

# AN ALTERNATE PROPERTY TAX PROGRAM REQUIRING A FOREST MANAGEMENT PLAN AND SCHEDULED HARVESTING

Donald F. Dennis and Paul E. Sendak<sup>1</sup>

**Abstract:** Vermont's Use Value Appraisal property tax program, designed to address problems such as tax inequity and forced development caused by taxing agricultural and forest land based on speculative values, requires a forest management plan and scheduled harvests. A probit analysis of enrollment provides evidence of the program's success in attracting large parcels of undeveloped land, in providing financial relief in areas where taxes are most burdensome, and in encouraging more affluent landowners, whom previous studies show to be less interested in timber production, to harvest timber.

## INTRODUCTION

Private forests are expected to play an important role in meeting future timber needs. Nearly three-quarters of the Nation's timberland is privately owned, being particularly concentrated in the eastern hardwood region. Approximately 82 percent of the Nation's hardwood growing stock, nearly 249 billion cubic feet, is in private ownership (USDA Forest Service 1988).

Public policy makers and industrial planners are concerned that these lands may not meet their potential in fulfilling future needs for timber. Continued division of the forest into smaller parcels and increased development may make harvesting uneconomical over large areas. There is also concern that increasingly affluent landowners, who are more interested in the nontimber aspects of land ownership, may be unwilling to manage and harvest their forests. These concerns are supported by several empirical studies (Binkley 1981, Dennis 1989, 1990, Widmann and Birch 1988).

This study provides evidence that alternatives to property taxation based on fair market value can slow parcelling of the forest and entice otherwise uninterested landowners to manage and harvest timber. Vermont's Use Value Appraisal (UVA) property tax program was designed to address problems, such as tax inequity and development of rural land, caused by taxing agricultural and forest land based on speculative values. Private forests are particularly important in Vermont, where only 10 percent of the timberland is publicly owned. Vermont's program is unique in that it requires a forest management plan that includes scheduled harvesting, an annual conformance report, and periodic inspection by State foresters.

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<sup>1</sup>Forest Economists, USDA Forest Service, Northeastern Forest Experiment Station, George D. Aiken Forestry Sciences Laboratory, 705 Spear Street, South Burlington, VT 05403.

Enrollment has been rapid and by 1989, 21 percent of the state's eligible forest land was enrolled. Since tax burdens are shifted, this program comes under frequent scrutiny.

A probit model was used to analyze the relationship between the probability of enrollment in the program and characteristics of the parcel, owner, and surrounding community. The results are useful in assessing potential future enrollment and provide insight into the program's effectiveness by identifying characteristics of enrolled lands. The results also provide insight in evaluating the merits and potential enrollment in similar programs in other states. The more important inferences are that the program is successful in attracting large parcels of undeveloped land, in providing financial relief in areas where the property tax is most burdensome, and in encouraging more affluent landowners, whom previous studies show to be less interested in timber production, to manage their woodland and harvest timber.

## VERMONT'S USE VALUE APPRAISAL PROGRAM

In 1977, Vermont enacted a UVA property tax program that included three separate categories: farmland, agricultural land, and forest land. Although each provides important benefits, our analyses and discussion are confined to the forest land program.

The UVA program was established by the Vermont legislature to achieve more equitable taxation for undeveloped land, encourage productivity, and help preserve the scenic landscape. The scenic landscape was specifically stated to be a "working" landscape and the legislation was meant to help preserve the viability of the state's agricultural and forest industries.

Entry into the program is optional, but each parcel must consist of at least 25 acres and be managed under a forest plan approved by the Vermont Department of Forests, Parks and Recreation. Private consulting foresters generally prepare the plans, which must meet specified requirements that include scheduled harvests. In addition to annual conformance reports, State foresters inspect the property at least once every 5 years.

A penalty, equivalent to 10 percent of the fair market value at the time of a conversion, is assessed if enrolled land is converted to a non-qualifying use. Failure to comply with the management plan may be deemed conversion to a non-qualifying use and trigger the penalty. The penalty, called a land use change tax, is guaranteed by a lien placed on the property at the time of enrollment. The lien remains with the parcel through transfers of ownership.

Tax relief is provided by modifying the assessed value of the parcel to reflect its value for growing timber, instead of development potential. The modified or use values are determined annually by the Current Use Advisory Board, based on a capitalization of expected returns from timber growth. The 1989 use values for forest land were \$65 per acre for productive land (USDA Forest Service Site Classes I to III) and \$10 per acre for non-productive and open land. By contrast, Armstrong (1988) reported that in 1987 average per-acre market prices for Vermont forest land were \$296 for parcels larger than 250 acres, \$509 for parcels

between 100 and 249 acres, and \$658 for parcels of 75 to 99 acres. Landowners saved approximately 75 percent of their tax liability by entering the program.

The State legislature appropriates funds annually to reimburse towns for lost revenue resulting from modified assessments. The reimbursement is the difference between fair market value and use value, multiplied by the town tax rate, with a maximum currently set at \$24.50 per acre. Reimbursements for the total program (farm, agricultural, and forest) exceeded \$7.3 million in 1988. Since the amount is significant for a small state like Vermont, the program comes under critical review each year. Failure of the State legislature to appropriate funds for the program in any year gives enrollees the option of leaving the program without penalty.

## DATA

Forest characteristics were obtained for 338 sample plots measured by the USDA Forest Service during its periodic survey of Vermont (Frieswyk and Malley 1985). Each plot was located on a privately owned parcel of at least 25 acres, the minimum size eligible for enrollment in the UVA program. Species composition, timber volume, basal area, road access, elevation, and a variety of other physical characteristics were recorded. State forestry personnel identified whether the sample plots were located on parcels enrolled in the UVA program. The owner of each parcel was sent a questionnaire requesting the owner's age, education level, occupation, tenure of ownership, income, whether he or she was brought up in a rural or urban environment, and several other characteristics. Characteristics of the surrounding community, such as population density, town growth rate, and the town tax rate were obtained from State census and property valuation data.

## METHODS

A binary choice (probit) model was used to analyze the relationship between a dichotomous dependent variable ( $Y_i$ ), coded 1 if the  $i$ th parcel was enrolled in the UVA program or 0 if it was not, and characteristics of the forest, property owner, and surrounding community ( $X_i$ ). Detailed discussions of the generalized use of probit models may be found in many econometrics textbooks (e.g. Judge et al. 1982). A brief explanation follows.

We assume that the probability of a parcel being enrolled in the UVA program is represented by an unobservable random index ( $Y_i^*$ ), which can be defined as a function of observable characteristics ( $X_i$ 'B) and a random disturbance ( $e_i$ ). If the observed choice ( $Y_i$ ) equals one when  $Y_i^* > 0$  and zero when  $Y_i^* < 0$ , then:

$$P(Y_i=1)=P(Y_i^*>0)=P(e_i<X_i'B)=F(X_i'B)=\int_{-\infty}^{X_i'B} f(e)de \quad (1)$$

$F(\ )$  is the cumulative distribution function and  $f(\ )$  is the probability density function of  $e_i$ , which are specified to be normal in the probit model.

Because the specification is nonlinear, the estimated coefficients do not represent the change in probability of enrollment resulting from a unit change in an explanatory variable. The marginal change in probability depends on the original probability as determined by the values for all the variables and coefficients. The marginal change in probability is computed as:

$$\frac{\partial P_i}{\partial X_{ik}} = f(X_i' B) B_k \quad (2)$$

where  $k$  indexes the explanatory variables. The sign of a coefficient shows the direction of change while the magnitude depends on the value for  $f(X_i' B)$ , which reflects the steepness of the cumulative distribution at  $X_i' B$ .

## RESULTS

Table 1 lists and briefly describes each variable. The results provided in the upper portion of Table 2 are for the probit analysis of the entire sample ( $N = 338$ ). So that the effects of individual owner characteristics, such as education, could be analyzed, a subsample was formed that excluded all parcels held by businesses or organizations. These results are reported in the lower portion of Table 2 ( $N = 252$ ).

Table 1.--Variable Summary

Variable	Definition
ACRES	Natural logarithm of acreage of forest ownership
ROAD	Coded 1, if parcel is within 1/4-mile of a maintained road; 0 otherwise
IND	Coded 1, if parcel is owned by a forest industry; 0 otherwise
DEN	Population per square mile in town where plot is located
GRO	Population growth rate in town where plot is located
TR	Equalized town property tax rate
ED	Years of formal education

Table 2.--Probit results

Explanatory Variable	Coefficient	Standard error	Mean in UVA Program	Mean not in UVA Program
N = 338      All parcels				
Constant**	-2.6739	0.5766	1.00	1.00
ACRES**	0.2186	0.0618	6.48	5.76
ROAD	-0.1583	0.1732	0.55	0.66
IND**	-0.7725	0.3668	0.15	0.13
DEN	-0.0018	0.0018	37.38	41.06
GRO**	-0.0305	0.0143	6.85	8.84
TR*	0.6603	0.2036	1.71	1.57
Likelihood ratio statistic = 30.11				
N = 252      Individually owned parcels				
Constant**	-3.1657	0.8421	1.00	1.00
ACRES**	0.1626	0.0729	5.59	5.04
ROAD	-0.1878	0.2172	0.61	0.71
ED**	0.0935	0.0309	15.53	14.17
DEN	-0.0045	0.0032	34.36	42.94
GRO**	-0.0584	0.0192	6.42	8.98
TR*	0.4799	0.2515	1.75	1.65
Likelihood ratio statistic = 30.28				

\*Significant at the 10-percent level.

\*\*Significant at the 5-percent level.

There was some concern from both the public and lawmakers that large industrial owners might be the primary beneficiaries of the program and little public benefit would be obtained, since these owners were likely to retain and manage their land, regardless of tax liabilities. A positive relationship was estimated between the natural logarithm of ownership size and enrollment in the UVA program. Larger parcels more likely may be held for long-term timber production due to economies of scale in both harvesting and management and due to larger overall tax liabilities that offer greater incentive for enrollment. However, all else equal, industrial holdings appear less likely to be enrolled. There was a negative correlation between industrial ownership and enrollment. We estimate that approximately 10 percent of total benefits paid for the forest land portion of the UVA program accrue to forest industry.

Development potential and speculative values were expected to be higher in densely populated or rapidly growing areas and for parcels with close proximity to a maintained road. The estimated coefficients for all three variables were negative but only the coefficient for the town growth rate was significant at the 10-percent level.

Higher tax rates appeared to motivate landowners to seek tax relief. Program enrollment was positively correlated with the equalized town property tax rate.

More highly educated landowners were more likely to enroll their land in the UVA program, but other owner characteristics that we tested were not significantly correlated with enrollment. An owner's age, occupation, income, tenure of ownership, and whether he or she was brought up in a rural or urban environment did not appear to influence enrollment significantly. Also, an expressed concern that out-of-state residents were more likely to benefit from the program was not substantiated. The estimated correlation between enrollment and Vermont residency was positive, but not statistically significant.

Forest conditions did not appear to affect enrollment. No significant correlations were found between enrollment and per-acre timber volume, basal area, and variables that measured species composition. These results corroborate the results of another study that found little difference in statewide inventory statistics for enrolled and unenrolled lands (Sendak and Dennis 1989).

## DISCUSSION

Probit analysis also can be used to estimate the probability of enrollment for parcels with selected characteristics. Since future enrollment was of interest, the probability of enrollment was calculated at the mean values of the explanatory variables for all parcels not currently enrolled in the UVA program. This estimate was 0.18, compared with an estimated probability of 0.25 when computed at the mean values for enrolled parcels.

The probit results indicate how changes in the characteristics of the parcel, owner, and community are expected to influence future enrollment. The results suggest that continued division of the forest and population growth will tend to slow enrollment. However, continued increases in the education levels of landowners and increased tax liabilities should have an opposite effect. An estimated elasticity of approximately 2 suggests that increases in education will have a relatively strong impact on enrollment. Elasticity measures the percentage change in the probability of enrollment expected to result from a 1-percent change in an explanatory variable.

The strong correlation between enrollment and education level suggests that the program is effective in enticing otherwise uninterested owners to manage and harvest timber. Previous empirical studies of timber supply from private forests yielded strong negative correlations between harvesting and education levels (Binkley 1981, Dennis 1989). Brighton (1988)

estimated that 40 percent of the participants had never worked with a forester before enrollment.

Overall, Vermont's UVA program appears successful. Rapid enrollment has brought 21 percent of the state's eligible forest land into the program by 1989. Total net growth of timber on UVA land could supply approximately half of the average annual statewide removals (Sendak and Dennis 1989). Improved silvicultural practices and supervision of logging by foresters should increase the long-run productivity and health of Vermont's forests. Improved productivity and the commitment of an increasing portion of the state's forest land to long-term timber production should enhance greatly the prospects for Vermont's wood using industries.

Landowners and the general public also benefit. Inequities, inherent in the unmodified ad valorem property tax, are reduced when taxes are based on the value for growing timber, as opposed to development potential. The tax savings relieve development pressures and to some extent compensate landowners for the externalities, like wildlife habitat, scenery, and improved water quality, that their lands provide. The strong positive correlation between enrollment and parcel size suggests that the program is effective in attracting large blocks of undeveloped land, which public sentiment has shown to be desirable. There has been considerable public concern over the recent sale of 985,000 acres in northern Vermont and New Hampshire by Diamond International. Suddenly, large blocks of land that were traditionally open to the public became available to developers.

The positive correlation between enrollment and tax rates suggests that the program is effective in relieving tax pressures in areas where it is needed most. Providing equitable taxation is a stated goal of the program.

Although, the overall success of the program is supported, one troubling, but minor, concern emerged. Since enrollment was negatively correlated with both population density and a town's growth rate, the program may be least effective in attracting participants in areas where it is needed most, from the perspective of maintaining open space. However, each undeveloped parcel is likely to provide significant aesthetic benefits to local residents in densely populated areas.

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