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# A comparison of participants and non-participants of state forest property tax programs in the United States

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## ABSTRACT

Information collected by the National Woodland Owner Survey, supplemented with state forest property tax program, land use, and socio-economic data, was used to develop a national characterization of participants enrolled in state forest property tax programs and their forest land. Family forest owners who owned a single parcel of forest land, were at least slightly familiar with their state's property tax program, and whose forest land qualified to participate in their state's program were included in the analysis. Landowner and parcel characteristics were organized into eight categories hypothesized to distinguish participants and non-participants. The analysis found that enrolled lands are larger, more likely found in predominantly forested landscapes, more actively managed, and less likely used for hunting than non-enrolled forest land. While enrollment in a state forest property tax program is positively associated with higher population density, no correlation was found between enrollment tendency and land development pressure, as defined in this analysis. The owners of enrolled forest lands generally report higher household incomes than their non-enrolled counterparts. However, owners whose forest land is enrolled in a forest property tax program do not express greater concern about the level of property tax levied on their forest land, and are no less likely to divest their land than non-enrollees. The information generated from this study may help state forest property tax program administrators and public policy makers improve the ability of these programs to achieve their intended objectives, such as incentivizing the production of timber, other ecosystem goods and services, and forest land protection, through more effective marketing and targeting efforts.

## 1. Introduction

The majority (58%) of the 330.2 million ha (816 million acres) of forest land in the United States (U.S.) is privately owned (Butler et al., 2016b). Of the private forest owners, 93% are family forest owners (FFO), defined as families, individuals, trusts, estates, and family partnerships. Collectively these owners, estimated at 10.7 million, control 117.4 million ha (290 million acres) or 36% of America's forest land (Butler et al., 2016b). They provide numerous forest-based goods and services such as timber, wildlife habitat, recreational opportunities, water regulation, and aesthetics (Butler et al., 2016c).

A broad suite of policy tools have been used to encourage FFO to implement good stewardship and land management practices (e.g., Greene et al., 2005), discourage forest land fragmentation and parcelization (e.g., York and Munroe, 2010), and encourage landowners to make long-term investments in their forest land (e.g., Cushing, 2006;

D'Amato et al., 2010). These tools include technical assistance, information, educational programs, financial incentives, regulations, and tax policy (Kilgore and Blinn, 2004; Greene et al., 2005; Butler et al., 2012). Of particular prominence and importance in the U.S. are financial incentives offered to forest landowners through property tax policy (Greene et al., 2005).

Property tax policies have been developed over 150 years to encourage good forest stewardship and the production of forest-based goods and services (Fairchild, 1935; Jacobson and McDill, 2003; Fortney and Arano, 2010). Forest property tax programs exist in every state, are administered by state and/or local governments, and were initially used to encourage long-term investments in timber production and reduce the need for private forest landowners to forfeit or develop land because of high tax bills (Jacobson and McDill, 2003; Fortney and Arano, 2010). More recently, their focus has broadened to emphasize the production of a wide range of ecosystem goods and services,

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including protecting forest land from conversion to a different land use (Kilgore et al., 2017). State forest property tax programs can vary extensively with respect to their fundamental basis for taxation, enrollment requirements, administrative procedures, land management and use restrictions, annual tax benefit, and ecosystem services promoted. Criteria associated with enrolling in a state forest property tax program often include minimum forest conditions (as measured by area with trees, stocking levels, and/or growth rates), a commitment to enrolling for a minimum period of time, a written plan to guide land management actions, penalties for non-compliance and/or early withdrawal, and management and use restrictions (Kilgore et al., 2017, 2018).

The annual financial incentives provided by state forest property tax programs can be substantial. In 2015, these programs collectively provided forest landowners over 1.6 billion dollars in incentives. Nationally, the participants of these programs received an annual incentive that averaged nearly \$19 per ha, although individual program benefits ranged from under \$2.47 to more than \$148 per ha per year (Kilgore et al., 2017).

A recent review of the forest property tax literature found that major areas of investigation have focused on state forest property tax program design, use, and administration (e.g., Hibbard et al., 2003; Fortney and Arano, 2010); property tax impacts on forest land investment and management decisions (e.g., Klemperer, 1982; Amacher et al., 1991; Brockett and Gebhard, 1999; Cushing, 2006; Greene et al., 2014); property tax policy influence on forest owner tenure decisions (e.g., Poudyal et al., 2009; Butler et al., 2012; Ma et al., 2014); and factors influencing enrollment in state forest property tax programs (e.g., Dennis and Sendak, 1992; Thomas et al., 2002; Kilgore et al., 2008; Fortney et al., 2011; Bagdon and Kilgore, 2013; Wolde et al., 2016).

Regarding this latter area, drivers of participation in specific state forest property tax programs can be grouped into three broad categories: landowner characteristics, land characteristics and context, and the tax program characteristics. Several landowner characteristics such as age, socioeconomic status, place of residence, and ownership objectives, attitudes, and concerns have been found to be associated with a landowner's decision to enroll in a forest property tax program. For example, landowners with high educational attainment, concern about development surrounding their forest land, and concern about property tax levels are more likely to be enrolled in a forest property tax program (Dennis and Sendak, 1992; Fortney et al., 2011). Forest land characteristics including parcel size, access, market value, ownership and management history, and surrounding land uses have been found to be associated with forest property tax enrollment tendencies. For example, Bagdon and Kilgore (2013) found that forest land not containing water or road frontage are more likely to be enrolled in a forest property tax program, as are larger parcels (Ma et al., 2014). Several forest property tax program characteristics have been found to be associated with forest property tax program enrollment. They include the requirement to have a forest management plan and restrictions on land uses, both of which have been found to reduce enrollment likelihood (Ma et al., 2014; Butler et al., 2012; Fortney et al., 2011; Kilgore et al., 2008).

To our knowledge, a national assessment of the enrollees of state forest property tax programs in the U.S. does not exist. Specifically, we were interested in describing a national characterization of FFO (and the forest land they own) who are enrolled in forest property tax programs, and important similarities and differences between tax program enrollees and non-enrollees. To address this information gap, we used a national woodland owner dataset, supplemented with state forest property tax program, land use, and socio-economic data to identify, describe, and contrast the participants and non-participants of state forest property tax programs. Having this information may help state forest property tax program administrators and public policy makers design and market these programs to achieve their intended objectives, such as incentivizing timber production and/or other ecosystem goods and services to protecting forest land from development.

## 2. Data and methods

The analysis used data from the National Woodland Owner Survey (NWOS), a periodic mail survey of private forest owners in the U.S. conducted by the USDA Forest Service, Forest Inventory and Analysis program. We utilized the most recent cycle of the NWOS, which was collected from 2011 to 2013 and consists of responses from 10,092 FFO with at least 0.4 ha (1 acre) of forest land (Butler et al., 2016b,c). Family forest ownerships are defined as families, individuals, trusts, estates, and family partnerships who own forest land. Forest land is defined as: "Land that has at least 10 percent crown cover by live tally trees of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence." To qualify, the area must be at least 0.4 ha (1 acre) in size and 37 m (120 ft) wide (Butler et al., 2016a). The overall cooperation rate for FFO of at least 0.4 ha (1 acre) was 52% (Butler et al., 2016b). The survey included questions on such topics as owner demographics, ownership characteristics, forest ownership objectives, past, current and future land use behaviors and intentions, concerns, recreational usage, information sources, and conservation program participation. Dickinson and Butler (2013a,b) and Butler et al. (2016a) provide further information on NWOS sampling design and survey administration.

Several screening steps were performed that resulted in a reduction in the set of NWOS records that were retained for this analysis. Thirty percent of the NWOS respondents own multiple parcels. Because landowners are asked to answer each question for all the wooded land they own in the state, there is no way of attributing an action (e.g., conducted a timber harvest) to a specific parcel owned by the respondent if more than one wooded parcel is owned. Therefore, 3028 NWOS records containing landowners owning more than one parcel of forest land in a state were removed from the dataset.

Most state forest property tax programs have specific criteria of the owner or land that need to be met in order for forest land to be eligible for enrollment. We applied each state property tax program's minimum land area eligibility criteria, as described in Kilgore et al. (2017), to the NWOS records for that state. An additional 3201 NWOS records where the forest land did not meet the minimum land area eligibility requirements of the state's forest property tax program were removed. After this screening step, 3863 NWOS records were retained.

A final screening of the NWOS records was performed to ensure only respondents indicating some level of familiarity with their state's forest property tax program were included. We applied this filter to ensure the most direct comparison between participants and non-participants of state forest property tax programs (i.e., all landowners we studied were eligible to enroll their forest land and knew their state had a forest property tax program that would reduce the tax burden on their forest land). To do so, we used the NWOS question that asked landowners to indicate their familiarity with their state's forest property tax program, with responses on a 5-point scale ranging from extremely familiar to not at all familiar. Only those NWOS records where the landowner indicated they were at least slightly familiar with their state's forest property tax program were included. Removing respondents who were not aware of their state's forest property tax program reduced our dataset to 1752 records of FFO who owned a single parcel of forest land, were at least slightly familiar with their state's property tax program, and whose forest land qualified to participate in their state's program. Of these respondents, 1080 were enrolled in their state's forest property tax program (62%) and 672 (38%) were not, as indicated by responses to the NWOS question which asked whether any of their wooded land was currently enrolled in their state's forest land property tax program.

Two supplemental datasets were appended to the NWOS dataset. One contained georeferenced land use (e.g., land cover) and socio/economic characteristics (e.g., population density, housing density) of the area surrounding the wooded parcel owned by each NWOS respondent. These data came from the National Land Cover and U.S.

Census datasets and were linked to individual NWOS records by the Family Forest Research Center at the University of Massachusetts Amherst (Jake Hewes, personal communication 10/05/2015). The second dataset included data on each state's forest property tax program (e.g., program eligibility requirements; enrollment and annual tax incentives provided) developed by Kilgore et al. (2017). Eight states administer multiple forest property tax programs. For those states, the tax program with the greatest enrollment, based on participation identified in Kilgore et al. (2017), was selected to represent the forest property tax characteristics offered in that state.

Relative probabilities (also known as “probability ratio” and “relative risk”) were used to identify similarities and differences between tax program participants and non-participants. Relative probabilities are the ratio of one probability to another. In the context of this study, relative probabilities indicate the probability a FFO enrolled in a state forest property tax program has undertaken (would undertake) an activity or that the landowner or their wooded land exhibits a certain characteristic, divided by the probability a non-participating landowner has/would undertake the same activity or their land exhibits the characteristic.

In order to conduct relative probability analyses, responses to all questions containing multiple response categories were converted to a binary variable. We used several questions from the NWOS survey that asked respondents to select their response from a 5-point scale (e.g., 1 = not important, 2 = of little importance, 3 = moderately important, 4 = important, and 5 = very important). The responses to these questions were converted to binary responses, with a value of 1 assigned for responses of important or very important and a value of 0 if one of the other three response options. Several NWOS questions with categorical response categories were used in our analysis, including landowner annual income, education level, and number of times they have sold or given away their wooded land. The responses to these questions were converted to binary variables based on the median response value. For example, a binary variable for annual income was created with respondents assigned a value of 1 if their response was > \$99,999 and 0 otherwise. For education, a binary measure of education level was determined by setting all landowners who stated an Associate's degree or higher was their highest level of school completed to a value of 1 and 0 otherwise. For the number of times a portion of forest land had been transferred, landowners who had transferred their land at least once were assigned 1, and all others 0. This variable was included as an indicator of constancy of past forest land ownership characteristics.

Several variables used in this analysis were derived from continuous variables, including landowner age, percent of household income derived from their wooded land, size of property, tenure, and several ancillary parcel characteristics. These variables were also converted into binary response variables based on the median values for each variable. Specifically, for these variables, a value of 1 was assigned if the landowner's response was greater than the median response, and 0 if it was less than or equal to the median response. For example, a value of 1 for the variable ‘Forest’ indicates that the proportion of land that is forested within 1 km of the parcel is greater than the median value for all parcels of 0.76 (Table 1).

FFO who were familiar with, eligible, and enrolled in their state's forest property tax program were compared to those FFO who were not enrolled, but eligible to participate and familiar with the program. Landowner and parcel characteristics were organized into eight categories which we thought would distinguish tax program participants and non-participants. These eight categories were derived from a review of the literature on FFO participation in assistance programs generally and forest property tax programs specifically (see Introduction for literature consulted), forest property tax program objectives as specified in state laws and administrative rules, and available NWOS and ancillary socio-economic and parcel data, and are the ones we thought would represent broad, distinguishing categories of characteristics relevant to the enrollment decision (e.g., forest land

characteristics, reasons for owning wooded property). The categories describe the socio-economic and demographic characteristics of the owner; attitudes and concerns regarding their wooded land; reasons owners own their wooded land; owner participation in forestry assistance programs; past land management activities, practices, assistance, and uses; planned future activities; forest land characteristics; and land use and development activity or potential.

Tests for differences between forest property tax program participants and non-participants were made using two sample *t*-tests and Chi-square tests (Dalgaard, 2008). Statistically-significant differences were identified at  $\alpha = 0.05$ . All statistical tests were performed using SAS 9.4 software (SAS Institute Inc., 2013).

### 3. Results

A summary of the analysis for the eight categories of landowner and parcel characteristics which were hypothesized to distinguish tax program participants and non-participants is presented below and in Table 1.

#### 3.1. Owner socio-economic and demographic characteristics

FFO enrolled in forest property tax programs differ from non-enrollees in several regards. While these two cohorts are similar with respect to their age, enrolled owners are 1.22 times as likely to have an annual income that exceeds \$99,999 and are 1.18 times as likely to have obtained at least an Associate's degree, compared to non-enrollees. Landowners enrolled in a state's forest property tax program are also 1.25 times as likely to derive some portion of their annual income from their wooded land relative to non-enrolled landowners (Table 1).

#### 3.2. Owner attitudes/concerns

Participants in forest property tax programs are no more concerned about the level of taxation on their forest land than non-participants, with over 78% of both cohorts expressing concern over taxes. They are also no different from non-enrolled owners with respect to their concern about land development activity in the area where their forest land is located or their ability to pass their forest land on to heirs. Yet participants appear to be more sensitive to timber markets or financial incentive programs. For example, participants of forest property tax programs are 1.48, 1.35, and 1.18 times as likely to view cost-sharing programs, strong timber markets, and favorable tax policies, respectively, as being helpful as compared to non-participants of tax programs (Table 1).

#### 3.3. Reasons for owning wooded property

Participants and non-participants of forest property tax programs are similar in many respects with regard to the reasons they own forest land. Specifically, the importance of owning forest land for wildlife, recreation in general, as an investment, as a place to live, and as an asset to pass on to their heirs is viewed equally as important among participants and non-participants. In contrast, participants of forest property tax programs are more likely to own the land for timber and aesthetic reasons. For example, 46% of participants own their land for timber production versus 37% of the non-participants. Those landowners who are not enrolled in a forest property tax program are 1.16 times as likely to own their land for hunting, relative to enrolled landowners (Table 1).

#### 3.4. Assistance and advice

While both participants and non-participants of forest property tax programs who were at least somewhat familiar with tax programs are equally aware of programs that provide financial assistance for various

**Table 1**  
Percent frequency and relative probability of FFO enrolled and non-enrolled landowners in a state forest property tax program.

Category/variable	Description	Percent of those enrolled (N = 1080)	Percent of those not enrolled (N = 672)	Relative probability	p-value
<b>Owner Socio/Economic/Demographic Characteristics<sup>b</sup></b>					
Age	Owner > 63 years	51.15	47.31	1.08	0.1410
Income	Owner income > \$99,999	35.50	29.14	1.22 <sup>a</sup>	0.0140
Education	Owner education ≥ Associate degree	62.93	53.13	1.18 <sup>a</sup>	0.0001
Income from woods	Some portion of annual income derived from wooded land	33.22	26.64	1.25 <sup>a</sup>	0.0080
<b>Owner Attitudes/Concerns<sup>c</sup></b>					
Taxes concern	Concern for taxes	79.67	78.51	1.07	0.5600
Development concern	Concern for development	47.38	48.31	0.98	0.7130
Succession concern	Concern for passing land down to heirs	79.54	76.44	1.04	0.1310
Tax help	Helpfulness of more favorable tax policies	77.28	65.36	1.18 <sup>a</sup>	0.0001
Timber markets help	Helpfulness of stronger timber markets	62.46	46.29	1.35 <sup>a</sup>	0.0001
Cost share help	Helpfulness of cost sharing for woodland management	56.68	38.25	1.48 <sup>a</sup>	0.0001
<b>Reasons for Owning Wooded Property<sup>c</sup></b>					
Aesthetics	For beauty or scenery	85.32	81.27	1.05 <sup>a</sup>	0.0280
Wildlife	To protect/improve wildlife habitat	80.08	76.50	1.05	0.0850
Investment	For land investment	47.95	46.15	1.04	0.4810
Children	To pass land to heirs	72.95	68.68	1.06	0.0710
Timber	For timber products	45.79	37.35	1.23 <sup>a</sup>	0.0001
Recreation	For recreation other than hunting	57.07	53.26	1.07	0.1400
Hunting	For hunting	47.00	54.86	0.86 <sup>a</sup>	0.0020
Residence	To live on property	82.63	81.62	1.01	0.6590
<b>Assistance and Advice</b>					
Cost share familiarity <sup>c</sup>	Familiarity with cost share programs	22.47	23.69	0.95	0.5560
Cost share	Past participation in a cost share program	25.17	13.26	1.90 <sup>a</sup>	0.0001
Advice	Received advice on care, management, or protection for their wooded land in past five years	59.49	34.24	1.74 <sup>a</sup>	0.0001
<b>Past Activities, Practices, and Assistance</b>					
Transfer <sup>b</sup>	Forest land transferred at least once	22.16	20.85	1.06	0.5280
Management plan	Has a forest management plan	59.06	20.24	2.92 <sup>a</sup>	0.0001
Harvest 5 years	Harvested trees for sale in the past five years	37.04	26.19	1.41 <sup>a</sup>	0.0001
Invasive 5 years	Treated invasive plant species in the last five years	30.48	29.71	1.03	0.7350
Harvest	Harvested trees for sale since owning the property	61.64	49.73	1.24 <sup>a</sup>	0.0001
Forester	Use of forester during harvest	58.14	33.53	1.73 <sup>a</sup>	0.0001
Logger	Use of certified or master logger During harvest	48.01	36.61	1.31 <sup>a</sup>	0.0002
<b>Future Plans<sup>c</sup></b>					
Future harvest	Likelihood of future harvesting	41.72	25.46	1.64 <sup>a</sup>	0.0001
Future transfer	Likelihood of transferring property in the future	14.38	14.61	0.98	0.9000
Sell	Would sell forest land if offered a reasonable price	19.87	18.65	1.07	0.5390
Wooded	Agreement with wanting to keep their wooded land wooded	90.71	86.86	1.04 <sup>a</sup>	0.0120
<b>Forest Land Characteristics</b>					
Tenure <sup>b</sup>	Ownership tenure > 23 years	49.85	49.69	1.00	0.9490
Residence	Home or primary residence on or within one mile of wooded land	59.11	63.19	0.94	0.0890
Farm	Owns a farm or ranch in state	33.18	40.00	0.83 <sup>a</sup>	0.0040
Cabin	Cabin on or within one mile of wooded land	24.60	20.39	1.21 <sup>a</sup>	0.0420
Size <sup>b</sup>	Wooded land > 36 ha	55.46	41.07	1.35 <sup>a</sup>	0.0001
<b>Proximate Land Use and Development Activity/Potential</b>					
Population <sup>b</sup>	Number of people per square kilometer within the Census block group where land is located > 34.3	53.98	43.30	1.25 <sup>a</sup>	0.0001
Forest <sup>b</sup>	Proportion of land that is forested within 1 km radius of where land is located > 0.76	55.65	43.45	1.28 <sup>a</sup>	0.0001
Agriculture <sup>b</sup>	Proportion of land that is agricultural crop or pasture within 1 km radius of where land is located > 0.10	45.93	56.25	0.82 <sup>a</sup>	0.0001
Development <sup>b</sup>	Proportion of land that is developed within 1 km radius of where land is located > 0.04	51.30	50.15	1.02	0.6400
Road density <sup>b</sup>	Number of road pixels (30 m) within 1 km of where land is located > 176	49.54	45.68	1.08	0.1170

<sup>a</sup> Statistical significance at  $\alpha \leq 0.05$  level based on the Wald Chi-Square statistic.

<sup>b</sup> Response measure at median response value.

<sup>c</sup> Categorical response converted to binary.

forest land planning and management practices, owners whose forest land is enrolled in such programs are nearly twice as likely to have participated in a cost share program. This cohort is also 1.74 times as likely to have talked to someone or received advice about the care, management or protection of their forest land as non-participant landowners (Table 1).

### 3.5. Past activities, practices, and assistance

Landowners enrolled in a forest property tax program are 2.92 times as likely to have a forest management plan, 1.41 times as likely to have harvested timber in the past five years, and 1.24 times as likely to have harvested timber since owning their wooded land relative to

landowners who are not enrolled. Of the landowners who had harvested timber since owning their wooded land, property tax program participants are 1.73 times as likely to have used a forester during the harvesting process and 1.31 times as likely as non-program participants to have used a certified or master logger when a timber harvest was conducted. With regard to forest land sale activity, landowners enrolled in a forest property tax program are no more likely to have sold or given away any of their forest land (in part or whole) than non-enrollees. Participants and non-participant FFO are, also, equally likely to have treated their forest land for invasive species (Table 1).

### 3.6. Future plans

The intent to harvest timber in the next five years is 1.64 times more likely for landowners who are enrolled in a forest property tax program than those not enrolled, as 42% and 25%, respectively, report having such future harvest plans. Property tax program participants are also slightly more likely to want to keep the land forested, although > 86% of both cohorts expressed this intention. With regard to their likelihood of selling or giving away any of their wooded land in the next five years, low percentages of both participants and non-participants expressed an intention to do so (approximately 15%). Both landowner cohorts are also equally likely to sell their forest land if offered a reasonable price, although the percentage of each cohort intending to do so was fairly low at approximately 19% for non-participants and 20% for participants (Table 1).

### 3.7. Forest land characteristics

Taking into account minimum parcel size requirements for each state's forest property tax program, larger wooded parcels are more likely to be enrolled than smaller parcels. Specifically, enrolled parcels are 1.35 times as likely as non-enrolled parcels to be > 36 ha (89 acres) compared to non-enrolled parcels. Forest land enrolled in a property tax program is also more likely to have a cabin associated with it. However, enrolled forest land is less likely (0.83 times) to be part of a farm or ranch, compared to non-enrolled forest land. No differences between enrolled and non-enrolled landowners were found for ownership tenure or having a home on or near the wooded land (Table 1).

### 3.8. Development potential/activity

Enrolled family forest land is more likely to be located where population density is > 34.3 individuals per square kilometer (13.2 individuals per square mile) as compared to non-enrolled lands. Yet enrollment does not appear to be related to either the level of development or density of roads adjacent to forest land. With regard to surrounding land uses, higher property tax program enrollment is associated with an increasing proportion of the surrounding land area in forested cover, and lower enrollment is associated with an increasing proportion of agricultural land in the surrounding landscape. For example, forest land enrolled in a property tax program is 1.28 times as likely to be in locations where the surrounding land use is at least 76% forest cover, relative to non-enrolled forest land. In contrast, non-enrolled forest land is 1.22 times as likely to be located in an area characterized as having > 10% agriculture relative to land enrolled in a state forest property tax program (Table 1).

## 4. Discussion

The analysis provides a number of important insights on the enrollees of state forest property tax programs across the U.S., relative to FFO who are not enrolled in such programs. Below are some observations about the similarities and differences between these two cohorts of FFO.

### 4.1. Enrolled lands are larger and more likely found in predominantly forested landscapes

The analysis found that larger tracts of forest land are more likely to be enrolled in state forest property tax programs. Enrollment of larger acreage forested parcels is not surprising as the annual property tax savings is a function of property size. This finding is consistent with other studies which found parcel size to be an important predictor of landowner participation in financial incentive programs (see Beach et al., 2005 and Floress et al., 2018 for examples). Enrolled lands are also more likely to be located in predominantly forested areas as opposed to areas where agricultural land uses are common. In contrast, non-enrolled forest lands are more likely to be associated with a farm or ranch than lands enrolled in forest property tax programs, possibly due to more favorable property tax treatment for farm land relative to forests in some areas and lack of awareness by some FFO of the forest property tax program benefits. These findings suggest that efforts to protect the remaining forest land in largely non-forested, rural landscapes may not be accomplishing their intended objective.

Our three measures of development (Population, Road Density, Development) produced somewhat inconsistent results. We found enrollment in forest property tax programs occurs at approximately the same rate, irrespective of the proportion of developed land and road density surrounding the enrolled parcel. Yet, forest land enrollment in state property tax programs is positively correlated with population density. Overall, it is unclear whether use of these programs is occurring at a higher rate in those areas most prone to forest land conversion pressure. Converting these three variables measuring development from continuous to binary may have obscured the relationship between enrollees and non-enrollees.

### 4.2. Owners of enrolled land have higher household income

In general, the participants of state forest property tax programs have higher income than those forest landowners that do not participate in such programs. These individuals may have a greater ability to hire professionals (e.g., tax professionals) who can advise them on strategies for reducing their tax liability. However, a significantly higher percentage of enrolled landowners indicated that cost share programs would be helpful to them than non-participants, suggesting that they may be a more receptive cohort to cost-share program marketing efforts. This finding could also reflect a greater awareness of cost-share programs among tax program participants. It is important to note that our finding only suggests an association between property tax program participation and landowner income; it does not indicate that enrolling land in forest property tax programs increases the affluence of enrolled landowners. Level of FFO education, a variable often associated with or used as a proxy of FFO wealth, was also found to be an indicator of enrollment in tax programs, with higher-educated FFO more likely to be enrollees. This finding is consistent with other research (e.g., Williams et al., 2004).

The length of time an individual owns forest land does not appear to influence tendency to enroll in a forest tax program – both new and long-standing owners are enrolled in forest tax programs at approximately the same rate. This finding is consistent with other studies that have examined the relationship between tenure and property tax program enrollment (e.g., Kilgore et al., 2008).

### 4.3. Enrolled lands are more actively managed

When compared to non-participants, property tax program participants appear to be more active forest managers. This is evident by participants being more likely to have commercially harvested timber (and plan to harvest timber in the future), acquired a plan to guide the management of their forested property, participated in a program that helps underwrite the cost of specific forest management practices, and

received advice on how to manage their forest land. These findings need to be interpreted with some caution, as many of these actions (e.g., having a forest management plan) are a requirement to participate in a state forest property tax program (Kilgore et al., 2017). As such, it is not known whether enrolling in a forest property tax program motivated owners to be more active managers, or whether these actions had or would have occurred absent enrollment in the tax program. Some studies of forest owner participation in financial incentive programs (e.g., Baughman, 2002; Miller et al., 2012; Kreye et al., 2018) have concluded that some owners would have undertaken the management practices absent the financial assistance, which may be the phenomenon observed with some forest property tax program participants. Additionally, our analysis only found an association between the level of management and property tax program participation – no causal affect is implied.

#### 4.4. Enrolled lands are less likely used for hunting

While landowners who view the protection of wildlife habitat as an important forestland ownership reason are no more likely to have their forest land enrolled in forest property tax program, participants are less likely to rate ownership for hunting purposes as an important ownership reason as compared to non-participants. This finding may reflect the requirement (or option) of some states in which land enrolled in forest property tax programs is open to the public for hunting (e.g., Maine, Massachusetts, Michigan, Wisconsin). Studies have found that forest landowners highly value exclusive hunting rights and that the cost of relinquishing this right can be substantial (Kilgore et al., 2008). The lower enrollment probability among landowners who value their forest land for hunting may also reflect the belief among some woodland owners that commercial timber harvesting (numerous states emphasize commercial timber production as a primary goal of their program; e.g., Alabama, Indiana, West Virginia, Wyoming) can have detrimental effects on wildlife habitat, which could result in a diminished hunting experience.

#### 4.5. Owners of enrolled land are not more concerned about property taxes

One unexpected finding was that a landowner's concern over the level of property taxes levied on his/her forest land does not appear to be associated with a greater probability of enrollment in a forest property tax program. This reluctance to enroll in a program that provides substantial property tax relief in spite of a concern about taxes may be explained, in part, by the overall adversity to participating in government-sponsored programs among some forest landowners (e.g., Leahy et al., 2008). It may, also, reflect the unwillingness of landowners to commit their land for multiple years to a property tax program that prohibits certain land management and/or use activities, or requires significant back payment of taxes and/or penalties for withdrawing from the program, as was found by others (e.g., Kilgore et al., 2008; Butler et al., 2012; Bagdon and Kilgore, 2013).

#### 4.6. Owners of enrolled land are not more likely to retain their forest land

State forest property tax program participants are equally as likely as non-participants to divest of their forest land at some point, either through sale or gift. This finding suggests that while property tax programs often constrain the types of land management activities and uses allowed, they are not viewed as a major impediment to the future ownership plans for their forest land. This finding has implications for other forest conservation and land protection programs (e.g., conservation easements) that also encumber the land against certain land uses. Williams et al. (2004) also found that participation in a forest property tax program was not associated with reduced intentions of an FFO to convert their forestland in the future. Further, our results are broadly consistent with other studies that found tax policy has a modest

impact on landowner behavior (e.g., Kilgore, 2014; Wagner et al., 2002). Together with the other findings, our study suggests forest property tax programs may not be effective in accomplishing certain objectives such as keeping forests as forests, an assertion also posited by Williams et al. (2004).

## 5. Conclusions

The analysis describes the strength of association between certain characteristics of landowners and their forest land and their likelihood of participating in a state forest property tax program. These data may be useful to individual states considering property tax policy as a means for accomplishing public policy goals. For example, states interested in improving wildlife habitat on private forest land can use the results to assess the likelihood that property tax policy will be effective in achieving this objective. Conversely, our study also raises the possibility that tax programs may not be effective at stimulating management behavior changes or decisions to keep forested lands forested; important points for policy makers to consider as they assess the efficacy and cost-effectiveness of future forest property tax programs. Consequently, knowing the characteristics of the owners and forest land more likely to be enrolled may help state forest property tax program administrators and policy makers design and market their programs in such a manner that enrollment is sufficiently high to accomplish the program's land use and/or management objectives, and that targeting and outreach resources are most effectively employed.

There are a few study limitations readers need to keep in mind when interpreting the results. For example, our study only included data on single-parcel forest owners. Given the positive association between acres owned and property tax program enrollment, we expect multi-parcel owners (in so much as they would tend to be higher acreage owners) would enroll at a higher rate than single parcel enrollees. By extension, we would also expect to see a greater distinction between enrollees and non-enrollees with respect to other owner and land characteristics associated with larger acreage ownerships, since greater forest acreage has been found to be associated with a diversity of management behaviors (see Floress et al., 2018 for specific examples). Additionally, for those eight states that administer multiple forest property tax programs, we assumed landowners in these states were enrolled in a state's most popular program (as measured by acres enrolled). Large differences in forest property tax programs within a given state (e.g., enrollment requirements and procedures, penalties, tax benefits) could have had an impact on our study findings.

An important next step would be to determine the causal effect of these associations. Specifically, one important area for future investigation is whether property tax program enrollment motivates landowners to be more active forest managers, or whether these owners are actively managing their forest land at the time of enrollment. Also, it is unclear how educating or making landowners familiar or aware of programs might affect their enrollment. As has been found in previous research, enhanced awareness of programs does not necessarily translate into increased participation in programs or associated actions by FFO (e.g., Jarrett et al., 2009). However, FFO awareness of tax programs has been found to be high (William et al. 2004), and some level of familiarity would be a necessary precursor before an FFO might consider enrollment. Second, our analysis excluded those survey respondents who were not familiar with their state's forest property tax program. Understanding those strategies that are effective in increasing landowner awareness of their state's forest property tax program could be an important step in increasing program participation. Third, future analyses that include both single and multi-parcel owners would provide a more complete understanding of forest property tax enrollment tendencies. Finally, it would be insightful to determine whether regional factors in terms of forest conditions, timber markets, or cultural norms influence a forest landowner's decision to participate in a forest property tax program.

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