

## Article

# Socioeconomic Predictors of Family Forest Owner Awareness and Use of U.S. Federal Income Tax Provisions

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**Abstract:** Family forest owners (FFOs) control a majority of private forestland in the United States and have widely diverse ownership and management objectives. Many FFOs manage their holdings for timber production and, thus, are concerned with issues such as reforestation incentives and tax treatment of timber revenues. Their actual knowledge of the tax aspects of timber management varies, with some owners even unaware of the federal income tax provisions that apply to timber. This research used econometric techniques to establish socioeconomic predictors of FFO awareness and use of federal income tax provisions. Socioeconomic factors (such as size of forest holding, ownership objective, education, age, and income) were evaluated in terms of association with awareness and use of income tax provisions. Data were obtained from a survey of 1350 South Carolina FFOs (472 useable responses). A two-step sample selection methodology revealed that membership in a landowner organization and size of forest holding positively influence landowner awareness of the seven tax provisions, while ownership objective and level of education exhibited varying degrees of influence. Overall, the findings suggest that size of forest holding is the key determinant that influences landowner use of the provisions. These tax incentives are one of the foundations of federal policies encouraging active forest management by FFOs and the effectiveness of the various incentives has crucial implications for forest policy analysis.

**Keywords:** federal income tax; family forest; capital gains tax; seven-year amortization

## 1. Introduction

Family forest owners (FFOs) control approximately 62 percent (107 million hectares) of private forestland in the United States [1]. FFOs, including families, individuals, trusts, estates, family partnerships, and other unincorporated groups of individuals, are crucial to maintaining sustainable forests and timber supply [2]. They are a diverse group of individuals who hold and manage forestland for a multitude of reasons [3]. Many of these reasons (e.g., aesthetics, privacy, home, or family legacy) do not provide a direct annual revenue stream to the landowner [4]. When landowners manage their holdings for income producing objectives, such as timber production or hunting leases, they must pay federal income tax on any net revenue derived from their holdings [5].

The federal income tax has a profound effect on the profitability of managing forestland. Land expectation value (LEV), the value of forestland in permanent timber production, is significantly affected by the tax rate applied to timber income [6–8]. Especially for low productivity sites, the economic feasibility of forest management practices quickly dissipates with higher tax rates [9]. On the contrary, a landowner's use of tax provisions that apply to timber (e.g., amortization of reforestation expenses) can dramatically improve their returns [10].

Unfortunately, landowner knowledge of the tax provisions that apply to timber, as well as other tax aspects germane to forest management, varies greatly [11,12]. Moreover, despite the vast body of family forest literature, few researchers have examined whether FFOs are aware of or use the incentives and other beneficial income tax provisions found in the Internal Revenue Code (IRC) [13,14]. As beneficial as tax provisions can be to ensure sustainable forest management in the future, efforts must be made to bridge the chasm that exists in the literature [15].

This study established socioeconomic predictors of FFO use of seven different tax incentives: long-term capital gains treatment of timber income (LTCG), annual deduction of management expenses (ADME), depreciation and the section 179 provision (DS179), deduction for casualty losses and other involuntary conversions (CLIC), the reforestation tax credit (RTC), amortization of reforestation expenses (ARE), and the ability to exclude qualifying reforestation cost-share payments from gross income (ECSP) [4]. Logistic regression techniques coupled with a two-stage sample selection (T-SSS) process were used to develop models that examined which socioeconomic factors are associated with landowner awareness and use of the seven tax incentives. In the first stage, the landowner awareness model was developed. In the second stage, conditional on landowner awareness, a model was developed to determine which factors affected the use of each provision.

### 1.1. Federal Income Tax Provisions

Since early in the twentieth century the U.S. federal government has established a range of tax provisions in the IRC to encourage sustainable forest management and land conservation [16]. Seven of the most commonly utilized forestry tax provisions are described below [17–19]. The first four are available to taxpayers in general, while the last three are specifically for forest landowners.

#### 1.1.1. Treatment of Qualifying Income as a Long-Term Capital Gain (LTCG)

Taxpayers in general are allowed long-term capital gain treatment of income from the sale or disposal of a qualifying asset held for more than twelve months. The income must be from timber held as an investment or as a trade or business to qualify for treatment. The IRC also requires that timber be disposed of in one of three ways: a lump-sum sale, a pay-as-cut contract in which the owner retains an economic interest in the timber, or a sale where the owner personally cuts the timber. The main benefit is taxation at a lower rate than ordinary income [7,20–22].

When the data were collected for this study, the four upper level ordinary income tax rates ranged from 28 percent to 39.6 percent and the corresponding capital gains tax rate was 20 percent. The bottom ordinary income tax rate of 15 percent had a corresponding capital gains tax of only 10 percent. Obviously, capital gains tax treatment would result in substantial tax savings [22].

#### 1.1.2. Annual Deduction of Management Expenses (ADME)

Taxpayers may in general deduct certain management costs from gross income. These costs include the day-to-day activities that are required to manage timber property, such as hiring salaried labor, consulting forester fees, and travel expenses that can be directly related to income potential for the property. These types of expenses are considered “operating costs.” Other expenses, termed “carrying charges,” include property taxes, insurance premiums, and interest payments, all of which may also be deducted from gross income. The property does not have to be producing income in order to qualify for this deduction; the deduction is based upon intent to produce future income [5,23].

### 1.1.3. Depreciation and the Section 179 Deduction (DS179)

Taxpayers in general may qualify for bonus depreciation and the Section 179 deduction which allow for up to \$24,000 per year in qualified expenditures to be deducted from gross income. Qualifying expenditures include equipment purchases, roads, fences and other such items used in the production of timber. The taxpayer must use the property as a trade or business to qualify and the deduction must be taken the year the equipment is placed into service. For every dollar over \$200,000 of qualifying property, the deduction is reduced by a dollar.

Of course, equipment, buildings, and other non-permanent assets may be depreciated over their determinable useful life as they are “used up.” Timberland owners may depreciate equipment as long as the land is held as either an investment or as an active trade or business. Section 179 allows the qualifying costs, in effect, to be expensed in the current year, rather than be depreciated over a useful life. Since the time of this initial survey, the deductible amount has increased [5,24].

### 1.1.4. Deductions for Casualty Losses or Other Involuntary Conversions (CLIC)

Taxpayers in general may deduct casualty losses or other involuntary conversions. For family forest landowners this provision covers timber losses caused by beetle attacks, ice storms, theft, and condemnation. These are termed involuntary conversions and to qualify the timber must be held as an investment or as an active trade or business. Normal losses from diseases or natural mortality do not typically qualify for this deduction. Southern pine beetle attacks do qualify for this deduction. However, since they are deemed a sudden and unexpected loss, the amount of the loss that may be deducted is limited to the basis invested in the timber [5,25–27].

### 1.1.5. Reforestation Tax Credit (RTC)

Specific to forest owners was a ten-percent reforestation tax credit on up to \$10,000 of reforestation expenses annually. This was a major tax incentive at the time of the survey, but it has since been repealed. Tax credits that apply to forestry are rare, so this study addresses the relative importance of this powerful incentive tool. This tax credit was tied to the seven-year amortization provision for reforestation expenses (discussed in the following paragraph, section 1.1.6.) and reduced any amortization by 50 percent of the tax credit taken [28–30].

### 1.1.6. Amortization of Reforestation Expenses (ARE)

A second forestry specific provision allowed qualified landowners to amortize (deduct) up to \$10,000 of reforestation expenditures per year. The schedule for amortization was one-fourteenth the first year, followed by one-seventh the next six years, followed by one-fourteenth in the eighth and final year. Since the time of the initial survey (2001), passage of the American Jobs Creation Act of 2004 amended the reforestation amortization section of the laws to allow FFOs to deduct up to \$10,000 per qualified timber property per year of qualified reforestation expenses, while eliminating the reforestation tax credit [28]. Forest owners are also allowed to amortize any amount in excess of \$10,000 over 84 months [31–33].

### 1.1.7. Exclusion of Qualifying Reforestation Cost-Share Payments from Gross Income (ECSP)

The third forestry specific tax provision concerns government cost-share payments. Qualifying government cost-share payments may be excluded from gross income. Several federal cost-share programs are available to timberland owners, as well as a multitude of state cost-share programs that qualify for this incentive. Examples are the Conservation Reserve Program and the Environmental Quality Incentives Program. Two conditions must be met in order for the cost-share payments to qualify for exclusion from gross income: (1) the money must be used to conserve the soil and water, to protect the environment, to improve the forest, or to provide habitat for wildlife and (2) the amount of money cannot substantially increase the value of the property [7,34–36].

## 1.2. Relevant Literature

FFOs' knowledge of federal and state provisions is often limited. An early survey of small woodland owners in Southwest Arkansas found that none of the respondents mentioned the capital-gains treatment of timber income when asked about taxation [37]. Other early family forest surveys never even addressed landowner awareness and use of forestry cost-sharing programs such as the Agricultural Conservation Program [38]. Often, when these studies did address taxes, it was in terms of influence on landowner's plans and rarely was the issue of awareness of tax provisions included. One study focused on the impact of property taxes in Michigan's Upper Peninsula, but never were FFOs asked if they were even aware of these tax provisions [39].

One of the earliest studies that inquired about a landowner's awareness and use of forestry tax provisions was conducted in urban fringe area of Michigan and found that property taxes had little impact on the management of woodlots. Only three percent of FFOs had taken advantage of capital gains tax provision for their timber income, due to beliefs that the tax benefits were small or that too much "red tape" was involved [40]. An additional nine percent were aware of the provision, but never used it because they had not harvested timber products. Even when the provisions were explained to the FFOs, 55 percent remained indifferent. Later FFO studies in Michigan centered on programs designed to shelter woodlands from property taxes between timber harvests [41].

An early FFO study in the Missouri Ozarks ignored the various federal tax provisions, but mentioned the Missouri Conservation Commission Forest Crop Law and property taxes [42]. Likewise, an Iowa FFO study looked at awareness of the property tax advantage under the Iowa Forest Preserve Law, but did not mention of the federal tax provisions [43]. When FFOs were made aware of forestry tax provisions, nearly half expressed an interest in utilizing them to increase the profitability of growing timber [44]. As FFO studies focused on the federal tax provisions, their importance in forest management and landowner behavior became apparent. Capital gains treatment of timber income was generally regarded as one of the most critical provisions to encourage timber growing [45]. A North Carolina study found that of FFOs that reforested, 80 percent used cost-share, 60 percent utilized the reforestation tax credit, and 55 percent used both incentives [30]. Another study found that of farmers who had made a final harvest of their timber and then reforested, 71 percent had used the cost-sharing and or the reforestation tax incentives [10]. Cost-share is consistently supported as having a major impact on timber growing [13].

Awareness of federal timber tax provisions was studied in South Carolina [46,47]. Seventy-eight percent of FFOs were aware of capital gains treatment of timber income, and of those, 85 percent made use of it. The annual deduction of forest management expenses had similar levels of awareness and use. Only 50% of FFOs were aware of the depreciation and section 179 deductions for income-producing property; of those aware, only 67 percent had actually used it. Just over half of FFOs were aware of the reforestation tax credit and amortization of reforestation expenses provision. Roughly three-quarters of those aware of the two provisions actually used them. Least awareness of a tax provision was 42 percent for the exclusion of qualified reforestation cost-sharing payments from gross income. Of those aware of the provision, 70 percent had used it. Many of the responses from FFOs not utilizing the provisions indicated that approximately one-quarter to one-third felt that the benefit was not worth the time and effort needed [46,47].

The literature suggests a key factor influencing tax provision awareness and use is size of forest holding (and the related factors of income, education, and age). In addition, these factors are likely to be positively correlated with a forest owner management objective that emphasizes timber production or a profit motive [37–46].

## 2. Methods

Data for this study were drawn from a 2001 South Carolina FFOs survey [46,47]. While the data are over a decade old, this study is an evaluation of the effectiveness of the various federal tax provisions, and the use of "older" data offers the advantage of considering tax provisions that proved

effective in the past for possible reuse. The RTC has been eliminated as a tax incentive, but has a long history of having significant effects on forest landowner behavior. This is the first time forestry income tax provisions has been evaluated in term of awareness and use in this manner, and this analysis establishes a base line to measure the effectiveness of the seven provisions, as well as changes in awareness and use over time. The value of these results to forest policy analysts is enhanced by the broader array of tax provisions under discussion.

Data are based on a survey of FFOs using the total design method [48]. A list of FFOs in South Carolina was obtained from a large national forestry organization (members tended to have timber production and profit motive objectives). Using data from that organization ensured a minimum forest size of 4 ha. A total of 1350 questionnaires were mailed to randomly selected South Carolina FFOs in late January 2001. Four hundred and ninety-eight survey forms were returned, of which 472 contained usable forms, yielding a response rate of 35 percent. Those that were deemed unusable were either left entirely blank or were considered incomplete. The questionnaire consisted of 58 questions, seven about knowledge and use of each of the seven tax provisions, and nine about demographic characteristics. The binary response variable for knowledge and use of each of the seven tax provisions took the value 1 if a landowner was aware or had used one of the tax provisions and 0 otherwise (Table 1).

**Table 1.** Summary of dependent variables.

Variable	Description	Value
LTCG—Aware	Long-Term Capital Gain Treatment	FFO was aware = 1, Unaware = 0
LTCG—Use	Long-Term Capital Gain Treatment	FFO used = 1, Nonuse = 0
ADME—Aware	Annual Deduction Management Expense	FFO was aware = 1, Unaware = 0
ADME—Use	Annual Deduction Management Expense	FFO used = 1, Nonuse = 0
DS179—Aware	Depreciation and Section 179 Deduction	FFO was aware = 1, Unaware = 0
DS179—Use	Depreciation and Section 179 Deduction	FFO used = 1, Nonuse = 0
CLIC—Aware	Casualty Loss/Involuntary Conversion	FFO was aware = 1, Unaware = 0
CLIC—Use	Casualty Loss/Involuntray Conversion	FFO used = 1, Nonuse = 0
RTC—Aware	Reforestation Tax Credit	FFO was aware = 1, Unaware = 0
RTC—Use	Reforestation Tax Credit	FFO used, Nonuse = 0
ARE—Aware	Amortization of Reforestation Expenses	FFO was aware = 1, Unaware = 0
ARE—Use	Amortization of Reforestation Expenses	FFO used = 1, Nonuse = 0
ECSP—Aware	Exclusion Reforestation Cost-Share Payment	FFO was aware = 1, Unaware = 0
ECSP—Use	Exclusion Reforestation Cost-Share Payment	FFO used = 1, Nonuse = 0

The independent variables for this analysis were derived from nine demographic questions initially used to analyze the differences between the respondents [47]. The nine demographic questions focused on the landowner's reasons for owning timberland, education level, household income level, and occupation. Also included in the demographic questions were queries about how many acres of forestland and total acres of land the landowner owned, as well as the landowner's membership in a forest organization and use of a written management plan. A summary of the independent variables used in the analysis can be found in Table 2.

**Table 2.** Summary of independent variables.

Variable	Description	Value
TA	Total area owned by FFO	Total area (ha)
FA	Forested area owned by FFO	Forest area (ha)
PF	Percent of total area forested	Percent forest area (%)
PRO	Forest held for investment purposes	Investment = 1, Not = 0
BTO	FFO belongs to a landowner organization	Belongs = 1, Not = 0
MP	FFO has a written forest management plan	Has plan = 1, Not = 0
LOE	FFO has a college education	Has degree = 1, Not = 0
OCC1	FFO is a blue-collar worker	Blue-collar worker = 1, Not = 0
OCC2	FFO is a white-collar worker	White-collar worker = 1, Not = 0
OCC3	FFO is a farmer	Farmer = 1, Not = 0
OCC4	FFO is a homemaker	Homemaker = 1, Not = 0
OCC5	FFO is retired	Retired = 1, Not = 0
OCC6	FFO works in a field not mentioned	Field not mentioned = 1, Not = 0
AGE 1	FFO less than 30 years of age	Age less than 30 years = 1, Not = 0
AGE 2	FFO between ages 30 to 49 years	Age between 30 to 49 years = 1, Not = 0
AGE 3	FFO between ages 50 to 65 years	Age between 50 to 65 years = 1, Not = 0
AGE4	FFO over 65 years of age	Age over 65 years = 1, Not = 0
HIL1	Household income level less than \$30,000	Income less than \$30,000 = 1, Not = 0
HIL2	Household income level \$30,000 to \$85,000	Income \$30,000 to \$85,000 = 1, Not = 0
HIL3	Household income level over \$85,000	Income over \$85,000 = 1, Not = 0

### Logistic Regression Analysis

Seven separate empirical models, described below, were developed to examine awareness for seven of federal income tax provisions. The response variable represents awareness in one of the seven tax provisions: long-term capital gains treatment of timber income (LTCG\_Aware), annual deduction of management expenses (ADME\_Aware), depreciation and the section 179 deduction (DS179\_Aware), casualty loss and involuntary conversions (CLIC\_Aware), reforestation tax credit (RTC\_Aware), amortization of reforestation expenses (ARE\_Aware), and exclusion of qualifying cost-share payments (ECSP\_Aware). The response variable takes the value 1 if a landowner is aware of a particular tax provision and 0 otherwise.

The empirical models also included a number of independent variables described in Table 2, measuring land characteristics, ownership characteristics, and demographics. For instance, with LTCG\_Aware as the response variable, independent variables included BTO and LOE in order to examine whether a landowner's participation in a landowner organization and college education is associated with knowledge of the long-term capital gain treatment provision. Due to the binary format of the dependent variables, binary logistic regression was used to analyze the data. In binary logistic regression, probabilities are assigned to each of the two possible outcomes. For a binary response variable  $Y$  and a vector of independent variables  $X$ , the specific form of the function used for the logistic regression model, as used in this study, is Equation (1):

$$\pi|x_i = \frac{e^{\beta_0 + \beta_1 x_1 + \dots + \beta_i x_i}}{1 + e^{\beta_0 + \beta_1 x_1 + \dots + \beta_i x_i}} \quad (1)$$

where  $\pi|x_i$  = probability of the dependent variable = 1,  $e$  = the base of the natural logarithms,  $\beta_0$  = the constant of the equation, and  $\beta_i$  = the coefficient associated with the independent variable  $x_i$ .

The logit transformation is often used for the relationship function [49]. The transformation is defined as Equation (2):

$$g(\pi(x)) = \ln \left[ \frac{\pi(x)}{1 - \pi(x)} \right] \quad (2)$$

which results in  $g(\pi(x)) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots \beta_i x_i$ .



The result of this transformation is that the logit  $g(\pi(x))$ , is linear in its parameters, similar to traditional linear regression. An important difference between traditional linear regression and logistic regression models concerns the conditional distribution of the outcome variable. In the linear regression model the relationship function is Equations (3) and (4):

$$U_y | x_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots \beta_i x_i \quad (3)$$

$$y = U_y | x_i + \varepsilon \quad (4)$$

where  $\varepsilon$  is the error term and expresses an observation's deviation from the conditional mean. The most common assumption is that  $\varepsilon$  follows a normal distribution with mean zero and a variance that is constant across levels of the independent variables [49].

However, this is not the case with dichotomous outcome variables. The error term in this case can only assume two values: 0 or 1. In this scenario, the value of the outcome variable given  $x$  is expressed as Equation (5):

$$y = \pi | x_i + \varepsilon \quad (5)$$

In this situation  $\varepsilon$  may only assume one of two possible values. When  $y = 1$  then  $\varepsilon = 1 - \pi | x_i$  with probability  $\pi | x_i$ , and if  $y = 0$ , then  $\varepsilon = -\pi | x_i$  with probability  $1 - \pi | x_i$ . Thus,  $\varepsilon$  has a distribution with mean zero and variance equal to  $\pi | x_i [1 - \pi | x_i]$ . That is, the conditional distribution of the outcome variable follows a binomial distribution with probability given by the conditional mean,  $\pi | x_i$ .

The statistical software package JMP was used to perform the logistic regression analyses [50]. The analysis used T-SSS modelling to examine which socioeconomic factors were associated with landowner awareness of the tax provision. Then conditional on landowner awareness, a model was developed to determine which factors affected their use of the provisions. T-SSS analyses have been widely used in the literature to analyze cost-share programs, hunting lease markets, and other forestry-related issues [51–55]. Our T-SSS model examined the determinants of landowner awareness and use of tax provisions. Use of tax provisions was assumed to be contingent upon whether these landowners are aware of the provisions. In the selection stage, landowner awareness of a specific tax provision was modeled as a function of landowner characteristics variables. In the outcome stage, landowner use of the provisions was specified as a function of similar explanatory variables.

Conceptually the model is expressed as the selection equation of  $Z_i = g(x_i)$  and outcome equation of  $Y_i = f(Z_i)$ , where  $Z$  is a binary variable that indicates whether landowner  $i$  is aware of an individual tax provision (*i.e.*, LTCG, ADME, DS179, CLIC, RTC, ARE, or ESCP);  $Z_i$  equals one if the landowner is aware of the program, and zero otherwise.  $Y$  is a binary variable that indicates whether landowner  $i$  has used the tax provision, and 0 otherwise. The variables of awareness ( $Z_i$ ) and use ( $Y_i$ ) are related, but may be influenced by different explanatory variables, or by the same set of socioeconomic factors to a different degree. Therefore,  $Z_i$  may be different from  $Y_i$ . Both the selection and outcome logistic regressions were reported for each tax provision.

The literature shows that many of these independent variables are highly correlated [56–60]; thus, initial screening using contingency tables was conducted to detect any potential multicollinearity problems that might have distorted the analysis. Multicollinearity occurs when linear or near-linear dependencies exists between the explanatory variables. This can adversely affect the results of the regression analysis. Traditionally, with least squares estimation in standard multiple regressions, decomposition of the correlation matrix of explanatory variables has been used as a diagnostic tool to determine the distortion of multicollinearity on parameter estimation and prediction. Our model used dichotomous data and the normality assumptions of least squares linear regression were not appropriate [61,62]. Examination of the contingency tables for the explanatory variables resulted in the use of the forested acres (FA) variable as a proxy for total acreage (TA) owned and landowner organization (BTO) as a proxy for use of a management plan (MP). Belonging to a landowner organization has been shown to be highly correlated with use of a forest management plan [1,3,9,15]. The FA variable was also used as a proxy for household income level and age (both are very positively

correlated with forest area) [1,3,9,15]. Since the initial study from which the data were derived was not designed around an econometric analysis, the occupation category of variables was omitted from the analysis because no logical grouping of this category could be made upon inspection of the contingency tables for possible multicollinearity and balanced data issues.

### 3. Results and Discussion

#### 3.1. Descriptive Statistics-Dependent Variables

The descriptive statistics for the dependent variables are presented in Table 3. Landowner awareness and use (by those aware) of each provision was measured by a binary variable, so its mean is reported as a percentage. Awareness of the provisions varied widely, with respondents being most aware of the capital gains treatment of timber sale revenue (LTCG) and the annual deduction of forest management costs (ADME) incentives. While a substantial percentage (more than three-quarters) of the respondents were aware of these two provisions, just over half were aware of the reforestation tax credit (RTC), seven year amortization of reforestation expenses (ARE), section 179 depreciation (DS179), and casualty losses and involuntary conversions (CLIC) provisions. Only 41 percent of respondents indicated they were aware of the exclusion of qualifying cost-share (ECSP) incentive (Table 3). For those not aware of the tax provisions, many reported that their accountants most likely had at least some knowledge of the existence of the provisions [46].

**Table 3.** Awareness and use (by those aware) of forestry tax incentives [46].

Forestry Tax Incentive	Knowledge of Incentives		Use of Incentives	
	Frequency	Percentage	Frequency	Percentage
Capital Gains Treatment (LTCG)	360/465	77	304/360	84
Management Cost (ADME)	359/465	77	304/359	85
Depreciation/Deduction (DS179)	233/465	50	153/233	66
Timber Losses (CLIC)	273/465	59	61/273	22
Reforestation Tax Credit (RTC)	252/465	54	195/251	78
Seven-Year Amortization (ARE)	256/465	55	203/256	79
Cost-Share Payments (ECSP)	191/465	41	135/191	71

Utilization of six of the seven tax provisions was fairly high, ranging from two-thirds to 85 percent (Table 3). Only 22 percent had taken advantage of casualty losses or involuntary conversion, but given this incentive is subject to opportunity, the low percentage was expected. Awareness varied across the tax incentives. The reforestation tax credit and seven-year amortization incentives were closely tied in terms of landowner awareness and use. As the tax law linked these two incentives, this was expected. Nearly 50 percent of those FFOs that were aware of these two incentives used them, indicating both are powerful forest policy tools to encourage reforestation (Table 3).

FFOs had low awareness of the exclusion cost-share payments from taxable income provision (ECSP). Despite low awareness (41 percent), 71 percent of those who knew about it had in fact used the tax provision in the past. Depreciation and the Section 179 deduction was the second to last in term of FFO awareness and use was relatively low (Table 3). With those exceptions, awareness and use of the other forestry tax provisions was high, resulting in significant reforestation activities.

#### 3.2. Results

The results for the econometric models are presented in Tables 4 and 5. A summary of the significant ( $\alpha = 0.05$ ) variables of the awareness models revealed that the variables representing landowners' membership in a landowner organization (BTO) and size of forest holding (FA) were consistent at predicting respondents' awareness for all seven of the tax incentives examined in this study (Table 4). Based on initial screening tests, this also implies that landowners with a professionally



prepared management plan would likely be more aware of these incentives. Relationships between demographic characteristics are subtle and the model does not allow inferences about correlations between these variables (correlation does not infer causation). However, the literature suggests that landowners who are actively involved in a landowner organization or possess a professionally prepared forest management plan tend to be more abreast about issues germane to managing forestland than other groups of owners [3,9].

**Table 4.** Summary of Awareness Models for the Seven Tax Incentives.

Independent Variable	Probability > Chi-Square						
	LTCG	ADME	CLIC	DS179	RTC	ARE	ECSP
Constant	0.0286	0.9156	0.0057 *	<0.0001 *	0.0056 *	0.0008 *	<0.0001 *
BTO	<0.0001 *	<0.0001 *	<0.0001 *	0.0001 *	<0.0001 *	<0.0001 *	<0.0001 *
FA	0.001 *	<0.0001 *	0.0002 *	0.0006 *	0.0026 *	0.017 *	0.0393 *
PRO	0.0092 *	0.0376 *	0.8308	0.1981	0.8811	0.0402 *	0.3571
LOE	0.0439 *	0.0314 *	0.0007 *	0.037 *	0.0586	0.0003 *	0.7638
PF	0.8998	0.0781	0.0815	0.004 *	0.0918	0.0342 *	0.0074 *

\* Significant at the  $\alpha = 0.05$  level.

**Table 5.** Summary of Use Models for the Seven Tax Incentives.

Independent Variable	Probability > Chi-Square						
	LTCG	ADME	CLIC	DS179	RTC	ARE	ECSP
Constant	0.001	0.0004 *	0.0503	0.0140 *	0.8952	0.4648	0.5207
BTO	0.6856	0.5255	0.1521	0.1341	0.5111	0.1921	0.7165
FA	0.0019 *	0.1288	0.0017 *	0.0285 *	0.0136 *	0.0603 **	0.3100
PRO	0.8895	0.0722	0.7811	0.3364	0.0754	0.1765	0.1710
LOE	0.9146	0.8648	0.2020	0.4147	0.3960	0.8688	0.8182
PF	0.2559	0.1958	0.2198	0.0322 *	0.2791	0.2592	0.4470

\* Significant at the  $\alpha = 0.05$  level. \*\* Significant per the effect likelihood ratio test.

The historically significant variable, size of forest holding (FA), was also a good predictor of landowners' awareness of the tax incentives. Past research has found that size of forest holding is a key characteristic that is highly correlated to forest management on family forests [59]. Even the current family forest literature continues to show size of forest holding to be strongly correlated with many variables related to forest management, especially forest owners' technical knowledge and attitudes towards timber harvesting [3], making it perhaps the key variable in predicting FFO behavior. This supports the fact that the BTO variable has a substantial influence on landowners' awareness of the provisions. Size of forest holding has also been considered to be a good proxy for landowners' level of education, another one of the variables that was a significant ( $\alpha = 0.05$ ) predictor of landowner awareness in this analysis [3].

The variable capturing landowners who held their forestland for investment purposes had little influence on the awareness for the casualty loss, depreciation and deductions, reforestation tax credit, and exclusion of qualifying cost-share payments provisions. Theory would suggest that an individual who is in the business of maximizing profits would explore all possible avenues to reduce costs; however, this appears to not be the case. One explanation for this inconsistency is that profit maximizers only expend their energy exploring cost minimizing avenues when needed [58]. The lack of influence PRO has on the awareness of the casualty loss provision would support this claim. It truly is a case specific provision.

The same reasoning would apply to the exclusion of qualified cost-share payments incentive. Landowners not engaged in cost-share programs have little incentive to explore avenues which minimizes their tax liabilities from participation. The provision that allows for the deduction and

depreciation of applicable equipment or property improvements has a similar tendency; those engaged in land ownership for investment reasons may find that holding equipment or adding qualified improvements erodes their overall returns.

The fact that PRO positively influenced the awareness of ARE, but not RTC, is a little surprising. Since these two provisions are closely linked, one would surmise that knowledge of one would be highly correlated to the awareness of the other. Moreover, PRO has significant influence on the LTCCG provision, which is also associated with timber harvesting activities. This suggests that information regarding the seven-year amortization and long-term capital gains treatment of timber provisions is more readily available.

Examining a summary of the use models in this analysis reveals that the size of forest holding (FA) variable was the only significant ( $\alpha = 0.05$ ) one at predicting landowners' use of the provisions. The first stage selection model significantly reduced the sample size for the second stage, which was used to generate the use models, and this may have impacted those results. This also confirms the findings of earlier studies that very few of the socioeconomic predictors examined are useful at estimating landowner use of the provisions [46,47].

Our findings suggest that, with a few exceptions, specific landowner demographics can be attributed to a landowner's awareness of the federal income tax provisions examined in this study. These predictors can possibly be used in the future to target specific landowner groups in an effort to better educate them about the tax provisions. The use of the incentives however, does not seem to depend on any particular factor examined, except for the size of forest holding.

#### 4. Conclusions

FFOs hold their land for a variety of reasons, many of which do not produce income. For the objectives that involve generation of income, the owners are subject to the federal income tax. This study examined how the size of forest holding and other landowner characteristics influences FFO knowledge and use of federal tax provisions germane to timber management under the 2001 Internal Revenue Code. The seven tax provisions examined in this study encompass a wide range of forestry tax incentives, including all of the specific types that might be of interest to forest policy analysts. One advantage of the timing of the data used in this study is a wider range of forestry tax incentives than exists today. Survey respondents were South Carolina FFOs and corresponded to the general population of FFOs in the United States [1]. However, respondents were selected from a group of FFOs that typically have strong financially-oriented timber management objectives. So some caution should be used in interpreting these results relative to a more general population of FFOs.

A two-step sample selection model was employed to analyze FFO use behavior conditional on awareness of these tax provisions. The T-SSS model produced several interesting results. From the first stage of selection and binary logistic model, landowner awareness of all seven tax provisions was positively related to size of forest holding and membership in a forest landowner organization. This implies that family forest landowners that both had larger holdings and belonged to some sort of forest landowner organization were most likely to be aware of the seven tax provisions. Having a college education and holding land for investment purposes exhibited varying degrees of influence on landowner awareness of individual provisions. Landowners with these characteristics have also been more apt to receive cost-share funding [63], technical assistance [64], and use a professionally prepared forest management plan [1].

Landowners who have at least a college education were more aware of five of the seven tax provisions: the long-term capital gains treatment of timber, annual deduction of management expenses, casualty loss and involuntary conversions, the section 179 deduction and depreciation, and the amortization of reforestation expenses than those with less formal education. This finding, coupled with the fact that membership in a landowner organization also positively influences awareness, provides valuable insights on the importance of disseminating information to FFOs. These results show this is especially true for the reforestation tax credit and cost-share payment exclusion provisions.

While the amortization of reforestation expenses provision was closely tied to the reforestation tax credit (RTC) provision at the time of the initial survey, landowner awareness for the RTC was influenced by landowner organization membership, but not level of education. This is just one example that demonstrates how landowner organizations serve as a conduit for distributing the information produced by forest service and state extension service publications, among others. This finding is further supported by the influence membership has on the casualty loss/involuntary conversion and cost-share payment exclusion provisions. Both of these provisions could be considered case-specific in nature, and do not apply to most FFOs. However, it further demonstrates the importance of forest landowner organizations.

In the outcome stage, landowner use of the provisions was modeled conditional on their awareness of the provisions. Surprisingly, size of forest holding was the only variable that influenced landowner use of the provisions in this study. Although this historically significant variable has been shown to influence many of the forest management activities FFOs engage in, it is rather disturbing in the sense that, presently, parcelization is considered to be one of the major threats to sustainable forest management [65]. Driven by urban development and other pressures that decrease forest tract sizes, parcelization tends to result in a loss of economies of scale which often makes forestry practices economically infeasible. This may also lead to forest fragmentation, an ecological issue [65]. Tax provisions can be leveraged to mitigate economies of scale losses, which may in turn, reduce overall forest fragmentation. However, many FFOs do not utilize the provisions because they believe that the tax provisions do not apply to their situation or that the benefit is too small to bother with [47]. Some of the tax provisions are very complex (e.g., ECSP and CLIC) and there may be some truth to those FFO arguments. For example, respondents that have not harvested timber have no need to utilize the long-term capital gains or amortization of reforestation expenses (the reforestation tax credit was repealed by the American Jobs Creation Act of 2004) provisions, but may utilize the annual deduction of management expenses while preparing for a timber harvest in the future.

The argument from some FFOs that some tax provisions are not “worth the bother” is problematic because it challenges the effectiveness forestry education extension activities have had on landowner awareness [47]. For example, respondents that did not utilize the long-term capital gains provision, but harvested timber, could have realized tremendous tax savings. Moreover, the benefits of the tax savings has increased since the time of the survey; capital gains treatments is now a more valuable tax provision (capital gains tax rates have decreased). Taxpayers that utilize the reforestation tax provisions currently would also realize larger benefits *versus* those offered in 2001. In 2001, the reforestation tax credit provided a ten percent tax credit to landowners that spent up to \$10,000 for tree planting costs such as site preparation, seeds, seedlings, and labor that could be subtracted from the amount of taxes otherwise owed to the federal government. Moreover, those that utilized the credit could amortize \$9500 of the \$10,000 over an 84 months period by utilizing the amortization of reforestation expenses provision. During this same time period, landowners that spent up to \$10,000 but did not utilize the ten percent tax credit could amortize the full amount over an 84 months period. Since the initial study, the reforestation tax credit was repealed by the American Jobs Creation Act of 2004 and landowners are now allowed to deduct up to \$10,000 per qualified timber property per year and amortize any amount in excess of \$10,000 over 84 months.

Models developed in this study examined which socioeconomic factors influence landowner awareness and landowner use of seven federal income tax provisions. The findings confirm that educational efforts and ownership objectives influence landowner awareness of the provisions. However, none of these have much influence on landowner use of the provisions. Tax policy has profound impacts on the profitability of forest management; it also has the potential to be huge player in the conservation of many forested tracts across the United States.

Modifications to some the provisions (e.g., long-term capital gains and reforestation tax provisions) since the initial study in 2001 have further increased their benefits, which in turn, could increase the amount of forested acres sustainably managed. Size of forest holding was the most significant variable

in predicting tax provision use, making it a key research area in terms of examining the awareness and use of federal tax provisions by FFOs. This single variable would enable forestry researchers to develop tools to increase FFO timber management profitability and forest sustainability. If we as society value the many benefits forests produce, it will be imperative to not only disseminate information on tax provisions, but also educate FFOs on their specific benefits.

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## Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of Open Access Journals
FFO	Family Forest Owner
LEV	Land Expectation Value
IRC	Internal Revenue Code
USDA	United States Department of Agriculture
LTCG	Long-Term Capital Gains Treatment of Timber Income
ADME	Annual Deduction of Management Expenses
DS179	Depreciation and Section 179 Provision
CLIC	Casualty Loss and Involuntary Conversion
RTC	Reforestation Tax Credit
ARE	Amortization of Reforestation Expenses
ESCP	Exclusion of Qualifying Cost-Share Payments from Gross Income

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