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Expanding Family Forest Owner Options to Keep Their Land in Forest Use

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Abstract

Family forest owners (FFOs) own the majority of US forests and 47% of forests in the Northeast. Over 90% of northeastern FFOs want their land to stay wooded. Maintaining forest-based ecosystem services necessitates finding ways to help FFOs achieve goals for keeping their land undeveloped. Conservation easements (CEs) prohibit residential and commercial development, typically in perpetuity, but are currently underused. Understanding what drives CE interest may help maximize their potential as a conservation tool. We explored northeastern FFOs' likelihood of CE adoption through contingent behavior responses to permanent and temporary CE scenarios. For each commitment length, we tested a range of financial compensation amounts and FFO characteristics. Increased financial compensation did not increase CE adoption likelihood for either commitment length, whereas attitudinal variables strongly influenced intention for both. Respondents did not appear to prefer temporary to permanent easements but were equally likely to consider adoption, suggesting that providing both tools may be in order. Providing FFOs with more options to keep their land in forest use, especially when there is currently high interest in this goal but low participation, has the potential to attract new and different segments of FFOs, thereby sustaining the essential ecosystem services derived from forests.

Study Implications: Family forest owner interest in land protection in the northeastern US is high; over 90% owning four or more ha have indicated they want their land to stay wooded. Few, however, have taken advantage of conservation easements (CEs) to protect their land. Highly effective at ensuring the continual provision of forest benefits, CEs prohibit land uses such as residential and commercial development. Although research acknowledges CE interest, little is known about what characteristics of the tool are desirable. Gaining greater understanding of these characteristics can help expand the options FFOs have to achieve their goal of keeping their land in forest use.

Keywords: contingent behavior, land protection, conservation easement, forest conversion, policy

The Northeast is one of the most heavily forested regions of the US. However, since 1985, the region has lost more than 350,000 ha of forestland to primarily low- and high-density residential development, reversing a 150-year trend of afforestation in the region (Drummond and Loveland 2010, Thompson et al. 2013, 2017, Jeon et al. 2014). The loss of this forest cover results in a reduction of ecosystem services, including climate change mitigation through carbon sequestration and storage, wildlife habitat, clean water and air, and forest products (Stein et al. 2005). Ensuring the future provision of these essential ecosystem services

necessitates the development and implementation of strategies to help slow this trend in forest loss.

Like much of the eastern US, the northeastern US is heavily forested with ownerships dominated by family forest owners (FFOs) (i.e., families, individuals, trusts, estates, and family partnerships) holding ≥4 ha (Butler et al. 2021). FFOs represent 47% of the forested land in this region (Butler et al. 2021). The decisions FFOs make about the future ownership and use of their land are primary drivers of forest conversion.

FFO interest in keeping their land in forest use in the northeastern US is high; 91% of FFOs owning ≥4 ha indicate that they want their land to stay wooded, reflecting 90% of FFO-owned land (Butler et al. 2021). These findings provide optimism that large landscape goals to conserve ecosystem services are possible; however, intention does not equal future action. Helping FFOs achieve their goal of keeping their land in forest use and maintaining the many ecosystem services their forests provide requires finding formal, long-term approaches. There are a variety of programs designed to help maintain ecosystem services from FFO land, each with its own set of goals, requirements, and strategies (Table 1). However, these options may not be sufficient or fully effective enough to adequately address the critical issue of forest loss. In other words, FFOs may not have the right tools available to them to satisfy their ownership goals of avoiding forest loss.

A number of programs primarily seek to protect ecosystem services by encouraging FFOs to engage in active forest management activities such as the development of a forest management plan, implementation of wildlife habitat enhancements, and the control of invasive/exotic plants. For example, the USDA Forest Service and Natural Resources Conservation Service (NRCS) offer Farm Bill programs intended to encourage FFOs to actively manage their forest through technical assistance and financial incentives in the form of cost-share payments (e.g., the Forest Stewardship Program and Environmental Quality Incentives Program). These programs seek to encourage forest management; however, to date they fall short of guaranteeing that land remains in forest use. The assumption that well-managed forests, generating income, provide the financial return necessary for the landowner to maintain the land in its forested use long-term is disputable (D'Amato et al. 2010). Increases in land values, relatively flat stumpage prices, and smaller property sizes leading to fewer forest management options have led to circumstances in parts of the Northeast where forest management is not sufficient to pay for the property taxes (D'Amato et al. 2010). In addition, despite considerable federal investment over the past several decades, the number of FFOs that have adopted these programs remains quite low. In the US, only 4% of FFOs owning ≥4 ha have participated in cost-share programs, representing 13% of FFO-owned land (Butler et al. 2021). Although these and other programs (e.g., the American Tree Farm Certification Program) meet the need of a segment of FFOs, it seems clear that these programs, in both intent and adoption rate, will not be enough on their own to ensure forest cover at any meaningful scale.

In addition, every state offers some form of current use or preferential tax program to forest owners. The broad goal of these programs is to help recognize the ecosystem services FFO lands provide to the public by making the cost of ownership of forested land more affordable through preferential property taxes (Greene et al. 2005, Butler et al. 2012). Although every state's current use program is different, there are some common elements, including a commitment to keep the land in an approved use, such as forest management, for a specified time period (Butler et al. 2012). Change to an unqualified land use, such as conversion of managed forest to residential use, typically results in a landowner's removal from the program, return to a nonpreferential property tax rate, and, depending on the state, possibly a penalty for withdrawal from the program. According to the National Woodland Owner Survey, 17% of FFOs participate in a property tax program (Butler et al. 2021). Unlike the USDA Farm Bill programs, current use programs provide a formal mechanism to help discourage forest conversion and incentivize forest use through lower property taxes, but because FFOs can typically remove their land at any time from a current use program, there are no long-term assurances that the forest will remain forest.

One tool that eliminates the possibility of forest conversion, with no opportunity for withdrawal, is a conservation easement (CE). CEs are legal agreements that may be placed on all or a part of a property that maintains land in private ownership but extinguishes some rights that may compromise the conservation values of the land (i.e., residential and commercial development, mining), and allows other rights such as farming, forestry, and recreation to continue (Butler et al. 2012, Catanzaro et al. 2014, Vizek and Nielsen-Pincus 2017). In this way, CEs control the future use of the land to help meet FFO personal and financial goals while also maintaining the ecosystem services provided by their land. CEs are commonly

Table 1. Examples of the most common programs and tools for U.S. family forest owners (FFOs).

Name	Sponsoring organization	Goal	Formal mechanism to maintain forest use?	Length of formal mechanism	Further information	Percent involvement of FFOs owning at least 4 ha
Permanent conservation easement	Public and private conservation organizations	Maintain ecological, cultural, and/or recreational value of land in perpetuity by extinguishing land uses that would reduce these values	Yes	Perpetuity	Examples: Forest Legacy Program (https://www.fs.usda.gov/managing-land/private-land/forest-legacy); land trusts (landtrustalliance.org)	3%[a]
Temporary conservation easement	Public and private conservation organizations	Maintain ecological, cultural, and/or recreational value of land for a designated period of time by extinguishing land uses that would reduce these values	Yes	Designated timeframe (e.g., 30 years)	Example: Health Forest Reserve Program (HFRP) (https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/)	0.01%[b]
Current use preferential tax program	State, county, municipal government	Reduce family forest owner property tax burden in exchange for helping to meet societal goals, such as timber production and open space conservation	Yes	Remove the land at any point. May incur a penalty.	Butler et al. (2012)	17%[a]
Environmental Quality Incentives Program (EQIP)	USDA Natural Resources Conservation Service	Provide financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits	No	Not applicable	https://www.nrcs.usda.gov/eqip/	Data unavailable
Forest Stewardship Program (FSP)	USDA Forest Service, State forestry agencies	Connect private landowners with the information and tools they need to manage their forests and woodlands	No	Not applicable	https://www.fs.usda.gov/managing-land/forest-stewardship/program	3%[c]
American Tree Farm System	American Forest Foundation	Enhance the quality of America's woodlands by giving forest owners the tools they need to keep their forests healthy and productive	No	Not applicable	https://www.treefarmsystem.org/	2%[d]

[a]Butler et al. (2021); [b]Reflects participation of the 12 states included in the HFRP program; calculated using data from USDA Natural Resources Conservation Program (2021) and Butler et al. (2021); [c]Number reflects those receiving technical assistance from 2007-2011 (Butler et al. 2014); [d]Calculated using data from American Forest Foundation(2021) and Butler et al. (2021).

held in perpetuity, but CEs with shorter timeframes are possible. For example, the NRCS's Healthy Forest Reserve Program (HFRP) offers 30-year easements to private forest owners with specific land attributes; however, this program is currently only available in twelve US states, with a total of 105 easements held through 2015 (USDA Natural Resources Conservation Program 2021). CEs lower the economic value of land by eliminating residential and commercial development, potentially leading to reduced taxes, such as local property taxes and estate taxes (Catanzaro et al. 2014). However, only 3% of FFOs owning ≥4 ha (reflecting 6% of FFO-owned land) have a CE in the US (Butler et al. 2021). The northeastern US states tip the scales slightly: on average, 5% of FFOs owning ≥4 ha have CEs, reflecting 8% of FFO land in the region (Butler et al. 2021). Despite these low rates, a regional study of FFOs in the northeast (Markowski-Lindsay et al. 2018) found that nearly 50% of respondents think that controlling future use of their land is an important thing to do to keep most or all of their land forested.

To help FFOs achieve their goals of keeping their land forested, they must have the right tool for the job. In other words, tools must have both a formal mechanism to maintain forest use over a long time period and have characteristics that encourage FFO participation. Based on high interest in keeping forest in forest but current low participation rates in available programs, there may be a gap between current use programs, in which land can be removed at any time, and permanent CEs, in which land is committed in perpetuity. Extensive interest in keeping forested land wooded prompts the question, why are CE adoption rates so low? The situation suggests that there are characteristics of CEs that make them unappealing to a large segment of landowners. Developing a better understanding of what drives interest in CEs may help maximize their potential as a conservation tool. Indeed, Rabotyagov and Lin (2013) conclude that whether landowners will participate in an easement program is less the question than what kind of easement program they are willing to join.

Peer-reviewed literature has explored landowner participation motives and attitudes towards CE adoption. Brenner et al. (2013) found that upstate New York landowners most interested in CEs are those who undertake activities related to recreation and subsistence on their land rather than activities for economic gain. Factors such as personal connections to the land, desires to contribute to the public good, having a forest management plan, influential informal social networks, greater parcel sizes, and higher incomes (Farmer et al. 2011, Ma and Kittredge 2011, Ma et al. 2012, Kittredge et al. 2013) are all associated with FFO willingness to adopt CEs. Social and neighborhood connections (Ma and Kittredge 2011) and environmental and financial beliefs (Vizek and Nielsen-Pincus 2017) are also associated with positive attitudes towards FFO CE adoption. Despite concerns about private ownership risks leading to negative attitudes towards CE adoption by current nonparticipants (Gruver et al. 2017, Vizek and Nielsen-Pincus 2017), FFOs who have actually adopted CEs believed they had greater control over the future use of their land (Gruver et al. 2017).

Less frequent are studies describing what specific aspects of CEs are preferable. A New York conjoint analysis (Kelly et al. 2015, 2016) assessed FFO likely enrollment in various forest conservation program types, including CEs, and explored whether time commitment, payment value, payment mode, and forest management requirements affected interest in participation. In the agricultural landowner realm, Bastian et al. (2017) explored whether easement length, financial benefit, and other easement attributes (e.g., managerial control, public access) influenced CE interest in Wyoming and Colorado, a study worth expanding to FFOs. Similarly, Rabotyagov and Lin (2013) examine FFO contract preferences, but in this case, it is for attributes of working forest conservation contracts, exploring contract length, payment value, forest management requirements, and extent of forestland covered in Washington.

Gaining a greater understanding of CE characteristics most preferable to FFOs can help foresters provide tailored options to FFOs to increase adoption of a tool that has been recognized as an important element of forest conservation in landscapes dominated by FFOs (Foster et al. 2010). We build on the Kelly et al. (2015) study, which provides a solid starting point for exploring what factors are important when considering CEs but reports a low response rate; we also hypothesize that time commitment and payment value are important factors associated with CE participation in our study region. Landowners are sensitive to highly controlling programs, including those requiring permanent CEs (Sorice et al. 2013). FFOs are noted as being concerned about leaving their heirs options for the future (Catanzaro et al. 2014, Kelly et al. 2015, 2016), and permanent decisions may seem to limit future heir options. Could offering

a nonpermanent easement option engage more landowners to adopt CEs? The impact of financial obligations on decision-making is well documented in the literature for numerous fields. Could the financial obligations associated with adopting CEs be influencing adoption?

In particular, in this study we explore the following:

1. Whether the timeframe associated with a CE (i.e., the tenure of the easement) influences FFOs willingness to adopt a CE. We hypothesize that temporary easements fill a gap in FFO options for keeping their land in forest use and will garner greater interest than permanent easements.
2. Whether the financial compensation for adopting a CE influences FFOs' willingness to adopt a CE. We hypothesize that higher levels of compensation will result in greater interest in adopting the tool.
3. The extent to which landowner characteristics, as reported in the FFO literature, influence CE adoption. We hypothesize that owner, ownership, and attitudinal characteristics influence the likelihood of CE adoption.

We consider how our findings are relevant for foresters and policy makers in landscapes where FFOs comprise a significant amount of the ownerships.

Materials and Methods

Study Area

Our study area focused on the northeastern region of the US. We studied FFO preferences for CE characteristics using data from a 2016 survey of FFOs who own land in Massachusetts, Maine, New York, and Vermont. FFOs owning ≥4 ha in these states account for over 45% of the area's forestland, owning nearly 8 million ha of forest (Butler et al. 2021). We established our study region by selecting two forest landscapes from each state predicted to be areas of medium or high forest conversion threatened by housing density increases in the coming decades (Stein et al. 2005, Ducey et al. 2016, Olofsson et al. 2016, Brown 2017) that also contain extensive forest cover and critical public forest benefits (e.g., water quality, biodiversity, recreation) (Figure 1).

Sampling

State and municipal agency property information provided the sample of FFOs owning ≥4 ha of forested land. Ownerships of this size are better suited for economically viable forests (Hatcher et al. 2013), forest management, and other forestry-based activities (Butler et al. 2016), including easements. Although most data records reflected single-property ownerships, some

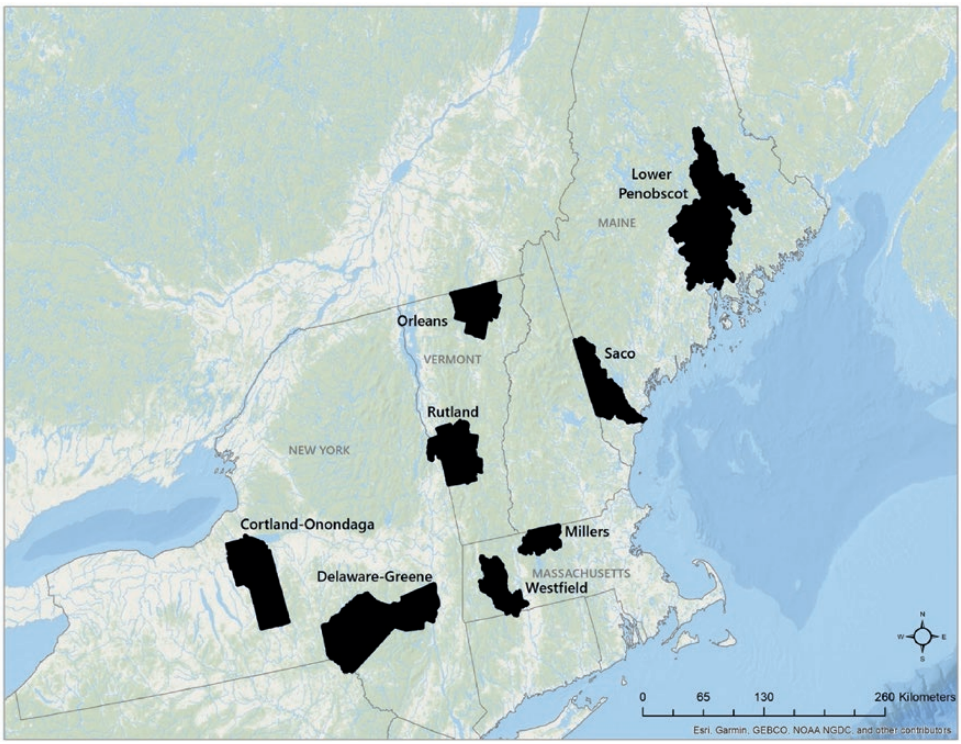


Figure 1. Four-state US study region chosen for analysis.

data reflected multiple-property ownerships, which we collapsed into one record, retaining the largest parcel. Given our interest in mostly forested landscapes that are viable working forests and possess high ecological value, we used a stratified sampling approach based on parcel size (i.e., 16 ha) to ensure that larger parcels were represented in the sample. We randomly selected landowners for participation from each stratum, selecting half to exceed a minimum area of 16 ha and half falling below that minimum area. Within each stratum, we randomly selected landowners such that the total sample of twenty-five hundred landowners was divided evenly across strata and the eight areas (312 or 313 per study area equally split across each stratum, 625 per state).

Survey Design and Administration

Prior to survey administration, we pretested our instrument with forest owners in the sample region. After addressing respondent comments, in 2016, we administered the survey using a modified Dillman method (Dillman et al. 2014): a prenotice postcard sent three days prior to the mail survey, a mail survey including a detailed cover letter explaining the importance of responding, a thank you postcard sent one week later expressing appreciation or reminding individuals to respond, and replacement mail survey and detailed cover letter sent three weeks after previous survey mailing. We asked questions to elicit preferences for CE characteristics and intentions and decisions to designate future ownership and use, and to understand barriers to proceeding with future planning goals, ownership, and land characteristics. The survey content and human subjects protocol were reviewed and approved by the University of Massachusetts Institutional Review Board in accordance with their Human Research Protection Program.

Each respondent was asked to respond to one hypothetical situation: whether or not they would agree to a scenario that described a CE option, including detail on CE length of commitment and financial compensation amount. CE commitment lengths were permanent, based on the typical commitment length used across the region, or temporary (30 year), based on the HFRP. Half of the sample received the permanent CE scenario and the other half received the temporary CE scenario. Three versions of each commitment-length scenario were distributed equally and randomly to the sample across strata and region. Each version presented a different financial compensation amount (Figure 2). The range of financial compensation amounts for the permanent easements was determined through discussions with attorneys and land trust professionals having extensive experience with CEs in the Northeast region. The range of financial compensation amounts for the temporary easement mirrored the HFRP. As such, we tested two CE commitment lengths: permanent and temporary (i.e., 30 years) and, for each of these, three financial compensation amounts, thus testing all six scenario possibilities.

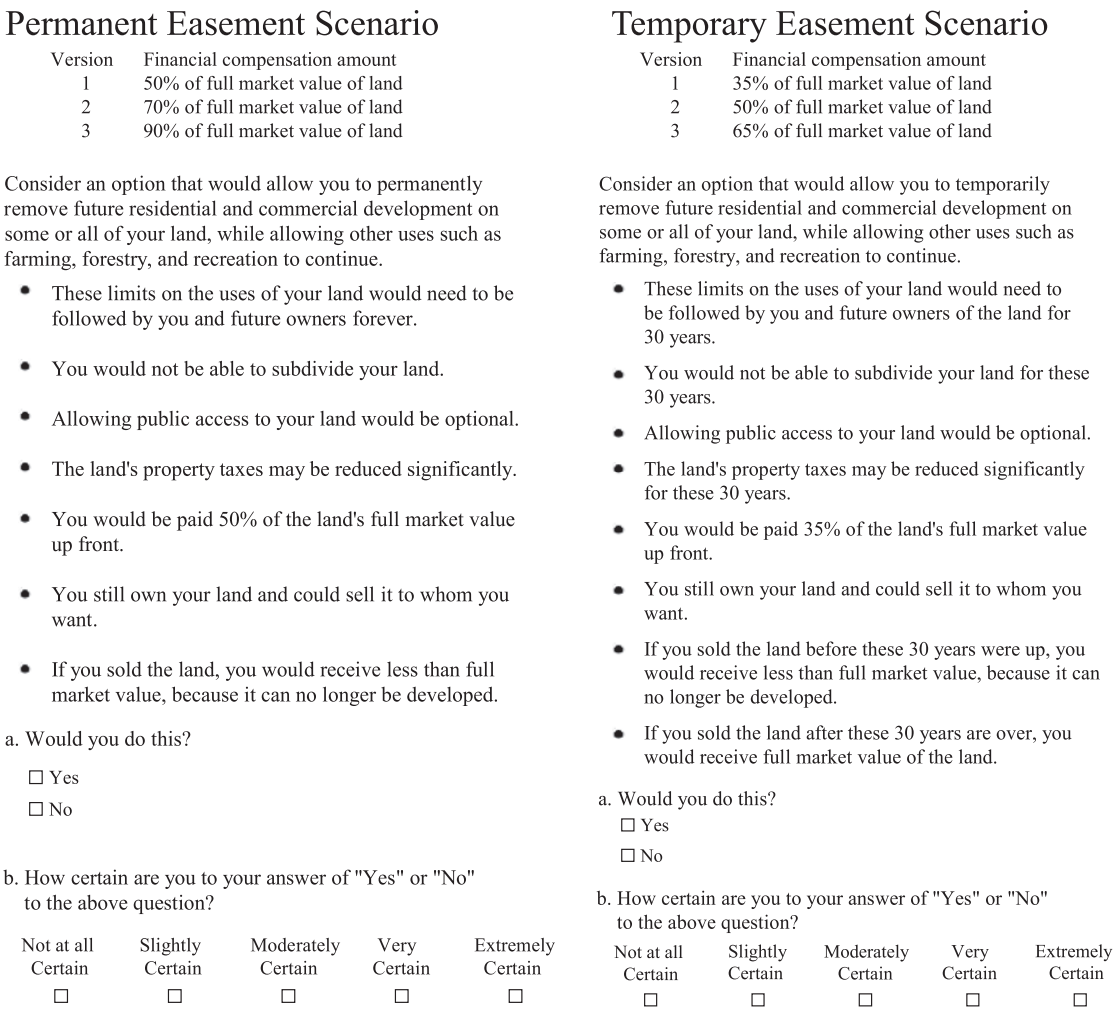
The range of financial compensation amounts differed between permanent and temporary easements to reflect realistic ranges for each easement type. The permanent easement versions indicated respondents would be paid 50%, 70%, or 90% of the land's full market value up front. The temporary easement versions indicated respondents would be paid 35%, 50%, or 65% of the land's full market value up front. Randomly, each respondent was presented with one scenario that asked their willingness to participate in the program (yes/no) and their certainty of their answer (five-point Likert scale rating).

Statistical Analysis

We constructed statistical models to understand the extent to which various factors influence FFO willingness to participate in the hypothetical CE scenarios. We developed our models to explore how they may be influenced by the length of commitment of the CE, financial compensation, and ownership characteristics. Because financial compensation amounts differed across easement types (i.e., permanent versus temporary), we analyzed temporary and permanent easement responses in two separate models; pooling the data would reflect the collinearity between finances and timeframe.

Each model explored the probability of agreeing to the hypothetical scenario dependent on CE compensation amounts and three types of ownership characteristics derived from the literature on CEs: FFO characteristics, attitudes, and existing experience with forest conservation tools. We tested various model specifications by nesting models using these explanatory variables. Our model selection approach was based on Akaike information criterion (AIC) scores and selecting the most parsimonious model. The resulting permanent and temporary CE models resulted in the same specification, described below.

For FFO characteristics, the literature indicates that FFO age, gender, education, income, ownership tenure, absentee ownership, and amount of wooded land owned have significant influence on CE adoption or intention to adopt (See Cho et al. 2005, LeVert et al.



Permanent Easement Scenario

Version	Financial compensation amount
1	50% of full market value of land
2	70% of full market value of land
3	90% of full market value of land

Consider an option that would allow you to permanently remove future residential and commercial development on some or all of your land, while allowing other uses such as farming, forestry, and recreation to continue.

- These limits on the uses of your land would need to be followed by you and future owners forever.
- You would not be able to subdivide your land.
- Allowing public access to your land would be optional.
- The land's property taxes may be reduced significantly.
- You would be paid 50% of the land's full market value up front.
- You still own your land and could sell it to whom you want.
- If you sold the land, you would receive less than full market value, because it can no longer be developed.

a. Would you do this?

☐ Yes

☐ No

b. How certain are you to your answer of "Yes" or "No" to the above question?

Not at all Certain	Slightly Certain	Moderately Certain	Very Certain	Extremely Certain
☐	☐	☐	☐	☐

Temporary Easement Scenario

Version	Financial compensation amount
1	35% of full market value of land
2	50% of full market value of land
3	65% of full market value of land

Consider an option that would allow you to temporarily remove future residential and commercial development on some or all of your land, while allowing other uses such as farming, forestry, and recreation to continue.

- These limits on the uses of your land would need to be followed by you and future owners of the land for 30 years.
- You would not be able to subdivide your land for these 30 years.
- Allowing public access to your land would be optional.
- The land's property taxes may be reduced significantly for these 30 years.
- You would be paid 35% of the land's full market value up front.
- You still own your land and could sell it to whom you want.
- If you sold the land before these 30 years were up, you would receive less than full market value, because it can no longer be developed.
- If you sold the land after these 30 years are over, you would receive full market value of the land.

a. Would you do this?

☐ Yes

☐ No

b. How certain are you to your answer of "Yes" or "No" to the above question?

Not at all Certain	Slightly Certain	Moderately Certain	Very Certain	Extremely Certain
☐	☐	☐	☐	☐

Figure 2. Example questions and version descriptions for permanent and temporary easement scenarios.

2009, Ma and Kittredge 2011, Ma et al. 2012). As such, both the permanent and temporary CE models include these explanatory variables. FFO attitudes shown to play significant roles in decisions and intentions include those related to family and emotional ties to the land (Gruver et al. 2017), attitudes about contributing to the public good (Farmer et al. 2011), community attachment (Bastian et al. 2017), environmental beliefs and protection (LeVert et al. 2009, Vizek and Nielsen-Pincus 2017), and perceived risk to private ownership (Vizek and Nielsen-Pincus 2017). Both permanent and temporary CE models specified three legacy-based attitudinal variables resulting from a principal components analysis (PCA) of seven legacy goal items. The PCA returned three components (explaining 75% of the total variation across the items) that we used to construct three predictor variables: (1) future ownership goals (i.e., providing an inheritance, a fair outcome, or full range of options for future owners); (2) altruistic goals (i.e., providing benefits for the community, environment or wildlife); and (3) financial legacy goals (i.e., providing financial security for themselves or heirs). These attitudinal variables roughly correspond to those reported in the literature. Experience with using forest conservation tools has been shown to be related to easements (Ma et al. 2012, Song et al. 2014); as such, each model included whether the respondent is currently enrolled in a current use property tax program (i.e., a program that reduces property tax for wooded and agricultural land).

Both models incorporated respondent uncertainty measured by a self-reported rating of how certain they were of their answer on a five-point Likert scale. We mapped responses to a numerical certainty scale (Loomis and Ekstrand 1998) and projected a range of certainty onto the binary responses, with the low end reflecting more certain negative responses, the middle reflecting the most uncertain responses, and the high

end, the more certain positive responses. Although our intention was to distinguish between all certainty levels in our analysis, we collapsed responses into three levels to ensure that each projection onto the binary responses represented at least of 10% of the sample. (See Table 2 for this mapping, as well as all explanatory variables).

For both models, we fit an ordered logit regression model (Greene 2011) on the intention to participate, accounting for uncertainty. Ordinal models are based on latent variables influencing respondent choices, the assumption that respondents make choices that increase their utility or satisfaction, and the idea that there is a continuous, unobservable variable that reflects respondent opinion or utility associated with their choice (Train 2003). We define the utility derived from the *i*th respondent from the *j*th scenario (U_{ij}) as:

$$U_{ij} = Z_j\beta_j + W_i\beta_i + \varepsilon, \quad (1)$$

where Z is a vector of CE characteristics, W is vector of forest ownership characteristics, β is the unknown, estimated parameter vector, and ε is a logistically distributed random component. The unobserved respondent utility is reflected as a discrete rating they choose, varying from 1 (extremely, very, or moderately certain they would not do) to 3 (extremely, very, or moderately certain they would do). In the sense of Klosowski et al. (2001), r_{ij} is the *i*th respondent's rating from the *j*th scenario related to utility through the transformation function, *h:*

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

Equation (2) provides the transformation needed for each respondent's rating of their given easement scenario to be dependent on the previously described easement and forest ownership characteristics. Unknown utility cutoffs delineating the three ratings enable the ordered logit model to be constructed (Greene 2011): if a respondent's utility is below the first cutoff, the rating 1 is chosen, if the utility is between the first and second cutoffs, the rating is 2, etc. The relationship between ratings and utility cutoffs are as follows, with the first cutoff normalized to zero:

$$\begin{aligned} r_{ij} &= 1 \; if \; U_{ij} \leq \mu_1 \\ r_{ij} &= 2 \; if \; \mu_1 < U_{ij} \leq \mu_2 \\ r_{ij} &= 3 \; if \; \mu_3 < U_{ij}. \end{aligned} \quad (3)$$

We used the Stata16 *ologit* package to estimate both ordinal logistic models.

Results

The mail survey resulted in a 27% cooperation rate (636/ 2337); 163 of the 2,500 addresses were undeliverable. Nonresponse bias assessment (15% of the mail respondents) indicated no significant differences with respect to questions relevant to designating future use or conversion of forest to residential or commercial development. Of these receipts, we removed 103 FFOs owning <4 ha of wooded land, 78 FFOs who already had an easement on their property, and 113 respondents who did not provide sufficient information for inclusion in the model estimation. The resulting sample of 342 respondents included 170 receiving the permanent easement scenario and 172 the temporary scenario. Financial compensation levels were roughly evenly distributed across scenarios. For the permanent easement scenario, 36% of the sample received the 50% compensation level, 31% the 70% compensation level, and 34% the 90% compensation level. For the temporary easement scenario, 31% of the sample received the 35% compensation level, 37% the 50% compensation level, and 33% the 65% compensation level. (Percentages do not total 100% due to rounding.)

Sample Characteristics

Over one-third of the estimation sample opted for the hypothetical CE scenario they were given, split relatively evenly across easement commitment lengths. Without accounting for certainty, 36% of permanent scenario respondents and 34% of temporary scenario respondents opted in. Taking certainty into account with the responses indicated similar percentages between commitment length scenarios. On average, 24% were extremely, very, or moderately certain of their "yes" answer (22% permanent scenario, 26% temporary scenario); 56% of respondents were extremely, very, or moderately certain of their "no" answer (55% permanent scenario, 58% temporary scenario); and 20% were slightly or not at all certain of their answer (23% permanent scenario, 17% temporary scenario); χ^2 tests show insignificant differences among these.

Owner characteristics indicated respondents were (on average) 64 years old, college educated, male, had an annual household income around $74,000, and lived on their land. On average, respondents have owned their land for approximately 27 years and own 32 ha. The majority of respondents were not enrolled in a property tax program (Table 2). Characteristics of the 342 respondents in our estimation sample largely corresponded to those of FFOs in the broader northeastern US revealed by the National Woodland Owner Survey (NWOS) data (Butler et al. 2021). The comparison revealed similar demographic and ownership characteristics (i.e., age, tenure, property tax enrollment frequency). Our respondents, on average,

Table 2. Estimation sample descriptive statistics.

		Combined sample (n = 342)	Permanent easement subsample (n = 170)	Temporary easement subsample (n = 172)
Independent variables	Units	Mean (SD)	Mean (SD)	Mean (SD)
Compensation amount	percent	59.8 (17.4)		
Permanent: 50/70/90			69.5 (16.7)	
Temporary: 35/50/65				50.3 (12.0)
Age	years	63.9(11.9)	64.0 (12.3)	63.8 (11.6)
Education (college degree)	1/0	0.62(0.49)	0.59 (0.49)	0.65 (0.48)
Gender (female)	1/0	0.27(0.44)	0.25 (0.44)	0.28 (0.45)
Income	USD(000's)	73.9(25.1)	74.6 (25.6)	73.1 (24.6)
Owner absentee	1/0	0.44(0.50)	0.43 (0.50)	0.45(0.50)
Ownership tenure	years	26.7(14.8)	27.8 (15.6)	25.7 (13.9)
Wooded land amount owned[a]	hectares	32.4 (41.0)	32.6 (34.9)	32.3 (46.4)
Legacy goal: future owners	PCA score	0.00(1.5)	-0.01 (1.5)	0.01(1.5)
Legacy goal: altruistic	PCA score	-0.04 (1.1)	-0.15 (1.1)	0.06 (1.2)
Legacy goal: financial	PCA score	0.06(1.2)	0.03 (1.2)	0.08(1.2)
Property tax program enrolee	1/0	0.29(0.45)	0.29 (0.46)	0.28 (0.45)
Response variable—certainty level	Ordinal logit coding	Response frequency (percent)	Response frequency (percent)	Response frequency (percent)
Yes—extremely/very/moderately certain	3	81 (23.7%)	37 (21.8%)	44 (25.6%)
Yes/No—slightly/not at all certain	2	68 (19.9%)	39 (22.9%)	29 (16.7%)
No—extremely/very/moderately certain	1	193 (56.4%)	94 (55.3%)	99 (57.6%)

[a]The model estimation uses the natural logarithm of the wooded land amount owned.

more frequently were female (27% versus 21%), held a college degree (62% versus 54%) and owned more land (32 ha versus 24 ha). Although the category does not allow a direct comparison of absentee ownership statistics, in our estimation sample, 44% did not have a primary residence on their forested land, whereas, in the NWOS sample, 32% did not having a primary residence within one mile of their forested land. Had we asked whether a primary residence was within one mile of their land, it is possible the absentee ownership percentage could have been closer to 32%. Household income was not collected in the NWOS survey.

Model Results

Overall, the ordered logit model performed well, based on χ^2, AIC, and pseudo-R^2 results (Table 3). We tested for multicollinearity among potential explanatory variables using variance inflation factor diagnostics; tolerance levels below 0.4 are associated with high multicollinearity (Allison 1999). The lowest tolerance level for variables in this analysis was 0.6.

For both commitment length scenarios, future ownership and altruistic legacy goals had the strongest association with likelihood of participation. Those with altruistic goals (items related to benefits for wildlife, environment, or community) were roughly two times more likely to agree to the scenario than those without altruistic goals (odds ratios = 1.9 and 2.0; *P*-values ≤ 0.1%). Those with goals related to future owners (items related to providing an inheritance, a fair outcome, or full range of options for future owners) were roughly 30% less likely to agree to the scenario than those without that goal (permanent scenario *P*-value ≤ 1%; temporary scenario *P*-value ≤ 5%). That is, those without future owner goals were 1.3 (1/0.75) to 1.4 (1/0.73) times more likely to agree to the scenarios than those with those goals.

For the temporary easement scenario, male landowners were 2.5 times (1/0.4) more likely than females to agree to the scenario (*P*-value ≤ 5%); no significant effect was found with the permanent scenario.

For the permanent easement scenario, those with a college education were roughly two times more likely to agree than those with lower levels of education (*P*-value ≤ 10%); no significant effect was found with the temporary easement scenario. With an odds ratio of 0.98, permanent easement respondents showed nearly equal likelihood of agreeing with the scenario across financial compensation amounts (*P*-value ≤ 5%). Those responding to the higher financial compensation amounts were roughly 2% less likely to agree to the scenario than those responding to the lower financial compensation amounts. Financial compensation was insignificant with the temporary scenario.

Table 3 presents odds ratio results and Supplement 1 presents full model results, including coefficient estimates.

Discussion

FFOs have access to a number of traditional programs that play an important role in the larger picture of forestland conversion, but they do not provide a direct

Table 3. Model results of factors affecting preferences for hypothetical conservation easements.

	Permanent easement model[a]	Temporary easement model[a]
Independent variable	Odds ratio (SE)	Odds ratio (SE)
Compensation amount	0.98† (0.01)	1.02 (0.01)
Age	0.99 (0.02)	0.99 (0.02)
Education (college degree)	1.91* (0.68)	1.56 (0.59)
Gender (female)	1.05 (0.39)	0.40† (0.16)
Income	1.01 (0.01)	0.99 (0.01)
Owner absentee	1.21 (0.42)	1.47 (0.52)
Ownership tenure	1.01 (0.01)	1.01 (0.01)
ln(Wooded land amount owned)	1.31 (0.28)	1.01 (0.20)
Legacy goal: future owners	0.75†† (0.09)	0.73† (0.10)
Legacy goal: altruistic	1.91††† (0.34)	2.03††† (0.33)
Legacy goal: financial	1.15 (0.17)	1.19 (0.22)
Property tax program enrolee	1.21 (.51)	1.00 (0.40)

[a]*P*-value: ≤ 0.1% = †††,≤1% = ††,≤5% = †,≤10% =*

In both models, likelihood ratio χ^2 tests are significant (permanent: 41.73, prob > chi2 = 0.0000, pseudo R^2: 0.1231, AIC = 325.3, *n* = 170; temporary: 36.44, prob > χ^2 = 0.0003, pseudo R^2: 0.1096, AIC = 324.2, *n* = 172).

mechanism for keeping land in forest use. Finding the right tool(s) for the job of meeting FFO goals of keeping their land forested, thereby maintaining critical ecosystem services, necessitates having the right suite of options. We focus on easements because they are designed to keep forest as forest for a guaranteed period of time. Based on stated FFO preferences of preferring programs with fewer restrictions and greater reward, we hypothesized that temporary easements would have greater adoption rates than permanent easements and that higher amounts of compensation would results in greater adoption. Although the results of our analyses surprised us, they do not discount the importance of developing an alternative to the permanent CE to attract FFOs for whom a permanent easement may not be the right fit. We believe that our results indicate that temporary easements could help fill a current gap in program options by appealing to a segment of FFO with the goal of keeping their land in forest.

Our results showed that more respondents responded positively to the temporary CE question (26%) with certainty than to the permanent CE (22%), but not with statistical significance. Adding the forested land of another 22% to 26% of FFOs to the existing acreage already permanently protected would go a long way to ensuring the sustained flow of essential ecosystem services from our forests. In addition, another 17% (temporary) to 23% (permanent) of respondents were unsure as to their intention to participate, suggesting that there may be an even greater opportunity to increase the adoption of CEs through outreach and education.

In terms of our hypothesis, respondents did not appear to prefer temporary to permanent easements, but they were equally likely to say they would consider adoption. The χ^2 tests of responses accounting for respondent uncertainty showed no significant differences. We had expected far more respondents to prefer a shorter time frame because of the reluctance to tie their heirs' hands (Catanzaro et al. 2014, Kelly et al. 2016). Although not statistically significantly different from the responses to the permanent easement, as we had expected, it is important to note that there was still meaningful interest in temporary CEs as a tool to keep land in forest use for a guaranteed period of time. Our result is similar to that of Brenner et al. (2013) who found 30% of their respondents were willing to consider CEs.

The lack of response to financial compensation was an unexpected and surprising result for the second hypothesis (i.e., no increased likelihood of choosing a scenario based on financial compensation with the permanent easement and no significance with the temporary easement). This finding suggests that, for at least a segment of landowners, willingness to adopt these tools was based on goals beyond financial gain. This is not dissimilar to Rabotyagov and Lin's (2013) finding that the impact of current net returns was small relative to other forestland and landowner characteristics.

Although easement duration and financial compensation provided interesting findings, our analysis shows that it is the attitudinal variables that have the strongest influence on intention to adopt. In the northeast region of the US, we find differences among FFOs with respect to preferences for CEs. At roughly double the rate, respondents with altruistic goals (i.e., goals of providing benefits for the community, environment, or wildlife) were more interested in easements than others. Clearly, this result supports lessons from past research that place-based attachments play an important role in avoiding forest fragmentation (Creighton et al. 2008). Targeting landowners having altruistic goals for educational interventions would likely be an effective and efficient strategy to increasing CE adoption and therefore ecosystem protection.

We see that FFOs' strong legacy goals of passing land to heirs is also influential in their intentions to adopt. Consistent with the literature, landowner goals related to future ownership (i.e., providing an inheritance, a fair outcome, or a full range of options for future owners) corresponds negatively to CE intention to adopt. FFOs with future ownership goals were less likely to adopt this tool than those without that goal. We believe that there is a segment of FFOs who want to maintain all the options for their heirs. Reluctance to state an intention for a "highly controlling program" (Sorice et al. 2013) such as a CE is not that unusual when considering it involves making decisions that will affect the flexibility and opportunities for future generations.

Education level had a very strong relationship with the intentions to adopt a CE, but only with permanent easements. Owners with college degrees were nearly two times more likely to agree to the permanent CE scenario than those without college degrees. Although education level was not significant in the temporary easement, the finding with permanent easements is consistent with the literature (LeVert et al. 2009). Those with higher levels of education may feel more prepared to undertake the process of adopting a permanent easement, have more skills to do so, and more financial resources to hire professional help.

Our results show that males were more likely to adopt the temporary easement than females; gender was not significant in the permanent easement model. Estate-planning literature suggests differences in thoughts and behaviors between genders (Mater et al. 2005, Lidestav 2010, Grubbstrom and Soovali-Sepping 2012, Markowski-Lindsay et al. 2020). Other studies have shown gender differences in financial decisions, specifically finding that, in general, women have less enthusiasm for, lower confidence in, and less willingness to learn about personal finance topics than men do (Chen and Volpe 2002). Possibly, these gender-based differences result from differing risk perceptions (Gustafsod 1998) or differences in self-efficacy (Junge and Dretzke 1995, Wigfield et al. 1996, Pajares 2002). It is possible that males see the temporary easement as a "good deal" in financial terms because, while compensation is offered, the restrictions expire and eventually leave the land with all of its rights back, giving future owners all of their options.

In a world where individuals are increasingly given more choices in nearly every facet of their lives, it makes sense to provide FFOs with more options to keep their land in forest use, especially when there is currently high interest in this goal but low participation in turning it into a reality. Offering FFOs whose main goal is to keep their land in forest use other options to choose from has the potential to attract new and different segments of FFOs, thereby expanding the amount of forest cover guaranteed protection. However, conservation organizations engaged in permanent land protection are often hesitant to adopt temporary easements because it makes more sense for them to use their limited and valuable time working with FFOs interested in permanently conserving their land. Developing ready-made, preapproved, temporary easements not tailored to the individual FFO, as with permanent CEs, may allow conservation organizations and landowners to adopt CEs more expediently. A fast-track option such as this may encourage more adoption of the tool by both FFOs and conservation organizations. It may also serve as a stop-gap measure for families finding themselves in a sudden, unexpected transition of ownership, allowing them to place a temporary easement on the land and giving them time to examine and resolve their longer term goals.

Conclusion

To date, most FFO programs have focused on encouraging FFOs to engage in actively managing their forest, with the assumption that active forest management alone will sustain the myriad of ecosystem benefits these forests provide. However, these programs have very low participation rates and do not specifically address forest conversion, a top threat identified by most states (National Association of State Foresters 2021). To address the critical issue of forest loss, we need the right tools. Put another way, a forester would not use a single tree selection system to regenerate shade intolerant species, so why would we use a program designed to encourage active forest management to maintain forest use? Like our proud silvicultural legacy of adaptation, our programs must also adapt and evolve to address current forest issues and goals of FFOs.

Offering a variety of strategies is likely to increase adoption by meeting the needs of different FFO segments. Although it is ideal that these strategies, such as permanent CEs, permanently conserve forests, the tools offered should include a diversity of options. We believe adding temporary easements to the toolbox can help slow forest loss for a guaranteed period of time and may even lead to adoption of permanent CEs. Further, a better understanding of which segments of the FFO population are most open to land protection strategies helps to more effectively pair tools with those with the greatest likelihood of adoption, maximizing limited time, energy, and resources.

This research suggests future areas of inquiry with respect to FFO preference for CEs. Although landowners demonstrated interest in both tools, our study only focuses on CE commitment length and compensation; it does not address the tax implications associated with these tools. Extending research into this area would be an important next step, as would expanding the number of CE scenarios received by each respondent in a conjoint-style survey. In addition, whereas this research designed financial compensation levels to reflect typical ranges for each easement type, future research could design these levels so that respondents could be pooled together into one model to improve the efficiency of the statistical model. The nature of the survey underlying this research was of a personal and difficult nature (estate planning), potentially influencing the overall response rate. Future surveys designed to better understand the influence of CE and landowner characteristics on adoption could focus more on a variety of tools to, perhaps, decrease the difficult nature of the topic of estate planning.

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