



University of  
Massachusetts  
Amherst

## Economic incentives for coordinated management of forest land: a case study of southern New England

Item Type	article;article
Authors	Klosowski, R;Stevens, T;Kittredge, D;Dennis, D
DOI	<a href="https://doi.org/10.1016/S1389-9341(00)00035-6">10.1016/S1389-9341(00)00035-6</a>
Download date	2024-10-07 18:20:43
Link to Item	<a href="https://hdl.handle.net/20.500.14394/42672">https://hdl.handle.net/20.500.14394/42672</a>

# Economic incentives for coordinated management of forest land: a case study of southern New England

R. Klosowski<sup>a</sup>, T. Stevens<sup>a,\*</sup>, D. Kittredge<sup>b</sup>, D. Dennis<sup>d</sup>

<sup>a</sup>*Department of Resource Economics, Draper Hall, University of Massachusetts, Amherst, MA 01003, USA*

<sup>b</sup>*Department of Natural Resources Conservation, Holdsworth Hall, University of Massachusetts, Amherst, MA 01003, USA*

<sup>d</sup>*USDA Forest Service, Northeast Experiment Station, Burlington, VT, USA*

Received 28 March 2000; received in revised form 3 October 2000; accepted 13 October 2000

---

## Abstract

Coordinated management among many private forest land owners will often be required to achieve ecosystem management at the landscape scale. A case study of landowners in southern New England shows that although most hold favorable attitudes towards coordinated management, economic incentives may be needed to actually implement coordinated management programs. Yet the conjoint analyses used in this study suggests that economic incentives, such as property tax reductions, are not likely to substantially increase the probability that coordinated management programs will actually be undertaken. For example, an increase in property tax savings from \$706 per year to \$2000 per year only increased the probability of program adoption from 1.4 to 5.6%. Alternative ways in which coordinated management programs might be marketed are discussed. © 2001 Elsevier Science B.V. All rights reserved.

*Keywords:* Economic incentives; Ecosystem management; Coordinated management; Conjoint analysis

---

## 1. Introduction

Landscapes large enough for effective ecosystem management (EM) often have many owners (Brunson et al., 1996). Although forest land frag-

mentation continues to increase worldwide, this problem is particularly apparent in much of the eastern United States, western Europe and the formerly communist countries of central and eastern Europe. In southern New England, for example, more than 75% of forest land is classified as non-industrial private forest, NIPF, and over 55% of this land is in parcels that are less than 100 acres (Birch, 1996). Some degree of coordinated management among many private owners will,

---

\*Corresponding author. Tel.: +1-413-545-5714; fax: +1-413-545-5853.

*E-mail address:* [tstevens@resecon.umass.edu](mailto:tstevens@resecon.umass.edu) (T. Stevens).

therefore, be required to achieve EM at the landscape scale.

Previous research suggests that although most landowners in southern New England hold favorable attitudes toward the concept of coordinated management to achieve EM objectives (Rickenbach et al., 1998), the majority would probably not actually undertake coordinated management programs that involve either explicit or implicit cost to themselves (Stevens et al., 1999). Economic incentives may therefore be needed to accomplish the degree of coordination required for successful EM, but little is known about the relationship between incentives and the likelihood of coordinated management program participation.

This paper focuses on a case study of the effect of economic incentives on the probability of NIPF landowner participation in coordinated management programs. The impacts of several other factors on program participation, like harvest restrictions, and landowner characteristics, are also investigated.

## 2. Background

Surveys of NIPF landowners conducted by Brunson et al. (1996) and by Rickenbach et al. (1998) indicate that most landowners in southern New England are favorably disposed to the idea of coordinated management to achieve effective EM. However, Brunson et al. (1996) also found that few respondents would definitely be willing to undertake management activities jointly without first seeing examples of how this would work.

More recently, Stevens et al. (1999) surveyed 1250 southern New England residents owning 10 acres or more of forest land. A conjoint analysis was used in which each owner was asked to rate four different hypothetical management scenarios that are examples of ones that might be applied in an EM plan, on a scale of 1–10 with 10 indicating scenarios, if any, the individual would definitely undertake. Management activities in each scenario included maintenance of apple trees for wildlife habitat, protection of rare ferns, improvement of a recreational trail, and harvest of a specified percentage of timber land. A split sam-

ple survey approach was employed wherein landowners were partitioned into two groups. Each received an identical survey except that in one group all management activities would be coordinated with two neighbors while the other group was asked about the same management activities for a single equivalent parcel owned by the individual.

The results indicated that these landowners would be as likely to undertake coordinated management programs as they would be to undertake the same programs independently. However, the probability of undertaking any of the management scenarios examined in this study was quite low; the probability of program adoption ranged from 0.02 to 0.18, suggesting that economic incentives may be needed to inspire landowners to participate in coordinated management among properties.

A second conjoint study by Stevens et al. (2000) presented 1116 southern New England landowners with four management scenarios; maintenance of the status quo (do nothing) and three alternatives involving coordinated management to be achieved by setting aside a portion of a hypothetical tract of land to create a buffer zone to provide a wildlife corridor connecting two larger off-property wildlife habitats. The alternative scenarios involved: (1) various levels of acreage set aside for the buffer zone; (2) a range of annual costs of buffer zone maintenance through planting and soil stabilization; and (3) three levels of increase in the population of a rare species of wood turtle downstream of, (and off) the landowner's hypothetical property. The probability of coordinated program adoption ranged between 0.13 and 0.52, depending on the conjoint model specification, for a program that: (1) sets aside a 12-acre buffer zone; (2) costs each landowner \$200 per year; and (3) results in a 12% increase in the turtle population. However, since all survey respondents were already enrolled in a forest stewardship management program, the estimated probability of coordinated program adoption is undoubtedly higher for this group than for the forest landowner population in general. In other words, this study also tends to suggest that incentives will probably be needed to implement

coordinated management programs that require participation by a majority of owners.

### 3. Methods

In order to investigate the effect of economic incentives on the likelihood of coordinated program adoption among southern New England landowners, a survey was administered to five landowner focus groups in the spring, 1999. Focus group participants were solicited by phone from a list of several hundred Massachusetts landowners who were identified through town property ownership records. Everyone contacted by phone was offered \$50 to participate in one of the focus groups. A total of 57 landowners participated in this study.

The survey administered to these focus groups consisted of three parts: (1) a preliminary set of questions; (2) conjoint questions consisting of a series of alternative coordinated management programs that each participant was asked to rate; and (3) follow-up questions<sup>1</sup>. The preliminary questions, which dealt mainly with landowner traits and attitudes, included questions on the amount of land owned, reasons for ownership, gender, age, income from the land and other sources, membership in organizations and enrollment in existing forest management programs.

The conjoint section of the survey presented a scenario asking each respondent to assume that they owned a hypothetical 100-acre parcel of land. The market value of this land was specified, and the portion that could be developed for residential use was defined. Annual land taxes and annual income available from timber harvest were also specified. Graphics were used to show the layout of this land. This helped to ensure that participants were all considering the same scenario.

The participants were then told to imagine that the Massachusetts Department of Environmental Management, working with local landowners and

interest groups, had developed an EM plan for a large area under multiple ownerships that included this parcel. Participation would be voluntary, but economic incentives would be provided to encourage landowners to submit to certain restrictions and requirements related to the management of the land.

Each participant was then presented with the status quo (do nothing) and 16 alternative versions of the plan which they were asked to rate on a scale of 1–9 in terms of the likelihood that they would participate (1 = definitely would not; 9 = definitely would). Each version of the plan consisted of different combinations of levels of five attributes:

- Timber harvest/protected areas. Harvest would be allowed on some portion of the land currently available (1/3, 2/3, or all), while the remaining portion would be protected (2/3, 1/3, or none, respectively) from harvest.
- Recreation. The landowner either would be required to allow limited public access to a trail corridor on their land or they would not be required to do so.
- Magnitude of incentive. The land would be assessed for tax purposes at some portion of its market value (1/3, 2/3, or full value).
- Duration of commitment. The landowner would have to make a commitment of either 10 years or 20 years.
- Penalty. If the landowner withdrew from the plan prior to the fulfillment of their commitment, they would be required to pay back taxes on the difference between market values and assessed value on the removed land, plus interest on that difference, for either the most recent 3 years or the most recent 6 years of the unfulfilled commitment.

The participants were provided with specific financial implications of each alternative based on annual reduction in timber sale revenues associated with the ‘timber harvest/protected areas’ attribute, and the annual reduction in taxes associated with the ‘magnitude of incentive’ attribute.

The combinations of attribute levels used in this study were chosen using the SPSS Conjoint

---

<sup>1</sup> The survey instrument was pre-tested with a group of 10 landowners.

software package, which yields an orthogonal design that allows analysis over the entire range of combinations with the smallest possible subset of those combinations. The 16 management pro-

grams and the status quo situation considered in this study are summarized in Table 1.

Conjoint analysis was used to estimate the effect of economic incentives on the likelihood that

Table 1  
Summary of coordinated programs

	Timber harvest/ protected areas <sup>a</sup>	Recreation public access	Magnitude of incentive <sup>b</sup>	Duration of commitment	Penalty
Alternative 0 (status quo)	All avail., none protect. \$1200/year revenues \$0/year loss	None	Assessed full \$3000/year tax \$0/year gain	N/A	N/A
Alternative 1	1/3 avail., 2/3 protect. \$400/year revenues \$800/year loss	Limited	Assessed 1/3 \$1000/year tax, \$2000/year gain	20 years	Back taxes, interest 6-year max.
Alternative 2	2/3 avail., 1/3 protect. \$800/year revenues \$400/year loss	Limited	Assessed 2/3 \$2000/year tax, \$1000/year gain	10 years	Back taxes, interest 3-year max.
Alternative 3	1/3 avail., 2/3 protect. \$400/year revenues \$800/year loss	None	Assessed full \$3000/year tax \$0/year gain	10 years	Back taxes, interest 3-year max.
Alternative 4	All avail., none protect. \$1,200/year revenues \$0/year loss	None	Assessed 1/3 \$1000/year tax, \$2000/year gain	10 years	Back taxes, interest 6-year max.
Alternative 5	2/3 avail., 1/3 protect. \$800/year revenues \$400/year loss	None	Assessed full \$3000/year tax \$0/year gain	20 years	Back taxes, interest 6-year max.
Alternative 6	All avail., none protect. \$1,200/year revenues \$0/year loss	None	Assessed full \$3000/year tax \$0/year gain	10 years	Back taxes, interest 3-year max.
Alternative 7	All avail., none protect. \$1,200/year revenues \$0/year loss	Limited	Assessed full \$3000/year tax \$0/year gain	10 years	Back taxes, interest 6-year max.
Alternative 8	All avail., none protect. \$1,200/year revenues \$0/year loss	Limited	Assessed 2/3 \$2000/year tax, \$1000/year gain	20 years	Back taxes, interest 6-year max.
Alternative 9	All avail., none protect. \$1,200/year revenues \$0/year loss	Limited	Assessed full \$3000/year tax \$0/year gain	20 years	Back taxes, interest 3-year max.
Alternative 10	1/3 avail., 2/3 protect. \$400/year revenues \$800/year loss	Limited	Assessed full \$3000/year tax \$0/year gain	20 years	Back taxes, interest 3-year max.

Table 1 (Continued)

	Timber harvest/ protected areas <sup>a</sup>	Recreation public access	Magnitude of incentive <sup>b</sup>	Duration of commitment	Penalty
Alternative 11	All avail., none protect. \$1,200/year revenues \$0/year loss	None	Assessed full \$3000/year tax \$0/year gain	20 years	Back taxes, interest 6-year max.
Alternative 12	2/3 avail., 1/3 protect. \$800/year revenues \$400/year loss	Limited	Assessed full \$3000/year tax \$0/year gain	10 years	Back taxes, interest 6-year max.
Alternative 13	All avail., none protect. \$1,200/year revenues \$0/year loss	None	Assessed 2/3 \$2000/year tax, \$1000/year gain	20 years	Back taxes, interest 3-year max.
Alternative 14	All avail., none protect. \$1,200/year revenues \$0/year loss	Limited	Assessed 1/3 \$1000/year tax, \$2000/year gain	10 years	Back taxes, interest 3-year max.
Alternative 15	1/3 avail., 2/3 protect. \$400/year revenues \$800/year loss	None	Assessed 2/3 \$2000/year tax, \$1000/year gain	10 years	Back taxes, interest 6-year max.
Alternative 16	2/3 avail., 1/3 protect. \$800/year revenues \$400/year loss	None	Assessed 1/3 \$1000/year tax, \$2000/year gain	20 years	Back taxes, interest 3-year max.

<sup>a</sup>Loss refers to potential timber reserve foregone as compared with the status-quo.

<sup>b</sup>Gain refers to tax savings as compared with the status-quo.

landowners would participate in the plans presented. Three conjoint models were employed. In all cases, individuals are assumed to make choices that increase their utility or satisfaction. The utility that the  $i$ th individual derives from the  $j$ th management program ( $U_{ij}$ ) can be represented as:

$$U_{ij} = Z_j B_{ij}^* + C_i B_i + e_{ij} \quad (1)$$

where  $Z_j$  is a vector of attributes (timber harvest, tax incentive, public access, etc.) of the  $j$ th management program,  $B_{ij}$  is a vector of unknown parameters (or weights) associated with these attributes,  $C_i$  is a vector of other factors, including individual characteristics influencing utility,  $B_i$  is a vector of unknown parameters and  $e_i$  is a random variable.

In conjoint analysis, a respondent's utility level ( $U_{ij}$ ) for each of the  $j$  programs is not known.

Rather, a program rating  $r_{ij}$  is observed. We assume that:

$$r_{ij} = h(U_{ij}) \quad (2)$$

where  $h$  is a transformation function. Each individual's rating of alternative management programs therefore depends on the program attributes discussed above and characteristics of the individual like age and income.

The first conjoint model employed in this study examines the empirical relationship between EM program attributes, other characteristics and respondent's ratings. The model that was estimated is:

$$\begin{aligned} \text{Rate} = & B_0 + B_1 \text{ HARVLOSS} + B_2 \text{ RECACC} \\ & + B_3 \text{ TAXGAIN} + B_4 \\ & \text{COMMIT} + B_5 \text{ PENALTY} + B_6 \end{aligned}$$

$$\begin{aligned}
& \text{ACRETOT} + B_7 \text{ GENDER} + B_8 \\
& \text{AGE} + B_9 \text{ INCTOT} - E + B_{10} \\
& \text{INCTOT} - D + B_{11} \\
& \text{INCTOT} - C + B_{12} \\
& \text{INCTOT} - B + B_{13} \\
& \text{FORASSOC} + B_{14} \text{ CHAP61} + B_{15} \\
& \text{SIP} + B_{16} \text{ FOREVER} + e \quad (3)
\end{aligned}$$

where Rate is the individual ratings of the 16 programs and the status-quo and all other variables are defined in Table 2. In this formulation variables 6–16 are included to capture the effects of tastes, preferences, and other circumstances that vary among individuals.

As shown in Table 2, we hypothesize that program ratings (and utility) decline with an increase in harvest revenues foregone, length of program commitment, and magnitude of penalty. However, as the incentive (TAXGAIN) increases, we expect an increase in program rating, all else held constant.

The second model assumes that when enrolled in one of the coordinated management programs

considered here, individual utility is represented by Eq. (1), and that individual utility derived from forest land ownership in the status quo situation may be expressed by:

$$U_{i0} = Z_0 B_{i0}^* + C_i B_i + e_{i0} \quad (4)$$

where  $Z_0$  represents the vector of forest land attributes associated with the status quo. The individual is assumed to enroll in a management program if, and only if:

$$U_{ij} \geq U_{i0} \quad (5)$$

Utility difference,  $dV$ , can then be expressed as:

$$dV = U_{ij} - U_{i0} \quad (6)$$

If utility is assumed to be linear, additive, and separable with respect to all attributes,  $dV$  is given by:

$$dV = U_{ij} - U_{i0} + e_{ij} - e_{i0} \quad (7)$$

Table 2  
Survey data summary

Coordinated management	Units	Minimum value	Mean value	Maximum value	Expected sign
<i>Plan characteristics</i>					
HARVLOSS	\$/year	0	282.353	800	–
RECACC	1 = yes; 0 = no	0	0.471	1	+ / –
TAXGAIN	\$/year	0	705.882	2000	+
COMMIT	Years	0	14.118	20	–
PENALTY	Years	0	4.235	6	–
<i>Landowner characteristics</i>					
ACRETOT	Total acres	3	140.364	972	
GENDER	1 if male	0	0.768	1	
AGE	Years	29	55.286	82	
INCTOT – E	\$ > 100 000	0	0.091	1	
INCTOT – D	\$75 000 to \$100 000	0	0.091	1	
INCTOT – C	\$50 000 to \$75 000	0	0.291	1	
INCTOT – B	\$25 000 to \$50 000	0	0.345	1	
FORASSOC	1 = yes; 0 = no	0	0.429	1	
CHAP61	1 = yes; 0 = no	0	0.839	1	
SIP	1 = yes; 0 = no	0	0.375	1	
FOREVER	1 if yes	0	0.679	1	

The probability of program participation can then be written as:

$$Pr = G(dV) \quad (8)$$

where  $G$  is the probability function for the random component of utility ( $e_{ij} - e_{i0}$ ). Assuming a logit probability function for  $G$ , the probability of program participation is:

$$Pr = G(1 + e^{-dV})^{-1} \quad (9)$$

Empirical estimates of the probability of program participation therefore involve estimating  $dV$  [see Eq. (7)]. The following approximation of utility difference was used:

$$dV = B_0 + B_1(Z) + B_2(C) + e \quad (10)$$

where  $Z$  is the vector of the *change* in program attributes from the status quo [see Eq. (7)], and other variables are as defined above. From Eq. (9), the model that is estimated is a binary logit model:

$$E(Y) = \frac{1}{1 + e^{-(B_0 + B_1(Z) + B_2(C) + e)}} \quad (11)$$

where the dependent variable,  $Y$ , is a binary variable such that  $Y = 1$  for programs that were rated above the status quo, and  $Y = 0$  otherwise, while  $B_0$ ,  $B_1$ , and  $B_2$  are estimated coefficients. Eq. (11) can then be used to calculate the probability,  $E(Y = 1)$ , that a program with attributes  $Z$  is preferred to the status quo.

The third model is the same as the second except that the binary dependent variable,  $Y$ , is set equal to one for programs that would *definitely* be undertaken (rating = 9) and  $Y = 0$  otherwise (rating = 1–8). Eq. (11) is then used to calculate the probability that a specific program would actually be adopted.

#### 4. Results

The data derived from the surveys are presented in Table 2. As shown in Table 2, the average value of harvests forgone associated with the programs presented was approximately \$282

per year while the average incentive (TAXGAIN) was a tax reduction of approximately \$706 per year. The average management program involved a 14 year commitment and the average penalty for early withdrawal (back taxes plus interest) was approximately 4 years.

In terms of landowner characteristics, the average participant owned 140 acres of forest land, and was approximately 55 years old. Approximately 35% of the respondents had annual incomes in the \$25 000 to \$50 000 range, and approximately 43% belonged to a forestry association. Approximately two-thirds of the study respondents said they would consider a perpetual commitment to a coordinated program (FOREVER).

Of particular importance is that 84% were enrolled in Chapter 61, which provides reduced property taxes in exchange for timber management, and approximately 38% were enrolled in the Stewardship Incentive Program, SIP. This state program provides landowners with cost-sharing for management practices such as habitat improvement and recreation/aesthetics enhancements.

The Chapter 61 program, administered by the Massachusetts Department of Environmental Management, allows a substantial property tax deferral for woodland owners who follow a prescribed management plan. Only approximately 14% of all eligible landowners in the state are enrolled. Therefore, the participants in this study are clearly not representative of the population as a whole. We suspect that Chapter 61 participants are likely to be more knowledgeable about land use issues and more likely to enroll in coordinated management programs.

Results of estimating the three conjoint models are presented in Table 3.<sup>2</sup> Focusing first on the ratings model (model 1), program ratings increased, as expected, with the magnitude of the

<sup>2</sup> Results from model 1 were derived from the OLS procedure. Ordered logit results were virtually identical. Results from models 2 and 3 were derived from the logit estimating procedure. Sensitivity of the results to model specification and estimating method can be obtained from the senior author.



Table 3  
Parameter estimates and significance

	Model 1 Estimate (Prob >  T )	Model 2 Estimate (Prob > $\chi^2$ )	Model 3 Estimate (Prob > $\chi^2$ )
HARVLOSS	-0.000159 (0.5154)	-0.000055 (0.8272)	-0.001010* (0.0663)
RECACC	0.030622 (0.8499)	0.131400 (0.4322)	-0.199400 (0.5194)
TAXGAIN	0.001445** (0.0001)	0.000700** (0.0001)	0.001120** (0.0001)
COMMIT	-0.039598** (0.0060)	-0.028800* (0.0854)	-0.062100** (0.0285)
PENALTY	-0.122690** (0.0106)	-0.073900 (0.1851)	-0.101400 (0.2637)
ACRETOT	-0.001737** (0.0005)	-0.001120** (0.0285)	-0.001620 (0.1908)
GENDER	1.159723** (0.0001)	-0.280000 (0.1851)	0.420000 (0.3267)
AGE	0.000982 (0.8964)	-0.004470 (0.5658)	0.019900 (0.1557)
INCTOT - E	-0.656681* (0.0687)	0.857600** (0.0181)	-14.787100 (0.9705)
INCTOT - D	0.665580 (0.1008)	0.793100* (0.0590)	-0.805400 (0.2208)
INCTOT - C	-0.555135** (0.0450)	0.201700 (0.4847)	-1.701300** (0.0002)
INCTOT - B	-0.760633** (0.0057)	-0.447600 (0.1140)	-1.175300** (0.0041)
FORASSOC	0.460554** (0.0086)	0.582000** (0.0017)	-0.016700 (0.9635)
CHAP61	-0.212037 (0.3790)	0.201400 (0.4157)	-0.312200 (0.4438)
SIP	0.497713** (0.0047)	-0.350500* (0.0570)	-0.345300 (0.3603)
FOREVER	0.354479* (0.0621)	-0.089900 (0.6508)	0.396900 (0.2976)

\* Significant at 90%, \*\* significant at 95%.

economic incentive offered (TAXGAIN) and ratings decreased with length of commitment and penalty. However, the value of timber harvests forgone (HARVLOSS) and recreation access (RECACC) were not statistically significant factors. This finding is consistent with several previous studies (see Rickenbach et al., 1998) suggesting that timber harvest is not a primary concern of most NIPF landowners in southern New England.

It is also important to note that program ratings decreased with the total acreage held by the landowner and increased for those who were enrolled in SIP or were members of a forestry association. Enrollment in Chapter 61 was not statistically significant, but this is likely due to the lack of variability associated with this variable (almost 84% of respondents were enrolled in Chapter 61).

Results from model 2 (estimates of landowner interest) differ in several respects. The primary difference from the perspective of this study is that program penalty was not a statistically significant factor related to interest in program participation (i.e. ranking above the status quo). Also, those who are enrolled in the SIP program are less likely to be interested in coordinated management.

Results derived from the third model (probability that a program would definitely be undertaken) differ from the second in that the decrease in the probability of program adoption with increases in the value of timber harvests forgone is statistically significant. Perhaps the loss of timber revenue was more difficult to tolerate when the landowner was asked to make a firm commitment to a program. As expected, the likelihood of coordinated program adoption increased with the incentive offered and decreased with the length of commitment. However, penalty, total acres, and membership in forestry associations, Chapter 61 or SIP were not statistically significant factors influencing whether the coordinated program would definitely be adopted (rating = 9).

The estimates derived from model 2 (Table 3) were used as shown in Eq. (11) to estimate the probability that landowners are interested in coordinated management programs (i.e. rating

Table 4  
Probabilities of program interest and adoption<sup>a</sup>

	Range of values	Mean value	Interest model 2		Adoption model 3	
			Probability at min.	Probability at max.	Probability at min.	Probability at max.
HARVLOSS	0–800	282.353	0.444	0.433	0.018	0.008
RECACC	0–1	0.471	0.425	0.457	0.015	0.012
TAXGAIN	0–2000	705.882	0.324	0.660	0.006	0.056
COMMIT	0–20	14.118	0.541	0.399	0.032	0.010
PENALTY	0–6	4.235	0.518	0.408	0.021	0.011
ACRETOT	3–972	140.364	0.478	0.236	0.017	0.004
GENDER	0–1	0.768	0.494	0.424	0.010	0.015
AGE	29–82	55.286	0.469	0.411	0.008	0.023
INCTOT – E	0–1	0.091	0.421	0.632	0.051	0.000
INCTOT – D	0–1	0.091	0.422	0.618	0.015	0.007
INCTOT – C	0–1	0.291	0.426	0.476	0.022	0.004
INCTOT – B	0–1	0.345	0.479	0.370	0.020	0.006
FORASSOC	0–1	0.429	0.380	0.523	0.014	0.014
CHAP61	0–1	0.839	0.399	0.448	0.018	0.013
SIP	0–1	0.375	0.473	0.387	0.016	0.011
FOREVER	0–1	0.679	0.455	0.433	0.010	0.016

<sup>a</sup>Probabilities represent the likelihood of adoption or interest with the variable in question at its minimum or maximum value and all other variables at their mean values. The probability with all variables at their mean values is 0.014 for model 3, and 0.440 for model 2.

greater than that given to the status quo). The results of these calculations are summarized in Table 4. As shown in Table 4, the probability that landowners are interested in these programs is quite high. With all model 2 variables at mean values, the probability that a study participant would be interested in the ‘average’ coordinated program is 0.44 (44%). Even with no financial incentive (TAXGAIN = 0), 32% of owners would be interested in coordination, and, the level of interest increases dramatically as the incentive increases.

However, as is also shown in Table 4, the probability that landowners would actually adopt programs of the type examined in this study is very small, even when sizable incentives are offered. With all model 3 variables at their mean values (see Table 4), the probability that the ‘average’ EM program would be adopted by the group of landowners participating in this study was only 0.014 (i.e. 1.4%). An increase in the economic incentive from approximately \$706 per year (mean value) to \$2000 per year (maximum value) increased the probability of program adop-

tion from only 1.4 to 5.6%, all else held constant. A decrease in the duration of program commitment from 14 years (mean value) to 0 years (minimum value) only increased the probability of program adoption from 1.4 to 3.2%.

## 5. Summary

This analysis tends to confirm the findings of several previous studies; landowners are quite interested in coordinated management, but the likelihood of NIPF owners actually enrolling in such programs is quite small. The probability of coordinated plan adoption remains very small even when substantial incentives are offered. This is consistent with the low rates of enrollment in existing plans in southern New England and is somewhat alarming with regard to the prospects for success of ecosystem management of the type examined here. However, this analysis does suggest ways in which coordinated programs might be marketed. For example, resource agencies could target landowners already involved in

forestry-related organizations and programs. Not only do these landowners appear from our analysis to be more favorably inclined toward coordination, the organizations and programs themselves could be an efficient means for identifying landowners and disseminating information.

Some of the broader implications of this research from a management plan development standpoint are that coordinated management plans will have a higher likelihood of being adopted if they offer large tax incentives and short commitments. In terms of other plan characteristics studied here, it is also useful to know that NIPF landowners do not seem terribly concerned with the loss of potential timber revenue and they are fairly agreeable to reasonable public recreational use of their land. The willingness of landowners to make sacrifices (timber harvests, recreation access) and their desire for flexibility suggests that agencies seeking to develop a viable plan might consider imposing fairly stringent requirements, but also allowing landowners to enroll on a trial basis. However, if wide scale adoption of coordinated management is to be achieved, something other than the type of economic incentive examined here will probably be needed. We suggest that future research should focus specifically on the reasons why landowners

are uncertain about actually enrolling in coordinated management programs.

### **Acknowledgements**

This study was funded in part by the Cooperative State Research, Extension, Education Service, U.S. Department of Agriculture, and Massachusetts Agricultural Experiment Station, Project No. 72.

### **References**

- Birch, T.W., 1996. Private Forest-Land Owners Of The United States, 1994. Resource Bulletin NE-134. USDA Forest Service, Northeast Research Station, Radner, PA.
- Brunson, M.W., Yarrow, D., Roberts, S., Guyan, D., Kuhns, M., 1996. Nonindustrial private forest owners and ecosystem management. *Journal of Forestry* 94, 14–21.
- Rickenbach, M.G., Kittredge, D., Dennis, D., Stevens, T., 1998. Ecosystem management: capturing the concept of woodland owners. *Journal of Forestry* 96, 18–24.
- Stevens, T.H., Dennis, D., Kittredge, D., Rickenbach, M., 1999. Attitudes and preferences toward co-operative agreements for management of private forestlands in the northeastern United States. *Journal of Environmental Management* 55, 81–90.
- Stevens, T.H., Belkner, R., Dennis, D., Kittredge, D., Willis, C., 2000. Comparison of contingent valuation and conjoint analysis in ecosystem management. *Ecological Economics* 32, 63–74.