EVALUATION OF A PARTICIPATORY BIRD CENSUS PROJECT ON KNOWLEDGE, ATTITUDES AND BEHAVIORS OF FARMERS TOWARDS CONSERVATION IN COFFEE-GROWING REGIONS OF COLOMBIA

By

GLORIA MARIA LENTIJO JIMENEZ

A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

UNIVERSITY OF FLORIDA

2010

ACKNOWLEDGMENTS

I would like to thank the Fulbright Program, Dexter Fellowship, University of Florida Latin American Studies, Colciencias Colombia, and the National Federation of coffee growers of Colombia for the financial support to study at the University of Florida. I would like to thank the chair and members of my supervisory committee, Dr. Mark Hostetler, Dr. Susan Jacobson, and Dr. Karen Kainer, for their mentoring and time, the coffee growers who participated in my surveys, the Comités de Cafeteros for their logistic support while in Colombia and Cenicafé. I thank my parents, my brother, Rafael Vasquez, Jorge Botero, and all my friends for their encouragement.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Thesis Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science

EVALUATION OF A PARTICIPATORY BIRD CENSUS PROJECT ON CONSERVATION KNOWLEDGE, ATTITUDES, AND BEHAVIORS OF FARMERS IN COFFEE-GROWING REGIONS OF COLOMBIA

By

Gloria María Lentijo Jiménez

August 2010

Chair: Mark Hostetler
Major: Wildlife Ecology and Conservation

Involvement of local communities in conservation projects is considered as a key issue for the success of programs that aim to promote biodiversity protection, but despite potential benefits, participatory approaches are often not evaluated. A participatory bird census (PBC) project has been administered to local coffee farmers in Colombian coffee-growing regions with an emphasis on bird identification, censuses on coffee farms, and general bird-conservation practices. My objectives were 1) to evaluate the effect of the PBC project on conservation knowledge, attitudes and behaviors of coffee farmers and 2) to learn about the barriers farmers perceive toward adopting coffee practices that could improve biodiversity measures and natural resource conservation. I conducted in-person interviews with 261 Colombian coffee farmers, from which 73% where small-scale farmers with a coffee area of less than 5 hectares. I divided respondents into four categories to control for the effects of participation in an environmental coffee certification program (Rainforest Alliance certification); as well as the PBC project: (1) non-PBC participant, non-Rainforest Alliance certified; (2) PBC participant, non-Rainforest Alliance certified; (3) non-PBC participant, Rainforest

Alliance certified and (4) PBC participant, Rainforest Alliance certified . Interview results indicated that PBC participant/Rainforest and PBC participant/non-Rainforest were more knowledgeable about migratory and threatened birds. In general, farmers in all groups had positive attitudes toward birds. Ninety-six percent of respondents agreed that birds provide benefits to their farms and 87% believed that running a coffee business is not incompatible with bird conservation. PBC participant/Rainforest, PBC participant/non-Rainforest and non-PBC participant/Rainforest groups believed they had the skills to perform bird conservation-practices on their farms. PBC participant/Rainforest and non-PBC participant/Rainforest groups were more likely to preserve forest fragments and natural vegetation along streams, although 76% of farmers were performing conservation behaviors. Farmers believed that lack of environmental awareness and lack of knowledge were the main barriers to perform bird conservation practices in the region.

The results of my study suggest that participatory programs like the PBC project have the potential to promote bird conservation on private lands, particularly in association with monetary compensations. Bird conservation in coffee-growing regions can become more of a reality if programs give farmers detailed biodiversity management information.

CHAPTER 1
INTRODUCTION

Involvement of local communities in conservation projects is considered as a key issue for the success of programs that aim to promote biodiversity protection (Bawa 2006; Vermeulen & Sheil 2006; Kainer et al. 2009). After decades of excluding local people, ecologists have witnessed the benefits of using participatory methodologies to involve communities in environmental resource management and the creation of protected areas processes (Gillingham & Lee 1999; Calheiros et al. 2000; Mehta & Heinen 2001). These benefits include enhancement of people's feelings of 'ownership' of their environment (Evans et al. 2008; Campbell & Vainio-Mattila 2003), and improved understanding of local environmental problems. Therefore, communities can have a role in analyzing and proposing solutions which are more appropriate for the local context (Ericson 2006; Sheil & Lawrence 2004; Reed 2008) and can result in successful long term conservation actions. A participatory process helps reinforce bonds between communities (Reed 2008), promoting them to research, study, learn, and then acting together to identify problems, propose solutions and perform interventions (Selener 2005).

Some studies have shown that positive attitudes toward parks and conservation efforts are highly influenced by level of education and involvement that communities have had on establishment or management of the conservation area (Fiallo & Jacobson 1995; Kideghesho et al. 2007; Lee & Zhang 2008; Selebatso et al. 2008). Better attitudes toward conservation areas or projects can guarantee their sustainability over the long term (Alexander 2000; Mehta and Heinen 2001), as well as generate better outcomes for biodiversity conservation.

Despite these potential benefits, using a participatory approach is not enough to guarantee a significant impact on the knowledge, attitudes, and behavior of participants (Napier 1998; Mehta and Heinen 2001; Brossard 2005; Gubbi et al. 2009). Formal evaluations are needed to show the effects of community projects on biodiversity protection (Chess 2000; Sheil & Lawrence 2004; Ferraro & Pattanayak 2006). An evaluation can help determine the impact of a new project or policy and even ways to improve or refine on a specific initiative to enhance its effectiveness (Chess 2000; Rossi et al. 2004).

Attitudinal studies had been widely used with communities in protected areas as a way to offer guidance for management decisions and to assess the efficacy of policies being promoted (Fiallo & Jacobson 1995; Holmes 2003; Kideghesho et al. 2007). Some researchers have also assessed farmer perceptions toward biodiversity (Mccan et al. 1997; Jacobson et al. 2003; Herzon & Mikk 2007; López del Toro et al. 2009), and have found that farmer knowledge and attitudes toward the environment, as well as social structure (e.g. farm size, income, and experience with farming) (Camboni & Napier 1993) can affect farmer willingness to employ new biodiversity-friendly practices. Evaluations of farmer knowledge and attitudes toward biodiversity can help to design effective extension programs for conservation in agroecosystems.

Colombian coffee agroecosystems. With so much natural habitat transformation for agriculture, there is a need to think about how we can preserve biodiversity in agricultural areas. The probability of preserving natural habitats in reserves and national parks is becoming increasingly difficult (Daily 1997, Petit et al. 1999). Many studies now offer evidence that coffee agroecosystems can sustain high levels of biodiversity,

including a large proportion of forest species (Petit & Petit 2003; Perfecto &Vandermeer 2008). In Colombia, coffee-growing farms are not only composed of coffee, but other land-cover types like riparian habitat, forest patches and live hedgerows that result in a heterogeneous landscape (Muriel & Kattan 2009). Such landscape heterogeneity can enhance avian diversity in coffee agroecosystems (Estrada et al. 1997; Daily et al. 2001; Hughes et al. 2002; Estrada & Coates-Estrada 2005; Arbeláez et al. 2007).

Studies from Cenicafé (National Coffee Research Center of Colombia) have registered more than 400 bird species on various coffee farms and nearby communal forests of Colombia (Jorge Botero, personal communication). These counts represent approximately 20% of Colombian avifauna, including 26 threatened species (Espinosa et al. 2009) and 34 Neotropical migrants (Botero et al. 2005). The presence of species of conservation concern indicates that Colombian coffee-growing regions may have an important role for bird conservation. Although more research is needed to evaluate the contribution of coffee agroecosystems for bird survival over the long term (Komar 2006), promotion of management strategies that increase landscape heterogeneity can be an effective tool for conserving bird habitat.

Recently, several sustainable programs have been promoted in Colombia to help decrease the impact of coffee production on the environment (Guhl 2009). One is the Rainforest Alliance certification, which is provided by The Rainforest Alliance, a non-profit organization that gives an independent seal of approval that ensures that coffee (in this case) is produced in compliance with strict guidelines protecting the environment, wildlife, workers and local communities (Rainforest Alliance 2010). The Rainforest Alliance certification started in Colombia in 2002 and in 2009, approximately

0.6% of Colombian coffee farmers have been certified in 13 states with approximately 13,800 certified hectares (Rodrigo Calderón, personal communication).

Participatory Bird Census. To help promote bird conservation on Colombian coffee farms, Cenicafé established the Participatory Bird Census (PBC) project. Since 2004, a PBC research team visits a rural, coffee growing area, two to three times a year, for a 6-day period. In this participatory project, local coffee communities are invited to participate in three main activities during each visit:

1. Bird census: Birds are surveyed during 4 days in different habitats such as coffee crops, forest fragments, and riparian habitats through fixed- radius point count method. Depending on logistical constraints, between 6 and 10 point counts are established in each locality and surveyed every day, from 6:00 am to 10:00 am.

2. Education program: Every visit integrates an educational topic, such as how to recognize and describe a bird using binoculars and field guides, and how to take data. During successive visits the topics become more complex and deal with migration, biogeography, endemism, endangered species, and identification of important avian habitats.

3. Meetings with community leaders: During these meetings researchers discuss PBC findings with local leaders, educate them further about birds in their locality, and discuss use of results in coffee marketing programs and for coffee certification (e.g. as organic or sustainable producers).

Farmers take part in the PBC project either by helping to survey the birds, using their farms as census sites, taking part in educational activities, and/or helping to communicate to other landowners about birds recorded during the census. Since project inception, several communities have promoted their own conservation initiatives in their regions, including creation of birdwatcher groups, replication of educational activities about birds in rural schools, and conservation planning in communal reserves. Through farmer's participation, the PBC project aims to build capacity and facilitate the empowerment of communities in bird conservation and other environmental related issues (Lentijo et al. 2008).

To date, however, the impact of the PBC project on farmer conservation knowledge, attitudes and behavior has not been formally evaluated (Lentijo et al. 2008). In my study, I compared knowledge, attitudes and behaviors toward bird conservation of farmers that did and did not participate in the PBC project. In addition, I ascertain the barriers farmers perceive toward adopting coffee practices that could improve biodiversity measures and natural resource conservation. I hypothesized that PBC farmers will have improved knowledge and attitudes about local birds and their conservation and that they will have implemented conservation actions for birds.

CHAPTER 2
METHODS

Study Area

I selected five Colombian states (Cauca, Huila, Tolima, Cundinamarca and Santander) (Figure 2-1) where the PBC project has performed activities for over a year and that are currently accessible and secure. Coffee plantations are located over the mountains of the three branches (Cordilleras) of Colombian Andes and Sierra Nevada de Santa Marta, between 1200 and 2000 meters above sea level. It is a region with great diversity in climate, soils and topography and therefore, great ecological diversity, which results in a heterogeneous national coffee-growing region. The cultivated area corresponds to approximately 874,000 hectares in 19 states (or Departamentos). It is a densely populated region with more than 500,000 coffee farmers (FNC 2010). The average size of an individual coffee farm in Colombia is approximately 2 hectares, and 95% of coffee farmers are considered small-scale farmers that own less than 5 hectares of land (FNC 2010). Coffee farmers belong to the National Federation of Coffee Growers of Colombia (FNC), a nongovernmental institution with regional offices in most of municipalities with coffee plantations. These regional offices (Comités de Cafeteros) have an extension service that provides technical advice for farmers and disseminate new technologies developed by Cenicafé- the research branch of the FNC.

Survey Instrument Design

A survey was designed to measure conservation knowledge, attitudes and behaviors, as well as household demographics (Appendix). Questions included Likert scale (Likert 1932), yes/no/unsure questions, open-ended questions, and questions with several options to choose.

To construct the survey, I followed three steps: 1) I had informal conversations with Colombian extension professionals and people involved with the PBC project to find out what aspects would be important to evaluate, 2) once the questions were selected, the questionnaire was reviewed by three extension professionals and the PBC project team, and 3) I pre-tested the questionnaire with 10 coffee farmers that had not participated in the PBC project. A special concern for my study was the use of Likert scale questions because Albertin and Nair (2004) found these to be difficult while interviewing coffee farmers in Costa Rica. During the pre-test, before starting the Likert type questions, I gave each respondent a cardboard scale with different colors and the title for each of the possible responses: 1) totally agree, 2) somewhat agree, 3) not sure, 4) somewhat disagree, and 5) totally disagree. The use of this cardboard proved to be useful for respondents to remember the possible choices for answering, by reading the possible response or by identifying each response with a different color.

I assessed knowledge about birds through four questions that asked respondents to name the species they had seen on their farms, knowledge about migratory and threatened birds, and the causes they thought decreased bird diversity. The responses for species observed were categorized in low knowledge (less than 10 species) and high knowledge (10 species or more). The other knowledge questions were categorized as correct/incorrect.

I assessed attitudes toward birds and conservation using 10 Likert-type statements and five closed-ended questions. Attitudinal questions concerned benefits birds provide for farms, skills needed to perform practices to preserve birds, support for reserve creation and a conservation fund for birds in coffee-growing regions, and

willingness to invest on conservation practices. Cronbach alpha for attitude statements was less than 0.5 (Cronbach 1951); therefore I performed an individual analysis for each statement.

I explored conservation behaviors with yes/no questions about current practices conducted on coffee farms such as conservation of forest fragments, conservation of natural vegetation along streams, planting more trees, forbidding hunting and reducing the use of agrochemical products. For positive responses about conservation of forest fragments and natural vegetation on farms, I added a subsequent verification question on the size of the area intended for environmental conservation. For respondents that did not have any conservation area on their farm, I included a question about their willingness to stop coffee production on an area of the farm to facilitate natural regeneration as a new conservation area. Lastly, barriers to perform conservation behaviors or practices were explored through one open-ended question.

Participant Selection

Coffee farmers in Colombia maintain a very close relationship with Comités de Cafeteros and its extension service. In general, coffee farmers form groups or associations that have a name, an internal organization and several members. These associations are registered in their local Comités de Cafeteros and several visit Cenicafé each year from diverse parts of Colombia, and during these visits they get information about biodiversity conservation and the PBC project. From this interaction the PBC research team selected farmers' associations that clearly expressed their interest in participating in the PBC project through Cenicafé or Comités de Cafeteros.

In each of the five states, local Comités de Cafeteros provided me lists of all farmers associations within the state. Then I narrowed the sampling frame of farmers

associations taking into account the following criteria: (1) accessibility; (2) security; (3) associations that were not aware of the PBC project (for the case of non-participants), and (4) Rainforest Alliance-certified farmers. Because Rainforest Alliance-certified farmers are already doing practices that can be considered beneficial for bird conservation, the certification may confound the effects of the PBC project to influence adoption of conservation behaviors. Thus, I made an effort to include a balanced number of Rainforest Alliance-certified farmers in both participant and non-participant groups.

From this narrowed list, I selected all farmer associations that participated in the PBC project for more than two years, to assure that the project was established and that the majority of farmers in a given association had access the PBC activities. For PBC participant associations, I obtained lists of adult farmers that own a farm and participated in at least one educational activity or one bird census during PBC project's visits. Based on the number of PBC participant associations, I randomly selected a non-participant matching association to interview as a control. All the farmers that were members of the selected control associations were asked to participate in the interview. The resulting list included 128 PBC participants from whom 77 were Rainforest Alliance certified and 171 non-PBC participants, from whom 121 were certified.

I contacted all participants and non-participants by telephone at least two weeks before the interview to explain its purpose and to schedule an appointment either in the closest town or in their farms when logistic conditions permitted. The survey was administered between May to September 2009 and conducted in Spanish through face to face interviews by myself and a local researcher, both native speakers. Before each

interview, a brief consent statement was read to each participant, mainly to explain the interview, to ask permission to conduct it, and to inform the respondents that they would remain anonymous.

Data Analysis

I performed the analyses comparing four groups: (1) non-PBC participant, non-Rainforest Alliance certified (NP-NRF); (2) PBC participant, non-Rainforest Alliance certified (P-NRF); (3) non-PBC participant, Rainforest Alliance certified (NP-RF) and (4) PBC participant, Rainforest Alliance certified (P-RF). First, I performed bivariate analyses (cross tabulations and chi square tests) to explore differences on demographic factors between the four groups. Continuous demographic factors (e.g. farm area, age, coffee production) were categorized into ordinal variables to perform bivariate analyses. I used Spearman correlation to determine if specific questions were correlated with demographic variables. For demographic variables that were different between the groups and correlated to responses of certain questions, these were taken into account as covariates in the below logistic regression model.

Next, to explore the effect of participation in the PBC project on respondents' answers, I used a binary logistic regression model for each question. I considered the response to each question as the dependent variable and categorized the response of each question as a binary variable (0 and 1). Each participation category (NP-NRF, P-NRF, NP-RF, and P-RF) was the independent variable for each logistic regression model and NP-NRF group were used as the baseline group for comparison.

These analyses were performed using the Statistical Package for the Social Sciences (SPSS) Version 16.0, with alpha 0.05. I considered don't know/not sure responses as missing data and I used listwise deletion in these cases. For the logistic

regression models I used the forced entry method, in which all the independent variables are placed into the regression model in one block, and parameter estimates are calculated for each block. To check for assumptions of logistic regression models, I ran collinearity diagnostics for model variables and did not find any issues of collinearity between the independent variables. I also examined residuals and did not find any substantial outliers or influential cases. For each logistic regression model, I present the intercept, chi square (χ^2) value, significance level (*P*) and odds ratio (ExpB) for only the independent variable (participation category). In addition, I present the chi square value and significance level for the final model that includes the independent variable and the demographic variables for which their effect was controlled.

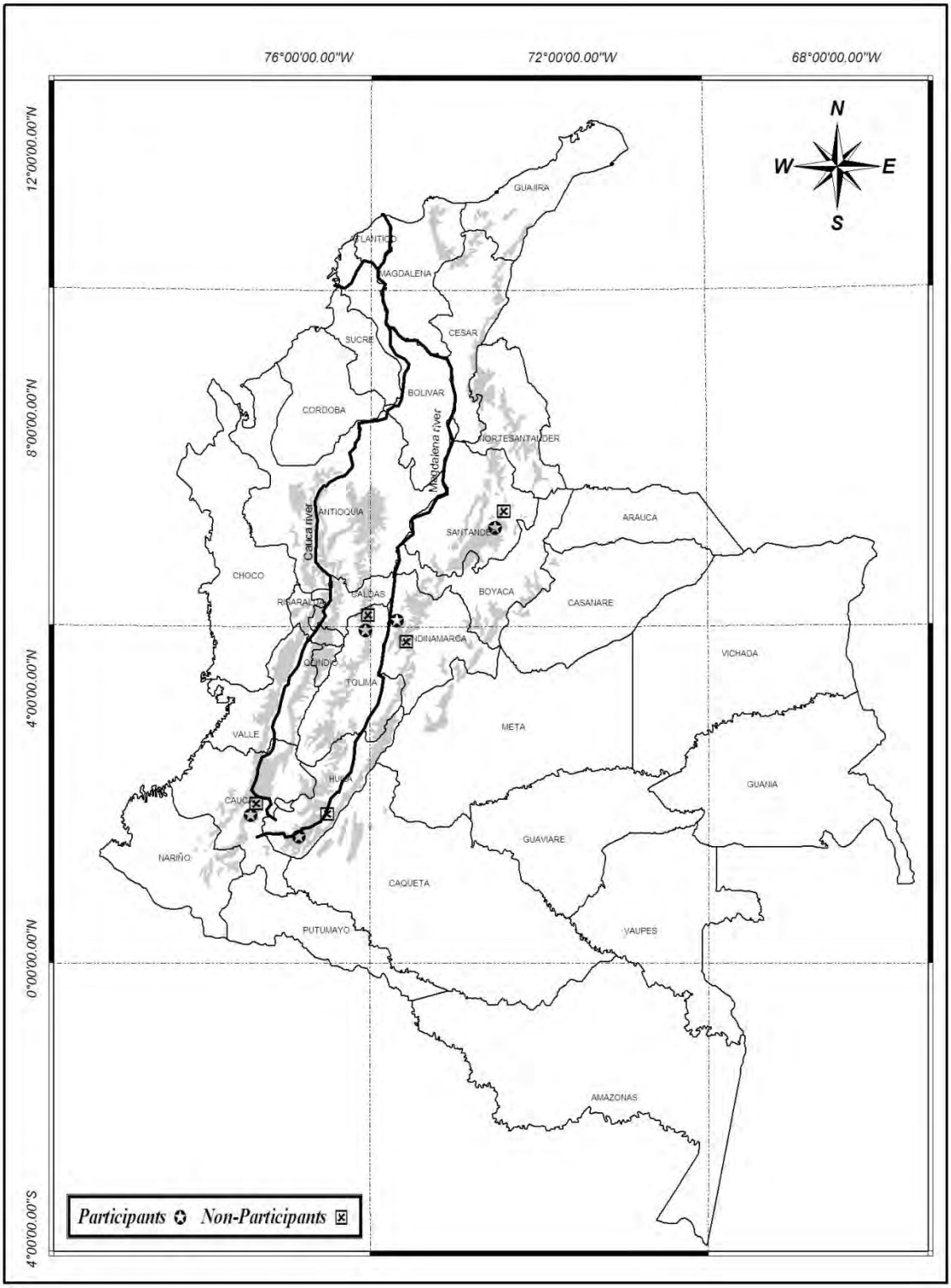

Figure 2-1. Location for participant and non-participant coffee farmers associations in Colombia. Coffee-growing region is shown in gray.

CHAPTER 3
RESULTS

Characteristics of the Sample

Of the 299 farmers contacted for the survey, 108 PBC participants and 153 non-participants were interviewed. Non-response rate was 15.6% for participants and 10.5% for non-participants. Sample sizes for the four groups were: P-RF=66, P-NRF=42, NP-RF=105 and NP-NRF=48. Demographic variables that were significantly different between the four groups included education (elementary, high school and higher education), area of farm cultivated with coffee (in hectares), type of coffee-growing mode (under shade, under semi-shade and without shade or sun coffee) and coffee production during the previous year (in kilos) (all *P* values <0.05). These demographic variables were also correlated (*P*<0.05) with the responses of several questions and thus used as covariates in the logistic model.

A majority of respondents (71%) were male with ages between 19 and 83 years old with an average age of 46. Approximately half of farmers in all groups had from 20 to 40 years of experience growing coffee. With regard to education, 51.3% had some elementary school, 29.5% had some high school and 19.2% had higher degree education (technical or college). A majority of NP-NRF (62.5%) reported lower levels of education; and more P-RF and NP-RF farmers had higher education (χ^2=12.75, *P*< 0.05). Most of the respondents (72.8%) were small farmers with less than 5 hectares cultivated with coffee. Compared to other groups in this study, more P-RF and NP-RF farmers (20.6%, n=256) had larger (more than 5 hectares) coffee farms (χ^2=23.22, *P*<0.01) with a maximum of 26 hectares. The average ($\bar{x}$) production of coffee was 4750 kilos during the previous year, and P-RF ($\bar{x}$=7962.5 kilos) and NP-RF ($\bar{x}$=4701

kilos) farmers produced more coffee than NP-NRF ($\bar{x}$=1638.7 kilos) and P-RF ($\bar{x}$=2418.7 kilos) (χ^2=40.24, *P*<0.01). With respect to the growing mode, 37.5% of farms had shade-grown coffee, 45.4% had some shade trees on the farm (semi-shade), and 16.9% had sun coffee with no coverage of trees in coffee plots. More NP-NRF (35.4%, n=48) and P-NRF (29.3%, n=41) farmers had sun coffee farms compared to P-RF (4.5%, n=66)) and NP-RF (11.4%, n=105) with sun coffee farms (χ^2=38.53, *P*<0.01).

Knowledge about Birds

Logistic regression results showed that the P-RF, P-NRF and NP-RF groups had greater knowledge about the number of bird species observed on their farms compared to the baseline group NP-NRF (Table 3-1, Question 1). The P-RF and P-NRF groups were 4.7 and 5.4 times more likely to list more than 10 bird species compared to the baseline group (NP-NRF). Almost half of the respondents (47.9%) could identify 10 or more bird species on their farms.

The P-RF and P-NRF groups had more knowledge about migratory birds. These two groups were more likely to answer correctly when presented with a definition about what migratory birds are compared with the baseline group NP-NRF (Table 3-1, Question 2). Between 80 and 83% of P-NRF and P-RF answered correctly compared to 44.4% of NP-NRF and 52.5% of NP-RF that answered correctly.

Regarding knowledge about threatened species, the P-RF and P-NRF groups were significantly more aware about the presence of threatened species in their area compared with the baseline group NP-NRF (Table 3-1, Question 3). From all respondents that were aware of the presence of threatened birds (n=145), 15.2% answered correctly when asked to name the threatened species in their region.

When asked about the most important reasons for bird diversity loss in coffee-growing regions, out of 494 answers given by all respondents, the main causes mentioned were habitat loss (33.2%), use of agrochemical products (19.2%) and hunting (18.21%).

Attitudes and Capability toward Bird Conservation

For Likert-type statements (Appendix, Questions 5 to 14), only one of 10 questions had a significant logistic regression model. P-RF, P-NRF and NP-RF groups indicated that they had the skills needed to implement farm practices that can help bird conservation compared to the baseline group NP-NRF (Table 3-2, Question 12). In fact, a majority of NP-NRF (83.3%, n=48) believed that they did not possess the skills to perform practices to conserve birds.

All other Likert-type statements showed no difference among the four groups (all *P* values >0.05). In general, all four groups had positive attitudes toward birds and conservation. Ninety six percent of all respondents agreed that birds provide benefits to their farms (n=253). With respect to performing practices to preserve birds in the farm, a large percentage of farmers (71.5%, n=235) disagreed with the statement that it is very expensive to perform farm practices to conserve birds, and 77.4% (n=239) would spend more money on new practices that might benefit birds. Most of the respondents (86.8%, n=258) believed that running a coffee business is not incompatible with bird conservation and 70% (n=246) disagreed that conserving birds does not offer any benefit for their coffee business. Almost all respondents (96.9%, n=256) considered that their farm provides a good shelter for birds and that they can play an important role for bird conservation in their region (97.2%, n=254). Among respondents, 95.8% (n=259)

agreed that they would like to go to workshops related on how to perform practices to conserve birds on their farms.

For attitudinal closed-ended questions during the survey, two of five questions were significant ($P<0.05$). Logistic regression showed that P-RF, P-NRF and NP-RF groups were more likely to believe that birds are going to increase or stay stable in the near future (Table 3-2, Question 16). Additionally, P-RF were 17 times more likely to believe birds are going to increase or stay stable compared to the baseline group (NP-NRF) (Table 3-2, Question 16) and the main reason they mentioned is that the PBC project and RF are giving them skills to preserve birds on their farms. Regarding willingness to donate 1% of coffee sales to create a fund for bird conservation in coffee-growing regions, logistic regression results revealed that P-RF and NP-RF groups would be more willing to donate compared to the baseline group NP-NRF (Table 3-2, Question 17).

A majority of respondents (98.4%, n=258) stated that they would support the creation of new natural reserves in their region to conserve birds. When asked about how they would support a new reserve, out of 308 answers given by respondents, the main ways to support new reserves would be labor (69.5%), ceding part of the land for new reserves (19.5%), and monetary donation (11%). Concerning the willingness to invest in farm practices to preserve the environment, 90% of respondents would be willing to invest from 1 to 5 days of labor a month. On the other hand, 74.2% (n=256) of respondents expected a monetary compensation or a premium when performing conservation practices for birds on their farms.

Conservation Behaviors

For yes/no questions about conservation behaviors, 3 of 6 questions had a significant logistic regression model. P-RF and NP-RF groups were more likely to preserve forest fragments and natural vegetation present on the farm, compared to the baseline group NP-NRF (Table 3-3, Question 20a). Across all respondents, 82.3% said they were preserving forest fragments and natural vegetation present on the farm. P-RF and NP-RF groups were significantly more likely to report preserving vegetation in streams compared to the baseline group NP-NRF (Table 3-3, Question 20b). Across all respondents, 74% answered that they were preserving riparian vegetation, and P-RF group was 23 times more likely to perform this practice. Logistic regression showed that NP-RF group was more likely to prohibit hunting on the farm (Table 3-3, Question 20d). Across all respondents, 96% answered that hunting on their farms is prohibited. A large percentage of respondents (76.25%, n=219) reported that they were performing all the conservation behaviors asked in the survey. Almost all respondents (n=261) said they were growing trees that produce food for birds (92.3%), and restricted the use of agrochemical products (95%).

When exploring the size of areas intended for environmental conservation on farms, the average area conserved was one hectare. Seventy-five percent of respondents (n=212) had an area of less than one hectare for environmental conservation. From respondents that did not have any preserved area in the farm, 66.6% (n=32) were not willing to set aside a coffee-producing area for 5 years to preserve it as a conservation area.

Barriers Farmers Perceive toward Adopting Conservation Practices for Birds

The top three reported barriers to adopting conservation practices for birds were lack of environmental awareness, lack of knowledge, lack of willingness and interest, and economic profit is more important than conservation (Table 3-4). When asked about how other farmers can be encouraged to do these practices, 77.8% of respondents answered promoting more educational programs, 14% answered invite farmers to participate in specialty coffees program (e.g., Rainforest Alliance Certified and Organic Certified) and 11% considered keep doing the PBC project.

Table 3-1. Significant binary logistic regression models for questions on knowledge about birds by Colombian coffee farmers in three groups: PBC participants/non-Rainforest Alliance certified (P-NRF); non-PBC participant/ Rainforest Alliance certified (NP-RF); and PBC participants/Rainforest Alliance certified (P-RF).

Question		Variables in the equation				Final Model	
		P-NRF	NP-RF	P-RF	Cons.	χ^2	*P*
(1) List bird species	B	1.55	1.33	1.69	-1.23	20.46	0.015
	χ^2	8.71	8.79	11.71	6.39		
	P<0.05	*	*	*	*		
	Exp(B)	4.72	3.79	5.45	0.29		
(2) Know migratory birds?	B	2.28	-0.017	1.17	0.162	22.48	0.007
	χ^2	8.97	0.001	3.91	0.066		
	P<0.05	*		*			
	Exp(B)	9.86	0.98	3.22	1.176		
(3) Aware of threatened birds?	B	1.51	0.663	1.99	-1.67	39.62	0.000
	χ^2	7.52	2.46	14.98	11.61		
	P<0.05	*		*	*		
	Exp(B)	4.56	1.94	7.34	0.19		

Note: For each model only the independent variable (participation category) and the constant (Cons.) are shown with the intercept (B), χ^2 (Wald statistic), significance value odds ratio (Exp B) and χ^2 statistics for the final model. The final model statistics include demographic variables whose effect was controlled for. For complete questions see Appendix.

Table 3-2. Significant binary logistic regression models for questions on attitudes about birds and ability to implement bird conservation practices by Colombian coffee farmers in three groups: PBC participants/non-Rainforest Alliance certified (P-NRF); non-PBC participant/ Rainforest Alliance certified (NP-RF); and PBC participants/Rainforest Alliance certified (P-RF).

Question		Variables in the equation				Final Model	
		P-NRF	NP-RF	P-RF	Cons.	χ^2	*P*
(12) Skills for bird conservation practices	B	1.55	1.62	1.37	-1.35	30.00	0.000
	χ^2	7.48	11.19	6.81	6.75		
	P<0.05	*	*	*	*		
	Exp(B)	4.69	5.07	3.96	0.26		
(16) Number of birds in the future	B	1.20	1.46	2.83	1.06	35.98	0.000
	χ^2	4.35	9.41	14.77	3.27		
	P<0.05	*	*	*			
	Exp(B)	3.33	4.32	17.02	2.89		
(17) Donate for bird conservation	B	0.56	1.02	1.37	-0.92	19.40	0.022
	χ^2	0.92	5.09	7.19	3.43		
	P<0.05		*	*			
	Exp(B)	1.76	2.77	3.93	0.40		

Note: For each model only the independent variable (participation category) and the constant (Cons.) are shown with the intercept (B), χ^2 (Wald statistic), significance value, odds ratio (Exp B) and χ^2 statistics for the final model. The final model statistics include demographic variables whose effect was controlled for. For complete questions see Appendix.

Table 3-3. Significant binary logistic regression models for questions on conservation behaviors by Colombian coffee farmers in three groups: PBC participants/non-Rainforest Alliance certified (P-NRF); non-PBC participant/ Rainforest Alliance certified (NP-RF); and PBC participants/Rainforest Alliance certified (P-RF).

Question		Variables in the equation			Final Model		
		P-NRF	NP-RF	P-RF	Cons.	χ^2	*P*
(20a) Preserve forest?	B	1.20	1.49	1.94	-1.20	27.37	0.001
	χ^2	3.07	6.50	7.90	3.02		
	P<0.05		*	*			
	Exp(B)	3.31	4.43	6.97	0.30		
(20b) Preserve vegetation in streams?	B	0.06	1.30	3.15	-0.90	41.24	0.000
	χ^2	0.01	3.83	7.33	1.22		
	P<0.05		*	*			
	Exp(B)	1.06	3.67	23.42	0.41		
(20d) Forbid hunting?	B	1.31	2.53	18.51	1.11	32.08	0.000
	χ^2	1.94	4.79	0.00	0.68		
	P<0.05		*				
	Exp(B)	3.71	12.53	1.09E8	3.03		

Note: For each model only the independent variable (participation category) and the constant (Cons.) are shown with the intercept (B), χ^2 (Wald statistic), significance value odds ratio (Exp B) and χ^2 statistics for the final model. The final model statistics include demographic variables whose effect was controlled for. For complete questions see Appendix.

Table 3-4. Colombian coffee-farmers' perceptions of barriers toward adopting conservation practices for birds.

Barriers to adopting conservation practices for birds (% of total respondents (n=267) reporting a barrier)	%
Lack of environmental awareness	52.4
Lack of knowledge	46.8
Lack of willingness and interest	12.4
Economic profit is more important than conservation	8.6
Some people like to hunt	8.2
Don't belong to specialty coffees program	7.1
Some people want to increase the cultivated area	5.6
Some people prefer to apply agrochemical products	4.5

Note: These percentages total more than 100% because respondents could give multiple answers.

CHAPTER 4
DISCUSSION

The results of my study suggest that the PBC project has been moderately successful in improving participants' bird knowledge and skills needed to perform bird conservation practices. Similarly, studies that evaluate the effect of environmental education and community conservation programs have found that participation in educational activities can improve general knowledge of environment and species (Kruse & Card 2004; Brossard et al. 2005; Engels & Jacobson 2007). Colombian coffee farmers reported very positive attitudes toward birds, which can be explained because birds are charismatic and are easily observed in Colombian coffee farms (Botero & Baker 2001). Rainforest Alliance-certified farmers in my study were more likely to employ conservation behaviors than non-certified farmers. Similarly, research on adoption of conservation practices by farmers has found a correlation between farmers' willingness to employ environmentally-friendly practices and the economic benefits derived from these practices (Winters et al. 2004; Herzon & Mikk 2007). Below, I discuss results of my study with greater detail.

Knowledge about Birds

Farmers that participated in the PBC project were able to list more bird species than the baseline group (NP-NRF). This result was expected because the PBC project distributed plastic brochures with illustrations of birds to farmers that participated in the PBC project. With RF-certified farmers, one possible explanation for the high level of knowledge is that the Rainforest Alliance certification requires farmers to have lists of birds and trees present on their farms.

PBC participants (P-RF and P-NRF) had significantly more knowledge about migratory birds compared to the baseline group. Bird migration is an important subject, as one of the PBC objectives is to promote conservation of migratory birds in coffee-growing regions. During visits to participants' farming regions, the PBC project staff distributed posters and a Biocarta migratory bird bulletin, which contained illustrations of common migratory birds in coffee-growing regions of Colombia. In addition, educational activities included games and readings about migration and the role of coffee-growing regions for conserving Neotropical migratory birds. These educational activities probably had a positive effect on farmer's understanding and ability to identify migratory birds.

With respect to knowledge about threatened birds, the two PBC groups were more aware of threatened birds in their regions. However, these farmers had difficulty in naming the particular enlisted threatened species registered in their regions. In general, farmers thought that several bird species had decreased on their farms and/or regions, but most of these mentioned birds were not listed as such in the Red Book of threatened birds of Colombia, and many of them are actually fairly common. This can be explained because the term extinction risk have permeated Colombian culture, but has been misused. The public believe that all species face a threat to disappear (Espinosa et al. 2009). The PBC project performed educational activities about generalities of threatened birds in coffee-growing regions. At the time of my study, the PBC research team had produced a poster about birds in coffee-growing regions with some pictures of threatened species and press releases with specific information about threatened birds in Cenicafe's web page. However, press releases are not widely

distributed among participants as were other publications and internet access by farmers is difficult. Therefore, the ability of farmers to identify specific threatened birds in their area was limited perhaps because of lack of availability of educational materials.

Overall, PBC participants did have improved knowledge about birds. The traditional thinking in the field of environmental education has postulated that knowledge about the environment and its problems could motivate individuals to act toward the environment in more responsible ways (Hungerford & Volk 1990). Although knowledge is an important driver for behavior, moving people from awareness to action is not a simple task. Knowing about something does not guarantee caring or doing anything about it (Jacobson et al. 2006). Several authors state that having more information will not necessarily motivate a change or adoption of a new behavior (Hungerford & Volk 1990; Kollmuss & Agyeman 2002). On the other hand, lack of knowledge can be itself a barrier to change behaviors (Monroe 2003). Colombian farmers in my study indicated that lack of awareness and lack of knowledge were primary barriers for the adoption of bird conservation practices. People need to have basic information about environmental issues and how they should act to promote conservation (Kollmuss & Agyeman 2002). Therefore educational programs like the PBC project that help to remove awareness and knowledge barriers can lead to changes in farmers' conservation behaviors over the long term.

Attitudes and Capability toward Bird Conservation

The PBC groups (P-RF and P-NRF) and the non-participant, Rainforest-certified group (NP-RF) believed that they possessed skills to perform bird conservation practices on their farms. Compared to farmers that had not received any environmental educational training (NP-NRF), it seemed that the PBC project and Rainforest Alliance

certification empowered farmers' abilities to perform conservation behaviors. According to the Theory of Planned Behavior (Ajzen 1985), perceived behavioral control is the perception that one has the ability to conduct a behavior, and this perception is one of the factors that helps predict an intention to act. If farmers believe that they can implement bird-friendly practices on their farms, this ultimately can drive farmers' intention to modify or apply new practices that promote bird conservation.

The four groups did not differ in their perception that birds provide benefits to their farms, but nearly all (96%) thought that birds benefit their farms. Similarly, in a study of attitudes and knowledge of shade-coffee farmers toward vertebrates and their ecological functions in Mexico, López del Toro et al. (2009) found that a majority of farmers had friendly attitudes and high knowledge about birds. Other studies on attitudes of farmers toward birds and biodiversity in the United States and Europe have also found that farmers hold positive attitudes toward birds (Jacobson et al. 2003) and were more interested in birds and mammals than other taxonomic groups like insects and plants (Herzon & Mikk 2007). This can be explained because birds are charismatic and conspicuous, and farmers regularly interact with them and consider birds to be aesthetically pleasing (López del Toro et al. 2009). In some cases, though, birds can be viewed as pests when they cause severe damage to crops (Avery et al. 1993; McIvor & Conover 1994; Cummings et al. 2005). The factors mentioned above can help foster positive attitudes toward birds, especially if they do not cause damage to commercial crops (Laubhan & Gammonley 2001), as in the case of Colombian coffee plantations (Cenicafé researchers, personal communication). My results suggest that there seems to be a positive social climate that Colombian coffee farmers like birds. The intention to

act is also influenced by the subjective norm, which is the perception of social pressure to conduct a behavior (Ajzen 1985). In the case of Colombian coffee farmers, this positive social climate toward birds can put pressure on farmers that being bird-friendly is socially accepted.

A majority of respondents, across all four coffee farmer groups, believed that it is not too expensive to implement farm practices to conserve birds and that they would invest up to five days of labor a month to perform practices that preserve the environment. Similarly, in a study of conventional coffee farmers' perception on biodiversity in Colombia, Salazar et al. (2007) found that 94% of farmers were willing to give their own labor to help protect the environment in their region, but they were not willing to make monetary investments. Interestingly, RF-certified groups were more willing to donate 1% of their sales to create a fund for bird conservation. Because certified farmers have a premium for their coffee, this might mean better economic capacity to invest in other activities (Guhl 2009).

Furthermore, a majority of Colombian farmers answered that they should be compensated for performing practices on their farms that promote bird conservation. Similarly, Herzon and Mikk (2007) found that farmers in Estonia and Finland were willing to perform conservation actions for birds as long as these practices were low-cost and farmers reported that reimbursement for substantial changes in the structure of the farm area would be necessary. These caveats also hold true for coffee-farmers in Colombia that would not be willing to set aside a productive area to promote natural regeneration for environmental conservation. Economically, this may not be viable for certain farmers. Interestingly, almost all respondents in my study believed their farms

already provided good bird habitat. Similarly, Jacobson et al. (2003) found that over 93% of organic and conventional farmers in their study in Florida farms thought that their farms provided good habitat for birds. Several studies have shown that farmers tend to overrate their perception of production and/or practice adoption efficiency (Msuya & Duvel 2007; Duvel 2007). This tendency to overrate may affect farmers' perception of the need to change or implement new practices in their farm (Ahnström et al. 2008). Nevertheless, coffee farmers in my study stated that they were willing to implement new environmentally-friendly practices that can be promoted through educational programs like the PBC project.

Conservation Behaviors

PBC participants and non-participants did not differ for most conservation behavior questions, and a majority of respondents indicated that they were performing bird conservation practices. Because results are based on a self-reported interview, farmers may have been less willing to express honest answers. Research has shown that farmers can easily express their willingness to adopt practices that are more environmentally friendly, but they may not have implemented such practices (Gillingham and Lee 1999, Ahnström et al. 2008). However, in the case of RF-certified farmers, it is more likely that they were performing the conservation practices evaluated in my study. These practices are included as requirements in the certification standards and certified farmers are inspected every year to assure they are fulfilling RF certification requirements.

Furthermore, questions about conservation behaviors in my study were very general. I did not explore about specifics on the behaviors and how farmers are performing those behaviors. For example, when asking farmers if they have reduced the

use of agrochemical products, I did not asked about how much reduction they have made or what kind of agrochemicals they use and periodicity. Even when farmers give honest answers about the conservation practices they are doing on their farms, farmers' perceptions on how they are performing the behavior or practice could vary. For instance, although farmers in my study stated they were conserving forest fragments and natural vegetation, research has shown that farmers prefer to manage uncultivated areas as tidy and clean habitats (Ahnström et al. 2008). Therefore floristic diversity, vertical stratification, and canopy height of these habitats may be very low and therefore their contribution to bird conservation may be limited.

Barriers Farmers Perceive toward Adopting Conservation Practices for Birds

Farmers perceived that lack of environmental awareness, lack of knowledge, lack of willingness and interest, and the prevalence of economic profit were the main reasons why they or other farmers were not performing conservation practices. Several researchers have found that typical barriers to adoption include risk aversion, lack of knowledge (Alston & Reding 1998; Castaño 2002) and limited availability of information (Winters et al. 2004; Shi and Gill 2005; Rosenberg & Margerum 2008). Several researchers have emphasized the importance of understanding farmer's characteristics and motivations to adopt conservation behaviors to improve extension programs (Mercer 2004; Rosenberg & Margerum 2008). Winters et al. (2004) found that adoption of soil conservation practices by Andean farmers in Ecuador was successful when combined with alterations to the agricultural system that enhanced the short-term profitability of agriculture and complemented conservation goals.

Colombian coffee farmers indicated that educational programs and participation in specialty coffees certification schemes can be effective strategies to involve farmers in

conservation practices. Environmental certification programs like Rainforest Alliance can be an important incentive to bolster farmers' adoption of conservation practices. Certified farmers receive economic benefits through premiums paid when selling their coffee. My results suggested that RF-certified farmers benefited from workshops and visits provided by extension professionals from Comités de Cafeteros that promote RF certification. However, the premiums for being certified are dependent on the market demand and vary year to year according to consumers' preferences (Giovannucci 2003). For example, RF premiums for certified farmers in Colombia were US$0.19 per kilo in 2007, US$0.21 per kilo in 2008, and US$0.10 per kilo in 2009 (Rodrigo Calderón, personal communication). During the interviews in my study, certified-farmers mentioned that the decrease on RF premiums threatens their presence with the certification program because the certification requirements do not match the premiums received. Therefore if the market is not providing stable premiums, an incentive program for conservation in coffee-growing regions of Colombia might not be feasible over the long term.

In such an unstable market, environmental education and extension programs that use noneconomic motivational strategies would highlight the personal benefits (De Young et al. 1993) for farmers when adopting conservation practices. These motivational strategies include enhancing farmers' feeling of personal satisfaction, a desire to improve the land for future generations and social responsibility from doing environmental responsible management (Vanclay 2004; Rosenberg & Margerum 2008). Such noneconomic strategies may help to sustain conservation behaviors in highly variable markets.

Jacobson (1987) suggests that to achieve an attitudinal and behavioral change toward conservation environmental education and extension programs need to effectively communicate information. Winters et al. (2004) suggested that interventions may focus on providing information on how to implement conservation practices, instead of only focusing on the problems. With Colombian coffee farmers, it could be more useful if educational programs provide information on how farmers can apply conservation practices on their farms, instead of focusing on coffee production as the cause of environmental problems. Even if farmers are aware that coffee production might be (in part) causing a decline on bird populations, educational programs like the PBC should focus on providing farmers with tools to reverse this trend and promote bird-friendly habitats on coffee farms.

Limitations of the Study

In estimating the PBC project's effect, selection bias (Ferraro & Pattanayak 2006) can be a factor because farmers voluntarily participated in the PBC program. Participants and non-participants could have differed in their awareness toward the environment and their initial motivation to conserve birds. Therefore, differences discovered in my study may have arisen because of initial conditions instead of participation in the PBC program itself. This is of special concern for attitudes, but all groups were shown to have positive attitude toward birds. Regarding knowledge and skills to implement bird conservation practices, it is unlikely that farmers in the region came to the PBC program with elevated skills and knowledge, as bird conservation is not a common enterprise with coffee farmers (Iván García, personal communication). Further, surveys were based on self-reported actions, which does not mean that respondents were actually performing the behaviors. Additional field visits would be

necessary to confirm which practices are being implemented on farms, and to measure whether PBC participants' coffee farms actually contain more bird habitat than non-participants' farms. Additional research is needed to understand the long term viability of bird populations and how farmers' practices translate into more suitable bird habitat on coffee farms.

Conclusions and Future Directions

The PBC project had a positive impact on participants' knowledge and perceived capability to perform conservation behaviors, improving their overall understanding and perceptions about birds. These results are encouraging because projects like the PBC can appeal to noneconomic motives for conservation and influence farmers' decisions to use more specific bird-friendly practices such as growing more trees that provide food resources for birds, creating corridors that connect forest fragments on different farms to improve landscape connectivity or increase vertical stratification of natural vegetation, which can lead to better habitats for bird conservation over the long term.

Coffee farmers perceived that the main barriers to perform bird conservation practices were lack of knowledge and lack of environmental awareness. Since there are not too many organizations promoting environmental education with coffee farmers, it is important for Cenicafé to continue with the PBC project to educate more farmers. Bird conservation in coffee-growing regions can become more of a reality if educational programs can help promote an ethic of conservation that leads to environmentally responsible behavior (Monroe 2003). Since coffee farmers already hold positive attitudes toward birds, this can be a starting point to educate them about other environmental issues and for promoting sustainable agricultural practices. The presence of an important percentage of Colombian avifauna in coffee-growing regions should

encourage educators to promote empowerment of local coffee communities on their biodiversity as an integral part of their agroecosystems and the heritage that they should help to preserve.

The results of my study suggest that educational programs like the PBC project have the potential to promote bird conservation in coffee-growing regions. Following the framework provided by the Theory of Planned Behavior (Ajzen 1985), an intention to implement a behavior is best predicted by a combination of (1) the attitudes toward the behavior (2) the subjective norm, and (3) the perceived behavioral control. In the case of Colombian coffee farmers, it seems that these three factors are present, and positive attitudes toward birds combined with social pressure to conduct bird-friendly behaviors, and confidence to implement bird conservation practices are important steps toward the conservation of bird habitat on coffee farms. While PBC participants may be interested in conserving bird habitat, it is necessary to emphasize activities that give farmers precise information and show how and where they can perform simple and low-cost bird-conservation practices.

Some tools that the PBC project has used to promote bird-friendly practices include the publication of Biocarta bulletins and posters about birds and their conservation, regional workshops on bird conservation and a workshop about the use of native trees for ecological restoration on farms. However, some of these workshops have limited funds and are offered for two or three farmers that are members of each association participating in the project. To help overcome these economic constraints and the barriers for adoption of conservation practices, the PBC project could use strategies such as demonstration farms. By supporting an interested and innovative

farmer to adopt bird-friendly practices, the PBC project could use such a farm as a model for other farmers in the region because it can provide a local example on how to perform such practices. To put into operation these activities it is vital to train more local extension professionals to rely on when researchers are not on the field or when the project has ended.

APPENDIX
SURVEY QUESTIONS

Questions about knowledge

1. Can you do a list of the birds that you have observed in your farms? You just have to tell me the ones that you know with the names that you know.

2. Do you know what migratory birds are? I am going to read 3 definitions and you have to tell me which one is correct:

   ☐ Migratory birds are birds that make a trip from North America to tropical countries like Colombia, where they come to produce offspring, between September and March.

   ☐ Come to coffee-growing regions from other regions of Colombia looking for food

   ☐ Travel from North America to tropical countries like Colombia where they come to feed, between September and March, and then return to North America to breed.

3. Do you know of any threatened bird species in your region?

   YES ☐ NO ☐ If yes, Which? _____

4. Some birds are diminishing in the coffee-growing regions of Colombia. What do you think are the most important threats for birds in your region?

Questions about attitudes and capability to implement bird conservation practices

Statements from 5 to 14 could be answered with a Likert-type scale as following:

1) strongly agree, 2) somewhat agree, 3) not sure/don't know, 4) somewhat disagree,

and 5) strongly disagree.

5. Birds provide benefits to my farm

6. Teaching kids about birds is as important as to teach them math

7. It is very expensive to perform farm practices to conserve birds

8. I would like to go to workshops related on how to perform practices to conserve birds in my farm

9. Bird conservation is incompatible with running a coffee business

10. My farm provides a good shelter for birds

11. I can play an important role for bird conservation in my region

12. I lack the skills needed to implement farm practices that can help bird conservation

13. I would spend more money on new practices that might benefit birds

14. Currently, conserving birds does not offer any benefit for my coffee business

15. Would you support the creation of natural reserves in your region to conserve birds?

    YES ☐ NO ☐ If yes, how would you support?

- ☐ Donating money to non-profit organizations that support creation of reserves
- ☐ Ceding part of your land for conservation
- ☐ With labor, for example doing reforestation in new reserves

16. Considering how are things in coffee-growing regions of Colombia, do you think that the number of bird species in your region is going to:

- ☐ Increase or stay stable
- ☐ Decrease

17. How willing would you be to donate 1% of your coffee sales to create a fund for bird conservation in coffee-growing regions?

- ☐ Willing
- ☐ Not willing

18. If you implement practices to conserve birds in your farm, would you expect a monetary compensation when you sell your coffee?

    YES ☐ NO ☐

19. How much are you willing to invest to implement farm practices to conserve the environment?

- ☐ One to five days of labor a month
- ☐ More than five days a month
- ☐ Currently I am not willing to invest

Questions about conservation behaviors

20. Which of the following practices are you currently doing on your farm? I am going to read a list and you should tell me yes or no.

    20a. Preserving forest fragments and natural vegetation present in the farm

    20b. Preserving natural vegetation along streams

20c. Growing trees that produce food for birds

20d. Forbid hunting

20e. Restricting using agrochemical products

21. What is the size (in hectares) of the conservation area do you have on your farm?

If you don't have a conservation area on your farm, are you willing to stop producing for 5 years in an area of your farm to leave it as a conservation area?

YES ☐ NO ☐

Questions about barriers

22. What do you think are the most important reasons why you or other farmers are not implementing these practices?

23. Considering the reasons that you just commented, can you think about any idea about how farmers can get involved and do these practices

Demographics

1. What is your age?

2. What is highest education degree that you have earned?

☐ Less or equal to Elementary

☐ Less or equal to High School

☐ Less or equal to Technician or University degree

3. What percentage of your annual income comes from your farm?

☐ Less than 25%

☐ Between 25% and 75%

☐ More than 75%

4. How many years of experience do you have cultivating coffee?

5. What is the size of your farm in hectares?

6. How many hectares do you have cultivated with coffee?

7. What kind of coffee growing mode do you have in your farm?

- ☐ Shade
- ☐ Semi-Shade
- ☐ Sun

8. What is the coffee trees' density per hectare in your farm?

9. What was the production in cargas (in dry coffee) of your farm last year?

10. Does your farm currently possess a certification?

    YES ☐ NO ☐ If yes, Which? _____

11. Do you belong to any farmer's group in your region?

LIST OF REFERENCES

Ahnström, J., J. Höckert, H. L. Bergeå, C. A. Francis, P. Skelton, and L. Hallgren. 2008. Farmers and nature conservation: what is known about attitudes, context factors and actions affecting conservation? Renewable Agriculture and Food Systems **24(1):**38-47.

Ajzen, I. 1985. From intentions to actions: A theory of planned behavior. Pages 11-39 in K. Kuhl, and J. Beckman, editors. Action-control: from cognition to Behavior. Springer, Heidelberg, Germany.

Albertin, A., and P. K. R. Nair. 2004. Farmers' perspectives on the role of shade trees in coffee production systems: an assessment from the Nicoya Peninsula, Costa Rica. Human Ecology **32(4):**443-463.

Alexander, S. E. 2000. Resident attitudes towards conservation and Black Howler Monkeys in Belize: the Community Baboon Sanctuary. Environmental Conservation **27(4):**341-350.

Alston, D. G., and M. E. Reding. 1998. Factors influencing adoption and educational outreach of integrated pest management. Journal of Extension **36(3):** http://www.joe.org/joe/1998june/a3.html (accessed May 2010).

Arbeláez, D., G. M. Lentijo, and J. E. Botero. 2007. Las aves en las zonas cafeteras. Biocarta 11. Cenicafé, Chinchiná, Colombia.

Avery, M. I., J. I. Cummings, D. G. Decker, J. W. Johnson, J. C. Wise, and J. I. Howard. 1993. Field and aviary evaluation of low-level application rates of methiocarb for reducing bird damage to blueberries. Crop Protection **12(2):**95-100.

Bawa, K. S. 2006. Globally dispersed local challenges in conservation biology. Conservation Biology **20:**696-699.

Botero, J. E., and P. S. Baker. 2001. Coffee and biodiversity: A producer-country perspective. Pages 94-103 in P. S. Baker, editor. Coffee futures: a source book of some critical issues confronting the coffee industry, CAB International, Wallingford, UK.

Botero, J. E., G. M. Lentijo, and D. Arbeláez. 2005. Aves migratorias. Biocarta 7. Cenicafé, Chinchiná, Colombia.

Brossard, D., B. Lewenstein, and R. Bonney. 2005. Scientific knowledge and attitude change: the impact of a citizen science project. International Journal of Science Education **27:**1099-1121.

Calheiros, D. F., A. F. Seidl, and C. J. A. Ferreira. 2000. Participatory research methods in environmental science: local and scientific knowledge of a limnological phenomenon in the Pantanal wetland of Brazil. Journal of Applied Ecology **37:**684-696.

Camboni, S. M., and T. L. Napier. 1993. Factors affecting use of conservation practices in east central Ohio. Agriculture, Ecosystems and Environment **45:**79-94.

Campbell, L. M., and A. Vainio-Mattila. 2003. Participatory development and community-based conservation: opportunities missed for lessons learned? Human Ecology **31(3):**417-437.

Castaño, G. E. 2002. Estudio sociocultural de los caficultores y su relación con el manejo integrado de la broca del café. Revista Cenicafé **53(1):**34-38.

Chess, C. 2000. Evaluating environmental public participation: methodological questions. Journal of Environmental Planning and Management **43(6):**769-784.

Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. Psychometrika **16(3):**297-334.

Cummings, J. L., S.A. Shwiff, and S.K. Tupper. 2005. Economic impacts of blackbird damage to the rice industry. Wildlife Damage Management Conference **11:**317–322.

Daily, G. C. 1997. Countryside biogeography and the provision of ecosystem services. Pages 104-113 in P. Raven, editor. Nature and human society: the quest for a sustainable world. National Research Council, National Academy Press, Washington, D. C.

Daily, G. C., P. R. Erlich, and A. Sánchez-Azofeifa. 2001. Countryside biogeography: use of human-dominated habitats by the avifauna of southern Costa Rica. Ecological Applications **11:**1-13.

De Young, R., A. Duncan, J. Frank, N. Gill, S. Rothman, J. Shenot, A. Shotkin, and M. Zweizig. 1993. Promoting source reduction behavior: the role of motivational information. Environment and Behavior **25(1):**70-85.

Duvel, G. H. 2007. Monitoring in extension: from principles to practical implementation. South African Journal of Agricultural Extension **36:**78-93.

Engels, C. A., and S. K. Jacobson. 2007. Evaluating long-term effects of the Golden Lion Tamarin environmental education program in Brazil. The Journal of Environmental Education **38(3):**3-14.

Ericson, J. A. 2006. A participatory approach to conservation in the Calakmul Biosphere Reserve, Campeche, Mexico. Landscape Urban Planning **74:**242-266.

Espinosa, R., A. M. López, and J. E. Botero. 2009. En peligro de extinción. Biocarta 14. Cenicafé, Chinchiná, Colombia.

Estrada, A., and R. Coates-Estrada. 2005. Diversity of Neotropical migratory landbird species assemblages in forest fragments and man-made vegetation in Los Tuxtlas, Mexico. Biodiversity and Conservation **14:**1719-1734.

Estrada, A., R. Coates-Estrada, and D. A. Meritt Jr. 1997. Anthropogenic landscape changes and avian diversity at Los Tuxtlas, Mexico. Biodiversity and Conservation **6:**19-43.

Evans, S. M., S. Gebbels, and J. M. Stockill. 2008. Our shared responsibility: participation in ecological projects as a means of empowering communities to contribute to coastal management processes. Marine Pollution Bulletin **57:**3-7.

Ferraro, P. J., and S. K. Pattanayak. 2006. Money for nothing? A call for empirical evaluation of biodiversity conservation investments. Public Library of Science Biology **4:**482-488.

Fiallo, E. A., and S. K. Jacobson. 1995. Local communities and protected areas: attitudes of rural residents towards conservation and Machalilla National Park, Ecuador. Environmental Conservation **22(3):**241-249.

FNC (Federación Nacional de Cafeteros de Colombia). 2010. La tierra del café. Available from: http://www.cafedecolombia.com/particulares/es/la_tierra_del_cafe/ (accessed May 2010).

Gillingham, S., and P. C. Lee. 1999. The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. Environmental Conservation **26(3):**218-228.

Giovannucci, D. 2003. The state of sustainable coffee: a study of twelve major markets. International Coffee Organization and International Institute for Sustainable Development, London and Winnipeg. Cenicafé, Cali, Colombia.

Gubbi, S., M. Linkie, and N. Leader-Williams. 2009. Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. Environmental Conservation **35(4):**331-339.

Guhl, A. 2009. Café, bosques y certificación agrícola en Aratoca, Santander. Revista de Estudios Sociales **32:**114-125.

Herzon, I., and M. Mikk. 2007. Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: a comparative study from Estonia and Finland. Journal for Nature Conservation **15:**10-25.

Holmes, C. M. 2003. The influence of protected area outreach on conservation attitudes and resource use patterns: a case study from western Tanzania. Oryx **37(3):**305-315.

Hughes, J. B., G. C. Daily, and P. R. Ehrlich. 2002. Conservation of tropical forest birds in countryside habitats. Ecology Letters **5(1):**121-129.

Hungerford, H. R., and T. L. Volk. 1990. Changing learner behavior through environmental education. Journal of Environmental Education **21(3):**8-22.

Jacobson, S. K. 1987. Conservation education programs: evaluate and improve them. Environmental Conservation **15(2):**129-136.

Jacobson, S. K., K. E. Sieving, G. A. Jones, and A. Van Doorn. 2003. Assessment of farmer attitudes and behavioral intentions toward bird conservation on organic and conventional Florida farms. Conservation Biology **17(2):**595-606.

Jacobson, S. K., M. D. McDuff, and M. C. Monroe. 2006. Conservation education and outreach techniques. Oxford University Press, New York.

Kainer, K., M. L. DiGiano, A. E. Duchelle, L. H. O. Wadt, and J. L. Dain. 2009. Partnering for greater success: local stakeholders and research in tropical biology and conservation. Biotropica **41(5):**555-562.

Kideghesho, J. R., E. Røskaft, and B. P. Kaltenborn. 2007. Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. Biodiversity Conservation **16:**2213-2230.

Kollmus, A., and J. Agyeman. 2002. Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research **8(3):**239-260.

Komar, O. 2006. Ecology and conservation of birds in coffee plantations: a critical review. Bird Conservation International **16:**1-23.

Kruse, C. K., and J. A. Card. 2004. Effects of a conservation education camp program on campers' self-reported knowledge, attitude and behavior. Journal of Environmental Education **35(4):**33-45.

Laubhan M. K., and J. H. Gammonley. 2001. Agricultural producers' perceptions of Sandhill Cranes in the San Luis Valley of Colorado. Wildlife Society Bulletin **29(2):**639-645.

Lee, H. F., and D. D. Zhang. 2008. Perceiving the environment from the lay perspective in desertified areas, northern China. Environmental Management **41:**168-182.

Lentijo, G. M., D. Arbeláez, O. Castellanos, N. G. Franco, A. M. López, and J. E. Botero. 2008. Enfoques participativos en investigación como una herramienta de conservación de las aves en zonas cafeteras de Colombia. Ornitología Neotropical **19 (Suppl.):**567-574.

Likert, R. 1932. A Technique for the Measurement of Attitudes, Archives of Psychology **140**.

López del Toro, P., E. Andresen, L. Barraza, and A. Estrada. 2009. Attitudes and knowledge of shade-coffee farmers towards vertebrates and their ecological functions. Tropical Conservation Science **2(3):**299-318.

Mccan, E., S. Sullivan, D. Erickson, and R. De Young. 1997. Environmental awareness, economic orientation, and farming practices: a comparison of organic and conventional farmers. Environmental Management **21(5):**747-758.

McIvor, D. E., and M. R. Conover. 1994. Perceptions of farmers and non-farmers toward management of problem wildlife. Wildlife Society Bulletin **22:**212-219.

Mehta, J. N., and J. T. Heinen. 2001. Does community-based conservation shape favorable attitudes among locals? An empirical study from Nepal. Environmental Management **28(2):**165-177.

Mercer, D. E. 2004. Adoption of agroforestry innovations in the tropics: a review. Agroforestry Systems **61-62:**311-328.

Monroe, M. 2003. Two avenues for encouraging conservation behaviors. Human Ecology Review **10(2):**113-125.

Msuya, C. P., and G. H. Duvel. 2007. The role of independent and intervening variables in maize growers' adoption of seed spacing in the Njombe district of Tanzania. South African Journal of Agricultural Extension **36:**109-123.

Muriel, S. B., and G. H. Kattan. 2009. Effects of patch size and type of coffee matrix on Ithomiine butterfly diversity and dispersal in cloud-forest fragments. Conservation Biology **23(4):**948-956.

Napier, T. L. 1998. Conservation coalitions cannot overcome poor conservation programming. Journal of Soil and Water Conservation **53(4):**300-303.

Perfecto, I., and J. Vandermeer. 2008. Biodiversity conservation in tropical agroecosystems: a new conservation paradigm. Annals of the New York Academy of Sciences **1134:**173-200.

Petit, L. J., and D. R. Petit. 2003. Evaluating the importance of human-modified lands for Neotropical bird conservation. Conservation Biology **17:**687-694.

Petit, L. J., D. R. Petit, D. G. Christian, and H. D. W. Powell. 1999. Bird communities of natural and modified habitats in Panama. Ecography **22:**292-304.

Rainforest Alliance. 2010. Sustainable agriculture, coffee. Available from: http://www.rainforest-alliance.org/agriculture.cfm?id=coffee (accessed June 2010).

Reed, M. S. 2008. Stakeholder participation for environmental management: a literature review. Biological Conservation **141:**2417-2431.

Rosenberg, S., and R. D. Margerum. 2008. Landowner motivations for watershed restoration: lessons from five watersheds. Journal of Environmental Planning and Management **51(4):**477-496.

Rossi, P. H., M. W. Lipsey, and H. E. Freeman. 2004. Evaluation: a systematic approach. 7th edition. Sage Publications, Thousand Oaks, California.

Salazar, H. M., H. Duque, G. M. Lentijo, and J. E. Botero. 2007. Descripción del uso actual de la biodiversidad por parte de los caficultores. Pages 160-181 in P. S. Baker, and H. Duque O., editors. Guía para la caficultura sostenible en Colombia: un trabajo articulado con los caficultores, extensionistas y la comunidad. Cenicafé, Chinchiná, Colombia.

Selebatso, M., S. R. Moe, and J. E. Swenson. 2008. Do farmers support Cheetah *Acynonyx jubatus* conservation in Botswana despite livestock depredation? Oryx **42(3):**430-436.

Selener, D. 2005. Definitions, assumptions, characteristics and types of participatory research. Pages 5-15 in: J. Gonsalves, T. Becker, A. Braun, D. Campilan, H. De Chavez, E. Fajber, M. Kapiriri, J. Rivaca-Caminade, and R. Vernooy, editors. Participatory research and development for sustainable agriculture and natural resource management: a sourcebook. Volume 1: understanding participatory research and development. International Potato Center-Users' Perspectives with agricultural Research and Development, Laguna, Philippines and International Development Research Centre, Ottawa, Canada.

Sheil, D., and A. Lawrence. 2004. Tropical biologists, local people and conservation: new opportunities for collaboration. Trends in Ecology and Evolution **19:**634-638.

Shi, T., and R. Gill. 2005. Developing effective policies for the sustainable development of ecological agriculture in China: the case study of Jinshan County with a systems dynamics model. Ecological Economics **53(2):**223-246.

Vanclay, F. 2004. Social principles for agricultural extension to assist in the promotion of natural resource management. Australian Journal of Experimental Agriculture **44:**213-222.

Vermeulen, S., and D. Sheil. 2006. Partnerships for tropical conservation. Oryx **41:**434-440.

Winters, P., C. C. Crissman, and P. Espinosa. 2004. Inducing the adoption of conservation technologies: lessons from the Ecuadorian Andes. Environment and Development Economics **9:**695-719.

BIOGRAPHICAL SKETCH

Gloria was born in Manizales, Colombia in 1977, and right after she was born, her family moved to Cali, Colombia. She spent her childhood in Cali, where she earned a degree in biology from Universidad del Valle, in 2003.

Since 2000, Gloria has been interested in Colombian birds and their conservation, and upon graduation, Gloria moved to Manizales to work at Cenicafé (National Coffee Research Center of Colombia). At Cenicafé, Gloria has performed bird inventories in coffee-growing regions of Colombia, and since 2004, she has worked in a project called Participatory bird census in coffee-growing regions of Colombia, where she performed research with a participatory focus with local coffee communities.

In 2008, with support of a Fulbright Scholarship, Gloria traveled to the United States to pursue graduate studies at the University of Florida. After completing her master's degree Gloria will be returning to Colombia, to resume activities at Cenicafé to continue exploring opportunities to promote bird conservation with farmers in coffee-growing regions of Colombia.