Miami-Dade County Agriculture & Rural Area Study

Non Market Values Associated with Agricultural and Rural Lands in Miami-Dade County

Volume I

Main Report

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Executive Summary

Rapid population growth in Miami-Dade County is putting intense development pressure on the relatively few remaining acres of agricultural and rural lands - lands that support an economically important and unique sub-tropical agricultural industry. A contingent valuation study conducted as part of the Miami-Dade County Agricultural and Rural Area Study found that a large majority of county residents believe retaining some of these lands in undeveloped use is important. Furthermore, county residents, overall, are willing to pay between $79 million and $190 million to support a program that would ensure that some undeveloped land remains in the future.

The contingent valuation survey was administered to a random sample of county residents. Respondents said that retaining some agricultural and other undeveloped land was important in order to preserve and important agricultural industry, maintain a source of locally grown food, provide habitat for wildlife, protect environmental quality, preserve quality of life, and provide opportunities for public recreation. While different types of undeveloped land contributed to different degrees to these "benefits," survey respondents believed a program to retain undeveloped land should focus on farmland with other undeveloped private land and public parks as somewhat less important objectives, respectively.

Study participants generally favored low density over high density rural residential development. Given that this development pattern would ultimately lead to complete conversion of undeveloped land, however, a majority were willing to accept some higher density suburban development as long if it was located adjacent to existing development. Focus group participants suggested that residential development should occur on lands suited to development (i.e., land already underdeveloped or land adjacent to already developed areas) and that land better suited to agriculture or land that provided important environmental amenities should remain undeveloped.

Overall, the contingent valuation study suggested that:

- A large majority of Miami-Dade County residents believe it is important to do something to retain some of the county's existing agricultural and other undeveloped land in largely undeveloped use for the future.
- Most residents believe it is important that a program to retain agricultural and other undeveloped land compensate landowners for any loss in property value caused by the program.
- Many county residents are willing to accept some higher density residential development in areas suited to such development (i.e., adjacent to or within existing residential areas) in exchange for retaining some agricultural and other undeveloped land in areas most suited to undeveloped uses.
- On average, county residents believe a retention program should focus on lands in agricultural use with retention of some other undeveloped land for environmental reasons and some public land for recreation as less important objectives.

These preferences are largely consistent with elements of the "preferred development scenario" that evolved from the Agricultural and Rural Area Study.

Non Market Values Associated with Agricultural and Rural Lands in Miami-Dade County

Introduction

The retention of agricultural and rural lands provides many benefits to communities. Some types of benefits stem from changes in economic activity. These include the economic benefits associated with agricultural production or the lower cost of providing public services to undeveloped land as opposed to developed land. Other benefits arise from the contribution of undeveloped land to a community's rural character, quality of life, or environmental quality. Because benefits in this latter class are not often reflected in market prices, they are referred to as non market benefits. A number of studies confirm the importance of non market benefits (Kline and Wichelns 1996; Krieger 1999; Ready, Berger, and Blomquist 1997; Bowker and Didychuk 1994; Foster, Halstead, and Stevens 1982). Non market benefits, however, are more difficult to quantify than are benefits based on established markets. Nevertheless, a complete accounting of the value of retaining agricultural and rural lands must include estimates of non market benefits.

The scope of services for the Miami-Dade County Agricultural and Rural Area Study recognized the importance of non market benefits and instructed the contractor to "utilize contingent valuation or other comparable techniques to estimate the economic value of non market benefits provided by agricultural, open and rural lands and uses in the study area." This report summarizes a contingent valuation study of the non market benefits associated with agricultural and rural lands in Miami-Dade County.

The report begins with a description of the project background and research procedures. It includes a review of the contingent valuation method and details of its application to the current study. The main part of the report summarizes survey results regarding preferences for retaining agricultural and rural lands and presents estimates of the non market values associated with such lands. The report concludes with a discussion of the implications of the study for land retention policies in Miami-Dade County.

Background

Miami-Dade County contains almost 1.3 million acres of land, most of which is undeveloped public land in national, state, and local parks and water conservation areas. Undeveloped public land accounts for about 72 percent of the county's land area. Of the roughly 28 percent of the land area in private ownership, 65 percent is developed for residential, commercial, or industrial use. Of the 115,000 acres of undeveloped private land, about 97,000 acres was in agricultural use in the year 2000 (Degner). Almost all of the agricultural land (87,812 acres) is in the southern part of the county, south of US Highway 41.

This study focused on future development in Miami-Dade County's agricultural area and the value of retaining some agricultural and rural lands in the area in undeveloped use. The contingent valuation questionnaire somewhat arbitrarily defined an area containing most of the agricultural land in the southern part of the county as the "planning area." Figure 1 shows land use in Miami-Dade County and the boundaries of the planning area as defined in the contingent valuation survey.

Miami-Dade County's agricultural land base supports an economically important and unique sub-tropical agricultural industry. Intense development pressure driven by rapid population growth,

however, poses a substantial risk to the future of the land base and the agricultural industry (Degner). The Agricultural and Rural Area Study aimed, in part, to examine the full range of economic benefits associated with retaining undeveloped agricultural and rural lands. Retaining such lands may mean allowing higher density development on some currently undeveloped lands in order to accommodate expected growth while retaining some land in a largely undeveloped state. Thus, the study estimates the economic consequences associated with development alternatives that differ in the amount of undeveloped land retained and the density and location of new development in the agricultural area. The remainder of this report describes an application of the contingent valuation method to estimate the non market benefits associated with the development alternatives.

Contingent Valuation

Non market values are values that do not have market determined prices. For goods traded in markets - land for example - the market price is a measure of value. The market price/value will be determined in part by the productive potential of the land. The market price of farmland, for instance, will reflect the value of agricultural products it is capable of producing, or its potential value in some developed use. Agricultural and other undeveloped land, however, provides many valuable goods and services that are not accounted for in its market price. For instance, it may provide habitat for wildlife, contribute to the scenic beauty of an area, or help maintain water quality. All of these functions of undeveloped land are valuable but, because they are rarely bought or sold in established markets, there is no easily observed price that reflects that value.

Though they are not readily observable, non market values are real and are important for decision making. Land use decisions based only on market values are based on incomplete information about the cost sand benefits. Decisions about land use should consider the full range of costs and benefits associated with alternative uses, not just those represented by market prices.

Contingent valuation is one of several methods developed by economists to estimate non market values. The contingent valuation method uses surveys or interviews to directly elicit from respondents the monetary value they attach to a good or service of interest. Non market values may be associated with direct use of a good or service - for instance, recreation in a natural setting. However, some people may value a good or service they intend to experience passively (*e.g.*, as scenery during a daily commute) or may never intend to experience directly. In some cases, these "passive use" or "non use" values may comprise a large share of total non market value. The contingent valuation method is the only valuation method capable of estimating both use and non use values.

Questionnaire Development

Application of the contingent valuation method relies on an interview (either in person or by telephone) or a self administered questionnaire (*e.g.*, mail or internet surveys). These methods of collecting data share the need for a well designed questionnaire. The quality of the contingent valuation questionnaire determines the quality of the data and, thus, the quality of resulting estimates of non market value. Given the importance of the contingent valuation questionnaire, the research procedures used in this study devoted considerable effort to questionnaire development.

The ultimate objective of a contingent valuation questionnaire is to elicit from the respondent a meaningful expression of willingness to pay for the good or service in question. Many design elements of the questionnaire affect this objective. An effective questionnaire should communicate

clearly and unambiguously with potential respondents. This means using language and concepts that are familiar and relevant to a majority of respondents (Fischhoff and Furby 1988). It means designing a sequence of questions and concepts that prompt respondents to think through the implications of the decisions the questionnaire asks of them. It also means designing individual questions and response categories in such a way that respondents can provide meaningful answers (Sudman and Bradburn 1982). Finally, it means formatting the questionnaire to facilitate comprehension and ease and accuracy of response (Dillman 2000).

The questionnaire design process began with six focus groups designed to explore county residents' general attitudes concerning land use and the language they used to discuss the issue. Information from the focus groups aided in developing a draft questionnaire. Next, a series of iterative one-on-one interviews tested the performance of the draft questionnaire. Revisions based on the interviews produced a final questionnaire. This section reviews the questionnaire design process.

Focus Groups

Focus groups are moderated discussions among selected groups of individuals. They are well suited to identifying commonly held opinions and attitudes, familiar language, and thought processes. In the context of contingent valuation questionnaire design, focus groups aid in developing a questionnaire that communicates effectively with potential respondents. In particular, they are useful in identifying issues that are relevant to potential respondents, learning the language and concepts respondents use to discuss the issues, and exploring thought processes respondents use when addressing the issues.

While focus groups are a useful tool in questionnaire design, it is important to recognize their limitations. Focus groups can generate powerful statements about the issues of interest. Narrative excerpts from focus groups can provide compelling evidence to support the results of a statistically valid survey. Because focus groups are not generally randomly selected and because the discussion may be influenced by the dynamics of the group, however, statements from focus groups should not be interpreted as representative of the overall population.

For the Miami-Dade County Agricultural and Rural Area Study, six focus groups were convened in March of 2002. A professional market research firm recruited 12 to 15 participants for each group. Groups were recruited from six specific regions selected to reflect a representative range of development densities, socioeconomic groups, and experience with undeveloped land. In addition, each group was recruited to contain a representative mix of age, gender, and income. Since many Miami-Dade County residents are most comfortable speaking Spanish, two of the groups were recruited specifically from among those most comfortable speaking Spanish and moderated by a native Spanish speaker. Table 1 summarizes details of the six focus groups. Appendix A contains complete transcripts of the focus groups.

Designing The Contingent Valuation Questionnaire

The focus groups contributed to development of a draft questionnaire. The draft questionnaire was then tested in a series of pretest interviews. Pretest interviews are a final step in questionnaire design that help determine whether the draft questionnaire performs as intended. Interviews were conducted individually over a period of three days. During the interviews, respondents were asked to "think out loud" as they filled out the questionnaire. The interviewer paid particular attention to

verbal and non verbal cues that indicated whether a respondent understood and accepted the questionnaire, whether they interpreted questions as intended, whether they could answer questions meaningfully, and whether response categories were adequate. Pretest interviews revealed ambiguous questions, misunderstandings by respondents, and questions respondents had about interpretation of the questionnaire. During the interviews, the interviewer also probed respondents to explore thought processes and understanding of key issues.

Fifteen pretest interviews were conducted over three days in Miami. Participants were drawn from among employees of Duany Plater-Zyberk during the first two days. For the final day of interviews, a professional market research firm recruited seven randomly selected Miami residents. After each set of interviews, the questionnaire was revised to correct problems identified during the interviews. Subsequent interviews tested the revised draft questionnaire.

The questionnaire underwent substantial revision during pretesting. Most of the revisions improved the clarity of concepts and questions. The final questionnaire that emerged from the pretests seemed to work well.

The Final Questionnaire

The primary purpose of the questionnaire was to elicit preferences for alternative development patterns and willingness to pay to retain agricultural and rural lands. To elicit reasoned, meaningful responses to the key questions, the questionnaire also had to prompt respondents to consider the implications of alternative development patterns for their own wellbeing. Thus the selection and sequence of questions developed a thought process to help respondents consider the role of agricultural and rural lands in their lives.

The questionnaire framed the issue as one of planning for future growth. The first questions prompted respondents to think about some of the problems associated with growth and the role of planning in addressing those problems. The questionnaire then introduced the concept of land use as a primary function of planning. It contained a map of Miami-Dade County that showed the locations of public lands, developed private developed lands, and undeveloped private lands.[1] A series of questions prompted respondents to think about the kinds of land that were near their homes and their direct experience with different kinds of land in Miami-Dade County.

Next, the questionnaire expanded on the concept of undeveloped land. It distinguished between two types of undeveloped lands that were important to the objectives of the survey - farmland and other undeveloped private land that was not use for farming. Questions focused on the perceived importance of retaining these types of land in undeveloped use, the reasons for retaining farmland and other undeveloped land, and the preferred mix of land to retain.

The questionnaire then focused on the question of planning for future development in the "planning area" - the largely agricultural area around the City of Homestead. A map showed current land use in the planning area with the location of different kinds of development. Development alternatives under consideration in the Agriculture and Rural Area Study included "rural residential" development with a maximum density of one dwelling unit per five acres and "suburban residential" development with a density of between three and six homes per acre. The map therefore showed the

[1] Land use data in GIS format was obtained from the South Florida Water Management District. A detailed study conducted by the University of Florida provided data on land in agricultural use (Degner).

approximate location of these types of development patterns as well as those of farmland, public lands, and urban areas. Inset photographs illustrated typical rural residential and suburban residential densities and farmland.[2] All of the photographs were carefully pretested to ensure that respondents identified them as intended and recognized them as typical scenes from Miami-Dade County. Captions with the photographs described the corresponding land use or density and the number of acres of land in the use within the planning area.

The questionnaire next introduced two development alternatives for the planning area. The alternatives - labeled Alternative A and Alternative B - showed potential land use in the planning area in the year 2025, the planning horizon for the Agriculture and Rural Area Study. Alternative A was the same for all questionnaires and illustrated the projected buildout in the planning area at the rural residential densities allowed under current zoning. Under Alternative A, virtually all of the private farmland and other undeveloped land would be developed at rural residential densities by the year 2025.[3]

Alternative B proposed a different pattern of development. It suggested that some land could be protected from development. To accommodate expected growth under Alternative B, some new development would have to occur at suburban residential density. Thus, Alternative B proposed allowing some suburban residential development near existing urban areas, reducing the amount of land that would be developed at rural residential densities, and protecting some farmland and other undeveloped land from being developed. Once again, maps - with inset photographs - showed how the planning area would look under each of the alternatives. The descriptions identified the number of acres in each type of land use.

Once the questionnaire presented the development alternatives, it introduced methods for protecting land from development. The purpose of this section of the questionnaire was to familiarize respondents with land protection tools and to introduce them to the notion that protecting land would cost money. In addition to zoning, the questionnaire presented purchasing land outright for public use and purchasing development rights to private land as methods to permanently protect land from development.

Contingent Valuation Scenario

The main component of a contingent valuation questionnaire is a "valuation scenario." The valuation scenario is the section of the questionnaire that elicits the amount respondents are willing to pay for the good or service in question. Contingent valuation research often deals with goods or services for which markets do not exist. Thus, respondents are generally not familiar with thinking about the goods or services in monetary terms. The valuation scenario describes a plausible, market-like setting in which the respondent is asked to make a choice between provision of or access to the good or service in question and money (Mitchell and Carson 1989). The conditions necessary for the method to generate meaningful responses are similar to those necessary in a market, *i.e.*, that

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[2] The South Florida Water Management District provided oblique aerial photographs of residential development. Photographs of farmland were taken by researchers during a tour of the Homestead area.

[3] Development alternatives were modeled after population and land use projects developed by Planning Works as part of the Agriculture and Rural Area Study.

respondents are fully informed, that they recognize and consider budget constraints, and that they can not receive the good or service without paying for it. Thus, to facilitate a meaningful response, the scenario must present respondents with a complete description of the consequences of the choice. It must describe a way for the good to be provided that is plausible and acceptable. It must use a method of payment that is acceptable to respondents and does not facilitate strategic responses or free-riding.

For the Agriculture and Rural Area Study, the valuation scenario first described a purchase of development rights program that would permanently retain some farmland and other undeveloped private land in the study area in undeveloped use. The description explained how purchase of development rights programs work - that they pay landowners a fair price for development rights, that the landowner would still own the land and could continue to use it, and that the land could never be developed. To counter a broad distrust of local government apparent from the focus groups, the scenario explained that the program would be financed by donations to a non-profit conservation organization. To avoid an incentive for free-riding, the scenario stated that the donation would not be collected unless total pledged donations were sufficient to purchase development rights to the desired land. Thus, the donation mechanism operated very much like a public referendum - the preferred format for contingent valuation scenarios (Arrow et al. 1993).

The scope of services called for comparing the costs and benefits (including non-market benefits) associated with two alternative development patterns for the county's agricultural and rural lands. From a development perspective, the two alternatives differed primarily in the quantity, location, and density of new development that would occur in the study area between the present and the year 2025. Different development patterns, in turn, implied different levels of retention of undeveloped lands.

The parameters of the final alternatives (*e.g.*, the number of acres in different development densities and the number of acres of undeveloped land) were not completely specified at the time the contingent valuation questionnaires were developed. Thus, three stylized alternatives were developed that bracketed the likely parameters of the final development alternatives. The valuation scenario presented respondents with two alternatives and asked them to choose the preferred alternative. The first alternative (Alternative A) was the same for all respondents. Alternative A reflected projected (to the year 2025) development under existing zoning and land use regulations that permit only "rural residential" densities of one house per five acres. Since Alternative A meant essentially doing nothing, implementing Alternative A required no donation from the respondent.

The second alternative (Alternative B) proposed to use donated money to purchase development rights to a specified number of acres of agricultural and other undeveloped private land in the study area. Three versions of Alternative B proposed retention of increasing amounts of undeveloped land. The three versions of Alternative B were designed to retain roughly three-quarters, one-half, and one-quarter of the undeveloped land in the study area. To accommodate expected growth while retaining some farmland and other undeveloped land, Alternative B proposed allowing some "suburban" density development of three to six houses per acre adjacent to existing suburban and urban areas. The acres in rural residential and suburban development were selected to be consistent with the amount of undeveloped land retained. The questionnaire included maps to illustrate each alternative.

Table 2 summarizes the parameters of the development alternatives. Each respondent was asked to compare Alternative A with only one version of Alternative B. In addition to varying the version of Alternative B presented in different questionnaires, the experimental design also varied the cost of implementing Alternative B. The design specified ten different proposed donation

amounts for each choice between alternatives.[4] Each respondent received only one alternative pair and one proposed donation amount. In addition to the two alternatives, the valuation scenario described current conditions.

The valuation scenario explained that the only way to ensure permanent retention of the undeveloped land was to donate money to a conservation organization that would buy development rights to the land. The valuation scenario specified the donation from the respondent's household required to implement Alternative B and asked how certain the respondent was to make the requested donation.

Most people have likely given little thought to the monetary value of agricultural and rural lands. A lack of familiarity with the good in question may make it difficult for some respondents to answer definitively whether or not they would donate money. A contingent valuation questionnaire that offers only yes or no choices about donation intentions would force respondents who were uncertain about their choice to either give a response that implied certainty or make no choice at all, *i.e.*, refuse to answer the question (Ready, Whitehead, and Blomquist 1995). In either case, responses may not accurately reflect respondents' true values. A number of studies suggest that forcing respondents to express certainty may lead to overstatement of value (Ready, Navrud, and Dubourg 2001; Champ et al. 1997).

In keeping with recent research on how to deal with uncertain respondents (Alberini, Boyle, and Welsh 2003), the contingent valuation questionnaire asked respondents to express, on an 11 point scale, how certain they were that they would or would not donate the specified money amount. Possible responses ranged from zero (certain not to donate) to 10 (certain to donate) with the center value of five labeled "not sure." Appendix B of this report contains complete copies of the questionnaires and valuation scenarios.

Sample Selection and Survey Administration

The questionnaire was sent to a random sample of 1,500 Miami-Dade County households. The 2000 Census classified 99.3 percent of Miami-Dade County households as urban. Thus, a random sample of 1,500 households would be expected to include only ten rural households. To obtain adequate representation from suburban and rural areas in the southern part of the county, the sample was selected to represent two strata - urban and rural. The urban stratum was drawn from 271 census tracts that comprised the urban core of Miami and its near suburbs. The urban census tracts contained 603,152 households, 78 percent of all households in the county. The rural stratum was drawn from 76 rural and suburban census tracts in the southern part of the county and contained 173,622 households. The final sample was about evenly split between the urban and rural strata with 745 questionnaires distributed to the urban stratum and 755 to the rural stratum. The analysis of survey data accounted for the unequal sampling rates in the two strata.

The cultural diversity of Miami-Dade County presented a unique survey administration challenge. A large portion of the population - perhaps as great as 22 percent - speak only Spanish. As many as an additional 38 percent may speak English but be more fluent in Spanish. Identifying

[4] Donation amounts were $5.00, $25.00, $50.00, $100.00, $200.00, $300.00, $400.00, $500.00, $1,000.00, and $2,000.00. To accommodate the statistical analysis, donation amounts were selected so that most respondents would agree to donate the lowest amount and most would not agree to donate the highest amount.

the language preferred by each person in the sample was not possible prior to distributing the questionnaire. Thus, the questionnaire and related material were translated into Spanish and each potential respondent received a copy in English and a copy in Spanish.

The questionnaire was administered by mail using a modified version of the Total Design Method (TDM) (Dillman 1978). The TDM focuses on the many small details of survey design and administration that affect response rates and data quality. The TDM specifies four separate contacts with respondents in order to increase response rates. The first contact consists of a copy of the questionnaire and a cover letter requesting participation in the survey. One week after the initial mailing, each person in the sample receives a postcard reminding them to complete the questionnaire and thanking them if they have already done so. The TDM specifies two additional contacts spaced at intervals of three and seven weeks after the initial mailing. Each includes another copy of the questionnaire and an increasingly demanding request for a response and is sent only to those who have not responded by the date of the mailing.

Time and budgetary constraints precluded a full application of the TDM in this case. Instead of a second copy of the questionnaire in week three, each person who had not yet responded received a letter requesting their participation and asking whether they would like another copy of the questionnaire and their language preference. Each letter contained a stamped postcard on which to indicate a questionnaire preference. Each person who requested an additional questionnaire received one in their preferred language.

The first mailing and reminder postcard produced about 150 returned questionnaires representing a response rate of about 11 percent. The third contact generated an additional 38 responses for a total of 188 completed questionnaires and a response rate of 13 percent.[5]

Representativeness of Respondents

Respondents appeared to be somewhat older, wealthier, better educated, and more comfortable conversing in English than the overall population of Miami-Dade County. On average, respondents were 54 years of age compared to an average of 47 years for the population of the county. The median income of respondents fell in the interval between $35,000 and $49,999. The 2000 Census reports a median income of $35,966 for all households in Miami-Dade County - just at the lower edge of the interval for respondents. The average respondent had completed a college degree while the average individual in the county has some college but no degree. Table 3 compares characteristics of respondents with known characteristics of the population of Miami-Dade County.

A majority of respondents (82 percent) chose to complete the English language questionnaire implying they were more fluent in English than in Spanish. It is difficult to determine the proportion of the population that would choose to respond in Spanish. The 2000 Census, however, reports that as many as 35 percent of individuals speak English less than "very well." Thus, differences in responses rates by questionnaire language suggest that those who did not speak English were less likely to complete the questionnaire than those who were most comfortable responding in English. Thus, responses may under represent those who are more comfortable answering in Spanish.

Two thirds of respondents reported being raised in the United States. Again, it is difficult to tell whether this proportion is similar to that of the population. The 2000 Census reports that

[5] The 97 questionnaires sent to outdated addresses and deceased individuals were removed from the sample when calculating response rates.

about 50 percent of the Miami-Dade County population was born in the United States. Being born outside the United States, however, does not necessarily imply that a respondent was not raised in the United States.

Landowners are also poorly represented in the survey. Those who owned five acres or more of land comprised only three percent of survey respondents. It was not possible to determine the proportion of the sample that owned five acres or more of land. Thus, it is difficult to assess whether landowners were less likely to respond than those who did not own land.

Only three respondents identified the area in which they lived as farmland or rural. Most (56 percent) identified their living situation as urban while 37 percent said they lived in a suburban setting. By strata, a majority (63 percent) of the urban stratum identified their area as urban compared to 30 percent of the rural stratum. A small majority (55 percent) of the rural stratum identified themselves as suburban.

Finally, households in the rural stratum were somewhat more likely to respond than those in the urban stratum. The sample contained roughly equal numbers from each stratum. The rural stratum, however, generated 57 percent of all responses. It could be that households in the rural stratum found the issues more relevant to their lives and activities.

Preferences for Development Patterns and Undeveloped Land

The primary objective of the contingent valuation survey was to estimate the non market value associated with agricultural and rural lands. It was also important, however, to explore respondents' preferences for development patterns and undeveloped land. Specifically, sections of the questionnaire focused on motivations for retaining undeveloped land, preferences for different types of undeveloped land, and opinions about development alternatives and methods for retaining land in undeveloped use. Responses to these questions may be useful in deciding how to structure a program to retain agricultural and rural lands in Miami-Dade County.

In addition to providing information about preferences for undeveloped land, questions that focused on experience with and attitudes toward undeveloped land prompted respondents to explicitly consider how undeveloped land affected their lives. Educating respondents about the issues and prompting thought about the impacts of undeveloped land helped them make reasoned choices about how much retaining undeveloped land is worth.

The remainder of this section draws on selected questionnaire responses to describe attitudes toward retaining undeveloped land and preferences for development patterns. Appendix C contains complete summaries of responses for each question. The summary data contained in Appendix C is are the raw, unweighted responses. They will not, therefore, exactly match the weighted summary statistics contained in this report.[6]

Planning for Undeveloped Land

During the process of questionnaire design, the focus group discussions addressed county residents' definition of undeveloped land. Focus group participants identified Federal, State, County,

[6] Because of unequal sampling rates for the rural and urban strata, the raw data from the survey had to be weighted prior to analysis in order for results to reflect the attitudes of all households in the county.

and local parks; farmland; other private undeveloped land not used for farming; vacant land within urban areas; and wetlands as open space. One important conclusion from the focus groups was that almost all participants identified farmland as one type of undeveloped land.

Prior to introducing the issue of agricultural and rural lands, the questionnaire asked respondents to indicate the level of their concern about selected impacts of growth and development in Miami-Dade County. The impacts selected for inclusion in the questionnaire were those raised by focus group participants. The loss of farmland and undeveloped land ranked as the second most important concern after traffic congestion. More respondents were concerned about the loss of farmland and undeveloped land than about school crowding, water shortages, increased crime, or air and water pollution - all issues mentioned by focus group participants. Table 4 summarizes the relative importance of respondents' concerns about the impacts of growth.

The loss of farmland and undeveloped land is not an idle concern. These lands are important, in part, because county residents use them. A large majority of respondents (88.8 percent) reported visiting undeveloped land during the 12 months prior to the survey. Local parks received the highest visitation with 76.4 percent of respondents reporting a recent visit. Many (66.1 percent) had visited a public beach. National parks attracted visits from 57.5 percent of respondents. Surprisingly, 41.2 percent reported having visited private undeveloped land or farmland.

Focus group participants provide added detail about how Miami-Dade County residents use undeveloped land. Participants had the most direct experience with public parks. They used parks frequently for recreation, sports, family activities, fishing, and hunting. Most also said that they frequently visited public beaches. They also believed parks and other accessible open spaces were important contributors to quality of life and that the County needed to provide adequate publicly accessible open space when planning development. The following transcribed comments illustrate the importance of undeveloped land in developed areas.

> "Well, even if they redeveloped the inner or the city, you still need open space. If you're talking condos, townhouses, apartment complexes, whatever. If you're going to redevelop that area, you're going to need open space because people need open space. They need space to get out. They need a park area. They need to be able to just get a breath of fresh air, get away from it all. So, I think when you start talking about developing any area, open space should be part of the equation." (Focus group participant)

> "I think it's [undeveloped land] just good for mental health, that's why we need open spaces. If we've had a bad day we can go for a walk and be alone, communicate with nature, the birds or whatever we want. It's healthy. It's good for us." (Focus group participant)

Respondents from the two sampling strata reported somewhat different use of undeveloped land. Respondents in the rural stratum were somewhat more likely to have visited a national or state park or natural area than respondents from the urban stratum and much more likely to have visited private undeveloped land. Respondents from the two strata were about equally likely to have visited public beaches and local parks. Table 5 summarizes the use of undeveloped land by strata. The weighted results in the "all households" column(s) reflect estimated visitation by a random sample of county households.

The Importance of Undeveloped Land

Both the focus groups and the survey found that county residents believe agricultural and rural lands are important. Learning why they are important will help target a land retention program to suit the preferences of county residents. Of particular interest was the question of whether residents believe a land retention program should focus on agricultural land, other undeveloped private land, or on providing more publicly accessible land.

The loss of undeveloped land is enough of a concern that well over 70 percent of respondents said it was either "very important" or "somewhat important" to keep some of the county's remaining farmland and other undeveloped private land from being developed in the future. Overall, respondents believed retention of farmland was slightly more important than retention of other undeveloped private land. Average levels of importance for keeping some farmland and other undeveloped private land from being developed were 5.3 and 4.9, respectively.[7] In general, respondents from the urban stratum placed a slightly higher importance on retaining both farmland and other undeveloped land than did respondents from the rural stratum.

The survey also asked respondents to name the most important reasons they believed retaining some farmland and other undeveloped private land was important. Table 6 summarizes responses. The responses suggest that respondents viewed agricultural land somewhat differently than other undeveloped private land. Over the entire sample, the single most important reason for retaining farmland reflected an agrarian concern - protecting the local agricultural industry. Many respondents also identified a source of locally grown food as an important reason for retaining farmland. A focus group participant described his use of agricultural land in the following terms.

> "Out in the Redlands, there are places you can go to pick your own vegetables. If you want to buy your vegetables, your potatoes, your beans cheaper you can go to the Redlands." (Focus group participant)

Other participants mentioned the importance of being able to buy locally grown produce in area stores.

While some focus group participants spoke of negative environmental impacts associated with agriculture, more than a third of survey respondents associated agricultural land with maintaining environmental quality. Again, the focus group discussions provide some insight into the link between agriculture and the environment. One participant admitted that agriculture used scarce water and reduced water quality. However, he also thought it was better for the environment than residential development.

> "High density housing versus very low density residential or agriculture has less of an impact than it would if you created a Kendall..." (Focus group participant)

Participants in one focus group discussed the role of farmland as a buffer to the Everglades, an area they believed was vitally important to the area's ecosystem and to maintaining environmental quality. One participant summed up the group's thoughts in the following words.

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[7] Average importance levels were calculated as the arithmetic average of numeric response categories of the questionnaire where 0="not at all important" and 6="very important."

> "Plus, that area [the Redlands] acts as a buffer to the Everglades. So, if you run people right out to the edge of it [the Everglades], then where does all their garbage spill over? It spills over into the Everglades." (Focus group participant)

Relatively few respondents selected "slowing growth and development" as an important reason to retain some land in agricultural and other undeveloped use. As the following response to an open-ended question illustrates, however, the negative impacts of growth are certainly on the minds of some respondents.

> "[Alternative] B clearly maintains a balanced level of public access to open-beautiful-clean-green, locally grown food, and it concentrates growth in places already "dense" urban suburbia - so there will be less loss of habitat and space. [Alternative] A looks like a sprawling dense hideous nightmare of malls, traffic and pollution throughout our county - awful." (Survey respondent)

Environmental and scenic concerns were the most important reasons to retain other (not farmed) undeveloped land. Providing opportunities for public recreation was the least important reason.

Qualitative responses to open-ended questions provide another rich source of evidence about perceived differences between land in agricultural use and other undeveloped land. By far the most common comment about agricultural land was that it was productive land that contributed to the local economy. About 60 of the 137 written responses mentioned either the economic contribution of agriculture or the fact that farmland was being used productively. Other than two respondents who mentioned the importance of undeveloped land to the tourism industry, few associated other undeveloped land with economic benefits. In fact, five mentioned that undeveloped private land (not farmland) was just waiting to be developed and six specifically stated that it was wasted land in the sense that it was not in productive use.

Many respondents, however, believed that undeveloped private land that was not being used for agriculture did provide valuable benefits. In particular, about 30 respondents specifically wrote about the importance of undeveloped land as a natural environment and as wildlife habitat. More respondents mentioned environmental benefits in the context of undeveloped (not farmed) land than in the context of farmland. Ten specifically mentioned negative environmental impacts associated with farmland - specifically the use of water and the use of chemicals. This does not mean that most people believe farming is detrimental to the environment, just that some associated non-farmed land more than farmland with environmental and wildlife benefits.

The following quotes illustrate common comparisons between farmland and other undeveloped private land. The quotes do not represent the strength or breadth of opinions. They are only illustrative of some beliefs about the differences between farmland and other undeveloped land.

> "Farmland is presently being used to provide a living to its owners - undeveloped private land is kept by its owners for its potential future value." (Survey respondent)

> "Main difference is economic, value. Farmland produces wealth. Undeveloped open land does not, but in my opinion, it is as important or maybe more important because it provides vital open space for wildlife and vegetation to exist." (Survey respondent)

> "It is crucial to honor and maintain wetlands and natural undeveloped private land for our humanity, sanity, and health of all beings. Farmland, on the other hand, uses pesticides, fertilizers, spraying poisons, it is off-limits to "pesky" creatures who wish to feed (birds, mammals, etc.)" (Survey respondent)

> "I prefer to have my vegetables and fruits locally grown. I love going down Krome in the winter to buy vegies. If we have no farmland, then we have no fresh products. Private undeveloped land [not farmland] is therefore not so important to me." (Survey respondent)

Respondents seemed to view both farmland and other undeveloped land as scenically beautiful although they mentioned scenic beauty somewhat more often in the context of undeveloped land than for farmland. The following comment illustrates that some people find agricultural landscapes scenically appealing.

> Most importantly is that farmland contributes to our economic growth and stability. I consider it "scenic beauty" also! Ever seen people/families picking tomatoes or onions on a Sunday afternoon? Nice." (Survey respondent)

The questionnaire elicited another measure of the relative importance of retaining farmland, other undeveloped private land, and publicly accessible land. A question told respondents that the county had decided to protect 10,000 acres of undeveloped land. This land could be farmland, other undeveloped private land, or public parks. It then asked respondents to select how many of the 10,000 acres should be allocated to each of the three types of land. The results suggest that, on average, Miami-Dade County households would choose to allocate 45 percent of the land to farmland, 31 percent to other undeveloped private land, and 24 percent to public parks. The results suggest that additional land for public recreation is less important than farmland and other undeveloped land. This allocation appears consistent with comments from many focus group participants who said that Miami-Dade County's expansive public lands were adequate. They also imply that farmland and other undeveloped private land, even if it is not publicly accessible, provides valuable amenities to county residents.

Development Preferences

When asked what kind of development they preferred for the planning area in the future, 52 percent of respondents said they believed it should be a mix of rural residential and suburban development. The weighted responses suggest that 47 percent of Miami-Dade County households would prefer a mix of rural residential and suburban development. Thus, even though evidence from the focus groups and written comments on questionnaires indicated that many residents viewed suburban development in the study area as undesirable relative to rural residential development, many were willing to accept some higher density development if it meant that some farmland and other undeveloped land would remain undeveloped.

Participants in one of the focus groups expressed the opinion that some land was more suited to development than other land. They believed that land that was suitable for development should be developed at higher density in order to retain land that was better left undeveloped. The following exchange illustrates the general theme.

"Yes, there should exist places to cultivate and there should be open areas for parks that could help the community without affecting housing projects, animals. To make apartments, also could help the community." (Focus group participant)

"[There should be a] balance between the construction and ecology projects, the flora and fauna." (Focus group participant)

"[The balance could be accomplished by] instead of expanding [low density development], develop it [at higher density]." (Focus group participant)

"Instead of expanding the low construction [suburban density] areas, develop them higher [greater densely]." (Focus group participant)

The survey also asked respondents how they would prefer the county go about retaining land in undeveloped use. Questions focused on two issues - whether compensating landowners was important if a retention plan reduced property values and then on which retention tools respondents viewed as acceptable or feasible for use in Miami-Dade County. Almost half (46 percent) of respondents said it was "very important" that any retention program compensate landowners for whom the program reduced the value of land. An additional 32 percent said it was somewhat important. The weighted responses suggest that 43 and 28 percent of households in the county believe compensation is very important or somewhat important, respectively.

Respondents supported the use of a variety of tools to retain undeveloped land. Outright purchase was the least preferred with 47 percent approving of its use. About 67 percent of respondents supported either zoning or purchase of development rights as tools for land retention. The weighted results suggest that about half of county households would support the purchase of development rights to retain agricultural and other rural lands. About 60 percent would favor zoning to accomplish land retention objectives. However, only 34 percent likely believe that zoning should be the only approach to land retention.

Responses to open-ended questions revealed much about development preferences and reasons for retaining some undeveloped land. When comparing the two development alternatives, respondents most often mentioned the obvious difference in the amount of agricultural and other undeveloped land. The most revealing comments about development preferences, however, concerned different views of congestion. In particular, some respondents associated unlimited rural residential growth with increased traffic congestion and environmental degradation. For instance, one respondent wrote:

"The fewer homes built, the better. Too much congestion, too much additional taxes for all services that would be required for so many additional people." (Survey respondent)

"I think whenever you bring people, the more people, the more garbage, the more pollution, the more everything. The fewer people, the better." (Focus group participant)

Alternatively, a few respondents expressed the view that the suburban residential development pattern that retained some undeveloped land would lead to more congested communities. The following responses illustrate this view.

"Alternative A [rural residential buildout] will develop all lands. Alternative B [mix of rural residential and suburban residential with retained undeveloped land] will create overcrowded centers with open undeveloped areas outside." (Survey respondent)

"Generally speaking, there is not enough room between houses for families to enjoy, i.e., backyard, room for fence to ensure safety, etc." (Survey respondent)

"Alternative A will let spaces between home and buildings. Alternative B will have just the necessary space between homes." (Survey respondent)

Overall, the written responses indicated concern about the loss of farmland and other undeveloped land and about quality of life (e.g., scenic beauty, congestion, and rural character.)

Non Market Values Associated with Agricultural and Rural Lands

The primary objective of the contingent valuation survey was to estimate the non market value associated with retaining some of Miami-Dade County's agricultural and rural lands in a largely undeveloped state. To estimate the total non market value associated with retaining agricultural and rural lands, the analysis first estimated the average per household value from survey responses and then applied that value to all households in the county.

This section first reviews the willingness to pay responses - respondents' answers to whether they would be willing to donate money to retain land. It then describes how average household willingness to pay (donate in the language of the questionnaire) was estimated from the discrete choice (donate/don't donate) survey responses. An alternative estimation method was used to determine the factors that affect an individual's donation choice. Finally, the section presents estimates of the total value associated with retaining agricultural and rural lands aggregated over all households in Miami-Dade County.

Survey Responses About Values

The valuation scenario asked respondents whether or not they would make a voluntary donation to a non profit conservation organization to permanently retain some agricultural and rural lands in undeveloped use. The strong negative reaction among focus group respondents to any increase in taxes led to the decision to use the donation payment structure. While voluntary donation mechanisms may not be as incentive compatible as a tax (Hoehn and Randall 1987), they can produce reliable estimates of value if carefully designed and administered (Champ et al. 1997).

The questionnaire asked respondents how certain they were to make the proposed donation. Possible responses ranged from zero (certain not to donate) to ten (certain to donate). About half of the respondents (52 percent) gave certain responses, either certain to donate or certain not to donate. Many of the remaining respondents (22 percent of all responses) were "not sure" whether they would donate or not (a response halfway between certain not to donate and certain to donate). Only 26 percent expressed levels of uncertainty other than the neutral "not sure" response. Table 7 summarizes responses at each proposed donation amount. Responses in Table 7 have been weighted to represent all households in Miami-Dade County. Appendix C contains the unweighted responses.

Common statistical techniques for analyzing discrete choice contingent valuation responses require certain yes or certain no responses that imply certainty. Thus, the actual responses were

recoded to a yes/no format. Recent research suggests that interpreting "certain to donate" responses as "yes" and all other responses as "no" closely reflects actual donation behavior (Champ et al. 1997). This approach is also the most conservative in terms of estimating the value of retaining land. This study followed the conservative approach of Champ, et al. in interpreting donation responses. Table 8 summarizes donation choices as yes/no responses with no uncertainty.

The responses summarized in Table 8 indicate that respondents made economically rational choices. Economic theory suggests that the proportion of respondents who will agree to donate money will decline as the amount of the proposed donation increases. In general, this relationship holds for the donation responses even though the probability does not decline smoothly with increases in the proposed donation amount. The relationship is statistically significant with a probability of only one percent that it is due to chance. Economically meaningful responses suggest that respondents made the reasoned economic choices that are necessary for valid estimates of value.

Average Household Willingness to Donate

Average per household willingness to donate is obtained from discrete choice (yes/no) responses by estimating the probability that an individual chosen at random will donate a specified amount of money. As the amount of the proposed donation increases, the proportion of people willing to donate decreases. Thus, responses describe a probability distribution that defines the probability of making a donation as a function of the magnitude of the proposed donation as well as other variables of interest. The mean of the probability distribution is usually interpreted as the average household willingness to donate.

There are two ways to estimate the probability distribution of willingness to donate that provide the basis for estimates of average per household values. One approach is to assume a particular distribution - most often the normal or logistic - and then to estimate the parameters of the distribution from the data. This approach has the advantage of being able to estimate the effects of explanatory variables like income, age, and other factors on a respondent's donation choice. The method also generates statistical measures of the reliability of the estimated distribution. The approach has the disadvantage of imposing a particular probability distribution on the data. If the distributional assumption is incorrect, estimates may be inconsistent (Greene 1993).

An alternative, nonparametric, approach avoids imposing a distributional assumption but does not permit estimating the impacts of other factors on donation choice. The nonparametric approach estimates lower and upper bounds on average per household willingness to donate. This study uses the nonparametric approach to estimate average per household willingness to donate. It uses a parametric approach to estimate the influence of other factors on willingness to donate.

Nonparametric Estimates of Average Willingness to Donate

The ten different proposed donation amounts were randomly assigned to respondents. The group of respondents who received questionnaires with a particular donation amount is therefore a random sample of county residents. Thus, the proportion of respondents at each proposed donation amount that said they would be certain to donate is an estimate of the proportion of all Miami-Dade County residents that would be certain to donate that amount(Coslett 1983). For example, the estimates of Table 8 suggest that 62.5 percent of county residents would be willing to donate at least $5, that 35.7 percent would be willing to donate at least $50, and so on. As expected, the proportion

of respondents willing to donate generally decreases as the amount of the proposed donation increases.

Because of the relatively small number of responses for each suggested donation amount, the estimates of the proportion of the population willing to donate at each amount are somewhat imprecise. The level of imprecision is a function of the number of responses at each proposed donation amount. Table 9 shows a 90 percent confidence interval for each probability estimate. A 90 percent confidence interval defines a lower and upper bounds of an interval that is 90 percent certain to contain the actual probability. Thus, from the first row of the table, the probability that a Miami-Dade County household chosen at random would be willing to donate at least $5 is 90 percent certain to fall between 28.0 percent and 88.0 percent. The best guess of the actual probability is the point estimate of 62.5 percent.

The empirical (cumulative) probability distribution used to obtain nonparametric estimates must be nonincreasing - the probability of donation at any donation amount can not be higher than the probability at the next lowest donation amount. Because of the relatively small sample sizes, the observed proportion of respondents willing to donate does not always decline with increases in the donation amount. To calculate lower and upper nonparametric bounds on willingness to pay, the data must be aggregated into intervals in which probability is nonincreasing (Turnbull 1974). The technique combines data from adjacent intervals where probability is increasing until a nonincreasing function is obtained.

Table 10 shows the final empirical distribution of willingness to pay. The column labeled "cumulative distribution" shows the point estimate of the probability that a household chosen at random will be willing to pay at least the lower bound donation amount given in column one. Thus, there is a chance of 0.625 that a household chosen at random will be willing to pay $5 or more. The data indicate nothing about the maximum amount members of this group would be willing to pay, just that the minimum is $5. The next row gives an estimate of the proportion of households that would be willing to pay at least $25. Subtracting this estimate from the estimated proportion of households willing to pay at least $5 yields the proportion of households for which willingness to donate falls in the interval between $5 and just under $25. Thus, the final column of Table 10 gives the probability that a household chosen at random will be willing to donate an amount between the lower and upper bounds of the associated interval.

Discrete choice data do not yield enough information to determine the exact amount respondents are willing to pay within a particular interval of donation amounts. For instance, the data suggest that 38.7 percent of the population would be willing to donate between $5 and $25. For some, the maximum amount they are willing to donate may be $5. For others it may be $20. The lower (upper) bound on willingness to donate is derived by assuming that the entire proportion of the population that fall in a particular interval are willing to donate the lower (upper) bound of the interval. Thus the nonparametric lower (upper) bound estimate of average household willingness to donate is the sum over all intervals of the product of the lower (upper) bound of the interval and the proportion of the population for whom willingness to donate falls within the interval. Performing this calculation on the data in Table 10 yields a lower bound on average household willingness to donate of $98.94 and an upper bound of $237.45.

The lower and upper bounds derived in the previous paragraph represent the best estimates of average willingness to donate. Because of the relatively small number of observations for each donation amount, however, the probability estimates of Table 10 are somewhat imprecise. The technique described above can also be used to calculate estimates of average willingness to donate associated with the 90 percent confidence intervals shown in Table 9. While the best guess is that

average willingness to donate falls between the nonparametric bounds of $98.94 and $237.45, it is 90 percent certain to fall within the interval between $28.90 and $496.60.

Factors Influencing Willingness to Donate

The nonparametric analysis described in the previous section provides estimates of average willingness to donate. It does not estimate the impact of factors other than donation amount on willingness to donate. Economic theory suggests that factors such as age, income, and education may affect individual willingness to donate. Furthermore, previous research suggests that willingness to donate for retaining agricultural and rural lands may depend on physical characteristics of the area in which respondents live, experience with undeveloped land, cultural background, and on the perceived importance of retention. The parametric estimation described in this section estimated the influence of these sorts of factors on average willingness to donate.

Knowledge of the influence of land use, socioeconomic, and other factors on willingness to donate is important for two reasons. First, comparison of estimates with expectations from economic theory and previous research provides a check on the consistency of responses. Responses that seem consistent with expectations from economic theory or previous research are likely more reliable than those that are inconsistent with expectations. Second, estimates of the influence of socioeconomic factors make it possible to adjust estimates of willingness to donate to account for discrepancies between characteristics of respondents and those of the population. For instance, in this study, respondents were somewhat older, wealthier, better educated, and more likely to speak English than would be expected in the general population (see Table 3). If these factors have a significant influence on willingness to donate, then the estimates from the collected data may not accurately represent the population of Miami-Dade County.

A probit model was used to estimate the determinants of willingness to donate. Alternative specifications of the model tested whether specific characteristics of respondents had statistically significant effects on willingness to donate. In particular, tests for internal consistency of responses examined whether the stated importance of preserving farmland and other undeveloped land (question 7), a stated willingness to consider making a donation to retain land (question 15), and a history of donation to environmental organizations (question 16) were significant determinants of willingness to donate. The correspondence between the perceived importance of retaining farmland and other undeveloped land and willingness to donate was very strong. Of the 31 respondents who said they were “certain to donate”, all but three said it was important to retain farmland and other undeveloped land. In fact, the correspondence was so close that the variable could not be included in the formal probit analysis. Both willingness to consider a donation and a history of donation were significantly related to a positive willingness to donate. These results suggest that respondents answered questions in a consistent manner.

Specifications of the probit model also tested whether socioeconomic factors had significant effects on willingness to donate. In particular, the analysis explored whether age, income, language, education, and the length of time a respondent had lived in Miami-Dade County influenced willingness to donate. None of these factors had a statistically significant effect on the willingness to donate response. Economic theory suggests that respondents with higher incomes would be more likely to make a donation than those with lower incomes. The estimated effect of income was positive as expected. However, probably because of the relatively small number of observations, the magnitude of the income effect was not statistically significant.

Table 11 defines the variables used in the final probit model. Table 12 reports the results of the probit analysis using these variables. The final model does not include the socioeconomic and other variables that were not statistically significant in alternative model specifications. The first column of Table 12 lists the variables contained in the model. The variable COST is the proposed donation amount. Consistent with expectations from economic theory and from the nonparametric model, the estimated coefficient of COST (the effect of the variable on willingness to donate) is negative and statistically significant. The effect of INCOME is positive as expected but not statistically significant. Both willingness to consider making a donation (DONATE) before the amount of the donation was known and a history of donation to environmental organizations (HISTORY) were positive and statistically significant determinants of a positive willingness to donate response.

Willingness to donate responses were not sensitive to the number of acres proposed to be retained in agricultural or undeveloped use. The coefficient of the variable ACRES is positive as expected (respondents would be expected to be more willing to donate to retain more land) but was not statistically significant. Alternative versions of the questionnaire proposed to retain 31,400 acres of land, 55,000 acres of land, or 78,700 acres of land. The fact that the number of acres proposed to be retained did not have a measurable impact on respondents' willingness to donate could mean several things. First, it could mean that respondents are largely indifferent between retaining these different amounts of land. Perhaps retaining 31,400 acres of land would achieve most respondents' objectives for retaining land and retaining additional land would produce little or no additional value. Many were clearly not indifferent, however, between retaining no land and retaining the proposed amount of land. Whatever the reason, the results suggest that residents of Miami-Dade County are willing to donate as much to retain 31,400 acres of agricultural and rural land as to retain 78,700 acres of land.

A key reason for the parametric analysis was to provide a means to adjust the willingness to donate estimates to account for the fact that respondents were generally older, wealthier, better educated, and more likely to speak English than the general population. However, because none of these variables were statistically significant determinants of willingness to donate, there is little basis for adjusting the estimates. Income was the most statistically significant of the socioeconomic variables. Since the median income of all households is (barely) within the median income interval for respondents, however, there is, again, no basis for adjusting the average household willingness to donate estimates based on differences in income.

Non Market Value of Miami-Dade County's Agricultural and Rural Lands

The purpose of this study was to estimate the value Miami-Dade County residents place on retaining agricultural and rural lands. The nonparametric analysis generated lower and upper bounds for average per household willingness to donate money to retain land in agricultural and rural use.

Estimating a total value (to all households in the county) associated with retaining agricultural and rural lands is simply a matter of multiplying average per household values by the number of households. The 2000 Census reported 776,774 households in Miami-Dade County in 2000. The Census Bureau has not released projections for the number of households in 2003. However, between 1990 and 2000, the number of households increased at an annual rate of just over

one percent.[8] At this rate of growth, Miami-Dade County would contain as many as 800,311 households in 2003.

Multiplying the number of households by income adjusted estimates of average household values yields estimates of total value ranging from about $79.18 million to about $190.03 million. The 90 percent confidence interval for total willingness to donate is $23.13 million to $397.51 million. Table 13 summarizes estimates of the non market value associated with retaining some of Miami-Dade County's agricultural and rural lands.

Conclusions

Both focus groups and a survey of Miami-Dade County households revealed strong public support for retaining some agricultural and rural lands in the southern part of the county. Focus group participants spoke of the rapid population growth in Miami-Dade County and how that growth had affected their quality of life. They generally believed it was important to retain some farmland and other undeveloped land for environmental and quality of life reasons. Survey respondents provided a quantitative measure of the level of concern about retaining undeveloped land. They ranked the loss of farmland and other undeveloped land second only to traffic congestion as the growth-related problem that concerned them most.

Agricultural and other rural lands are important for a number of reasons. A large majority of county residents use undeveloped lands for recreation. In addition to the recreational benefits of publicly owned undeveloped land, many focus group participants and survey respondents believed that these lands contributed crucially to maintaining environmental quality, wildlife habitat, and quality of life. Many believed it was specifically important to retain farmland because they believed it was important to preserve the local agricultural industry and heritage and to protect access to locally grown food.

If Miami-Dade County decides to develop a land retention program, it should carefully consider what amenities county residents associate with agricultural and rural lands, the relative value of those amenities, and the mix of undeveloped land that would provide the amenities most valued. In general, county residents appear to value farmland for its contribution to the agricultural industry and as a source of locally grown food available primarily through farmers markets. They value other undeveloped land primarily for its contribution to wildlife habitat and maintaining the quality of the environment - although farmland contributes to both of these functions better than does developed land.

Although residents have the most directly experience with publicly owned land, they place a high value on retaining private land in an undeveloped state. When asked how they would allocate land preservation efforts across different types of undeveloped land, survey respondents allocated just under half to agricultural land, about 30 percent to preserving other undeveloped land, and only about a quarter to providing additional public land for recreational use. Respondents from urban and rural areas did not differ significantly in their preferences for retaining different types of undeveloped land.

While there is substantial agreement that it is important to retain some agricultural and rural lands, there is less agreement about how to retain land. About three-quarters of survey respondents believed it was important to financially compensate landowners for any loss in the value of land as

[8] The 1990 Census reported 692,355 households in Miami-Dade County in 1990.

a result of retention efforts. On the other hand, zoning, which does not compensate landowners, was the most acceptable retention tool. Almost 70 percent believed that Miami-Dade County should consider purchasing land outright or purchasing development rights as a means to retain some undeveloped land.

Focus group participants seemed to favor lower density residential development to higher densities. Their primary concern with higher density residential development seemed to be related to increased congestion rather than scenic or environmental concerns. In general, however, county residents seemed willing to accept increasing density in already developed areas - urban and suburban areas - in order to keep some farmland and other undeveloped land from being developed. Most survey respondents seemed willing to accept a mix of rural (five acre lots) and higher density suburban (3 to 6 homes per acre) residential development if it allowed some land to be retained in agricultural and other undeveloped use.

A majority of county residents would consider financially supporting a program to permanently retain some agricultural and rural lands in the southern part of the county in an undeveloped state. The number of households that would be willing to support a program depends on the cost and, perhaps as importantly, on how they are asked to pay. If the payment is in the form of a voluntary donation to a nonprofit conservation organization, over 60 percent of households would likely be willing to make a one-time donation of between $5 and $25.

Paying for a retention program through taxes to local government may be unacceptable to many households. The focus groups suggested that many people mistrusted local government to either use money collected through taxes in the manner intended or to manage a land retention program effectively and without a political agenda. Because of the strong objection to taxes, the survey research did not address the issue of a tax to finance land retention. Thus, it is not possible from the research to quantify support for a tax financed land retention program. The qualitative research suggests, however, that local governments will have to work hard to redeem their public image and provide strong assurances that money will be used as intended in order to institute a tax financed retention program.

Values Associated with Alternative Development Scenarios

One objective of the Agricultural and Rural Area Study was to estimate the market and non market benefits associated with three alternative development scenarios. The scenarios included: (1) a rural residential scenario, (2) a suburban residential scenario, and (3) a preferred development scenario. The rural residential scenario corresponds to Alternative A in the contingent valuation survey where new development in the agricultural area would continue at a density of one house per five acres. Under the rural residential scenario, there would be a projected 38,308 new residents in the agricultural area by the year 2025. The new residents would require 13,489 additional single family homes built on a total of 67,445 acres of land - almost all of the remaining undeveloped land.

The suburban residential scenario corresponds to Alternative B in the contingent valuation survey. The suburban residential scenario assumes that the predominant future development in the agricultural area would be at an average density of 4.5 dwelling units per acre. The expansion of residential development at this density would occur adjacent to existing suburban residential development. Projects suggest that the suburban residential scenario would result in 254,619 additional residents in the agricultural area by the year 2025. These residents would require 89,654 new homes that would cover approximately 19,923 acres of currently undeveloped land - leaving a substantial amount of land (approximately 67,949 acres) in agricultural or other undeveloped use.

The three versions of Alternative B used in the contingent valuation survey proposed to retain either 31,400 acres, 55,000 acres, or 78,700 acres of agricultural and other undeveloped land. The experimental design thus includes the amount of undeveloped land projected under the suburban residential scenario. Survey respondents were not sensitive to the number of acres proposed to be retained. That is, they were equally likely to be willing to donate the proposed amount of money whether the proposed program would retain 31,400 acres, 55,000 acres, or 78,700 acres of agricultural and other undeveloped land. Thus, the survey results suggest that residents of Miami-Dade County are willing to pay an average of between $98.94 and $237.45 per household to support a land retention program that would result in a development pattern consistent with the suburban residential scenario as opposed to the rural residential scenario.

The preferred development scenario would permanently retain about 75 percent of the current agricultural and other undeveloped land in the agricultural area in a largely undeveloped state. The scenario would retain development value consistent with the current allowable density of one dwelling unit per five acres and would either purchase development rights (PDR) and transfer development rights (TDR) to compensate landowners for reducing final gross density at buildout to about one dwelling unit per 20 acres. Implementing the preferred development scenario would require some source of financing with which to purchase development rights to agricultural and other undeveloped land.

The focus groups and the survey both indicated substantial support for a land retention program with the characteristics of the preferred development scenario. Estimates from the contingent valuation survey suggest that Miami-Dade County households would be willing to pay between $98.94 and $237.45 per household to support a purchase of development rights like program that permanently retained 75 percent of the existing agricultural and other undeveloped land in the study area. These per household values translate to between $79 million and $190 million in aggregate value over all households in Miami-Dade County.

Focus group participants and survey respondents believed that the appropriate development pattern in the agricultural area was one that increased residential density in areas adjacent to existing development in order to retain some undeveloped land - a development pattern consistent with the preferred development scenario. A willingness to accommodate higher residential densities adjacent to, or within, existing residential areas in exchange for retaining some undeveloped land is also consistent with the TDR component of the preferred development scenario.

While the contingent valuation survey suggests that many households are willing to financially support a program to retain some agricultural and other undeveloped land, focus group participants, and survey respondents, expressed some resistance to financing such a program through taxes. To the extent that the preferred development scenario places the cost of retention on developers or new home buyers through the proposed TDR component instead of on all households through the PDR component, it will likely be more acceptable to a greater number of county residents. Both the PDR and TDR components should appeal to those households (roughly three-quarters of survey respondents) who believed it was important that a retention program compensate landowners for any loss in property value such a program would entail.

The contingent valuation survey results also suggest that county residents would support a program that focused primarily on retaining lands in agricultural use. They also believed it was important to protect other undeveloped land that as not used for agriculture, primarily for environmental reasons, and to provide some additional publicly accessible land. These preferences could be satisfied through a parallel retention program that focused on such lands or they could be

integrated into the selection criteria for the PDR and TDR components of the preferred development scenario.

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Table 1. Summary of Focus Group Characteristics

Region represented	Language	Number of participants
Aventura, Sunny Isles, North Miami Beach, North Miami, Opa Locka, Miami Gardens	English	11
Miami Beach, Miami Shores, Miami, Hialeah, Miami Springs	Spanish	12
Miami Lakes, Doral	English	10
Brickell, Key Biscayne, Coral Gables, Coconut Grove, South Miami	English	12
Kendall	Spanish	10
Redlands, Homestead, Florida City, South Dade	English	10

Table 2. Parameters of Contingent Valuation Scenarios

Parameter	Alternative A (do nothing)	Alternative B		
		Version 1	Version 2	Version 3
Acres of undeveloped land	0	31400	55000	78700
Acres of protected undeveloped land	0	31400	55000	78700
Acres of rural residential development	99600	64500	39800	15000
Acres of suburban development	29700	31100	32200	33300
Cost to respondent's household	$0.00	Varied[a]	Varied[a]	Varied[a]

a. Different versions of the questionnaire presented different donation amounts.

Table 3. Characteristics of Respondents Compared to Population

Characteristics	Respondents	Population
Average age (years)	54	47[a]
Median household income ($)	$35,000 - $49,999	$35,966[b]
Mean education level	College degree	Some college[c]
English responses (%)	82	n.a.
Spanish responses (%)	18	n.a.
Raised in U.S. (%)	66	n.a.
Land owners (%)	3	n.a.
Urban stratum (%)	43	50
Rural stratum (%)	57	50

a. Average age of residents over 19 years of age - 2000 Census of Population and Housing.
b. 2000 Census of Population and Housing.
c. Educational attainment of population 25 years of age and older - 2000 Census of Population and Housing.
e. Represents sample percent rather than population percent.
Note: n.a. means that data was not available for comparison.

Table 4. Relative Concern About Impacts of Growth

Growth impact	Responses	
	Number	Percent[a]
Traffic congestion	121	73.9
Loss of farmland and undeveloped land	52	31.5
School crowding	47	28.6
Water shortages	32	19.8
Increased crime	31	18.8
Air and water pollution	28	17.1

a. Proportion of respondents who reported impact as one of the two with which they were most concerned.

Note: Weighted to reflect all households.

Table 5. Use of Undeveloped Land by Stratum

Land type	All respondents[a]		Rural stratum		Urban stratum	
	Number	Percent	Number	Percent	Number	Percent
National or state parks and natural areas	97	57.5	67	63.8	43	55.1
Local public parks	129	76.4	86	81.9	58	74.4
Public beach	112	66.1	68	64.8	52	66.7
Undeveloped private land/farmland	70	41.2	65	61.9	26	33.3
None	19	11.2	7	6.7	10	12.8

a. Weighted to reflect all households.

Table 6. Reasons for Retaining Farmland and Other Undeveloped Land

Reason	Responses	
	Farmland[a] (%)	Other undeveloped private land[a] (%)
Preserve county's scenic beauty	18.2	36
Maintain quality of environment	35.5	52.2
Provide habitat for wildlife	15.9	41.8
Slow growth and development	31	33.4
Provide source of locally grown food	35.5	n.a.
Protect agricultural industry	53.9	n.a.
Provide opportunities for public recreation	n.a.	28.5

a. The proportion of respondents who chose a particular reason as one of the two most important.

Note: Weighted to reflect all households.

Note: n.a. means not asked

Table 7. Donation Choice by Donation Amount and Level of Certainty

Proposed donation	Responses by level of certainty (number & percent)										
	0	1	2	3	4	5	6	7	8	9	10
$5.00	2 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (66.7)
$25.00	5 (71.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (28.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
$50.00	4 (30.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (30.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (38.5)
$100.00	3 (23.1)	2 (15.4)	0 (0.0)	0 (0.0)	0 (0.0)	4 (30.8)	1 (7.7)	0 (0.0)	1 (7.7)	0 (0.0)	2 (15.4)
$200.00	4 (22.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (16.7)	0 (0.0)	0 (0.0)	4 (22.2)	5 (27.8)	2 (11.1)
$300.00	12 (54.5)	1 (4.5)	0 (0.0)	0 (0.0)	0 (0.0)	2 (9.1)	0 (0.0)	2 (9.1)	2 (9.1)	0 (0.0)	3 (13.6)
$400.00	10 (38.5)	0 (0.0)	2 (7.7)	0 (0.0)	0 (0.0)	5 (19.2)	0 (0.0)	0 (0.0)	2 (7.7)	0 (0.0)	7 (26.9)
$500.00	5 (25.0)	2 (10.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (35.0)	2 (10.0)	0 (0.0)	0 (0.0)	2 (10.0)	2 (10.0)
$1,000.00	9 (33.3)	0 (0.0)	3 (11.1)	0 (0.0)	2 (7.4)	5 (18.5)	2 (7.4)	2 (7.4)	2 (7.4)	0 (0.0)	2 (7.4)
$2,000.00	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Note: Weighted to reflect all households. Unweighted responses in Appendix C.

Table 8. Donation Choices

Proposed donation	Number of responses	Donation choice (%)[b]	
		Yes	No
$5.00	8	62.5	37.5
$25.00	7	0	100
$50.00	14	35.7	64.3
$100.00	14	14.3	85.7
$200.00	19	10.5	89.5
$300.00	24	12.5	87.5
$400.00	29	24.1	75.9
$500.00	21	9.5	90
$1,000.00	26	7.7	92.3
$2,000.00	5	0	100

a. Responses 0 (certain not to donate) through 9 coded as "no." Only 10 (certain to donate) coded as "yes".
b. Weighted to reflect households.

Table 9. Confidence Intervals for Donation Choices

Proposed donation	Point estimate of probability of donation	90% confidence interval bounds	
		Lower	Upper
$5.00	62.5	28	88
$25.00	0	0	34
$50.00	35.7	15	62
$100.00	14.3	3	38
$200.00	10.5	2	29
$300.00	12.5	3	29
$400.00	24.1	12	41
$500.00	9.5	2	27
$1,000.00	7.7	2	23
$2,000.00	0	0	45

a. Only "certain to donate" responses coded as "yes." All others coded as "no."
b. Weighted to reflect households.

Table 10. Nonparametric Distribution of Donation Choice

Donation amount interval		Cumulative distribution	Probability of agreeing to donate an amount in interval
Lower bound	Upper bound		
$0.00	$5.00	1	0.375
$5.00	$25.00	0.625	0.387
$25.00	$100.00	0.238	0.044
$100.00	$500.00	0.194	0.099
$500.00	$1,000.00	0.095	0.018
$1,000.00	$2,000.00	0.077	0.077
$2,000.00	$2,000.00	0	0

Table 11. Variable Descriptions

Variable	Description	Minimum	Maximum	Mean
COST	Amount of proposed donation	$5.00	$2,000.00	$428.30
ACRES	Number of undeveloped acres retained	31400	78700	53640
INCOME	Log of household income	8.52	12.21	10.62
DONATE	Would consider making a voluntary donation to retain undeveloped land	0	1	0.41
HISTORY	History of donation to conservation organizations	0	1	0.31

Table 12. Estimated Probit Model

Variable	Description	Estimated coefficient[a]	Standard error
Constant	Intercept	-3.5492*	1.9138
COST	Proposed donation amount ($)	-0.1668E-2***	0.0006
ACRES	Acres retained (acres)	0.000003	0
INCOME	Log of income (dollars)	0.1848	0.1742
DONATE	Would consider donation	1.4073***	0.3263
HISTORY	History of donation	0.5324*	0.313

a. Indicator of the impact of one unit change in a variable on probability of making a donation.

Note: The estimated model correctly predicts 124 of 153 donte/don't donate choices.

Note: * means a variable is significant at the α=0.10 level. *** means a variable is significant at the α=0.01 level.

Table 13. Willingness to Donate to Retain Agricultural and Rural Lands

Estimate	Lower bound of 90 percent confidence interval	Nonparametric bounds		Upper bound of 90 percent confidence interval
		Lower	Upper	
Average per household[a]	$28.90	$98.94	$237.45	$496.69
Total willingness to donate[b]	$23.13 million	$79.18 million	$190.03 million	$397.51 million

a. Average per household willingness to donate adjusted for differences in income between respondents and population.

b. Total willingness to donate for all households in Miami-Dade County based on an estimate of 800,311 households in 2003.