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The Cost of Acquiring Public Hunting Access on Family Forests Lands

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To address the issue of declining access to private forest land in the United States for hunting, over 1,000 Minnesota family forest owners were surveyed to estimate the cost of acquiring non-exclusive public hunting access rights. The results indicate landowner interest in selling access rights is extremely modest. Using binary logistic regression, the mean annual compensation required to purchase public access on these lands is estimated at $50 per acre. Significant predictors of landowner willingness to sell unrestricted public hunting access rights are the compensation offered, owner's use of the property for hunting, land's hunting quality and market value, location of owner's residence, current posting practices, future ownership intentions, and concern for property damage. The high payment required to purchase this right reflects the value owners attach to exclusive hunting rights, cost of enrolling in a government-sponsored program, and inability to control who and how many hunt on the property.

Keywords hunting, public access, wildlife recreation, contingent valuation, economics

Introduction

National studies point to a decline in the amount of private land that is open to the public for recreation, from 25% in 1985 to 11% by the late 1990s (USDA, 2004). This trend is particularly evident in the eastern United States, where the most important constraint on outdoor recreation opportunities is securing access to private lands (Cordell et al., 1999). Major reasons for family forest landowner resistance to allowing public access on their land include safety, liability, and economic considerations (Zhang, Hussain, & Armstrong, 2006; Mozumder, Starbuck, Berrens, & Alexander, 2007). The latter reason includes the opportunity to generate income from leasing hunting rights to individuals or groups (Zhang et al., 2006).

An estimated 3% of private landowners receive compensation for allowing hunter access to their property (Cordell et al., 1999). The formal arrangement for selling this access right is generally one of three types. The first is a hunting lease, which is a legal

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contract transferring use of real estate to a leaseholder (individual, group, or organization) for a specified period, typically a hunting season or year (Capozzi, Dawson, & Germain, 2003). This type of arrangement provides the leaseholder exclusive access rights to the property. The second method for selling hunting access rights is a fee-based permit. Such an arrangement allows the permit holder the right to access the land for a limited period of time, which can vary from one day to the entire hunting season (Mozumder et al., 2007). Unlike a hunting lease, fee-based permit holders do not hold an exclusive access right to the property, but must share the property's use with other hunters who also hold a fee-based permit. Landowners frequently limit the number of fee-based permits to address safety, property damage, and overcrowding concerns.

The third arrangement to allow access to private land is a government-sponsored walk-in hunter access (WIHA) program. In recent years, several states have established WIHA programs on private lands to address the shrinking supply of land open to public hunting. Hellend (2006) reported 11 states (primarily those west of the Mississippi) had WIHA programs in 2006. Because landowner participation in these programs is voluntary, program success depends on an administrative framework and financial incentive structure that will attract substantial landowner interest. Landowners participating in a WIHA program receive a payment from the state, typically based on the acreage enrolled, soil productivity, wildlife habitat potential, or hunter use days. The public is typically restricted to walk-in hunting only on enrolled lands (i.e., motorized access is usually not permitted and hunters are not usually allowed to camp or target practice on the land), which are identified by signs placed on the property's boundaries and/or maps prepared by the state wildlife agency. In most instances, hunters are not required to contact the landowner before entering the property. Sources of funding for WIHA programs vary from state to state and can include a portion of hunting license fees, annual membership fees, hunting license surcharges, and voluntary donations (Helland, 2006).

In this study, we assessed Minnesota family forest owner interest in enrolling in a state-sponsored WIHA program. A fair amount of research has been conducted on private land hunting leases and fee-based hunting (e.g., Butler & Workman, 1993; Capozzi et al., 2003; Zhang et al., 2006; Mozumder et al., 2007) and, to a lesser degree, reasons landowners post their land against trespass (e.g., Wright, Kaiser, & Fletcher, 1988; Jagnow et al., 2006). We were not able to find any studies, however, that estimated landowner's willingness to accept (WTA) monetary compensation in return for allowing unrestricted public hunting access to family forest land. Given the potential for other states to develop WIHA programs, we were also interested in examining factors that influence a landowner's decision to enter into such an access program.

Methods

The contingent valuation method (CVM) was employed to estimate a family forest owner's willingness to accept (WTA) compensation in return for keeping forest land open to non-motorized public hunting. Contingent valuation is a well-established survey-based method commonly used to estimate the monetary value of a wide range of natural resource and environmental goods and services. It is an especially useful technique for estimating the value of goods and services for which there are no markets.

Data for the study was obtained through a mail-back questionnaire sent to Minnesota family forest landowners. Potential recipients of the survey included individuals owning at least 20 contiguous acres of predominantly forested land. Assessor's offices in Minnesota's 15 counties with the largest acreage of family forest land were contacted to obtain

information on forest land that met these eligibility criteria. Only forested parcels owned by individuals (i.e., family forest owners) were selected. A pre-test of the draft survey questionnaire was conducted to ensure all survey questions were clear and the response data were understandable and useable.

To generate the number of survey responses needed to meet the study's desired level of confidence and precision, 1,024 surveys were mailed. The survey was administered between October and December 2006 following the method described by Dillman (2000), yielding an overall response rate of 67% and a usable response rate of 63%. An analysis of the survey respondents and non-respondents found no significant differences in key landowner metrics (e.g., acres of forest land owned) between the two groups, suggesting the data obtained and described in this report can be interpreted as being representative of Minnesota's family forest landowners meeting the study selection criteria.

Our choice of potential explanatory variables regarding an owner's interest in selling public hunting access rights was guided by reviewing existing research on family forest owners and their attitudes, motivations, concerns, and issues relative to hunter trespass. This body of research suggests family forest owners are a heterogeneous group with diverse ownership objectives and motivations. It also implies how owner and tract characteristics, forest land ownership objectives and uses, and property damage and liability concerns associated with allowing public access influence a landowner's decision to allow public hunting access (Wright et al., 1988; Jagnow et al., 2006; Zhang et al., 2006). We hypothesized that a landowner's interest in participating in a government-sponsored public access program would be influenced by both their motivations for owning forest land and concerns regarding public trespass. As such, the 20 questions contained in our questionnaire requested information on reasons for forest land ownership, past and anticipated future land use activities, perspectives on allowing walk-in hunter access, the quality of hunting opportunity provided, availability of forest land for use by the public in the immediate area, future ownership plans, and owner demographic information (e.g., land ownership tenure, forest land parcels and acres owned, location of residence in relation to forest land owned, age).

Following the recommendations of the 1993 Report of the NOAA Panel on Contingent Valuation (Arrow et al., 1993), we posed the WTA payment question in a referendum-style format in which respondents are provided a description of a project along with the associated costs and/or benefits and then asked to "vote" in favor or against the referendum (Cameron, 1988). The NOAA panel recommended using this closed-format referendum style question because it mimics the way individuals make decisions in an actual market situation (e.g., Would I pay (or accept) this dollar amount for this good?). This approach is generally preferred over one in which respondents are asked to specify the dollar amount themselves they would be willing to pay or accept, as respondents may have little familiarity with the good they are being asked to value and may not be able to estimate a reasonable value for the good.

The NOAA Panel further recommended that referendum-style CVM questions include a "would not vote" or "unsure" option in addition to the "yes" and "no" vote. The rationale was to provide an option for respondents who are indifferent between a yes and a no vote, unable to make a decision without more time or more information, prefer another mechanism for making their decision, or are bored with the survey and anxious to end it as quickly as possible (Arrow et al., 1993).

The referendum-style question we presented to survey participants was: "If you were guaranteed an annual payment of $X for each acre of your forest land that was left open to walk-in public hunting, would you participate in this walk-in hunter access program?

(For example, if you allowed walk-in public access for hunting on 20 acres of your forest land, you would receive ($X times 20) each year you participated in the program.)" Survey participants were offered one of four payment levels ($5, $10, $20, $30). The levels were randomly assigned so that one-fourth of the participants was offered each payment amount. The literature provides little guidance on the payment levels to be offered to acquire this right. We chose $5 per acre annual payment as the lowest payment, as this is comparable to the difference in property tax liability for enrollees of Wisconsin's Managed Forest Law (MFL) who selected the program option of allowing public hunting access to their land in return for lower property taxes (Nielson & Bergman, 2004; Pingrey, 2005). Since fewer than 20% of MFL-enrolled lands have this public access option, we felt $5 per acre per year was a reasonable low end level of compensation to be offered. The highest payment offered was $30 per acre per year, as we felt a higher payment might appear unrealistic to many survey recipients and would not appeal to those who fund such programs. Moreover, a review of payment levels made to participants of WIHA programs in several states suggested $30 per acre per year was a reasonable upper-end payment offer.

Model Estimation

We followed Hanemann (1984) in developing a random utility model to estimate WTA in a discrete choice format. Landowner responses were analyzed using a binary logit model to estimate the probability of enrollment in the WIHA program; identify landowner, tract, and perceptions on allowing hunter walk-in access that influence willingness to participate; and estimate WTA values (Hanemann, 1984; Richardson & Loomis, 2005).

In its simplest form, the logit model is:

$$\text{Logit}(Y) = \ln\left(\frac{\pi}{1-\pi}\right) = \alpha + \beta' x \tag{1}$$

where:

π = probability of an outcome of interest
α = intercept
β' = vector of regression coefficients
x = vector of predictor variables

Equation 1 can be written to estimate the probability of occurrence of a specified outcome (Peng, Lee, & Ingersoll, 2002).

$$\pi(Y \mid x) = \frac{e^{\alpha+\beta' x}}{1+e^{\alpha+\beta' x}} = \frac{1}{1+e^{-[\alpha+\beta' x]}} \tag{2}$$

Following Cameron (1988), we estimated Equation 2 and then converted it to a WTA equation by dividing the constant term and each coefficient (other than the coefficient on the payment amount variable) by the negative value of the payment coefficient. Mean/median WTA value was then estimated using this new equation, multiplying the transformed coefficients by the mean of each variable, according to the procedure described by Hanemann (1984).

Neither the NOAA panel nor subsequent literature offer clear direction as to how best to handle uncertain/unsure/would not vote options in willingness to pay or accept analyses

and value estimations. Studies suggest that the choice of how to handle the not sure response category is an empirical one that must be made on a case-by-case basis. After running several statistical tests to determine whether our not sure responses could all be reassigned or pooled to either the yes or no response, we decided to drop the not sure responses from our analysis and focus only on those landowners who answered yes or no to the contingent valuation question.

Results

Table 1 summarizes the survey responses to the contingent valuation question on willingness to accept a specified compensation level for enrolling forest land in a WIHA program. Interest in participating in a WIHA program was extremely modest at an annual payment level of both $5 and $10 per acre per year, with only 5% of respondents indicating they would do so at each level. The percent of affirmative responses when offered a $20 per acre per year payment increased to 13%, whereas 17% expressed a willingness to enroll in a WIHA program when the payment amount presented was $30 per acre per year. The immediate implication is clear: even a payment of $30 per acre per year, which is as high as we felt "reasonable" ex ante, would stimulate entry by fewer than half the landowners. This quick judgment is supported by more elaborate statistical analysis later in the article.

Individuals who stated they were not sure if they would enroll in a WIHA program at the payment amount presented to them did so for a variety of reasons. One-quarter of the respondents who were not sure whether they would enroll indicated they would consider doing so with additional restrictions imposed on the public access granted. Twenty percent of the not sure responses required additional clarity over liability issues associated with allowing public access before making a decision. Only 8% indicated their reason for being unsure was due to a lack of information about the program (e.g., rights given up, compensation provided) as described in the questionnaire, suggesting most survey respondents understood the valuation trade-off they were asked to make.

Table 1
Landowner willingness to enroll in a WIHA program at various annual per acre payment levels offered to survey respondents

Payment offered	Response	Number of responses	Percent of responses
$5	Yes	7	5
	No	119	80
	Not sure	22	15
$10	Yes	8	5
	No	118	76
	Not sure	30	19
$20	Yes	21	13
	No	106	67
	Not sure	32	20
$30	Yes	28	17
	No	96	58
	Not sure	41	25

Probability Estimation

Guided by the factors we hypothesized would influence a landowner's decision to enroll in a WIHA program, 12 potential explanatory variables from the survey data set were identified. Table 2 describes these 12 variables and the expected influence each has on a

Table 2
Variables hypothesized to influence family forest owner participation in a WIHA program

Variable	Description	Hypothesized effect on WIHA program interest
WIHA program characteristics		
PAYMENT	A categorical variable indicating the payment offered ($/ac/yr).	Positive
Landowner attitudes: Public access		
DAMAGE	A binary variable indicating if the owner agrees damage and/or littering is an important concern associated with allowing public access.	Negative
LIABILITY	A binary variable indicating if the owner agrees getting sued is an important concern associated with allowing public access.	Negative
Landowner characteristics		
HUNT	A binary variable indicating that hunting is the most important reason for forest land ownership.	Negative
TENURE	A binary variable indicating if the owner has owned the forest land for at least 15 years.	Positive
BEQUEST	A binary variable indicating if the owner plans to keep the land and pass it on as an inheritance.	Negative
ABSENTEE	A binary variable indicating if the owner lives away from the land.	Positive
Forest land characteristics		
ACRES	A continuous variable indicating the size (acres) of the forest land parcel.	Positive
POST	A binary variable indicating if the forest land is currently posted.	Negative
HUNTQUALITY	A binary variable indicating if the owner considers the quality of hunting on the forest land to be good or excellent.	Positive
AVAILABILITY	A binary variable indicating if the availability of hunting land (public or private) within one mile of the forest land is limited or very limited.	Positive
VALUE	A continuous variable indicating the 2005 assessor's estimated market value per acre of the land ($ per acre).	Negative

Table 3
Descriptive statistics of WIHA program predictor variables

Variable	Mean	Minimum	Maximum	Standard deviation
WIHA program characteristics				
PAYMENT ($ per acre per year)	16.15	5	30	9.56
Landowner attitudes: Public access				
DAMAGE	0.73	0	1	0.44
LIABILITY	0.65	0	1	0.48
Landowner characteristics				
HUNT	0.48	0	1	0.50
TENURE	0.46	0	1	0.50
BEQUEST	0.81	0	1	0.40
ABSENTEE	0.89	0	1	0.32
Forest land characteristics				
ACRES (acres)	60.30	20	720	63.02
POST	0.68	0	1	0.47
HUNTQUALITY	0.61	0	1	0.49
AVAILABILITY	0.43	0	1	0.50
VALUE ($ per acre)	1,133.54	28	14,873	1,054.32

landowner's decision to enroll in a WIHA program. Table 3 provides descriptive statistics for each variable in the final data set.

The probability that a family forest landowner would choose to enroll in a WIHA program was estimated using Equation 2. Table 4 summarizes the results of our model estimation. The model is significant at $p < 0.01$, indicating the equation is useful in predicting the probability a landowner will enroll in a WIHA program. Figure 1 illustrates the probability of a landowner enrolling under different payment levels when all independent variables except the payment amount are set at their mean values. At the $5 per acre payment level, the probability of enrollment is only 2%. Doubling the annual payment to $10 per acre only increases enrollment probability by 1%. At $30 per acre per year, the model estimates only a 15% likelihood that a landowner will enroll in a WIHA program.

Significant Predictors of Enrollment

Eight of the 12 variables tested in the model are significant predictors of a landowner's interest in enrolling in a WIHA program at $p \leq 0.10$ (Table 4). The payment amount offered ($ per acre per year), hunting being the owner's most important reason for ownership, whether the forest land is currently posted against public trespass, and the owner's plan to pass the forest land on as an inheritance are significant at $p \leq 0.01$. The model suggests landowners are responsive to the payment level offered (PAYMENT), with the odds of enrollment in a WIHA program increasing 1.09 times with each $1 increase in the per acre annual payment offered. The odds of landowners to enroll in a WIHS program who consider hunting the single most important reason for owning their forest land (HUNT) are approximately three-tenths (0.3167) times the odds of owners who considered other ownership reasons (e.g., timber production, real estate investment) to be the

Table 4
Probability model results (dependent variable is WIHA program enrollment probability)

Variable	Coefficient	Wald	Std. error	Odds ratio
WIHA program characteristics				
PAYMENT	0.0876***	20.5844	0.0193	1.0916
Landowner Attitudes: Public Access				
DAMAGE	–0.8099*	3.8191	0.4144	0.4449
LIABILITY	0.0135	0.0012	0.3959	1.0136
Landowner Characteristics				
HUNT	–1.1499***	8.3687	0.3975	0.3167
TENURE	–0.1614	0.2131	0.3496	0.8506
BEQUEST	–1.2161***	11.0678	0.3655	0.2964
ABSENTEE	1.8369**	5.0309	0.8190	6.2772
Forest land characteristics				
ACRES	–0.0012	0.1280	0.0034	0.9988
POST	–1.7108***	22.5053	0.3606	0.1807
HUNTQUALITY	0.7686**	4.0125	0.3837	2.1568
AVAILABILITY	–0.5414	2.1285	0.3711	0.5819
VALUE	–0.0007**	4.2087	0.0003	0.9993
Constant	–2.0138***	3.7044	1.0463	
–2 Log likelihood	233.056			
Model Chi-square	102.694			
Obs. with payment acceptance = 1	55			
Obs. with payment acceptance = 0	401			
Overall % correct	91.7			

*$p \leq .1$, **$p \leq .05$, ***$p \leq .01$.

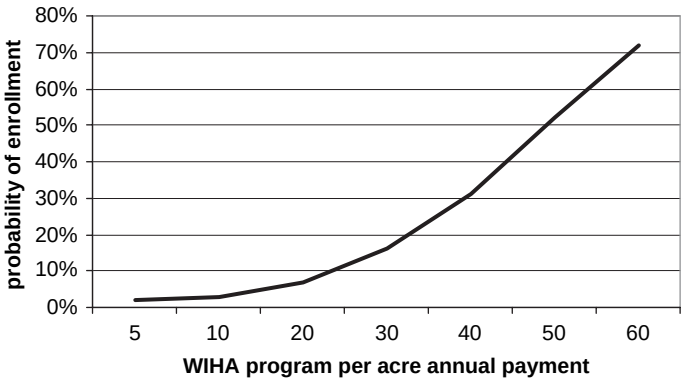

Figure 1. Predicted probability of enrollment in a WIHA program at different annual per acre payment levels (all variables other than the payment amount are set at their mean value).

principal ownership motive. The odds of landowners who post their forest land (POST) enrolling in such a program are 0.18 times the odds of landowners who don't post. The odds of a landowner who plans to pass the forest on as an inheritance (BEQUEST) are

approximately 0.3 times the odds as someone who plans to sell the land, either in part or whole.

Differentiating between resident and absentee owners, the forest land's estimated market value per acre and the perceived quality of hunting on the property are significant predictors of enrollment at $p \leq 0.05$. The odds that a survey respondent whose home is not located on the forest land (ABSENTEE) would enroll in a WIHA program are more than six times the odds of one who lives on the property. Interest in enrolling in a hunter access program decreases with increasing land value (VALUE), suggesting the value of the right to exclude access is positively correlated with the land's value. Owners with high quality hunting land are more likely to enroll in a WIHA program than owners of forest land with lesser quality hunting opportunity. This finding is consistent with Wright et al. (1988) who found owners with less wildlife present on their properties were more likely to prohibit hunting access. A landowner's concern for damage to or littering on the property (DAMAGE) as a result of allowing public hunting access is significant at $p \leq 0.10$.

Several factors we thought would have an influence on landowner interest in participating in a WIHA program are not significant. We expected a landowner's liability concerns associated with allowing public access (LIABILITY) would influence program interest. We also anticipated individuals with larger forest tracts (ACRES) would be more likely to enroll, as was documented by Zhang et al. (2006). Similarly, we expected those who had owned their forest land for a long period of time (TENURE) would be more likely to participate in a WIHA program. Previous research, however, found no clear relationship between tenure (which we found to be highly correlated with age) and the owner's likelihood of allowing public trespass (see Wright et al., 1988; Jagnow et al., 2006). Finally, in line with the findings of Swensson and Knight (2001), we thought forest land located in areas with limited public hunting opportunity (AVAILABILITY) would require less compensation to acquire public access rights.

Whether or not the respondent was an absentee forest landowner had a substantial impact on the probability of enrolling in a WIHA program (Figure 2). At the mean payment amount offered to survey respondents ($16.15), 1% of resident family forest owners were predicted to enroll compared to 6% for absentee owners. At an annual payment of $30 per acre, the model estimated an 18% probability of enrollment for absentee owners, but only a 3% probability for on-site owners.

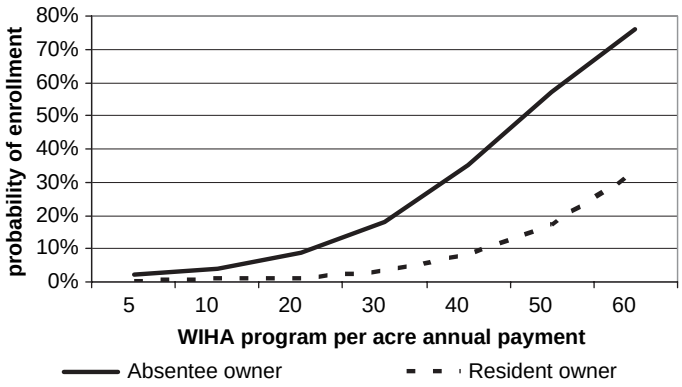

Figure 2. Predicted probability of WIHA program enrollment at different annual per acre payment levels for absentee and resident forest land owners (all variables other than the payment amount are set at their mean value).

Mean/Median WTA

As is customary in the WTA literature we report a mean/median payment level, but urge caution with this result as the calculated mean/median WTA falls outside the range of prices offered to the family forest owners who participated in our study. Following the methods of Cameron (1988) and Hanemann (1984), our probability model was converted to a model that enabled us to estimate mean/median WTA to enroll in a WIHA program. Table 5 indicates the model's estimated mean/median WTA and the contribution of independent variables to the minimum compensation required by family forest owners to enroll their forest land in a WIHA program. The landowners responding to our survey required, on average, nearly $50 per acre per year to keep their forest land open to non-motorized public hunting access. The difference in required compensation between resident and absentee owners is nearly $21 per acre. Similarly, for those who currently post their forest land, WTA is nearly $20 more than those family forest owners who do not prohibit public access. Landowners who view hunting as their single, most important reason for forest ownership need an additional $13 per acre in order to enroll compared to family forest owners whose principal reason for ownership is not hunting related.

Conclusions

In addition to the payment level offered, landowner interest in allowing public hunting access is affected by the owner's perceived impact (damage) on the land of allowing public access, several ownership motivations and characteristics (whether hunting is the primary ownership reason, future ownership plans, whether the land is currently posted, and the location of the owner's residence relative to the forest land owned), and some tract

Table 5
Contribution of independent variables on estimated landowner WTA

Variable	WTA coefficient	Contribution to WTA[1]
Landowner attitudes: Public access		
DAMAGE	9.25	$6.75
LIABILITY	–0.15	–$0.10
Landowner characteristics		
HUNT	13.13	$6.30
TENURE	1.84	$0.85
BEQUEST	13.88	$11.20
ABSENTEE	–20.97	–$18.62
Forest land characteristics		
ACRES	0.01	$0.83
POST	19.53	$13.32
HUNTQUALITY	–8.77	–$5.33
AVAILABILITY	6.18	$2.64
VALUE	0.01	$8.71
Constant	22.99	22.99
Mean/Median WTA ($/ac/yr)		$49.54

[1]Coefficient multiplied by the variable's mean value derived from survey responses.

characteristics (quality of hunting offered on the land, and the land's market value). Previous studies also found many of these factors were significant drivers of landowner participation in hunting leases (see, for example, Zhang et al., 2006; Mozumder et al., 2007). The several readily-identifiable landowner and/or tract characteristics (e.g., whether the land is posted, absentee versus resident family forest owner, forest land's estimated market value) facilitates effective targeting of WIHA program education and recruiting efforts. Yet, the large number of factors influencing landowner interest in such a program makes identifying the combination of landowner and tract characteristics that will maximize program enrollment probability a formidable challenge. This is consistent with Church and Ravenscroft (2008) who found that while the financial incentive amount offered is an important determinant to granting public access, other factors such as their attitudes toward incentives programs, land ownership goals, values, and motivations also play an important role.

A second major conclusion is that the cost of establishing a WIHA program directed at Minnesota's family forest owners would be substantial. Our model estimated it would cost nearly $50 per acre per year to secure participation among half the state's family forest owners. In one of the few studies reporting the mean compensation required to acquire hunting rights, Gray (1998) estimated mean WTA to be $25 per acre. Even after adjusting for inflation and recognizing limitations associated with our mean/median WTA estimate, Gray's WTA estimate appears to be substantially less than our estimated mean/median WTA for acquiring public access rights to Minnesota forest land.

When capitalized at 5%, the net present value of buying in perpetuity the public access right based on our estimated average WTA value of $50 per acre per year is $1,000 per acre. With an average market value of just over $1,100 per acre for the forest land tracts included in our study, this capitalized value of public access represents nearly 90% of the land's fee value.

The high payment landowners require to enroll in a WIHA program may reflect, in part, their concern over the lack of control over how access is granted. Other hunter access valuation studies estimated the value of assigning exclusive access rights through a lease program, whereas the right valued in our study was for unrestricted, general public access. With a hunting lease, landowners not only know who is accessing the property, but have the ability to choose the lessee. However, landowners participating in a government-sponsored WIHA program have no control over which or how many hunters can access their property. It could be these latter owners are demanding higher payment to compensate for any property damage that might occur as a result of allowing uncontrolled public access to their forest land. The fact that concern over damage to and/or littering on the property is a significant driver of Minnesota family forest owner interest in participating in a WIHA program bolsters this supposition.

The study also sheds light on how family forest owners view involvement in government programs. Our model estimated that those landowners in our study who do not currently post their forest land would still require, on average, approximately $36 per acre to enroll in a WIHA program. For such landowners, enrolling in a WIHA program would not require any change in behavior, impose explicit additional commitments, or require that additional rights be given up. This class of landowner appears to attach a substantial cost simply to participate in a government-sponsored program. Other family forest owner studies have also documented the negative sentiment toward government involvement in forest land ownership and management activities (e.g., Greene, Daniels, Jacobson, Kilgore, & Straka, 2005).

One-fifth of the respondents were undecided about whether they would participate in a WIHA program at the payment level offered, suggesting there is the potential to capture additional interest among the state's family forest owners than was found in this study.

Realizing this additional potential will require careful attention to the design of a government-sponsored WIHA program and the manner in which it is marketed to family forest landowners.

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