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The Role of Gender in Management Behaviors on Family Forest Lands in the United States

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In the United States, 58% of the 11 million family forest ownerships with at least 10 acres of forestland have at least one female owner. Within the single-owner population of landowners, women are the sole owners of and primary decisionmakers for 31% of ownerships. Despite the number of female family forest owners (FFOs), little research has focused on whether land-use and land-management attitudes and behaviors differ between female and male FFOs. This research uses data from the 2013 iteration of the US Department of Agriculture Forest Service's National Woodland Owner Survey. Random forest analysis and regression techniques were used to understand what factors differentiate single-owner female and male FFOs and whether gender is a significant predictor of select land-use and land-management behaviors. Statistically significant differences between male and female landowners were found; female FFOs are more likely to have inherited land, particularly from a spouse, whereas male respondents were more likely to manage for wildlife, have a commercial timber harvest, and have undertaken management activities in the past 5 years. There are considerable similarities between the attitudes and behaviors of female and male owners, but the differences are important in understanding constraints and barriers and should be considered in the design of forestry programs and outreach.

Keywords: female landowners, nonindustrial private forestland, National Woodland Owner Survey, land transfer, family woodland owners

More than 11 million owners make decisions about private forested land in the United States that will have an impact on more than 420 million acres, 58% of the nation's total forestland (Butler et al. 2016c). These decisions will affect the health of these forests and will shape the benefits they provide to the public in the form of timber resources, recreational access, and their ability to sequester carbon and filter air and water. Of these private owners, the majority are families, individuals, trusts, and estates, collectively referred to as family forest owners (FFOs), that own their forests for a wide variety of reasons including privacy, esthetics, and recreation (Butler et al. 2016c). Some of the most important decisions FFOs make that affect their lands include whether, when, and how to harvest timber and whether or not to sell, bequeath, or develop parts of their property, henceforth referred to as land-management and land-use decisions.

Owner attitudes and characteristics of FFOs in the United States, such as reasons for owning forested land and landowner age, have been found to be correlated with land-management decisions (Silver et al. 2015), but the impact of gender on these decisions has not been extensively explored. Across the United States, the percentage of FFOs with women as the primary decisionmaker increased from 11% in 2006 to 22% in 2013 (Butler et al. 2016c) although the distribution of land acquisition mode remained relatively stable between the two periods.[1] The majority (58%) of forest ownerships across the United States are owned by two people, most often a man and woman. Although specific data are not available, it is assumed that many of these are married couples. Many of the decisions made by male FFOs

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may involve direct participation or consultation with a female partner, spouse, or family member, although this assumption deserves further investigation.

Although women are the primary decisionmakers for more than 44 million acres of forestland in the United States (Butler et al. 2016b) and undoubtedly influence the land-management decisions on many more acres, little is known about whether or how their management attitudes, behaviors, and intentions may differ from those of their male counterparts. Household survey research in the United States has found that compared with men, women show more concern for the environment (Mohai 1992) and for the protection of forest resources. In a review of farmer demographics and environmental behavior, female farmers were found to be more environmentally oriented than male farmers, most likely because of social and cultural influences (Burton 2014).

Although gender is examined in some FFO studies in the United States, it is rarely the focus. The sparse literature reports that include gender and forest management reveal that although women are more likely to inherit land, they are less likely to participate in a wide variety of management activities from harvesting to enrollment in landowner assistance programs, such as cost-share or tax programs. Women, on average, are *less* likely to convert their forestland to nonforest uses (Poudyal et al. 2014), to support the application of herbicides or prescribed burning on nonindustrial private forestlands (Bliss et al. 1997), to express interest in participating in forest incentive programs (Sullivan et al. 2005), to have intentions to participate in forest carbon trading (Miller et al. 2012), and to enroll in conservation assistance programs (Kaetzel et al. 2009). In contrast, one qualitative study did find female owners to be more likely to have participated in cost-sharing programs than male owners (Schelhas et al. 2012). In terms of land characteristics, female forest owners were found to own smaller forested parcels (Effland et al. 1993). The differences between female and male owners in terms of ownership objectives are less clear. One study found ownership objectives to be similar (Andersson et al. 2010), while others showed differences such as women were more likely than men to state that passing their land on to their children is important (Schelhas et al. 2012), female forest owners were more likely than male owners to have amenity objectives (i.e., esthetics or biodiversity), and male owners were more likely to have consumptive objectives (i.e., timber or firewood) than female owners (Majumdar et al. 2009).

In the general population of the United States, women tend to outlive men, with a life expectancy of 81.2 years for women and 76.4 years for men (Arias 2015). Thus, it is assumed that the final key land-use decision, such as selling or bequeathing their land, is more likely to rest with female FFOs. The intergenerational land transfer literature supports this assumption. In a survey of participants in conservation-based estate planning workshops and outreach events, more female FFOs responded than male FFOs, suggesting that a higher proportion of women were actively seeking land transfer information and advice (Catanzaro et al. 2014). Majumdar et al. (2009) found that more women inherit their land than men, but it is unclear how much of that land was inherited from a deceased spouse versus a parent or other family member. Although previous research has shown that female FFOs are typically less active in land-management activities, it is unclear how land inheritance and/or landowner age at the time of inheritance may moderate this behavior. Women are increasingly likely to inherit farmland (Petrzelka and Marquart-Pyatt 2011), and although they are more likely to be landlords, leasing their farmland to others, they are also less likely to participate in management decisions with their tenants (Rogers and Vandeman 1993).

More studies directly focused on female forest owners have been conducted in the Nordic countries than in the United States. In Scandinavia, female FFOs are typically older than male FFOs (Lidestav and Ekstrom 2000) and harvest less often (Lidestav and Ekstrom 2000, Kuuluvainen et al. 2014). Scandinavian women have been found to exhibit more proenvironmental behavior in general than men (Tindall et al. 2003), although this has not been found to translate to the forestry context (Varghese and Reed 2011, Vainio and Paloniemi 2013); female owners are not more likely to sustainably manage their forests than their male counterparts. However, Finnish women are more likely to rely on forest management associations than men (Korhonen et al. 2012).

Given the relative paucity of focused research on female FFOs in the United States and their important role in final land-use and land-management decisions, we aim to better understand how female FFOs differ from male FFOs using data from the US Department of Agriculture (USDA) Forest Service's National Woodland Owner Survey (NWOS) (Butler et al. 2016b). In addition to collecting information on forest landowner attitudes and behaviors, the NWOS collects information on the demographics, including gender, of the primary decisionmaker and thus can provide valuable insight into female FFOs across the country. The objectives of our research were as follows: to explore significant differences between male and female FFOs in the United States; to use random forest methods to determine the most important factors that differentiate male and female FFOs, and to determine whether gender is a signifi-

Management and Policy Implications

Our results indicate that a large proportion of female family forest owners (FFOs) are inheritors of woodland and that there has been an increase in female FFOs in the United States since 2006. These findings suggest a need for programs and outreach that are designed specifically for "new" female woodland owners. We found that women prefer to get advice from family members rather than from professionals, and current programs and outreach techniques do not seem to be engaging many female FFOs. Outreach efforts and programs that are targeted to female FFOs and encourage them to contact professionals (foresters and wildlife biologists) for advice and financial assistance for stewardship planning may make it easier for these women to take a more active interest in their land. We suggest that even if female owners had previously been involved in the decisionmaking and management of their land, along with another family member, being thrust into the sole decisionmaker role as a consequence of inheritance could be daunting. Providing easy access to credible advice may be an important factor in assuring that they take active stewardship of their land. Policies, assistance, and mechanisms that enable and foster networks of female woodland owners would be extremely beneficial, allowing female woodland owners to meet other women in similar circumstances, share information and concerns, and become confident in their own decisionmaking through the support of other women and professionals.

Table 1. Description of select variable categories and variables used in the bivariate statistics and empirical model that describes attributes of male and female FFOs.

Variable	Description and code
Age*	Landowner age (continuous)
Education*	Landowner highest level of education: 1 = less than 12th grade; 2 = high school/GED; 3 = some college; 4 = associates degree; 5 = bachelor's degree; 6 = advanced degree
Income*	Landowner's household income (categorical)
Inherited their land*	Landowner inherited their wooded land: 1 = yes; 0 = no
Acquired land from spouse	Landowner got their wooded land from their spouse: 1 = yes; 0 = no
Ownership objectives	Five-point Likert scale, where 1 = not important to 5 = very important
Beauty	How important beauty is as a reason for owning woodland
Privacy	How important privacy is as a reason for owning woodland
Family	How important raising a family is as a reason for owning woodland
Hunting	How important hunting is as a reason for owning woodland
Timber	How important timber is as a reason for owning woodland
Child*	How important passing land on to children or other heirs is as a reason for owning woodland
Has cut wood for sale in the past 5 yr	Landowner has harvested timber from their wooded land for sale in the past 5 yr: 1 = yes; 0 = no.
Likelihood of cutting wood for sale in the next 5 yr*	Landowner is likely to cut or remove wood for sale in the next 5 yr: 1 = yes; 0 = no
Has managed for wildlife habitat in the past 5 yr	Landowner has managed for wildlife habitat in the past 5 yr: 1 = yes; 0 = no
Has participated in programs (cert, tax, ease, cost)*	Landowner has participated in any one of the following programs: green certification, enrollment in a tax program, conservation easement, cost-share: 1 = yes; 0 = no
Concerns about climate change*	Landowner concern for global climate change; five-point Likert scale with 1 = no concern and 5 = great concern
Likelihood of transferring land in the next 5 yr	Landowner is likely to sell or give away any of their wooded land in the next 5 yr; five-point Likert scale with 1 = extremely unlikely and 5 = extremely likely

* Variable used in logistic regressions.

cant predictor of key land-management and land-use decisions.

Methods

NWOS

The NWOS is conducted by the USDA Forest Service Forest Inventory and Analysis (FIA) program to increase the understanding of the attitudes, behaviors, and demographics of private forestland ownerships across the United States (Butler et al. 2016b). We used data from the 2011–2013 iteration of the survey to examine differences between male and female FFOs. A total of 8,576 FFOs with ≥10 ac responded to the survey with an overall cooperation rate of 51.6%. Telephone follow-up interviews were conducted with 12% of the mail survey nonrespondents to test for nonresponse bias. Because no clear nonresponse bias was found, no adjustments were made to the estimates (Butler et al. 2016c). For detailed information on the NWOS sampling procedures and implementation, please refer to Butler et al. (2016a) and Dickinson and Butler (2013).

We limited our analysis to respondents who indicated they were the sole owner of their forestland (n = 1,619, 19% of survey responses). We did this because this is the most straightforward initial approach for investigating gender differences between FFOs, and it resulted in 505 female FFOs and 1,114 male FFOs in the sample. In the future, we hope to explore more nuanced relationships between gender, owner, decisionmaker, and decision-influencer roles (i.e., multiple-owner ownerships where women are the primary decisionmakers).

Three empirical methods were used in this study to examine gender differences between FFOs. The bivariate and random forest methods were used to identify differences between genders. In these analyses, gender was the dependent variable. We then used gender in the logistic regression as an independent variable, among other variables describing demographic characteristics, concerns, and attitudes, to test whether gender was a significant predictor of select landowner behaviors or intentions.

Variables

We used a suite of unweighted variables from the NWOS to describe this population of interest (Table 1; see Supplemental Table S1 for a complete list of the variables used). Based on important variables from the literature related to gender, we examined landowner demographics (Effland et al. 1993, Lidestav 1998), landownership objectives (Andersson et al. 2010, Richardson et al. 2011), forest management behaviors (Lidestav and Ekstrom 2000, Umaerus et al. 2013), advice topics (i.e., timber management, wildlife, and conservation) (Mater et al. 2005, Richardson et al. 2011), concerns (i.e., development, transferring land to the next generation, insects, and disease) (Mater et al. 2005), and intentions for the future of their forested land (Redmore and Tynon 2011).

Bivariate Statistics

To examine relationships between gender and landowner attitudes and behaviors, we compared female and male FFOs across our suite of variables using bivariate statistics. We examined relationships between gender and the categorical variables using χ^2 tests for independence in R (R Core Team 2014). To examine relationships between gender and continuous variables (size of forest holdings and age), we used point-polyserial correlations using the polycor package in R (Fox 2010). We used a P value threshold of 0.05 to identify significant differences between genders for each variable.

Random Forest Analysis

Random forest analysis (Hothorn et al. 2009) was used to better understand which characteristics, attitudes, and behaviors are important in distinguishing between male and female FFOs. The random forest analysis combines a series of conditional inference trees that are sampled independently and without replace-

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Table 2. Bivariate analysis of gender and independent categorical variables.

Variable	Level	Male	Female	Significance ($P < 0.05$)
Age	65 yr and older	44 (488)	60 (292)	*
Size of forest holdings	100 ac or more	47 (520)	39 (197)	*
Education	College degree or higher	51 (570)	56 (280)	*
Income	>$50,000	38 (423)	31 (155)	
Purchased their land	Yes	79 (883)	62 (313)	*
Inherited their land	Yes	31 (349)	44 (221)	*
Acquired land from spouse	Yes	0 (3)	13 (62)	*
Objective				
Beauty	Very important or important	78 (843)	76 (373)	
Nature	Very important or important	69 (744)	72 (343)	
Water	Very important or important	64 (689)	66 (310)	
Wildlife	Very important or important	77 (811)	76 (356)	
Privacy	Very important or important	66 (704)	56 (265)	*
Family	Very important or important	36 (383)	31 (146)	
Hunting	Very important or important	54 (581)	33 (161)	*
Recreation	Very important or important	51 (544)	35 (166)	*
Timber	Very important or important	38 (412)	33 (158)	*
Investment	Very important or important	53 (581)	52 (251)	
Child	Very important or important	64 (695)	69 (336)	
Has cut wood for sale in the past 5 yr	Yes	31 (335)	25 (125)	*
Has cut wood for personal use in the past 5 yr	Yes	43 (475)	24 (120)	*
Likelihood of cutting wood for sale in the next 5 yr	Extremely likely or likely	32 (339)	22 (106)	*
Likelihood of cutting wood for personal use in the next 5 yr	Extremely likely or likely	46 (483)	26 (123)	*
Has managed for wildlife habitat in the past 5 yr	Yes	37 (406)	21 (104)	*
Have done no management in the past 5 yr	Yes	17 (191)	29 (141)	*
Has a management plan	Yes	29 (316)	25 (125)	
Enrolled in a tax program	Yes	27 (296)	24 (116)	
Has a conservation easement	Yes	6 (62)	3 (15)	*
Has recreated on own land in the past 5 yr	Yes	70 (754)	51 (249)	*
Has participated in programs (cert, tax, ease, cost)	Yes	41 (455)	34 (170)	*
Has received advice in the past 5 yr	Yes	35 (388)	30 (148)	*
Received advice from family	Yes	21 (82)	32 (46)	*
Likelihood of transferring land in the next 5 yr	Extremely likely or likely	19 (215)	22 (110)	

Percentage of each gender that falls into each variable category and statistical differences between each gender for each variable ($P < 0.05$) based on χ^2 tests. Sample sizes are in parentheses.
* $P < 0.05$.

ment to determine the most important variables identifying male and female landowners. For each tree, the variable at each node is chosen at random to determine the relationship between dependent and independent variables. A "node" refers to a split in the data set at a particular variable, where the distribution of gender is significantly different on each side of the split. From the series of conditional inference trees, the most important variables in distinguishing male and female landowners are identified (Hothorn et al. 2006). The full set of independent variables was used in the random forest analysis (see Supplemental Table S1[S]). We used the PARTY package in R for the random forest analysis (Hothorn et al. 2009).

Logistic Regressions

We used a subset of the variables described above, as well as gender, in a series of logistic regressions examining forest management and forest use as the dependent variables (see Table 1 for a list of the independent variables used in the analysis). As with all interpretation of bivariate statistics and subsequent regression analyses, there is potential for multicollinearity. We checked for multicollinearity in our independent variables and trimmed our predictors when multicollinearity was discovered. We used a variable inflation factor (VIF) and found that the VIFs for our models were 0.8 or less, suggesting no multicollinearity (Allison 1999). The dependent variables examined include having cut or removed trees for sale in the past 5 years, managing for wildlife habitat in the past 5 years, and planning to transfer land in the next 5 years. We examined model accuracy using confusion matrices, which estimate the validity of the model by comparing the average predicted values with the estimation sample. The confusion matrix analysis tells us how accurate the model is in predicting results by determining the number of true positives, true negatives, false positives, and false negatives, with the correctly predicted values occurring in the diagonal of the table (Ting 2011).

Results

Bivariate Statistics

We examined the bivariate relationships between gender and the variables used as input into the logistic regression and random forest analyses. Here we present select statistically significant bivariate statistics (Table 2), as well as the complete set of variables (Supplemental Table S2). Female FFOs are more likely to have inherited their land, particularly from a spouse or other family members, whereas male FFOs are significantly more likely than female FFOs to have purchased their forestland. Women are less likely than men to own their land for privacy, hunting, recreation, or timber. Women are also less likely than men to participate in forest management activities such as harvesting timber for sale and for personal use in the past 5 years; managing for wildlife; participating in landowner assistance programs, including cost-share, easements, green certification, and tax programs; recreating on their own land in the past 5

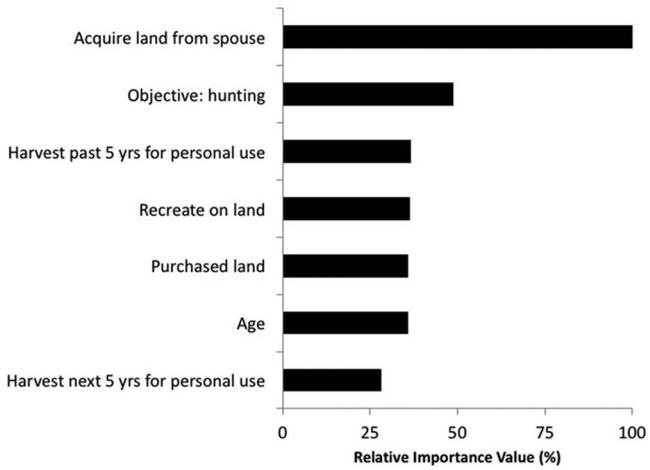

Figure 1. Relative importance of variables from random forest model. The values represent the importance values divided by the maximum importance value multiplied by 100.

years; and receiving advice about their woodland (Table 2). Female FFOs are more likely to have undertaken no management activities in the past 5 years than male FFOs (Table 2). In addition, when they do receive advice about land management, female FFOs are more likely than male owners to receive that advice from family members (Table 2). Finally, women are more likely than men to believe that climate change is a concern for their woodland.

Random Forest

The random forest analysis identified 7 variables that were at least 25% of the maximum importance value. These are the most important variables and the best at discerning between genders of landowners. The most important variable (100% relative importance value) was whether the landowner had acquired his or her forested land from a spouse (Figure 1). Other important variables include owning land for hunting, having cut or removed trees for personal use in the past 5 years, recreating on the land in the past 5 years, having purchased land, age, and cutting or removing trees for personal use in the next 5 years (Figure 1).

Logistic Regressions

After dropping records with missing data for one or more independent variables, our sample size for the models is 794 (49%). Across the three models, gender was only a significant predictor for having managed for wildlife habitat in the past 5 years, where men were more likely to have managed for wildlife in the past 5 years then women. Gender is not a significant predictor in the two other models (Table 3).

Based on the confusion matrices, the model describing landowners having harvested timber for sale in the past 5 years has a prediction accuracy of 80%. The model describing landowners having managed for wildlife habitat in the past 5 years has a prediction accuracy of 74%, and the model describing the likelihood of landowners selling or giving away land in the next 5 years has a prediction accuracy of 81%.

Discussion

When gender was examined for differences in land-management attitudes and behaviors, we found several distinctions between male and female FFOs. Our findings suggest that although women do indicate more concern for the effects of climate change on their woodland, they are otherwise not more likely than men to be concerned about other environmental issues affecting their woodland, such as invasive plants, water pollution, or wind or ice storms. This finding at least partially supports the results from Ozanne et al. (1999), who found that women exhibit greater overall environmental concern than men. Our findings support the conclusions of Lidestav and Ekstrom (2000) that women are less likely to harvest timber commercially and for personal use, both in terms of past actions and future intentions. We found that women were less likely to have recreation, hunting, timber, or privacy as ownership objectives—differences that were also found between male and female FFOs in Alabama (Schelhas et al. 2012). Female FFOs were more likely to have inherited their land whereas male owners were more likely to have purchased their land, which is also consistent with previous research in a forestry and agricultural context (Effland et al. 1993, Petrzelka and Marquart-Pyatt 2011, Schelhas et al. 2012).

However, gender was only a significant predictor in the regression model examining decisions to undertake activities to improve wildlife habitat, indicating that men are more likely than women to manage their forestland to actively promote wildlife. Gender was included in logistic regression models to predict timber harvesting, in which it was previously found to significantly predict the likelihood of timber harvesting (Lidestav and Ekstrom 2000). However, we did not find gender to be a statistically significant predictor of past commercial harvesting behavior. It is likely that although there were significant differences between male and female FFO timber harvesting behaviors in our bivariate comparison, other variables such as size of forest holding were more important predictors of harvesting behavior than gender.

Land Transfer

Our findings suggest that the means by which one's forestland is acquired may be related to a landowner's gender. Specifically, our bivariate analysis indicates that male FFOs were more likely than females FFOs to have purchased their lands, whereas female FFOs were more likely than male FFOs to have inherited their lands, particularly from a spouse. Thus, male owners more often made a purposeful decision to become a forestland owner, whereas female owners were more likely to become default owners as a result of events such as the death of a spouse or parent. The random forest results also support this, with the variable "acquiring land from a spouse" being the most discerning variable between male and female FFOs.

The bivariate analysis also found that male FFOs were more likely than female FFOs to undertake forest management activities such as harvesting and managing for wildlife. Women were more likely to inherit their land but less likely to undertake management on their land. Although our analyses cannot confirm causality, this finding at first glance seems to contradict the results of Majumdar et al. (2009), who found that NWOS respondents who inherited their forestland were more active forest managers. We argue, however, that the age or life stage at which one inherits his or her forestland may also be an important part of the equation. Although Majumdar et al. (2009) found that inheritors were more likely than

Table 3. Logistic regression results.

Explanatory variable	Cut or removed trees in the past 5 yr for sale		Manage for wildlife in the past 5 yr		Plans to transfer land in the next 5 yr	
	Coefficient (SE)	Odds ratio	Coefficient (SE)	Odds ratio	Coefficient (SE)	Odds ratio
Intercept	−2.10 (0.82)*		−3.27 (0.79)†		−3.93 (0.82)†	
Gender: male	0.21 (0.25)	1.24	0.67 (0.23)‡	0.92‡	−0.08 (0.23)	1.95
Size of forest holdings	0.21 (0.08)*	1.23*	0.36 (0.08)†	1.17†	0.16 (0.08)*	1.43*
Age	−0.01 (0.01)	0.99	−0.02 (0.01)*	1.04*	0.04 (0.01)†	0.98†
Education	−0.03 (0.22)	0.97	−0.01 (0.20)	1.05	0.05 (0.22)	0.99
Home	0.29 (0.22)	1.34	−0.32 (0.19)	0.93	−0.08 (0.21)	0.73
Farm	−0.02 (0.21)	1.13	−0.21 (0.20)	0.53	0.05 (0.21)	1.10
Income						
<50,000	0.14 (0.31)	1.15	0.05 (0.28)	0.60	−0.52 (0.30)	1.05
50,000	0.01 (0.31)	0.98	0.06 (0.27)	1.05	−0.43 (0.29)	0.81
≥200,000	0.12 (0.36)	1.01	0.10 (0.32)	0.65	−0.64 (0.34)	1.06
Advice	0.43 (0.23)	1.54	0.78 (0.21)†	1.35†	0.30 (0.24)	2.17
Management plan	0.59 (0.24)*	1.80*	0.37 (0.22)	0.69	−0.37 (0.25)	1.45
Program enrollment	−0.13 (0.23)	0.88	−0.11 (0.21)	0.84	−0.18 (0.23)	0.90
No management activities	−17.64 (500.79)	0.00	−17.82 (493.91)	0.83	−0.19 (0.28)	0.00
Future cut for sale	1.44 (0.22)†	4.24†	−0.03 (0.22)	1.92	0.65 (0.24)‡	0.97‡
Future cut for personal use	−0.30 (0.22)	0.74	0.24 (0.20)	0.90	−0.10 (0.22)	1.27
Concern over development	−0.48 (0.22)*	0.62*	0.32 (0.20)	1.26	0.23 (0.22)	1.38
Concern over climate change	0.36 (0.22)	1.44	0.06 (0.20)	0.79	−0.23 (0.22)	1.06
Concern over heirs	−0.14 (0.28)	0.87	0.09 (0.25)	0.69	−0.38 (0.25)	1.09
Concern over insects/disease	0.13 (0.24)	1.13	−0.15 (0.22)	0.96	−0.04 (0.23)	0.86
Objectives						
Amenity	−0.46 (0.36)	0.63	1.41 (0.41)†	1.26†	0.23 (0.33)	4.10
Financial	1.08 (0.21)†	2.95†	0.22 (0.21)	0.78	−0.25 (0.24)	1.25
Passing land to heirs	0.06 (0.24)	1.06	0.05 (0.22)	0.64	−0.44 (0.23)	1.06
Inherited land	0.33 (0.22)	1.39	−0.28 (0.20)	0.63	−0.46 (0.22)*	0.76*
Help with woodland management	−0.27 (0.24)	0.76	0.26 (0.21)	0.66	−0.42 (0.24)	1.30
Help with transferring land	−0.07 (0.24)	0.93	0.26 (0.22)	1.33	0.28 (0.25)	1.30
Help with easements	0.42 (0.26)	1.52	−0.19 (0.23)	1.81	0.59 (0.25)*	0.82*

The values are coefficients with SE in parentheses. The reference for gender is "Female." The reference level for education is "Less than college." The reference level for income is "$51,000–$199,000."
* $P < 0.05$.
† $P < 0.001$.
‡ $P < 0.01$.

noninheritors to have ownership goals and intentions that were commensurate with the pursuit of active forest management, their analysis did not address the idea that age, life stage, or circumstances under which one inherits his or her forestland may moderate the influence of inheritance. A widow/widower who acquires forestland later in life through inheritance may have little interest and/or physical and financial ability to actively manage or use his or her forestland. This scenario contrasts with a situation in which children may acquire their forestland through inheritance from parents at a different life stage and/or younger age. Majumdar et al. (2009) argue that those who inherit forestland may be more focused on timber production and active forest management than noninheritors due, in part, to an intergenerational transfer of human capital and knowledge related to forestland management and stewardship. We argue that may be true so long as the inheritor is at a life stage to make forest management a viable pursuit. Given that our random forest analysis found acquiring land from a spouse specifically was important in differentiating female and male FFOs, it stands to reason that a proportion of such owners would be older owners who acquired their land as a result of the death of a spouse and perhaps at an age or a life stage at which interest in forest management had waned.

The implications are that women in the family should be involved in decisions about forest management as early as possible. If there were, for example, a decline in forest management activities when female owners receive forestland as a result of bequeathment from spouses, this underscores the need to work with landowners to develop strategies in earlier ages and life stages for how to deal with their forested lands in later life. Our findings may also signal an unmet or growing need to develop assistance strategies for women who may suddenly find themselves as owners, perhaps sole owners, of forestland, but without much experience in, expertise in, or knowledge of how to be a forestland owner or primary decisionmaker.

One of our study suppositions is that because the average life expectancy of women is higher than that of men (Arias 2015), female FFOs may be more often in the position to be making decisions about final disposition of their forest holdings than men. We examined this by testing whether gender was influential in the intention of FFOs to transfer their land in the next 5 years and found that gender was not a significant factor. Moreover, we found that the majority of respondents, male and female, did not intend to make this imminent land transfer. This may be a topic that transcends gender or other FFO demographic attributes but does not remove the need for education, training, outreach, or planning assistance for landowners.

Wildlife and Recreation

We found that male FFOs have a greater interest in wildlife and hunting pursuits on their lands. Our logistic regression results indicate that male FFOs are more likely than female FFOs to have undertaken management activities to improve wildlife. Traditional wildlife habitat improvement activities, such as thinning, creating canopy

openings, creating early successional habitat, planting deer food plots, and silvicultural treatments favoring oak and beech species that produce food for deer, bear, and other wildlife may be less appealing to women than to men. Moreover, male FFOs were found to be more likely to own their land for hunting or recreation and more likely to have recreated on their lands in the past 5 years than females FFOs. However, both male and female FFOs indicated that an important reason they own their forestland is for the benefit of wildlife.

Taken together, these findings suggest that there is a segment of male FFOs who are likely to undertake wildlife habitat improvement projects in an effort to improve hunting conditions on their lands. If female owners do not participate in hunting activities to the same degree as male owners, it would stand to reason that they would be less likely to undertake management or stewardship activities on their land if they think the only outcome is improved hunting opportunities. Yet, female FFOs indicate the great importance of wildlife as an ownership reason, indicating they may be more interested in passive wildlife recreation pursuits such as bird-watching or simply knowing they are providing a refuge for species. Implications of this finding are that messaging and incentive programs targeted to female owners may be more effective if they emphasize the connections between activities that support healthy wildlife habitat and general biodiversity rather than improved hunting potential.

Forest Management

In addition to managing forestland for wildlife, hunting, and recreation, we also examined the differences between gender and forest management. We found that female FFOs are more likely to have engaged in no management in the past 5 years, whereas male FFOs are participating in more programs such as cost-share, conservation easements, and tax incentive programs, although overall participation in these traditional programs is low for both men and women. These results do not indicate whether female FFOs decide not to actively manage their forest and participate in programs because they do not perceive a benefit, whether they are simply not aware of these options, or whether they lack the interest, time, and opportunity to participate. Moreover, female landowners may be undertaking or interested in undertaking different types of forest management and stewardship activities than have been traditionally explored in the literature. The study was limited by the questions asked in the NWOS, because the survey does not ask why an FFO choses to participate (or not); null results may not mean that management activities are similar between male and female FFOs but do seem to indicate that female FFOs are less likely to manage their land.

Other traditionally underserved populations of landowners, such as African-American FFOs, have also had lower forest management participation rates, and successful programs have been implemented to try to increase access to information about sustainable forest management practices to minority landowners (Schelhas et al. 2017). Similar programs can be geared to female FFOs to increase participation in forest management practices, if that is a goal of land managers. Kilgore et al. (2015) found that landowners receiving assistance (advice, management plan, and/or cost-share) were more likely to participate in some degree of forest management. Although this result was not gender specific, reaching out to female FFOs to offer assistance may increase their likelihood of participating in forest management.

Conclusions

General Conclusions

Our results show that female FFOs own their forestland for a diversity of reasons. Some of their ownership reasons are very similar to those for male FFOs (e.g., beauty, nature, water, and wildlife), whereas others are less common than those of their male counterparts (e.g., hunting, recreation, and timber). Our research, as well as previous research, has found that women tend to be less active managers of their forestland in general (Bliss et al. 1997, Ripatti 1999). Extrapolating, then, this finding suggests that women may be less likely to undertake any type of management or stewardship activity, even if it would serve to support the achievement or protection of the ownership goals they hold for their land. It is also possible that female landowners are interested in management activities that were not offered as options in the NWOS. Female FFOs clearly value the amenity features of their forested land such as beauty and nature, yet we do not know whether they perceive what could or should be done to help promote these values. It is also unclear whether they are participating in these activities. The NWOS, as well as previous studies on forestry and gender, have tended to focus on a small subset of forest management behaviors and activities, such as harvesting. Additional research is needed to explore a broader range of stewardship and management activities on family forestlands and determine whether gender plays a role. Moreover, we need to advance in our understanding of causality: why female FFOs are doing (or not doing) different activities on their lands.

In general, we did not find gender to be a statistically significant predictor of select land-management behaviors and intentions, thus not fulfilling our hypothesis that gender would predict timber harvesting behavior. This finding could signal that gender is not a reliable predictor of forest management activities, conservation intentions, or land transfer intentions or that it is moderated by other demographic factors such as age, finances, health, and/or family circumstances.

Natural resource agencies and organizations could develop specific outreach programs that are targeted to female woodland owners. Research in social network theory has underscored the influential and empowering roles that robust social networks can play in supporting active land management (Knoot and Rickenbach 2011, Ruseva et al. 2014).

The emphasis should be on providing information and advice in a comfortable environment (e.g., with other women and at convenient times of day) (Huff 2017) about activities such as wildlife habitat enhancement and passive recreation along with planning for the future of their woodland and how different land management activities can help them meet their goals as a forest owner. There is a need to consider a broader suite of forest management and stewardship activities when one is working with female land owners and in developing assistance, outreach, and education programs targeted to female owners. Our results indicate that female owners undertake fewer of the "traditional" forest management activities. It is possible that the forestry community has not yet found the type of activities that strongly resonate with female owners. Another possibility is that the forestry community needs to focus more on helping female owners understand how management activities can help support their landownership goals.

Partnering with female woodland owner associations and other such networks can be valuable to natural resource agencies and organizations for attracting women to educational and assistance programs. There are active female woodland organizations in seven states (Maine, Pennsylvania, South Carolina, Wisconsin, Minnesota, and Oregon), and the Women Owning Woodlands (WOW) website aims to provide regional and local networks with programs and information, advertise events, and share information (Huff 2017). Huff interviewed leaders of the WOW networks in active states and found that, although women are interested in conservation, traditional woodland owner programs often do not meet their needs. Other women's groups, including religious and civic associations, may also be effective ways to reach female woodland owners with messages about land stewardship.

Limitations

Although it is useful to look at our results within the broader scope of family forest literature related to gender, it is important to understand the limitations of our study. We chose to analyze men and women listed as the sole owner in the NWOS. As a result, we did not include female FFOs who were listed as a second woodland owner or women listed as the primary decisionmaker, but with a second person also listed as an owner. Parsing the data in this manner allows for a comparison of similar decisionmaking contexts, rather than introducing error caused by the more complex nature of joint ownership and decisionmaking. However, this means our results can only be applied through the lens of sole-owner ownerships. We also acknowledge that, although ownerships may legally be held by individuals, management decisions often include other, nonowner family members, and quantifying those influences is beyond the scope of this article. Whereas the FFOs in our sample indicated that they make the management decisions for their wooded land, others, such as spouses, children, parents, other family members, business partners, land managers, foresters, and others may also have been involved in land-use and land-management decisions.

A clearer understanding of how landowners interpret "wildlife" is necessary to fully understand the nuances between the value a landowner places on game species for hunting versus nongame wildlife species. Distinguishing this nuance is important in understanding landowners' objectives for owning land as well as motivations for undertaking activities that may support their wildlife objectives, which is critical in the design of policies and programs that seek to influence landowner behaviors. Although understanding those nuances related to wildlife is beyond the scope of this article, we suggest the value of this as a topic of future research.

Future Research

Despite these limitations, this was the first national, comprehensive, quantitative study of female FFOs in the United States and the beginning of a longitudinal study on female FFOs that we will continue through future iterations of the NWOS. More research is needed on many topics related to female woodland ownership, however. Research is also needed to examine the role of gender in decisionmaking over a broader set of forest management and stewardship activities, as well as the roles that age, life circumstances, and family dynamics play in conjunction with gender. Further research is also needed to better understand the context of forestland inheritance and the barriers or constraints that this landowner segment may face, as well as the implications of land transfer on forest management. We believe mixed-method analysis, including quantitative, qualitative, and ethnographic research, would greatly improve our understanding of the future research topics outlined above. Increasing our understanding of female FFOs' attitudes, values, concerns, and decisionmaking processes will assist the forestry community in crafting education, information, assistance, and tools that will help this important segment of landowners better engage with their land.

Endnote

1. It is important to note that these statistics are just for the self-identified primary decisionmakers in the 2011–2013 National Woodland Owner Survey (Butler et al. 2016) administered by the USDA Forest Service.

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