CONSERVING CROP DIVERSITY AND DEVELOPMENT IN ECUADOR: THE IMPACT OF PROJECTS FOR CONSERVING DIVERSITY OF TRADITIONAL CROPS AND THEIR CONTRIBUTION TO THE FOOD SAFETY AND LIVELIHOODS OF THE INDIGENOUS COMMUNITIES IN COTACACHI

By

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To Hedda and Werner Ohland

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LIST OF ABBREVIATIONS

ARS	Agricultural Research Service
CECIB	Centros Educativos Interculturales Bilingües (Centers for Intercultural and Bilingual Education)
DD	Difference-in-Differences method
DENAREF	Departamento Nacional de Recursos Fitogenéticos y Biotecnología
EX-SITU	Outside the parcels or farms
FAS	Foreign Agricultural Service
IFAS	Institute of Food and Agricultural Sciences
IN-SITU	Inside the parcels of farms
INEC	Instituto Nacional de Estadísticas y Censos
INIAP	Instituto Nacional Autónomo de Investigaciones Agropecuarias
INTI-RAYMI	Festival of the Sun in (in Kichwa language)
IPGRI	International Plant Genetic Resources Institute
ITT	Intention to treat
OVB	Omitted Variable Bias
PL-480	Public Law 480 Food for Progress within the USDA-FAS
RUNA-TUPARI	Indigenous Gathering (in Kichwa language)
SUMAK MIKUY	Excellent Food (in Kichwa language)
TOT	Treatment on the treated
UCODEP	Unidad y Cooperación para el Desarrollo de los Pueblos
UNORCAC	Unión de Organizaciones Campesinas e Indígenas de Cotacachi (Union of indigenous and peasant communities of Cotacachi)
USDA	United States Department of Agriculture

Abstract of Thesis Presented to the Graduate School
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CONSERVING CROP DIVERSITY AND DEVELOPMENT IN ECUADOR: THE IMPACT OF PROJECTS FOR CONSERVING DIVERSITY OF TRADITIONAL CROPS AND THEIR CONTRIBUTION TO THE FOOD SAFETY AND LIVELIHOODS OF THE INDIGENOUS COMMUNITIES IN COTACACHI

By

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Our study seeks to estimate the effect of the program called “Complementary Conservation and Sustainable Use of Underutilized Crops in Ecuador: Rescue, promotion and use of inter-Andean plant genetic resources" upon livelihoods, food safety, and welfare of rural households in Cotacachi. This program included four components that were aimed at achieving sustainable outcomes in the areas of: in-situ and ex-situ crop diversity conservation, agro-diversity education, and agro-industry and agro-tourism development. The analysis of this program revealed that the components for conserving crop diversity, education, and agro-tourism were the most successful. We also found that the program influences households’ decisions.

We combined qualitative and quantitative analysis of these four components in order to establish the impact of the intervention. To estimate the impact of the crop diversity conservation component, we used a baseline and follow-up monitoring and evaluation survey and applied difference-in-differences method to compare pre and post-intervention outcomes of participants and non-participants in treated communities. This analysis showed that there was an increase in native crops consumption post-

intervention for both participants and non-participants. In particular, the analysis showed an effect of the program upon crop diversity and bean varieties planted in parcels, and improve household income for program participants. To estimate the impact of the educational component, we constructed treatment and control groups and were able to compare their outcomes applying single-difference method. This analysis showed that children who attended the treated schools had stronger knowledge of concepts related to conserving agro-diversity and the environment than children who attended other schools. However, the nature of the interventions in agro-industry and agro-tourism did not warrant such a quantitative approach. Thus, we performed unstructured in-depth interviews with some of the participants in these sectors. This qualitative analysis showed that participants in agro-tourism reported to have experienced an increase in income derived from their agro-tourism businesses plus other tangible and intangible benefits. In contrast, the participants of the agro-industry component reported that the cost of inputs, labor, and other resources invested in the production of crops to supply the plant with the ingredients for the food-processed products were not justified. They did not perceive an improvement in their household's economy.

CHAPTER 1
INTRODUCTION

One of the reasons that motivated us to conduct this study was the need to contribute to the identification of a sustainable economic development model for farming communities in Cotacachi, Ecuador. For over two decades, several projects have been implemented to promote biodiversity conservation and sustainable rural development and poverty alleviation in the farming communities of the Andean region of Ecuador. We believe these programs should be analyzed in order to measure and identify what impact --whether social, economic, environmental or cultural-- such programs had on the livelihoods of the people and the place where they were implemented. That is why the objective of this study was to measure the impact created specifically for one of these projects. The project to which we refer has been called “Complementary Conservation and Sustainable Use of Underutilized Crops in Ecuador: Rescue, promotion and use of inter-Andean plant genetic resources." Throughout this study, we will analyze the complexity and dynamics of this program to identify the impact it has had -if any- on the lives of families in the rural communities of Cotacachi, and if the project influenced families to see the conservation of bio diversity of crop species as a way of life in Ecuador.

The program was designed and implemented as a pilot model to generate sustainable development for the peasant communities of Cotacachi based on conserving biodiversity. The 'sustainable development' concept promoted by this project was based on the conservation of agro-biodiversity of native crops and, the promotion and use of those crops as a way to promote nutrition, food security, sustainable agriculture and, to create jobs and based on the results of its impact evaluation, it is

expected to be model to be replicated in other peasant communities of the Andean region. The project emphasized that before making an effort to work for conserving crop diversity, there are several factors closely linked to that goal that must be taken into account. These factors are ethnicity and culture of the indigenous communities, traditional farm practices, crop uses, and environment, among others.

Another reason that motivated us to make this study was the design of the program that included four different sub projects. It was interesting to see how this program was created by integrating four different sub projects (complementary conservation of native crop species, agro-industry, education and agro-tourism) that complement the main objective of the program, which was the conservation of agro-biodiversity in the long run. As researchers, we saw that one of the advantages of the design of the project is that one or more of the sub projects may be replicated in other peasant communities of Ecuador whether separately or in groups and at lower cost. They were also designed based on the same concept to generate sustainable development and create jobs in specific areas where they were going to be undertaken, and of course, taking into account the social reality of the population and local conditions.

As the program was initially formulated to promote the conservation of Cotacachi's traditional crop species and varieties that were endangered (such as corn, bean, taxo, and tree tomato varieties), the fact that implementers included these sub projects to contribute to the community’s social development is itself innovative and presents important opportunities for learning about the links between conservation and other dimensions of economic development. Each subcomponent was aimed at contributing,

to different degrees, to the overall program goals of improving welfare while raising awareness of the importance of native crops for the communities of Cotacachi, plus the importance of transmitting their ancestral knowledge and farm practices to future generations.

In this study, we analyzed these four components in detail to determine the importance and contribution of each one to the impact of the program; and also to establish the benefits and gains that may be attributable to the program. To facilitate the reading and understanding of this document, we have divided it into five chapters. The first chapter contains information on the importance of conservation of agro-biodiversity for food security and specifically, it examines the case of Ecuador. It presents important reasons why the Cotacachi region has been considered a cradle of agro-biodiversity. The second chapter describes the project and its four sub components. The third chapter describes the methodology we used to manipulate and analyze the data in order to measure the impact of the project. Chapter four includes information on the research site, the survey process to collect the data, and the results obtained from manipulating those data in the empirical analysis by component. Chapter five contains the conclusions of this study and its contribution to current research as well as important recommendations for future studies.

Biodiversity in Ecuador

Ecuador is considered one of the richest countries in the world with respect to ecosystems as well as plant and animal biodiversity; one of the cradles of world agriculture that keeps a unique and significant agro-biodiversity that is important for humanity. The geographic location of Ecuador plus the presence of the Andes determine the existence of a diverse variety of forests and microclimates. Ecuador has

different climates that include the humid ecosystems in northern Ecuador- the rainforest -and dry ecosystems in the south including the pacific coast and the volcanic area in the Andes (Lozano, P., 2002).

Ecuador is well-known as one of the seventeen mega diverse countries in the world. As Ecuador is a diverse country, researchers have found several species that only exist in Ecuador (León-Yánez, 2000). There are 46 natural types of vegetation in Ecuador, and those are currently considered ecosystems. Also, a catalog of vascular plants published in 1999 that includes approximately 16,000 plant species, of those 4,000 are unique species in Ecuador (Jorgensen y León-Yánez, 1999).

Additionally, Ecuador has a significant diversity of fitogenetic resources. These fitogenetic resources represent not only biodiversity in Ecuador but also cultural diversity due to the fact they are the result of the effort and cultural evolution of the Ecuadorian peasant communities for generations. Unfortunately, socio-economic changes, as well as changes in environment are causing the loss of this native agro-biodiversity. Therefore, a need exists for programs designed to promote conserving biodiversity (INIAP, 2010).

This thesis presents in Chapter 2, the different strategies and activities implemented during program intervention that had the objective to link conservation and economic development to encourage small farmers to conserve their cultural diversity and farm practices in order to conserve biodiversity as a way of life in Ecuador. In this study we did not estimate the impact of household farm practices upon agro-biodiversity directly but we compared the socio-economic and demographic characteristics of the treated households which participated in the activities of the program with the non-

participant households to capture gains due to the program with respect to welfare, consumption of native crops and parcel diversity. This may prove that households may have the opportunity to conserve their native agro-biodiversity with the help and intervention of this and similar programs.

Conserving Diversity of Crop Species in Ecuador

The plant genetic resources of Ecuador are the biological basis of its human survival. The conservation of those plants species is an important requirement for food security in the long run. . In many cases, these invaluable plant genetic resources are conserved in-situ by indigenous communities in the Andean region. These indigenous peasant communities also preserve the ancient knowledge related to the use of those plant genetic resources and the properties of each variety, as well as the farm practices required for their production (INIAP, 2010).

Currently these in-situ conservation activities carried out by farmers and peasant indigenous communities are being supported and complemented by the formal scientific sector such as the Ecuadorian Institute of Agriculture lNIAP, an Ecuadorian institution that has been making efforts during decades to achieve the ex-situ conservation of this heritage of crop species in gene banks through its National Department of Genetic Resources and Biotechnology (DENAREF). It is important that both mechanisms in-situ and ex-situ conservation remain active to ensure the conservation of the agro-biodiversity in order that these genetic resources remain available to farmers and scientists, so that the peasant communities and scientists can respond to the changing needs of the Ecuadorian agriculture in the long run (INIAP, 2010).

One of the objectives of this study with respect to conserving diversity of crop species in Ecuador is to identify if the program intervention affected the number of crop

species and crop varieties in parcels (in-situ conservation) of the treated households. We know that the program was created to rescue the native crop species in Ecuador as well as the crop varieties that are endangered such as tree tomato, taxo, corn and beans. Therefore, Chapter 4 of this thesis presents our estimation of the impact of the different strategies implemented during program intervention by implementers and households to diversify their parcels and conserve crop species and varieties. Statistical evidence that the program truly affected positively the in-situ conservation and parcel diversity (number of crop species and varieties) would extend the work of Tapia (2005) and Rhoades (2006) about the importance of programs for conserving the diversity of crop species in Ecuador.

Cotacachi, One of the Cradles of World Agriculture

Cotacachi is one of the most diverse agricultural areas worldwide due to their high rates of endemic native species of flora and fauna. It is also located within one of the so-called world's biodiversity hotspots, the Cotacachi-Cayapas Nature Reserve. Furthermore, this Andean region is known as one of the most diverse in Ecuador, in terms of distribution of mammals, amphibians and plants. In Cotacachi, researchers have identified 61 species of edible plants, and of those, 34 are native species, while others are introduced species from the Old World (Kristin Skarbo, 2006). Cotacachi is also the cradle for over 40 varieties of maize and beans (Municipality of Cotacachi, 2010).

Although Cotacachi has a significant diversity of crop species and varieties of crops, a national survey in 2001 revealed Cotacachi's farmers were not using all those crops species and varieties. Instead, there was a trend towards the production of a few varieties of corn, beans and potatoes (Municipality of Cotacachi and UNORCAC, 2010).

As malnutrition and poverty rates among indigenous communities of Ecuador increased according to the census of 2001(INEC, Census 2001), it has been noted that the families of the Andean communities have adopted new food consumption patterns distinguished by lower nutritional value (FAO and INEC, 2010). In the case of Cotacachi, most of the population that live in the 43 peasant communities of the county planted and consumed only a few of the vast array of varieties of their main crop species such as corn, beans, tree tomatoes, taxo, zapallo, blackberries and chili peppers before the program intervention according to INIAP (INIAP, 2010).

Another objective of this study was the estimation of the effect of program intervention upon the consumption of the crop species mentioned above and their varieties (with the exception of taxo, zapallo, blackberries and chili peppers due to the fact we did not have enough data to run the regressions with respect to those crops). During program intervention, treated households were encouraged to plant more of those varieties of crops that were endangered.

Cotacahi also has a cultural and linguistic diversity as well as ancestral knowledge of farm practices. Our study also estimated the impact of the educational component of the program (Chapter 4) upon children's knowledge of their cultural diversity and farm practices. We stated the hypothesis that there was a difference -with respect to the children knowledge of their cultural and agricultural diversity, farm practices and environment- between the children who attended the schools of the program and the children who did not. This study tried to find statistical evidence to prove that there was a difference in children's knowledge between the two groups. With this statistical evidence we may show that the children who attended the schools of the program had

strong knowledge with respect to cultural and agricultural diversity as well as farm practices and environment than the children who did not. Strong knowledge with respect to those concepts may help the peasant communities of Cotacachi transfer knowledge of their ancestral farm practices to the future generation in order to conserve the significant diversity of crop species and varieties of crops that Cotacachi has as well as to preserve their cultural diversity and linguistic diversity due to the fact that the schools of the program are intercultural and bilingual (Kichwa-Spanish).

Due to the fact the town of Cotacachi is surrounded by the Cotacachi and Imbabura volcanoes, volcanic lagoons as Cuicocha and Llaguarchocha, near the Cotacachi-Cayapas Nature Reserve and the world-renowned Otavalo handicraft market, an important development strategy in this area has been the investment in the development of agro-tourism. As Cotacachi has a strong indigenous organization that was constituted 31 years ago, UNORCAC, and it works with 39 of the 43 communities of Cotacachi, those 39 communities were eligible to be part of the agro-tourism program but only a group of households from five peasant communities were actually participating. We used data from those households that participated in the agro-tourism business for the evaluation of the agro-tourism component.

Also, thanks to the agricultural biodiversity of Cotacachi, INIAP decided to apply a survey to determine the number of crop species and crop varieties planted by the households of Cotacachi and create an inventory of the endangered species in order to implement strategies to rescue them and promote their uses. INIAP applied the survey in 39 of the 43 communities of Cotacachi. We used that data as preliminary data for our analysis of the conserving crop diversity component (Chapter 4).

UNORCAC also tried to determined parcel diversity of the Cotacachi households through a census for agro-biodiversity and living conditions. We also used that data source as a baseline for this study and estimation of the impact of the program upon diversity of crops and crop varieties.

CHAPTER 2
GENERAL INFORMATION OF THE PROJECT TO EVALUATE

The project we assessed is called “Complementary Conservation and Sustainable Use of Underutilized Crops in Ecuador: Rescue, promotion and use of inter-Andean plant genetic resources ". Two major international institutions such as the United States Department of Agriculture -USDA and Bioversity International contributed to the design and implementation of the project. The Corporación Programa Alimentario PL-480 helped with financial support. The Organization of Peasant Communities of Cotacachi County-UNORCAC and the Ecuadorian Institute of Agriculture-INIAP also contributed with the implementation, capacity building, training and baseline data of the communities. This program began in 2001 and was implemented in two phases that included the implementation of four different subprojects during those two phases that lasted until 2008. It was focused on applied science to achieve the overall objective of the project which was connecting conserving diversity of native crop species with rural economic development of the peasant communities in Ecuador.

Implementation of the Program

During the implementation of the project, the team worked hard to achieve and link the two goals of conservation and development. For this purpose, the project established a collaborative linkage between formal agricultural research institutions and the smallholder sector, which facilitated the transfer of information and other resources related to conservation and development. Implementers worked to strengthen conservation efforts, increase the daily use of the genetic resources and native crop species among the local people, and encourage the use of these resources for agro-industry.

The project description (INIAP and UNORCAC, 2010) conceives human beings as the most critical element for the conservation and wise use of plant genetic resources. Therefore implementers developed strategies to encourage stakeholders -from different sectors of the society such as the peasant communities, Municipality, INIAP, Government, researchers, and locals- to work on conserving these plant genetic resources and take advantages of this joint effort. The team of implementers of the project was formed with local and international technicians, including agronomists, geneticists, economists, ethno biologists, and education specialists in agribusiness, tourism and community development. This crew was linked closely with a network of agricultural communities through the peasant organization, UNORCAC, which has its own team of technicians and developers who are familiar with the communities involved and their living conditions.

Also, the project was implemented with significant participation of farmers of the 39 participant communities (39 of the 43 peasant communities of Cotacachi County) as most of the activities for conserving crop diversity were offered to all the households of participant communities and all of them were encouraged to participate; of course some of the households decided to not participate due to several reasons (i.e. lack of time or interest, other activities, etc.). In spite of this, the implementers had the support, help and participation of most of the farmers in those 39 participant communities. All these people from the local and international institutions, as well as the participant communities worked together and contributed to the project with their expertise.

Carrying out a project of this magnitude was possible thanks to the participation of several institutions. Not only USDA and Biodiversity International collaborated on the

project but also several local public and private institutions of Ecuador. [1] During informal interviews with members of the PL-480 Corporation, they also informed their satisfaction of having cooperated in a program designed to conserve biodiversity. They assured being glad of having collaborated with INIAP, UNORCAC and USDA to promote rural development in Ecuador through the program we have evaluated for this study.

During the project, implementers showed particular interest in the diversity of crops that grow in Cotacachi because they represent the cultural diversity of the communities that have preserved them. Implementers were very interested in identifying the cultural and farm practices associated with these crops. They identified some facts from certain activities of the indigenous peasant communities, such as the preparation of traditional dishes with native crops. The fact that the women from the indigenous communities prepared traditional dishes with native crops and offered them to local and foreign visitors would indicate that the peasant communities would also be likely to participate in activities such as agro-tourism. Therefore, implementers determined that agro-tourism had the potential to generate significant benefits for these communities and promote the use of native crop species as well. A key factor that should be taken into account for the conservation of traditional crop species in rural communities is the understanding of the socio-cultural importance that these species have for the communities, including the ancient knowledge associated with the conservation and use of those crop species. In this sense, implementers also identified that education could be used as a way to increase awareness of the importance of the

[1] The main ones were INIAP-DENAREF, UNORCAC and UCODEP. Other international institutions such as ARS and FAS of the USDA, and the International Plant Genetic Resources Institute IPGRI also contributed to the implementation of the project as they collaborated in ex-situ conservation's activities.

diversity of crop species among rural communities, and that this would attract the support -of the rural communities and locals- for conservation of those crop species. In sum, agricultural communities are key actors in the conservation and use of underutilized crop genetic resources. For this reason, it is necessary that they assume a greater role in the management of these resources, from whose conservation their own welfare depends. It is very important that rural communities and Ecuadorians in general have the initiative of promoting the use of Andean crops to generate rural development in their communities. And that would serve as an example for other peasant communities in Ecuador to initiate the promotion of their native crop species uses as a way to conserve their agro-biodiversity and support for good nutrition (Rhoades, 2006).

During the project, INIAP and UNORCAC determined that the cultural factor is crucial for in-situ conservation of agro-biodiversity of crops. In addition to the efforts for conserving the diversity of crops ex-situ, the greatest strength for the continuation of the activity of conserving crop diversity is within the communities, in other words, on-farm conservation. The in-situ conservation is linked to the cultural diversity, and also the knowledge of farm practices in the communities. As Javier Llacsa (2006) mentioned, it is impossible to conserve the diversity and variability of Andean crops without the culture that supports it, referring to the conservation of native crops among the indigenous communities of Peru. In this sense, INIAP and UNORCAC said that in Ecuador we have the same scenario, it would be impossible to preserve this diversity of Andean crops without the help and influence of the cultural diversity and traditional farm practices of the indigenous communities. Hence, during the project they worked with the women of the communities in activities such as seed fairs, nutrition workshops and

ancestral knowledge, traditional food fairs, etc., with the objective to link all these cultural factors and lead to the promotion and use of their native crops and promote the conservation of the agro-biodiversity of crops (INIAP and UNORCAC, 2010).

The integration of the two methods in-situ and ex-situ for conserving agro-biodiversity has been used as a complementary conservation strategy by the program implementers and it is also one of the objectives of the project. To achieve the goal of linking in-situ and ex-situ conservation of agro-biodiversity, several innovative activities were carried out during the project. These activities involved the participation of national and international institutions, as well as local indigenous peasant communities. They were working together in multidisciplinary teams though the program activities. These teams performed multifaceted activities that integrate scientific methods and ancestral knowledge to contribute to rural development in different manners that were appropriate to local conditions and in accordance to the conservation and sustainable use of native plant genetic resources.

Components of the Program

The program included four strategic components that were implemented simultaneously from 2001 to 2008. These components were: 1. Fomenting the conservation of crop diversity (ex-situ and in-situ conservation, and the promotion of the crop species uses). 2. Agro-industry development (sustainable use of native crops, including consumption, agribusiness and marketing). 3. Education (for conserving crop diversity and environment, as well as the preservation of cultural heritage). 4. Investing in agro-tourism.

Conserving Crop Diversity

The mechanism for conserving genetic plant resources is called complementary conservation within the project framework and it promotes and coordinates the preservation of native seed samples in both gene banks (ex-situ conservation) and on-farm (in situ conservation). This implied preserving the genetic diversity of four groups of priority crops: chili peppers, fruits such as blackberries, taxo and granadilla, and tree tomatoes; vegetables such as sambo and pumpkin, as well as preserving crop varieties such as corn and bean varieties. The first activity carried out to reach the goal of this component was the implementation of a survey to determine the range and distribution of diversity of these crop species and the varieties of corn and beans that have been planted in parcels of the 39 participant communities. The implementers carried out these activities trying to understand all human and natural processes that lead to the maintenance of the diversity, and to identify the limiting factors for the conservation of agro-biodiversity in-situ.

This baseline survey involved 379 households from the peasant indigenous communities of Cotacachi County. Those households were chosen as a representative sample of the population of Cotacachi's peasant communities based on a stratified sampling method where each community was a stratum and the number of households randomly selected from each community was based on the proportion that the community represented of the total target population.

Following the survey, strategies to maintain native crops on-farm and to promote their uses among Cotacachi peasant communities were implemented. Different ways to add both cultural and economic value to native crops were explored (including the components presented below), focusing on the idea of increasing the attractiveness of

the use and conservation of traditional crops as a way of life for households in these communities. The goal was to enable households to receive market and non-market benefits, improving their living conditions as a result of maintaining and using their ancestral seeds.

INIAP was the institution in charge of the ex-situ plant genetic resource conservation. To start working on the ex-situ conservation activities, researchers and technicians carried out collecting missions to introduce new germplasm resources to INIAP. They complemented the activities using geographic information systems and biotechnology for characterization of genetic resources found during the collecting missions to achieve the ex situ conservation. The collection missions were carried out not only in Cotacachi but also in other areas of the highlands.

Our study is focused on the in-situ conservation and its contribution to the communities' development. It is out of the scope of this study to assess the impact of the program on the ex-situ conservation of native crop species.

As part of the in-situ (on-farm) conservation components, the implementers from INIAP and UNORCAC provided the farmers from the participating communities with seed samples of the native crop species and varieties they already conserved ex-situ in the plant gene bank. A group of those farmers was involved in the evaluation of the gene material that INIAP collected as they helped INIAP to collect the crop species from different communities as well as look for those crop varieties. During that process, farmers identified promising plant gene materials that were distributed to farmers (indigenous and mestizos) in Cotacachi in order to diversify and enrich their farm production. Another activity carried out by INIAP and UNORCAC was the organization

of local fairs to exchange and expose native seeds to facilitate access to the ancestral plant gene resources. The fairs also served to support informal seed exchange systems, and to document and disseminate traditional knowledge of agro ecosystem of Cotacachi.

Finally, to consolidate the message of conserving biodiversity of crops, a Calendar and a Culinary Guide of Cotacachi and their traditional crop species were published in English and Spanish. The team of implementers published two books called Culinary Guide of Cotacachi with recipes of the traditional dishes based on native crop species. These books were given not only to the Agro-tourism participants but also to women from all the peasant communities to promote the use of native crops among the communities in order to improve nutrition, health and emphasize the cultural value of diversity of their crop species.

An ethno-botanic garden was also built, close to UNORCAC's headquarters, to complement the other three components of the program. This garden compiles prototypes of most of the native crop species and plant genetic resources, especially medicinal gene resources of Cotacachi. The garden is visited every year by students from the intercultural bilingual CECIB schools and other neighbor schools, local and foreign tourists, and of course, it is visited by the community of Cotacachi. UNORCAC administration is also in charge of managing this garden. A group of volunteers from the community and also international volunteers such as members of the Peace Corps are also involved in garden maintenance.

Education

The third component, education on conserving agro-biodiversity, environment and cultural heritage, helped the communities to raise awareness about the importance and

cultural value of local crop species and varieties, as well as the transfer of knowledge on farm practices for the future generations. As the local peasant communities were expected to strengthen the sustainable use of native crop species and varieties, the implementers carried out activities to reach the goals of this component through Cotacachi's education system. One of the activities carried out to achieve the goals of this component was the creation of an appropriate educational program in elementary schools, according to the local conditions and idiosyncrasy of the participant communities. Through a series of workshops and meetings with the participation of implementers from Biodiversity International, INIAP, UNORCAC, USDA and the organization of the Environmentalist Teachers of Cotacachi, as well as community leaders, and twenty teachers from the Intercultural Bilingual CECIB school network, a tutorial was created to support educational processes in the schools, with a focus on the cultural value of local crop species and varieties. Implementers expected the tutorial to be used by both teachers and students of those elementary schools of Cotacachi that were included in the program.

In order to introduce the new educational program to Cotacachi's educational system, implementers worked with elementary schools, under the hypothesis that elementary schools are a fertile field for environmental education, as well as for conserving the diversity of crop species and cultural heritage in the long run. The elementary schools that were chosen to be part of the program were 19 schools randomly selected from a group of Intercultural and Bilingual (Kichwa and Spanish) schools affiliated with the Centers for Intercultural and Bilingual Education (CECIB) network. Those schools have a flexible curriculum that allowed the implementers to

introduce the educational program elaborated for this component. In Cotacachi they are located in 19 of the 39 participant schools. Those 19 elementary schools had a total of 64 teachers and 1267 students during the academic year 2007-2008 when implementers introduced the educational program.

The elementary schools' teachers from the CECIB schools included in the program made use of the tutorial developed during this component as mandatory resource material for classes. Therefore, children of the 19 schools and rural communities of Cotacachi received knowledge about conserving agro-biodiversity and environment as well as conserving cultural heritage from the teachers who used the tutorial during classes. The tutorial included the creation of small gardens inside schools where both teachers and students could put into practice what they learned during the conserving crop diversity course. Children and teachers had the opportunity to develop skills, to transfer knowledge of farm practices, native crop species and their uses to further generations. This group of teachers also collaborated with INIAP and UNORCAC in the organization of the seed fairs and motivated the students' families to participate in that kind of activity as a way to strengthen the student's knowledge about conserving crop diversity and cultural heritage.

Agro-tourism

The fourth component, agro-tourism, was implemented to complement the community tourism initiative "Runa Tupari ". The Runa Tupari project includes seventeen rustic lodgings and a group of six native guides. The program analyzed in this study contributed with the construction of rustic lodges in five communities, in order to complement the tourist package to be offered to tourists all over the world by the Runa Tupari Native Travel Cia Ltda, a tourist agency which has its headquarters in

downtown Otavalo since 2001 and started under the UNORCAC sponsorship as an initiative of UNORCAC to promote agro-tourism. The participant households chosen to be part of this component were selected based on several characteristics of the household such as household size, income, willingness to participate in workshops and training on agro-tourism as well as the willingness to afford part of the cost for the construction of the rustic lodge. Only 17 households in four communities (of the 39 participant communities) had these characteristics. The Runa Tupari tourism agency collaborated with INIAP and UNORCAC in the implementation of this component and organized the workshops and also provided managing support to the families enrolled in the program. Runa Tupari was also in charge of promoting the rustic lodges internationally and distributing the tourists among the rustic lodges.

The agro-tourism component was created to add economic value to the biodiversity of crop species of Cotacachi's peasant communities and to create job opportunities for the participant households. Women of the enrolled households received training to develop culinary skills and often diversified parcels with native crop species and varieties. Enrolled households and native guides were provided with training on guidance and managing groups of tourists, as well as entrepreneurship and leadership skills, in order to offer and show tourists the attractions of traditional ecosystems associated with their native culture and agricultural landscape, offer dishes prepared with traditional crops, etc. These activities were expected to encourage conservation in rural communities and to educate the participant families in the wise use, protection and management of natural resources at the same time that they learned entrepreneurship skills.

Agro-industry

The activities of this component were created to add cultural and economic value to their native crops in order to increase the benefits to farmers in Cotacachi. The implementers investigated new uses, processing methods and identified new markets for the prioritized crops. Through workshops and capacity building, the implementers trained families from the indigenous communities on the cultural value of their native crops, nutritious properties, culinary uses, food processing (preparing craft processed products) and principles of commercial packaging. Research was done to identify production levels and feasibility of a local agricultural industry based on the transformation of native crops into processed products. This component also involved the creation of a processing plant. To complement this infrastructure, various machines and equipment for basic operation of a rural industrial plant were installed. To run this agribusiness, the implementers from INIAP and UNORCAC developed a pilot portfolio of processed products and helped a group of members of the communities to organize and create a cooperative to lead and manage the agribusiness; this group was made up of 14 members from 9 communities –of the 39 participant communities- who had active participation in their communities and were involved in the UNORCAC's hands on activities. Finally, developers worked on the identification of local and regional markets for the products they processed in the plant. In our study, we interviewed the members of the cooperative who participated as suppliers in the agribusiness project; however, we did not have access to plant workers or plant records.

CHAPTER 3
METHODOLOGY

In this study, we use qualitative and quantitative analysis of the program components, in order to establish the impact of the interventions. The quantitative analysis is based on the conceptual framework of causal inference through counterfactual scenarios, which seeks to find the cause-and-effect relationships between a program intervention (treatment) and the changes in outcome variables that occur for the individuals or subjects affected by that intervention. However, the nature of the interventions in agro-industry and agro-tourism did not warrant such quantitative approach. Because of the focalized and selective nature of these components, with a smaller number of participants, we performed unstructured in-depth interviews with the participants in these components in order to draw conclusions on their perceptions of the effects of the program and suggest some recommendations. This qualitative analysis is presented as part of Chapter 4.

In this chapter we focus on explaining the logic of impact evaluation as seen through the lens of causal inference through counterfactual scenarios. We also explain how it was applied in the context of our program and given the data we had available.

Impact Evaluation and Causal Inference

Impact evaluations can be divided into two categories: prospective and retrospective (Paul J. Gertler, Sebastian Martinez, Patrick Premand, Laura B. Rawlings, Christel M. J. Vermeersch (2007)). Prospective evaluations are developed at the time the program is being designed and are built into program implementation. Baseline data are collected prior to program implementation for both treatment and comparison

groups. Retrospective evaluations assess program impact after the program has been implemented, generating treatment and comparison groups ex-post.

In general, prospective impact evaluations are more likely to produce strong and credible evaluation results (Wolpin, 2007). For our study, we had reliable baseline data on agro-biodiversity and some welfare measures from surveys implemented by INIAP and UNORCAC in 2002 and 2005. We complemented these data through a follow-up survey applied to a subsample of the initially interviewed households in 2010, and extended it by including further questions on e.g. educational outcomes. We also extended the sample by applying the follow-up survey to households from the Otavalo area, a nearby town with similar geographic and social characteristics.

Thus, for outcomes related to agro-biodiversity and income, we have baseline as well as follow-up information, enabling us to perform a prospective evaluation. For the educational component we only had information from our follow-up survey, which includes a comparison group ex-post, allowing us to perform a retrospective evaluation.

Causal Inference

The basic impact evaluation question essentially constitutes a causal inference problem (Paul J. Gertler, Sebastian Martinez, Patrick Premand, Laura B. Rawlings, Christel M. J. Vermeersch (2007)). In order to assess the impact of the program on the welfare of Cotacachi's households we assessed the causal effect of the program on outcomes such as consumption, welfare and agro-diversity. The objective was to answer questions such as: Did the intervention have an impact? Are Cocatachi's households consuming or using more crop species or varieties of those crops in 2010 than before the program? What was the impact of the program on the households' income? Or what was the impact or causal effect of the program on the household's

farm diversity? Or what is the effect of the educational component upon children's participation on events related to the conservation of crop diversity and environment? Or what is the effect of the educational component upon children's knowledge of corn and bean varieties?

To answer all these questions during the impact evaluation process of this program, specifically for the conserving crop diversity and educational components, we used the basic impact evaluation formula described by Martin Ravallion (2007)

$$\alpha = (Y \mid P = 1) - (Y \mid P = 0) \qquad (3\text{-}1)$$

where:

α is the causal impact of the program

Y is the outcome

P stands for program participation and ($P = \{0, 1\}$)

This model shows that the causal impact (α) of a program (P) on an outcome (Y) is the difference between the outcome (Y) with the program (in other words, when P = 1) and the same outcome (Y) without the program (that is, when P = 0). For the evaluation of the conserving crop diversity component, this is equivalent to saying that we want to measure income or number of crop species at the same point in time for the same household in Cotacachi, but in two different states: with and without the program. Therefore we would like to observe i.e. how much income or number of crop species the same household would have had at the same point in time both with and without the program, so that the only possible explanation for any difference in that household's income or number of crop species would be the program (assuming the household composition is stable at that point in time). If we could do this, we would eliminate any

outside factors that could cause or affect the difference in income. We could then be confident that the relationship between this program and income is causal.

The Counterfactual

As we mentioned, the impact (α) of the program (P) is the difference in outcomes (Y) for the same household with and without participation in a program, but we have to realize that measuring the same household in two different states –even if the household composition is stable- at the same time is impossible (Ravallion, 2008). At any given moment in time, a household either participated in the program or did not participate. Therefore, the household cannot be observed simultaneously in those two different states: with and without the program. This is called "the counterfactual problem". Here we raised the question of how do we measure what would have happened if the other circumstance had prevailed? (Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M., 2011).

We know we can observe and measure the outcome (Y) for households participating in the program (Y | P = 1) but we have no data to measure and determine what these households' outcomes would have been without the program in Cotacachi (Y | P = 0). Then, based on the previous model we mentioned (3-1), we can say that the counterfactual is defined by the term (Y | P = 0). Therefore, for this program evaluation, we could raise the various questions i.e. what would have happened to the outcomes of a specific household if it had not participated in the program? Or what the income or any other outcome (Y) would have been for this specific household in the absence of this program (P), or what would have been the number of crop species and corn and bean varieties per household in the absence of the conserving crop diversity component? Or what would have happened to children of the participant households –regarding

knowledge of conserving crop diversity and environment-in the absence of the educational component? Etc.

During the impact evaluation of the program in Cotacachi, we were able to obtain the first term of the formula (3-1), that means (Y | P = 1)—the outcome under treatment. We measured the outcomes of interest for the group of households that participated in the program either in the conserving crop diversity component or educational component. But, for the second term of the formula (3-1) which is (Y | P = 0) we are unable to establish this measure for the participant households; therefore, we were required to estimate the counterfactual in order to obtain information. To do this for the conserving crop diversity component evaluation, we are having the help of a comparison group, which is the group of households from participant communities of Cotacachi that did not participate in the program for any possible reason-due to the component was offered to all the households in participant communities; and for the educational component evaluation, we are having the help of a control group, which included the group of households from participant communities of Cotacachi that did not participate in the component plus the group of non-eligible households from non-participants communities of Otavalo, a neighboring county where the program was not offered.

To construct a good counterfactual to evaluate the educational component, we selected a group of households with similar characteristics of the beneficiaries of this component. We selected these households based on two basic characteristics which are the type of elementary school the children -of each household- were attending and the location of that school, as the beneficiaries of the component were households with

children attending CECIB schools located in the communities. In this way, we selected a group of households with these characteristics from the group of households we randomly surveyed in non-participant communities of Otavalo in 2010.

Pre and Post Intervention Data

Having pre and post intervention data is useful for the identification of changes in outcomes of the households, as well as the identification of differences between treatment and control groups. Both baseline data and follow-up surveys help us to observe the changes in outcomes (Y) such as number of crop species and corn and bean varieties of the Cotacachi's households through time; comparing both data sets, we are able to analyze in depth the changes in outcomes (Y) before and after the program. The data collected post intervention of the educational component in both Cotacachi and Otavalo in 2010 helped us to determine the differences between the treatment and control group with respect to children's knowledge of agro-biodiversity, environment and cultural diversity. In sum, the purpose of using pre and post intervention data is to obtain the impact of the program based on two measures (1) The changes in outcomes of the participants and non-participants in Cotacachi before-and-after the program, and (2) the difference in outcomes between the treatment and control groups.

Method for Impact Evaluation: Difference-in-Differences and Single-Difference

There exist different impact evaluation methods that could help us to evaluate the impact of this program. To mention some of them, we have: randomized assignment, randomized promotion, regression discontinuity design (RDD) and matching methods—all produce estimates of the counterfactual. But, reviewing some impacts evaluations

models of different programs for poverty alleviation in Latin America and the Caribbean by John Newman (2002), Laura B. Rawlings (2003), Martin Ravallion (2008), Gladys Lopez-Acevedo (2012) and others (i.e. Khandker, S. R., Koolwal, G. B., & Samad, H. A. ,2010) we found that the difference-in-differences (DD) method offered us an additional set of tools that can be applied in the impact evaluation of this program due to the fact that the program assignment rules and implementation are complex and none of the methods previously mentioned is feasible. Through this study, we will see how DD method could be a powerful statistical tool as it is commonly used on impact evaluation of programs for poverty alleviation and food security (Khandker, Shahidur (2010), Ravallion (2008), Paul J. Gertler (2011)). Also, the DD method absolutely requires the existence of baseline data. We have baseline data of Cotacachi to evaluate the conserving crop diversity component.

The difference-in-differences method can be used for Cotacachi's beneficiaries versus Cotacachi's non-participants impact evaluation. As it compares the changes in outcomes over time between a population that is enrolled in the program (the treatment group) and a population that is not (the comparison group), we can use it for Cotacachi because we have before-and-after program data. Then we can just subtract the difference between outcomes of participants and the non-participants before the program is introduced from the difference after the program. This will deal with the troublesome unobserved variables provided they do not vary over time.

Two types of differences are implied in this methodology. The difference in the before-and-after outcomes for the beneficiary group—the first difference—controls for factors that are constant over time in that group, since we are comparing the same

group to itself. But we are still left with the outside time-varying factors. One way to capture those time-varying factors is to measure the before-and-after change in outcomes for a group that did not enroll in the program but was exposed to the same set of environmental conditions—the second difference. If we “clean” the first difference of other time-varying factors that affect the outcome of interest by subtracting the second difference, then we have eliminated the main source of bias that worried us in the simple before-and-after comparisons. The difference-in-differences approach thus combines the two counterfeit counterfactuals (before-and-after comparisons and comparisons between those who choose to enroll and those who choose not to enroll) to produce a better estimate of the counterfactual.

In the Cotacachi’s beneficiaries versus Cotacachi’s non-participants impact evaluation it is very important for DD to be valid, the comparison group must accurately represent the change in outcomes that would have been experienced by the treatment group in the absence of treatment. To apply difference-in-differences, all that is necessary is to measure outcomes in the group that receives the program (the treatment group) and the group that does not (the comparison group) both before and after the program. The method does not require us to specify the rules by which the treatment is assigned.

In sum, the impact of the program for the conserving crop diversity component’s evaluation could be simply computed as the difference between two differences:

$$\text{DD impact} = (B - A) - (D - C) = (B - E) \qquad (3.2)$$

Where:

A is the outcome variables for the beneficiaries before the program

B is the outcome variables for the beneficiaries after the program

C is the outcome variables for the non-participants before the program

D is the outcome variables for the non- participants after the program

For the two counterfeit counterfactuals we previously mentioned, the difference in outcomes before and after the intervention for the treatment/beneficiary group is (B − A) and the difference in outcomes after the intervention between the treatment/beneficiary and comparison/non-participant groups is (B − D). Instead, in difference-indifferences, the estimate of the counterfactual is obtained by computing the change in outcomes for the comparison/non-participant on group (D − C). This counterfactual change is then subtracted from the change in outcomes for the treatment/beneficiary group (B - A).

The table 3.1 can give us an idea for making the Cotacachi's beneficiaries versus Cotacachi's non-participants impact evaluation. First, we have to calculate the difference in the outcome (Y) between the before and after situations for the treatment/ beneficiary group (B − A). Second, we have to calculate the difference in the outcome (Y) between the before and after situations for the comparison/non-participant group which is (D − C). And finally, we have to calculate the difference between the differences in outcomes for the treatment/beneficiary group (B − A) and the difference for the comparison/non-participant group (D − C), so the DD = (B − A) − (D − C). This "difference-in-differences" is our impact estimate.

Table 3-1. The difference-in-differences method

	After (Follow-up)	Before (Baseline)	Difference
Treatment/beneficiaries	B	A	B − A
Comparison/ non-participants	D	C	D − C
Difference	B − D	A − C	DD = (B − A) − (D − C)

Source: Gertler, Martinez, Premand, Rawlings, Vermeersch (2011). Impact evaluation in practice. World Bank Publications

Because we only have ex-post data for the educational component, we can only apply a single difference to the analysis (treatment versus comparison group) of this component. However, a matching method may complement the single-difference methodology applied to this component, in order to analyze the differences in outcomes between beneficiaries' households from Cotacachi and the non-participants and non-eligible households from Otavalo. Our matching method uses program assignment rules (for the educational component), to find a comparison group that has not participated in the program, but which could have been elegible given these rules. This is the case of the Otavalo group, an artificial comparison group that identifies for every possible observation under treatment at least one non-treatment observation that has the most similar characteristics possible. As mentioned earlier, we selected households based on two basic characteristics: the type of elementary school the children -of each household- were attending and the location of that school – eligible for this component were households with children attending schools for intercultural bilingual education (CECIB schools) located within the communities.

CHAPTER 4
EMPERICAL IMPLEMENTATION

Research Site

Cotacachi and Otavalo are located in Imbabura Province, in the northern Andean region of Ecuador (Figure 4-1). The economic and cultural activity of the region centers on the main trade city of Ibarra, the capital of the province, located 25 kilometers northeast of Cotacachi. Although Ibarra is the main city in the Imbabura province, Cotacachi is the biggest county with a surface of approximately 1,802 square kilometers. On the other hand, Otavalo has a smaller area with a surface of 507.47 square kilometers. Cotacachi borders Otavalo and both counties are located approximately 104 kilometers north of the Ecuadorian capital, Quito. The official languages are Spanish and Kichwa in both counties. The weather in both counties is similar; the average temperature is 14 degrees Celsius. Both counties are strategically located, surrounded by volcanoes, lagoons, and rich in biodiversity of crops. They are world-renowned for their cultural diversity, traditions, art and music. Although most of the urban and part of the rural population is focused on developing offerings for tourists as their main income generating activity, most of the rural population is engaged in agriculture, as their crops are the basis of their nutrition (Municipality of Cotacahi and Otavalo, 2010).

Cotacachi is a town rich in cultural and linguistic diversity. The county of Cotacachi is known as the Ecuadorian capital of Music and it is also famous for manufacturing products made with leather and for its tourism. Cotacachi is near the popular tourist destination of the Cotacachi-Cayapas Nature Reserve with its stunning volcanic lagoon. Cotacachi is located at an altitude of 2418 masl. The population of

Cotacachi is approximately 40,036 inhabitants based on the last census of 2010 by INEC, and of those inhabitants, 19,946 are female and 20,090 are male. The predominant ethnicity is indigenous and mestizo but there is a small population of afro-Ecuadorians and motubio ethnicity as well. In Cotacachi, the indigenous population in 2001 was 34.7% of the total, and that increased for 2010 as the indigenous population was 40.6% of the total population in the County by that time. The predominant language among the rural communities is Kichwa, especially for elderly; and most of the young people and children speak both Kichwa and Spanish as they learn Spanish in the elementary schools of Cotacachi. In the last two decades, the Center for Intercultural Education has played an important role to conserve their linguistic and cultural diversity due to the fact it is an educational system that provides knowledge in both languages (Municipality of Cotacahi, INEC and UNORCAC 2010).

In the same way, Otavalo is well known for tourism and it is the home of the world-renowned handicraft market Plaza de los Ponchos and other demographic characteristics. The population of Otavalo is approximately 104,874 inhabitants based on the last census of 2010 by INEC, and of those inhabitants, 54,428 are female and 50,446 are male. Even though Otavalo is smaller in size than Cotacachi (507.47 square kilometers), it has a greater population. And the urban population represents 44.3% of the total population of the County while the rural population represents 55.7%. The predominant ethnicity is indigenous and mestizo but there is also a small population of afro-Ecuadorians and motubio ethnicity. In Otavalo, the indigenous population in 2001 was 55.4% of the total population and that increased for 2010 as the indigenous population was 57.2% by that time, which means that the population of Cotacachi grew

to a rate of 1.68% between 2001 and 2010. The urban and rural communities of Otavalo are located at different altitudes between 1,100 masl in the area of Selva Alegre to 4.700 masl in the area of the Imbabura volcano. (Municipality of Otavalo and INEC, 2010).

There are some similarities in the rural communities of Cotacachi and Otavalo counties. Cotacachi has four parishes that include 43 peasant communities and Otavalo has nine parishes that include more than 80 peasant communities. The communities of both counties have similar cultural diversity and farm practices. Even though both counties are rich in diversity of crop species, the peasant communities focus on corn, beans and potatoes to provide consumption and nutrition needs. In the communities of both counties the Inti Raymi (Fest of the Sun) is celebrated every June according to the crop harvest calendar in order to thank mother earth for the crops and harvest, as well as, crop productivity. The Inti Raymi celebration is also linked to the corn seeds which are considered the symbol of crops and cultural diversity in the peasant communities of both counties (Municipality of Cotacachi and Otavalo, and UNORCAC, 2010).

One difference between the communities of both counties is the access to local markets. It is known that households from both counties have the opportunity to offer their crops in the local markets of Cotacachi and Otavalo but Otavalo has bigger and more popular food markets than Cotacachi. Due to the fact Cotacachi does not have enough local markets where farmer can offer their products and exchange their seeds, UNORCAC has been working the last decade to change that situation as they developed some small local markets and well-promoted seed fairs where farmers of

Cotacachi may have the opportunity to exchange seeds and products. To complement this effort, UNORCAC also develop a local market beside the health center for the peasant communities located in the urban area of Cotacachi. In this local market, farmers from Cotacachi and Otavalo participate every week whether offering their products or exchanging their seeds. UNORCAC has also invited other communities from other neighbor towns in addition to the communities of Cotacachi and Otavalo. And they have also carried out several seed fairs at the biggest market of Otavalo in order to promote the conservation of their native crop species (UNORCAC, 2010).

We have to recognize that UNORCAC plays an important role in Cotacachi's peasant communities. And one of the limitations of our fieldwork was not having an institution such as UNORCAC in Otavalo to help us collect the data in the peasant communities of Otavalo. Because of that, access to the peasant communities of Otavalo was restricted as it is not usual that they collaborate with information of their communities and participate in surveys if their leaders are not in agreement with that and do not allow them to do it. Even with this limitation, we could collect data from an acceptable group of households from Otavalo with similar characteristics and household composition to those in Cotacachi for our study.

Survey and Data Description

Our study uses baseline data composed of two surveys administered at different points in time, and follow-up data collected during our fieldwork in 2010. The baseline included data collected by INIAP and UNORCAC in 2002 and 2005.The data collected by INIAP in 2002 were about farm practices and parcel characteristics while the data collected by UNORCAC in 2005 were about living conditions. Additional to the data about living conditions, parcels characteristics, and farm practices included in the

baseline, the data collected after the program -during our fieldwork in 2010- extended the previous survey instruments to include information about program participation and children's knowledge of conserving agro-biodiversity and environment. These data were collected through surveys and interviews applied not only to the households of the peasant communities of Cotacachi, but also to the group of households from Otavalo County. For these surveys, we used the same parameters presented in the baseline plus other parameters that helped us to evaluate the impact of the four components of the program. We describe these surveys in further detail in the next subsections.

Cotacachi's Baseline Data: INIAP Survey and UNORCAC Census

The survey applied by INIAP in 2002 was designed to elaborate a diagnostic of the agro-biodiversity conserved in-situ in Cotacachi. This survey included some questions about social and economic characteristics of the households and general characteristics of the communities of Cotacachi, but it focused mostly on parcel characteristics, number of crop species and crop varieties per household, and farm practices.

INIAP did not survey all Cotacachi households; instead, they used a representative sample of 379 households. This group of households was a sample obtained from a population of 3,300 households. It was obtained through a stratified sampling method where every community was a stratus and the proportion of households selected from every stratus based on the weight of the stratus inside the population which was the forty three peasant communities of Cotacachi. The proportion of households selected from each community was 10-25% of the total households. Only in a few communities where the number of households was less than 50, the proportion of households selected for the sample was 25% in order to reduce bias.

The data collected by UNORCAC in 2005 was a census with the participation of 3,224 of the 3,300 households from the peasant communities of Cotacachi. In 2005 when the second phase of the program began and the Conserving crop diversity, Agro-Industry and Education components were just implemented, the UNORCAC decided to collect data from the 43 communities of rural Cotacachi to elaborate a diagnostic of the living conditions of the households in those peasant communities based on a local perspective as the UNORCAC's perspective which would be different from the Government perspective. The survey included similar questions to those included in the Census carried out by INEC which is a government institution that gathers data about living conditions nationally. And it also included several questions to capture local notions of welfare, which came into light during workshops with the community leaders. These questions were about the characteristics of the households, level of education of the members of the households, employment, health of children and adults, basic services (access to pipe water, electricity, telephone, and sewage system), nutrition and food security, agricultural and animal production, social aspects, participation in the community, expenditures, and income.

Data Collection in 2010 for Treatment and Control Groups

We interviewed seven hundred households in the Ecuadorian counties of Cotacachi and Otavalo from June to September of 2010. We applied a survey that included questions about living conditions (household characteristics, education, employment, activities to generate income, gender, health, basic services, nutrition and food security, social and communitarian issues, consumption, income) farm characteristics (type of soil, years of use, size, slope, number of crops cultivated, etc), production activities, crops and seed characteristics (percentage of the crop in the

parcel, crop varieties, crop uses, exchange of seed levels, storage method, selection criteria, related issues, etc.), perception of received aid from local and international institutions, perception of satisfaction due to the project, and children´s knowledge of conserving agro-biodiversity, environment and cultural diversity.

About half of the interviewed households were from Cotacachi and the remaining half from Otavalo. The participants in the survey were mostly indigenous families from the agricultural communities of the two counties. Just a few of the participants were mestizos (a mix of indigenous, afro-Ecuadorian, and/or Spanish ethnicities). The group of households interviewed in Cotacachi included the households from 39 participant communities, which were enrolled in any of the four components of the program. It included 247 households that were tracked from the group of 379 households interviewed before by INIAP in 2002;

As the data collected in Cotacachi in 2010 were part of a follow-up survey, we tried to apply the survey to the same sample of 379 households that INIAP had in 2002. Our goal was to track those 379 households as we knew that those households were also interviewed by UNORCAC in 2005. Unfortunately, we did not find the whole group of households due to some factors such as migration, family disintegration, etc. Of those 379 households that were interviewed in 2002, we found 247 which were 65.17% of households of the original sample. As these 247 households are part of the INIAP's 2002 sample, they were distributed among 39 of the 43 peasant communities of Cotacachi. The Cotacachi sample was extended by including the group of participant households of the agro-tourism component and their –physically- closest neighbor; and the participants of the agro-industry and educational components. We have to recall

that a specific household could have participated in either one or more components depending on the eligibility rules to participate.

The interviewed households from Otavalo were randomly selected in 11 control communities to help us to construct the control group to evaluate the educational component of the program. We tried to interview a considerable number of households (350) to have more options to choose from, when looking for households that were more similar -in characteristics such as location, household composition, income, etc.- to those in the participant communities of Cotacachi.

We selected a group of households that had similar characteristics to those we had in Cotacachi. Those characteristics were location, altitude, some socio-economic factors, agricultural production, as well as, cultural and linguistic diversity. These households were randomly selected within the communities. We applied the same survey applied in Cotacachi, with the same questions about living conditions, parcels characteristics, farm practices, -in this case-participation in similar programs, and children's knowledge of conserving agro-biodiversity and environment. During our analysis we also had to filter those households and drop some of them with inconsistent information, reducing the sample to 321 households. Later, to evaluate the educational component, we chose a group of 131 households from that sample because those 131 households had similar characteristics as the households from Cotacachi which enrolled in the educational component. Therefore, we only used that subset of households to construct the Control group to evaluate the component.

Members of UNORCAC helped us to identify the communities of Otavalo that had similar characteristics to those in Cotacachi. Regarding location, we selected

households in Otavalo that were located in a geographic area similar to Cotacachi which is rural area close to the mountain. Also, they were located at different levels of altitude. They ones located at altitudes between 2300-2500 masl were considered as located in the low part of Otavalo, between 2600-2800 masl were considered as located in the middle part of the mountain, and the households located at 2900-3500 masl were considered to be located in the Paramo area or highest altitude of Otavalo. We selected the group based on this characteristic due to the fact the crop species, soil, parcels slope, and irrigation system change among different levels of altitude. In the same way, we based our selection on social and economic factors, as well as ethnicity, farm practices, agricultural activities and production, crop diversity and seed varieties. Based on the characteristics mentioned above, the eleven communities we selected were Esperanza-La Libertad, Gualsaquí, Gialsaquí-Puise, Moras Pungo, Urcu Siqui, Achupallas, Muenala, Quinchiqui Bajo, Quinchiqui Medio, Quinchiqui Alto and Agato.

Empirical Analysis by Project Components

Our analysis to estimate the effect of the program upon the livelihoods of the families from the peasant communities in Cotacachi includes four parts. Each part is dedicated to analyze each component of the program. The first analysis focuses on estimating the impact of the program on enhancing welfare through conserving crop diversity; the second part focuses on estimating the impact of the educational component; the third part focuses on the analysis of the Agro-tourism component; and the fourth part is dedicated to analyzing the Agro-Industry component. To estimate the effect of the conserving crop diversity component, we used the Cotacachi baseline and follow-up surveys, comparing a group of 247participant and non-participant Cotacachi households, before and after the program. The TOT estimate (see Chapter 3, last

section) is obtained by calculating the difference-in-differences program impact estimate on a number of outcomes, through a fixed-effect regression. This regression form is a generalization of the difference-in-differences approach that implicitly controls for all household-specific factors –observable and unobservable—that are constant over time. Explicitly, it also allows to control for preexisting observable factors that may distinguish participants from non-participants systematically and that change within units over time, yet are not related to the program impact. As such, this generalization removes the largest potential sources of omitted variable bias (OVB) affecting the impact estimate. This estimate can be interpreted as the within-unit change in the outcome that is due to program participation.

In order to estimate the impact of the Education component, we only used the data collected in Cotacachi and Otavalo during our fieldwork in 2010 (with information for that year for a treatment and a control groups). Thus, while we cannot use a fixed-effect regression (we lack observed variation over time in our variables), we used the OLS regression generalization to calculate the single-difference impact estimate (difference of average outcome between treatment and control groups), which still allowed us to control for characteristics of treatment and control groups that are different and may affect outcomes, independently of the participation in the program; removing this source of OVB.

The third and fourth parts of the study involve a qualitative analysis of the agro-tourism and agro-industry initiatives, which assesses the perceived impact of both components on participants through unstructured interviews with them.

Quantitative Analysis of the Conserving Crops Diversity Component

For the conserving crop diversity component, the beneficiaries were the households that enrolled in any of the component activities. For a household to be considered as a participant or beneficiary, it had to have participated in at least one of the activities carried out during this component or have received any related help from INIAP and UNORCAC during the intervention, as those institutions were in charge of the implementation of this component. The main activities associated with this component were: the seed and traditional food fairs; workshops about nutrition, native crop production and uses, traditional food preparation and how to prepare processed products made up of native crops; use of the cook book of traditional recipes; visits to the ethno-botanical garden; diversify the parcel with native crop species or other species donated by INIAP or UNORCAC; cultural events in the community for conserving crop species, crop varieties (specially corn and bean), environment and cultural diversity.

Any household in the participants' communities was qualified to sign up for any of the above mentioned activities. Even though all households in the 39 communities of Cotacachi were eligible to enroll, some fraction of households –at the sample level- 21.86% percent -of those 247 households (54 households) evaluated- decided not to do so. In this scenario, 78.14% percent of the 247 households (193 households) decided to enroll in the activities and they actually received the services that the program provided. Table 4-1 shows the distribution of households across treatment and control groups, for the pre and post intervention periods (2002 and 2010).

Estimation

We analyzed changes that occurred in households from 2002 to 2010 for several outcome variables, and, if any change occurred, we tried to determine if that effect may be attributed to the program intervention. Specifically, we looked for differences in household income, food expenditures,[2] the number of crop species grown, the number of corn, bean and tree tomato varieties grown by the household, as well as changes on nutrition associated with the consumption of vegetables, tubers, fruits and grains, by adults and children. [3]

The specific fixed effect difference in difference regression model estimated has the following general form:

$$y_{it} = \beta_0 + x_{1it} * x_{2it}\,\beta_1 + x_{2it}\,\beta_2 + \boldsymbol{z}'_{it}\,\beta_3 + u_i + \varepsilon_{it} \qquad (4\text{-}1)$$

where y_{it} denotes the specific outcome under consideration for household i in month t, x_{1it} is a dummy variable that takes the value of 1 for participants and 0 for non-participants, x_{2it} is a dummy variable that takes the value of 1 for the year 2010 (post intervention) and 0 for the baseline year (pre intervention). The coefficient of the interaction of these two variables β_1 captures changes over time in the outcome variable that are related to program participation, while the coefficient β_2 captures changes over time that are not related to the intervention. The variable $\boldsymbol{z}_{it}$ identifies a set of explanatory variables that are used to account for household characteristics that vary over time and may have an effect on the outcome, independently of participation, such

[2] The empirical estimation uses the logarithm of income and food expenditures.

[3] We asked each household what is the monthly income earned by each member of the family in age to work, how much are the monthly expenses in food, how many crop species and corn and bean varieties they planted in their parcels, how often the members of the family (children and adults) consumed grains, vegetables, tubers, and fruits.

as whether the household received a loan in that year or whether the mother's education level has changed. In turn, u_i is a household-specific parameter that integrates all time-invariant characteristics of the households (Allison, 2005). Finally, $\boldsymbol{\varepsilon}_{it}$ is a random variable, assumed to be normally distributed, with the mean of zero and variance of σ^2.

Control Variables and Expected Effects

As explained above, besides the interaction (treatment effect) term and the year dummy included as explanatory variables in all regressions, we included other controls aimed to capture differences in household characteristics. The control variables in equation (4-1) --captured by $\boldsymbol{z}_{it}$ -- include a basic set of regressors that are used to explain all of the outcomes, plus some additional ones that enter only specific equations. The basic set of regressors (for household i in year t) are: the total cultivated land area (in m2), the mother's level of education (in years),a dummy for whether the household owns the house in which they live, the log of total household income, a dummy for whether the household received a loan in the previous year they were interviewed (whether after the Program in 2010, or before the Program from 2002), the gender of the household head (1=female, 0=male), the number of children in the household, the number of present working age females and the number of present working age males (we include the log of household income to explain all outcomes, except for the income outcome itself). For the income and food expenditures outcome regressions, we include a dummy denoting whether insufficient food was available in a specific year due to having had a poor harvest. Finally, the income equation also included the number of different types of animals owned by the household in that year (these are separated into cattle, pigs, sheep, goats, chicken for meat production,

chicken for egg production and guinea pigs). Table 4-2 presents a summary of all variable definitions and the short names used in the regression tables. And Table 4-3 shows descriptive statistics of all regression and control variables as well.

The treatment interaction term could be expected to be positively significant for most regressions as the program was expected to have an effect upon the welfare of households (measured by income and food expenditures) and agro-diversity (measured by number of crop species and corn, bean and tree tomato varieties). However, while in a perfect market economy food expenditures would be expected to be highly correlated with household welfare, a setting like Cotacachi with high levels of self-production and consumption of food, households who increase their production diversity may have to purchase fewer items in the market and this would decrease their food expenditure levels. Another caveat that we had concerns the consumption outcomes. These outcomes were based on a question that allows for three categories of frequency of consumption of a specific type of crop: always, sometimes, never. While our intention was to define the outcomes as dummies equal to 1 for always or sometimes and zero otherwise, this was not possible for the lack of observations with the response “never.” Thus, the variation in these dependent variables is limited to reflect mostly the difference between “always” and “sometimes,” which may not be enough to show significant correlation with program participation.

Regarding the basic set of regressors, it is expected that households with larger size of land and that designate the land for agricultural production would be more likely to have more crop species in the parcels as well as plant additional varieties of corn and beans. This variable may also be positively correlated with household income and

consumption of different types of foods. However, it is unclear how it may relate to food expenditures, since more land may contribute to more self-consumption and less food expenditures; or to the contrary, to more crop sales (more income) and more food money for food expenditures. We hypothesized that the former may be the case, since we control for income in the regression.

The variable for mother's level of education in years was expected to have a positive impact on parcels diversity. Research on food security has shown that mothers play an important role in nutrition, education and household decisions (Quisumbing, Brown, Feldstein, Haddad, and Peña, 1995). In the same way, women of Cotacachi were expected by project implementers to play an important role on household nutrition, as well as on the diversity of parcels and the household economy. UNORCAC's leaders recalled they were working on different activities with the women of the communities- especially women who have children- to encourage them to diversify their parcels and make more use of their native crops, specially the corn, for their children's nutrition, and as a way to conserve the Cotacachi's agro-diversity.

The variables related to house ownership and if the household received a loan were intended to capture wealth aspects that were not captured by the income variable, but which could positively influence welfare indicators and frequency of consumption of different food types. While they could influence parcel diversity in a positive manner, by making seeds and commercialization of products more affordable, the effect on agro-diversity may be ambiguous as wealthier households may tend to specialize in cash crops. An analogous logic holds for the household income variable, with expected

positive effect on welfare and consumption frequency, yet an uncertain effect on parcel diversity.

The gender of the household head was expected to have a negative coefficient for outcomes such as household income and food expenditure, since it has been found in many contexts that female headed households do not have the same access to income earning opportunities as male headed ones. The expected effect on agro-diversity and frequency of consumption of crops is ambiguous, since women heading households may, on the one side, have a stronger preference for agro-diversity than men, yet be more pressed for finding cash to finance other household needs, such as children's education.

The basic regressors also included the count of children, male and females in the households. The effect of the number of children on income and frequency of consumption was expected to be negative. It was expected to be positive on food expenditures, as households with more children may have to spend more on food. The effect of these variables on agro-diversity would be positive, if the children help with any of the production activities. Regarding the number of working age males and females, these variables are expected to have a positive effect on income, food expenditures, and frequency of consumption, but an ambiguous effect on agro-diversity.

Whether insufficient food was available in a specific year due to having had a poor harvest was expected to have a negative effect on income and an ambiguous effect on food expenditures (the household may need to buy more of their food when the harvest is poor, yet they may not have enough income and their expenditure may drop). Finally, the number of working age members not present in the household and the number of

animals in the farm are expected to be positively related to income. The former because there is a large percentage of households in Ecuador that receive remittances, and the latter, especially for the most commonly commercialized animals such as cattle, guinea-pigs and chicken.

Results of the Estimated Equations

The estimated coefficients for the variables relating to welfare, agro-diversity and frequency of consumption are presented in Tables 4-4 to 4-7. From the descriptive statistics we saw that, in aggregate, most outcome variables increased their levels during the period of time in question, with the exception of the number of varieties of tree tomatoes and taxo.[4] A quick perusal across all tables shows that the treatment effect coefficient --the effect of participating in program activities-- is positive and significant for household income, for the number of crop species in the farm and for the number of bean varieties. The year effect, in turn, was positive and significant for food expenditures, variety of crop species and all frequency of consumption variables (except for child tubers' consumption).

For the welfare indicators, these results mean that while food expenditures increased during this time period for all the households, they did not increase significantly for program participants. To the contrary, the increase in income for Cotacachi households was mostly related to program participation. In the case of agro-diversity, we found that the program had a significant effect on the increases in crop species and bean varieties, yet not on the number of varieties of corn. Finally, the

[4] For these two, however, the proportion of households not growing any variety at all in 2002 is very high (86% for taxo and 68% for tree tomato) and it increases over time (93% for taxo and 86% for tree tomato in 2010). These two crops are also crop species that INIAP and UNORCAC were promoting for consumption and conservation of varieties.

change in the frequency of consumption from “sometimes” to “always” of a number of food types was not associated to program participation. There was one exception concerning children’s consumption of grains, which seems to be negatively associated with program participation. We think that this may be related to the fact that households were increasing their welfare may be substituting grain for protein. Unfortunately, we do not have any measure of protein intake in the sample.

Beyond the changes in the outcomes due to program participation, we found that income increased significantly for households with more present working age males, more working age members living elsewhere and number of cattle. It decreased with the area cultivated, with having faced food shortages due to bad harvests and with the number of goats. Households headed by women also had worse income outcomes compared to the male headed ones. The increases in food expenditures, in turn, were tightly related to increases in income, in loans and in cultivated land area.

For our agro-diversity measures, we found a consistent positive and significant effect of cultivated area on the diversity increases of varieties and crop species. Interestingly, increased household income played a role in the increase of crop species, yet not on the increase of crop varieties. Decreases in crop species were associated with female household headship and decreases in the number of varieties are related to the same variable, as well as to the number of working age females. This highlights the relevance of our hypothesis that women may be pressed for finding cash to finance household needs, such as education, due to their reduced income opportunities and lower wage levels. Thus, women may have less time and resources to invest in diversifying the parcels.

Finally, the frequency of consumption of most food types was positively related to increases in cultivated land area, for both adults and children. The number of working age males present increased the frequency of consumption of fruits and owning the house where a household lives increased adult consumption of vegetables. To the contrary, the number of women of working age present had a negative effect on the consumption of fruits by children.

Quantitative Analysis of the Education Component

With respect to the educational component of the program, the implementers of the program selected 19 elementary schools located in 19 of the 39 participants' communities of Cotacachi to be part of this component, in order to work with the children who were attending those schools. The selected group of elementary schools is part of the Intercultural Bilingual Education Network (CECIB). Table 4-8 shows the list of those nineteen elementary schools –distributed per community. We have to recall that there were more CECIB schools distributed among the 39 participant communities of Cotacachi and other neighbor towns as well.

To be able to estimate the impact of this component, we needed data from control communities. We selected eleven control communities in Otavalo -that had similar characteristics to the ones in Cotacachi- where the program was not offered. Those communities also had CECIB schools and households with children attending those schools as well as other elementary schools of the region.

For our analysis of this component, we used the data collected from the interviews of 341 households located in Cotacachi (210) and Otavalo (131). This group of 341 households was selected as a subset of households from a sample of seven hundred households that were distributed in the 39 participant communities of Cotacachi (350)

and the eleven control communities of Otavalo (350). We selected this subset of 341 households because they had the needed characteristics to be part of the evaluation of this component as they had at least one child attending elementary school by 2010, and the child/children was/were home during the interview to answer our questions. The questions we used were designed for children of elementary school level between seven and eleven years old. This group of questions was about the children´s elementary school characteristics and their knowledge of agro-diversity, cultural diversity and the environment.

After determining the group of 341 households from Cotacachi and Otavalo with children attending elementary schools, we had to identify those households with children attending the elementary schools of the program and the ones that did not, in order to distribute them into two groups, the treatment and control group. In the Treatment group were the 'beneficiaries' of the program which were the households from the participant communities with children attending any of the nineteen CECIB schools (Intercultural Bilingual Education in Kichwa and Spanish language) that belonged to the program. On the other hand, the "Control" group was formed by two other subgroups of households: the non-participants (in participant communities) and the non-eligible (in control communities). As the participant communities are located in Cotacachi because it was the town that received the treatment; and the control communities are located in Otavalo because it was the town that did not receive the treatment, the "Control" group for the educational component was made up of the group of households from both counties, Cotacachi and Otavalo, which had children attending any type of school other than the ones in the program. That group of schools (in the

Control group) included other CECIB schools that do not belong to the program, as well as other public and private elementary schools.

From those 341 households located in Cotacachi (210) and Otavalo (131) we used to evaluate this component, we assigned the households for the Treatment and Control group in order to compare both groups and estimate the impact of the component. Of those 210 households in the participant communities, only the 70.95% (that is 149 of those 210 households) enrolled in the educational component of the program, therefore the Treatment group was made up of those 149 households. The rest of those 210 households –at the sample level- 29.05% (61 of 210) had children in other schools than the ones in the program; therefore those 61 households are the non-participants in participant communities. The Control group was made up of the non-participants (61 households in participant communities of Cotacachi) and the non-eligible which were those 131 households in the control communities of Otavalo; all those 192 households had children that attended elementary schools that were not part of the program. In summary, we had 149 households for the "Treatment Group" and 192 households for the "Control Group"

School Characteristics

The implementers of the project decided to include the nineteen (CECIB schools) in the Education component based on certain characteristics. These schools are located in the peasant communities of Cotacachi. In addition, this group of schools were Centers for Bilingual (Kichwa-Spanish) and Inter-Cultural Education; therefore they were already working with the students on maintaining linguistic and cultural diversity. As the main objective of the component was to maintain the agricultural heritage for the conservation of biodiversity of crops in the long run, this group of

schools had all the characteristics the implementers looked for to start working with the children and reach the main goal of conservation of agro-biodiversity. Therefore, the CECIB schools were included in the program as a strategy to share Cotacachi's farm practices knowledge among the children of the peasant communities of Cotacachi.

The group of implementers, ecologists, and teachers who worked for this component focused their effort on the students' learning about the importance of using and conserving their traditional crops as their ancestors did in the past. During classes, they followed a guide developed in cooperation with teachers and one environmental specialist. In addition, children had the opportunity to cultivate several crops using their ancestral farm practices in their schools' gardens. As a curricular activity, children at the CECIB schools learned about the diversity of local crops and plant species during their visit to the Ethno-botanical garden in Cotacachi which was designed to educate not only the children of the schools of the program but also children attending other schools plus the local and foreign tourists that visit Cotacachi. This is supposed to be an advantage for students and locals in Cotacachi compared to Otavalo. We have to recall that local and foreign tourists who visit the garden to see the diversity of the local crops leave small donations as a way to support the garden and contribute to its maintenance.

We had some difficulties to make a quantitative analysis of the characteristics between the schools that were included in the Program and the rest of schools included in this study. From our survey we collected data about certain characteristics of the children' schools such as the type of school (i.e. CECIB, Private, Public, etc) and the location of the schools (i.e. inside the community, urban area of Cotacachi or urban area of Otavalo) and we also gathered additional information from the treated schools

thanks to UNORCAC that provided us the number of students and teacher population and linguistic diversity of every CECIB school -for a specific academic period- but unfortunately we were not able to collect data from those schools that were not part of the program –with respect to certain characteristics such as infrastructure, student and teacher population or linguistic diversity—in order to make a quantitative analysis of those characteristics between the schools of the program and the rest of schools. Even though we did not ask the members of the households about those characteristics of the other schools during the interviews, several parents made informal comments from their point of view and gave us information about those schools that are not part of the program and those comments helped us to make a qualitative analysis of the characteristics of both groups of schools.

From the point of view of several parents we interviewed, there are some differences between the CECIB schools that are located in the rural area and the schools located in the urban area, especially with respect to infrastructure and linguistic diversity. Some of the parents mentioned that the schools located in the urban area of both Cotacachi and Otavalo counties are bigger in terms of size, and with a better infrastructure compared to those located inside the peasant communities (CECIB schools that are part of the program and others). They also assured us that in the schools of the urban area the first spoken language is Spanish while the dominant language in the CECIB schools is Kichwa.

Some parents also commented that schools of the urban area offer their children a better quality of education compared to those located in the rural area. They recalled that this is a strong reason that influences them to make efforts to send their children to

the schools in the urban area; this agrees with what the leaders of UNORCAC said about the student migration from the CECIB schools to the eight schools located in the urban area of Cotacachi which had an average of 1086 students registered between 2000 and 2004 (UNORCAC, 2010). Also, some parents informed that the schools in the urban area are “Complete” schools which means that those schools have six or more teachers for the six grades of the Elementary School System, in other words, they have one or more teachers per class; while in the rural area the situation is different because the CECIB schools –depending on their economic resources- used to be “Unidocente”, “Pluridocente”, or –in a few cases- “Completa”.

Table 4-9 presents some characteristics of the CECIB schools (which are part of the program) with respect to location and the number of students and teachers per school for the academic year 2007-2008 (UNORCAC, 2010). In this table it can be seen that during the academic year 2007-2008, only 5 of the 19 CECIB schools (26.32%) had 6 or more teachers, 12 of 19 (63.15%) schools are “Pluridocentes” and 2 of the 19 (10.53%) schools are “Unidocente”. We have to recall that the number of the teachers and students of the CECIB schools changes every academic year (UNORCAC, 2010). Also in Table 4-9, the term “Unidocente” means that the school only has one teacher for all grades (six grades), “Pluridocente” means that the school has between two and five teachers for all grades, and the term “Complete” means the school has six or more teachers for all the six grades; in other words, each class has at least one teacher.

Finally, several parents commented on some similarities with respect to the ethnicity of the teachers. The parents confirmed that the majority of the teachers at the

urban area schools are Mestizo and a few of them speak both Kichwa and Spanish; the situation with respect to teachers' ethnicity and language at the CECIB schools is similar to the rest of the schools because the majority of the teachers are also Mestizo and 20% of them speak both languages Kichwa and Spanish, and 80% of them speak only Spanish. During an informal conversation with some members of UNORCAC, they said that the fact that only 20% of the CECIB teachers speak Kichwa is a weakness of the CECIB system as the objective of that type of school is to preserve the linguistic and cultural diversity of the population of Cotacachi, but they also said that they are doing their best to change that situation and increase the number of teachers who speak Kichwa in order to reach the goal of that school system.

Figure 4-2 shows that the 149 households of the Treatment group (100%) had children attending the CECIB schools that were included in the program. Also, Figure 4-2 shows that from those 192 households in the Control group, 51 households (26.56%) had children attending public schools; 9 households (4.69%) had children attending private schools; 121 households (63.02%) had children attending other CECIB Schools that were not part of the program; and 11 households (5.73%) had children attending other types of schools that they did not specify. Based on this, we can conclude that the households in treatment and control groups are comparable as 121 households in the Control group (63.02%) had children who attended the CECIB schools that were not part of the program; therefore those households were similar to those 149 households in the Treatment group which had children who attended the CECIB schools of the program.

Regarding the location of the schools involved in this study, Figure 4-3 shows the distribution of the households with children attending school by the location of the schools. From the group of 149 households that had children attending the school of the program (Treatment Group), 144 of those 149 households (96.64%) had children attending schools located in the same community where they live; and 1 of those 149 households (0.6%) had children attending a school located at Cotacachi town (urban area). From the group of 192 households that had children attending other schools that were not included in the program (Control Group), 109 of the 192 households (56.77%) had children attending schools in their own communities; 26 of the 192 households (13.54%) had children attending schools located in other communities different than the community where they lived; 23 of the 192 households (11.98%) had children attending schools located at Cotacachi urban area; 18 of the 192 households (9.38%) had children attending school at Otavalo's urban area; 13 of the 192 households (6.77%) had children attending school at Peguche (one of Otavalo's touristic areas); 1 of the 192 households (0.5%) had children attending a school at "Imantag Pueblo" (Center of the Imantag parish which is located in Cotacachi's rural area).

Children's Knowledge of Cultural and Agro Diversity and Environment

Our survey included questions about children's participation in the Education component activities and children's knowledge of cultural and agro diversity and environment. The children of the interviewed households were asked if they had participated in cultural events in the previous years (whether at schools or in their communities), if their parents also attended their school or cultural events (whether at schools or in the communities), if their teachers have talked and taught about environment during the classes, if they have visited the ethno-botanical garden that was

built during the project at least once, if they have knowledge of the corn and bean varieties that have been planted in their communities, if their families are keeping seeds of their traditional crops (specially corn and beans), and if they know what crop species their ancestors planted in the past, if they have home gardens, if they cultivate crops (specially at the school gardens), if they know about the use and importance of water to cultivate crops, if they recycle their home's organic residuals and finally, if they know the meaning of Inti Raymi (Feast of the Sun).

The questions of our survey were based on the curricular material and "Guide Book" that the group of teachers and environmentalist—who worked for the Program--developed for the students of the schools included in the program. During the interviews, we found the questions were easy to understand by the interviewed children and they were always willing to answer the questions.

The children who attended the CECIB schools of the program were expected to answer the questions positively as they were supposed to be familiar with those topics due to the fact they were exposed to the activities carried out during the program. We expected the children from the households of the Treatment group to have participated in cultural activities at the schools and inside their communities due to the fact that several activities related to conservation of agro-diversity of crops –especially corn- and environment were offered to the students of the CECIB schools of the program. The parents from the households in the Treatment group were also expected to have participated in those activities with their children as the teachers at the CECIB schools invited the parents to participate. Those children were expected to know about their traditional crop species, importance of water and recycling, as well as the meaning of

the Inti Raymi celebration as the teachers of the CECIB schools were trained to teach these concepts with the help the “Guide Book”. The children from the households of the Treatment group were also expected to have visited the ethno-botanical garden - that was built during the project- at least once due to the fact that they had this activity in the academic curriculum and the garden is located in the Cotacachi County.

Estimation

We analyzed differences that occurred in households of the treatment and control group for several outcome variables, and, if any difference occurred, we tried to determine if that effect may be attributed to the program intervention. Specifically, we looked for differences in children’s knowledge with respect to: crop species the ancestors planted, corn and bean varieties in Cotacachi,[5] family's practice of keeping seeds, and Inti-Raymi meaning. We also considered children’s participation in cultural events, parents participation in cultural events, whether children visit the ethno-botanical garden, whether they have access to a home garden; children’s knowledge of planting crops, recycling organic residuals and taking care of water.

We assumed no interference with the comparison units of Otavalo and we included a dummy variable that distinguishes Cotacachi households from Otavalo ones, which should capture potential effects of the program on cultural and environmental knowledge of children from Cotacachi households in general. This allowed us to locate the program’s impact amongst its direct participants (Ravallion, 2007) and the potential impact amongst indirect ones.

[5] As corn and beans are the crop species that the households of the rural communities in Cotacachi and Otavalo use the most for self-consumption and nutrition, we believe the conservation of varieties of these two crop species is crucial for the communities in the long run.

The specific single-difference regression model (the OLS regression) estimated has the following general form:

$$Y_i = a + bP_i + cX_i + v_i \qquad (4\text{-}2)$$

Where Y_i denotes the specific outcome under consideration for household i; a, b and c are estimated parameters; P_i is a dummy variable that takes the value of 1 for participant households and 0 for non-participants and non-eligible households. X stands for the control variables, such as a dummy indicating whether the household is located in Cotacahi or in Otavalo, the mother's education, the size of the family, and log of income. The symbol *v* represents a residual that includes other determinants of the children's knowledge (about cultural and agricultural diversity and environment) and measurement errors. We assumed that v is a random variable, normally distributed, with the mean of zero and variance of σ^2. For the ith household which had children attending any CECIB school of the program, the outcome will be $a + bP_i + cX_i + v_i$. If the household did not have children attending any of the CECIB school of the program but other type of elementary school, then its outcome will be $a + cX_i + v_i$. The difference between the two is the gain in children's knowledge (about cultural and agricultural diversity and environment) due to the program, which is just b (Ravallion, 1999).

Control Variables and Expected Effects

As explained above, besides the participation term (treatment effect) and the "treated county" dummy (1=Cotacachi, 0=Otavalo) included as explanatory variables in all regressions, we included other controls aimed to capture differences in household characteristics. The control variables in equation (4-2) --captured by X_i -- included a basic set of regressors that are used to explain all of the outcomes. The basic set of regressors (for household i) are: the mother's level of education (in years), the number

of people per household and the log of total household income per month, Table 4-10 presents a summary of all variable definitions and the short names used in the regression tables, and Table 4-11 shows descriptive statistics.

The variable treatment effect and treated county are included in all equations. Both variables were used to separate the households into two groups but in two different ways. The variable treatment effect is included as a dummy variable distinguishing between those households that did and did not have children attending the CECIB schools that were included in the program. On the other hand, the variable treated county is a dummy variable used to distinguish the households of Cotacachi County from those households in Otavalo County. These variables would be expected to be positive for the regressions as children who attended the CECIB schools of the program were involved in many activities to learn about native crop species; therefore, they were expected to know more about corn and bean varieties. Also, Cotacachi is the county where the program was carried out- hence Cotacachi households could have more households with children who know about the corn and bean varieties, independently of their school education.

With respect to the variables of the number of people per household, mother's level of education in years and the log of household income, these variables would be expected to be significant and with positive coefficients for the regressions. Larger households would need to know more about crop species to provide for the needs of consumption; therefore, the household’s members would be more likely to share that knowledge with the children. Mothers with more schooling would be more likely to share their knowledge of the crop species with their children. Finally, our analysis

showed that households with more income had more crop species in their parcels and more varieties of corn and beans, therefore, wealthier households would be expected to have children who knew about the native crop species, especially corn and beans.

Descriptive Statistics by Group

Table 4-11 shows the percentage of households which had children who answered positively to the knowledge questions of our survey in the Treatment and Control groups. While analyzing each household, we found there was a wide difference in children's responses to the conserving of biodiversity questions between groups of households. Table 4-11 shows that the number of households of the Treatment group that had children who participated in cultural events, children with knowledge of corn and bean diversity, children with knowledge of the crop species their ancestors planted in the past, children with access to a garden at home, and children with knowledge of the Inti Raymi is higher than those of the Control group. With respect to participation in cultural events, only 59.8% of the households in the Control group had children who participated in cultural events -whether at school or in the communities- while in the Treatment group the percentage of households was 99.3%. In regard to children's knowledge of corn varieties, only 14% of households in the Control group had children who knew the varieties of corn while 99% of the households in the Treatment group did. With respect to bean varieties, 59.5% of households in the Control group had children who knew the varieties of bean while 98.5% for the Treatment group did. Therefore, children in the Treatment group knew more about the varieties of corn and beans that are used in their communities as they mentioned those varieties. With respect to children's knowledge of the crop species their ancestors used to plant in the past, only 34.05% of the households in the Control group had children who knew what species of

crops their ancestors planted, while the percentage of households in the Treatment group with children who knew those species of crops was 98.5%. They also mentioned the crops their ancestors used to plant the most were corn and beans. Regarding children's access to a garden at home, 64.3% of the households in the Control group had home gardens while 100% of households in the Treatment group did. Regarding children's knowledge of Inti Raymi, 30.1% of the households in the Control group had children who knew the meaning of Inti Raymi while that percentage was 84.17% for households in the Treatment group.

Table 4-11 also shows that the number of households with parents who participated with their children in their schools or cultural events, children's capacity to plant native crops or any other crops, and children's capacity to recycle their home organic residuals in the Treatment group was higher than those in the Control group. With respect to parents' participation, we determined that 38.5% of the Control households had parents who also participated in their children's activities whether at school or in the communities, while that percentage was 54.5% for Treated households. Regarding children's capacity to plant native crops or any other crops, we found that 75.6% of the Control group's households had children who have planted crops (especially corn, beans or blackberries) either at schools or home gardens while in the Treatment group, all households (100%) had children who have planted crops. About children's capacity to recycle their home organic residuals, we found that 76.3% of the Control group's households had children who have recycled the home organic residuals, while that percentage of households in the Treatment group was 100% which means that all children from the treated households have recycled the organic residuals.

Surprisingly, children did not visit the Ethno-botanical garden or any other community garden as is shown in Table 4-11. As previously mentioned, to complement this component –and the other components- the implementers built an ethno-botanical garden that contains the most of the important native species of plants of the region (grains, vegetables, fruits, medicinal, and ornamental plants). But surprisingly, only 2% of the treated households had children who visited the garden -with their families- and they did the visit in 2010. On the other hand, we found that 9% of the children of the Control group's households visited any other garden -especially as a curricular activity, and also with the family- during the previous two years. This was an interesting result for us because we expected more visits to ethno-botanical gardens from the children of the treated households. However, 100% of children in the Treatment group had access to a home garden, which may be the reason why they did not feel the need to go to the community garden.

There were other questions in our survey, listed on Table 4-11, whose children's responses were similar and positive in both groups. These questions were with respect to teachers' custom to talk and teach about the environment during classes, children's knowledge of family's custom to keep seeds, children's knowledge of the need of water to plant crops and children's custom to take care of water. Regarding teachers' custom to talk and teach about environment during classes, we found that 97% of the households in the Control group had children whose teachers were talking and teaching about environment during classes, and we found a similar percentage of households in the Treatment group where 100% of households had children who assured the same. Similarly, 97.1% of the households in the Control group and 100% in the Treatment

group had children who knew the family have kept seeds; and children also gave the reasons to keep seeds, and said they have kept the seeds in order to conserve the crop species, to be able to cultivate the next season, to keep the ancestors' seeds, and to have enough food. Also, 99.4% of the households in the Control group and 100% in the Treatment group had children who knew the need and importance of water to plant crops, as they said that plants need water to live and grow healthy to provide fruits. Finally, 98.3% of the households in the Control group and 100% in the Treatment group had children with the custom of taking care of water; those children also explained to us the different ways they take care of water and their reasons to do that, as they said they are not wasting the water, they close water pipes after using it, they do not deposit garbage in the rivers or contaminate the fountains due to the fact that water is important for human beings and animals plus the fact that it serves to cultivate our food.

Results of the Estimated Equations

The estimated coefficients for the variables predicting the children's knowledge of cultural and agricultural diversity and environment are presented in Table 4-12. In explaining the different outcomes we tried to determine if the treatment truly made a difference, as well as the differences between the children from Cotacachi and the children from Otavalo. We also tried to estimate if the other variables of the equation were predictors of children's knowledge of cultural and agricultural diversity and environment.

Our analysis showed that the variable treatment effect is statistically significant for children's knowledge of the corn varieties (but not the bean varieties) and also for the children's knowledge with respect to the crop species their ancestors planted, the Inti Raymi meaning, children and parents' participation in cultural events as well as

children's visit to the garden. This variable perfectly predicts the outcome of children's usage to plant crops, recycle organic residuals and take care of water; and children's knowledge of family usage to keep seeds and their access to home garden. Even though this variable is not significant for children's knowledge of bean varieties, the coefficient of this predictor is positive in both equations as well as for the rest of regressions mentioned above, with the exception of children's visit to the garden which is negative. This would indicate that the fact that children are attending the schools associated with the Program (CECIB schools) is related to higher knowledge of corn and bean varieties which is what we expected.

Our results also supported our hypothesis that the treated county (Cotacachi) has a stronger positive effect upon children's knowledge of corn and bean diversity as well as children's knowledge with respect to the crop species their ancestors planted, the Inti Raymi meaning, children and parents' participation in cultural events as well as children's visit to the garden. This variable was also significant for children's practice of planting crops, recycling of organic residuals and taking care of water; and children knowledge of family practice of keeping seeds and their access to home garden. The coefficient of this predictor is positive in both equations corn and bean varieties. This would indicate that the households from Cotacachi have a larger proportion of children with knowledge of corn and bean varieties. This result also makes sense as the CECIB schools associated with the program are located in Cotacachi. The Cotacachi/Otavalo dummy was significant and positive for children's participation in cultural events but negative for parents' participation in cultural events. This would indicate that parents whose children were attending the treated CECIB schools had strong participation in

their cultural events. But in general, parents in Cotacachi are less participative in their children's cultural events. This result was somewhat unexpected.

Table 4-12 shows that the number of members per households had a positive effect on children's knowledge about corn and bean varieties as well as children's knowledge of family usage to keep seeds. The positive coefficients of this predictor - in the three equations -suggests that the households with larger number of members may have more children that knew the varieties of corn and beans their families planted, and also if their families keep seeds. This result was also expected as we had the hypothesis that larger households need more resources to sustain themselves; therefore the need to plant more species of crops for self-consumption which would create the need to acquire more knowledge of those species, knowledge they may share with the rest of members of the family.

The effect of mother's level of education in years is significant and positive for the children's knowledge of bean varieties and children's visit to the garden equations. This conclusion is inferred from the positive significance of the coefficient in the equation for children that know about bean varieties and the lack of significance in the equation for children that know about corn varieties, which would indicate that the mother's level of education is unrelated to children that know about corn varieties. This result was somewhat unexpected.

Finally, the variable for household income is statistically significant and positive for children's participation in cultural events, children's visit to the garden, children's access to home garden and children's knowledge of recycling organic residuals. These results were somewhat expected due to the fact that wealthier families may have parents with

more time to dedicate to accompany the children to these activities and resources to spend on them. On the other hand, the variable for income was not significant for children's knowledge of corn and bean varieties. This contradicts our hypothesis which suggested that wealthier families had more children that know about corn and bean varieties. Actually, the coefficient of this variable is negative in both equations which would indicate that less wealthy families are related to a higher proportion of children that know about corn and bean varieties. This result was somewhat unexpected and may indicate that poorer households need to keep more parcel diversity and know about varieties, instead of buying in the market. It also may mean that the program targeted the poor specially, and increasing children's awareness of corn and bean diversity at the same time.

Qualitative Analysis of the Agro-Tourism Component

To evaluate the agro-tourism component of the project in Cotacachi, we interviewed all the people involved in this component in order to make a qualitative analysis. We interviewed the Runa Tupari's employees. We also interviewed the owners of the seventeen rustic lodges distributed in the four communities of La Calera (5), Morochos (4), Santa Barbara (4) and Tunibamba (4). We also interviewed the closest neighbor of each family of the rustic lodges; that means we interviewed 34 families in those communities, 17 rustic lodges plus 17 neighbors, to be able to make an analysis and give conclusions. We also interviewed some members of UNORCAC, who helped in the implementation of all the four components of the project, especially in this one. With these interviews we tried to identify the direct and indirect beneficiaries of the project. We also tried to establish what those benefits were and what they meant for

the participants. These data were not enough to make a quantitative analysis for this agro-tourism component, which is the reason we focused on the qualitative analysis.

Implementation

Promoting Agro-tourism was based on offerings for tourists by Runa Tupari Native Travel and the indigenous families of Cotacachi. This was done taking advantage of the diversity of crops, local culinary traditions and women's expertise in using crops to produce a variety of items that have been sold to tourists during these years. Also, due to the fact that Cotacachi is surrounded by the Cotacachi and Imbabura volcanoes, volcanic lagoons such as Cuicocha and Llaguarchocha, near the Cotacachi-Cayapas Nature Reserve and the world-renowned Otavalo´s handicraft market, and it is one of the cradles of world agriculture, it was an important strategy to invest in the construction of rustic lodges in order to complement the tourist package to be offered to tourists all over the world by Runa Tupari Native Travel, a tourist agency which has its main office in downtown Otavalo since 2001 and started as an initiative of UNORCAC to promote agro-tourism. Three rustic lodges were built thanks to the project from 2002 to 2008 with a capacity to receive 3 tourists each and a dozen more were previously built in 2001 by Agriterra, a Dutch foundation. All this effort has had an important impact in Cotacachi especially for having been focused on the diversity of crops, local culinary traditions and local women who play an important role in Andean agriculture and family nutrition (Quisumbing, Brown, Feldstein, Haddad, & Peña1995).

Based on the interview to some members of the UNORCAC board of Directors, and also one of the people who helped during the implementation of the project –,Runa Tupari Native Travel was legally constituted as part of UNORCAC and, as a company to offer the service of tourism. Runa Tupari's headquarters are in the downtown Otavalo,

very close to the handicraft market. The company had its legal creation in 2001 and it is recognized by the Superintendence of Companies and the Ministry of Tourism of Ecuador to operate as a tourism company under the name of 'Runa Tupari Native Travel Cia. Ltda'. The Runa Tupari shareholders are UNORCAC (90%) and the four communities involved in the project (10%). Runa Tupari Native Travel was created with the objective to generate jobs for the families of the peasant communities of Cotacachi. That is why Runa Tupari started working with some indigenous families in the communities of La Calera, Chilcapamba, Morochos and Tunibamba in 2001. We have to recall that UNORCAC represents 39 communities of Cotacachi, therefore these communities profited indirectly from Runa Tupari and the project. And those who benefited directly from the project and Runa Tupari were the four participant communities.

At the beginning, Runa Tupari developed those twelve rustic lodges to have a capacity for 3 tourists each one. Therefore, they had a capacity for a maximum of 36 visitors. The rustic lodges were built using local labor, local materials and traditional building techniques in order to make them fit with the environment and the rest of the houses of the communities. Of course, they were also built trying to offer all the facilities to the visitors such as private bathroom, hot water, a fire place to make the room warmer, and a backyard with a variety of crops of the region.

During the project, INIAP and UNORCAC helped to revitalize the home gardens of the owners of the rustic lodges and other groups of families in Cotacachi. The families were provided with a greater diversity of crops which included vegetables, tubers, grains and fruits. INIAP and UNORCAC also provided them with improved varieties of citrus

which resist the temperature of the Andean region. These diverse home gardens have been providing the families with products for their own consumption and have also been generating surpluses that the families sold at the town market or just shared with their relatives or neighbors and, in the case of the participants of this component, they shared their surpluses with their Ecuadorian and foreign visitors . The owners of the lodges have also taken advantages of the home gardens to teach the tourists about their farm practices and, traditional crops and their uses.

Due to the fact that agro-tourism was a new concept for the indigenous of the communities of Cotacachi, the team of implementers decided to offer some workshops on tourism to the young people of those communities. In this way they tried to ensure the quality of the services of tourism offered by Runa Tupari. The workshops were carried out with the participation of young men and women from different communities. The topics addressed in those workshops were: customer service, maintenance of rooms and floors, food preservation techniques, culinary skills, human relationships, first aid training, tourism guidance, methods for managing groups, valuation of cultural heritage, valuation of the environment, etc. At the end of the workshops, only the women of the families participating in the rustic lodges showed interest in all the topics, as well as a small group of young men. Then, UNORCAC and Runa Tupari trained those local men to become native tourist guides. The men who participated in this component had the opportunity to receive more capacity building in tourism, environment, microfinance, and how to deal with locals and foreign tourists. It was also very important for all of them to take the English courses the project provided in order to establish an effective communication between them and the tourists. One of the

limitations was that only a few of them were able to speak the English language. Currently, this group of young men is regularly working as tourism guides. The Natives Guides received a certificate from the Department of Tourism and were recognized by the Department of Environment (Runa Tupari, 2010).

UNORCAC and Runa Tupari with the help of an international chef trained the women who participated in this component -that means the ones who managed the rustic lodges- in the preparation of traditional dishes inspired by local crops. These women showed such a great interest in developing their culinary skills during the course that they took the challenge of demonstrating their expertise during an international fair of traditional dishes in Milan-Italy. This was another advantage that women in Cotacachi have had in order to better attend the visitors who rented the rooms in their rustic lodges and it was an opportunity to show them the culinary traditions of their communities. In this way, when visitors decided to stay in these rustic lodges, they had the unique opportunity to immerse themselves in the indigenous culture and enjoy the daily activities of the family such as preparing traditional meals, cultivating crops or working in the harvest, walking around the community, visiting the community gardens, etc.

The team of implementers of the project used the strategies mentioned above as well as others as part of the UNORCAC initiative to generate job opportunities for locals during the project and in the long run. The owners of the rustic lodges also offered tourists the products made up by the food-processing plant Sumak Mikuy as a way to increase their income and show the tourists the innovative ideas that the local families are working in. Agro-tourism was also promoted during the seed fares and Inti Raymi

celebration every year. At the same time, UNORCAC and INIAP have been taking advantages of these kinds of events to promote the fair of traditional food which has been conducted every year. These fairs have had the participation of the local women who attended the workshops on nutrition and cooking practices using their native crops. Besides having the opportunity to show their skills and culinary traditions to locals and tourists, they have had the opportunity to increase their income while selling the traditional food during the fairs. Another strategy to complement this part of the project is that UNORCAC has recognized various groups of women from different communities for their skills in designing traditional clothes using local crops to make handcrafted necklaces and bracelets made of native crops. Women have been selling these items to tourists in the rustic lodges or through the UNORCAC and Runa Tupari offices in order to increase their income as well.

Results

In 2010, we saw that the number of rustic changed since 2001, when this initiative started with Runa Tupari Native Travel by UNORCAC. In 2001, Runa Tupari started working with twelve rustic lodges located in four peasant communities of Cotacachi. Those communities were strategically selected and they are: La Calera, with a capacity of 3 rustic lodges; Chilcapamba with 3 rustic lodges; Morochos, with 4 rustic lodges; and Tunibamba with a capacity of 2 rustic lodges. Three more rustic lodges were built during the first phase of the project. Those additional rustic lodges were built in the communities of la Calera and Tunibamba. In the same way, four more rustic lodges were built in another peasant community called Santa Barbara in 2007, due to the good results Runa Tupari, UNORCAC, the participants and the communities obtained from this project.

On the other hand, the owners of two of the three rustic lodges in the community of Chilcapamba decided not to participate in the project anymore and, they stopped working with Runa Tupari Native Travel in 2006. During the interview of the members of UNORCAC, they also said that the owners of those three rustic lodges decided to leave the project because they figured out the agro-tourism component was generating a lot of profits for them and they did not want to share these profits with Runa Tupari Native Travel, UNORCAR, and the Community. So, they wanted to continue working in this business but being independent from Runa Tupari Native Travel. By that time, they took the risk of working in the agro-tourism business by themselves because they already acquired the knowledge, as well as the experience to run this kind of business. On the one hand, implementers were happy that the project contributed for these participants to become entrepreneurs. But, on the other hand, the team lamented the fact that those participants did not want to be enrolled in the project anymore and work hand in hand with Runa Tupari either, and with this, they broke up the contract they had with the two institutions.

Finally, in 2010, after all those events of enrolling more participants in this component of the project and the disengagement of those participants from the community of Chilcapamba, we saw that Runa Tupari Native Travel was working with seventeen rustic lodges. Now, the distribution of the rustic lodges in the communities is the following: La Calera (5), Morochos (4), Santa Barbara (4) and Tunibamba (4).

From the time Runa Tupari Native Travel started in 2001 until the time we visited the participants of this project in 2010, the visits to the rustic lodges by local and foreign tourists have increased. Figure 4-4 shows how the number of tourists has increased

during the years of the program intervention and even after it. You can also see that the owners of the rustic lodges received 256 visitors in 2001 and 1,468 visitors in 2010 with an average of 925.9 visitors per year during those ten years (Runa Tupari, 2011). This also means an average increase of 24% of the visitors annually and, that those tourists stayed at the rustic lodges an average of 2.21 nights, per year, during those ten years. These results are based on information that Runa Tupari Native Travel has of those seventeen rustic lodges. In 2010, Runa Tupari received 1,468 visitors. That means that each rustic lodge hosted 86 visitors that year, as they had to distribute the visitors equally among those 17 rustic lodges. Runa Tupari's directives said that sometimes it was difficult for them to be equitable with the distribution of the tourists in each community but that they tried to do their best. Sometimes they have big groups of visitors or family groups that prefered to stay in the same community or even the same rustic lodge.

During the interview to the owners of the seventeen rustic lodges of Cotacachi, all of them assured us that they received a lot of benefits from this component and the project helped them to improve their way of life and increase their income. They said that thanks to the Project and Runa Tupari Native Travel they increased their income because they aware of receiving payments -from Runa Tupari Native Travel- for hosting the tourists in their lodges as well as for offering them their food, being their tourism guides, and teaching them about their culture, their crops and their farm practices, etc. The payment for hosting a tourist has also increased. In 2005 the owners received only $8 US dollars per tourist including two meals (breakfast and dinner) plus $2 extra dollars if owners also offer them the lunch. In 2010, the owners of the rustic lodges

received a payment of 10 US dollars for every visitor per night and they also received additional payment (in US dollars) if they provided –at least- 2 meals per day to the visitor.

Additional to the families of the rustic lodges, there were other families that benefited directly from the Agro-tourism component. The families of the native guides were receiving more income as they received at least 10 dollars per tourist when they were giving the tour around the region. The price for guidance changes depending on the size of the group, the time and the place of the tour. There were also five families in the communities that are renting horses to the tourists. They were also benefiting from this component as they receive at least $7 dollars per horse they rent. Also, there were some groups of singers and dancers of the communities who participated in the well-known “Cultural Nights” where they danced and sang for the community and tourists. They played traditional instruments and wore traditional clothes. Those groups received at least $15 dollars per show. In the same way, the people working at Runa Tupari’s office were also benefiting from the project. We have to recall the agro-tourism component was a complement for the indigenous families -that were direct beneficiaries- to get additional income since their main activity is agriculture. They were aware that this project for sustainable tourism boosts the rural economy.

Other direct beneficiaries of the agro-tourism component were the people who work at the Runa Tupari’s office in Otavalo. Runa Tupari had three employees, two administrative (manager and accountant) and one operative. We did not know how much income they obtained from the project because they did not share this information with us. Also, Runa Tupari Native Travel had a van for the transportation of a

maximum of 6 tourists. In case they have a bigger group, Runa Tupari hires the service of another company that provides bigger cars. They are paid for this additional way of transportation according to the hours of service and the size of the group.

The component also had a group of indirect beneficiaries. UNORCAC had 90% of Runa Tupari's shareholders and as it represented 39 communities of the 43 communities that form Cotacachi, those 39 communities also received benefits from the project since UNORCAC provided capacity building, training, workshops, water treatment, etc, with the funds they obtained from Runa Tupari Native Travel. In this way, all the funds are reinvested in the 39 communities that UNORCAC represents. On the other hand, for those four communities where the rustic lodges are located (La Calera, Morochos, Santa Barbara and Tunibamba), the Community Savings Fund of each community received –directly- $0.50 cents per tourist per night.

Participants also said that due to the project they had higher self-esteem and they profitedfrom the cultural exchange experience as well. They were proud of their cultural diversity and ethnicity. They liked the fact they had an opportunity to progress in the social and economic aspects. They felt very comfortable being more participative in the community through this project. They informed us that they were very happy and proud of their home gardens since the project helped them to diversify them. In their gardens they had to cultivate different prototypes of crops to share with the visitors not only to teach them about them but also to taste them in traditional dishes. They assured us that this was a benefit that helped them to reduce the cost of their food and it was an attractive visual element in the community as well. The diverse garden facilitated the organization of the visits and cultural agenda for the tourists. It also

helped them to communicate their ancestral farm practices to the tourists and their experience as farmers. This also helped them to interact with other families of the community.

In additional to the above mentioned, some of the women we interviewed informed us that this was a valuable experience for them due to the fact they were now more independent of their husbands. They assured us to have more self-esteem and being proud of themselves due to the fact they were earning their own money plus they were more confident to interact with the locals and foreign people without being overshadowed by their husbands. During the fieldwork, we realized that there was a difference between interviewing a woman who participated in this component and the others who did not. The women working in the rustic lodges were more confident than the other women who did not participate. The women of the rustic lodges perceived the agro-tourism component as a productive system that they could easily incorporate in the family activities.

During the interviews, participants also informed us about some concerns of this agro-tourism component and gave some recommendations to improve it. They said that it could be beneficial for the participants if Runa Tupari organizes more meetings for all the group of owners of the rustic lodges in order to exchange experiences gained during the project. They said that those activities could be helpful for the participants to generate more ideas that improve their business of agro-tourism. The families enrolled in the agro-tourism component also agreed with the participants of the agro-industry component in terms that the agro-industry component should be improved in order to complement the agro-tourism component in a better way. They said that many times

they have had surpluses of their crops in their home gardens but those surpluses were lost because the food-processing plant Sumak Mikuy had not been processing them in the last 3 years. They also needed better marketing strategies to be able to offer and sell the Sumak Mikuy products to the visitors in their rustic lodges. Participants also talked about improving the irrigation systems in their communities because that was an important factor for success in crop production for their home gardens and families, especially in the Morocho's community, where they have lost their production many times due to the lack of a good irrigation system. Participants from the communities of Morochos and Tunibamba also said that the garbage collection system should be also improved in order to offer a quality service to the tourists. They had some strategies to manage the organic residual but needed some help to treat the inorganic ones.

One of the main concerns for the participants was the low number of visitors they had in average during the year and the high-demanding summer season. This is a concern that all the people involved in the project had as demand of tourists is a key factor in terms of income and available resources. The owners of the rustic lodges assured they would like to have more visitors during the year and in a periodically way, without peaks, as they used to have during summer time. On the one hand, they were happy that they had a lot of tourists from June to August but on the other hand, they don't have enough logistic and resources for such an amount of tourists in such a short period of time. That is one of the reasons they would like their neighbors also being taken into account to be part of the project in order to have more rustic lodges to offer a better service to the visitors and satisfy the high demand they usually have during the summer. They were also concerned about the terms of the payments for the agro-

tourism service during summer. They said that due to the fact the demand of the tourists is seasonal; Runa Tupari should find a feasible price for the tourists' packages in order to give the owners feasible price stability for their services. They said that the increase of payments per tourist they had in last 4 years has been good but not enough to satisfy the low income they have had during the other season of the year. UNORCAC members and Runa Tupari employees also see the necessity to increase the number of tourists since that is a key factor for the future of Runa Tupari Native Travel and also for the success of the project in the long run. They also agreed that it is unfair to put a lot of work on the owner's hands during the summer due to a large amount of visitors and not giving them any job during the rest of the year.

To give a solution to the problem of the seasonal low number of tourists per year, Runa Tupari and UNORCAC has been working together to developed some strategies to attract more tourists to visit the rustic lodges in Cotacachi periodically during the year. They have been working on some new tourist packages to offer to international and local potential visitors (Runa Tupari, 2012). In 2008 they made some improvements to the web page to facilitate the information of the town and the rustic lodges to make Cotacachi more attractive as a destination for the potential visitors' eyes. They also improved the website reservation system. In 2009, they started offering tourist packages to some schools located out of the Imbabura province. This kind of tourist package addressed to schools was a success since some of the schools from the Coastal, Andean and Amazon region used to make yearly trips with their classes at the end of the academic year. Teachers from those schools saw that this tourist package is a good experience for their students. Another advantage of this strategy was that

schools from different regions have different academic periods. Some of them used to make these trips during January and others during November. Nowadays, Runa Tupari has also included another kind of tourist package to diversify their products and their tourism portfolio (Runa Tupari, 2012). These tourist packages are addressed to a more diverse public such as students from universities, people who like to volunteer, people interested in organic farming, people involved in sustainable development, etc. As we saw in Figure 4-4, the seventeen rustic lodges have been receiving more tourists every year and they had a total of 1468 visitors in 2010. Participants of the project recognized they have improved the agro-tourism business a lot since the time they started up in 2001 but, they were also aware they have to continue improving in order to be present in the market for the long run.

When I interviewed the non-enrolled families, they said they were willing to participate in the agro-tourism project but Implementers had a 'family profile' that they were not able to fulfill to be part of this program. The owners of the rustic lodges also desired their neighbors who were non-enrolled in the program to participate, too. Implementers said they would also like to include more families in the program but not all those families have the minimum requirements to fulfill the 'family profile' for this program. Implementers make use of some instrumental variables to identify the families that may have success in this project. Before implementers started the agro-tourism component, UNORCAC identified the four communities of La Calera, Morochos, Chilcapamba and Tunibamba as potential places for tourist activities. In those four communities they held some workshops to motivate the families to participate in the project. These workshops also let the implementers make an inventory of the families

that were interested on participating in the program in order to filter them based on the desired characteristics and chose the potential families to run the agro-tourism business. Even with the high interest shown by most of the families, they decided not to continue to the next phase of the selection process when they figured out they had to invest $1500 US dollars as a matching fund to build the rustic lodge. After that, implementers also filtered the families based on their income, living conditions (size of the house, house construction materials, access to water and electricity, family size), social attitudes and other behavioral dispositions. At the beginning, the idea was to build four rustic lodges in each of the four selected communities, but only 12 families were able to fulfill the minimum requirements to run the business in those four communities, and of course, with the help of the implementers. That is why there were few rustic lodges in a few communities even though there were a lot of families willing to participate. On the other hand, the implementers have been trying to include more families in the program and that is the reason why they made the selection process one more time in 2006. On that occasion, they included the four families of the community Santa Barbara. They said that they are going to continue with this process of identifying potential families to include them in the program because that is one of the goals of the project, to generate more jobs for the rural families in the agro-tourism business. And that is also the reason why they have continued working on the capacity building for the families of the communities in Cotacachi.

Qualitative Analysis of the Agro-Industry Component

To evaluate the agro-industry component of the project in Cotacachi, we tried to interview all the people involved in this component in order to make a qualitative analysis. We interviewed some of the indigenous families who participated directly in

the project being involved in the legal constitution of the food-processing plant Sumak Mikuy as shareholders although the most of them did not want share their experience and information with us due to the fact they felt unsatisfied with the program. We also interviewed the owners of the seventeen rustic lodges distributed in the four communities of La Calera (5), Morochos (4), Santa Barbara (4) and Tunibamba (4) due to the fact they were still working with the food-processing plant since its start-up. We also interviewed the closest neighbor of each family of the rustic lodges. We also interviewed some members from UNORCAC, who helped in the implementation of all the four components of the project, and who were still working on this one. In addition, we interview a group of 245 families in 39 of the 43 communities of Cotacachi. The objective of these interviews was to try to identify any impact of this component on the Cotacachi peasant communities as well as determine the direct and indirect beneficiaries of this agro-industry project. In the case that the component has truly brought benefits to the communities, we also tried to establish what those benefits were and, what they meant for the participants. These data were not enough to make a quantitative analysis for this agro-industry component, which was the reason why we focused on the qualitative analysis, as we did with the agro-tourism component.

Implementation

Promoting Agro-Industry in Cotacachi was the main reason for the construction of a food-processing plant to produce and package salsas, marmalades and other products made from local crops. These crops were provided by local farmers who were organized and trained through the project in order to produce and supply the primary products for the food-processing plant. The farmers who participated in this part of the project created an association with UNORCAC to legalize this microfinance which

included this food-processing plant under the name of Sumak Mikuy in 2005. We confirmed in 2010 that the food-processing plant was still running in Cotacachi and it was located next to the UNORCAC's building. Now the processed products are sold in the area hotels, the rustic lodges, small grocery stores, and delicatessens in Cotacachi as well as other cities in the central part of northern Ecuador. The most of the people employed in this plant to run the operative activities were locals. The administrative employees were from Ibarra, the capital of Imbabura province. We did not have the opportunity to interview them due to their busy schedule but we had the opportunity to interview some members from UNORCAC.

During the interviews of the members of UNORCAC, they talked about the challenges they have had to face to keep running this business during and after the project. They said they did not have people with the expertise in marketing to help them with strategies to increase the distribution of the products locally and internationally. Since the beginning of the Sumak Mikuy's start-up in 2005 until 2010, they had to make some changes to the product portfolio. UNORCAC had to improve their portfolio of products and make them adaptable to a market that was not used to the original products they made. They said that UNORCAC felt the responsibility to implement all the possible economic and marketing strategies in the arena to maintain the plant producing in the long run. The success of this component was one of the UNORCAC's main challenges as an organization and due to the fact the implementers invested approximately 20% of the budget in this component.

Women from the indigenous communities of Cotacachi -especially the ones who were already enrolled in the agro-tourism component- were taught how to replicate the

processed products in their own homes. They participated in various workshops to learn more about the nutritious and commercial value of their crops and how to improve their cooking practices. As a result of all these efforts and workshops, the participants compiled most of the traditional recipes learned in a cook book. The book of traditional recipes had its Spanish and English version for the use of locals and foreigners. UNORCAC was in charge of replicating the book and giving them to the women of the communities who have been using it to try to improve their families' nutrition. The group of women which showed the most interest in replicating the Sumak Mikuy products was the one working in the rustic lodges and they perceived the idea of replicating those products at home as an opportunity to share the products with tourists. They said that as a result of doing this, the probability of selling the Sumak Mikuy products to the tourists increased. They said that this was an advantage for women from indigenous communities in Cotacachi unlike indigenous women in Otavalo, a town which borders Cotacachi. And they were very proud of the knowledge they acquired due to this component.

Results

The families that took part in the legal constitution of Sumak Mikuy as shareholders seemed to be unsatisfied with this component. They alleged that they never had an important role in this company as they expected. They just signed as shareholders of Sumak Mikuy but they never received any economic benefit from this company. They said everything stayed on paper but nothing in their pockets. Some of them also provided the plant with the crops to produce the processed products but, they stopped supplying it because they felt there was not economic benefit or other incentives to justify all the hours of work they invested in this job. They said that

another reason to leave the agro-industry project was the lack of ongoing advice from UNORCAC's agricultural extension agents. They assured that the extension agents worked with them only during the first months when they started cultivating the crops designated to supply the plant but a few months later they stopped monitoring the crops and the capacity building as well.

We interviewed a group of families of 39 peasant communities of Cotacachi to know about their perception of the agroindustry component. We asked if they participated or not in this project, in which way they participated and if they received any benefit from the component. For those families that were not enrolled in this program, we asked them about their reason to not participate in this component. We interviewed 245 families of 39 peasant communities of Cotacachi plus the seventeen rustic lodges and their seventeen closest neighbors. Therefore, we had a total of 279 families to interview. From those 279 families only 21 assured that they have participated in different activities of the component (7.5%). On the other hand, 258 families informed they were not enrolled in the program (92.5%). Of those families which were enrolled, three families assured they participated as workers in the food-processing plant. Eight families assured they participated as providers of uvilla (goldberry) for the food-processing plant. One family assured they attended the workshops UNORCAC offered to learn how to replicate the processed products. And nine families said they participated in other activities of the component without specifying them. Those 21 families also said they benefited from this component in different ways. Ten families assured that participating in this component helped them to increase their income. Eight families assured that this component helped them to learn more about the local

crops and their uses. One family assured that they profited from the cultural exchange they experienced due to participating in this component. The members of one family assured the component helped them to increase their income as well as to learn more about the local crops and their uses. In the same way, the 258 families that did not participate in the component also gave their reasons for not being enrolled. 184 families assured they did not participate because they did not know about this program. 48 families assured they did not receive any invitation to participate. 22 families assured that they did not have enough time to participate in a program like this. And finally, 4 families commented that they were not interested in this kind of program.

Some of the families we interviewed also made some recommendations to improve the project. They said that UNORCAC and their extension agents should give ongoing advice and capacity building to the families that supply the crops to Sumak Mikuy. In this way, the families said they could increase their crops' production and better supply the food-processing plant. They also said that Sumak Mikuy should give them a better price for their crops as they invest a lot to cultivate them. They would like to have a better payment from Sumak Mikuy that justifies the investment of their resources (labor, inputs, transportation of the production, etc.). The owners of the rustic lodges said they need more capacity building and strategies to better offer the Sumak Mikuy products to the tourists in order to have success on sales.

Summary of the Results of the Components of the Program

Our survey of the livelihoods of households of the peasant communities of Cotacachi County located in Imbabura, Ecuador produced the results that were expected. The program intervention had a positive effect in household' decisions as well as in the children's knowledge of cultural and agricultural diversity and

environment. Our analysis of these four components showed that the conserving crop diversity, the educational and the agro-tourism components were the most successful components of the program as we found statistical evidence that those components affected positively the welfare, parcel diversity, consumption and conservation of native crops. With respect to parcel diversity, our analysis showed an increase inthe number of crop species per household and the number of bean varieties, especially for households that participated in the program. We also identified an increase in income due to the treatment, but we did not identify a significant effect of the program intervention upon food expenditures which was an expected result due to the fact one of the program objectives was to reduce the monthly food expenditures for the families of the peasant communities motivating them to produce their own food and that is reasonable due to the increase of crop species per household due to the program. In this way, we can attribute to the program intervention that participants' households increased the number of crops they cultivated from 2003 to 2010, as well as, the number of corn and bean varieties planted in their parcels. With respect to consumption of native crop species (i.e. vegetables, tubers, grains, and fruits) per household, the results showed there was an increase in the consumption of those crops (for children and adults) by 2010 (after intervention) but, the consumption did not increase especially for the participants. With respect to Education, we found statistical evidence that the children who attended the CECIB schools of the program had stronger knowledge of concepts related to conserving agricultural and cultural -diversity and environment than the children attending other schools -located in either Cotacachi or Otavalo County- that were not part of the program

The qualitative analysis of the Agro-tourism and Agro-industry showed that participants' households were more satisfied with their participation in the Agro-tourism project than in the Agro-industry one. The owners of the rustic lodges that are part of the Agro-tourism component showed their satisfaction with the program as they assured the program had a positive effect in their livelihoods. They informed to have experienced an increase in income that they attributed to the fact of participating in the agro-tourism business plus other benefits they also perceived from the program intervention such as more diverse parcels, better nutrition, higher self-esteem, cultural exchange, and women's empowerment. On the other hand, the participants of the Agro-industry component informed us the cost of inputs, labor and other resources invested on the production of crops to supply the plant with the ingredients for the processed food products were not justified because they did not perceive any benefit nor improvement in their household's economy.

Figure 4-1. Republic of Ecuador and the Imbabura province

Table 4-1. Cotacachi households' distribution for the DD Method

COTACACHI GROUP	After Program 247 hh	Before Program 247 hh	Difference
Treatment /Beneficiaries	B=193 hh	A=193 hh	B − A
Comparison/Non-participants	D=54 hh	C=54 hh	D − C
Difference	B − D	A − C	DD = (B − A) − (D − C)

Table 4-2. Variables included in the agro-biodiversity, welfare, and consumption regressions

Variable name	Description
Crop Species	Number of crops species in the parcel(s)
Corn varieties	Number of varieties of corn in the parcel(s)
Bean varieties	Number of varieties of beans in the parcel(s)
Tree tomato varieties	Number of varieties of tree tomato in the parcel(s)
Treatment effect	Interaction term of a dummy variable for treated households
Year	Dummy variable indicating if the household was interviewed in 2010 which is after the program
Cultivated land area (in m2)	Size of the total parcel(s) in square meters the household has available for agricultural production
Mother's level of education in years	Years of schooling of the mother
Owns house	Dummy variable indicating if the family is the owner of the house where they live
Log of household income	Log of income per family per month
Log of food expenditures	Log of total expenditures per family per month
Household received loan	Dummy variable indicating if the family received a loan in the previous year

Table 4-2. Continued

Variable name	Description
Nofoodharvest	Dummy variable indicating if the household did not have enough food during the previous year due to poor harvest
gender of household head	Dummy variable indicating if the gender of the household head is feminine
Number of children	Number of children per household with ages between 0-10 years old
Number of working age females present in household	Number of female members of the household in age of work (between 15-78 years old) who are present in the household the most of the time
Number of working age males present in household	Number of male members of the household in age of work (between 15-78 years old) who are present in the household the most of the time
Number of working age adults not present in household	Number of household members in age of work (between 15-78 years old) who are not present in the household the most of the time
n_cattles	Number of cattle per household
n_pigs	Number of pigs per household
n_sheep	Number of sheep per household
n_goats	Number of goats per household
n_chicken_meat	Number of chicken for meat production per household
n_chicken_egg	Number of chicken for egg production per household
n_guinea_pig	Number of guinea pigs per household

Table 4-2. Continued

Variable name	Description
Adults consume veggies	Dummy variable indicating if the adults in the family consume vegetables very often
Adults consume tubers	Dummy variable indicating if the adults in the family consume tubers very often
Adults consume fruits	Dummy variable indicating if the adults in the family consume fruits very often
Adults consume grains	Dummy variable indicating if the adults in the family consume grains very often
Children consume veggies	Dummy variable indicating if the children in the family consume vegetables very often
Children consume tubers	Dummy variable indicating if the children in the family consume tubers very often
Children consume fruits	Dummy variable indicating if the children in the family consume fruits very often
Children consume grains	Dummy variable indicating if the children in the family consume grains very often

Table 4-3. Descriptive statistics of regression variables for agro-biodiversity, welfare, and consumption

	Pre Intervention (Year 2005)	Post Intervention (Year 2010)
Number of Households per group	247	247
Monthly income per household		
Mean	248.94	355.54
Std.Dev.	*174.91*	*287.09*
Number of observations	247	247
Monthlyfood expenditures per household		
Mean	46.01	72.32
Std.Dev.	*35.68*	*51.57*
Number of observations	245	247
Household received loan (1=yes, 0=no)		
Mean	0.50	0.43
Std.Dev.	*0.50*	*0.50*
Number of observations	245	247
Owns house (1=yes, 0=no)		
Mean	0.84	0.90
Std.Dev.	*0.37*	*0.30*
Number of observations	247	247
Insufficient food available for household, due to poor harvest (1=yes, 0=no)		
Mean	0.21	0.15
Std.Dev.	*0.41*	*0.35*
Number of observations	247	247
Mother's level of education in years		
Mean	2.04	3.34
Std.Dev.	*2.36*	*3.83*
Number of observations	247	246
Cultivated land area(in m2)		
Mean	4437	6025
Std.Dev.	*10046*	*10314*
Number of observations	247	247

Table 4-3. Continued

	Pre Intervention (Year 2005)	Post Intervention (Year 2010)
Number of Households per group	247	247
gender of household head (1=female, 0=male)		
Mean	0.06	0.10
Std.Dev.	0.23	0.30
Number of observations	247	247
Number of children in household		
Mean	1.87	1.40
Std.Dev.	1.58	1.42
Number of observations	247	247
Number of working age females present in household		
Mean	1.66	1.80
Std.Dev.	0.98	1.09
Number of observations	247	247
Number of working age males present in household		
Mean	1.63	1.71
Std.Dev.	0.91	1.05
Number of observations	247	247
Number of crop species		
Mean	3.22	5.41
Std.Dev.	1.57	4.16
Number of observations	247	247
Number of corn varieties		
Mean	1.01	1.36
Std.Dev.	0.75	1.17
Number of observations	247	247
Number of bean varieties		
Mean	1.06	1.45
Std.Dev.	0.91	1.10
Number of observations	247	247

Table 4-3. Continued

	Pre Intervention (Year 2005)	Post Intervention (Year 2010)
Number of Households per group	247	247
Number of taxo varieties		
Mean	0.14	0.07
Std.Dev.	0.36	0.25
Number of observations	247	247
Number of tree tomato varieties		
Mean	0.36	0.14
Std.Dev.	0.57	0.35
Number of observations	247	247
Adult's consumption of vegetables		
Mean	0.50	0.68
Std.Dev.	0.50	0.47
Number of observations	238	247
Adult's consumption of tubers		
Mean	0.78	0.87
Std.Dev.	0.41	0.34
Number of observations	243	247
Adult's consumption of fruits		
Mean	0.27	0.41
Std.Dev.	0.44	0.49
Number of observations	240	247
Adult's consumption of grains		
Mean	0.84	0.88
Std.Dev.	0.37	0.33
Number of observations	240	247

Table 4-3. Continued

	Pre Intervention (Year 2005)	Post Intervention (Year 2010)
Number of Households per group	247	247
Children's consumption of vegetables		
Mean	0.50	0.69
Std.Dev.	0.50	0.46
Number of observations	191	184
Children's consumption of tubers		
Mean	0.77	0.87
Std.Dev.	0.42	0.34
Number of observations	197	185
Children's consumption of fruits		
Mean	0.27	0.43
Std.Dev.	0.45	0.50
Number of observations	191	185
Children's consumption of grains		
Mean	0.83	0.87
Std.Dev.	0.37	0.34
Number of observations	194	185

Table 4-4. Fixed-effects regressions for welfare indicators

Variables	(1) Log of household income	(2) Log of food expenditures
Treatment effect	0.384***	-0.0192
	(0.133)	(0.144)
Year (0=2005, 1=2010)	0.103	0.416***
	(0.122)	(0.132)
Cultivated land area(in m2)	-0.0932**	0.0858*
	(0.0360)	(0.0446)
Mother's level of education in years	-0.0108	0.0205
	(0.0160)	(0.0198)
Owns house (1=yes, 0=no)	0.0158	-0.177
	(0.128)	(0.119)
Insufficient food available for household, due to poor harvest(1=yes, 0=no)	-0.215**	-0.00404
	(0.102)	(0.101)
Log of household income	--	0.191**
	--	(0.0791)
Household received loan (1=yes, 0=no)	0.0953	0.214**
	(0.0935)	(0.0978)
gender of household head (1=female, 0=male)	-0.511***	-0.0199
	(0.175)	(0.216)
Number of children in household	0.0361	0.0230
	(0.0430)	(0.0424)
Number of working age females present in household	0.0361	0.0657
	(0.0650)	(0.0610)
Number of working age males present in household	0.191***	-0.0576
	(0.0501)	(0.0618)
Number of working age adults not present in household	0.271***	--
	(0.0671)	--

Table 4-4. Continued

Variables	(1) Log of household income	(2) Log of food expenditures
n_cattles	0.0791*	--
	(0.0404)	--
n_pigs	0.000565	--
	(0.0149)	--
n_sheep	-0.0453	--
	(0.0386)	--
n_goats	-0.0343**	--
	(0.0170)	--
n_chicken_meat	-0.00132	--
	(0.00168)	--
n_chicken_egg	0.00138	--
	(0.00404)	--
n_guinea_pig	0.00202	--
	(0.00305)	--
Constant	4.745***	2.477***
	(0.186)	(0.411)
Observations	490	490
Number of househ_247	247	247
R-squared	0.326	0.282
State FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4-5. Fixed-effects regressions of agro-diversity outcomes

Variables	(1) Crop species	(2) Corn varieties	(3) Bean varieties	(4) Tree tomato varieties
Treatment effect	1.175**	0.134	0.361*	-0.0535
	(0.504)	(0.170)	(0.213)	(0.106)
Year (0=2005, 1=2010)	1.259***	0.176	-0.0586	-0.143
	(0.424)	(0.146)	(0.184)	(0.0943)
Cultivated land area(in m2)	0.464*	0.105*	0.240***	0.0205
	(0.239)	(0.0540)	(0.0747)	(0.0288)
Mother's level of education in years	-0.0404	0.00366	0.0434	0.00253
	(0.0617)	(0.0271)	(0.0297)	(0.0134)
Owns house (1=yes, 0=no)	-0.475	0.159	-0.00842	-0.0507
	(0.542)	(0.175)	(0.232)	(0.113)
Log of household income	0.414*	0.130	0.0835	0.00185
	(0.246)	(0.0947)	(0.0894)	(0.0434)
Household received loan (1=yes, 0=no)	-0.615	-0.0402	-0.237*	0.0439
	(0.409)	(0.125)	(0.135)	(0.0641)
gender of household head (1=female, 0=male)	-1.803*	-0.183	0.600	-0.240*
	(1.031)	(0.235)	(0.380)	(0.143)
Number of children in household	0.0133	0.00332	0.00160	0.0268
	(0.213)	(0.0601)	(0.0707)	(0.0304)
Number of working age females present in household	-0.475	-0.118*	0.0424	-0.0125
	(0.345)	(0.0631)	(0.0939)	(0.0489)
Number of working age males present in household	-0.298	0.0709	0.0301	-0.00728
	(0.289)	(0.0776)	(0.0782)	(0.0352)
Constant	2.906*	0.260	0.402	0.344
	(1.565)	(0.527)	(0.499)	(0.264)
Observations	490	490	490	490
Number of househ_247	247	247	247	247
R-squared	0.287	0.102	0.158	0.122
State FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4-6. Fixed-effects regressions of frequency of consumption for adults

Variables	(1) Adults consume veggies	(2) Adults consume tubers	(3) Adults consume fruits	(4) Adults consume grains
Treatment effect	0.321	-1.499	-0.326	-1.200
	(0.618)	(0.931)	(0.709)	(0.868)
Year (0=2005, 1=2010)	1.042*	2.163**	1.810***	1.397*
	(0.555)	(0.921)	(0.682)	(0.826)
Cultivated land area(in m2)	0.751**	0.510	0.396	0.934**
	(0.364)	(0.615)	(0.303)	(0.474)
Mother's level of education in years	-0.109	-0.0237	-0.0948	-0.0756
	(0.0981)	(0.108)	(0.0833)	(0.0910)
Owns house (1=yes, 0=no)	2.000**	1.666	0.281	0.452
	(0.949)	(1.202)	(0.708)	(0.699)
Log of household income	-0.293	0.231	-0.393	-0.147
	(0.336)	(0.279)	(0.331)	(0.478)
Household received loan (1=yes, 0=no)	0.0249	-0.304	0.361	-0.385
	(0.407)	(0.455)	(0.506)	(0.427)
gender of household head (1=female, 0=male)	-0.244	14.41	-2.279	0.296
	(1.278)	(1,353)	(1.400)	(1.767)
Number of children in household	0.230	0.423	0.253	0.0427
	(0.190)	(0.289)	(0.288)	(0.242)
Number of working age females present in household	-0.416	0.305	-0.265	-0.225
	(0.277)	(0.314)	(0.328)	(0.362)
Number of working age males present in household	-0.0500	-0.533	0.772**	-0.259
	(0.297)	(0.347)	(0.345)	(0.382)
Observations	190	138	160	118
Number of househ_247	95	69	80	59
Pseudo R-squared	0.267	0.193	0.268	0.151

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4-7. Fixed-effects regressions of frequency of consumption for children

Variables	(1) Children consume veggies	(2) Children consume tubers	(3) Children consume fruits	(4) Children consume grains
Treatment effect	-0.313	-1.378	-0.719	-2.281*
	(0.949)	(0.973)	(0.949)	(1.239)
Year (0=2005, 1=2010)	1.515*	1.508	2.365**	2.102*
	(0.887)	(0.917)	(0.953)	(1.194)
Cultivated land area(in m2)	1.467**	0.571	0.762*	1.009
	(0.651)	(0.513)	(0.461)	(0.684)
Mother's level of education in years	-0.270**	-0.0249	-0.0873	-0.0487
	(0.137)	(0.125)	(0.104)	(0.116)
Owns house (1=yes, 0=no)	16.75	0.0805	-0.864	0.378
	(2,637)	(1.144)	(0.850)	(0.907)
Log of household income	-0.133	0.596	-0.742	-0.250
	(0.431)	(0.434)	(0.544)	(0.580)
Household received loan (1=yes, 0=no)	-0.381	-0.755	-0.504	-0.532
	(0.608)	(0.521)	(0.651)	(0.534)
gender of household head (1=female, 0=male)	18.72	15.67	10.99	-0.645
	(3,429)	(2,339)	(1,645)	(1.956)
Number of children in household	0.283	0.109	0.131	0.135
	(0.317)	(0.313)	(0.320)	(0.334)
Number of working age females present in household	-0.170	0.182	-1.090**	0.470
	(0.386)	(0.482)	(0.510)	(0.624)
Number of working age males present in household	-0.133	-0.482	1.079**	-0.169
	(0.343)	(0.420)	(0.528)	(0.505)
Observations	130	96	112	80
Number of househ_247	65	48	56	40
Pseudo R-squared	0.404	0.201	0.342	0.216

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4-8. List of the nineteen CECIB schools that are part of the program

No.	CECIB schools	County
1	Marco Herrera Escalante	Cotacachi
2	Juan Morales y Eloy	Cotacachi
3	Nasacota Puento	Cotacachi
4	José D. Albuja	Cotacachi
5	Martín González	Cotacachi
6	Pichincha	Cotacachi
7	Virgilio Torres	Cotacachi
8	Mons. Bernardino Echeverría	Cotacachi
9	San Jacinto	Cotacachi
10	Jorge Andrade	Cotacachi
11	Prov. de El Oro	Cotacachi
12	Enrique Vacas Galindo	Cotacachi
13	Marco Tulio Hidrobo	Cotacachi
14	Alejo Sáenz	Cotacachi
15	José Vasconcelos	Cotacachi
16	Alberto Moreno	Cotacachi
17	Cuicocha	Cotacachi
18	Segundo Moreno	Cotacachi
19	Luis Felipe Borja	Cotacachi

Source: UNORCAC (2010)

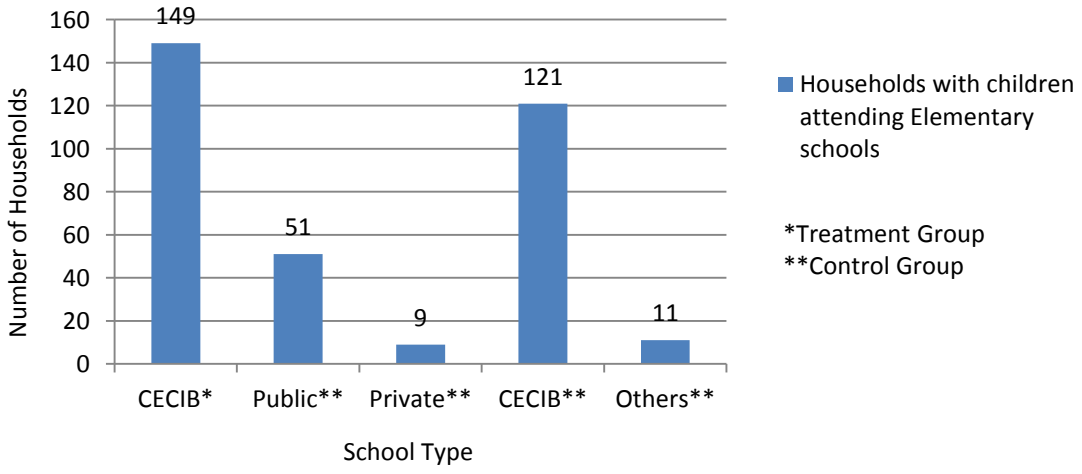

Figure 4-2. Number of households that had children attending elementary school by type of the school

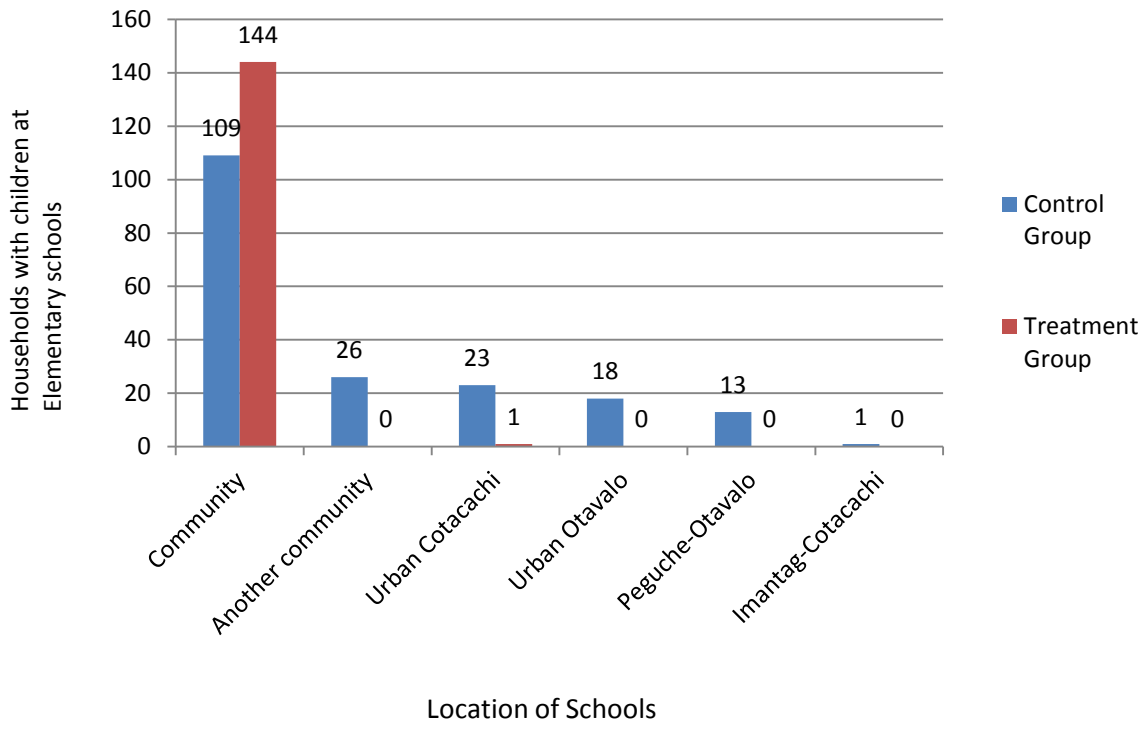

Figure 4-3. Number of households that had children attending elementary school by the location of the schools

Table 4-9. Characteristics of CECIB schools that were part of the program

No.	CECIB schools	Communities of Cotacachi	Number of teachers*	Number of students*	Classification by the number of teachers
1	Marco Herrera Escalante	Peribuela	3	90	Pluridocentes***
2	Juan Morales y Eloy	Azaya	2	42	Pluridocentes
3	Nasacota Puento	San Pedro	6	112	Completa****
4	José D. Albuja	Tunibamba	2	56	Pluridocentes
5	Martín González	Piava Chupa	2	38	Pluridocentes
6	Pichincha	Morochos	6	105	Completa
7	Virgilio Torres	San Nicolás	2	47	Pluridocentes
8	Mons. Bernardino Echeverría	Perafán	2	32	Pluridocentes
9	San Jacinto	El Cercado	7	160	Completa
10	Jorge Andrade	Iltaquí	2	34	Pluridocentes
11	Prov. de El Oro	Morlán	6	98	Completa
12	Enrique Vacas Galindo	Chilcapamba	5	87	Pluridocentes
13	Marco Tulio Hidrobo	Topo Grande	2	41	Pluridocentes
14	Alejo Sáenz	Pucalpa	1	20	Unidocente**
15	José Vasconcelos	La Calera	6	102	Completa
16	Alberto Moreno	Colimbuela	4	78	Pluridocentes
17	Cuicocha	Ucshapungo	1	21	Unidocente
18	Segundo Moreno	Cumbas Conde	3	72	Pluridocentes
19	Luis Felipe Borja	Piava San Pedro	2	32	Pluridocentes

Source: UNORCAC (2010)

*Based on the data registered for all grades during the 2007-2008 academic year

** Unidocente: School with only one teacher for all grades

*** Pluridocentes: School with 2-5 teachers for all grades

**** Completa: School with 6 or more teachers for all grades or 1 teacher per grade

Table 4-10. Variables included in the education regressions

Variable name	Description
Know corn varieties	Proportion of households with children who knew the varieties of corn
Know bean varieties	Proportion of households with children who knew the varieties of beans
Know ancestors grow	Proportion of households with children who knew what crops their ancestors planted
Know Intiraymi meaning	Proportion of households with children who knew the meaning of Inti Raymi
Participation in cultural events	Proportion of households with children who participated in cultural events
Parents company ce	Proportion of households with children whose parents participated with them in cultural events
Children visit garden	Proportion of households with children who visited the ethno-botanical garden
Child cultivate crops	Proportion of households with children who have cultivated crops
Child recycle organics	Proportion of households with children who have recycled organic residuals
Child cares water	Proportion of households with children who take care of water
Have a home garden	Proportion of households with children who had home garden
Household keeps seed	Proportion of households with children who knew the family keeps seeds

Table 4-10. Continued

Variable name	Description
Treatment effect	Dummy variable indicating if the household have children attending the CECIB schools that are part of the Program
Treated County	Dummy variable indicating if the household is located in Cotacachi
Number of people per household	Number of members in the household
Mother's level of education in years	Number of years of schooling of the mother
Log of household income	Log of income per household

Table 4-11. Descriptive statistics of regression variables for education

	Control	Treatment
Number of Households per group	192	149
Children attend cultural events		
Number of households	112	142
Percentage (%)	59.8%	99.3%
Number of observations	187	143
Parents attend school or cultural activities with children		
Number of households	44	78
Percentage (%)	38.5%	54.5%
Number of observations	114	143
Teachers talk and teach about the environment		
Number of households	180	139
Percentage (%)	97%	100%
Number of observations	186	139
Children visit the community garden		
Number of households	18	3
Percentage (%)	9%	2%
Number of observations	186	139
Children know corn varieties		
Number of households	126	136
Percentage (%)	14%	99%
Number of observations	182	137
Children know bean varieties		
Number of households	109	137
Percentage (%)	59.5%	98.5%
Number of observations	183	139
Children know the family keeps seeds		
Number of households	172	139
Percentage (%)	97.1%	100%
Number of observations	177	139
Children know what crops their ancestors planted		
Number of households	63	137
Percentage (%)	34.05%	98.5%
Number of observations	185	139

Table 4-11. Continued

	Control	Treatment
Number of Households per group	192	149
Children have home gardens		
Number of households	119	139
Percentage (%)	64.3%	100%
Number of observations	185	139
Children cultivate crops		
Number of households	140	139
Percentage (%)	75.6%	100%
Number of observations	185	139
Children know about the need of water to plant crops		
Number of households	177	139
Percentage (%)	99.4%	100%
Number of observations	178	139
Children take care of water		
Number of households	179	139
Percentage (%)	98.3%	100%
Number of observations	182	139
Children recycle organic residuals		
Number of households	139	139
Percentage (%)	76.3%	100%
Number of observations	182	139
Children know the meaning of Inti Raymi		
Number of households	56	117
Percentage (%)	30.1%	84.17%
Number of observations	186	139

Table 4-12. OLS regressions of children cultural & environmental knowledge

Variables	(1) Know ancestors grow	(2) Know bean varieties	(3) Know corn varieties	(4) Know Inti Raymi meaning	(5) Participation in cultural events	(6) Parents company ce	(7) Children visit garden
Treatment effect	2.181***	1.491	2.199*	1.934***	2.069*	1.159***	-2.870***
	(0.805)	(0.979)	(1.176)	(0.371)	(1.170)	(0.350)	(0.698)
Treated County *(1=Cotacahi, 0=Otavalo)*	3.812***	2.692***	2.493***	0.804*	3.993***	-1.113**	4.259***
	(0.545)	(0.634)	(0.636)	(0.437)	(0.710)	(0.476)	(1.133)
Number of people per household	-0.135	0.153*	0.149*	0.0289	-0.144	-0.0212	0.142
	(0.105)	(0.0831)	(0.0866)	(0.0613)	(0.0885)	(0.0597)	(0.111)
Mother's level of education-years	-0.0128	0.155**	0.0229	0.0626	0.0152	-0.0198	0.146**
	(0.0695)	(0.0712)	(0.0651)	(0.0394)	(0.0788)	(0.0361)	(0.0652)
Log of household income	-0.206	-0.282	-0.000393	-0.0565	0.599**	-0.101	0.961***
	(0.240)	(0.219)	(0.213)	(0.181)	(0.254)	(0.161)	(0.304)
Constant	-0.0127	0.0933	-0.620	-1.168	-2.787**	0.771	-11.25***
	(1.617)	(1.372)	(1.258)	(1.075)	(1.348)	(0.940)	(2.686)
Observations	323	321	318	324	329	256	324
Wald chi2(5)	107.7	53.61	36.81	85.12	70.2	12.81	33.77
Prob > chi2	0	0	0	0	0	0.0253	0
Pseudo R2	0.6445	0.396	0.309	0.2457	0.4146	0.0410	0.3707

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4-12. Continued

Variables	(8) Child cultivate crops	(9) Child recycle organics	(10) Child cares water	(11) Have a home garden	(12) Household keeps seed
Treatment effect	0 (omitted)[a]	0 (omitted)[a]	0 (omitted)[a]	0 (omitted)[a]	0 (omitted)[a]
Treated County *(1=Cotacahi, 0=Otavalo)*	2.493*** (0.779)	-0.369 (0.472)	-0.465 (1.111)	-0.533 (0.431)	0.518 (1.042)
Number of people per household	-0.0686 (0.0895)	-0.0324 (0.0734)	-0.0255 (0.108)	-0.0564 (0.0817)	0.482** (0.229)
Mother's level of education in years	-0.0385 (0.0666)	-0.0192 (0.0546)	0 (omitted) [a]	0.0447 (0.0589)	0.0999 (0.148)
Log of household income	0.224 (0.278)	0.331* (0.188)	0.171 (0.339)	0.718*** (0.201)	-0.354 (0.537)
Constant	-0.0323 (1.546)	-0.186 (1.151)	2.546 (2.380)	-2.821** (1.182)	2.449 (2.438)
Observations	185	182	75	185	177
Wald chi2(5)	11.51	8.55	0.96	23.53	12.71
Prob > chi2	0.0214	0.0733	0.8120	0.0001	0.0128
Pseudo R2	0.0960	0.0374	0.0144	0.1147	0.0867

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
a = perfectly predicts the outcome

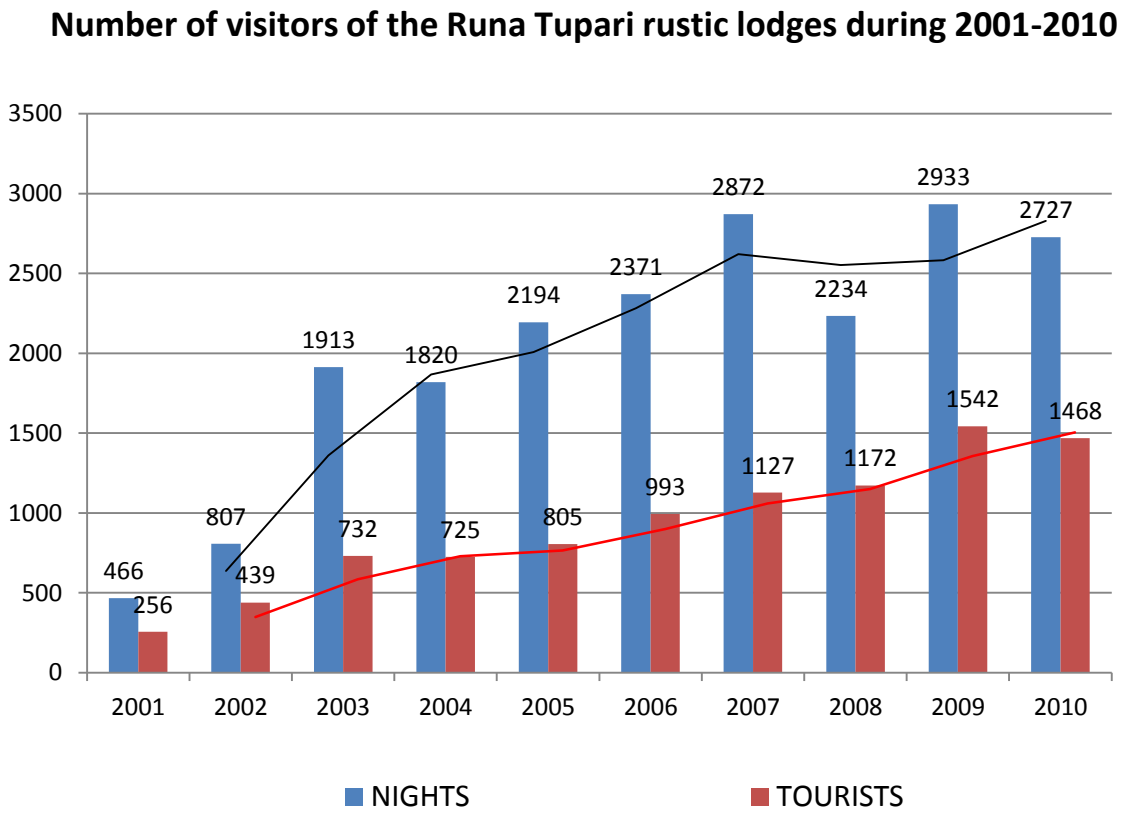

Figure 4-4. Number of tourists who visited the Runa Tupari's rustic lodges in Cotacachi during the years 2001 to 2010

Source: Runa Tupari Native Travel (2011)

CHAPTER 5
CONCLUSION

New Conceptual Framework

A need exists to better estimate the impact of the program upon household decisions. Several evaluations of food security and poverty alleviation programs have included randomized and non-randomized methodologies to evaluate similar components as the ones in this program -separately. Even though we analyzed the program to estimate its overall impact upon the livelihoods of the rural communities in Cotacachi, we found the necessity to evaluate each component separately. Our model and quantitative analysis showed that the program had an impact upon welfare, agro-diversity, and children's knowledge of cultural and agricultural biodiversity and environment. Even though the treatment was not significant for the households' consumption of native crop species (i.e. vegetables, tubers, grains, and fruits), the year 2010 (post intervention) was significant for those regressions, therefore we could attribute that increase (in the frequency of consumption for adults and children) to the program.

The Single-Difference and the Difference-in-Differences methods used in this study to estimate the impact of the program on the livelihoods of the people of the peasant communities of Cotacachi showed that the program had a significant impact upon household decisions and livelihoods. The households of Cotacachi County experienced an increase in income from 2005 to 2010, especially those which participated in the program; therefore we concluded that the increase was attributable to the program. Also, we found that children who attended the CECIB schools of the program had stronger knowledge of concepts related to cultural and agricultural

diversity and environment, and we had enough statistical evidence to attribute this result to the program.

Our qualitative analysis of the agro-tourism component showed that the program had a significant effect on women's empowerment. Research on food security has pointed out the important role of women for the household's nutrition and food access (Quisumbing, Brown, Feldstein, Haddad, & Peña1995). While analyzing this component we were able to capture several intangible benefits for the women who participated in this component as they assure us to have experienced higher self-esteem due to their participation in the program and they profited from the Cultural Exchange experience as well. We also identified a significant difference in behavior and confidence between the women who participated in the agro-tourism component and the ones who did not as we saw that women of the rustic lodges were more confident and communicative than the others. We also appreciated that these women were proud to show the visitors their cultural diversity and ethnicity. Women who participated in this component attributed their welfare to the program as they said they had improvement in the social and economic aspects due to the program; and they had begun to participate more in the community through this project. Also we appreciated that these woman were influenced to diversify their parcel due to the program and they were also more aware of nutrition than the other women especially by the fact they had development culinary skills during the project and were able to use native crops in more dishes than the others.

Finally, during our qualitative analysis of the agroindustry component we figured out this is the weakest component. Even though the proportion of the budget -20% of the program's budget- invested in this agro-industry component that included farm and

rural non-farm activities, this component did not have a significant effect on the rural households. We were not able to capture any positive effect of this component due to the fact that participants were unsatisfied with the project during the interviews and they did not perceive income gains derived from supplying the ingredients to the plant to manufacture the processed food products. We did not identify any intangible benefit, as we determined for the agro-tourism component.

Impact on Current Research

Our analysis of this program determined that the program addressed its goals of increasing welfare and promoting the conservation of agro- diversity in the long run. Even though the program was also focused on creating jobs through the agro-industry and agro-tourism components, in order to increase the income of the people in Cotacachi and motivate them to conserve their native crops species, our findings showed the importance of education in cultural and agricultural diversity and environment concepts -at Elementary schools- as a tool to promote conserving crop diversity as well. Analyzing the Education component showed that the component was even more successful than the other three components of the program to promote conserving crop diversity. These findings are expected to help designers and implementers of Food Security programs, as well as, poverty alleviation programs (i.e. ACCESO in Honduras) that are currently working for rural poor in developing countries. Our analysis of the overall impact of the program and the findings of the education component also extend the work of Tapia (2005) and Rhoades (2006). This study has also shown that the conserving crop diversity, education and agro-tourism components would be more likely to be replicated in other peasant communities of Ecuador due to the fact they helped to increase welfare, parcel diversity, consumption and conservation

of native crops, as well as the children's knowledge with respect to cultural and agricultural diversity and environment in the peasant communities of Cotacachi. Of course, these components may be replicated with some adjustments to the component's design, based on the characteristics of the population and local conditions where the component may be undertaken.

Need for Further Research

Our study leaves several areas of the program and impact evaluation methods to be examined to better understand the effect of the program on the livelihoods of the peasant communities of Cotacachi. First, this research was not able to fully explore the complexity and dynamics of the agro-industry component. This component included farm activities linked to the production of the crops to supply the ingredients to the food-processing plant. It also included rural-non-farm activities related to agricultural and extension education, leadership and management skills adoption, food markets and food marketing knowledge, as well as, transference of technology. During our study we were not able to examine in depth all those activities of the agro-industry component in order to establish input and output indicators to estimate the influence of the program upon those indicators. Therefore, we were not able to determine the relationship between the indicators and crop production, as well as, the relationship between indicators and food-processed product production and production technology either. As we did not examine in depth those factors during the fieldwork in 2010 and establish effective indicators, we were unable to estimate the impact of the program intervention upon parcel diversity, native crops uses, food security, crop production levels, living conditions, income and household' decisions, as well as, to estimate the effect of the

program upon training and linking the farmers to high-value markets. Second, more advanced statistical methods, such as propensity score matching may complement the difference-in-differences method we used in this study in order to analyze the differences in outcomes between households from Cotacachi and Otavalo, all of which we collected information from. Third, this research was not able to explore the differences in parcel and crop productivity before and after the program because the households have experienced changes in parcel diversity, use of crop varieties and parcel size through time, therefore, we were not able to capture the difference in productivity of crop species such as corn, bean or tree tomato as households had different varieties of these crops in different sizes of land that made us unable to estimate differences in production level due to the program intervention. Changes in parcel productivity needs to be examined as well as its relation to changes in parcel diversity and environmental changes that may have occurred during the program and a need exists for establishing parameters that may help to elaborate that estimation.

Regarding the complexity and impact of the agro-industry, another important factor –additional to that previously mentioned- that needs to be examined is the relation between the farm and rural-non-farm activities carried out for this component. A need exists to examine this relationship or how to connect them, in order to determine if the component truly increased overall economic activity and employment, as well as conservation of diversity in Cotacachi. Additionally, the income derived from this agro-industry system (farm and rural-non-farm income) needs to be examined to be able to determine if it is an important resource for the participant households and also for food security in rural Cotacachi (Ruben, 2001) as they were designed to improve returns to

crop and processed food product production through training the participants and linking the farmers to high-value markets (Cavatassi, R., González, M., Winters, P., Andrade-Piedra, J., Thiele, G., & Espinosa, P. ,2009, and Reardon and Berdegué, 2002) to help them to increase their income and improve their living conditions. Research on agro-industry and micro finances oriented to the processed food production in programs for poverty alleviation has shown the complexity and dynamics of a high-value market of processed products that this type of agricultural system has to face, especially in the food marketing sector (Reardon and Berdegué, 2009). The processed food products and food marketing sector implies challenges, risks, and management skill adoption by the entrepreneur smallholders –specially in Latin America- to have a successful agro-industry system (Johnson and Berdegué, 2004) that can contribute to increasing income, therefore the improvement of their living conditions and food security at the same time (Eaton and Shepherd, 2001). In sum, smallholder's capacity to undertake those farm and rural-non-farm activities of the agro-industry component needs to be examined, as well as the crop production system to supply the industry plant that processes the crops.

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BIOGRAPHICAL SKETCH

Mayra Rivas was raised in the city of Guayaquil (Ecuador) and also on her grandparents' farm where she first gained a passion for agriculture, the rural lifestyle and agribusiness. While in high school, Mayra was very active in the Hijas de la Caridad missionary group in Guayaquil where she served as a volunteer for teaching mathematics in elementary schools located in rural communities near her city. These activities enhanced her interest in mathematics and inspired her to pursue a degree in statistics with a focus on quality management systems at the Escuela Superior Politécnica del Litoral (ESPOL) of Guayaquil with the financial support of the Alfons Goppel Foundation, a German institution which provides scholarships to outstanding students in the poor areas of Ecuador. While at ESPOL, she had the opportunity to participate in an undergraduate research to assess the effects of school resources on student performance in the city of Guayaquil.

One of the highlights of Mayra's life and professional development was her collaboration with Professor Raul Paz in socio-economic development projects at ESPOL. Her work in those projects enhanced her interest in social and rural development. This experience spurred Mayra to continue her studies in food and resource economics at the University of Florida (UF) with a focus on agricultural development.

While at the University of Florida, Mayra gained interest on research and Academia as well as cooperative agreements between the University of Florida and other international universities. As Mayra works for the IFAS-Global (IFAS International Programs) office at UF, she had the opportunity to collaborate to initiate the cooperative agreement between UF and the Ecuadorian university Universidad Estatal del Sur de

Manabí. This inspired Mayra even more to continue her studies and begins a PhD in food and resource economics at University of Florida with funding provided by the Ecuadorian Government through the Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT). Mayra plans to return to Ecuador to work in Academia after she finishes her studies at the University of Florida. She desires to continue her work in agricultural development in her country, specially her research on impact evaluation of anti-poverty and rural development programs. Mayra is also interested in motivating Ecuadorian students to do research in that field as well as collaborating to further strengthen the cooperative agreements between UF and Ecuadorian universities.