it impossible for me to visit all of the households for interviews. Consequently, I prepared written surveys for the girls to administer on their trips home. From my first

experience surveying the girls, I realized that my questions could be misinterpreted due to differences in local vocabulary. Thus, in a version of participatory rural appraisal, I involved those being studied in the construction of the survey (Axinn and Pearce, 2006). I worked with girls and Sister Rivera to create questionnaires that were clear, short, easy to understand, and easy for the girls to administer themselves. In both the August 2006 and October 2006 questionnaires, the girls chose which family member(s) to survey, based on who they felt was most responsible for household and/or farming activities.

The first of these surveys (see Appendix 2) was very short, only three questions. Sister Rivera wanted to communicate with the parents what we had been working on at the farm site, and invite them to join it as it grew. Its purpose was to introduce the project to the families, to briefly explain its purpose and goals, and to ask simple baseline questions such as:

1. What do you grow at your house now?
2. What would you like grow at your house?
3. How would you prepare the land for this project?

All 34 participants in the family garden project were asked to complete a survey, with a response rate of 94% (n=32). Two families decided not to join the project because they did not have land available, and so did not respond to the survey.

The second of the family surveys (see Appendix 5) was also short with simple questions, so as not to overwhelm the respondents. It was given after the village garden project had begun. The focus of this survey was to ask if they had ever had a vegetable garden in the

past, in order to understand obstacles participants might face in this project and their prior experience with specific crop types. It also asked the participants to evaluate the project in terms of its success in their village or how it was affecting their lives, suggest areas for improvement or that they needed more support with, and sustainable agriculture issues about which they would like to learn more. All 34 participants in the family garden project were asked to complete a survey, with a response rate of 41% (n=13).

I interviewed Sister Maria Ceballas (June 2006) and Sister Carmen Rivera (September 2006, see Appendix 6 and 7) who were closely involved in the program to assess their commitment to continuing the project and how well they felt that the project had aided in the education and development of the young women and community. These interviews were largely unstructured. We did not hold to a predetermined set of questions. I addressed certain topics with the Sisters, but allowed their answers to direct follow-up questions. This method allows greater flexibility and enables interview to pursue new directions as warranted, and thus can reveal issues that the interviewer had not initially considered (Axinn and Pearce, 2006). These interviews provide more detailed background, context and reflection by the actors, and are related throughout this paper where appropriate.

I assess the project's strengths, weaknesses and likelihood of being continued based on the survey responses, the interviews with the Sisters, and notes and observations that I maintained over the year that I lived and worked in the village.

## CHAPTER 5. RESULTS

### 5.1 Semistructured Student Participant Interviews and Questionnaire

The student surveys were broken into different sections that focused on topics such as farming activities at their houses, agriculture in Honduras in general, and an evaluation of the perceived benefits of the class and project. Because the interview served as a follow-up to the misunderstood / difficult questions in the questionnaire, both surveys had similar questions (see Appendices 3 & 4). From the first section of the survey, I include the responses from both the questionnaire and the interview in this report, as these were the most 'straightforward' questions. This comparison produced redundant information from multiple methods. I analyze only the interview responses from the later sections of the survey because these questions were more difficult and needed probing and/or further explanations before the girls understood the question; therefore, the responses from the final sections of the written questionnaire proved unsuitable.

#### Section 1: *En su casa* /At your house

I included questionnaire responses from the first section of the survey that asked about farming methods in the girls' homes. Figure 4 compares the answers from this section on both surveys, as well as from the family survey responses, regarding household crop diversity. Though responses vary, 85-95% of all households grow maize and beans. Tomatoes and coffee are the next most commonly grown crops. The average number of crops grown per household was  $2.97 \pm 1.12$  from the student questionnaire; the average crop diversity was  $3.85 \pm 2$  from the family survey; while results from the interviews indicated an average number of crops per household of  $4.8 \pm 1.79$ .

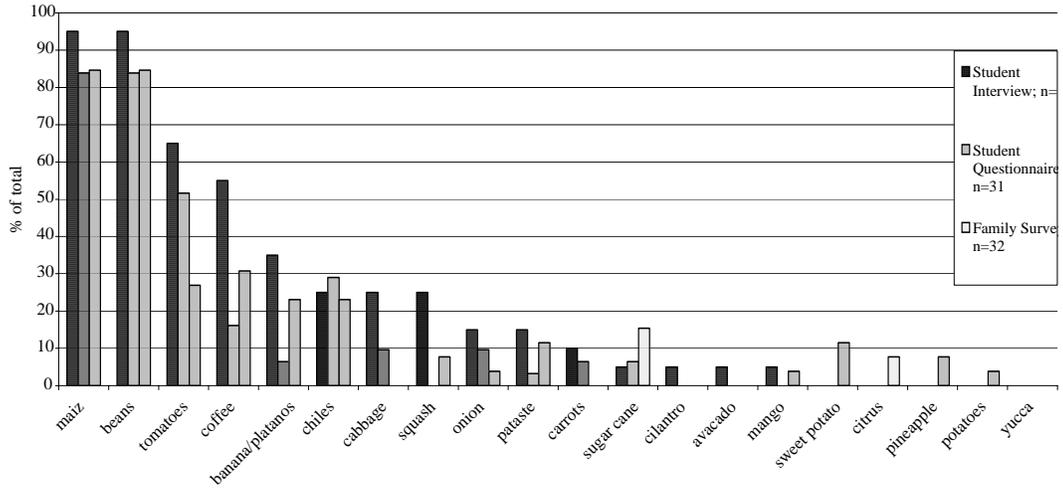


Figure 4. Crop diversity per household. Comparison of responses from student interviews, student questionnaire, and family survey responses. 6/2006-9/2006

The second set of questions regarded household farming activities (see figure 5).

Overall, 60 to 65% of households grow crops for subsistence only (as indicated by student interviews and questionnaires, respectively). In the interviews, probing revealed

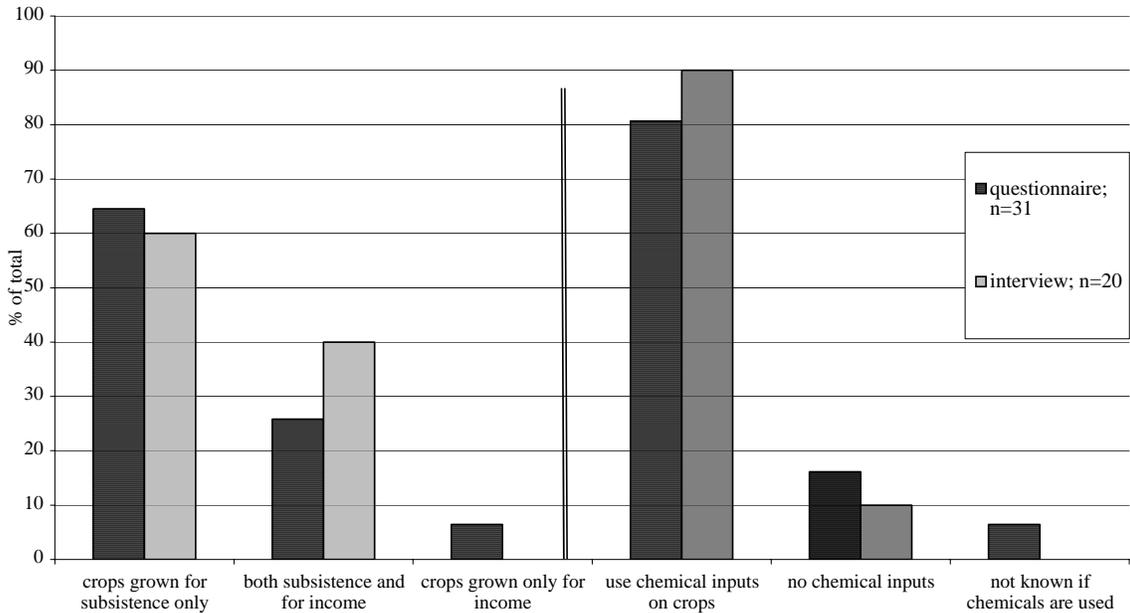


Figure 5. Farming Activity; Responses from student participant questionnaire and interview

that when crops are sold, it is only the higher-end / specialty crops such as coffee or tomatoes. Based on the questionnaire and interviews, 81-90% of households use chemical inputs such as pesticides and fungicides.

One hundred percent of the girls indicated that they help their families' grow crops. The average age the girls started working in the fields was  $9.7 \pm 2.84$ . The youngest started working outside at age five, and the oldest at 15 years old. Work for the girls includes weeding, watering, planting, harvest, fumigating, and fertilizing. Seventy-five percent of interview respondents reported they do not use any compost on their family farms. Of the 25% that do use compost, most was a chicken manure and coffee pulp mixture, used in very limited amounts.

### Section 2: *Agricultura en Honduras*/ Agriculture in Honduras

The most frequently cited barriers to diversified agriculture in this survey were a lack of money (55%), poor soil conditions (30%), lack of access to seeds (20%), and pest or fungus problems that made it too difficult to have a diversified farm system (20%) (see figure 6). The follow-up question asked what it would take, in the student's opinion, to have a more diversified farming system in the future. The most common responses were increased access to seeds (50%), more money to expand production (35%), and improved soil fertility (or the use of more compost) (30%) (see figure 7).

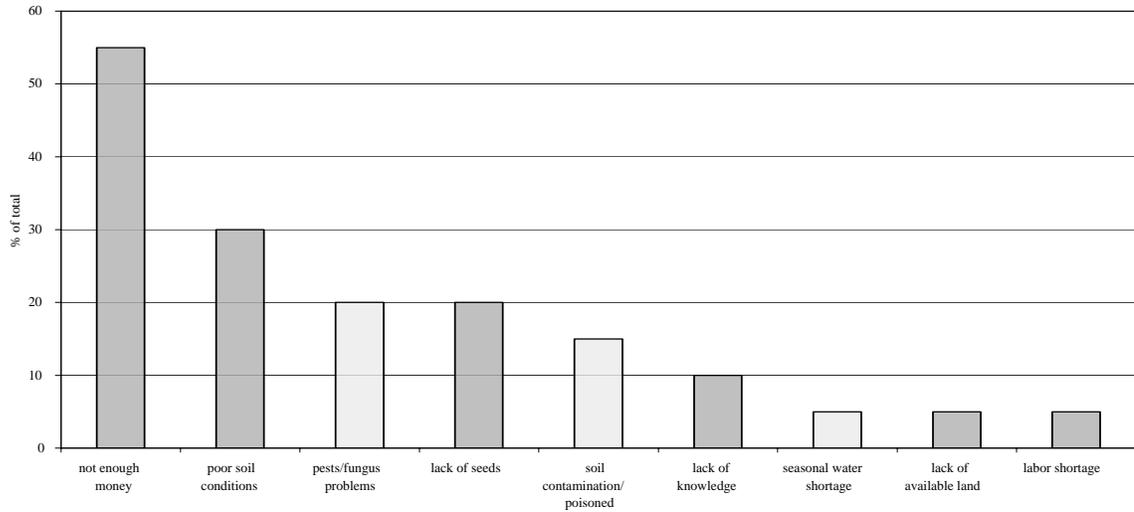


Figure 6. Perceived barriers to diversified agriculture in Honduras (n=20)

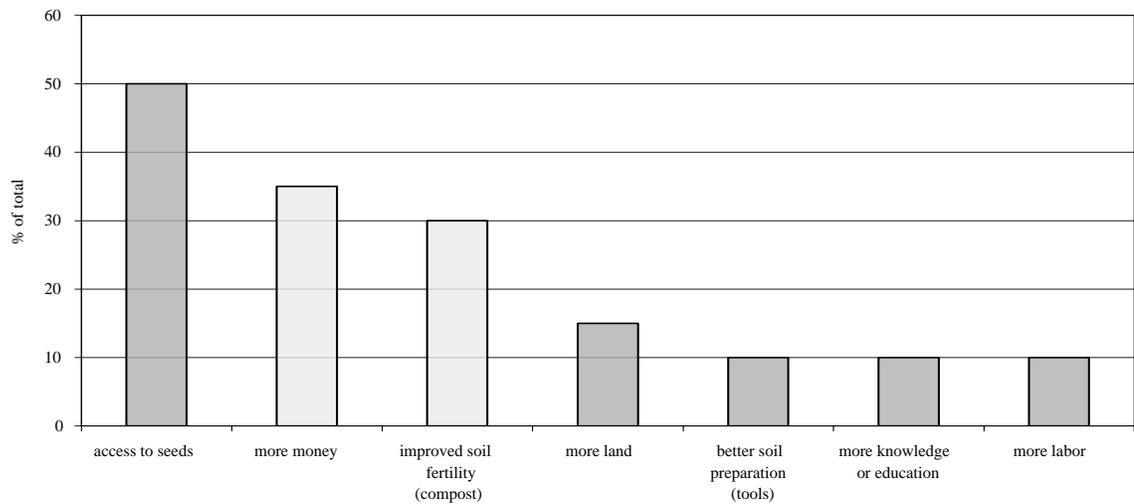


Figure 7. Requirements for more diversified agriculture in Honduras (n=20)

Section 3: *La programa de la huerta/ The farm program.*

These questions sought to ascertain what students learned during the course that they would use in the future or bring back to share with their family members and/or villages, as well as their understanding of the rationale behind the project such as why we were

growing so many different types of vegetables at the farm site. Students often indicated more than one new learned behavior or practice that they would use in the future. The most commonly cited learned behaviors were how to make and use compost (90%), and how to cultivate a wider variety of crops (65%) (see figure 8). In response to the question, “will you use anything you learned during this class at your house or in the future?”, the majority of girls responded that they would incorporate the use of compost into their farm system (75%) and grow a wider variety of crops (60%) as a result of the project (figure 9).

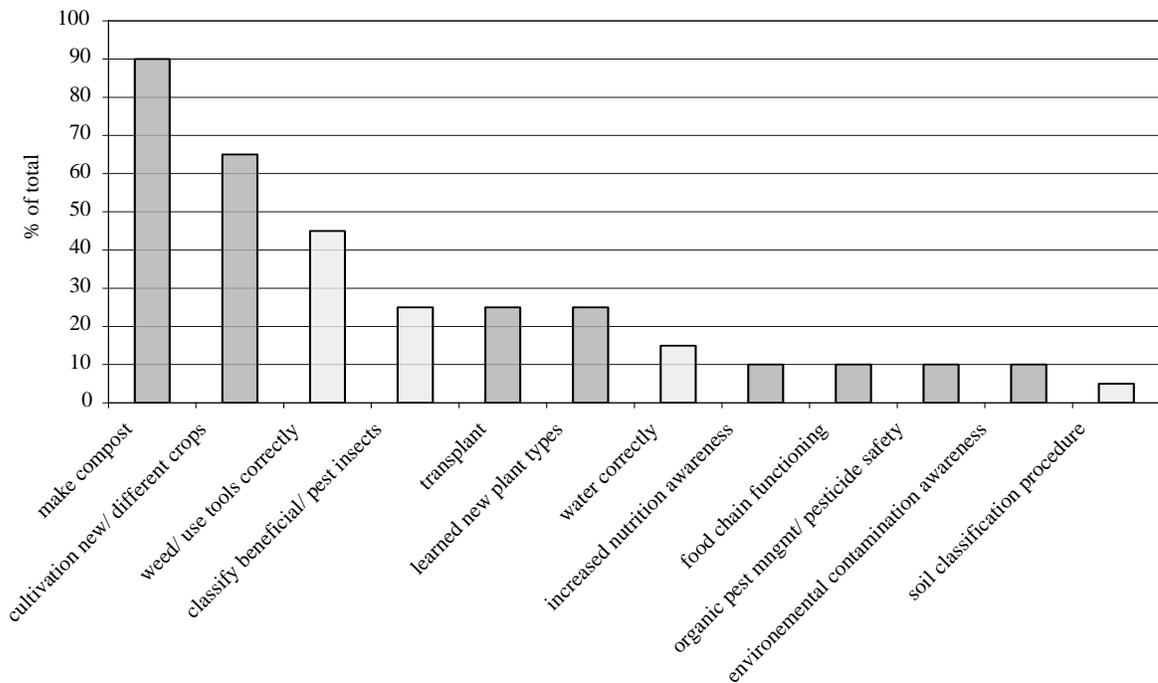


Figure 8. Skills reportedly acquired by project participants (n=20)

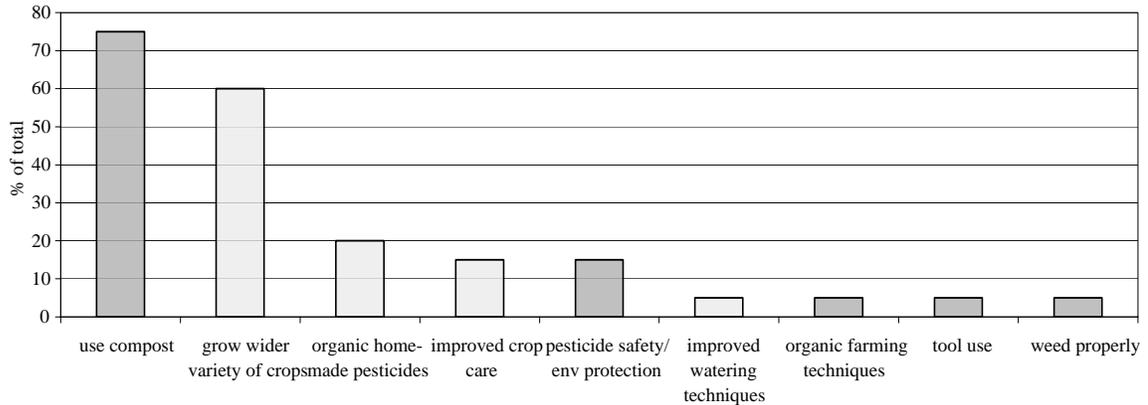


Figure 9. Project participants reported intention to use learned behavior / skills from project in the future (n=20)

Section 4: *Nutrición*/ Nutrition.

One of the assumptions of this project was that students did not have a wide variety in their diets at home, and that diversified agriculture could improve improve rural nutrition and dietary self-sufficiency. Because we were supplying the *Internado* with the harvest from the garden, I also hypothesized that the girls would be eating more vegetables at the boarding school than in their villages. Another assumption was that the education component of the classes could facilitate students adopting healthier eating habits through a better understanding of good nutrition.

To test the veracity of these assumptions, I asked a series of questions regarding household eating patterns and nutrition in the student survey (see Appendix 8). Eighty percent of respondents indicated that they eat very differently at the *Internado* than at their family homes. Ten percent said they eat the same types of foods at home and at the *Internado*, only there are more vegetables at the *Internado*. Ten percent said there was

no difference in diet at their home or at school. Of the 80% who indicated a difference, the main difference was that at the *Internado*, they eat a more varied diet, with more vegetables and meat. One participant reported eating more sugar at the *Internado*, since each meal is served with *frescos* (sugary drinks), and another participant stated that they eat more fat at the *Internado* than at her house. Students reported that their home diets consist largely of carbohydrates in the form of rice, spaghetti, plantains, bananas, and *pataste* (a local vegetable starch that grows on a vine), with beans and eggs. A few representative examples of the students' answers include:

- “At the *Internado*, we eat many vegetables, but at my house, we only eat a little bit of vegetables. Mostly just beans, rice, cabbage, and sometimes a little meat.”
- “At my house, I eat beans, rice, eggs, bananas, and tomatoes. At the *Internado*, I eat different foods, like pasta, cheese, butter, and more vegetables.”
- “At my house, I eat rice and beans every day, but [at the *Internado*] it is varied every day, including much more vegetables.”
- “In my house, we barely eat rice, only beans, spaghetti, milk, mango, and sometimes meat.”
- “At my house, they do not eat chicken and vegetables like at the *Internado*. I get much more sugar here than at my house because each meal has *frescos*.”
- “At my house, they eat only rice, beans, eggs, chicken, peppers, tomatoes, and *pataste*. Sometimes they have many different vegetables at my house, but only at certain times of the year.”

During the nutrition section of the education program, I realized the students had never discussed topics such as a balanced diet, healthy eating habits, or good nutrition in school. They were unable to identify which food group many common vegetables belonged in (they all belonged in the vegetable group), and told me that a fish was a type

of vegetable. We had a class on the importance of limiting the amount fat, sugar, and salt in our diets that seemed to be a real revelation for many of them. We discussed the types of diseases associated with diets high in fat, sugar, and salt, and in particular, the prevalence of diabetes in Honduras (Herman-Rivera and Thomas, 1999). Many of the students knew someone with diabetes. There was a visiting dentist in town that week, and many of the girls had multiple teeth pulled. I asked them if tooth decay could be connected to their diet, and they were not sure. They had never been taught that sugar could decay teeth. It was common to see people under the age of 18 with a full set of dentures, because all of their teeth were removed. Many young people waited anxiously for their last few teeth to decay, so they could get full dentures (pers obsv and comm, 2005).

Ninety-five percent of survey respondents stated that they were positively influenced to think more about good nutrition and the importance of a balanced diet as a result of the course (see Appendix 8 for full responses). A selection of responses from this question include the following:

- “Now I think about how much sugar and salt are in food, before I never did.”
- “I want to put more vegetables in salads, to eat many vegetables, and to change the types of foods we eat for better nutrition (not always eat the same foods everyday).”
- “I think about which types of foods have more fats, and now I barely eat greasy or fatty foods. I try to eat more vegetables now because they help to digest food and make the blood strong.”
- “I realize now that vegetables do not have much fat naturally, and they are helpful to our bodies.”
- “Its bad when we eat contaminated tomatoes [from pesticides].”

- “When we eat many fatty, sweet, or salty foods, we contaminate our bodies. I went back to my family and told them what I learned about fats, sugars, and salts, and to use less in foods they make.”

The girls learned to love beets, carrots, and even kale. They asked repeatedly to make kale *empanadas*, a recipe I made up to incorporate kale (which we found grows very well in Guaimaca during the rainy season) into their traditional food types. *Empanadas* are small individual-sized pies or turnovers that are filled with sweet fruit or meat. They are very common, and are available at every roadside restaurant or food stand. Instead of meat or sweet fruit, we filled these *empanadas* with kale, a good source of protein, iron, dietary fiber, vitamins A, C, E, K, B6, calcium, potassium, thiamin, riboflavin, copper and manganese (Nutrition Data, 2007). We sautéed the kale with onions, garlic, and spices, and baked the mix inside the pies in a dish similar to spinach pie eaten in the US, Italy, Greece, and elsewhere. I thought the girls would not like the *empanadas*, but they loved them. They repeatedly asked for the recipe and for kale seeds to start in their villages. When we started the class, they did not like many types of vegetables, especially lettuce and leafy greens. As the year progressed, I saw their attitudes change as they became more familiar with the vegetables; as they grew, harvested, and learned to cook each type themselves; and as they realized the value of each for better nutrition.

After the nutrition classes, the students also became more concerned with how much fat and salt the cook at the *Internado* used in their food, and spoke to Sister Rivera and me about their concerns. The cook was a local woman, her cooking was typical of the area, and ideas on diets low in fat and salt were new to her as well. We located a nutritionalist

working for the Catholic Medical Missionary Board in Honduras that agreed to visit Guaimaca to work with the cook and the community to prepare healthier food with local ingredients and the school farm harvest.

### Section 5: Evaluación/ Evaluation

Through the survey process, I wished to determine how the participants would evaluate the project and the action-oriented participatory education curriculum. I first asked the students why they thought we grew so many different types of crops in our project, to determine their comprehension of the project's goals. Fifty percent of respondents replied that the goal of a diversified garden is to improve nutrition; while 35% stated it was to grow different vegetables than what they currently grow at their homes, and 15% responded it was to help make the *Internado* self-sufficient in vegetable production since all produce went to feed the students (see figure 10).

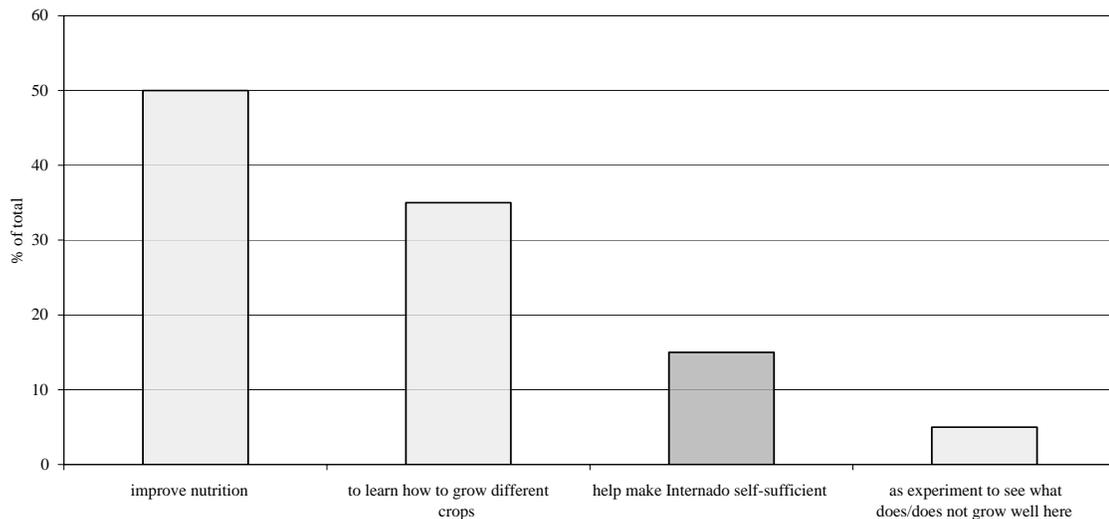


Figure 10. Student perception of why the garden project emphasized diversified farming (n=20)

Eighty percent of the participants reported a difference in the structure and learning process between the farm school and their high school classes (see Appendix 8). Of the remaining 20%, half (10%) did not see a difference, and 10% did not answer. Of the 80% that reported a difference, 56% noted they learned more because the program is action-oriented. For example:

- “At high school, classes are all in a classroom, and teachers only talk ABOUT the subjects, but here we have the *practica* [the practice of what we are doing, in this case the farm project] where we actually learn how to DO it. And it is easier to learn how to do something by doing it!”
- “At the garden, we work outside and are able to learn more doing than just listening in class. Because in the *practica*, when we learn how to do something, we actually do it at the same time.”
- “In school, they do not teach anything about agriculture. Only boys learn about farming or gardening. Girls only get sewing classes. But even the boys don't get much education in agriculture. They plant one plant and make pineapple jelly, and that is it.”
- “I learn more here because we have the garden to explain about the things we are learning”
- “The classes are the same, but the *practica* is very different. I like it very much because I learn how to DO things here.”

Forty-four percent of respondents mentioned that a main difference between this program and their public school relates to general deficiencies in the Honduran school system.

Responses involved statements such as:

- “The teachers only dictate [to us], they do not explain.”
- “Many times the teachers at high school do not show up, but you are always here to give us classes.”

- “At high school, we do not have all of the classes we are supposed to [because the teachers are absent]. But, here at the *Internado*, we have complete classes.”
- “The professors at the high school do not explain anything; they just give us schoolwork and tell us to figure it out ourselves. In the classes of natural science, for example, they do not tell or show us how to do anything.”
- “The teachers at high school do not explain the topics.”
- “At school, they do not have these types of classes about agriculture. They do not teach you very much. Just give a book to the students and no explanations. There is no practical learning about how to actually do things. This is very different in the class here.”

When I began the project, girls often came to class late, talked during class, did not appear to be listening, and often did not want to work on farming aspects of the program. I believe that this is a typical Honduran attitude towards school, where the public system is so chronically under-funded that teachers are absent more often than present. For example, from January 2005 to May 2005, the public high school in Guaimaca had only two full weeks of class. Every other week during that period, there was some reason that a day or more of classes were cancelled. Reasons included government holidays, teacher meetings, and most often, teacher strikes and protests over not being paid. Strikes could last for weeks, and at times striking teachers shut down transportation to Tegucigalpa by blocking the main roads (pers. obsv, 2005). When teachers were present, students and parents both told me they barely taught classes. Teachers more often dictate to their students, or write on the board and instruct students to copy the material. Students are expected to repeat back what they copied on their tests, regardless of whether they understand it. There is very little explanation, according to students and parents. Students do not have textbooks because neither schools nor students can afford them.

They often do not even have desks. In Guaimaca, some students were required to bring their own desks if they wanted to sit, because not enough were available in the overcrowded classes, and no money was available to purchase more. With this as the academic setting, it is not surprising that the girls were not initially interested in my classes.

As the months progressed, however, the girls clearly became accustomed to being asked open-ended, thought-provoking questions related to our topic of the day and thinking through their answers. They were given tests at the end of some classes to make sure they were paying attention, and their performance on these tests improved over time. I observed that as they became accustomed to an action-oriented learning style, they became more engaged. When we worked together on farm projects, I would often ask them, for example, to explain why we were using an organic plant-based pesticide instead of another type, and they were able to tell me the differences between persistent and non-persistent pesticides, their dangers, and why we should try to avoid using persistent pesticides. This knowledge may have been remembered because we used play-acting during a class on this topic to illustrate bioaccumulation of persistent pesticides in the food chain. I believe the girls became involved in the project themselves because of its action-oriented approach. When asked about the effectiveness of technique of teaching the girls, Sister Rivera stated:

“The way you are teaching them doesn’t happen in [their public] school. To be able to touch and see the different aspects of agriculture facilitates the learning process. We have a session in the evening where we go over their classes for the day and I am impressed by the degree of learning they

have from your class. The evaluation or exam has been very helpful for them to realize how much they are learning. The class is complete because it has theory, practice, and evaluation.” (pers. comm, 2006)

As the girls became involved and excited, they began to take ownership of the work they did in the fields. They told their parents about the organic and sustainable agriculture practices we used, and parents asked me for more explanations. The girls decided that the program should be expanded to their village during one of their meetings with Sister Rivera regarding supplemental classes. The girls valued the project enough to put in extra labor while they were home on the weekends to ensure the project’s success in their villages, and to encourage their parents to continue the work while they were at school during the week.

#### Section 6. *Beneficios de proyecto/ Project Benefits*

When asked what the participants feel they got out of the program, one hundred percent of respondents indicated that the program had positively influenced their lives, and that there were aspects of it they would use in the future (see Appendix 8). Specific responses varied from agricultural improvements (e.g. using compost - 53%, and growing more types of food - 53%), to improved food awareness and nutrition (32%), and environmental conservation (16%). Representative responses include:

- “I am more aware of food and nutrition now. For example, I am aware of how much salt and sugar are in foods and eat more vegetables now. I also learned how to grow more types of foods.”
- “I learned information about how the food chain works and how to care for plants and the land.”

- “Many people in the country do not have the tools or knowledge to do more farming or improve their farming. With this class, I have learned a lot that I will share with my family.”
- “In the *practica*, I learned more than in the class. For example, how to cultivate plants, how to make compost, and how to make [raised] rows. We grow food differently at my house now, but we will change and use the things I learned here in the future.”

When interviewed, Sister Rivera explained the potential she believes this project has not only to empower the girls and enable them to create a healthier future for themselves, but also to create a bridge between the Sisters of Guaimaca, the *Internado*, and the rural mountain communities.

“[The students] now know how to make an organic family garden, how to work as a team, organize their time, take responsibility for the project, and have the contact with nature and the land that can improve their personal outlook and mental health... Learning by doing. Teaching by doing. The girls not only learn themselves by doing, but also teach others what they have learned by doing it with them. The parents are learning from their daughters now, how to cultivate a variety of vegetables.

The girls are going to [other village garden sites] not only to assist them, but also to give mini workshops on both the theory and practice of organic farming. In November [2006], we are going to have a presentation to the community, where the girls will show the products that they are cultivating, and make some of the dishes with the food that they have learned about in the cooking class. For now, it is important that the most people possible are integrated into the project to ensure its success in the future. We are also starting a program with Heifer International to the give one cow to one family, and when that cow has a calf, the calf goes to

another family. And so on... This project has given a channel or medium for all of this to happen, and to have a give-and-take relationship or exchange of knowledge between the villages and the *Internado*.” (pers. comm, 2006)

### Section 7. Estructura de la clase/ The class structure.

The class structure consisted of 2 to 2.5 hour sessions, four mornings a week. We spent half of the time in ‘class’, sitting in the shade outside, discussing and exploring the topic of the day. We used the second half of the session to work in the field on the day-to-day maintenance of the school site. Seventy percent of participants stated that they would not change anything about the structure of the class, and there was nothing that they ‘liked least’ about the program. Aspects of the course that respondents liked least included:

- “Too much sun!”
- “The hour of the class because the sun is very strong [class was from 7:00 to 9:00 am]”
- “Hand weeding”
- “Weeding with a hoe”

All participants reported an aspect of the program that they ‘liked best’ (Appendix 8). Of all of the responses, weeding was the most common (53%). The next most common responses were that they enjoyed the class (21%) and making compost (21%).

The following is a representative selection of the responses:

- “I liked [the class] when we learned about the food chain and acted out the bioaccumulation of DDT in the food chain.”
- “I like caring for the garden: weeding, cultivating, and then when the rows are clean, watching how beautiful everything is growing.”

- “My favorite is the class, because it includes information on everything we eat and plant. It is complete and we can learn about all of it, why we do things and what is good for us.”

## 5.2 Household Questionnaires

### First Family/ Household Questionnaire, August 2006.

The family questionnaire introduced the work their daughters were doing at the Guaimaca farm project and asked the families if they would like to expand the project to the villages. The first question asked the parents or family members to list the crops they currently were growing. I compared their answers to their daughters’ answers (see figure 4). Maize and beans were by far the most commonly grown crops, as noted earlier. The next question asked parents to list the crops they would like to grow if they had access to seeds (figure 11). The most desired crop seeds were carrot (72%), onion (69%), cabbage (66%), and beet (63%).

The final question in the initial survey asked parents to describe how they would prepare their land for this project. Common responses were to build a fence around the area, to start a compost pile, to prepare the soil with a hoe. Before we initiated the project at their homes, Sister Rivera stated that they needed to have a fenced area and a compost pile as a sign of their commitment to the project. At the Guaimaca site, we needed a strong fence with barbed wire to keep thieves out of the garden. At the rural mountain sites, the fence was needed only to keep out livestock, mostly chickens, as thievery was not a problem in the small villages. Participants were able to make fences out of local materials such as branches and brush, so cost did not exclude anyone from participation in the project.

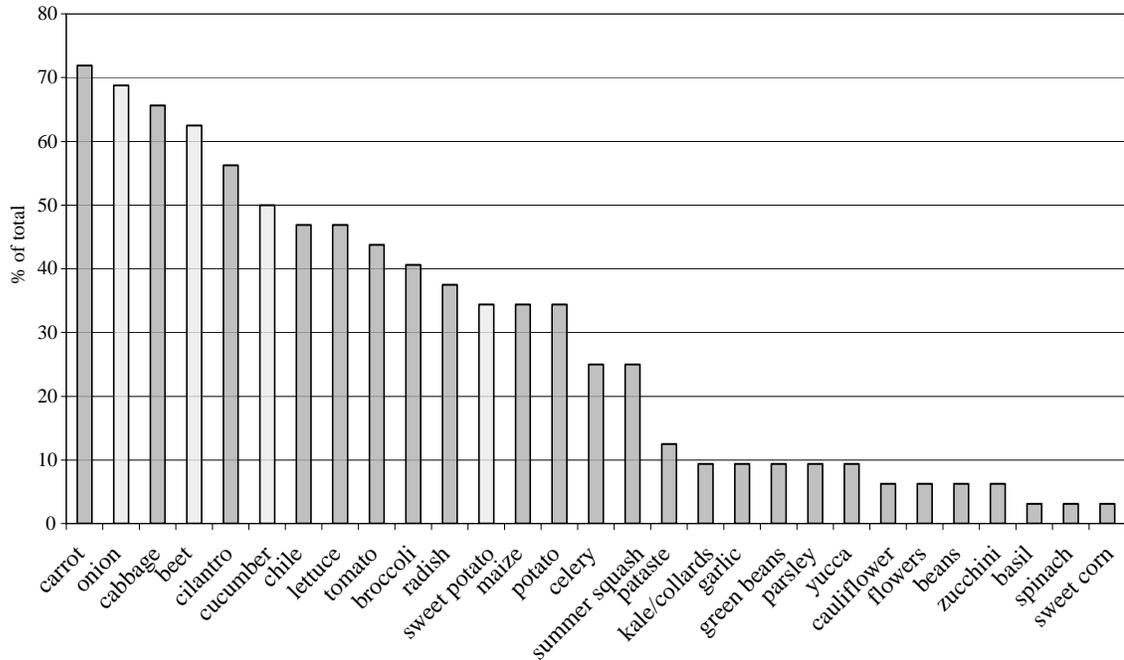


Figure 11. Household responses of seed types desired for diversification (n=32)

Second Family/Household Questionnaire, September 2006.

This questionnaire focused on past farm activities, the effectiveness of the program from the perspective of the participants, and what information participants would be interested in learning more about in regards to sustainable agricultural practices.

Forty-two percent of respondents reported that they have previously had a family garden; sixty-seven percent responded that they had never cultivated a vegetable garden. Of the five that responded positively to this question, one did not answer the follow-up question.

Three responded with a list of vegetables such as: cabbage, radish, *pataste*, cilantro, squash, pineapple, beets and lettuce. The final respondent stated:

“I had a vegetable garden before Hurricane Mitch, with a wide variety of crops, but Mitch flooded the river, scouring the river bottom, and deposited the sand and gravel on our fields, and ruined their productivity. Since then, I have not been

able to grow anything. Now, I am trying again and hope that using compost will heal the soil.”

One hundred percent of the respondents evaluated the program as very good to excellent for a variety of specific reasons, including:

- “We see it as a very good project, because it is a way to protect our health, and avoid contamination from pesticides.”
- “Very good because now we do not have to buy greens or vegetables, and this project is something that we have never done.”
- “It is very good because we can help create our own healthy foods for our family.”
- “To us, it is very good because we can grow our own healthy/nutritious food, and we can sell it too.”
- “The family garden project serves to improve our diet. It is a very good project because one can improve the level of the family.”
- “It is a good project because it is our garden, and we see the vegetables we planted grow.”
- “Very good, because this project has taught us to cultivate without chemicals, only with organic material.”

The question regarding how the project could be improved was misunderstood by some participants as meaning how could *they* make the project better themselves, rather than how could *we* as the project organizers improve the project. The following answers illustrate this misunderstanding:

- “We could improve it by caring better for it, weeding it, and working on it.”
- “Caring for the garden and appreciating what we make there”
- “In order to improve a family garden, especially an organic one, it is best to prepare compost to apply in time so as to not have problems with plant development”

- “To make a family garden better, first create compost”
- “Working, taking care of it, and always watering it”

However, some participants did provide constructive comments for improving the project, such as:

- “We would like to receive more trainings/ workshops that focus on family gardens/ vegetable gardening”
- “Technical workshops on farming”
- “Planting more seeds, working more closely/united, and giving more workshops”
- “Giving more information about taking care of the gardens, watering the plants, weeding them, protecting them, and controlling insects and fungus.”
- “More workshops about making compost, weeding, caring for the garden, planting more seeds”

Two respondents had no answer for this question, and a third responded said that the program could be improved by “working without becoming tired”.

The final question in the survey asked participants to indicate areas they would like to learn more about in order to improve their gardens or the project in general. The most frequent requests were for more information on how to make organic compost (54%) and organic pest control or integrated pest management (54%). Twenty-three percent of respondents indicated that they would like to learn more about organic farming in general. Information on seed germination techniques and how to prepare or cook the new foods they are growing were each sited once as topics of interest for future workshops.

## CHAPTER 6. DISCUSSION AND CONCLUSION

### 6.1 Discussion

The goal of this project was to affect rural agricultural practices and nutrition through an education program on diversified, sustainable agriculture. The surveys served to gather baseline information on local farming practices, determine what student participants learned from the program, and how effective the project had been at achieving its goals from their perspective.

#### 6.1.1 Using Compost

Surveys of the girls and their families revealed that poor soil conditions and lack of money are the primary constraints to creating more diverse and productive farming systems in Guaimaca. Composting could significantly improve soil fertility, structure, cation exchange capacity (CEC), and water and nutrient holding capacity, and thus, the potential to cultivate more diverse food crops. Poor soil and the use of compost were repeatedly cited (30%) as agronomic and production constraints to adopting more diverse farm practices. Student participants cited the use of compost (75%) more than anything else they learned from the project as something they will use in the future.

Since 100% of the students helped their families with their farming activities, the girls were not new to many aspects of farming. Composting was new to them, however, and they learned to love making and using it. They often fought over who would get to make the compost on any given day, or who would apply the compost to the field. They even argued over who would get to go and shovel manure into the pickup truck from a nearby

cow farm. This was hard, backbreaking, smelly work, but they each wanted an opportunity to participate. Normally, I would not consider the actual act of making compost exceptionally 'fun' or worth fighting over, but in this situation, I believe that the girls' previous farming experience enabled them to see the value of compost to improve farm fertility. They each struggled with their own families' hillside farms, and saw how poor the soil was at the field we used in Guaimaca at the start of the project. Many of them had even made comments to me at the beginning regarding the hopelessness of farming at that site with the soil we had. As we added more compost, they saw the value of compost for themselves. They stopped being disgusted female teenagers forced to work with manure, and started taking an active interest in the production and use of compost.

One aspect of this project was to create compost simply and cheaply using local materials. We focused on using cow and horse manure, which is abundant. Most families own a few animals, or at least a few chickens, which are also an excellent source for compost. However, most animals are free ranging, making it difficult to collect manure. Keeping animals penned or tied to an area for a portion of the day or night, so that manure is concentrated and thus easily collected is an important lesson. Plant wastes from farms, including weeds, crop residue, and coffee husks, were used in making compost as well. Lime and water were the remaining ingredients needed for the simple production of inexpensive compost. Honduran homes are all adobe and whitewashed with lime. Thus, lime is inexpensive, abundant, and already available to households repairing walls or making additions. We found that with proper watering, use of plastic

to keep the moisture trapped within the pile, and turning the pile weekly, compost could be produced in a few weeks. This is significantly faster than in many colder and/or drier climates where it often takes months (pers. obsv). The girls involved in the project taught workshops to their parents, reinforcing their familiarity with the process and their ability to disseminate the information in their home villages.

### 6.1.2 Seed Saving

Improved access to seeds (50%) was the most commonly cited constraint to crop diversification among the surveyed girls and their families. Access to good quality, affordable seeds and varieties are major barriers to diversifying agriculture throughout Honduras (pers. obsv, 2006). For example, farm supply stores throughout Honduras sell one single brand and type of seed (pers. obsv, 2006). Trips to the capital city are necessary to purchase seed varieties other than those most commonly grown. The Guaimaca project has a sponsored seed source from the US and receives free seed annually, but this is not a sustainable solution.

An alternative to purchased or donated seeds is for farmers to collect and save their own seeds. In the Guaimaca project, students learned how to save seeds from crops they grew and how to germinate saved seeds, again so they could disseminate this information to their villages. In addition, COHDEFOR planned a workshop (that was held after I left the site) to bring farmers together for a seed saving workshop and seed swap, where all were encouraged to exchange seed varieties. Sister Rivera planned a guest lecturer from Guatemala to visit Guaimaca (also after I left the site), to discuss heritage seed varieties,

traditional integrated farms, and seed saving. These topics are vital to self-sufficient food production.

### 6.1.3 Healthy Habits

Equally important to diversified sustainable farm system is improved education regarding nutrition and healthy eating habits. Student surveys indicated that the majority of home diets are carbohydrates in the form of rice, spaghetti, *platanos*, and beans. This diet frequently results in micronutrient deficiencies and is common throughout Central America where micronutrient deficiencies exceed protein-energy malnutrition (Ali and Tsou, 1997). Sister Ceballas, a nurse practitioner and nutrition specialist, believes that many of the girls in the program suffer from cognitive developmental damage as a result of nutrient deficiencies as children (pers. comm, 2006).

Eating habits in many countries are formed out of necessity, with what is most available being eaten most commonly. In Honduras, this translates to diets based on corn and beans, often supplemented with cheap, imported processed foods of low nutritional value (Herman-Rivera and Thomas, 1999). This situation is not unique to Honduras: traditional diets in many developing countries rely on carbohydrates such as bananas, cassava, sweet potatoes, rice, corn, wheat, millet and yams (Clugston and Smith, 2002). Globally, food systems often fail to provide adequate amounts of micronutrients to impoverished people (Graham, et al., 2007). Indeed, 50% of all deaths worldwide are associated with malnutrition, mostly in resource poor developing countries (WHO, 2002).

International market policies have influenced the nutritional status of people in developing countries through nutrition transition; that is, diets high in fats, processed carbohydrates, and low in micronutrient content (Lajolo, 2002). Paradoxically, obesity, diabetes, and heart disease coexist with micronutrient deficiencies and malnutrition in many countries where nutrition transition affects local diets (Clugston and Smith, 2002). Recent changes in food availability and cultivation have altered what is available in local markets in Honduras and elsewhere around the world (Gonzalez, pers. comm, 2005;). Mario Gonzalez, an organic farmer from the area, summarized the change in Guaimaca, which he observed:

“Once there were many local varieties of different crops, and people had a wider variety in their diet. This was in my lifetime, when I was a young boy and my grandparents were still farming. But in the 70’s, we found that corn and beans respond better to fertilizers and pesticides, while our traditional crops did not improve equally. I believe this is why we have seen more people stopped growing other crops” (pers. comm, 2005).

Nutrition, nutrient needs, diet, obesity, and physical activity are poorly understood in Latin America, and dietary education is needed to increase awareness of associated health risks (Lajolo, 1999). Many student participants entered this program not knowing if a fish was a meat or a vegetable, what a balanced diet meant, or why diets should not have high amounts of fat, salt, or sugar (pers obsv, 2006). Classes on nutrition are not taught in public school, and the idea of a balanced diet was new to all of the girls in this program. Ninety-five percent of student’s surveyed responded that they had been positively influenced to think about nutrition and a healthy balanced diet high in

vegetables and low in fat, sugar, and salt; and many made the connection between a self-sufficient diversified farm and improved nutrition.

#### 6.1.4 Participatory Action-oriented Education

In the United States, farm-to-school programs work with school-age children, particularly low-income youth, to improve health, nutrition, and community food systems (Vallianatos, et al., 2004). These programs typically connect schools with local agriculture, create school gardens where students participate in growing food, and integrate nutrition classes that connect the farm experience with healthy diets, and are experiencing growing support in school systems around the country (Rimkus, et al., 2004). Similarly, Life Lab Science Programs work in the field of environmental science and environmental education. Started in Santa Cruz, CA in 1978, today there are more than 1400 schools in the US that are part of the program. Life Labs create ‘living laboratories’ from school gardens, for children to study the natural world in an outdoor action-oriented setting (Life Lab, 2006). These programs are successful in the United States, and there is the potential to incorporate similar projects into curriculums in developing nations, such as Honduras.

In recent years, the World Bank and the Food and Agriculture Organization have promoted farmer field schools (FFS) as intensive participatory learning programs, which rely on interactive learning and field experimentation (Feder, et al., 2004). An important aspect of FFS is that participants are encouraged to teach others, and to become agricultural trainers (Godtland, et al., 2004). Participatory action-oriented learning can

be a powerful sustainable agriculture training tool and FFS seeks to ‘send farmers back to school’ as a means to influence their agricultural choices (Feder, et al., 2004).

This project sought to incorporate aspects of Life Lab, farm-to-school programs, and FFS. However, it differed in two main areas: 1) Farm-to-school programs generally connect farmers with schools, so that schools have a healthy local food source. In this project, the students became the farmers. All students had worked on their families’ farms, but none had experience with diversified and/or organic agriculture. They supplied their own school with the product of their labor, thus not only connecting farm and school, but also learning how to produce diverse healthy food for themselves in the future. 2) Where FFS work with adults; this project worked with female students. They in turn became their communities’ educators and trainers. The hope was that the young women could become their communities’ sustainable agriculture resource. This project worked with the next generation of farmers while they are in school to influence their future land use decisions and to connect food, farming, and nutrition.

#### 6.1.5 Lessons learned

The Guaimaca project had its share of difficulties and shortcomings to overcome. For the project itself, creating an organic, diversified school farm in the tropics was an enormous challenge. Before I was able to teach anything, I had to learn about a completely new farming arena. In my experience, tropical farming is much more complex than farming in temperate climates. In Honduras, where there is no winter, the insect population lives and multiplies year round, the soil is generally poor, there is a pronounced dry season,

and access to supplies is difficult. It was essential for me to make connections with the organic farmers in the area in order to learn how they managed their farms in the Guaimaca region. The advise of these farmers was critical to the success of our school farm site. They donated their time and labor to the project, helped me to find suppliers of organic controls, and provided regionally produced manuals on organic and/ or sustainable farming. One farmer even donated drip irrigation tape to the project because he was excited about the idea of our project, but believed that any other form of irrigation was not sustainable. I told him that I agreed, but that we could not afford to buy drip tape. He decided to give it to us free, plus the men to help install the system, because he wanted to help support the project.

A particular difficulty in this project was irrigation in the dry season. The drip system was indispensable, but became inconsequential in Guaimaca when the dry season hit, and the town water supply was turned off. We had a water tank installed on a stand in the field, which was fed by gravity from the town water supply. There generally was only enough water pressure at night to fill the tank, when no one else in town was using water (the entire town water supply was gravity fed, and we were towards the end of the line). But, in the dry season, there just was no water and it was incredibly difficult to continue the project. We used a pick-up truck to bring water to the field each morning in five 100-gallon barrels, which we filled from the well at the *Internado* (located about a mile from the site). The girls then watered the entire field by hand. It took us three trips and two hours to give the garden just enough water to survive. A well at the school garden site is essential to the continued success of the project. As I was leaving, Sister Rivera told me

that the student's families had agreed to donate their time to hand dig a well for the school field.

Another problem with the project was one that I did not realize was even a problem for many months, because I was not from Guaimaca, and did not understand the complex rules of conduct within the town. Apparently, it is against the law to have a farm within town limits, because of water restrictions. The Sisters knew this, and talked to the neighborhood *patrinado* (the man in charge of neighborhood decisions). The *patrinado* gave his permission for the project to continue, because it was community-based, educational, not-for-profit, and we were only taking water from the town supply at night, when no one else was using it.

Unfortunately, and unknown to us, we should have contacted the water coordinator of Guaimaca for permission, not just the local *patrinado*. I was told by local people that we had threatened the water coordinator's authority by not contacting him first. In turn, he shut off water to the entire neighborhood for a week. Obviously, this was not good. We arranged a meeting with the vice president of Guaimaca, the water coordinator, the *patrinado*, one of the Sisters, and me to discuss a solution. The water coordinator vehemently opposed the project, and the vice president initially agreed with him, because the project's water use was not part of the water plan for the city. However, once he heard the purpose of the project, the vice president changed his decision, and now he wants to collaborate on a similar project with the city, and to help make the project bigger and broader. Still, use of the city water for an agricultural project is not part of the city

water plan, and a better solution for the long-term success of the project would be to dig a well at the farm site.

In the interview with Sister Ceballas, I asked for her opinion regarding the main shortcomings or problems with the project. She responded

“Although the field is small, large amounts of diverse vegetables have been made available to the *Internado*. One shortcoming is the difficulty with having enough water at the field year round. One other shortcoming is that the irregular schedule of the public school leads to an irregular project schedule.”

The girls came to the field for class in the morning, and then went to public school in the afternoon. When they did not have public school, they had a different schedule, and did not come to class. The public school is severely under funded, and most weeks, they did not have a full week of classes due to strikes, teacher absences, and other problems. The public school schedule, or lack of schedule, was very disruptive to the project’s schedule. When the girls were unable to attend the class/work hours, I was often left asking neighbors for help to finish fieldwork that could not wait.

The use of mixed-method data collection in this study had advantages and disadvantages. This method proved useful given the range of participants, their ages, level of involvement in the project, and physical locations. Using questionnaires allowed the study to include responses from household family members living far from the research site, while interviews allowed participants to expand upon their answers and for the interviewee to follow-up on responses. However, as the results indicated, different

methods elicit different responses. I believe that this is a result of misunderstanding the question or focus of the question. In addition, the questionnaire format allowed for different response rates. I believe response rates were often determined by the purpose of the survey. For example, the first household survey had a response rate of 94%. I believe this is because it was necessary for the participants to respond to the questionnaire to be included in the project. The second household survey had a response rate of only 41%. In my opinion, this is because there was no incentive for the participants to respond. They did not necessarily 'gain' something from responding, and it was not a high priority for the girls to administer it, or for the household members to respond.

Semistructured or unstructured interviews allow questions to be expanded upon, while questionnaires do not have this flexibility. If feasible, it would have been advantageous to have conducted all surveys as interviews, rather than questionnaires.

#### 6.1.6 Future for Guaimaca Garden Project

Before I left Guaimaca, I worked with a local counterpart and trained him to take over the project. We co-taught workshops, classes, and co-directed the farm project. In addition, INFOP, a country-wide non-profit development organization that focuses on small scale hands-on projects, decided that they would like to be involved in teaching classes to the young women and adults involved in the project. COHDEFOR, the government agency responsible for natural resource management, began to support the project through weekly workshops on such topics as tree nurseries and homemade organic pesticides.

They typically spent one day with the group in a classroom, teaching the theory of the week's topic, and the next day in the school farm site, where we put into practice what we learned the previous day. This method fit well with the existing structure of the program, and was easy to incorporate. Additionally, they agreed to visit the mountain family gardens to give family members diversified agriculture technical support. As Sister Rivera explained, international and national policies have resulted in these agencies becoming interested in working with the Guaimaca project:

“I asked the families [of the students] who to work with to give workshops and increase local interest and knowledge in organic farming. They told me about the work COHDEFOR and INFOP are doing on behalf of the government here. Honduras has loans from other countries or institutions that they cannot repay. Instead of defaulting, they were offered debt forgiveness if they invest money instead in plans to eliminate poverty. These are some projects that are part of this plan. INFOP gives classes on agriculture and how to create a market for their products, and especially focusing on microenterprises so that they can organize and sell their products. INFOP has contacts with international markets to sell agricultural products and can ensure that the families are taught about these microenterprises.

For COHDEFOR, the local representative offered whatever help for the project he or the group could give. COHDEFOR focuses especially on caring and protecting the reserves in Honduras, and in this area El Chile and Misoko [local reserves in the mountains]. For example, COHDEFOR does workshops on creating greenhouses for growing trees and re-establishing the forests in the reserve. Another aspect is focusing on establishing more ecological tourism in the reserves. CODEFOR has much interest in conserving the biology and ecology of the villages, which are all within the reserves. They will help with giving workshops on agriculture and in reforesting the villages. They also said that they can help with finding and donating seeds and teach how to save seeds. Now they are trying to organize a meeting between all of the coordinators of the villages to share seeds and exchange different varieties between the areas.” (pers. comm, 2006)

The nuns selected regional coordinators from among the families involved in the garden project. These coordinators will work with the garden project families on problem

solving, will bring back information to the families unable to attend workshops in Guaimaca, and will act as a facilitator between the involved agencies and the families. In addition, the students are becoming community teachers by facilitating workshops for adults, working on mountain gardens and visiting villages to provide support and advice regarding the project. As discussed earlier, participatory learning has been successful in farmer field schools throughout the world, and has been promoted by World Bank and UN Food and Agriculture Organization in many countries (Feder, et al., 2004, Godtland, et al., 2004). Based on my observations, the future success of this project will depend on the commitment of the community. If households remain committed and involved, the project will have support from the Sisters, INFOP, and COHDEFOR to find solutions to unforeseen obstacles.

## 6.2 Conclusion

Global economic policies have transformed not only agricultural practices, but also eating habits in many developing countries. Worldwide, farming is increasingly agro-industrial monocrops destined for world markets. As a result of global economic policies, local markets are stocked with imported, cheap foods, that are low in nutritional value. The production of diverse local crops has declined as local and international market demand has declined. Neoliberal global trade and market policies can affect local people in negative ways, including: focusing production on export-oriented high-input crops, reducing incentives for growing diversified crops for local markets, and flooding markets with imported, processed foods (Gonzalez, pers. comm, 2005; Herman-Rivera and

Thomas, 1999; Graham and Welch, 1999; Graham, et al., 2007; Lajolo, 2002). These policies have changed not only agricultural practices, but also eating habits.

Sustainable and diverse agriculture offers an alternative development model for small-scale farmers. Through sustainable agriculture, farmers may be able to stabilize income through agricultural diversification, gain international niche market access, and defend their rights to resources and self-determination by forming powerful institutions able to collaborate with international NGOs and connect with distant consumers (Holt-Giménez, 2006). However, for the purpose of this study, the most interesting aspect is that it may be a means to improve rural nutrition and food security by increasing household nutritional self-sufficiency.

Structural changes in national and international policies are necessary to address global issues of malnutrition, micronutrient deficiencies, and failing agricultural systems.

However, these top-down structural changes may be slow to affect the most impoverished. To serve the immediate needs of resource poor subsistence farmers in Honduras, and elsewhere, education is an important component to self-sufficient production and consumption of healthy diets. Education in sustainable agriculture and nutrition should be action-oriented and participatory to engage participants in the learning process. To connect issues of food nutrition and farming, an educational project needs to be multidisciplinary and holistic, integrating agronomy, environmental science, and dietary components within the context of local socio-economic and environmental conditions.

Surveys of the students and their families in Guaimaca revealed that the greatest barriers to diversified agriculture in this Honduran case study are soil infertility, access to seeds, and lack of money. Students responded that one of the most important lessons they will take from this project is the knowledge of how to make their own compost and thereby improve soil fertility and structure. This could significantly improve the future productivity of home garden sites.

The Guaimaca project is still in its early stages; thus, it is too early to determine whether it can affect rural nutrition and agricultural practices of subsistence farmers. It is apparent, however, that participation in the courses positively influenced participants through education on nutrition and diversified farming, motivated them to start their own organic vegetable gardens, and facilitated connecting food and farming issues among student participants and their families. COHDEFOR, INFOP, the Sisters of Guaimaca, and the participants themselves are all interested in continuing the project, which demonstrates the effectiveness of the project in eliciting household, local and national support.

It is difficult to ascertain how relevant this project might be to other areas in Honduras or other developing countries. The conditions in Guaimaca are unique, specifically the interest, support, and commitment of the Sisters, who were essential to the success of the project. In assessing the potential applicability of this project elsewhere, it is also important to understand site-specific, socio-economic and environmental conditions in an

area, the macro- and microeconomic factors that influence local environmental and agricultural conditions, and then identify appropriate participatory education techniques that address these circumstances.

Nevertheless, micronutrient deficiencies are widespread in developing countries and small-scale, household-based diverse and sustainable agricultural practices offer a means to both dietary self-sufficiency and potential new niche markets. Education is a crucial component of successful employment of new site-specific agricultural techniques and improved dietary behaviors. As Sister Rivera discovered when exploring where to find agency support for the Guaimaca garden project: “Honduras has loans from other countries or institutions that they cannot repay. Instead of defaulting, they were offered debt forgiveness if they invest money instead in plans to eliminate poverty. [INFOP’s and COHDEFOR’s participation in our project] is part of this plan” (pers comm, 2006). As with this project, there is the potential that other Highly Indebted Poor Countries may be able to use Poverty Reduction Strategies to aid similar projects. There is the potential for using a site-specific model of action-oriented sustainable agriculture and nutrition education successfully outside of Guaimaca, Honduras.

## REFERENCES:

- Abraham, K. C. 1994. A Theological Response to the Ecological Crisis. In D.G. Hallman (Ed.) *Ecotheology: Voices from the North and South*. Maryknoll, NY: Orbis Books.
- Ali, M, and Tsou, S.C. 1997. Combating micronutrient deficiencies through vegetables a neglected food frontier in Asia. *Food Policy* 22(1): 17-38.
- Axinn, W.G, and Pearce, L.D. 2006. *Mixed Method Data Collection Strategies*. New York: Cambridge University Press.
- Adelekan, D.A. 2003. Multiple Micronutrient Deficiencies in Developing Countries. *Nutrition* 19(5): 473-474.
- Berg, B. L. 2007. *Qualitative Research Methods for the Social Sciences* (6<sup>th</sup> ed.) Boston, MA: Allyn and Bacon.
- Blaikie, P. 1985. The political economy of soil erosion in developing countries. Longman Press. Chapter 5, p. 79-106.
- Boff, L, and Boff, C. 1987. *Introducing Liberation Theology*. Maryknoll, NY: Orbis Books.
- Byrne, Damian. 1990. *In Mission Together, Letter of the Master of the Order*. November 1990. Available at:  
[http://www.op.org/international/english/Documents/masters\\_order/Byrne/mission.htm](http://www.op.org/international/english/Documents/masters_order/Byrne/mission.htm)
- Ceballas, Maria. 2006. Personal Communication. Sister of the Dominican Order and Nurse Practitioner, Guaimaca, Honduras.

- CIA. 2007. *World Factbook: Honduras*. Available at:  
<https://www.cia.gov/cia/publications/factbook/geos/ho.html>
- Clugston, G.A. and Smith, T.E. 2002. Global nutrition problems and novel foods. *Asia Pacific J Clin Nutr* 11(S6): S100-111.
- David, V.; Moncada, M.; and Ordonez, F. 2004. Private and public determinants of child nutrition in Nicaragua and Western Honduras. *Economics and Human Biology* (2):, 457-488.
- Drinkwater, L.E.; Letourneau, D.K.; Workneh, F; van Bruggen, A.H.C; and Shennan, C. 1995. Fundamental Differences Between Conventional and Organic Tomato Agroecosystems in California. *Ecological Application* 5(4) (Nov, 1995): 1098-1112.
- Easterly, W. 2001. *The Effects of IMF and World Bank Programmes on Poverty*. World Institute for Development Economics Research Discussion Paper No. 2002/102.
- Ecological Farming Association (EFA). 1990. *Asilomar Declaration of Sustainable Agriculture*. Available at: <http://eco-farm.org/efa/declaration/declaration.html>
- Environmental Investigation Agency. 2005. *The Illegal Logging Crisis in Honduras*. Center for International Policy, Washington, D.C,
- Feder, G, Murgai, R, and Quixon, J.B. 2004. Sending Farmers Back to School: The Impacts of Farmer Field Schools in Indonesia. *Review of Agricultural Economics* 25(1): 45-62.
- Godtland, E. M, Sadoulet, E., De Janvry, A., Murgai, R, and Ortiz, O. 2004. The Impact of Farmer Field Schools on Knowledge and Productivity: A Study of Potato Farmers in the Peruvian Andes. *Economic Development and Cultural Change* 53: 63-92.

- Gonzalez, Mario. 2005. Personal Communication. Organic coffee farmer, Guaimaca, Honduras.
- Graham, R.D, Welch, R.M, Saunders, D.A, Ortiz-Monasterio, I, Bouis, H.E, Bonierbale, M, de Haan, A, Burgos, G, Thiele, G, Liria, R, Meisner, C.A, Beebe, S.E, Potts, M.J, Kadian, M, Hobbs, P.R, Gupta, R.K, and Twomlaw, S. 2007. Nutritious Subsistence Food Systems. *Advances in Agronomy* 92: 1-74.
- Hattam, C. 2002. *Organic agriculture and sustainable agriculture and rural development*. Available at: [http://www.fao.org/organicag/doc/oa\\_sard.htm](http://www.fao.org/organicag/doc/oa_sard.htm)
- Herman-Rivera, B., and Thomas, A. 1999. Establishment of a diabetes education program and a diabetes support group in Camayagua, Honduras. *Journal of American Dietetic Association Supplement Vol 99 (9): A-108*.
- Holt-Giménez, E. 2006. Movimiento Campesino a Campesino: Linking Sustainable Agriculture and Social Change. *Food First Institute for Food and Development Policy, Backgrounder (12) 1: 1-4*.
- Haigh, M, Janksy, L., Hellin, J. 2004. Headwater deforestation: a challenge for environmental management. *Global Environmental Change* 14:51-61.
- International Monetary Fund (IMF) and the International Development Association (IDA). 2004. *Honduras: Joint Staff Assessment of the Poverty Reduction Strategy Paper*. First Annual Report. February 2, 2004
- Inter-American Development Bank (IADB). 2007. *Central America After Hurricane Mitch: The Challenge of Turning a Disaster into an Opportunity*. Available at: [http://www.iadb.org/regions/re2/consultative\\_group/backgrounder1.htm](http://www.iadb.org/regions/re2/consultative_group/backgrounder1.htm)

- Jaffe, R., and Appel, G. 1990. *The Growing Classroom: Garden-Based Science*. Dale Seymour Publications: Parsipanny, NJ.
- Khan, M.J, and Begum, S. 2002. Addressing Nutritional Problems in Homestead Gardening: CARE's Experience in Bangladesh. Proceedings of the Workshop on Alleviating Micronutrient Malnutrition through Agriculture in Bangladesh: Biofortification and Diversification as Long-Term, Sustainable Solutions; 2002 Apr 22–24. Dhaka, Bangladesh, 2004; 61-67.
- Korzeniewicz, R.P, and Smith, W.C. 200. Poverty, Inequality, and Growth in Latin America: Searching for the High Road to Globalization. *Latin American Research Review* 35(3):7-54.
- Kush, G.S. Challenges for meeting the global food and nutrient needs in the new millennium. *Proceedings of the Nutrition Society* 60: 15-26.
- Lajolo, F.M. 2002. Functional foods: Latin American perspectives. *British Journal of Nutrition* 88(S2): S145-S150.
- Lara, S. 2006. Personal Communication. Catholic Medical Mission Board (CMMB) head nurse at the Guaimaca Medical Clinic, Guaimaca, Honduras.
- Life Lab. 2006. About Life Lab Science Program. Available at: <http://www.lifelab.org/about.html>
- Medina Murillo, J. 2004. "Analysis: Maduro fears destabilization". The Washington Times on the web, July 6, 2004. Available at: <http://washingtontimes.com/upi-breaking/20040706-024315-4934r.htm>
- Mejia, T. 2005. "Priest Proposes 'March for Life' Across Mesoamerica". Terramerica on the web. Available at: <http://tierramerica.net/english/2005/0430/ipreguntas.shtml>

- Muller, A. 2006. IFOAM Event on Organic Agriculture and Food Security, CFS Special Forum. Rome, 2 November 2006.
- Nathan Associates Inc. 2006. *Regional Economic Performance Evaluation: CAFTA-DR Countries*. United States Department for International Development. June 2006.
- Neumann, R.P. 1992. Political Ecology of Wildlife Conservation in the Mt Meru Area of Northeast Tanzania. *Land Degradation and Rehabilitation* 3: 85-98.
- NOAA. 2006. Mitch: The Deadliest Atlantic Hurricane Since 1780. Available at: <http://lwf.ncdc.noaa.gov/oa/reports/mitch/mitch.html>
- NTE Report. 2002. *Foreign Trade Barriers – Honduras*. Available at: [http://www.ustr.gov/assets/Document\\_Library/Reports\\_Publications/2002/2002\\_NTE\\_Report/asset\\_upload\\_file917\\_6407.pdf](http://www.ustr.gov/assets/Document_Library/Reports_Publications/2002/2002_NTE_Report/asset_upload_file917_6407.pdf)
- Nutrition Data. 2007. *Nutritional Summary for Kale, cooked, boiled, drained, without salt*. Available at: <http://www.nutritiondata.com/facts-C00001-01c20di.html>
- Peters, R.T. 2004. *In Search of the Good Life; the Ethics of Globalization*. London: The Continuum International Publishing Group Ltd.
- Portes, A. 1997. Neoliberalism and the Sociology of Development: Emerging Trends and Unanticipated Facts. *Population and Development Review* 23(2): 229-259.
- Pyrovetsi, M., and Daoutopoulos, G. 1999. Farmers' needs for nature conservation education in Greece. *Journal of Environmental Management* (56):147-157.
- Ramakrishnan, U. 2002. Prevalence of Micronutrient Malnutrition Worldwide. *Nutrition Reviews* 6(5 II): S46-S52.

- Rimkus, L., Jones, P, and Ona, F. 2004. The San Francisco Farm-to-School Report: Results from the 2003 Feasibility Study. *San Francisco Food Systems Report*. January 2004.
- Rivera, Carmen. 2006. Personal Communication. Sister of the Dominican Order and Director of the *Internado*, Guaimaca, Honduras.
- Roberts, J.T, and Thanos, N, D. 2003. Trouble in Paradise: Globalization and Environmental Crises in Latin America. New York and London: Routledge.
- Roos N, Bouis HE., Hassan N, and Kabir KA (eds). 2002. Opening Session. Proceedings of the Workshop on Alleviating Micronutrient Malnutrition through Agriculture in Bangladesh: Biofortification and Diversification as Long-Term, Sustainable Solutions; 2002 Apr 22–24. Dhaka, Bangladesh, 2004: 3-23.
- Rosegrant, M.W. and Cline, S.A. Viewpoint Global Food Security: Challenges and Policies. *Science* 302(5652):1917-1919.
- Ruel, M. T, and Levin, C. E. 2000. Assessing the potential for food-based strategies to reduce Vitamin A and Iron Deficiencies: A review of recent evidence. *Food Consumption and Nutrition Division Discussion Paper No. 92 . International Food Policy Research Institute, Washington, DC*. July 2000.
- Sanchez, P.A., and Swaminathan, M.S. 2005. Cutting World Hunger in Half. *Science* 307: 357-359.
- Sarkar, S.K., and Bhattacharya, A.K. 2003. Conservation of biodiversity of the coastal resources of Sundarbans, Northeast India: an integrated approach through environmental education. *Marine Pollution Bulletin* (47): 260-264.

- Scialabba, N, E. 2003. Organic Agriculture: The challenge of sustaining food production while enhancing biodiversity. United Nations Thematic Group, Sub-Group Meeting on Wildlife, Biodiversity, and Organic Agriculture; Ankara, Turkey; 15-16 April 2003.
- Scialabba, N, E, and Hattam, C. 2002. *Organic agriculture, environment, and food security*. Food and Agriculture Organization of the United Nations, Rome. Available at: <http://www.fao.org/docrep/005/Y4137E/y4137e00.HTM>
- Scialabba, N.E, and Williamson, D. 2004. The scope of organic agriculture, sustainable forest management, and ecoforestry in protected area management. *Environment and Natural Resources, Working Paper No. 18*. Food and Agriculture Organization of the United Nations, Rome.
- Sobal, J. 1999. Food system globalization, eating transformations, and nutrition transitions. In: *Food and Global History*. Boulder, CO: Westview Press.
- Soluri, J. 2005. *Banana Cultures: Agriculture, Consumption, and Environmental Change in Honduras and the United States*. Austin: University of Texas Press.
- Stillwell, A. and San Martin, M. A. 2005. *Honduras: World Bank and IMF Support US \$1 Billion in Debt Service Relief for Honduras*. April 5, 2005. Available at: <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/LACEXT/0,,contentMDK:20435966~menuPK:258559~pagePK:146736~piPK:146830~theSitePK:258554,00.html>
- Taher, A, Talukder, A, Sarkar, N.R., Bushamuka, V.N., Hall, A., De Pee, S, Moench-Pfanner, R, Kiess, L, and Bloem, M, W. 2002. Homestead gardening for combating Vitamin A deficiency: The Helen Keller International, Bangladesh, Experience. *Proceedings of the Workshop on Alleviating Micronutrient Malnutrition through*

- Agriculture in Bangladesh: Biofortification and Diversification as Long-Term, Sustainable Solutions; 2002 Apr 22–24. Dhaka, Bangladesh, 2004; 75-80.*
- Toledo, A, and Burlingame, B. 2006. Biodiversity and nutrition: A common path toward global food security and sustainable development. *Journal of Food Composition and Analysis*: 477-483.
- Tontisirin, K, Nantel, G, and Bhattacharjee, L. 2002. Food-base strategies to meet the challenges of micronutrient malnutrition in the developing world. *Proceedings from the Nutrition Society* 61: 243-250.
- UN World Food Programme. 2005. *World Hunger – Honduras*. Available at: [http://www.wfp.org/country\\_brief/indexcountry.asp?country=340](http://www.wfp.org/country_brief/indexcountry.asp?country=340)
- USDA. 2003. *La Guía Pirámide de Alimentos*. Alexandria, VA: US Department of Agriculture, Center for Nutrition Policy and Promotion.
- USGS. 2004. *USGS Hurricane Mitch Program: Honduras country profile*. Available at: <http://mitchnts1.cr.usgs.gov/country/honduras.html>
- USGS. 2005. *Hurricane Mitch, Central America: Honduras suffered the brunt of Hurricane Mitch*. Available at: <http://landslides.usgs.gov/research/other/hurricanemitch.php>
- US Library of Congress. 1993. *Honduras – a Country Study*. Available at: <http://countrystudies.us/honduras/>
- Vallianatos, M., Gottlieb, R, and Haase, M. A. 2004. Farm-to-School: Strategies for Urban Health, Combating Sprawl, and Establishing a Community Food Systems Approach. *Journal of Planning Education and Research* 23: 414-423.

Viteri, F.E, and Gonzalez, S. D. 2002. Adverse Outcomes of Poor Micronutrient Status in Childhood and Adolescence. *Nutrition Reviews* 60(5 II): S77-S83.

Walker, T. W. 2003. *Nicaragua: Living in the Shadow of the Eagle*. Boulder, CO: Westview Press.

Welch, R.M, and Graham, R.D. 1999. A new paradigm for world agriculture: meeting human needs; Productive, sustainable, nutritious. *Field Crop Research* 60: 1-10.

Welch, R.M, and Graham, R.D. 2004. Breeding for micronutrients in staple food crops from a human nutrition perspective. *Journal of Experimental Botany* 55(396): 353-364.

Welch, R.M, and Graham, R.D. 2005. Agriculture: the real nexus for enhancing bioavailable micronutrients in food crops. *Journal of Trace Elements in Medicine and Biology* 18: 299-307.

World Health Organization (2002). The World Health Report 2002. Reducing Risks, Promoting Healthy Life. B. Campanini, (ed) pp.1-168. Geneva, Switzerland: World Health Organization.

Winters, L. A, McCulloch, N, and McKay, A. 2004. Trade Liberalization and Poverty: The Evidence so Far. *Journal of Economic Literature* 42(1): 72-115.

World Bank. 1996. *Poverty Reduction and the World Bank: Progress and Challenges in the 1990s*. Washington, DC: The International Bank for Reconstruction and Development/The World Bank.

Zanoli, R., Gambelli, D., Vitulano, S. 2007. Conceptual Framework on the Assessment of the Impact of Organic Agriculture on the Economies of Developing Countries. *FAO Concept Paper*. Polytechnic University of Marche, Ancona, Italy. January 2007.

## APPENDIX 1 Curriculum

Mapping of Garden: students observe stages of garden throughout year and map changes

Soil Structure and Composition

Insect Anatomy

Friend or Foe: Beneficial insects and pests

Food web in nature

Timeline of history of earth

Pesticides and Herbicides: uses, safety concerns

Bioaccumulation of DDT in soil

General Nutrition

Balanced diet

Role of Fat, Sugar, and Salt in our bodies

Cooking lessons: creating our own recipe book

Seed saving techniques

Home-made organic pesticides and fungicides

Starting your own tree nursery/ seedling beds

## APPENDIX 2. Initial family survey, August 2006

Dear parents,

We would like to present to you a small sample of a diversified vegetable garden, made with organic fertilizer. This is the work of each one of your daughters, and this is the fruit of their work, which we would like to present to you today [note: each student brought produce to their families from the school garden project]. We would like to invite you to join this project, with our support and the knowledge of your daughter.

Our objectives for now are:

- 1) that the knowledge and practice acquired by your daughters is strengthened in each of their homes by creating family vegetable gardens.
- 2) That your daughters can collaborate with you to make each household self-sufficient in food production, growing food that is part of a balanced diet and of high quality
- 3) That we can produce this garden with less chemicals and all enjoy better health.

Please answer the following questions in preparation for starting your family garden:

1. What type of seeds would you like to grow in your vegetable garden?
2. How have you prepared for the land that you will use for the garden?
3. What do you already grow at your house?

### APPENDIX 3. Student Participant Questionnaire, June 2006

#### At home

1. At your house, what (if anything) does your family grow? Is it grown for your family only or sold? Do you use pesticides?
2. Do you use or make compost at your house? If you do, is it the same type or different from what we do here?

#### Farming

3. Have you learned how to do anything differently here in the hands-on section of class? Think about what we do, is any of it new or different from what you knew before?
4. What does organic farming mean, and why do we do it here?
5. At your house, do you think you could or would use anything you have learned from this class? If so, what?

#### Nutrition

6. What types of foods should we eat to have a good diet and good health? Give examples, please.
7. Give examples of a few fruits, vegetables, grains, and proteins that are healthy that you eat regularly.

#### The class subjects

8. Why do we have this class? What do you think the purpose of it is?
9. What have you learned about pesticides? For example, what types of pesticides are there? What sort of clothing should you wear when using pesticides?
10. Do you remember any of the dangers of pesticides?
11. What did you learn about the environment or ecology?

#### Class structure

12. What do you like best about the class?
13. What would you change about the class if you could?

## APPENDIX 4. Student Participant Interviews, June, 2006

### Introduction

I am having Isabel [the local interpreter] help with the translation today because I want to make sure we are able to understand each other fully. I need to write your answers down, and she can help me make sure I get everything you say.

Thank you for talking with me. Your participation is completely optional. If you do not want to be interviewed, that is fine. No problem. Do you mind being interviewed?

This interview is going to be a lot like the written questions I gave you all a few weeks ago. I wanted to do an oral interview with some of you that are older so we could talk through the questions more, and I can help you to understand what they mean. Please feel free to stop me and ask questions at any time.

These interviews are part of the work I am doing for my university in the US. I am writing a paper about the classes I am teaching here, and the project in the garden. Sister Carmen wants to keep this class going next year, so these interviews are also to ask you what you liked or did not like about the class. I am interested in what you learned and what you got out of the program. From your answers, we can then improve the class next year if there are things we should change. There are no right or wrong answers. You can say whatever you want.

### At your house

Let's start with some background questions about farming at your house.

1. Do you grow fruits, vegetables, or coffee at your house? If so, what? About how many manzanas [1.75 acres] in cultivation?

If yes to #1, go to Qs 2-5, if no, skip to Q 6 :

2. Does your family grow it/these for your family only, or for sale?
3. Do you use pesticides at your house? Do you know what types or their names?
4. Do you help your family grow these crops?
5. What do you do to help?
6. How old were you when you started?
7. Do you use compost at your house?

### Agriculture in Honduras

Now I want to ask some general questions about farming in Honduras. These might be harder to answer. Its OK if you are not sure of the answer, you can just give me your best guess or opinion.

8. Why do you think it is, or would be, difficult to grow more fruits or vegetables here?

If no response: For example, do you think lack of money or labor restricts what is grown?

Lack of seeds? Lack of desire for other types of fruits or vegetable? Soil quality? Available land?

9. What would it take to grow more of a different crop and why?  
If no response: For example, would you need more money, more help, seeds, materials?

The farm program

OK, thanks. Next, I would like to ask you some specific questions about the class we have and garden work we do.

10. What have you learned to do here? What new skills do you have because of the class/garden work?
11. Why do you think we grow different types of vegetables at the garden, rather than just one?
12. Think about the things we do in the garden each week. Will you use anything you learned during this class at your house or in the future?
13. Did this class influence how you eat or think about food? If so, how? If no response: For example, do you know more about nutrition now? Do you eat different types of foods?

The class program

14. And how about the class. Can you tell me if this class differs from your classes at school?
15. What did you get out of this class? If no response: For example, how did this class influence you? what do you remember most about this class? How have you benefited from being in this class?
16. What did you like least about this class?
17. Finally, what was your favorite aspect of the class or garden work?

APPENDIX 5. Second family survey, September 2006

1. Have you had a family garden before?
2. If yes, what did you grow? If no, why not?
3. How would you evaluate this project so far?
4. In your opinion, how could we improve the project?
5. Is there anything you would like to learn more about regarding growing vegetables (i.e. workshop or class topics)?

APPENDIX 6. Interview questions for Sister Maria Ceballas, June 2006

1. What was your original mission, as Sisters of the Dominican Order, here in Guaimaca when you came in 2001? How or why did it change?
2. Why was this project with the school farm and the students initially pursued?
3. What are the goals and objectives of the school farm project?
4. What shortcomings or problems have there been with the project?
5. Who has been served by this project? Why?
6. How do you see the project growing or changing in the future?

APPENDIX 7. Interview questions for Sister Carmen Rivera, September 2006

1. Initially, why did you want to start this project with the farm and the girls as part of the *Internado*?
2. What did you want the girls to learn from this project? What skills or abilities?
3. Why did you want to expand the project to the villages?
4. What are some of the main benefits you hope will be a result of this project in the villages?
5. How will the project continue when I leave? Who will be responsible for the class?
6. How did you decide to work with CODEFOR and INFOP, or why?
7. What role will each group play in the project?
8. In the next few years, how do you envision the project changing or growing?
9. What are a few key needs of the project, or what more do we need to do or have to ensure it is a sustainable project?

10. What aspect of the girls' lives do you feel this project has affected? What about their families?

## APPENDIX 8. Student interviews responses to non-coded questions

### **Did this class influence how you eat or think about food?**

- Now I think about how much sugar and salt are in food, before I never did.
- yes, I didn't know that at my house, some foods had a lot of fats. For example, when they use a lot of *manteca* with *platanos* there is a lot of fat too.
- Yes, now I want to put more vegetables in salads, to eat lots of vegetables, and to change the types of foods we eat for better nutrition (not always eat the same foods everyday).
- Vegetables are good for our bodies. Fried foods have lots of fat. Now I think more about what foods have a lot of fats, sugars, and salts.
- Vegetables are good for nutrition. I thought about what foods had fats in them before this class.
- From learning about the food pyramid, I know which foods have more fats, or have different nutrients.
- Now I think about which types of foods have more fats, and now barely eats greasy or fatty foods. I also try to eat more vegetables now because they help to digest food and make the blood strong
- Now I think more about foods that have fats and sugar, and don't eat foods with a lot of grease/ fat anymore.
- No answer
- Now I realize that vegetables don't have much fat naturally, and they are helpful to our bodies
- I used to eat a lot of fatty foods, but now I am aware of the problems and tries not to. And we need lots of vegetables for our bodies to function.
- I need to eat fruits and vegetables for food nutrition. And less pig.
- We should not eat much fat and sugar because they will make us sick.
- Its bad when we eat contaminated tomatoes
- To watch how much fat, sugar, and salt are in a diet
- When we eat a lot of fatty, sweet, or salty food we contaminate our bodies. I went back to my family and told them what I learned about fats, sugars, and salts, to use less in foods they make. Because here at the *Internado*, its hard to do because so many different people make the food.
- Doesn't know
- I try to eat less foods high in fats now
- I know to eat more fruits, vegetables, and less foods with fat.
- Vegetables have important nutrients, for our health, and milk helps prevent malnourishment

### **Do you eat differently at the *Internado* than your house? How?**

- At the *Internado*, we eat many vegetables, but at my house, we only eat a little bit of vegetables: mostly just beans, rice, cabbage, and sometimes meat.

- At my house, I eat beans, rice, eggs, bananas, and tomatoes. At the *Internado* I eat different foods, like pasta, cheese, *mantequilla*, and more vegetables.
- At my house, they eat cabbage, rice, beans, tomatoes, and peppers. It is not too different at *Internado*.
- At my house, they do not eat many vegetables. Here they do.
- Not much different
- At my house, we eat mainly just beans, eggs, and cream. At the *Internado*, we eat more beets, carrots, and vegetable soups.
- At my house, we eat rice, beans, pasta, sometimes homemade, cabbage, chile, tomato, onion, and a little meat. At the *Internado*, the food is more varied.
- At my house, they eat food with much less fat than at the *Internado*. Beans, rice, cheese, *platano*, yucca, *malanga*, potatoes
- At my house, beans, rice, eggs only, but at *Internado* we have the same foods but also vegetables
- Most foods are the same, a few are different, but here there are more vegetables
- At my house, rice, beans, peppers, tomatoes. At the *Internado*, we eat more vegetables
- Same
- Same
- In my house, we barely eat rice, only beans, spaghetti, milk, mango, and sometimes meat.
- At my house, I eat rice and beans every day, but here it is varied every day including much more vegetables.
- At my house, they do not eat chicken and vegetables like at the *Internado*. I get much more sugar here than at my house because each meal has *frescos*.
- At my house, it's the same type of food each day: eggs in the morning, beans and rice and homemade cheese, same for dinner
- At my house they eat only rice, beans, eggs, chicken, peppers, tomatoes, and *pataste*. Sometimes they have lots of different vegetables at her house, but only at certain times of the year.
- Here we eat more vegetables and meat. At my house, they eat beans and rice, eggs, and spaghetti.
- At my house its basically beans and rice, here there is more variety, including meat.

**How does this class differ from your classes at school?**

- The class here is shorter and more practical
- I have learned much more in this class. Maybe because you know more than other people.
- The classes are the same, but the *practica* is very different. I like it very much because I learn how to DO things here.
- At school, they do not have these types of classes about agriculture. They do not teach you very much. Just give a book to the students and no explanations. There

is no practical learning about how to actually do things. This is very different in the class here.

- At high school, we do not have all of the classes we are supposed to [teachers are constantly absent, sick, or striking]. But here at the *Internado*, we have complete classes. At high school, classes are all in a classroom, and teachers only talk ABOUT the subjects, but here we have the *practica* where we actually learn how to DO it. And it's easier to learn how to do something by doing it!
- You can explain the classes better here than at high school. The professors at the high school do not explain anything; they just give us schoolwork and tell us to figure it out ourselves. In the classes of natural science, for example, they don't tell or show us how to do anything.
- At the high school, they don't teach agriculture.
- At the garden, we work outside and are able to learn more doing than just listening in class. Because in the *practica*, when we learn how to do something, we actually do it at the same time.
- No answer
- At school, they do not talk to us about plants, compost. They do not teach the same way because in the *practica* we learn how to DO it, and in the class we only talk about it.
- Not really
- Many times the teachers at high school do not show up, but you are always here to give us classes.
- The teachers at high school do not explain the topics.
- No answer
- In school, they do not teach anything about agriculture. Only boys learn about farming or gardening. Girls only get sewing classes. But even the boys don't get much education in agriculture. They plant one plant and make pineapple jelly, and that is it.
- Here I learn about organic applications and farming. There, its just chemicals and contaminants.
- They explain about gardening and farming in science, but not very well, only give a little information and then that's that. The teachers only dictate, they don't explain.
- I learn more here because we have the garden to explain about the things we are learning
- At school we don't have a garden to learn in
- Not too different

**What did you get out of this class? How did you benefit from this program?**

- I am more aware of food and nutrition now. For example, I am aware of how much salt/ sugar is in foods and eat more vegetables now. I also learned how to grow more types of foods.

- Many people in the country do not have the tools or knowledge to do more farming or improve their farming. With this class, I have learned a lot that I will share with my family.
- I now have the knowledge of how to make compost, weed, and water ever day.
- Learned about the different types of vegetables and what types of foods are important for good nutrition.
- Everything
- How to transplant, how to water, how to make compost
- The information about good nutrition
- In the *practica*, I learned more than in the class. For example, how to cultivate plants, how to make compost, and how to make rows. We grow food differently at my house now, but we will change and use the things I learned here in the future.
- Make compost
- The foods that have lots of fats versus those that don't, and also which foods and vegetables are good/ healthy
- Make compost
- To make compost and information about good nutrition, fats, sugars and salt intake
- Make compost, how to transplant and plant
- How to plant flowers and weed tomatoes
- In the *practica* I learned how to make compost and transplant.
- Information about how the food chain works and how to care for plants and the land
- Make compost
- How to plant, water, make [raised] rows, weed, and make compost. And from the class, I remember most about how the food chain works.
- I remember most about the game we played about nutrition and which foods are better or worse for our health.
- Make compost

**What was your favorite aspect of this class?**

- The theory of the class, and learning how to clean plants.
- I like everything equal
- Making compost
- The *practica*
- Weeding
- Weeding
- Weeding by hand
- I like caring for the garden: weeding, cultivating, and then when the rows are clean, watching how beautiful everything is growing.
- Transplanting
- The *practica*: making compost, preparing rows, planting
- Watering the plants
- Weeding and learning about good nutrition

- My favorite is the class, because it includes information on everything we eat and plant. It is complete and we can learn about all of it, why we do things and what is good for us.
- Weeding
- Hand weeding
- Hand weeding
- I liked when we learned about the food chain and acted out the bioaccumulation of DDT in the food chain.
- Making compost and making rows
- Making rows and planting
- Make compost