The Sustainable Choice: How Gendered Difference in the Importance of Ecological Benefits Affect Production Decisions of Smallholder Cacao Producing Households in Ecuador

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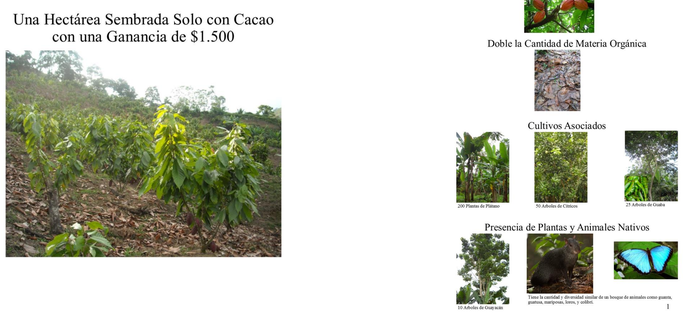
INTRODUCTION

Benefits other than just income influence the actions of economic actor (Useche & Blare 2013). Our work examines the adoption of cacao agroforesty production practices by smallholder producers in Ecuador to determine how ecological and subsistence non market benefits influence their adoption of cacao agroforests. In particular, we examine the differences that women and men place on these benefits.

METHODOLOGY

Fig 1.

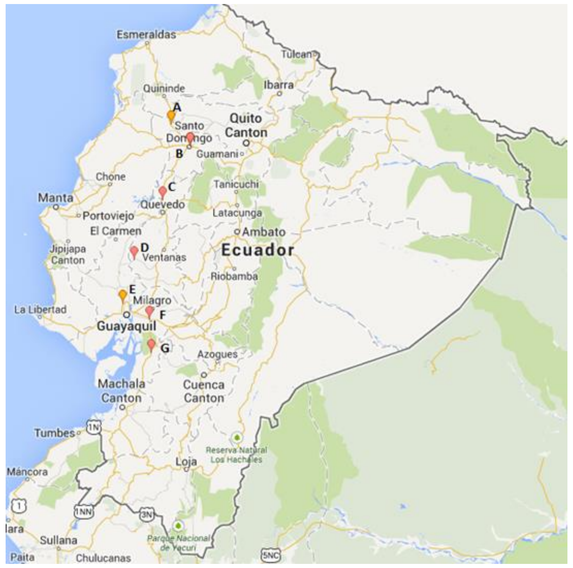


In 2012, we held focus group meetings near Santo Domingo de los Colorados to determine what nonmarket benefits are influential in smallholder farmers production decisions. We discovered that the soil quality, the inclusion of food crops in the farming system, and the presence of native plants and animals in addition to price influenced their decision to utilize agroforestry production methods.

We conducted choice experiments with 350 smallholder households near the busying stations for the largest Ecuadorian cacao exporter, Transmar, from March through July 2013. Each respondent was shown a series of six choices whereby she had to choose whether she preferred the monoculture or the agroforest parcel. Figure 1 provides an example of the profiles shown to the respondent. The attributes and price levels for the agroforestry option varied with each choice set presented to the respondent as shown in Figure 2.

Fig 2.

Attribute	Level
Profit	500 USD 750 USD 1000 USD 1250 USD 1500 USD (Only included as an attribute for the monoculture profile)
Organic Material	Same amount of organic material as in a cacao monoculture plot Double the quantity of organic material as in a monoculture plot
Subsistence Crops	No Additional subsistence crops included in the parcel Includes 200 plantains, 50 citrus trees, and 25 *Inga sp.* trees
Biodiversity	No native trees and no mammal presence and half the birds species found in a forest 10 *Guaiacum sp.* and the quantity and diversity of animals similar to that found in the forest including pacas, agoutis, parrots, hummingbirds and butterflies.



A. Site of Transmar's future buying station in La Concordia
B. Preliminary focus group meetings near Santo Domingo
C. Transmar's Buena Fe buying station
D. Transmar's Vinces buying station
E. Transmar's main plant and offices in Guayaquil
F. Transmar's Taura buying station
G. Transmar's Naranjal buying station

Fig 3.

Variable	RELM	FELM
Organic Material	0.462 (0.314)	0.503 (0.314)
Biodiversity	-0.860*** (0.329)	-0.700** (0.330)
Subsistence Crops	2.104*** (0.564)	2.202*** (0.546)
Profit	4.785*** (0.001)	5.053*** (1.069)
Gender	3.323*** (1.072)	omitted
Gender*Organ. Mat.	-1.326* (0.757)	-1.152 (0.744)
Gender* Biodiversity	-1.208 (0.819)	-1.002 (0.806)
Gender*Sub. Crops	-1.010 (1.318)	-0.931 (1.310)
Gender*Profit	-3.585 (2.532)	-3.361 (2.523)
Constant	5.415*** (0.709)	--------
X^2	99.73 (significant at 0.000)	101.72 (significant at 0.000)
Log likelihood	-655.04	-176.686
Number of Observations	2099	2099
Number of Groups	351	351

***Significance at the 1% level
**Significance at the 5% level
*Significance at the 10% level

EMPERICAL MODEL

A random effects logit model (RELM) was utilized to estimate the panel data for the effects of gender and each tested attribute on the respondent's preference for agroforestry production. Since the coefficients are similar to those in the fixed effect model (FELM), this model provides the best unbiased estimators (Cameron & Trivedi 2010). The coefficients are presented in Figure 3.

$$prob(WTP) = \alpha_i + \beta_1 profit + \beta_2 organic\ mat. + \beta_3 sub.crops + \beta_4 biodiversity + \beta_5 gender_i + \beta_6 gender_i * profit + \beta_7 gender_i * organic\ mat. + \beta_8 gender_i * sub.crops + \beta_9 gender_i * biodiveristy$$

The estimated coefficients from this model are translated into willingness to pay (WTP) estimates by dividing the coefficient of attribute or the attribute for gender by the coefficient for profit (Hanemann 1984). These values can be combined to determine the value of a cacao agroforest that contains any combination of the non market benefits and the value each gender on average place on each profile.

Figure 4 shows how much profit a male or female respondent would have to earn on a hectare of cacao of agroforest to be different between the farming methods. A negative value indicates that the respondent would not need to receive any profit on the agroforest parcel and still prefer it to the monoculture parcel.

Fig 4.

Profile	WTP Estimate	Lower Bound of 90% Confidence Interval
Organic Material		
Women	-49.01	674.44
Men	368.39	767.40
Biodiversity		
Women	-146.45	482.95
Men	548.11	820.52
Subsistence Crops		
Women	-765.79	-28.93
Men	-71.22	319.17
Organic Mat. & Biodiversity		
Women	130.70	744.11
Men	548.71	820.52
Organic Mat. & Sub. Crops		
Women	-488.69	234.57
Men	-17.37	319.20
Biodiversity & Sub. Crops		
Women	-586.07	41.47
Men	108.50	370.88
Biodiversity, Sub. Crops, & Organic Mat.		
Women	-308.91	335.34
Men	108.50	370.88

CONCLUSIONS

Two attributes of cacao agroforests, biodiversity and subsistence crops, were both found to significantly influence the smallholdher farmers' preference for agroforests.

Subsistence crops have a strongly positive margin effect on this choice while biodiversity has a small negative marginal effect as farmers are concerned that highly species diverse ecosystems includes undesirable species such as snakes and squirrels as

On average, women place a significantly stronger preference for agroforests than men do.

Providing women with voice in the production decision would likely encourage households to adopt cacao agroforests instead of monoculture production methods.

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