EVALUATING FARMER PREFERENCES FOR AGROFORESTRY SYSTEMS: SURVEY INSTRUMENT DESIGN

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Abstract

In order for agroforestry development programs to be successful in the field, it is important to understand what farmers actually want when it comes to on-farm production systems. Farmers in Calakmul, Campeche, Mexico implement various production systems in order to meet various needs. First and foremost, subsistence farmers need to produce enough food to meet the minimal dietary needs of their families, then and only then, will they consider other methods of production, i.e. producing trees to provide income, diversify food supply, and save for the future. Hosier (1989), states that agroforestry programs must be economically attractive to farmers if they are to be successful, and follows this with, "a positive on-farm economic analysis provides a necessary, but not sufficient, indication of the successful introduction of an agroforestry project." Accordingly, it is critical to understand the value farmers place on aspects of agroforestry systems which fall beyond the realm of traditional economic analyses of farming systems. For example, farmers may have more labor available at certain times of the year, hence a preference for systems that provide flexibility in planting schedules. The main objective of our work in Mexico was to apply choice-based conjoint analysis to potential agroforestry interventions for the purposes of valuing some of the nonmarket benefits received by farmers from certain systems. Opaluch (1993) points out, perhaps, the most important aspect of any conjoint study is the survey design and he spent 6 months designing his survey and only 1 ½ months collecting data. Accordingly, we spent over 5 months designing our survey (August ’97 – January ’98) and only 1 ½ months in the field, actually, collecting data (February ’98 – March ’98).

I. INTRODUCTION

Currently, the International Center for Research in Agroforestry (ICRAF) is working in Southeastern Mexico developing and disseminating agroforestry technologies to improve farm production while conserving and increasing forest cover in the buffer zone of the Calakmul Biosphere Reserve. The core zone of the Reserve permanently protects about one million hectares of forestland, but also removes this land from potential agricultural development. ICRAF's aim is to design agroforestry systems that will be readily adopted and utilized by farmers to help alleviate poverty and decrease rates of deforestation. Much is known about the soils and plants of Calakmul, and some information about farmer preferences can be gleaned from the revealed preferences of farmers, based on what they are currently cultivating and past surveys (Snook 1996). Most farmers in this region concentrate their efforts on developing their traditional milpa production system (maiz, frijol and chihua) and may not be aware of alternative technologies which could increase production, diversify outputs, and provide other benefits of value. In an effort to accelerate the impact of agroforestry, ICRAF is currently working in four separate ejidos, experimenting with alternative agroforestry production systems. In addition to the ecological/biological information, it is also important to understand what farmers actually want and what will lead them to adopt new technologies. As part of ICRAF's vision and plan of action I quote, "we (ICRAF) also need to understand the processes that lead farmers to adopt or reject a new technology and we need feedback from users. This will facilitate wider scale dissemination and enable our researchers to improve the design of agroforestry systems (ICRAF, 1997)." This is precisely where conjoint analysis can provide useful information, facilitating the appropriate design and application of agroforestry systems in Southeastern Mexico.

Conjoint analysis is a marketing technique most commonly used for measuring individuals’ preferences toward alternative new product or service designs containing multiple attributes. Specifically, conjoint analysis involves the measurement of the joint effect of two or more product or service attributes on consumer preferences. The technique has been used to value such natural resource-related opportuniites as waterfowl hunting trips, and nature and recreational parks (Zinkhan et al. 1997).

The main objective of this study was to develop the theoretical framework for applying conjoint analysis to agroforestry for the purposes of valuing potential benefits of agroforestry interventions, and to test, empirically, the validity of this method for developing utility-theoretic

welfare measures for agroforestry systems. Accordingly, the survey instrument must be clear, concise and able to generate the relevant data for achieving the objective stated above. Therefore, the objective of this paper is to lay the foundation for collecting data in the context of conducting a conjoint experiment in a development situation and to discuss what was learned at each step of the process and present some intial results from the survey.

The remainder of the paper is structured as follows: Section II describes the development of the survey instrument. Section III provides some initial results from the data collection and section IV concludes with comments and suggestions for improving field data collection methods.

II. METHODS

The experimental design phase, of any conjoint experiment, is perhaps the most important element of the study. Opaluch (1993) states, "if a conjoint experiment is not well-thought out from the beginning and precision is not taken in designing the survey instrument, then the information will be useless to the researcher." There are several stages to this process, summarized in the following 4 steps.

1.Pre-information stage.
2.Testing and designing the conjoint question.
3. Pretesting the survey instrument.
4.Implementation of the survey.

If the overall objective is to analyze potential agroforestry systems for their potential adoptability and their value, or worth, as production strategies, it is important to develop systems that not only address physical problems of production, but do so in such a way that farmers will actually consider implementing them within their overall production strategy. Numerous agroforestry projects have failed simply due to the lack of attention to the socioeconomics of the situation.
Therefore, it is important to understand the existing social, economic, and ecological conditions in the area under question. To this end, relevant background material should be obtained and synthesized. A thorough secondary data retrieval and assessment at the beginning of the process will enhance the overall quality, uniformity, and efficiency of the evaluation (Mercer 1993). This alone, however, is not sufficient and local land-use professionals as well as the farmers themselves need to be included in this process.

Therefore, key informant interviews and focus groups need to be conducted with local agricultural and forestry extension people. In addition to this, focus groups and informal interviews with farmers is highly recommended at this stage of the process in order to determine if local extension people and farmers view local problems the same way.

To this end, it is necessary to develop a list of key questions for debate in the focus groups. Our list consisted of the following questions to prompt some insightful debate with, both, farmers and technical experts.

What are the main limits to production?
What are some ideas to improve production?
What things should be considered when implementing a new system?
How can agroforestry address questions 1-3?

Lack of water resources, lack of transportation, pestilence, lack of technical training, and the rigidity of tree delivery from local nursuries were some of the problems identified by, both, farmers and technical experts. When exploring and considering the implementation of new and/or additional production systems some of the key variables identified were: meeting self-consumption needs, consistent production over time, i.e. minimizing variance in output, and immediate returns to labor, i.e. high discounting by farmers. Farmers saw agroforestry as a way to diversify outputs and combine short-term returns, i.e. crops, with long-term investment, i.e. timber producing trees.

At this point, it is necessary to compile a cumulative list of what are considered to be the most important characteristics for evaluation by the farmers.

Again, at this point in the process, we had 17 potential attributes for farmers to evaluate as making up the components of an agroforestry system. Here, we recommend categorizing each of the attributes. Our three categories were 1)Essential, 2)Secondary, and 3)Non-essential. This will allow the research team to more efficiently choose which attributes will be included in the initial testing of the conjoint

question. All surveys must be tested, extensively, in focus groups and field tests, in order to obtain quality data (Mercer 1993).

The next step requires transforming this information into a list of potential agroforestry systems. Once a list of potential systems has been drawn up, the next step is to determine if the systems make sense to the farmers. This is also the appropriate time in the development of the survey to answer such pertinent questions as: 1)do the farmers understand the question? 2)how many attributes can be included in each system?, 3)how many choices will each farmer make before becoming tired and disinterested?, and 4)how do farmers seem to make their choices, do they consider the whole system or do they focus on one or two characteristics?

At this stage, we discovered: 1) the farmers did understand the question, 2) 8 attributes seemed to be a lot of information to evaluate at once, so we narrowed this to five, 3) seven or eight choices appeared to be the limit for the farmers, (initially we tried 15). The literature pertaining to this question says up to 20 choices can be made, but in this particular context of interviewing, primarily, illiterate farmers, 20 choices could not even be considered. And 4) the farmers seemed to be considering the entire system and not just focusing in on one all important attribute.

The five attributes we decided to include were
1)the number of extra workdays it will take to implement the system,
2)how many years of technical assistance the farmer will receive,
3)what kind of products will come from each system,
4)the availability of seedlings and how they are obtained and
5)the effects this system will have on the environment.

At this point, the survey is ready for testing. Our survey consisted of 36 total questions and was broken into five sections. Section one contains general socioeconomic questions. Section two is concerned with farming activities in general. Section 3 asks the producer about tree planting activities. Section four is the conjoint experiment, and section five concludes with a contingent valuation question and closing comments.

The survey instrument is specifically designed in order to facilitate thinking about production strategies from the general to the specific, with final emphasis on planting trees on farms.

The total population for sampling consisted of all the communities participating in CONSEJO, which is the regional council for development in Calakmul. Considerations at this point, revolve around the basic question of whether it was more important to cover a larger area and less people in each community, or to concentrate on fewer communities and more people in each one. This decision will depend on local circumstances and the resources available to your survey team. We decided to conduct the survey in a minimum of 20% of the communities and to interview a minimum of 20% of the population in each community.

III. INITIAL RESULTS

Table 1. Ejidos surveyed

EJIDO	Total ejidatarios	Ejidatarios Surveyed	Interested in agroforestry	Interested in AF %
Ley de Fomento	44	15	11	73%
Felipe Angeles	24	10	9	90%
11 de Mayo	57	17	16	94%
La Guadelupe	84	22	11	50%
Josefa Ortiz	34	13	12	92%
El Refugio	30	12	12	100%
Carmen II	58	16	13	81%
Castellot	20	13	12	92%
Heriberto Jara	54	9	8	89%
Centauro del Norte	60	10	9	90%
20 de Junio	57	11	9	82%
San Antonio Soda	NA	10	7	70%
Nueva Vida	40	10	9	90%
16 de Septiembre	14	8	6	75%
Emiliano Zapata	NA	1	1	100%
Alvero Obregon	NA	5	2	40%
Narcisso Mendoza	NA	4	3	75%
Total		186	150	81%

A total of 186 farmers were interviewed in 17 different communities. Of the 186 farmers, 150 expressed interest in agroforestry as a potential production strategy for, at least, part of their farm. Hence, 150 farmers participated in the actual conjoint experiment. (Results of which have yet to be analyzed). Because, we have socioeconomic data for those interested and those not interested, we will be able to test for systematic differences between these groups of individuals.

Table 2 Summary Statistics

Variable	mean	Std. Dev.	Min.	Max.
Age	38	13.7	16	74
No. of kids	4	2.9	0	12
Years in present place	11.6	7.3	.3	39
Distance to fields	2.95 km	2.3	0	12
Total area	49.2 ha	26.5	0	120
Forested area	28.2 ha	25.3	0	95
Hectares in AF	0.39	.65	0	3
Hectares in trees	1.2	2.4	0	15
Original forest area	39.5 ha		0	120
Practicing forest improvement	16%	.37	0	1
Participation in other programs	43%	.49	0	1

n = 186

Table 2, above, summarizes the main characteristics of farmers in Calakmul. There are rather large standard deviations for most of the variables, which leads us to realize, it is difficult to draw generalized conclusions about the farmers of the Calakmul region. A typical farmer may be in his late 50s, no longer have children at home, and may have lived in his present location for over 15 years. The next farmer may be in his 20s, with 8 or9 children living at home, and may have moved to the region within the past year or two.

It is interesting to note, on average, farmers in Calakmul keep over 56% of their total land area in primary forest cover. Also, on average, when farmers arrived at their present locations, approximately 22% of the primary forest had already been cleared (roughly 10 hectares), meaning these farmers, on average, have only cleared 11 hectares, or an additional 24% of the total land area. The amount of forest cleared and forest remaining varies significantly, as can be seen in the following table.

TABLE 3

EJIDO	age	No. of children	Years in present place	Distance to fields	Primary forest HA	% of total land area in primary forest	Current AF users %	Participation in gov/ngo programs
Ley de Fomento	33.1	3.1	7.9	4.8	70.2	70%	20%	33%
Felipe Angeles	39.4	4	3.9	.73	20.9	52%	50%	80%
11 de Mayo	38.8	3.8	11.1	2.4	23.9	48%	35%	59%
La Guadelupe	41	5.1	12.4	2.2	18	45%	23%	27%
Josefa Ortiz	33.2	3.7	10.5	1.4	8.5	36%	31%	46%
El Refugio	31.3	2.8	9.1	2.5	32.2	61%	58%	50%
Carmen II	37.2	3.6	19.7	4.3	9.8	24%	25%	31%
Castellot	37	2.3	8.7	1	22.8	57%	31%	46%
Heriberto Jara	45.6	7.1	14.8	3.6	10.1	51%	56%	44%
Centauro del Norte	39.4	3.8	8.9	2.8	88.7	89%	10%	40%
20 de Junio	33.1	5.6	7.4	3	43.1	86%	27%	27%
San Antonio Soda	41.3	3.4	23.5	5	52.5	63%	70%	30%
Nueva Vida	46.5	3	8.1	3.2	27.7	55%	20%	60%
16 de Septiembre	39.3	4.9	6.3	4.2	20	40%	0%	63%

The ejido with largest total amount of primary forest remaining is Centaro del Norte, located immediately adjacent to the bisphere reserve, which also has the largest percentage of primary forest reamining. The ejido, Josefa Ortiz, has the fewest remaining hectares of primary forest per farmer and also the smallest percentage at only 36%. The last column of the table shows that many farmers participate in programs, sponsored by governmental and nongovernmental groups. Most of these participants are involved with CONSEJO, the local council for development in Calakmul.

Table 4. Responses to Contingent Valuation question

days	1	2	3	4	5	6	7
Yes	25	21	22	17	13	10	11
No	1	5	6	11	12	14	12
Prob (y)	.96	.81	.78	.60	.52	.42	.47

n=180

Overall, farmers appear to be very interested in conservation. A question was presented to each of the farmers about wheter or not they would be willing to work x amount of days per month in order to provide a protected area within the village. Community service is a part of ejido life, so it is not surprising that farmers were interested in and willing to work for a community park, solely to provide conservation benefits to the community. A breakdown of the responses to the amount of wordays per month for each ejido is found in the following table.

TABLE 5. % of "yes" responses to workdays per month for conservation

Days	1	2	3	4	5	6	7
EJIDO							
Ley de Fomento	--	100%	50%	83%	80%	67%	
Felipe Angeles	--	75%	62%	50%		100%	50%
11 de Mayo	--	83%	86%	43%	57%	25%	
La Guadelupe	60%	28%	50%	55%	37%	0%	50%
Josefa Ortiz	--	100%	75%	75%	60%	40%	25%
El Refugio	100%	75%	100%	40%	0%	50%	33%
Carmen II	80%	75%	0%	25%	50%	20%	33%
Castellot	100%	100%	75%	100%	67%	100%	100%
Heriberto Jara	100%	100%	100%	100%	67%	0%	50%
Centauro del Norte	100%	100%	75%	50%	--	--	--
20 de Junio	100%	100%	100%	100%	75%	40%	0%
San Antonio Soda	100%	100%	100%	50%	100%	0%	0%
Nueva Vida	--	--	100%	50%	40%	60%	33%
16 de Septiembre	100%	100%	100%	40%	50%	50%	50%

SUMMARY

Economic analyses of agroforestry systems present great challenges for researchers and depending on the overall objective of a given project, different types of analyses should be employed. A sound cost / benefit analysis is one part, but evaluating potential nonmarket benefits is also important. In order to collect quality information pertaining to farmer preferences, we endorse the aforementioned method for compiling information about farmer preferences for agroforestry systems in general.

The particular information will vary from project to project and location to location, but the general method for collecting data described here should be applicable in any context for evaluating farmer preferences for agroforestry systems.

Particular attention to include farmer opinions and knowledge at the early stages of agroforestry projects is crucial if practitioners hope to make agroforestry an integral component of conservation and sustainable development. Indigenous knowledge should not be overlooked and/or ignored, but needs to be cultivated and incorporated into the development process in order for agroforestry interventions to be successful in the future.

Farmers in Calakmul are full of knowledge, wisdom, and ideas for dealing with agricultural production problems and their input should prove to be an important component in ICRAF's work toward conserving the resources in Calakmul with an eye toward improving local economic conditions. Furthermore, if any development or conservation agency hopes or plans to influence the direction of conservation and sustainable development in Calakmul, it will be critical to include farmers at each and every step in the process.