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## PUBLIC ENVIRONMENTAL AMENITY BENEFITS OF PRIVATE LAND: THE CASE OF PRIME AGRICULTURAL LAND

John C. Bergstrom, B. L. Dillman, and John R. Stoll

### Abstract

Failure of land markets to account for environmental amenity benefits may lend support to public policies to protect agricultural land. The contingent valuation method is employed to estimate willingness to pay for such amenities in Greenville County, South Carolina. Marginal household amenity benefits were estimated at \$.06 per thousand acres using a payment card in a mail survey with 53 percent response. Bid payment vehicle was found not to significantly influence bids received. The informational structure of the contingent market was found to influence valuation responses, reinforcing the hypothesis that respondents react to alternative contingent market structures. The relationship between contingent market structure and directional effects upon responses is an important area for future research.

*Key words:* prime land, public policy, environmental amenities, contingent valuation.

The conversion of prime agricultural land (hereafter referred to as prime land)<sup>1</sup> to urban and related uses is considered by many people to be one of the more important land use problems now facing the United States. Many state and local governments have already adopted prime land protection programs of one kind or another, and the federal government, perhaps the largest single contributor to farmland conversion, included a Farmland Protection Policy (FPP) in the Agricultural and Food Policy Act of 1981 (Col-

ins; MacMullan). The economic justification for public intervention into the private agricultural land market, however, is unclear. One fairly controversial reason given for public intervention is the need to protect the environmental amenities provided to the public by privately held prime land. Two questions which are central to this controversy are addressed in this paper: (1) Are there conceptual reasons for suspecting that private land markets fail to adequately consider the environmental amenities provided by prime land?; and, (2) Are the environmental amenities provided by prime land a relatively large and therefore important benefit of prime land retention?

### CONCEPTUAL CONSIDERATIONS

#### Definitions

The existing literature is vague concerning the precise meaning of the environmental amenities provided by prime land (hereafter referred to as prime land amenities). In general, prime land amenities are the bundle of aesthetic and psychological benefits generated by natural or manmade aspects of the agricultural environment. More specifically, prime land amenities are defined as the scenic value of agricultural land and the environmental qualities of agricultural land which give it "nostalgic value."

Five elements of the agricultural environment combine to create what has been called the countryside landscape. These elements

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<sup>1</sup> Prime land is defined generally by the Soil Conservation Service as land best suited, primarily in terms of physical characteristics, for producing agricultural products (Cousins and Dillman).

are: topography, vegetation, water, sky, and manmade structures (Cox et al.; Cordell et al.; Schauman; Sinclair). Different degrees and combinations of these five elements produce landscapes which differ in visual quality. For instance, a more primitive agricultural setting composed of quaint barns and rustic wood fences may be more visually pleasing than a modern, commercial setting composed of prefabricated metal buildings and galvanized fences. For some individuals, however, the converse may hold.

There appear to be two major components of the nostalgic value of agricultural land. The first component relates to a desire to preserve a visual reminder of America's rural heritage (Hite and Dillman). The second, closely related, component focuses on the inherent goodness that many people associate with farm life. Research has shown that people believe that farm life produces basically good and morally strong citizens. Thus, rural and urban people may gain psychological benefits from the observation that others are living a rural lifestyle (CAST). As with scenic value, the magnitude of nostalgic value is likely to vary with the type of agricultural environment under consideration (e.g., large commercial farm vs. small family farm).

To summarize, prime land amenities are inputs into a household production process from which are derived scenic and nostalgic value. Scenic value is conceptualized as a nonconsumptive *use value* of agricultural land. That is, the general public gains utility from viewing private agricultural land without encroaching upon it (e.g., viewing from the roadside). To the extent that it is dependent on actual observation, nostalgic value is an additional nonconsumptive *use value* of private agricultural land. In the case that nostalgic value is gained simply from knowing that prime land exists, nostalgic value is conceptualized as a type of *existence value* which does not involve present or expected future use (for further discussion of concepts of value within a total value framework, see Randall and Stoll, 1983). The concepts of scenic and nostalgic value are obviously interrelated and not likely separable.

### Valuation Concepts

When prime land is protected, the environmental amenities provided by it are also

protected and open to the general public to "consume" on a nonexclusionary basis. Moreover, consumption exhibits elements of nonrivalry. That is, all consumers receive the same quantity of amenities since "consumption" by one person does not reduce the amount of amenities available to anyone else. Because of the characteristics of nonrivalry and nonexclusivity, prime land amenities escape adequate consideration by private land markets, giving rise to externalities. The externalities are in the form of *external benefits* which accrue to the general public when private agricultural land is retained. The presence of these external benefits suggests that prime land may be undervalued and underprovided by private land markets. Correction for external environmental amenity benefits provides a *potential* justification for public action to protect prime land. Final justification from an economic efficiency standpoint would depend on the magnitude of the environmental amenity benefits of prime land retention and the social costs of retention programs.

A quote from a National Agricultural Lands Study publication provides a striking example of how environmental amenities are usually considered in the prime land protection literature:

*As prime farmland disappears, food is not our only loss. The quality of our lives is diminished. There are garish signs and glaring storefronts where leaves once caught the rain and filtered the sunlight. There is asphalt where fields and woods once beckoned and refreshed the spirit. There is the loss, also, of farm family life, and the values that spring from living close to the land (Fields).*

Such rhetoric may win emotional support for prime land protection, but is of little value to policymakers who are interested in the economics of the issue. A first step towards determining the net benefits of prime land retention is to quantify the environmental amenity benefits of prime land retention. However, because competitive markets for the trade of prime land amenities do not exist, nonmarket valuation techniques must be utilized to value prime land amenities (Randall, 1983; Samuelson).

The retention of prime land generally involves a nonmarginal change in prime land amenities. Convincing arguments have been

put forth that nonmarginal changes are best handled by total value curve analysis (Bradford; Randall, 1981). A total value curve relates total willingness to pay by consumers to alternative "packages" of the good in question. Estimation of a total value curve allows a Hicksian demand curve to be derived for that good. Consumer's surplus, the preferred measure of the value of environmental amenities, can then be estimated for various quantities of amenity provision (Brookshire et al., 1980; Randall and Stoll, 1980).

In this study the contingent valuation method was used to estimate a total value curve for prime land amenities. The total value curve provides direct estimates of the external environmental amenity benefits of private agricultural land (Bergstrom). Contingent valuation was chosen over other non-market valuation techniques primarily because of its flexibility, previous use in a variety of valuation contexts, and applicability in the present situation. The advantages, as well as the disadvantages, of contingent valuation have been adequately discussed elsewhere (Brookshire and Crocker; Brookshire et al., 1976; Brookshire et al., 1980; Davis; Hoehn and Randall; Schulze et al.; Sellar et al.).

## METHODOLOGY

### Study Area

The site of the study was Greenville County, located in the Piedmont region of the State of South Carolina. Greenville County is typical of regions faced with a tradeoff between agriculture and urban-industrial development. In the past, the County was primarily agricultural. In recent years, however, the County has experienced rapid urban and industrial growth. Previous research in the Greenville-Spartanburg Standard Metropolitan Statistical Area (SMSA) has shown that urban-industrial development occurs mainly on the County's prime land (Cousins and

Dillman). The loss of prime land to development, and what to do about it, has been an issue of growing concern in Greenville County. Many residents are aware of the issue; thus, it was believed that they would be quite responsive to questioning about the subject.

Data for estimating a total value curve for prime land amenities were collected using a mail survey conducted in the winter and spring of 1981-82. Questionnaires were sent to 600 randomly selected Greenville County households. A total of 130 questionnaires of the original 600 mailed were undeliverable primarily because of incomplete addresses.<sup>2</sup> Of the 470 questionnaires received by sample households, 250 were returned, yielding a final response rate of 53 percent.

### Questionnaire Design

The questionnaire began with some preference/attitude type questions which dealt with a respondent's qualitative beliefs relative to prime land protection; these were designed to "warm up" the respondent and help focus attention on the prime land protection issue. Respondents were acquainted with the idea of paying for environmental amenities by reminding them that the public already pays for many types of environmental amenities, e.g., entrance fees to public parks. After these brief preliminaries, the contingent market for the valuation of prime land amenities was introduced.

The contingent market sought to measure household willingness to pay (WTP) for prime land amenities. The contingent market used was modeled after those constructed by Brookshire et al., 1976; Rowe et al.; and Thayer. In the first two studies, WTP to prevent the construction of power plants for aesthetic reasons was measured. In the Thayer study, WTP to prevent geothermal development in a National Forest for aesthetic reasons was measured.

The first question was for the respondent to consider a set of photos ("Situation A")

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<sup>2</sup> The sampling frame was developed from county telephone directories. Telephone directories were the most readily available sources of names and addresses for the sampling frame. Sampling bias was thought to be minimal considering that the percentage of United State's residences having telephones has reached an all time high of 94 percent (Dillman). The major disadvantage of telephone directories in this study was the high incidence of incomplete addresses. Property tax roles or voter registrations, although sometimes more difficult to access, may provide suitable alternatives.

which depicted developable areas of prime land in Greenville County which had not yet been developed. Photos of this land were taken with the aid of a county prime land map prepared by the Soil Conservation Service.<sup>3</sup> The photos in "Situation A" were selected to present prime land in its most aesthetically pleasing state based on the five visual quality characteristics discussed previously (e.g. topography, vegetation, water, sky, and manmade structures).

The respondent was then asked to consider a second set of photos (Situation B) which depicted how the areas shown in "Situation A" might look if they were developed for residential, industrial or commercial uses. The photos in "Situation B" were selected to represent prime land in a heavily developed state. Thus, the move from Situation A to Situation B was an "undeveloped" to "very developed" scenario change. After viewing these photos, the respondent was asked to state a bid for preventing the occurrence of "Situation B", that is preserving "Situation A". The respondent was asked explicitly to assume that the only benefit that could be expected from preserving "Situation A" was the protection of the environmental amenities provided by prime land (e.g., the protection of the scenic and nostalgic value of prime land). A contingent market was thus established in the questionnaire where the respondent was bidding for the retention of prime land amenities.

Because of the overall questionnaire design and the fact that the survey was targeted to heads of households, it was expected that respondents would bid in terms of their households. However, the valuation question itself was asked in individual form (e.g., "how much would *you* be willing to pay each year for prime land amenities?"). This procedure for collecting household bids is common in previous contingent valuation studies. Even if some respondents did happen to bid on

an individual basis, interpreting all bids (including these) on a household basis reduces the possibility of overestimating benefits when aggregating over a general population.

The questionnaire was modified so that a total curve could be estimated describing the value of the environmental amenities provided by different quantities of prime land. In line with arguments made by Bradford, the *quantity* of prime land protected may have an effect on the perceived aesthetic *quality* of that land. Thus, it is desirable to know how WTP for prime land amenities is related to varying quantities of prime land considered. This objective was accomplished by asking each respondent to state a maximum WTP for prime land amenities under the following four contingent situations; only  $\frac{1}{4}$  of the existing prime land in the County would be protected (18,000 acres); only  $\frac{1}{2}$  of the existing prime land in the County would be protected (36,000 acres); only  $\frac{3}{4}$  of the existing prime land in the County would be protected (54,000); and all of the existing prime land in the County would be protected (72,000 acres). This formulation is consistent with deriving a total value curve based upon elicitation of WTP to avoid loss of prime land amenity benefits, a Hicksian equivalent surplus measure of welfare change.<sup>4</sup> The first derivative of this total value curve generates an inverse Hicksian compensated demand curve for prime land amenities (Bradford; Brookshire et al., 1980; Randall and Stoll, 1980).

*Payment Vehicle Influence:* The questionnaire design also included a test for payment vehicle influence. One group of respondents was sent a questionnaire in which they were told that payment for prime land protection would be in the form of increased county taxes. A second group was sent a questionnaire stating that payments would be in the form of yearly pledges to a private, county prime land conservation fund. Conclusions about the presence of payment ve-

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<sup>3</sup> One shortcoming of the questionnaire is that it did not include a scaled down version of this map. Such a map would have helped some respondents visualize at least some familiar areas of prime land in the County. Confusion over the location of prime land in the County, however, was not demonstrated or voiced in the returned questionnaire. There are currently 72,000 acres of prime land in Greenville County. This land is distributed fairly evenly throughout the County.

<sup>4</sup> For a loss of amenity benefits, the measure of welfare loss which is consistent with the potential Pareto improvement criterion is a Hicksian compensating measure of consumer's surplus. However, as Willig notes, if income effects are small, as suspected with respect to prime land amenities, the difference between Hicksian equivalent and Hicksian compensating measures of consumer's surplus are minimal. Thus, because previous research has shown that respondents generally react more favorably to a "willingness to pay" question rather than a "willingness to accept compensation" question, the former format was selected.

hicle bias were drawn by comparing the WTP for each of these groups.

**Questionnaire Informational Structure:** The informational structure of a contingent market may influence a respondent's WTP (Rowe et al.). To analyze the effect of information on WTP, one group of respondents was sent a questionnaire which included information about the major benefits of prime land protection, in addition to the protection of environmental amenities. Respondents were then asked to state their WTP for prime land protection under two assumptions: (a) they could expect to receive all of the benefits of prime land protection mentioned in the questionnaire; and (b) they could expect to receive only the environmental amenity benefits of protecting prime land. The information provided in the questionnaire thus helped the respondents to recognize the major benefits of protecting prime land, and to eliminate all benefits other than the retention of environmental amenities when stating their WTP for prime land amenities.

A second group of respondents received a questionnaire which contained no information about the benefits of prime land protection. This group was asked simply to assume that they would receive only environmental amenity benefits if prime land were protected. Thus, the second group had to disentangle all of the other benefits accruing from prime land protection on their own, and abstract these other benefits away from the environmental amenity benefits when stating their WTP for prime land amenities. A comparison of the WTP for the two groups allowed conclusions to be drawn about the importance of information in the contingent market.

### Model Specification

At the time this study was being conducted, a search of the literature produced no previous empirical study of the *environmental amenity* benefits of prime agricultural land. Halstead, since then, has conducted a related study for agricultural land in Massachusetts, although the value of the nonmarket good measured included more than amenity benefits. The conceptual model presented here is based primarily on nonmarket valuation

studies of non-agricultural related environmental amenities (Brookshire et al., 1976; Brookshire et al., 1980; Randall et al., 1978; Randall et al., 1974; Rowe et al.; and Thayer). In these studies, WTP for environmental amenities was argued to be a function of quantity, quality, and socioeconomic variables such as age, income, and education.

Generally, the *quality* variable was deemed most important in the previous studies because of the conceptual desirability of estimating a total value curve for aiding in policy analysis. A total value curve relates total WTP for a nonmarket good to the total quantity of the good provided. The overall objective in the Greenville County study was to derive a total value curve which shows the relationship between quantity (number of acres of prime land) and WTP for prime land amenities. Conceptually, the expected relationship is that total value (WTP) increases at a decreasing rate as the number of acres of prime land increases. Such a relationship means that the first derivative of the total value curve generates a downward sloping Hicksian compensated demand curve. Previous empirical studies are also supportive of this expectation (Brookshire et al., 1980; Rowe et al.; Sellar et al.; Randall et al., 1974).

Quality, distance, attitude/preference, and socioeconomic variables are potential indicators of differences among households which may cause the total value curve to shift. In this study, the total value curve was estimated for prime land of a constant quality (the "Scenario A" or "best" level). As argued by Halstead, the distance from a household to the nearest tract of prime land may influence WTP for prime land amenities. Because access becomes less costly as distance decreases, a negative relationship between distance and WTP is expected. Residents living in rural areas of Greenville County are more likely to be physically closer to prime land than urban residents. Area of residence was therefore used as a proxy for distance.

Attitude/preference factors which may influence WTP for prime land amenities include farm background, involvement in commercial agriculture, and involvement in commercial development. Because of experience, people with farm backgrounds may have a greater appreciation for and awareness of the scenic and nostalgic values of prime land than people without farm backgrounds.

Thus, farm background is expected to increase WTP. Similarly, involvement in commercial agriculture suggests a preference for rural/agricultural environments, and is expected to increase WTP (Bultena et al.). On the other hand, involvement in commercial development may suggest a preference for urban environments, and is expected to decrease WTP for prime land amenities.<sup>5</sup> Socioeconomic variables which may influence WTP for prime land amenities include income, age, and education. Previous research has shown that as these variables increase in magnitude, citizens' general support for environmental quality goals increases as well (Bultena et al.; Brookshire et al., 1980; Randall et al., 1974). Thus, each variable is expected to be positively related with WTP for prime land amenities.

The contingent market structure itself was also a possible influence upon WTP for prime land amenities. At the time of this study, public opinion in the United States was generally not supportive of increasing tax burdens, as shown by Proposition 13 in California. Thus, it was hypothesized that a tax payment vehicle may be more likely to encounter aversion on the part of respondents and, therefore, to lower WTP. The contingent market was also designed to test the hypothesis that WTP may be sensitive to the particular informational structure of the contingent market. One group of respondents was given benefit information designed to help them abstract away all other benefits besides the environmental amenity benefits when stating their WTP. Respondents given this information were expected to bid lower than respondents not given this information because the latter group may have inadvert-

ently included WTP for other benefits when stating their WTP for prime land amenities.

The functional relationship for the total value (WTP) curve, with the hypothesized signs on physical, attitude/preference, and socioeconomic variables, was expressed as:

$$(1) \text{ WTP} = \beta_0 + \beta_1 \text{ ACRES} - \beta_2 \text{ PAYV} - \beta_3 \text{ INFO} + \beta_4 \text{ INCOME} + \beta_5 \text{ FARMB} + \beta_6 \text{ AGE} + \beta_7 \text{ EDUC} - \beta_8 \text{ DEVEL} + \beta_9 \text{ AGRIC} + \beta_{10} \text{ RES},$$

where:

WTP = total willingness to pay for prime land amenities (\$/year);

ACRES = amount of prime land to be protected (thousand acres);

PAYV = payment vehicle (0 = fund contribution, 1 = county tax);

INFO = amount of benefit information given to respondent (0 = no additional info., 1 = additional info. given);

INCOME = family income level (thousand dollars);

FARMB = farm background (0 = no, 1 = yes);

AGE = age of respondent;

EDUC = highest level of education;

DEVEL = involvement in commercial development (0 = no, 1 = yes);

TABLE 1. TOTAL VALUE CURVE FOR PUBLIC ENVIRONMENTAL AMENITY BENEFITS OF PRIVATE AGRICULTURAL LAND, GREENVILLE COUNTY, SOUTH CAROLINA, 1982

Dependent variable	Parameter estimates and t values											R <sup>2</sup>	F	N
	Intercept	Acres	Payv	Info	Income	Farmb	Age	Educ	Devel	Agric	Res			
WTP .....	-2.794 (-.90)	.060 <sup>b</sup> (2.39)	-1.302 (-1.27)	-5.069 <sup>b</sup> (-4.76)	.015 <sup>a</sup> (4.02)	-1.157 (-1.07)	.084 <sup>a</sup> (2.37)	2.158 <sup>a</sup> (3.51)	-2.027 (-1.27)	-2.335 (-.97)	1.592 (1.17)	.136	8.90 <sup>a</sup>	504
WTP .....	-4.088 (-1.38)	.060 <sup>c</sup> (2.39)	—	-5.286 <sup>a</sup> (-5.19)	.016 <sup>a</sup> (4.16)	—	.086 <sup>b</sup> (2.50)	2.109 <sup>a</sup> (3.47)	—	—	—	.138	17.24 <sup>a</sup>	508

<sup>a</sup> Significant at .01 level. <sup>b</sup> Significant at .05 level. <sup>c</sup> Significant at .10 level.

<sup>5</sup> One could postulate that rural oriented persons are more likely to take the amenity benefits of their lifestyle for granted, and that scarcity of prime land amenities in and around urban areas may prompt a greater concern among urban oriented persons for the retention of remaining prime land. These attitude/preferences are possible, but are not expected to be overriding.

- AGRIC = involvement in commercial agriculture (0 = no, 1 = yes); and
- RES = area of residence (0 = urban, 1 = rural).

## RESULTS

Ordinary least squares estimates of the conceptual model parameters are presented in Table 1, Row 1. These estimates are adjusted for protest bids.<sup>6</sup> Alternative model specifications which allowed for the acreage variables to exhibit a declining marginal relationship with WTP were tested. The hypothesis, however, that the relationship between WTP and the number of acres was linear could not be rejected. The linear form of equation (1) was therefore retained, and tentatively accepted as valid for the Greenville County case study region.

As indicated in Table 1, Row 1, variables relating to the payment vehicle, farm background, involvement in commercial agriculture, involvement in commercial development, and residence were not statistically significant.<sup>7</sup> An alternative model was therefore estimated without these variables which is more convenient for total value curve estimation. The estimates for this model are presented in Table 1, Row 2. Common statistical considerations, such as multicollinearity, autocorrelation, and heteroskedasticity were tested for and these were judged to present no overriding problems.<sup>8</sup>

For the Table 1, Row 2 model, the F-statistic indicated that the estimated equation accounted for a statistically significant proportion of the total variation in the dependent variable. The signs of the parameter estimates

are consistent with *a priori* expectations. The hypothesis that the number of acres protected did not significantly influence WTP was rejected. Specifically, it was found that every thousand acres added \$.06 to the total value of prime land amenities for the average household in Greenville County. The hypothesis that benefit information did not significantly influence WTP was rejected. It was found that respondents who did not receive information on the specific benefits of prime land retention bid approximately \$5.29 more than those who did receive this benefit information. This result confirmed the *a priori* supposition that, without benefit information, respondents would be unable to separate amenity value from other benefits such as food supply, local economic benefits, and more orderly economic development. The implication for future research is that respondents in a contingent valuation exercise may require a carefully structured set of information in order to provide accurate responses to complex valuation problems.

The hypothesis that family income did not influence WTP was rejected. In general, it was found that WTP increased with family income. In addition, two more socioeconomic variables (AGE and EDUC) were positively related to WTP for prime land amenities. These results provide further evidence that age, income, and education may provide reasonable indicators of general support for environmental quality goals.

A household total value curve was estimated using the second equation in Table 1 by expressing the dependent variable, WTP, as a function of the independent variable, ACRES, with the other variables being entered at their mean values. The INFO variable was given a value of 1 to indicate that the total

<sup>6</sup>Previous contingent valuation studies have suggested eliminating zero bids if these bids are thought to be protest bids (Brookshire et al., 1976; Randall et al., 1974). Respondents who indicated a zero WTP for prime land amenities were asked to provide a reason. If a respondent indicated a zero bid because prime land amenities give absolutely no satisfaction, the zero bid was considered legitimate and included in the computations. On the other hand, if a respondent indicated unwillingness to participate in the contingent market, for instance, because of the belief that it is unfair to ask people to pay for prime land protection, a zero bid was considered a protest bid. All such protest bids were eliminated before estimating the total value curve for prime land amenities.

<sup>7</sup>The lack of payment vehicle influence is consistent with studies conducted by Randall et al., 1978; Brookshire et al., 1980; and Thayer. Halstead detected some aversion on the part of respondents to tax payment vehicles; however, he did not formally test for payment vehicle bias.

<sup>8</sup>The Durbin-Watson test for autocorrelation was not significant, a scatter plot of residuals showed no evidence of heteroskedasticity, and a simple correlation matrix indicated reasonably low correlation between independent variables. Further evidence against the existence of a multicollinearity problem was the observation that regression coefficients and standard errors remained quite stable across the full and reduced models.



TABLE 2. ANNUAL WTP FOR ENVIRONMENTAL AMENITIES ASSOCIATED WITH PRIME AGRICULTURAL LAND, GREENVILLE COUNTY, 1982

Acres	Willingness to pay			Aggregate WTP 95% confidence interval	
	Annual mean per household	Aggregate	Aggregate per acre	Lower limit	Upper limit
18,000 .....	\$5.70	\$616,700	\$34.26	\$389,300	\$ 831,400
36,000 .....	6.78	733,600	20.38	552,000	901,500
54,000 .....	7.86	850,500	15.75	668,400	1,018,000
72,000 .....	8.94	967,400	13.44	738,600	1,180,800

value curve was estimated for respondents given more complete benefit information. The resulting estimated total value curve is expressed as:

$$(2) \text{ WTP} = 4.617 + .060 \text{ ACRES.}$$

The estimated household total value curve indicates that the total value of prime land amenities to the average household in Greenville County is equal to approximately \$5.70, \$6.78, \$7.86, and \$8.94 annually for 18, 36, 54, and 72 thousand acres of prime land protected, respectively, Table 2.

An expression for the aggregate total value curve was derived by multiplying the right-hand-side of equation (2) by the total number of households (108,250) in Greenville County. The equation for the aggregate total value curve is expressed as:

$$(3) \text{ AGGREGATE WTP} = 499,790 + 6,495 (\text{ACRES}).$$

Aggregate estimates, column 3, and per acre estimates, column 4, of WTP for the amenity benefits associated with the four acreage levels used in the questionnaire are also presented in Table 2.

### POLICY IMPLICATIONS

Four joint benefits of prime land protection are commonly recognized: (a) protection of local and national food supply; (b) protection of local jobs in the agricultural industry; (c) better and more organized development of urban and rural land; and (d) protection

of environmental amenities (Gardner). Gardner has argued effectively that the first three of these benefits are essentially concerned with the provision of private goods, which are accounted for adequately by private land markets. If only these benefits are considered, perhaps private land markets retain a socially optimal amount of prime agricultural land. Conceptually, however, the presence of external, environmental amenity benefits suggests that prime agricultural land may be undervalued and underprovided by private land markets. Correction for external environmental amenity benefits provides a potential justification for public action to protect prime land.

In Greenville County, the annual aggregate value of \$967,400 for the environmental amenities provided by prime land translates to approximately \$13.00 per acre.<sup>9</sup> This figure suggests that the per acre value of amenity benefits associated with prime agricultural land in Greenville County is, on average, quite low. This should not be surprising. Greenville County is located in a predominantly rural area; alternative supplies of agricultural land amenities are not difficult to find. In these types of situations, the marginal value of amenity benefits is unlikely to be a significant component of the social value of prime agricultural farm land. Further, because agricultural farm land is widely spread throughout the United States, it is unlikely that significant values will be placed upon Greenville County agricultural land by individuals residing outside the area.

<sup>9</sup> Halstead presented several per acre estimates, none of which are conceptually comparable to the Greenville County per acre estimates. First, the "nonmarket value" measured by Halstead included much more than the specific amenity benefits measured in the Greenville County study. Second, Halstead's estimates were derived from what appears to be an inadequately described contingent market which failed to indicate the quantity of land respondents were being asked to bid upon. Without a clearly defined quantity variable, there is no possibility of obtaining a reliable estimate of value per unit of the commodity being valued, e.g., acres preserved from development. In addition, the *ad hoc* procedure for assigning the quantity variable *ex post*, e.g., size of nearest agricultural land parcel, will lead to an overestimate of benefits if respondents perceived their bids as referring to more than just the nearest agricultural land parcel.

Hence, where Gardner's first three benefit categories are adequately accounted for by private markets, it appears that correction for external environmental amenity benefits may not justify public intervention to protect prime land, unless the costs of such intervention are quite low. The costs of prime land retention programs include administrative and enforcement costs, certain environmental disamenities associated with additional farmland (e.g., noise and water pollution), and the opportunity costs of forcing additional development to secondary lands where site preparation costs may be considerably higher (Cousins and Dillman). In Greenville County, or in other areas of the Country, these costs may outweigh the relatively low environmental amenity benefits of prime land retention.

The preceding discussion is not meant to imply that the amenity benefits provided by agricultural land are completely inconsequential. The results of this study suggest that prime land amenities are of some positive value to people. The *aggregate* environmental amenity benefits provided by agricultural land throughout the entire United States may be quite substantial. Yet, given the present availability of such benefits, an examination of essentially marginal changes in total availability is likely to yield small aggregate estimates of value changes.

## CONCLUSIONS

The protection of environmental amenities is often cited as one of the major benefits of protecting prime land from urban/industrial development. The value of prime land amen-

ities in a South Carolina county experiencing rapid conversion of prime agricultural land to urban/industrial use was estimated using the contingent valuation method. Aggregate amenity benefits for the existing 72,000 acres of prime agricultural land were estimated at approximately \$13.00 per acre.

Bid payment vehicle (county tax vs. special fund) was found not to influence valuation of prime land amenities. The informational structure of the contingent market was found to influence valuation responses, reinforcing the hypothesis that respondents may require a certain quantity and quality of information to provide accurate responses. In particular, when a project yields joint benefits, it may be necessary to include more detailed information on all benefits provided, even if the focus is upon valuation of a subset of these benefits.

The estimated value of prime land amenities of \$13.00 per acre is an empirical estimate of the external benefits perceived by residents of the study area as accruing when privately-owned prime land is retained. The relatively low value of these benefits suggests the possibility of zero or negative net benefits of local public programs to retain prime agricultural land. That is, if private markets account adequately for other benefit categories from prime land retention, e.g., food production, local jobs, and organized land development, it may be that public retention programs can not be justified on a benefit-cost basis. Final benefit-cost ratios for individual retention programs will depend on program costs, local preferences for development, and the quantity and quality of local agricultural land.

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