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Abstract

A contingent valuation survey of forest landowners in Southern Vermont and Western Massachusetts suggests that it would cost about $700 per acre to entice about one-half of Massachusetts and 33% of Vermont respondents to permanently conserve their forestland. Policies that promote early development of management plans and cooperation with neighbors are recommended because these activities appear to increase the likelihood that landowners will convey conservation easements. Education and a strong environmental ethic also improve the chances that respondents would sell conservation easements. A prediction-based contingent valuation format designed to reduce incentives for strategic behavior suggests that our results likely represent a lower bound estimate of landowner response to a large-scale conservation easement program.

JEL classification: Q23; Q28

Keywords: Conservation easements; Contingent valuation; Willingness to sell

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Introduction

Management and preservation of forested landscapes is critical to protect essential ecosystem services such as water quality and wildlife habitat. However, most non-industrial private forestland owners do not participate in existing state or federal management programs. For example, only about 13% of qualified forestland in Massachusetts is enrolled in the Chapter 61 program which provides a 95% property tax reduction in return for preparation of a forest management plan. Only 8% of eligible forestland is enrolled in the Massachusetts Stewardship Program funded by the USDA Forest Service, and surveys conducted by Klosowski et al. (2001) and Stevens et al. (2002) suggest that landowner participation in a wide variety of management programs with varying levels of economic incentive is likely to range from only about 2% to 18%.

Forestland fragmentation and conversion to development is another factor affecting provision of ecosystem services by forestland. Much of the forest in the United States (i.e., 42%; Butler and Leatherberry, 2004) is owned by private families and individuals. This type of ownership is even more common in the eastern states (e.g., Massachusetts 78%, Vermont 65%, New York 61%; Birch, 1996; FIA, 2002). As private land is sold and divided or converted, ownership size decreases; it is estimated that average parcel size in the United States will decline from a 1996 average of 10 to 7 ha by 2010 (Sampson and DeCoster, 2000). And forest loss can be as high as 18 ha/day in densely populated states like Massachusetts (Steel, 1999; MacConnell et al., 1991; Alerich, 2000).

New programs to protect forests and to foster forestland management are needed. Among the alternatives, increased use of conservation easements has often been suggested (Cho et al., 2005). However, easements may be expensive to obtain, and although some information about the public's willingness-to-pay (WTP) for easements has been published, very few studies have focused on the willingness of landowners to sell, WTS, conservation easements.

Information about WTS is important, in part, because this often determines the amount of land that can be preserved. And, understanding the relationship between landowner's socio-demographic characteristics, land ownership objectives and willingness to sell is critical for the design of efficient easement purchase programs.

In this study, we focus on forestland owner's willingness-to-sell conservation easements in southern New England, and on key characteristics of potential sellers. We begin with a brief overview of the concept of conservation easements and previous literature on the WTP for, and willingness-to-sell easements.

Background

As noted by Cho et al. (2005), conservation easements are "a legal arrangement between a landowner and a land trust or government agency that permanently limits development of land". The use of easements to protect land from development has

been increasing dramatically. Between 2000 and 2005, the amount of land under easement in the United States doubled to 6.2 million acres, and the number of land trusts increased by 32% to 1667 (Aldrich and Wyerman, 2006). During this same period, the amount of land under easement in the northeast increased by 1,547,089 acres (203%) (Aldrich and Wyerman, 2006). In Massachusetts, 161 land trusts collectively own 118,240 acres, hold easements on 61,569 acres, and have been involved in the conservation or reconveyance of protected land (e.g., passing easements on to state agencies) on 104,518 acres, for a total influence of 284,327 acres (Aldrich and Wyerman, 2006). In Vermont, 35 land trusts own 69,204 acres, hold easements on 399,681 acres, and have reconveyed 107,848 acres, for a total conservation impact of 576,733 acres (Aldrich and Wyerman, 2006). Land trusts, though often small and poorly funded, can be very effective catalysts for land protection, since they can act quickly, unencumbered by state and federal bureaucracies, and have strong local support. The recent expansion of the land trust "movement" nationally is a testimony to the important role they can play in the conservation of open space. However, the future role of easements depends, at least in part, on the public's WTP and landowner's willingness-to-sell easements.

Although several studies have estimated the public's WTP to preserve open space and agricultural land, we are aware of only one recent study of WTP for easements to preserve forestland in the United States (Cho et al., 2005). Results suggest that in Mason County, Georgia, WTP per household per year ranges between $10.97 and $21.79; an amount that could reduce forestland conversion in that region by 14–46%.

Very little evidence of landowners' willingness-to-sell conservation easements has been published. Dedrick et al. (2000) conducted a survey of non-industrial private forestland owners in Virginia to determine their attitudes toward the Nature Conservancy Forest Bank Program. In this program, the Conservancy buys timber rights from landowners in areas of ecological importance and then manages the timber in an ecologically sound manner. Dedrick et al. found that only 8% of respondents would enroll in such a program immediately and 15% expressed interest in participation in the future. However, 77% said they would not participate in this program.

Stevens et al. (2002) gathered information about private landowners' likely reaction to several alternative forest management programs, some of which required conveyance of timber rights in exchange for an annual payment. Likely participation rates ranged from only 2% to about 21% depending on the payment amount and other program requirements such as obligation to provide public access. Unlike the United States, private forestland in many European and Scandinavian countries is heavily influenced by zoning that prohibits or strongly discourages land use conversion to developed use (e.g., Grayson, 1993). There are examples, however, of forest policies designed to influence private woodland owner behavior and to promote conservation goals above and beyond discouraging or prohibiting overall land use conversion. In Finland, for example, METSO is a new program designed to enhance conservation values on private land that contribute to greater biodiversity regionally and nationally (METSO, 2008). Horne (2006) studied the likelihood that

private forest owners in Finland would enroll in variations of a voluntary conservation enhancement program based on the initiator of the contract, varying levels of restriction on forest use, annual compensation, duration of the agreements, and the ability to withdraw from the program. Likelihood of adopting a voluntary conservation program on private property was significantly increased if the landowners themselves initiated arrangement (as opposed to an environmental organization, which had a significant negative effect on adoption of the program). Landowners were more likely to participate if the contract duration was relatively short (e.g., 5–10 years), the present owner was allowed to cancel the contract, and restrictions on use involved small preserved patches of natural attributes or development of a nature management plan. Likelihood of adoption significantly decreased if no harvesting was permitted. Participation in the program increased with the level of compensation, with the average demand for annual compensation being approximately $143 per acre. Overall, these landowners are apparently reluctant to cede much control over their land without meaningful levels of compensation.

A more recent study by Siikamaki and Layton (2007) examined the potential effectiveness of incentive payment programs for biological conservation of non-industrial private forestland in Finland. Their survey of 2400 forestland owners suggested that incentive payment programs are likely to be more cost effective than top-down conservation regulations. Similar results have been reported in studies of conservation payment programs in Costa Rica, Mexico, Ecuador, and portions of Columbia (see http://www.oas.org/dsd/pes/programs.htm).

Taken together, these studies suggest that interest in programs paying owners for conservation of forestland is increasing.

Methods

A mail survey of 1,700 forestland owners in Southern Vermont and 1,200 owners in Western Massachusetts (owning 10 or more acres) contained a closed-ended contingent valuation (CV) question asking about willingness to sell a conservation easement for a specified amount of money per acre. Terms of the easement (see Appendix A) were the same for all survey recipients. Because prior research suggested that public access is a very controversial aspect of easements, the scenario explicitly stated that public access would not need to be granted.

The proposed "sales" price, which was randomly distributed to recipients, ranged from $100 to $700 per acre. This range was chosen because it is believed to be a realistic representation of the market value of forestland, with no development potential, in the region.

As noted by Murphy et al. (2005), a potential problem with the CV method is that respondents may often behave strategically. In their meta analysis, Murphy et al. (2005) found that WTP valuations are often overstated when compared to real payments. Although there is less information about this "hypothetical bias" in

willingness-to-sell studies, List and Gallet (2001) report that hypothetical bias associated with willingness to sell may often exceed that observed in the more common WTP format.

Although several alternative methods have been employed to correct for the potential problem of hypothetical bias, none appear to work well in all circumstances. In this study, we used a split sample approach; one-half of the Vermont landowners received a "prediction" form of the CV valuation question. This approach (see Appendix A) is based on the notion that when asked to predict the behavior of others, the locus of control is shifted away from the respondent resulting in less strategic behavior and hypothetical bias. In fact, Lusk and Norwood (2005) report that the prediction approach yields CV results that are very close to actual behavior.

Principle components analysis (PCA) was used to consolidate several highly correlated survey variables into fewer, uncorrelated dimensions. This technique was applied separately to three multiple part survey questions. The first was an eight part question asking respondents how recently they had considered various decisions about their land including potential sale, timber sale, and development of a management plan. The next was a six part question asking about ownership objectives, and the last was a 15 part question about attitudes towards land ownership and the environment in general. The principle components approach was used for two reasons. First, deriving several principle components from many correlated variables facilitates interpretation. For example, we can discuss a landowner's (or group of landowners') relative views on RECREATION (defined in Table 1) as a whole, as opposed to discussing responses to several different, but related specific questions about recreation. Second, PCA forms orthogonal, uncorrelated dimensions that can be used in subsequent regression analyses. These new variables are often an improvement over the original, correlated variables. However, it is important to note that principal components analysis assumes linearity and it is impossible to test for whether the selected components are statistically significant representations of the underlying data. Consequently, PCA should generally be considered an exploratory technique. The components derived in this study from survey responses are reported in Table 1.

The following logit regression models were then estimated:

$$\begin{aligned}\text{WTS} = f(&\text{acre, education, family, use, environment, recreation, must pay,}\\ &\text{management, land sale, cooperation, state, Ln offer, absentee}) \quad (1)\end{aligned}$$

The dependent variable, WTS, equals 1 if the respondent would be willing to sell an easement and 0 otherwise. Acre is size of land holding, education is highest level attained, state = 1 if Massachusetts and 0 if Vermont, and Ln offer is the natural log of dollars per acre. There are several large ski areas and all season resorts in part of the region examined in this study. As a result, about 26% of Massachusetts and 43% of Vermont respondents were classified as absentee. Since we hypothesize that absentee owners might respond differently to an easement program relative to residents, a dummy variable which equals 1 for an absentee owner was also included.

Table 1. Principle components.

Factor	Description
Management	Considered development of management plan or timber sale. (High values indicate never or long time ago, low values indicate recently.)[a]
Cooperation	Ever contacted neighbor or neighbor contacted you about cooperative management. (High values = never or long ago; low values = recently.)[a]
Land sale	Ever considered a land sale. (High values indicate never or long time ago; low values = recently.)[a]
Responsibility	Landowner feels responsibility for maintaining social and ecological benefits from forestland. (High scores = greater responsibility.)
Must pay	Owner feels that land must pay for itself. (High scores = strong feelings that land must pay.)
Recreation	Importance of land for recreation, scenery or privacy. (High score = more important.)
Environment	Importance of protecting environment and protecting land from development. (High score = more important.)
Use	Importance of income from timber, firewood, maple syrup. (High score = more important.)
Family	Importance of passing on land to children. (High score = more important.)

[a]1 = within the last 6 months; 2 = last year; 5 = within 5 years; 6 = never.

All other variables are defined in Table 1:

$$\text{WTSP} = f(\text{same independent variables as model 1 except for state}) \quad (2)$$

In model 2, WTSP equals 1 if a respondent predicted that a neighbor would grant a conservation easement and 0 otherwise. Data for this model was obtained from Vermont respondents only.

Results

The survey response rates were 44% and 46% for Vermont and Massachusetts, respectively. A short telephone survey of randomly selected non-respondents was used to test for non-response bias. Although similar in most respects, respondents were more likely to be enrolled in forest management programs and owned larger parcels compared to non-respondents. Consequently, our analysis focuses on survey respondents; the results should not be extrapolated to all forestland owners within the region.

About 56% of Vermont respondents live on their forestland. The average parcel owned by Vermont respondents was 63 acres (25.5 ha), three-quarters of respondents were older than 51 and 72% had completed college. Almost three-quarters had never considered granting a conservation easement and 47% had never thought about

development of a management plan for their forest (see Table 2). A larger percentage of Massachusetts respondents live on their land (74%), average parcel size was about the same as for Vermont, and 59% have a college degree. Sixty-three percent of Massachusetts respondents had never considered a conservation easement and 43% had never considered development of a management plan.

Also, as shown in Table 2, most respondents in both states have never contacted a neighbor about forest management issues. Most (67% Massachusetts and 70% Vermont) agreed or strongly agreed with the notion that their forestland benefits society as a whole. A majority said that recreation was an important or very important reason for land ownership and only a small percentage of respondents cited income from timber as an important reason to own forestland.

Table 3 shows the distribution of WTS responses by offer amount. If "don't know or maybe" responses are ignored, 47% of respondents said they would be WTS an easement for $700 per acre while 53% would not. As expected, the percentage of respondents WTS appeared to increase with the amount offered.

Table 2. Results of selected survey question (MA and VT).

Question	Results	
	MA	VT
5.2 and 4.9 for MA and VT respectively	5.24	4.93
Never considered sale of land (%)	58.4	63.6
Never considered timber sale (%)	30.5	32.6
Never considered management plan (%)	42.5	46.8
Never contacted neighbor about land management issue (%)	69.7	66.9
Agree or strongly agree that "land must pay way" (%)	29.8	22.4
Agree or strongly agree that their land benefits society (%)	66.7	70.1
Recreation on owners land is an important or very important reason for ownership (%)	58.8	64.5
Income from timber is a very important or important reason to own land (%)	8.7	7.8
Passing land to children is important or very important reason for ownership (%)	54.3	63.3

Table 3. Distribution of WTS by offer amount (percent)[a].

Response	Offer ($ per acre)			
	$100	$300	$500	$700
Yes (%)	37	37	42	47
No (%)	63	63	58	53
Total (%)	100	100	100	100

[a]Only Yes or No answers were included. A total of 11% of respondents gave a Don't Know or Maybe response.

Table 4. WTS model parameter estimates.

Parameter	Estimate	Standard error	Wald χ^2	$Pr > \chi^2$
INTERCEPT	−3.4685***	0.9247	14.0678	0.0002
Ln OFFER	0.2608*	0.1371	3.6159	0.0572
ACRE	−0.00172	0.00125	1.8878	0.1694
EDUCATION	0.2566***	0.0949	7.3145	0.0068
FAMILY	−0.038	0.0969	0.1573	0.6951
USE	0.1402	0.1064	1.734	0.1879
ENVIRONMENT	0.6143***	0.1081	32.2991	<0.0001
RECREATION	0.2173*	0.1136	3.6621	0.0557
MUST PAY WAY	−0.2157*	0.1121	3.7031	0.0543
MANAGEMENT	−0.1811*	0.1035	3.0623	0.0801
LAND SALE	0.1103	0.1002	1.2116	0.271
COOPERATION	−0.2603***	0.0946	7.5688	0.0059
ABSENTEE	0.4145*	0.234	3.1378	0.0765
STATE	0.7551***	0.2063	13.4027	0.0003

***Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.
Likelihood ratio 93.27 (<0.0001).

The logit models were then used to investigate the socio/economic factors associated with WTS. Results derived from the two logit models are presented in Tables 4 and 5.[1]

Statistically significant variables in Table 4 include Ln offer, education, environment, recreation, must pay way, management, cooperation, absentee, and state. As expected, the likelihood that a landowner would convey an easement increases with the amount of compensation offered (Ln OFFER). And, the more education a landowner has, the more likely he or she will convey an easement.[2] Those who feel "land must pay its way" were significantly less likely to be WTS. The USE variable was insignificant in this model, suggesting income from land is relatively unimportant in the context of conservation easements. However, the more importance a landowner places on protecting the environment and on recreation, the more likely he or she will convey an easement.

The variable MANAGEMENT is significant and negative. Lower scores on this factor mean that the owner has considered development of a management plan or sale of timber recently. The negative sign suggests that the more recently one of these decisions has been considered, the more likely a landowner will convey a

[1]These are log-linear models; the natural log of OFFER was used to insure that WTS cannot be negative.

[2]We did not specifically ask about household income since it is often not provided by respondents. However, education is often correlated with income.

Table 5. WTSP-prediction model parameter estimates.

Parameter	Estimate	Standard error	Wald χ^2	Pr > χ^2
INTERCEPT	−4.9102**	2.0084	5.9769	0.0145
Ln OFFER	0.5588**	0.2817	3.9345	0.0473
ACRE	−0.00258	0.00316	0.668	0.4137
EDUCATION	0.424**	0.2152	3.8805	0.0489
FAMILY	−0.1171	0.2363	0.2457	0.6201
USE	−0.1916	0.2597	0.5442	0.4607
ENVIRONMENT	0.1093	0.2219	0.2428	0.6222
RECREATION	0.1634	0.2218	2.5424	0.4615
MUST PAY WAY	−0.0469	0.2132	0.0485	0.8257
MANAGEMENT	−0.2162	0.2165	0.9968	0.3181
LAND SALE	−0.0347	0.2405	0.0208	0.8854
COOPERATION	−0.2842	0.1908	2.2184	0.1364
ABSENTEE	−1.3053***	0.4389	8.844	0.0029

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.
Likelihood Ratio = 27.6879*** (0.0061).

conservation easement. Conversely, landowners who have never considered a management plan (or have not considered one in some time) will be less likely to convey an easement, holding other variables constant.

Interpretation of the COOPERATION variable is similar to the MANAGEMENT component: landowners who have recently considered cooperation with other landowners, or have been recently contacted by a neighbor, are more likely to convey an easement. The variables for STATE and ABSENTEE are significant and positive, indicating that Massachusetts respondents and absentee owners are more likely to convey a conservation easement.

The second model (WTS prediction, Table 5) was estimated for respondents who received the prediction-based WTS question (i.e., ''Do you think any of your adjacent neighboring landowners would be willing to sell a conservation easement?''). One hundred and eighty-three respondents (all in Vermont) received the WTS prediction question and answered either 'yes' or 'no'. Of these, 148 provided usable responses to all independent variables.

As shown in Table 5, Ln OFFER is positive and significant in the prediction model. The more education a respondent has, the more likely he or she will predict that a neighbor will convey an easement. And, it is important to note that absentee owners are less likely to predict that a neighbor will be WTS a conservation easement.

In addition to providing information about the factors associated with WTS, logit models of the type estimated here are often used to derive point estimates of median and mean WTS. However, in referendum CV, median and mean value estimates are

often very sensitive to the logit model specification (Hanemann, 1984, 1989; Haab and McConnell, 1998; Vaughn et al., 1999). Vaughn et al., for example, report several central tendency estimates (derived from a single data set) that differ by a factor of 4. The logit models used in our study (see Tables 4 and 5) were specified in log-linear form to insure that WTS cannot be negative. However, as noted by Haab and McConnell (1998), models which are truncated at zero tend to have fat tails and since WTS can range from 0 to infinity, exceedingly high means and medians often result. Various ways of setting an upper bound on WTS have been used, but any upper constraint on WTS is likely to be somewhat arbitrary.

Consequently, we do not focus on median or mean estimates of WTS. Rather, we examine the likelihood of easement program enrollment when landowners are offered the approximate average upper bound market price of undeveloped land in the study area ($700 per acre). WTS probability estimates derived from the logit models are reported in Table 6. All probabilities were calculated at the means of the independent variables and with an offer price of $700 per acre.

Comparing the results in Tables 3 and 6, the logit model (pooled data) predicts a slightly lower probability of participation associated with a $700 per acre offer (47% from Table 3 and 43% from Table 6, pooled model). Since the logit model fit is not perfect, this difference should not be surprising.

Of particular interest is that when compared to Vermont, Massachusetts respondents appear to be much more likely to sell conservation easements (Table 6; likelihood of sale given a $700 offer equals 33% in Vermont and 51% in Massachusetts).

One reason for this finding may be differences in anticipated land values between the two states. Because of vacation opportunities, second home development, and skiing, forestland in the Vermont study area has the potential to be more valuable than similar land in the Massachusetts region. Another factor may be differences between these states in the "culture" surrounding land protection. In general, sale of conservation easements has been more common in the portion of Massachusetts examined in this study. For example, the state of Massachusetts recently spent about $9 million to protect land close to the region studied here. In Vermont, the emphasis has been more on easement donations as opposed to purchase. Consequently,

Table 6. Probability of WTS at offer price of $700 per acre.

Group	Probability (%)
Pooled	43
Vermont	33
Massachusetts	51
Absentee	50
Resident	40
Prediction[a]	47

[a]Prediction estimates refer to Vermont only.

Massachusetts landowners may have a much different expectation about easement purchase as compared to those in Vermont.

The results in Table 6 suggest a difference between individual behavior and the predicted behavior of others with respect to sale of conservation easements (47% prediction model vs. 33% Vermont self-estimates).[3] This may mean that survey respondents underestimated the likelihood that they would be WTS at the $700 price, as might be expected if hypothetical bias is present. However, further research about this issue is needed.

It is also important to note that with respect to individual WTS, landowners who have more education, are more concerned about environmental protection and recreation and have recently cooperated with neighbors are much more likely to be WTS a conservation easement (see Table 4). Also, absentee owners were much more likely to convey a conservation easement; the likelihood of sale at the $700 price was 50% for absentee and 40% for residents (see Table 6). However, the prediction model suggests that absentee owners predict that neighbors will be less likely to sell.

It is not clear why residents and absentee owners differ. Analysis of survey responses show that residents are more concerned about non-market values associated with their land. Absentee owners felt more strongly that "land must pay its way". However, residents were not statistically different from absentee owners with respect to age, education, duration of ownership or acres owned. Yet, compared to residents, absentees are more likely to convey a conservation easement but less likely to predict that a neighbor would grant an easement. More research about the differences between these two groups is clearly needed.

From a policy perspective, it is important to examine the relative influence of the statistically significant logit model variables on WTS conservation easements. Traditional odds ratio estimates associated with the logit models estimated here are somewhat difficult to interpret because many of our variables are categorical; implying, for example, that an increase in education from level 1 to 2 has the same impact as an increase from level 2 to 3.[4] With this caveat in mind, we focus only on the variables that are statistically significant and for which public policy can potentially control. Among these are management and cooperation.

Although, as noted above, odds ratios associated with each of these variables must be interpreted with caution, a one unit increase in the management variable implies a 18% decrease in the probability of conveying an easement. That is, a one unit delay in the consideration of management plan development (Table 4) results in an 18% decrease in the odds that the average landowner will be WTS an easement. And, a one unit delay in "cooperation" (see Table 4) implies a 22% decrease in the likelihood of selling an easement.

Consequently, public programs that encourage landowners to consider development of a management plan and cooperation with neighbors sooner, rather than

[3]The prediction model applies to Vermont respondents only.

[4]An alternative logit model specification employing $n-1$ dummy variables avoids this problem, but is not feasible given the number of categorical variables used in this study.

later, might have a large and statistically significant impact on the sale of conservation easements. Programs that have encouraged management plan development have traditionally relied on cost-sharing incentives or subsidies, in terms of $ per acre or $ per plan and have appealed to a relatively small segment of the overall landowner population. Programs to foster cooperation between neighbors are much fewer in number, and have largely been untested (e.g., Campbell and Kittredge, 1996), but recent results suggest that certain segments of the landowner population would be interested in explicit cooperation with neighbors for various reasons (e.g., land protection, habitat improvement, recreation, shared management expenses or timber harvesting; see Finley et al., 2006).

These findings can also be used to (1) help conservation organizations to cost-effectively target outreach campaigns to forestland owners amenable to conservation programs and (2) to tailor education campaigns to concentrate on changing attitudes about cooperation and development of management plans.

Finally, there are an estimated 585,054 and 378,601 forested acres in the Western Massachusetts and Southern Vermont areas surveyed in this study. Assuming an offer price of $700 per acre and that all landowners are "average", 423,316 acres of forestland could be protected at a cost of about $296 million.[5] At first glance, this might seem like an extraordinary sum for public investment, but when one considers the potential public benefits from land protected, it seems much less daunting. Investment in public infrastructure to yield social benefits on this scale is not without precedent. Metro Boston's non-filtered surface water supply is protected by the 100,000-acre forested Quabbin Reservation. To provide equivalent filtration, $500 million would be needed just to build the facility. Massachusetts built the Quabbin Reservoir and tunnels in the 1930s at a cost of $53 million, which in today's dollars is the equivalent of $599.5 million. Massachusetts residents made similar infrastructural investments in transportation in 1957 when $257 million was spent to construct 123 miles of Massachusetts Turnpike (the equivalent today of $1.7 billion). In the 1990s, Massachusetts spent over $14 billion for the Central Artery/Tunnel Project (known locally as the Big Dig) to facilitate traffic flow through Boston. It is also interesting to note that a tax on gasoline in Massachusetts of $0.01 per gallon (i.e., raising the current state and federal tax on gasoline from $0.39 per gallon to $0.40 per gallon) would return $27 million annually. And, there is a justifiable symmetry of taxing cars and trucks to pay for protected forestland that will perpetually sequester the carbon emitted on a daily basis. While it is beyond the scope of this paper to present tested policy solutions to the loss of forest and the emanating public benefits, our results do suggest important WTS information that can assist in the formation of policy alternatives for further study, experimentation, or consideration.

[5]This calculation is based on the probability estimates given in Table 6. At a $700 per acre price, 33% of Vermont respondents and 51% of Massachusetts respondents would be WTS easements. Assuming that 33% of Vermont forestland and 51% of Massachusetts forestland is owned by these groups, the total acreage preserved would be about 423 thousand acres.

Conclusions

In the context of public policy, the conservation of forestland is partly a financial question – How much would it cost to protect from development a significant amount of forestland? Our results indicate that it would cost about $700 per acre to entice about one-half of Massachusetts and 33% of Vermont landowners surveyed in this study to permanently conserve their forestland. In other words, Massachusetts owners (and absentee owners) would be willing to permanently protect their land at a lower cost. And as noted above, about 423,000 acres of forestland could be protected at a cost of about $296 million.

The likelihood that a landowner would convey an easement is greater for those who have recently undertaken cooperative activities with other landowners. As expected, a strong environment ethic improves the chances that a landowner would be amenable to selling an easement. Perhaps the biggest potential for development of a successful easement program would be an outreach program to encourage landowners to develop management plans and to cooperate with neighbors as soon as possible. Management plan subsidies and incentives have been available for decades and appealed to some. But, linking them more strongly to land protection and easements, and making a concerted effort to foster cooperation may result in more easements on private land.

Finally, prediction theory was utilized in our WTS analysis to account for potential strategic bias, our assumption being that respondents would be more accurate in their prediction of other landowner's behavior than their prediction of their own. Prediction and individual WTS results were different; and at a $700 per acre price, more than about 423 thousand acres might actually be conserved. Consequently, the results reported here may be viewed as a lower bound estimate of what might be achieved with a large-scale conservation easement program.

Appendix A

This next question asks about conservation easements. Please understand that we are only interested in your opinion on this issue. You are NOT being asked to join such a program. You will NOT be contacted by anyone regardless of your answer.

A conservation easement is a binding agreement that permanently limits uses of all or a portion of one's land in order to protect its conservation values. It would allow a landowner to continue to own and use the land and sell it or pass it on to heirs. But it would limit some of the rights associated with the land. For example, a conservation easement may stipulate that a landowner cannot sell the land for housing or development. Because the easement would extinguish the right to develop, it could result in a reduction in assessed value and property taxes.

Easements can vary greatly in their detail and level of restriction. They are voluntary arrangements between a landowner and an organization that holds the easement. The same way a right-of-way can be deeded from one landowner to

another, so can the development rights be deeded from one landowner to another organization through an easement.

Below, we present one possible easement scenario for your consideration. Since easements, their restrictions, and values can vary based on the agreement between a willing landowner and a conservation organization, there is not one universal approach. We describe one possible easement scenario below, and ask whether you think you would be willing to sell a conservation easement based on these features:

- 90% of your property would be protected from development by a conservation easement, with the remainder left out providing for up to 3 potential building lots in the future.
- On the 90% of the property with the easement, development would be restricted. That is, no structures could be built on this part of the land. Personal recreation, hunting, and timber harvest would still be allowed.
- The easement would be permanent. If the land was sold, the easement would remain in effect. The remaining 10% of the land with the three potential building lots could be managed, developed, or sold without restriction.
- In return for this easement, you and the surrounding community could be certain that this land would never be developed and would always remain forestland.
- You would not need to grant public access to the land which is protected by the easement.
- You would be paid \$100/\$300/\$500/\$700 per acre for the easement.

Question for WTS model

Would you be willing to sell a conservation easement according to the scenario above?

☐ Yes

☐ No. If no, why not? _____

Question for prediction model

Do you think any of your adjacent neighboring landowners would be willing to sell a conservation easement according to the scenario above?

☐ Yes

☐ No. If no, why not? _____

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