



# Where farm and forest meet: Comparing National Woodland Owner Survey respondents with and without farmland



Emily S. Huff<sup>a,\*</sup>, Kristin Floress<sup>b</sup>, Stephanie A. Snyder<sup>c</sup>, Zhao Ma<sup>d</sup>, Sarah Butler<sup>e</sup>

<sup>a</sup> Department of Forestry, Michigan State University, 480 Wilson Road, East Lansing, MI 48823, USA

<sup>b</sup> USDA Forest Service, Northern Research Station, 1033 University Place, Evanston, IL 60201, USA

<sup>c</sup> USDA Forest Service, Northern Research Station, 1992 Folwell Avenue, St. Paul, MN 55108, USA

<sup>d</sup> Department of Forestry and Natural Resources, Purdue University, USA

<sup>e</sup> Family Forest Research Center, Department of Environmental Conservation, University of Massachusetts Amherst, USA

## ARTICLE INFO

### Keywords:

Agricultural extension  
Farmer  
Family forest owner  
Forest management  
Land-use decision making  
NIPP

## ABSTRACT

Much is known about the characteristics, attitudes, and behaviors of U.S. family forest owners and agricultural landowners independently. However, little is known about those who own both woodland and farmland. To address this knowledge gap, we analyze National Woodland Owner Survey data to better understand similarities and differences between family forest owners who also own farmland, and those who do not. We found that, in general, farmland and woodland owners (FWOs) are very similar to woodland-only family forest landowners (FFOs) in terms of ownership objectives, attitudes and forest management activities. However, FWOs are less likely to have under 40 acres (16.2 ha) of forestland, more likely to live on their wooded land, and more likely to own their woodlands as a place to raise their family than woodland-only FFOs. While there is potential for dual forms of outreach, technical and financial assistance, and peer networks as both an agricultural landowner and a forest landowner, forest management behaviors of FWOs do not significantly differ from that of woodland-only FFOs. Professionals from agricultural or forestry extension, soil and water conservation organizations, and others responsible for delivering both agricultural and forestry programs and policy tools could explore opportunities to connect FWOs to both types of landowner programs that can assist them with forest management.

## 1. Introduction

The United States has a vast land base (914.5 million ha), and half of this land is used for agricultural purposes (ERS, 2011). Of the 2.1 million farms in the country, nearly 40% have woodlands of some type, accounting for 31 million forested ha (NASS, 2012) and roughly 18% of all privately-owned woodlands in the U.S. (Nickerson et al., 2011). Because of the significant ecological, economic and social benefits farms and privately-owned woods provide, a great deal of focus has been placed on understanding trends related to both. For instance, the United States Department of Agriculture (USDA) oversees implementation of both the Census of Agriculture and the Forest Inventory and Analysis Program (FIA) National Woodland Owner Survey (NWOS; Butler et al., 2016a), which provides information about trends in uses, values, and ownerships associated with these lands. While research has been conducted to characterize farmers (who may or may not own their land) and woodland owners independently, little is known about the overlapping population of farmland and woodland owners (FWOs) in

either the U.S. or abroad (e.g., Sandberg and Jakobsson, 2018).

In an analysis of open-ended questions on the NWOS, Bengston et al. (2011) concluded that a large share of FWOs view their woodlands as an incidental part of their agricultural land ownership with “little value in its own right, and thus little interest in managing it” (pg 349). Thus, being an FWO could present a barrier to forest management. However, by virtue of being a dual land-type owner, FWOs may have access to additional assistance programs, educational offerings, and professional and peer networks than woodland-only family forest owners (FFOs) which could enhance their capacity and opportunity for stewardship of their woodlands. The USDA, through agencies such as the Forest Service, Farm Service Agency and the Natural Resources Conservation Service, sponsors and provides a host of conservation programs, technical assistance, and outreach efforts aimed individually at farmer or woodland owners. For example, the Forest Stewardship Program (FSP) and the Forest Land Enhancement Program (FLEP) are the primary federal government technical assistance, education, and cost share programs for private woodland owners, designed to encourage long-

\* Corresponding author.

E-mail addresses: [ehuff@msu.edu](mailto:ehuff@msu.edu) (E.S. Huff), [kfloress@fs.fed.us](mailto:kfloress@fs.fed.us) (K. Floress), [stephaniesnyder@fs.fed.us](mailto:stephaniesnyder@fs.fed.us) (S.A. Snyder), [sbutler@eco.umass.edu](mailto:sbutler@eco.umass.edu) (S. Butler).

term stewardship of forest lands by assisting landowners in more actively managing their woodlands. Lands eligible for these programs must either have existing tree cover or be suitable for growing trees. Alternatively, the Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to undertake conservation practices that improve environmental conditions and natural resources. Eligible lands include cropland, rangeland, pastureland, and nonindustrial private forest lands, and eligible applicants must be engaged in livestock, agricultural or forest production activities (NRCS, 2017). Thus, with a greater availability of potential programmatic assistance and outreach offerings, we sought to explore similarities and differences between FWOs and woodland-only FFOs that might inform improved and efficient outreach and programming for dual land-type owners. Specifically, we sought to explore the differences between FWOs and woodland-only FFOs regarding their attitudes, values, and behaviors for their woodlands that might suggest the need and opportunity for different types of outreach, information, messaging and assistance for these two segments of FFOs. As well, we wanted to examine whether FWOs were less likely to undertake a variety of management activities on their wooded land than woodland-only FFOs; e.g., whether dual land-type ownership represented a deterrent to forest management.

### 1.1. Objectives

To date, few studies have examined the intersection of farmland and woodland owners by comparing and contrasting the characteristics and behaviors of FWOs and woodland-only FFOs in a comprehensive way. Anecdotally, there is evidence to speculate that the types and scale of land management and conservation activities that may be economically feasible and attractive to farmers, may not be tenable to woodland owners or in line with their ownership goals. A better understanding of the similarities and differences between FWOs and woodland-only FFOs in terms of land characteristics, owner demographics, and attitudes and values could contribute to developing tailored programs targeting FWOs and to innovating beyond the policies and programs used to assist primarily farmers rather than dual land-type holders. In addition, many current federal and state landowner assistance programs focus on either woodland owners or farmers and are often delivered by different personnel. More research is needed to assess if such a siloed approach is effective for assisting those who are at the intersection, which is a significant proportion of woodland owners in many states (authors in review; Clarke et al., 2017; Steele et al., 2006). To address these issues, we undertook a study utilizing a national dataset, the National Woodland Owner Survey (NWOS), which contains information on family forest lands and their owners (Butler et al., 2016a). The NWOS is a long-term, ongoing survey of private forest landowners in the United States administered by the USDA Forest Service. We utilized the NWOS data to:

1. Describe the population of FWOs.
2. Identify similarities and differences between woodland owners who do and do not own farmland with regard to their demographic and property characteristics, motivations for owning woodlands, management behaviors, government assistance program participation, and needs.
3. Discuss the associated opportunities and challenges for working with FWOs and FFOs

### 1.2. Literature review

In some FFO studies, woodland owners are either asked if their woodland is part of their farm or if they are a farmer (e.g., Butler et al., 2016a,b; Gan et al., 2005; Ma et al., 2012; Steele et al., 2006), though there has been debate about whether such a distinction is meaningful. Urquhart and Courtney (2011) argued, for example, that “by differentiating forest owners as to their agricultural practices or farming

background, the classification is limited to ‘farmers’ and ‘the rest.’” Thus, they argue such a distinction has limited utility for understanding forest owner land management decision-making processes because it defines an owner by what they are (i.e., *not* a farmer) rather than nuanced characteristics of what they are or do. This is further complicated by the fact that agricultural landowners are not always the operators or managers of the land, a trend that is increasing (NASS, 2012). We want to carefully distinguish between operating (farmer and non-owner) and non-operating (agricultural landowner) individuals. The NWOS only collects responses from landowners, which is most closely aligned with non-operating agricultural owners for comparative purposes in the literature. There is evidence, though, that the distinction between woodland owners and farmers who own woodlands has meaning. Specifically, this distinction has been used to aid the segmentation of woodland owners into different groups (e.g., Erickson et al., 2002; Kendra and Hull, 2005) and to relate landownership reasons to forest management decisions (e.g., Moser et al., 2009). Silver et al. (2015) analyzed common clusters from the numerous private woodland owner typologies that have been developed (i.e., Production, Protection, Consumption/Amenity, Recreationists, Passive, Multi-objective), and found that farmers fall into three of the six clusters identified. For instance, “production-oriented woodland owners” are partially comprised of farmers who actively manage their woodlands, while “passive woodland owners” included “more agriculturally inclined” producers who are less likely to undertake forest management actions (Silver et al., 2015). Thus, woodland owner segmentation studies have identified farmers as belonging to several FFO cluster types with varying characteristics, motivations, and actions.

Another example of such distinctions contributing to the understanding of land management decisions is a study conducted by Kendra and Hull (2005). They conducted a cluster analysis of new forest owners, and identified farmers as one of the unique woodland owner segments. Their analysis found the farmer segment to be willing and motivated to manage their woodlands, but lacking in the means, knowledge and time to do so. A similar result was described in Erickson et al. (2002), in which woodland-only FFOs in Michigan were more likely to take a “hands-off” and “no-management” approach to their wooded property than FWOs. In addition, Erickson et al. (2002) showed that although both FWOs and woodland-only FFOs cared about protecting the environment as a reason for retaining their woodlands, non-farmer woodland owners were more motivated by the aesthetic value of their property, and FWOs were more constrained by economic and natural factors in their ability to retain woodlands.

Quantitative analyses of survey data collected from FFOs have investigated a range of topics (see Table 1 for a summary of this literature), such as information-seeking behaviors (Kaetzel et al. 2010), decisions to limit public access to their land (Jagnow et al., 2006; Snyder et al., 2008), and timber harvesting decisions (Beach et al., 2005; Gan and Kebede, 2005; Hendee and Flint, 2013; Joshi and Arano, 2009). The impact of farmer/agricultural land ownership on respondents’ woodland management behaviors is not consistent across studies. Hendee and Flint (2013) did not find significant relationships between whether FFOs had ever farmed and whether they had a management plan, conducted a harvest, consulted a forester, or had undertaken timber stand improvement actions. Similarly, status as an agricultural producer or farmland owner is not related to enrolling in FFO conservation incentive programs (Fortney et al., 2011), participating in FFO cost-share programs (Ma et al., 2012), or having a conservation easement (Ma et al., 2012). Yet, others have found that FWOs were less likely to: post their woodlands against public recreational access (Jagnow et al., 2006; Snyder and Butler, 2012), maintain trails across their woodlands (Erickson et al., 2002), plant new trees (Erickson et al., 2002), conduct a harvest (Gan and Kebede, 2005), or participate in a forest certification program (Ma et al., 2012), but more likely to prevent their cleared land from reverting to woods (Erickson et al., 2002) than non-farmer FFOs. In a meta-analysis of studies dealing with FFO

**Table 1**

Major findings in the U.S., based on previous empirical studies of factors effecting farm and woodland owner (FWO) and woodland-only owner (FFO) intentions and behaviors.

Category and variable	Effect on or affected by FWOs and FFOs	Description of expected similarities or differences	Literature cited
<i>Property characteristics</i>			
Property size	Similar (+)	Positively related to forest management and to the adoption of agricultural conservation practices	Arano et al., 2004; Beach et al., 2005; Dickinson et al., 2012; Hull et al., 2004; Kaetzel et al., 2009; Kilgore et al., 2008; Miller et al., 2012; Prokopy et al., 2008; Baumgart-Getz et al., 2012; Ferranto et al., 2011
<i>Demographics</i>			
Age	Similar (-)	Negatively related to land management actions, although it has been occasionally found to have no relationship or a positive relationship with actions	Beach et al., 2005; Fischer, 2011; Fortney et al., 2011; Joshi and Arano, 2009; Ma et al., 2012; Snyder and Butler, 2012; Baumgart-Getz et al., 2012; Ma and Coppock, 2012; Prokopy et al., 2008
Education	Different	Varying effect on different management actions in the forestry literature, but generally positive effect when significant in the agricultural literature	Gan et al., 2014 (positive effect on wildfire mitigation practices); Beach et al., 2005 (positive effect on harvesting); Snyder and Butler, 2012 (negative effect on public access); Prokopy et al., 2008
<i>Reasons for retaining woodlands</i>			
Protecting the environment	Similar	Equally important for both FWOs and FFOs	Erickson et al., 2002
Aesthetics for retaining their woodlots	Different	More important for FFOs than FWOs	Erickson et al., 2002
Economic constraints	Different	More important for FWOs than FFOs	Erickson et al., 2002
Natural area constraints	Different	More important for FWOs than FFOs	Erickson et al., 2002
<i>Land management (general)</i>			
Land management orientation	Different	“Production-oriented woodland owners” are partially comprised of farmers who actively manage their woodlands. “Passive woodland owners” included “more agriculturally inclined” producers who are less likely to take forest management actions. Farmers were more willing and motivated to manage their woodlands.	Silver et al., 2015; Kendra and Hull, 2005
<i>Land management (specific behaviors)</i>			
Having a management plan	Similar	No significant difference	Hendee and Flint, 2013
Conducted a harvest	Similar	Varying effects	Beach et al., 2005 Hendee and Flint, 2013; Gan and Kebede, 2005; Erickson et al., 2002
Consulted a forester	Similar	No significant difference	Hendee and Flint, 2013
Took timber stand improvement actions	Similar	No significant difference	Hendee and Flint, 2013
Posted land against hunting	Different	FWOs were less likely to post their woodland against hunting	Jagnow et al., 2006; Snyder and Butler, 2012
Maintained trails	Different	FFOs were more likely to maintain trails across woodlands	Erickson et al., 2002
Planted trees	Different	Varying effects from FFOs more likely to plant new trees on their property to no difference	Erickson et al., 2002; Beach et al., 2005
Preventing cleared land from reverting to woods	Different	FWOs were less likely to keep their cleared land from reverting to woods	Erickson et al., 2002
Awareness of invasive species	Different	Varying effect. For example, FWOs in West Virginia tended to be more aware of some invasive plant species (e.g., multiflora rose), but less aware of other invasive plant species (e.g., tree-of-heaven, Japanese stilt grass), than FFOs.	Steele et al., 2006
Taking a “hands-off” and “no-management” approach	Different	FFOs were more likely to take a “hands-off” and “no-management” approach to their property	Erickson et al., 2002
Enrolling in FFO conservation incentive programs	Similar	No significant difference	Fortney et al., 2011
Participating in FFO cost-share programs	Similar	No significant difference	Ma et al., 2012
Participating in a forest certification program	Different	FWOs less likely to participate in a forest certification program	Ma et al., 2012
Having a conservation easement	Similar	No significant difference	Ma et al., 2012

\*Note: all articles are U.S. studies to narrow the scope for comparison to the NWOS data, which is also only U.S. landowners.

behaviors and intentions, Beach et al. (2005) found two studies in which FWOs were more likely to harvest timber (Boyd, 1984; Hyberg and Holthausen, 1989) and one in which they were less likely to harvest (Kuuluvainen and Salo, 1991) than non-farmer FFOs. In a very recent vote count analysis of family forest owner actions, the ownership characteristic “agricultural producer” was not a significant predictor (either positively or negatively) of any of the coded dependent variable actions (Floress et al., 2018). When considering invasive plant awareness, FWOs tended to be more familiar with some species compared to those FFOs who did not also own agricultural land (Steele et al. 2006).

In summary, as with typology studies, status as a farmer or farmland owner has not had a consistent relationship in predictive modeling studies of FFO behaviors.

While FFO typologies and behavior research somewhat regularly include the owner’s status as a farmer or agricultural land owner, the opposite is not true. Studies of farmers and farmer behavior tend to include woodlands only when they are part of the farmer’s land management decisions, if woodlands are included at all. Research intended to assess farmer adoption of best management practices, for example, may only ask how many forested acres are managed by the farmer (Genskow and Prokopy, 2011),

and we can speculate from FFO typologies that only a small segment of farmers are actively managing their woodlands (Silver et al., 2015). Further, it may be that what farmers consider woodland management differs from what is considered woodland management by non-farming FFOs or practitioners. Do farmers, for example, consider identifying invasive species on their property as a *land* management action, when land management might typically constitute, to them, such things as annual production practices, whether to participate in a multi-year set-aside program such as the Conservation Reserve Program, and large financial decisions about tillage systems?

Regardless of what landowners consider ‘woodland management’ to mean, when examining factors associated with farmer conservation actions and FFO land management and conservation actions, there are some broad similarities (Table 1). Among FFOs, property size has been found to be positively related to forest management and government program participation (Arano et al., 2004; Dickinson et al., 2012; Kaetzel et al., 2009; Kilgore et al., 2008; Ma et al., 2012; Miller et al., 2012) and property size is positively related to the adoption of agricultural conservation practices among farmers (Prokopy et al., 2008; Baumgart-Getz et al., 2012). Specifically, Ferranto et al. (2011) found that increasing property size was correlated with using land for income and for conservation-related improvements among private forest and rangeland owners. Farmers with larger acreage are likely to have increased capacity to take conservation actions, which may be because they have more employees, more income, and more time to take advantage of incentive programs (Baumgart-Getz et al., 2012). FFOs with larger acreage may be eligible for additional assistance program offerings (such as the Forest Stewardship Program which has a 10-acre minimum for enrollment in many states) than FFOs with smaller land holdings. On the contrary, FFOs with smaller properties are less likely to harvest timber, partly due to limited profitability (Hull et al., 2004). The age of the landowner is another factor that has been observed, across both farmer and FFO literatures, to have a significant negative relationship with land management actions, although it has also been occasionally found to have no relationship or a positive relationship with actions (Baumgart-Getz et al., 2012; Fischer, 2011; Fortney et al., 2011; Joshi and Arano, 2009; Ma et al., 2012; Ma and Coppock, 2012; Prokopy et al., 2008; Snyder and Butler, 2012). In addition, FFOs’ education level has been observed to have varying effects on different management actions, regardless of whether or not they own farmland. For example, Gan et al. (2014) observed a positive effect of higher education on the adoption of wildfire mitigation practices, while Snyder and Butler (2012) observed a negative relationship between FFO’s education level and the provision of public recreational access. Farmers’ education level is usually positively related to conservation practice adoption when it is significant (Prokopy et al., 2008).

## 2. Materials and methods

### 2.1. National woodland owner survey (NWOS)

The NWOS is a mail survey conducted by the USDA Forest Service, Forest Inventory and Analysis (FIA) program to increase the understanding of the attitudes, behaviors, and demographics of private

**Table 2**

Statistically significant results with Cramer’s V meeting or exceeding threshold of 0.1 from bivariate comparisons of independent categorical variables between family forest owners who own farmland and those who do not. Significance was determined based on a chi-square test with  $p < 0.05$ . Effect size was calculated using the Cramer’s V statistic. Asterisks denote when family forest owners with farmland have the higher percentage.

Category	Variable	Reference condition	With farmland (%)	W/out farmland (%)	$\chi^2$	Cramer’s V	<i>p</i> -value
Behavior	Done no management in the past 5 years	Yes	12*	2	79.864	0.104	< 0.0001
Property characteristics	Home on or within a mile of woodlands	Yes	66*	53	134.68	0.135	< 0.0001
		4.1–16.2 ha	18	30	227.89	0.176	< 0.0001
		16.6 – 40.5 ha	24	27			
		40.9 – 121.4 ha	26*	23			
		121.41 + ha	31*	18			
Ownership Objectives	Objective: Family	Very important or important	51*	37	131.01	0.133	< 0.0001

forestland ownerships across the United States (Butler et al., 2016a). This survey, like the FIA protocol, uses probability proportional to size sampling, thus larger landowners are more likely to be selected (Butler et al., 2016b). This is an important caveat, given that the NWOS is not likely to represent farmland accurately. Data from the 2011–2013 iteration of the survey were used for our study. A total of 8576 FFOs with 10 or more acres (i.e., 4+ ha) responded to the survey with an overall cooperation rate of 51.6%. Telephone follow-up interviews were conducted with 12% of the mail survey non-respondents to test for non-response bias. Because no clear nonresponse bias was found, no adjustments were made to the estimates (Butler et al., 2016a).

We examined key NWOS variables to better understand the similarities and differences between FWOs and FFOs. Farmland is defined in the NWOS as follows: “A farm or ranch is a place where, in most years, \$1000 or more is earned from the sale of crops (other than forest products) or animals.” This definition is consistent with that of the USDA Agricultural Research Service. Based on variables identified in the literature (Table 1) that are useful for understanding differences among FFOs and among agricultural producers, we examined landowner demographics, participation in landowner programs, forest management behaviors, property characteristics, advice topics, and intentions for the future of their forested land.

### 2.2. Bivariate statistics

To examine relationships between woodland ownerships with and without farmlands, we compared respondents who answered “yes” to the question “Do you own any land that is farmed or ranched” on the survey (i.e., FWOs) with those who answered “no” (i.e., woodland-only FFOs). We examined relationships between farmland ownership status and other categorical variables related to behaviors, property characteristics, intentions, demographics, ownership objectives, and information preference (Table 2 and Appendix Tables A1 and A2) derived from the NWOS questions using chi-squared tests for independence in R, a statistical software (Version 3.2.4, R Foundation for Statistical Computing, 2017), with a *p*-value threshold of 0.05 and a Bonferroni multiple-tests correction, to identify significant differences between woodland ownerships with and without farmlands for each variable. Finally, we estimated the effect size of each bivariate relationship using Cramer’s V. We consider the following thresholds for effect: 0.1 = small, 0.3 = medium, and 0.5 = large. Table 2 shows statistically significant results with Cramer’s V meeting or exceeding threshold of 0.1. Table A1 shows non-significant results while Table A2 shows significant results with low effect sizes. It is important to show non-significant results, because they indicate which characteristics are similar between FWOs and woodland-only FFOs. The significant results with low effect size may warrant additional investigation.

## 3. Results

Of the 8,576 NWOS respondents to the 2011–2013 iteration with 10+ acres (4.05 + ha), 3,071 (36%) indicated they owned farmland or

ranchland. The majority of respondents were males over the age of 55 with annual household incomes over 50,000 USD.

We found a number of statistically significant differences between FWOs and woodland-only FFOs (Appendix Table A1). However, post-hoc tests examining the effect sizes of these differences indicate mostly small or very small effect sizes of all the significant differences (ranging from 0.025 – 0.176) (Table A2). Below, we only report variables that are significantly different between FWOs and FFOs and that have at least a small effect size of 0.1. Two property characteristic variables had the highest effect sizes when comparing FWOs and woodland-only FFOs: Size of forest holdings for the 10–40 acres (4.1–16.2 ha) category (0.176) and home on or within a mile of their woodlands (0.135). FWOs are more likely than woodland-only FFOs to live on their land (66% versus 53%, respectively). However, they are less likely than woodland-only FFOs to have under 40 acres (16.2 ha) of woodlands (18% versus 30%, respectively).

Both FFOs and FWOs have a diversity of reasons for woodland ownership, and while there are some statistically significant differences, only one ownership objective has a meaningful, albeit small, effect size (0.133; Table 2). FWOs are more likely to own their woodlands as a place to raise their family than woodland-only FFOs (51% versus 37%, respectively).

While a number of management activities were significantly different between FWOs and woodland-only FFOs, the effect sizes for most management activities are too small to be meaningful. However, there is a small effect size (0.104) when comparing the percentage of FWOs undertaking no management activities to the percentage of woodland-only FFOs, with FWOs more likely to have undertaken no management activities on their woodlands in the past five years than woodland-only FFOs (12% versus 2%, respectively).

Overall, FFOs and FWOs are either not significantly different or have very small effects sizes rendering the difference meaningless, in terms of all demographics, most property characteristics (except fewer FWOs having small properties and more FWOs living on their land), most ownership objectives (except more FWOs owning their woodlands to raise family), most management behaviors in the past (except doing no management), management intentions in the future, information preferences, and concerns (Table 2 and Appendix Table A1). Across these similarities, it is worth noting that both FWOs and woodland-only FFOs largely own their woodlands for amenity reasons, including to enjoy beauty, to improve wildlife habitat, to protect nature and water, for privacy, and for recreation (89% for both groups). FWOs and woodland-only FFOs also have similar intentions for their woodlands. Comparable, but modest, percentages of both groups are likely or extremely likely to transfer their land in the next five years (18% of FWOs and 19% of woodland-only FFOs), although most of both groups want their woodlands to also stay wooded (83% of FWOs and 88% of woodland-only FFOs). Both FWOs and woodland-only FFOs are also similar in respect to having a forest management plan (30% of FWOs and 29% of FFOs), having received professional advice about their wooded land in the past five years (37% of FWOs and 36% woodland-only FFOs) and their preferences regarding receiving professional advice via written materials in the future (64% of FWOs and 68% of woodland-only FFOs).

#### 4. Discussion

While the effect sizes are generally very small, FWOs and woodland-only FFOs do have several meaningful differences that may have implications for how land management and conservation professionals would continue to work with these two types of FFOs. For example, FWOs are less likely to have small parcels of woodlands than woodland-only FFOs. Having more acreage is often positively associated with farmers' (who may or may not own the land) adoption of conservation behaviors (Prokopy et al., 2008; Baumgart-Getz et al., 2012), as it is with FFOs' adoption of forest management and conservation practices

(Beach et al., 2005; Silver et al., 2015; [removed for blind review]). By virtue of owning more woodlands, FWOs may have a greater capacity to undertake many forest and land management activities, but only if they are motivated to do so. However, we also see that FWOs are more likely to have done no forest management in the past five years than woodland-only FFOs. This presents a challenge and opportunity—if forestry professionals can effectively engage FWOs, they could generate forest management outcomes across larger parcels of woodlands, possibly more than if they only focus on FFOs in general. In addition, our result shows that FWOs are more likely to be resident landowners (i.e., less likely to be absentee landowners). This may be due to the fact that they also have farmlands to manage, which may be more difficult to do from afar. Previous research has shown that resident (operating) landowners are often more interested in forest conservation programs and more able to undertake active forest management (Kendra and Hull, 2005; Rickenbach and Kittredge, 2009; Petzelka et al., 2013). Therefore, there may be an opportunity to target FWOs for forestry outreach and education, as both larger acreage and resident forest landowners, motivating them to engage in forest management by identifying and highlighting co-benefits for their farmlands that may be produced from forest management.

Overall, our study provides evidence suggesting that FWOs and woodland-only FFOs in the United States are more similar in their attitudes and behaviors towards woodlands than what some studies have discussed previously (e.g., Erickson et al., 2002; Kendra and Hull, 2005; Moser et al., 2009; Silver et al., 2015). This finding further suggests that segmentation strictly along the lines of FWO versus woodland-only FFOs may not be warranted in research explorations or helpful for programmatic purposes such as offering outreach, information and assistance programs. Rather, our research suggests that other variables, such as size of forest holdings or previous forest management experience, may be more salient when trying to differentiate groups of FFOs and targeting them for various forestry policies and programs. We argue, based on this analysis, that farmland ownership (as defined by the NWOS) may not be a useful explanatory variable to include in predictive models of FFO behavior. However, a variable that better capture actual farmer activity and/or farmer identity may still be an informative predictor.

Further, our study identifies several characteristics of FWOs that may have been misunderstood or overlooked previously. For example, our results show that similar to woodland-only FFOs, FWOs own their woodlands more for amenity reasons than economic or timber production reasons. While FWOs may have a stronger interest in the economic aspect of their farmlands, they may in fact view their woodlands differently and this may have important implications for forest management and conservation. For example, messaging forestry-related information and opportunities to FWOs through agricultural extension channels may be more effective if the messages can be framed to highlight the amenity benefits of forest management rather than other benefits such as generating income from woodlands. Further, in a study of Iowa farmers, Atwell et al. (2009) found that respondents professed a strong stewardship ethic for their land, as has been similarly found among FFOs (Bengston et al., 2011). Thus, messaging, outreach and incentives that appeal to this stewardship ethic, across all of one's land holdings, and that emphasizes the beneficial environmental contributions of well-managed woodlands might be a way to encourage greater forest management among FWOs. It is also encouraging for forest conservation and protection groups to learn that FWOs, similar to woodland-only FFOs, hold strong desires to keep their woodlands wooded and that they do not have near-term plans to sell, develop or subdivide their woodlands. These groups (e.g., land trusts) seek connectivity of forest land cover and preservation of forest ecosystem services. This may be explained by the fact that FWOs generally consider amenity values important reasons for owning woodlands. This further suggests a need to reach out to FWOs to discuss how forest management can help improve the amenity values provided by their

woodlands as a way to motivate management and conservation actions by FWOs. However, keeping forests as forests is an obvious tradeoff with using land for farming, and so must be carefully considered in future exploration of dual land use owners.

In spite of FWOs having (or the potential to have) access to dual information, assistance, and peer network channels by virtue of being dual land-type owners, our study shows in fact no evidence of differences between FWOs and FFOs in rates of undertaking various forest management activities, participating in a range of landowner assistance programs, or receiving professional advice about their woodlands (*activities and behaviors*). This finding is counterintuitive and raises further questions. Are FWOs aware and taking advantage of all of the information, professional assistance, and programs that are available to them as both farmland and forestland owners? Are agricultural and forest extension agents communicating the forest management aspects of agricultural assistance programs with FWOs? To what extent have agricultural assistance programs like the Environmental Quality Incentives Program (EQIP) made it explicit that they do support forest management and conservation, which are in fact congruent with FWOs' amenity objectives for their woodlands? With the exception of new cross-ownership shared stewardship program created by USDA NRCS and USFS, outreach and assistance to agricultural land owners on woodland management topics is not done at the programmatic/policy-making level, but may be done in practice. With a better understanding of how the needs of FWOs and woodland-only FFOs may differ, funding and strategic planning can be better allocated and coordinated across agencies and programs.

Beyond amenity values, our ability to discern from the NWOS data about FWOs' motivations (*intentions and goals*) to undertake certain forest and land management activities is limited. However, it is possible that FWOs may have different motivations compared to non-farming FFOs. For example, FWOs may manage their woodlands to enhance or benefit their agricultural production, rather than managing woodlands for specific woodland-associated outcomes (e.g., tapping for maple syrup or shade trees for livestock). Treatment of invasive forest plants is another possible example. That is, FWOs who undertake invasive forest plant management may do so out of concern about invasive forest plants spreading to their farmlands, adversely impacting yields. Thus, there is an opportunity to target FWOs to encourage invasive plant eradication and to facilitate them to act as peer leaders in their communities for invasive plant management.

As farmland and woodland owners age, intergenerational land transfer becomes increasingly important in the context of minimizing development and other land use conversion (Mishra et al., 2010). Even though FWOs generally do not have near-term plans to sell, develop or subdivide their woodlands, they may be still interested in passing on their farm operation, of which their woodlands is one part. As such, despite our results indicating that FWOs hold strong desires to keep their woodlands wooded and FWOs value the amenities provided by their woodlands, they may not view woodlands as their primary concern when making intergenerational land transfer decisions. A topic to examine in future research is whether woodlands are a casualty when farmlands are transferred and/or converted; or if they stay intact when farmlands stay intact, highlighting the interdependency of farmlands and woodlands and the importance of FWOs for outreach about intergenerational land transfers.

Results from this study are most relevant to ownerships and programming in the United States and OECD member countries, which have similar forest governance and land tenure systems. Results may not generalize to other countries with different land tenure structures. Rather, there is a precedence for forest owners evolving out of more diversified farming systems in the U.K. (Howley, 2013) and across Europe (Wiersum et al., 2005). In many European countries, a woodland-only FFO was considered a 'new' type of owner in the early 2000s (e.g., Kvarda, 2004), suggesting that woodland ownership was formerly synonymous with agricultural enterprises in much of Europe. In the

U.S., FWOs may resemble this traditional FFO population in Europe, but more recently, the growing number of first-time and 'new' forest owners may be a similar trend in the U.S. and many European countries. Future research that examines and contrasts FFOs and FWOs in the U.S. with those outside of the U.S. and Europe where other governance and land tenure systems exist could enhance our understanding of the characteristics and behaviors of these segments of private woodland owners across broader cultural and ecological conditions.

## 5. Conclusions

While the results of the study did not identify strong significant differences among woodland owners who own farmland and those who do not, more research is needed that specifically targets data collection to farmers who also own woodlands as well as woodland owners who own farmland. Moreover, targeted research is needed that investigates the identity of being a farmer versus a woodland owner, and how that identity may influence decision making and conservation behaviors on each type of land. Identity refers to the self-perception of an individual, and often links their professional activities with their personal preferences and values (Weigert et al., 2007). In the case of farmers, there has been some research investigating the role of identity in environmental management practices (e.g., Sulemana and James, 2014). However, there is no known research that compares the identity of farmers (who may or may not own the land), woodland owners, and farmland-woodland owners. This idea bears further exploration, and an in-depth study would complement these analyses of farmland and woodland owners.

Moreover, research that examines whether or how demographics of FWOs and FFOs may influence their attitudes, behaviors and land-holding characteristics could further our understanding of how best to provide information and services to them. For example, female farmers have been found to hold more pro-environmental views and attitudes than male farmers (Burton, 2014), while female FFOs have been found to be less likely to undertake various forest management activities or participate in incentive programs (e.g., Bliss et al., 1997; Butler et al., 2017; Kaetzel et al., 2009; Miller et al., 2012). Further, Horst and Marion (2018) found that race, ethnicity and gender were associated with differences in land ownership versus tenancy of agricultural land, disparities in farm-related income, and size of farm operations and landholdings among U.S. farmland owners, operations and works. Examining the interplay of these factors in association with whether a woodland owner also owns associated farmland could provide further insight into landowner behaviors and decision-making.

Our analysis indicates that FWOs are no more likely to have participated in a range of government assistance programs for their woodlands, such as cost share and property tax programs, than woodland-only FFOs. While FWOs may have more programmatic assistance options by virtue of owning two land types, they do not appear to be availing themselves of these opportunities. Research that explores FWO awareness of, attitudes towards, and participation in the full range of landowner assistance programs available to them would be useful in gauging whether lack of awareness and interest is a barrier to participation, or if there are programmatic elements that aren't of interest or incongruent with their landowner objectives. State-level policy contexts and socioeconomic characteristics of farming and forestry communities would also be a fruitful area for further research.

Research that specifically distinguishes operating and non-operating agricultural landowners would also add important knowledge to this topic. Prokopy et al. (2008) pooled acres farmed and acres owned, and had a separate variable for ownership type (individual or corporate) and tenure (whether the operator owns farmland). Of these three (acres, type, and tenure), only acres was significant across multiple studies. However, more research is needed to determine which factors predict participation in conservation programs for different types of landowners and land managers. Importantly, this study does not

distinguish between operators and non-operators. The NWOS only collects data about the landowner, but the absentee owner variable may be a proxy for non-operating landowners. Further research that collects similar data from operating farmers, non-operating agricultural landowners, and woodland-only landowners is necessary to further refine outreach and engagement efforts. Given that the NWOS employs probability proportional to size sampling, a study that collects data based on the size characteristics of both farmland and forested land, by owner, would also help compare these populations and identify areas of overlap.

This analysis demonstrates that there are similarities between woodland owners who own farmland and those who do not, such as whether or not they have received advice about their woodlands. This suggests that outreach and extension programming could be administered to both farmland and woodland owning populations simultaneously. FWOs have opportunities for dual information pathways and information networks through both agricultural and forestry professionals and peers. The extent to which these dual information pathways or social networks are utilized is unknown, however, and would be an

important topic for future research inquiry. Conversely, there are a few differences between woodland owners with farmland and those without farmland, such as invasive plant management or the choice to reside on their forest on farm land (as opposed to live on a separate parcel). These may be untapped opportunities to reach individuals at this land ownership intersection with implications for policy and programming to promote conservation and best management practices on privately-owned lands.

**Acknowledgments**

Useful reviews were provided by Jesse Caputo and Lynne Westphal. We would also like to thank members of the Family Forest Research Center for helpful input during project development. Support for this research was provided, in part, by the USDA Forest Service Forest Inventory and Analysis (FIA) Program and the Northern Research Station. Funding sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Appendix A**

**Table A1**

Bivariate comparisons of independent categorical variables comparing woodland owners who own farmland and those who do not that were not statistically significantly different.

Category	Variable	Reference condition	Farmland (%)	No farmland (%)
Behaviors	Eliminated or reduced invasive insects	Yes	9	8
	Management Plan	Yes	30	29
Property characteristics	Participates in a certification program	Yes	4	4
	Acquired land by purchasing	Yes	76	76
Demographics	Owner 1 Education	Some college or less	48	46
		Associate's Degree or higher	52	54
Ownership Objectives	Objective: Amenity	Very important or important	89	89
	Objective: Nature	Very important or important	68	70
	Objective: Privacy	Very important or important	63	64
	Objective: Investment	Very important or important	55	54
Intentions	Will transfer land in the next 5 years	Extremely likely or likely	18	19
	Will transfer land because it is part of their investment strategy	Yes	31	30
	Will transfer land because there is a high market value	Yes	5	6
Information Preference	Has ever received advice about their woodland	Yes	37	36
	Received advice about conservation easements	Yes	23	24
	Would prefer to receive written advice	Yes	64	68
	Would prefer to receive advice verbally	Yes	49	47
Concerns	Received advice from a family member	Yes	24	21
	Concerns about development	Great concern or concern	44	44
	Concerns about invasive insects	Great concern or concern	70	70

**Table A2**

Statistically significant results from bivariate comparisons of independent categorical variables between family forest owners who own farmland and those who do not, regardless of effect size. Significance was determined based on a chi-square test with  $p < 0.05$ . Effect size was calculated using the Cramer's V statistic. Asterisks denote when family forest owners with farmland have the higher percentage.

Category	Variable	Reference condition	With farmland (%)	W/out farmland (%)	$\chi^2$	Cramer's V	p-value	
Behaviors	Cut wood for personal use in the past 5 years	Yes	46*	41	13.667	0.046	0.0002	
	Managed for wildlife habitat in the past 5 years	Yes	36*	33	6.926	0.031	0.0085	
	Participated in programs (cert, tax, ease, cost)	Yes	43*	38	23.063	0.056	< 0.0001	
	Cut wood for sale in the past 5 years	Yes	34*	30	15.593	0.046	< 0.0001	
	Done no management in the past 5 years	Yes	12*	2	79.864	0.104	< 0.0001	
Property characteristics	Home on or within a mile of woodlands	Yes	66*	53	134.68	0.135	< 0.0001	
	Inherited their land	Yes	41*	32	68.678	0.097	< 0.0001	
	Acquired land from spouse	Yes	3	31	7.076	0.032	0.0078	
	Size of forest holding	4.1-16.2 ha		18	30	227.89	0.176	< 0.0001
		16.6 – 40.5 ha		24	27			
		40.9 – 121.4 ha		26*	23			
	121.41 + ha		31*	18				

(continued on next page)

Table A2 (continued)

Category	Variable	Reference condition	With farmland (%)	W/out farmland (%)	$\chi^2$	Cramer's V	p-value
Demographics	Gender of primary owner	Male	85*	80	23.61	0.057	< 0.0001
	Age of primary owner	< 45	4	6	15.688	0.046	0.00350
		45-54	15	17			
		55-64	31	31			
		65-74	28*	27			
		75+	22*	20			
Annual household income	< \$25,000 - \$49,999	31	34	23.881	0.057	< 0.0001	
	\$50,000 - \$99,999	32	33				
	\$100,000 - \$199,999	21	21				
	\$200,000 +	15*	11				
Ownership Objectives	Objective: Beauty	Very important or important	75	80	29.442	0.063	< 0.0001
	Objective: Water	Very important or important	67*	63	13.596	0.043	0.0002
	Objective: Wildlife	Very important or important	75	77	4.345	0.0246	0.0371
	Objective: Family	Very important or important	51*	37	131.01	0.133	< 0.0001
	Objective: Hunting	Very important or important	56*	49	40.547	0.074	< 0.0001
	Objective: Recreation	Very important or important	72*	70	7.684	0.0325	0.0056
	Objective: Timber	Very important or important	41*	36	13.76	0.043	0.0002
	Objective: Child	Very important or important	74*	66	45.557	0.079	< 0.0001
Intentions	Likelihood of cutting wood for sale in the next 5 years	Extremely likely or likely	35*	31	12.021	0.041	0.0005
	Likelihood of cutting wood for personal use in the next 5 years	Extremely likely or likely	48*	43	15.779	0.046	< 0.0001
	Will transfer land because they are ready to give it away	Yes	22*	17	6.357	0.03	0.0117
	Will transfer land because it is too expensive	Yes	14	19	6.427	0.030	0.0112
	Will transfer land because they need the money	Yes	13	19	6.933	0.032	0.0085
	Will transfer land because they are no longer interested in owning it	Yes	11	15	4.382	0.0253	0.0363
	Want their woodlands to stay wooded	Strongly agree or agree	83	88	30.4	0.065	< 0.0001
	Would sell land if offered a reasonable price	Strongly agree or agree	19	26	39.157	0.073	< 0.0001
	Received advice from a professional about their woodland	Yes	69*	57	37.462	0.072	< 0.0001
Information Preference	Received advice about timber	Yes	67	71	5.562	0.028	0.0184
	Received advice about wildlife	Yes	49*	43	7.781	0.033	0.0053
	Received advice about conservation	Yes	47*	41	9.400	0.036	0.0022
	Helpfulness of advice on woodland management	Very helpful or helpful	52	57	18.202	0.050	< 0.0001
	Would prefer to receive advice from written materials or the internet	Yes	64	68	14.597	0.045	0.0001
	Concerns	Concerns about climate change	Great concern or concern	33	36	6.474	0.030
Concerns about transferring land to the next generation		Great concern or concern	82*	78	11.638	0.040	0.0006
Children or other family members would likely receive their transferred land		Yes	63*	51	16.484	0.048	< 0.0001

## References

- Arano, K.G., Munn, I.A., Gunter, J.E., Bullard, S.H., Doolittle, M.L., 2004. Modeling landowner participation in a proposed reforestation loan program. *Small-Scale For.* 3 (2), 177–190.
- Atwell, R.C., Schulte, L.A., Westphal, L.M., 2009. Landscape, community, countryside: linking biophysical and social scales in US Corn Belt agricultural landscapes. *Landsc. Ecol.* 24, 791–806.
- Baumgart-Getz, A., Prokopy, L.S., Floress, K., 2012. Why farmers adopt best management practice in the United States: a meta-analysis of the adoption literature. *J. Env. Manage.* 1, 17–25.
- Beach, R.H., Pattanayak, S.K., Yang, J.C., Murray, B.C., Abt, R.C., 2005. Econometric studies of non-industrial private forest management: a review and synthesis. *For. Pol. Econ.* 7 (3), 261–281.
- Bengston, D.N., Asah, S.T., Butler, B.J., 2011. The diverse values and motivations of family forest owners in the United States: an analysis of an open-ended question in the National Woodland Owner Survey. *Small-scale For.* 10, 339–355.
- Bliss, J.C., Nepal, S.K., Brooks, B.T., Larsen, M.D., 1997. In the mainstream: environmental attitudes of mid-south forest owners. *South. J. Appl. For.* 21 (1), 37–43.
- Boyd, R., 1984. Government support of non-industrial production: the case of private forests. *Southern Econ. J.* 51 (1), 89–107.
- Burton, R.J.F., 2014. The influence of farmer demographic characteristics on environmental behaviour: a review. *J. Environ. Manage.* 135, 19–26.
- Butler, B.J., Hewes, J.H., Dickinson, B.J., Andrejczyk, K., Butler, S.M., Markowski-Lindsay, M., 2016a. USDA Forest Service National Woodland Owner Survey: National, Regional, and State Statistics for Family Forest and Woodland Owners With 10+ Acres, 2011-2013. U.S. Department of Agriculture, Forest Service, Northern Research Station, Res. Bull. NRS-99. Newtown Square, PA, pp. 39 p.
- Butler, Brett J., Dickinson, Brenton J., Hewes, Jaketon H., Butler, Sarah M., Andrejczyk, Kyle, Markowski-Lindsay, Marla, 2016b. USDA Forest Service National Woodland Owner Survey, 2011-2013: Design, Implementation, and Estimation Methods. U.S. Department of Agriculture, Forest Service, Northern Research Station, Gen. Tech. Rep. NRS-157. Newtown Square, PA, pp. 43 p.
- Butler, S.M., Huff, E.S., Snyder, S.A., Butler, B.J., Tyrrell, M., 2017. The role of gender in management behaviors on family forest lands in the United States. *J. of For.* 116 (1), 32–40.
- Clarke, M., Ma, Z., Snyder, S., Floress, K., 2017. Private woodland owners and invasive plant management in Illinois. *The Voice for Illinois Forests* 12 (2) Summer 2017. Available at: <https://www.ilforestry.org/>.

- Dickinson, B.J., Stevens, T.H., Lindsay, M.M., Kittredge, D.B., 2012. Estimated participation in US carbon sequestration programs: a study of NIPF landowners in Massachusetts. *J. For. Econ.* 18 (1), 36–46.
- Erickson, D.L., Ryan, R.L., De Young, R., 2002. Woodlots in the rural landscape: landowner motivations and management attitudes in a Michigan (USA) case study. *Landscape Urb. Plan.* 58, 101–112.
- ERS 2011: <http://www.ers.usda.gov/data/majorlanduses>. Accessed March 17 2017.
- Ferranto, S., Huntsinger, L., Getz, C., Nakamura, G., Stewart, W., Drill, S., Valachovic, Y., DeLasaux, M., Kelly, M., 2011. Forest and rangeland owners value land for natural amenities and as financial investment. *Calif Agr.* 65 (4), 184–191.
- Fischer, A.P., 2011. Reducing hazardous fuels on nonindustrial private forests: factors influencing landowner decisions. *J. For.* 109 (5), 260–266.
- Floress, K., Huff, E.S., Snyder, S.A., Koshollek, A., Butler, S., Allred, S.B., 2018. Factors associated with family forest owner actions: a vote count meta-analysis. *Landsc. Urban Plan.* <https://doi.org/10.1016/j.landurbplan.2018.08.024>.
- Fortney, J., Arano, K.G., Jacobson, M., 2011. An evaluation of West Virginia's managed timberland tax incentive program. *For. Pol. Econ.* 13 (1), 69–78.
- Gan, J., Jarrett, A., Gaither, C.J., 2014. Wildfire risk adaptation: propensity of forestland owners to purchase wildfire insurance in the southern United States. *Can. J. Res.* 44 (11), 1376–1382.
- Gan, J., Kebede, E., 2005. Multivariate probit modeling of decisions on timber harvesting and request for assistance by African-American forestland owners. *S. J. Appl. For.* 29 (3), 135–142.
- Gan, J., Onianwa, O.O., Schelhas, J., Wheelock, G.C., Dubois, M.R., 2005. Does race matter in landowners' participation in conservation incentive programs? *Soc. Nat. Resource.* 18 (5), 431–445.
- Genskow, K., Prokopy, L., 2011. The Social Indicator planning and Evaluation System (SIPES) for Nonpoint Source Management: a Handbook for Watershed Projects. Great Lakes Regional Water Program.
- Hendee, J.T., Flint, C.G., 2013. Managing private forestlands along the public-private interface of Southern Illinois: landowner forestry decisions in a multi-jurisdictional landscape. *For. Pol. Econ.* 34, 47–55.
- Horst, M., Marion, A., 2018. Racial, Ethnic And Gender Inequities In Farmland Ownership And Farming in the U.S. *Agriculture and Human Values*. <https://doi.org/10.1007/s10460-018-9883-3>.
- Howley, P., 2013. Examining farm forest owners' forest management in Ireland: the role of economic, lifestyle and multifunctional ownership objectives. *J. Env. Manage.* 123, 105–112.
- Hull, R.B., Robertson, D.P., Buhoff, G.J., 2004. "Boutique" forestry: new forest practices in urbanizing landscapes. *J. For.* 102 (1), 14–19.
- Hyberg, B., Holthausen, D., 1989. The behavior of non-industrial private forest landowners. *Can. J. For. Res.* 19, 1014–1023.
- Jagnow, C.P., Stedman, R.C., Luloff, A.E., San Julian, G.J., Finley, J.C., Steele, J., 2006. Why landowners in Pennsylvania post their property against hunting. *Hum. Dimen. Wild.* 11 (1), 15–26.
- Joshi, S., Arano, K.G., 2009. Determinants of private forest management decisions: a study on West Virginia NIPF landowners. *For. Pol. Econ.* 11 (2), 118–125.
- Kaetzl, B.R., Hodges, D.G., Houston, D., Fly, J.M., 2009. Predicting the probability of landowner participation in conservation assistance programs: a case study of the Northern Cumberland Plateau of Tennessee. *S. J. Appl. For.* 33 (1), 5–8.
- Kendra, A., Hull, R.B., 2005. Motivations and behaviors of new forest owners in Virginia. *For. Sci.* 51 (2), 142–154.
- Kilgore, M.A., Snyder, S.A., Schertz, J., Taff, S.J., 2008. What does it take to get family forest owners to enroll in a forest stewardship-type program? *For. Pol. Econ.* 10, 507–514.
- Kuuluvainen, J., Salo, J., 1991. Timber supply and life cycle harvest of non-industrial private forest owners: an empirical analysis of the Finnish case. *For. Sci.* 37, 1011–1029.
- Kvarda, M.E., 2004. 'Non-agricultural forest owners' in Austria—a new type of forest ownership. *For. Pol. Econ.* 6 (5), 459–467.
- Ma, Z., Butler, B.J., Kittredge, D.B., Catanzaro, P., 2012. Factors associated with landowner involvement in forest conservation programs in the U.S.: implications for policy design and outreach. *Land Use Pol.* 29, 53–61.
- Ma, Z., Coppock, D.L., 2012. Perceptions of Utah ranchers toward carbon sequestration: policy implications for US rangelands. *J. Env. Manage.* 111, 78–86.
- Miller, K.A., Snyder, S.A., Kilgore, M.A., 2012. An assessment of forest landowner interest in selling forest carbon credits in the Lake States, USA. *For. Pol. Econ.* 25, 113–122.
- Mishra, A.K., El-Osta, H.S., Shaik, S., 2010. Succession decisions in U.S. Family farm businesses. *J. Agric. Res. Econ.* 35 (1), 133–152.
- Moser, W.K., Leatherberry, E.C., Hansen, M.H., Butler, B.J., 2009. Farmers' objectives toward their woodlands in the upper Midwest of the United States: implications for woodland volumes and diversity. *Agrofor. Syst.* 75 (1), 49–60.
- NASS, 2012. <https://www.agcensus.usda.gov/Publications/2012/> Accessed 17, March 2018.
- NRCS, 2017. <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/> Accessed 17, March 2018.
- Nickerson, C., Ebel, R., Borchers, A., Carriazo, F., 2011. Major Uses of Land in the United States, 2007. USDA Economic Research Service.
- Petrzelka, P., Ma, Z., Malin, S., 2013. The elephant in the room: absentee landowner issues in conservation and land management. *Land Use Pol.* 30 (1), 157–166.
- Prokopy, L.S., Floress, K., Klotthor-Weinkauff, D., Baumgart-Getz, A., 2008. Determinants of agricultural best management practice adoption: evidence from the literature. *J. Soil Water Cons.* 63 (5), 300–311.
- Rickenbach, M., Kittredge, D.B., 2009. Time and distance: comparing motivations among forest landowners in New England, USA. *Small-Scale Forestry* 8, 95–108.
- Sandberg, M., Jakobsson, S., 2018. Trees are all around us: farmer's management of wood pastures in light of a controversial policy. *J. Env. Manage.* 212, 228–235.
- Silver, E.J., Leahy, J.E., Weiskittel, A.R., Noblet, C.L., Kittredge, D.B., 2015. An evidence-based review of timber harvesting behavior among private woodland owners. *J. For.* 113 (5), 490–499.
- Snyder, S.A., Butler, B.J., 2012. A national assessment of public recreational access on family forestlands in the United States. *J. For.* 110 (6), 318–327.
- Snyder, S.A., Kilgore, M.A., Taff, S.J., Schertz, J.M., 2008. Estimating a family forest landowner's likelihood of posting against trespass. *N. J. Appl. For.* 25 (4), 180–185.
- Steele, J., Chandran, R.S., Grafton, W.N., Huebner, C.D., McGill, D.W., 2006. Awareness and management of invasive plants among West Virginia woodland owners. *J. For.* 104 (5), 248–253.
- Sulemana, I., James Jr, H.S., 2014. Farmer identity, ethical attitudes and environmental practices. *Ecol. Econ.* 98, 49–61.
- Urquhart, J., Courtney, P., 2011. Seeing the owner behind the trees: a typology of small-scale private woodland owners in England. *For. Pol. Econ.* 13 (7), 535–544.
- Weigert, A.J., Teitge, J.S., Teitge, J.S., Teitge, D.W., 2007. *Society and Identity: Toward a Sociological Psychology*. Cambridge University Press.
- Wiersum, K.F., Elands, B.H., Hoogstra, M.A., 2005. Small-scale forest ownership across Europe: characteristics and future potential. *Small-Scale For Econ, Manage Pol* 4 (1), 1–19.