THE MARKET VALUE OF INGRESS RIGHTS FOR WHITE-TAILED DEER HUNTING IN TEXAS

C. Arden Pope III and John R. Stoll

Abstract

The lease hunting system in Texas is described and discussed. Results of a hunter survey are reported and the value of ingress rights for white-tailed deer hunting in Texas is estimated. Results suggest that these rights are highly valuable and that services and facilities provided generally do not enhance the value of the hunting experience as much as access to additional game species on adequately large parcels of land.

Key words: deer hunting, recreational value, ingress rights, hunt lease system.

Proper management of both public and private lands containing wildlife populations requires that the relative value of wildlife to society be considered along with the value of other land uses. Two prominently used measures of value are consumer surplus and market or exchange value. Consumer surplus is a measure of the maximum amount an individual or group of individuals would be willing to pay for a commodity. It is the value of the benefits received for all units over cost of the commodity and is measured as the area below an estimated demand curve (Willig).

Two basic methods of estimating consumer surplus for nonmarket items have been used. One, the contingent valuation method (CVM), uses direct questioning or bidding to estimate willingness-to-pay (Brookshire et al.; Schulze et al.). The other, the travel cost method (TCM), uses inferences from observable behavior on expenditure-participation relationships to estimate the consumer's willingness-to-pay (Burt and Brewer; Gum and Martin; Loomis; and Ziemer et al.).

Market value or price is the most commonly used measure of resource value where markets for exchange of commodities exist. Theoretically, this measure is smaller than the consumer surplus measure of value (Gibbs). It is an important measure of value, however, because it is based on the amount individuals actually pay and is relatively easy to observe.

A recent study by Livengood estimates the value of deer harvested by the lease hunters. He estimates that hunters would be willing to pay about $25, on the average, to be assured of harvesting one deer. The present paper, in contrast, focuses on the market value of ingress rights for white-tailed deer hunting in Texas. This value is expected to be much higher than the value of the harvested deer. Recent estimates of the average market value of white-tailed deer hunting leases in Texas range from $152 to $393 per year illustrating that the right to engage in the recreational activity of hunting deer is much more valuable than the harvested deer itself (Stoll et al.; Pope et al.).

The market value of these leases is likely associated with both the right to access the wildlife resource itself and also the services and facilities provided. The amount this hunt lease value is associated with the right to access the wildlife resource versus services and facilities provided is of interest to both public and private managers of wildlife facilities.

Observed market purchases of hunting leases are utilized to infer hedonic or implicit prices associated with different services and facilities. The hedonic approach has been discussed extensively in economics literature (Rosen; Griliches; Maler) and used in a variety of applications, most notably to value urban amenities (Harrison and Rubinfeld; Brown and Pollakowski).

This paper describes the institutional setting in which Texas lease hunting takes place. This is followed by sections providing a description of data collection procedures and

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presentation of results. The final section offers a brief summary and a few concluding thoughts for consideration.

THE INSTITUTIONAL SETTING[1]

A market evaluation of the value of wildlife can be conducted with some success in Texas. When Texas entered the Union in 1845, it retained title to all public land. By 1898, however, it had divested itself of all unappropriated land (Fuqua). Today, Texas has 8 general types of habitat and 15 unique ecosystems that cover over 262,840 square miles. In Texas, there are approximately 3 million white-tailed deer on roughly 77 million acres of deer range (Texas Parks and Wildlife Department; Texas Sportsman). Almost all of this deer habitat is privately held land.

Texas wildlife populations are regarded as held in trust by the State for the use of the public, but access to this wildlife, for the most part, is controlled by private landowners. As Teer and Forrest pointed out, *"control of access has, for all practical purposes, transferred the custody of game animals from the State to the landowners"* (p. 194). Because the value of this wildlife, particularly for hunting, has been recognized by landowners and hunters, a market or leasing system for trespass (ingress) rights to access wildlife on private property has developed.

Four general types of leasing arrangements can be identified. The first and most common type of leasing arrangement is the annual or seasonal lease. Under this arrangement the landowner provides a hunter or group of hunters the privilege of hunting on the land for a particular hunting season or for a full year. Annual leases often allow hunters to hunt multiple species within their respective seasons throughout the year. Seasonal leases generally allow the hunting of limited species during their hunting season. The hunters and landowner agree on the services to be provided by the landowner, and harvest quotas for the hunters (within the established State and County game regulations). In addition, this arrangement may also include privileges to engage in other non-hunting activities such as wildlife and nature photography, camping, horseback riding, etc.

The second type of leasing arrangement is day-hunts. Under this arrangement the landowner allows the hunter access to wildlife on the land on a per-day basis similar to arrangements commonly made with trailer parks or other such recreational facilities. Again, services provided by the landowner and hunter quotas must be agreed upon.

A third type of leasing arrangement is where the landowner charges hunters directly for animals bagged. Charges may differ by sex, size, antler development, or other such characteristics. Often, there will be a base per-day or per-season charge for access to the property and an additional fee depending on the number and type of animals taken. This is a common form of leasing arrangement, especially for exotic game hunting on specialized ranches.

In a fourth type of leasing arrangement, the landowner sells rights to access land for hunting or other recreational activities to an outfitter, a recreational or sportsman's club, or other such organization. This entity is then allowed to manage access to the land for hunting or other outdoor recreation over a predetermined period of time and within an agreed upon set of conditions.

Under all leasing arrangements, the price of the lease is expected to vary depending on services offered, game species that can be hunted, quality and quantity of wildlife, aesthetic appeal of the land, number of acres of land involved, distance from metropolitan areas, and other such factors. Examples of services that can be provided to hunters by landowners include: lodging, meals, guiding, tree stands, target ranges, and campsites. Landowners can also undertake management practices such as building deer-proof fences around their property, providing supplemental feed to wildlife, performing population counts to help maintain a given sex ratio or age distribution, and establishing populations of exotic game, or other such practices. Each of these management practices is expected to help provide a marketable wildlife resource to outdoor recreationists interested in accessing wildlife.

State and county game authorities regulate and control hunting and bag limits. Multiple species hunting licenses can be purchased at a minimal cost. Hunters on private and public

[1]A description of the Texas hunt lease system with similar wording is also found in a related paper by Pope et al., and a more detailed description is given in a book by Wooters.

land are required to purchase a license and comply with hunting regulations. For example, when doe hunting is not permitted, landowners cannot sell hunting leases that allow hunting does. This restriction also makes it difficult for landowners to legally alter the sex ratio of deer populations on their lands.

The leasing market in Texas is generally not centralized or formal. Landowners sometimes advertise in newspapers or magazines and lists of landowners willing to sell leases can often be obtained locally. A large share of leasing arrangements are made through friends, relatives, and associates and are often informal. In addition, because wildlife is viewed not only as aesthetically desirable but also as a source of economic returns, most landowners zealously protect these resources by enforcing trespass laws.

HUNTER SURVEY

In 1978, a random sample of 8,000 hunters was drawn from a list of licensed Texas hunters that was provided by the Texas Parks and Wildlife Department. This statewide sample of 1977-78 season hunters was mailed a 4-page questionnaire and a cover letter in early August. A followup letter was mailed 1 week later to all members of the sample. At the end of the survey period, 1,196 questionnaires had been returned with 1,128 usable responses for an overall response of approximately 15 percent.

Although a higher response rate would have been desirable, a variety of hitherto unavailable information was collected. The questionnaire elicited information regarding type of land used for hunting, types of leases purchased, prices, and terms of leases. Hunters were also asked to identify the types of facilities (e.g., blinds, towers, cabins, landing strips) and services (e.g., planted fields, guides, field dressing, meals) provided with their hunting lease and which of these were actually used. In addition, the type of game for which the lease allowed hunting and the game actually hunted were elicited. Several questions regarding hunting preferences and socioeconomic characteristics were also included.

Approximately 42 percent of the hunters purchased at least one hunting lease. Approximately 17 percent purchased two or more hunting leases and 84 percent of the leases were annual or seasonal leases. For the purposes of this study, the only survey responses utilized were those from hunters who purchased at least one hunting lease that included the right to hunt white-tailed deer on an annual or seasonal basis, and that were complete with respect to price, location, and terms of the lease. This included 310 respondents. Also, although many of these hunters purchased more than one lease, only data pertaining to the primary or most expensive lease purchased were used.

Descriptive information regarding the sample respondents was compiled. Their average age was 40 years; 91 percent were male; and 85 percent were married. Approximately 61 percent of the respondents reported an annual family income greater than $20,000. Also, 83 percent of the respondents graduated from high school and 60 percent had attended college or technical school although not all graduated. The hunters were asked to indicate which qualities they considered important for a hunting lease. Qualities considered important by most of the hunters were "lots of game", "ability to bring family", and "different kinds of game."

A summary of responses with respect to price, location, and terms of the lease is presented in Table 1. The distance in road miles from the nearest major metropolitan area (Dallas, Houston, or San Antonio) was calculated (Statistical Research Service). The estimated number of deer per 1,000 acres of deer range in the lease county for 1977 was also obtained (Texas Parks and Wildlife Department).

MODEL AND ESTIMATED IMPLICIT VALUES

Econometrically, hedonic prices are estimated at the margin by regressing hunt lease prices on characteristics of the lease. Admittedly, a statistical identification problem may exist. This identification problem has been discussed in several articles and contexts (Working; Just et al.; Rowe and Chestnut; Rosen). Market prices alone reveal little about underlying supply and demand relationships; this is also true with hedonic prices. Both these prices do, however, reflect marginal values (Rowe and Chestnut; Rosen). Therefore, this study does not estimate total value or willingness-to-pay but, rather, the

marginal effects of different lease characteristics on the value of lease market prices for hunting leases in Texas.

Three basic groupings of independent variables were identified. The first dealt with location and size of the hunting parcel and deer density on the parcel. Because deer populations, climate, vegetation, soils, and topography vary greatly across Texas, six different regions were defined: South Texas Plains (R1), Trans Pecos (R2), High and Rolling Plains (R3), Hill Country (R4), Central Texas (R5), and East Texas (R6). Variables that indicated the number of acres included in the lease (AC), distance from major metropolitan areas (DIST) and deer density (DPTA) were created. Larger acreages and higher deer densities were hypothesized to increase the lease value, while farther distances from major metropolitan areas were expected to decrease the value of the lease.

The second basic grouping of independent variables involved the diversity of game offered on the property in addition to white-tailed deer. Dummy variables indicated whether any of 10 additional game species were offered (see Table 1). Additional game species were hypothesized to increase the lease price.

TABLE 1. COMMON CHARACTERISTICS AND TERMS OF LEASES THAT INCLUDED THE RIGHT TO HUNT WHITE-TAILED DEER ON AN ANNUAL OR SEASONAL BASIS, TEXAS, 1978

Variable	Variable description	Unit	Value
PRICE	Price of primary or most expensive lease purchased	dollar	209
AC	Number of acres included in the lease	acres	5,121
DIST	Distance from nearest major metro area (Dallas, Houston, or San Antonio)	miles	115
DPTA	Number of deer per 1,000 acres of deer range in county of lease	number	57
DOVE	Dove hunting allowed	percent	51.9
DUCK	Duck hunting allowed	percent	5.8
HOGS	Wild hog hunting allowed	percent	19.4
EXOT	Exotics hunting allowed	percent	1.9
FISH	Fishing allowed	percent	35.8
GEESE	Geese hunting allowed	percent	4.8
JAV	Javelina hunting allowed	percent	20.3
QUAIL	Quail hunting allowed	percent	53.5
TURKEY	Turkey hunting allowed	percent	48.7
SQUI	Squirrel hunting allowed	percent	45.5
RIDE	Permission to ride hunt provided	percent	17.7
DELI	Delivery to stand provided	percent	2.3
GUIDE	Guiding services provided	percent	1.3
FEED	Game feed provided	percent	11.3
BLIND	Hunting blind or tower provided	percent	21.0
FEEDR	Game feeders provided	percent	10.0
ELEC	Electricity provided	percent	33.5
WATER	Water provided	percent	33.5
CABIN	Cabin provided	percent	37.0
TRAIL	Trailer hookups provided	percent	6.1

TABLE 2. WHITE-TAILED DEER LEASE PRICE REGRESSION RESULTS, TEXAS, 1978

	Model I		Model II	
Variable	Parameter estimate	t-value[a]	Parameter estimate	t-value[a]
Intercept	165.70	3.5[c]	180.81	5.2[c]
R1	69.83	1.7[e]	—	—
R2	203.54	2.6[d]	144.27	2.0[d]
R3	44.45	1.1	—	—
R4	134.42	3.2[c]	91.88	5.2[c]
R5	37.36	1.1	—	—
AC.R1[b]	0.0440	6.9[c]	0.0500	9.8[c]
AC.R2[b]	−0.0135	−2.4[d]	−0.0143	−2.7[c]
AC.R3[b]	0.0002	1.3	—	—
AC.R4[b]	0.0053	1.3	—	—
AC.R5[b]	0.0015	0.1	—	—
AC.R6[b]	0.0037	1.2	—	—
DPTA	−0.4085	−1.2	—	—
DIST	−1.8129	−3.3[c]	−1.98	−4.0[c]
DIST²	0.0099	5.2[c]	0.01108	6.3[c]
DOVE	20.82	1.0	—	—
DUCK	−20.14	−0.6	—	—
HOGS	1.24	0.1	—	—
EXOT	−50.37	−0.8	—	—
FISH	−8.23	−0.4	—	—
GEESE	−26.32	−0.6	—	—
JAV	47.79	1.7[e]	60.15	2.7[c]
QUAIL	44.17	2.0[d]	28.18	1.7[e]
TURKEY	−6.40	−0.3	—	—
SQUI	−40.00	−1.8[e]	—	—
RIDE	0.92	0.0	—	—
GUIDE	−60.24	−0.8	—	—
FEED	8.05	0.2	—	—
BLIND	6.11	0.2	—	—
FEEDR	−47.71	−1.3	—	—
ELEC	−28.96	−1.0	—	—
WATER	−1.44	−0.1	—	—
CABIN	45.38	2.0[d]	—	—
TRAIL	2.42	0.1	—	—
R^2	0.49	—	0.45	—
R^2 (ADJ)	0.43	—	0.44	—
MSE	20,092	—	19,895	—

[a]Statistical significance at 1, 5, and 10 percent levels is indicated by c, d, and e, respectively.
[b] These variables represent the interaction between parcel size and region.

The third basic grouping of independent variables included the services and facilities that were provided with the lease. Dummy variables were used to indicate the impacts of these factors (see Table 1). Additional services and facilities were hypothesized to have a positive impact on lease price.

The *a priori* model required a large number of independent variables, many of which were of necessity dummy variables. Dummy variables, particularly in large numbers, increase the potential for serious multicollinearity problems and, thus, caution must be exercised in determining significance of variables and drawing inferences regarding variables which affect lease price. Therefore, several alternative model specifications were estimated and evaluated to determine which variables had coefficients that were relatively stable and consistently significant.

The results were surprisingly consistent and robust. Two of the model specifications are reported in Table 2. The first specification includes all the variables considered important on *a priori* grounds while the second specification includes only those variables that had consistently high absolute t-values and relatively stable regression coefficients.

Several interesting observations can be made from the results. For the alternative model specifications evaluated, there was little evidence that the numerous services and facilities provided with Texas white-tailed deer hunt leases contribute significantly to the market value of these leases. With the notable exception of CABIN, none of the services and facilities variables had significantly positive coefficients in any of the model specifications. Across all model specifications that included CABIN, the regression coefficient for CABIN was positive and ranged from 22 to 45. It was not included in Model II because it did not meet the criterion of having relatively stable and consistently high absolute t-values.

The variables most significantly related to lease price were the regional location dummies and number of acres in the lease (South Texas Plains, Trans Pecos, and Hill Country; the base region was East Texas), the distance to the nearest major metropolitan area, and whether or not quail and/or javelina hunting was allowed in addition to white-tailed deer hunting. The significance of the presence of javelina and quail is not surprising because both species are hunted and prized as game species in Texas.

An interesting functional relationship exhibited in the models involves lease prices and distance from the nearest major metropolitan area. Lease price falls as the lease location gets farther from the nearest major metropolitan area until it reaches approximately 89 miles, after which the price begins to rise. It could be hypothesized that leases near metropolitan areas are more valuable due to easy access but, after a certain distance, as leases get further away from major metropolitan areas, they become more valuable because of their remoteness. This hypothesis would be consistent with previous work arguing that the general population of hunters can be subdivided into various types based on their characteristics and hunting objectives (Kellart).

SUMMARY AND CONCLUSIONS

Properly managing lands with wildlife is difficult unless some understanding of the relative value of wildlife to society is obtained. The value of wildlife resources to society is difficult to measure because these resources often are publicly held with little or no market transactions available to reveal their relative price. Past attempts to determine the value of such resources have relied largely on nonmarket valuation techniques. Although these attempts provide useful information, accurate data on the amount individuals actually pay for access to these resources (within a reasonably developed market, and where free public access to wildlife resources is not readily available) are an interesting and important indicator of the value of these resources. Because almost all land in Texas is privately owned, and because a hunt lease market for buying and selling rights to access wildlife on private land for recreational purposes has developed, this can be done with some success.

Hunt leases, however, often include an assortment of different services and facilities, and average market price of these leases may overestimate the value of accessing wildlife resources for hunting purposes. In this paper, survey data pertaining to seasonal and annual white-tailed deer leases are evaluated in an attempt to determine the relative value of services and facilities provided. Regression analysis to estimate hedonic prices that reflect marginal values associated with characteristics of the lease failed to indicate that services or facilities (with the possible exception of provided cabins) significantly contributed to the average value of deer leases in Texas. This, of course, implies that most of the average market value of Texas hunt leases can be attributed to the right to access the wildlife resource.

Some caution must be exercised when attempting to draw conclusions from the survey data and regression results presented in this paper. Much of the variation in the prices of leases for hunting white-tailed deer is not explained. Although the coefficient of determination is similar to that obtained in other recreation studies, many important factors exist that have not been quantified. For example, prices of hunting leases are often affected by the interpersonal relationships between the parties buying and selling the

lease. Further, inaccuracies in measuring quality of available game, services, facilities, or general hunting experience could bias estimated ingress (access) right values.

Results of this study do suggest, however, that the annual right of ingress to hunt white-tailed deer has a significantly large economic value. Also, services and facilities provided generally do not enhance the value of the hunting experience as much as access to a variety of game species on an adequately large parcel of land.

REFERENCES

Brookshire, D. S., A. Randall, and J. R. Stoll. "Valuing Increments and Decrements in Natural Resource Service Flows." *Amer. J. Agr. Econ.,* 62(1980):478-88.

Brown, G. M. and H. O. Pollakowski. "Economic Value of Shoreline." *Rev. Econ. and Stat.,* 59(1977):272-8.

Burt, O. R. and D. Brewer. "Estimation of Net Social Benefit from Outdoor Recreation." *Econometrics,* 39(1971):813-27.

Fuqua, W. "The Giving Away of Texas." *Tierra Grande,* (Third Quarter, 1980):12-4.

Gibbs, K. C. "Economics and Administrative Regulations of Outdoor Recreation Use." USDA, Forest Service General Technical Report WO-2; March, 1977, p.98-104.

Griliches, Z. *Price Indexes and Quality Change,* Harvard University Press, Cambridge, Massachusetts, 1971.

Gum, R. and W. E. Martin. "Problems and Solutions in Estimating the Demand for the Value of Rural Outdoor Recreation." *Amer. J. Agr. Econ.,* 57(1975):558-66.

Harrison, D., Jr. and D. L. Rubinfeld. "Hedonic Housing Prices and the Demand for Clean Air." *J. Environmental Econ. and Mgt.,* 5(1978):81-102.

Just, R. E., D. L. Hueth, and A. Schmitz. *Applied Welfare Economics and Public Policy,* Prentice Hall, Inc., Englewood Cliffs, N. J., 1982.

Kellart, S. R. "Attitudes and Characteristics of Hunters and Anti-Hunters and Related Policy Suggestions." A working paper presented to the U.S. Fish and Wildlife Service, 1976.

Livengood, K. R. "Value of Big Game from Markets for Hunting Leases: The Hedonic Approach." *Land Econ.,* 59(1983):287-91.

Loomis, J. B. "Use of Travel Cost Models for Evaluating Lottery Rationed Recreation: Application to Big Game Hunting." *J. Leisure Res.,* 14(1982):117-24.

Maler, K. *Environmental Economics: A Theoretical Inquiry,* John Hopkins University Press, Baltimore and London, 1974.

Pope, C. A., C. E. Adams, and J. K. Thomas. "The Recreational and Aesthetic Value of Wildlife in Texas." *J. Leisure Res.,* 16(1984):51-60.

Rosen, S. "Hedonic Prices and the Implicit Markets." *J. Pol. Econ.,* 82(1974):34-55.

Rowe, R. D., and L. G. Chestnut. *The Value of Visibility: Theory and Application,* Abt Books, Cambridge, Massachusetts, 1982.

Schulze, W., R. C. d'Arge, and D. S. Brookshire. "Valuing Environmental Commodities: Some Recent Experiments." *Land Econ.,* 57(1981):151-72.

Statistical Research Service. *The Official State Mileage Guide,* Austin, Texas, 1982.

Stoll, J. R., C. Sellar, and R. F. Ziemer. "Recreational Use of Public vs. Privately Owned Lands for Hunting." progress report submitted to U.S. Fish and Wildlife Service, 1983.

Teer, J. G. and N. K. Forrest. "Bionomic and Ethical Implications of Commercial Game Harvest Programs." Transactions of the Thirty-Third North American Wildlife and Natural Resources Conference; March 11, 12, 13, 1968; Wildlife Management Institute, Washington, D.C.

Texas Parks and Wildlife Department. Job Performance Report. Federal Aid Project N. W-109-R-3; April 15, 1980.

Texas Sportsman. "Texas' Best Deer Hunting." *Texas Sportsman,* 10 (October, 1982):49-52.

Willig, R. D. "Consumers Surplus Without Apology." *Amer. Econ. Rev.,* 6(1976):587-97.

Wooters, J. *A Guide to Hunting in Texas,* Pacesetter Press, Houston, Texas, 1979.

Working, E. J. "What Do Statistical 'Demand Curves' Show?" *Qtr. J. Econometrics,* 41(1927):212-35.

Ziemer, R. F., W. N. Musser, and C. R. Hill. "Recreation Demand Equations: Functional Form and Consumer Surplus." *Amer. J. Agr. Econ.,* 62(1980):136-41.