

## policy

# Assessing the Relationship between Different Forms of Landowner Assistance and Family Forest Owner Behaviors and Intentions

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In this study, we examine how family forest owners who receive various types of assistance differ from unassisted landowners with respect to their forestland management practices, attitudes and concerns, and future management, use, and ownership intentions. We do so by utilizing a national database containing information on private forest owners and the forestland they own. By defining an assisted landowner according to several attributes contained in this database (e.g., has a forest management plan, received cost-share assistance, or received advice), important similarities and differences between recipients and nonrecipients of various types of assistance are identified. The study shows that assisted and unassisted landowners are different with respect to several characteristics of the owners and the forestland they own, land management practices undertaken, and reasons for forest landownership. For example, assisted landowners are more likely to harvest timber and improve wildlife habitat than the unassisted owners. Yet no distinctions are found between assisted and unassisted landowners with respect to their plans to either subdivide or sell their land. In many cases, the differences between assisted and unassisted landowners are not related to the type of assistance the landowner received.

**Keywords:** management plan, cost-share program, advice, landowner assistance, family forest landowner, National Woodland Owner Survey

Approximately 423 million acres of forestland in the United States are privately owned (Butler 2008). A substantial subset of this private forestland, some 264 million acres, is owned by 10 million individuals, families, and other unincorporated entities that are collectively termed “family forests” (Butler 2008). These

forests provide numerous economic and ecological goods and services such as timber products, water quality protection, fish and wildlife habitat, preservation of cultural and historic sites, carbon storage, and recreational opportunities that may be enhanced through forest management (Stein et al. 2009).

To help these owners effectively manage their forestland, landowner assistance has been delivered through numerous federal and state forest landowner assistance programs. Examples of current and past federal landowner assistance programs include the Forest Stewardship, Forestry Incentives, Agricultural Conservation, Forest Land Enhancement, and Conservation Reserve programs. The types of landowner assistance provided through these and other assistance programs include information and education materials, preparation of a forest management plan, professional advice and field-based assistance (Figure 1), and financial incentives in the form of cost sharing, no or low interest grants or loans, and income and property tax incentives.

Most assistance efforts initially focused on helping private forest landowners be more productive timber managers. More recently, the types of assistance made available have expanded in scope to help landowners manage their forests for attributes such as wildlife habitat, water quality, and biodiversity (Kilgore et al. 2007). Important research

Received August 8, 2013; accepted July 29, 2014; published online September 18, 2014.

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**Acknowledgments:** This project was funded, in part, by the USDA Forest Service, State and Private Forestry, Cooperative Forestry program (Grants 12-CS-11242305-061 and 12-CS-11242305-062) and the Minnesota Agricultural Experiment Station under Project MN 42-054.



**Figure 1.** Landowners and community conservation leaders gather in southeastern Massachusetts to exchange information and learn from one another. Photo by David Kittredge, University of Massachusetts at Amherst.

questions in this regard include whether forest landowner assistance is having a measurable impact on landowner behavior and intentions and, if so, to what degree is it furthering the public's interest in the stewardship of private forestland.

In this study, we compared family forest owners who received some form of assistance to unassisted landowners with respect to their forestland management practices, attitudes, and concerns and their future forestland management, use, and ownership intentions. We did so by using a national database containing information on private forest owners and their forestland. By defining an assisted landowner according to several attributes contained in this database (e.g., landowners who have a forest management plan), important similarities and differences between recipients and nonrecipients of various types of technical or financial assistance were identified. Such similarities and differences can, by extension, begin to provide insights on the relative impact different types of assistance have on private forest landowners.

## Background

Over the last half century, numerous evaluations of forestry assistance programs have been conducted (Jacobson et al. 2006).

The majority of these studies have had a state or regional focus and typically examined the rate of landowner involvement in an assistance program and the resulting impact of program participation on forest management and investment. In contrast, relatively few national evaluations of private forestry assistance programs have been carried out. Examples of these national evaluations include James and Schallau (1961), Mills and Cain (1976), Mills and Cain

(1979), Schuster (1983), Risbrudt and Ellefson (1983), Kurtz et al. (1994), Gaddis et al. (1995), Esseks and Moulton (2000), and Esseks and Moorehouse (2005). Although the results of these evaluative studies are mixed, in general they conclude that private forest landowner assistance programs have resulted in additional private investments in forestland management. However, many also found that some of the landowners who participated in such programs indicated they would have carried out the practice(s) without the assistance, particularly when the assistance was financial (Greene et al. 2007).

Although the aforementioned studies provide detailed information about the actions of private forest landowners who received assistance, their focus was on program accomplishments and/or the behavior of program participants. Consequently, these studies do not make direct behavioral and attitudinal comparisons between assistance program participants and nonparticipants. For example, both national evaluations of the Forest Stewardship Program (Esseks and Moulton 2000, Esseks and Moorehouse 2005) document program participants making investments in their forestland. However, they do not compare the rate and magnitude of these investments with forest management investments made by nonprogram participants. Similarly, these two studies do not describe how the "typical" assistance program participant's attitudes and behaviors toward his or her forestland differ from those of nonprogram participants.

We were interested in evaluating how

## Management and Policy Implications

This study found that forest landowners are more likely to undertake certain land management activities if they have received assistance. Therefore, linking forest landowners to some form of assistance may be important if a goal is to have landowners adopt practices such as wildlife habitat improvement or tree planting. Yet our analysis suggests that landowners are not very sensitive to the *kind* of assistance they receive. Landowners who received one of three forms of assistance (management plan, financial assistance, or advice) are similarly distinct from landowners who have not received the assistance. Our analysis also found little difference between assisted and unassisted owners when it comes to their plans to subdivide or sell their forestland. How policymakers should respond to these findings depends on the public policy goals. If the goal is to encourage landowners to implement land management practices such as improving wildlife habitat or reforestation, then providing some type of interaction with and assistance to landowners is important. Because the specific type of assistance does not appear to be an important factor, one strategy is to focus assistance efforts to reach the largest private forest acres per dollar spent. However, if the public policy goal is to "keep forest as forest," policymakers, managers, and extension foresters may need to diversify or expand current assistance approaches.

recipients of various forms of forest assistance differ from unassisted landowners with respect to a range of attitudes, behaviors, and planned actions for their forestland. To do so, we used the National Woodland Owner Survey (NWOS) to compare similarities and differences between assisted and unassisted family forest owners. The NWOS is a long-term, ongoing survey administered by the USDA Forest Service in 5-year cycles that generates a comprehensive profile of US private forest landowners (Butler 2008). The NWOS data are being increasingly used in research studies on family forests and their owners (e.g., Majumdar et al. 2009, Bengston et al. 2011, Butler and Ma 2011, Snyder and Butler 2012). The NWOS database contains information on private forest owners and the forestland they own, past forestland management activities undertaken, landowner concerns associated with owning and managing forestland, and future plans private forest owners have for their forestland. It also identifies landowners who have received several types of assistance (i.e., a forest management plan, advice, or cost-sharing funds).

By developing multiple definitions of an “assisted” private forest landowner, we were able to create profiles of both assisted and unassisted forest landowners and then compare the two cohorts with respect to a landowner’s past land management practices and future intentions. To our knowledge, this study is the first to describe how the recipients of different types of landowner assistance are similar to and distinct from family forest owners who have not received these types of assistance. This is important because it allows us to more directly and specifically identify relationships between different forms of assistance and landowner behavior and future plans for their forestland.

## Data and Methods

The 2006 NWOS data set, the most current and complete NWOS data set, contains information provided by approximately 16,000 US family forest owners regarding their attitudes, ownership purposes, and current and future land management objectives. Our initial inspection of the data found that a few respondents (~500 [3%]) own extremely large forestland acreage (e.g., more than 10,000 acres) and many (~1,300 [8%]) own extremely small parcels (e.g., less than 10 acres). We felt that including the information provided by these landowners

**Table 1. Number of assisted versus unassisted family forest landowners by assistance type.**

Definition	Assisted (%)	Unassisted (%)
Advice (A)	1,239 (34)	2,437 (66)
Management plan (M)	597 (16)	3,079 (84)
Cost-share (CS)	518 (14)	3,158 (86)
Advice and management plan and cost-share	249 (7)	3,427 (93)

Source: National Woodland Owner Survey (2006). The table contains only responses from family forest owners owning one parcel between 10 and 10,000 acres.  $n = 3,676$ .

could distort our characterization of the “typical” family forest owner. Therefore, only records associated with landowners owning between 10 and 10,000 acres were retained in our analysis.

A considerable number of NWOS respondents own multiple forest parcels. The NWOS questions, however, are not parcel specific. That is, landowners are asked to answer each question for all forestland they own in the state. This can be problematic if a respondent owns multiple parcels and manages them differently. For example, a landowner owning several parcels might conduct a commercial timber harvest on one 40-acre parcel and wildlife habitat improvement projects on the remaining six parcels encompassing 360 acres. Yet the data set treats both activities as occurring on all seven parcels and 400 acres. To test whether single parcel landowners are distinct from those owning multiple forest parcels,  $\chi^2$  tests were performed with respect to landowner objectives, landowner concerns, past activities, future plans, and assistance received. The analyses revealed that multiple parcel owners are different from single parcel owners in many respects. For this reason, only NWOS respondents who indicated they own one parcel were included in our analysis.<sup>1</sup>

Removing incomplete records and applying the acreage and parcel criteria decreased the number of NWOS records to 3,676, or about 23% of all of the landowners surveyed by NWOS. We consider this data set representative of US family forest owners who own one forest parcel. The remainder of this article describes our analysis of this subset of NWOS respondents.

We developed multiple definitions of assisted family forest landowners based on the types of assistance they received. The types of assistance we included are commonly associated with private landowner assistance programs. They include landowners who have

- a forest management/stewardship plan;

- received professional advice; and
- received cost-share assistance.

Note that the NWOS treats each form of assistance as a separate, distinct activity. Consequently, it is possible for a landowner to indicate that she or he has a forest management/stewardship plan but has not received professional advice or cost-share assistance.

The number and percent of assisted and unassisted landowners in our data set associated with each landowner assistance definition are listed in Table 1. The percent of landowners receiving assistance ranges from 34% (1,239 landowners who received advice) to 14% (518 landowners who received cost-share funding). Note that landowners can receive multiple forms of assistance. For example, a portion of the 34% of landowners in our database receiving advice also had a forest management plan and/or had received cost-share funds. There were 249 landowners (7%) who had received all three forms of assistance.

Relative probabilities (also known as “probability ratio” and “relative risk”) were used to identify differences between landowners receiving a specific type of assistance and those who have not. We chose to use relative probabilities rather than more sophisticated analytical techniques (e.g., multiple regression) due to NWOS data limitations. Specifically, the NWOS data set does not contain information on several likely predictors of landowner land management actions. Thus, any model examining the relationship between landowner assistance and behavior would omit important predictor variables. Moreover, relative probabilities have substantial virtue in their simplicity and the clear signals that resonate from them with respect to the relationships between landowner actions and various forms of assistance.

Relative probabilities were calculated to examine differences between assisted and unassisted landowners with respect to the six

**Table 2. Description of binary variables from the reduced NWOS data set used in the analyses and percentage of respondents ( $n = 3,676$ ).**

Category/variable	Description	Respondents (%)
Landowner characteristics	This category represents the demographics of the forest landowners.	
Age	Age of the landowner is older than 60. <sup>1</sup>	34
Land characteristics	This category represents the important characteristics of the forestland.	
Parcel size	Size of the forestland parcel owned is >72 acres (median size of forest landholding in our sample).	50
Past activity	This category represents the landowners' activities on their lands in the past 5 yr.	
Improved wildlife habitat	Whether the landowner conducted any wildlife habitat improvements projects.	21
Planted trees	Whether the landowner has planted trees on the property.	27
Reduced fire hazard	Whether the landowner implemented fire hazard reduction projects.	17
Posted against trespass	Whether the landowner posted the land to restrict public access.	45
Harvested timber	Whether the landowner has commercially harvested trees.	63
Collected NTFP	Whether the landowner collected or allowed the collection of nontimber forest products.	24
Leased	Whether the landowner has ever leased the forestland.	14
Conveyed easement	Whether the landowner has conveyed a conservation easement on the forestland.	7
Ownership purpose	This category represents important forest landownership reasons. <sup>2</sup>	
Objective aesthetics	Whether enjoying aesthetic beauty and scenery is an important reason for owning the forestland.	74
Objective timber	Whether the production of timber and other timber products is an important reason for owning the forestland.	23
Objective recreate	Whether recreation (other than hunting) is an important reason for owning the forestland.	46
Concerns	This category represents the landowners' concerns that are affecting the landowners' ability to use their forestlands. <sup>3</sup>	
Development	Whether development of nearby land is a concern for the landowner.	37
Keep land intact	Whether keeping the land intact for their children or other heirs is a concern for the landowner.	53
Future plans	This category represents the landowners' plans about their lands in the next 5 yr.	
Sell	Whether the landowner plans to sell all or some of the forestland.	6
Harvest	Whether the landowner plans to harvest timber on the forestlands.	22
Subdivide	Whether the landowner plans to subdivide parts or all of the forestland.	1
Afforestation	Whether the landowner plans to plant trees.	2
Convert	Whether the landowner plans to convert the forestland to another land use.	3
No plans	Whether the landowner has no plans for the forestland.	28
Collect NTFP	Whether the landowner plans to collect/allow collection of nontimber forest products from the forestland.	11

<sup>1</sup> 60 yr represents the midpoint value of the 10-year age class category most frequently cited by respondents to the 2006 NWOS survey.

<sup>2</sup> The 2006 NWOS survey respondents were asked to rank the importance of the reasons for owning their forestlands on a 1–7 scale, 1 being very important and 7 being not important. This importance scale was converted to a binary variable with a value of 1 assigned if respondents answered 1 or 2 and 0 if respondents answered 3, 4, 5, 6, or 7.

<sup>3</sup> The 2006 NWOS survey respondents were asked to rank their concern on a 1–7 scale, 1 being great concern and 7 being no concern. This scale response was converted to a binary variable with 1 assigned to responses of 1 and 2 (landowner is greatly concerned) and 0 to responses of 3, 4, 5, 6, and 7 (landowner is not concerned).

categories of information about the landowner and/or forestland described in Table 2. Relative probability is the ratio of the probability of two events and is calculated by dividing the probability of one outcome by the probability of a second outcome (see Siström and Garvan 2004 for a discussion of relative probabilities). In this study, relative probabilities indicate the probability that an assisted landowner has undertaken (for some analyses would undertake) an activity or exhibits a characteristic compared with the

probability that a landowner without the assistance has/would undertake the same activity or exhibit the characteristic. A relative probability of >1 indicates a higher likelihood of occurrence (e.g., if the focus is on timber harvesting, a relative probability of 2.0 means landowners receiving assistance are twice as likely to have harvested timber than landowners not receiving assistance), whereas a relative probability of <1 indicates a lower likelihood of occurrence (e.g., a relative probability of 0.5 means landowners

receiving assistance are half as likely as landowners not receiving assistance).

The following information contained in the NWOS database was used to compare and contrast assisted and unassisted family forest owners: landowner characteristics, land characteristics, past land management practices, ownership purpose, landowner concerns, and future plans. These six categories that we thought would distinguish assisted and unassisted landowners were developed based on a review of the literature, an assessment of private forest landowner assistance program objectives, and the information contained in the NWOS database. Several NWOS questions ask landowners to select their responses from a Likert rating scale, with response options typically ranging from 1 to 7 (e.g., 1 = very important and 7 = not important). To conduct the relative probability analyses, we converted these categorical responses to binary response measures of importance.<sup>2</sup> A description of these categories and the variables used in the analysis is found in Table 2.

## Results

Table 2 includes information from the reduced NWOS database ( $n = 3,676$ ) on family forest owners and their forestland. Two-thirds of the landowners were 60 years old or younger at the time of the survey. One-half owned at least 72 acres of forestland, which is the median parcel size in our sample. The majority of landowners had harvested timber (63%), whereas 21% had conducted wildlife improvement projects in the past 5 years. Aesthetics was a primary ownership objective for nearly three-fourths of the landowners, whereas 46% cited recreation as a primary ownership objective (respondents can indicate more than one important ownership objective). Importantly, even though nearly two-thirds had commercially harvested timber, only 23% indicated that timber management is a primary ownership objective. Just over one-third of the landowners were concerned about development occurring near their forestland, and 7% had a conservation easement on their property. Approximately 14% of the landowners had leased their forestland, primarily for recreation purposes. One in five owners (22%) planned to harvest timber in the future, whereas nearly 3 in 10 had no plans regarding the future use or management of their forestland.

**Table 3. Relative probabilities of assisted versus unassisted landowners (the latter defined as not receiving the assistance in question) with respect to land characteristics and landowner characteristics, past practices, objectives, ownership concerns, and future plans.**

Category/variable	Has received advice (A)	Has a management plan (M)	Has received cost-share assistance (CS)
Landowner characteristic			
Age (older than 60 yr)	0.80	0.80	NS
Land characteristic			
Parcel size (>72 acres)	1.60	1.65	1.60
Past activity			
Improved wildlife habitat	2.77	2.43	2.32
Planted trees	2.21	1.91	2.19
Reduced fire hazard	2.18	1.94	1.85
Posted against trespass	1.21	1.23	1.21
Harvested timber	1.33	1.35	1.40
Collected NTFP	1.45	1.25	1.32
Leased	2.10	1.86	2.14
Conveyed easement	1.98	2.21	2.23
Ownership purpose			
Objective aesthetics	NS	1.07	NS
Objective timber	2.24	2.00	2.40
Objective recreate	1.17	1.18	NS
Concerns			
Development	NS	NS	NS
Keep land intact	NS	NS	1.08
Future plans			
Sell	NS	NS	NS
Harvest	3.08	2.71	2.39
Subdivide	NS	NS	NS
Afforestation	3.42	2.39	2.41
Convert	NS	NS	NS
No plans	0.50	0.40	0.51
Collect NTFP	1.84	1.73	1.39

Source: National Woodland Owner Survey (2006). The table only contains landowners owning one parcel between 10 and 10,000 acres.  $n = 3,676$ . Relative probabilities are only reported when  $P \leq 0.05$ . NS, no significant differences between assisted and unassisted landowners.

### Assistance Type and Landowner Characteristics, Attitudes, and Behavior

Table 3 contains the relative probabilities for each of three types of assistance evaluated (i.e., forest management plan, cost-sharing, and advice). The value in each cell indicates the probability that a family forest owner receiving assistance has or would undertake an activity or exhibit a certain characteristic, compared with the probability of a landowner who has not received that same type of assistance. For example, when an assisted landowner is defined as having a forest management plan, an unassisted owner is defined as not having a forest management plan (but may have received cost-share assistance and/or advice). Therefore, these relative probabilities can be interpreted as the relationship between a specific type of assistance and landowner behavior, irrespective of any other assistance the landowner has received (including receiving no assistance whatsoever). Relative probabilities are calculated for landowner and land characteristics, past land management practices, landowner

objectives, ownership concerns, and future plans for each of the three types of assistance.

Family forest owners who had a forest management plan, received cost-share assistance, or received advice are generally two to three times as likely to have carried out several different types of forest management practices relative to landowners who did not receive that particular form of assistance (Table 3). These include having improved forest wildlife habitat (2.32–2.77 times as likely), planted trees (1.91–2.21 times as likely), and reduced wildfire hazard (1.85–2.18 times as likely). The assisted landowners are also 1.21–1.23 times as likely to have posted their land against trespass and 1.33–1.40 times as likely to have harvested timber commercially, compared with landowners who did not receive the assistance.

With respect to ownership objectives, landowners who had a forest management plan are twice as likely to own their land primarily for timber production compared with landowners who did not have a plan (Table 3). The probability that timber pro-

duction was a primary ownership objective increases to 2.24 and 2.40 times if the owner received cost-share assistance or advice, respectively. Yet landowners receiving cost-share assistance or advice are just as likely to have aesthetics as a primary ownership objective as landowners who did not receive each type of assistance.

A landowner's concern about the development of nearby land does not appear to be correlated with whether he or she has received assistance (Table 3). The analysis found that family forest owners receiving specific types of assistance are not different from those without the assistance with respect to their concerns about development pressure surrounding their forestland. Similarly, landowners with a forest management plan or the recipients of advice on how to manage their forestland are not different from the unassisted owners with regard to concerns about keeping their forestland intact for their children or other heirs.

With respect to future plans for their forestland, landowners receiving various types of assistance are not different from landowners who have not received the assistance with respect to their future plans to sell, subdivide, or convert their forestland (Table 3). The assisted landowners are considerably more likely to intend to harvest timber, collect nontimber forest products (NTFP), and plant trees in the future and less likely to have no plan for the use or management of their forestland compared with the unassisted owners.

### Assisted versus Unassisted Landowners

We also evaluated the three types of assistance individually by partitioning the data such that landowners who had received *only one* of these three types of assistance were identified and contrasted with forest landowners who had not received any assistance. In addition, landowners who had received cost-share assistance *and* advice *and* had a forest management plan (i.e., all three forms of assistance) were compared with landowners who had received none of these three assistance efforts (Table 4). These analyses differ from those in the previous section in that assisted landowners here are contrasted with those who had received no assistance whatsoever.

Table 4 contains the relative probabilities for family forest owners receiving only one or all three forms of assistance. Family

**Table 4. Relative probabilities of assisted to unassisted landowners with respect to land characteristics and landowner characteristics, past practices, objectives, ownership concerns, and future plans.**

Category/variable	Has only received advice (OA)	Only has a forest management plan (OM)	Has only received cost-share assistance (OC)	Has a management plan, received advice and cost-share assistance (MCAall)
Landowner characteristic				
Age (older than 60 yr)	0.76	NS	NS	NS
Land characteristic				
Parcel size (>72 acres)	1.39	1.47	1.45	2.01
Past activity				
Improved wildlife habitat	2.42	2.10	1.97	4.39
Planted trees	1.98	NS	1.42	3.19
Reduced fire hazard	1.14	1.65	1.48	2.89
Posted against trespass	1.22	NS	NS	1.30
Harvested timber	1.22	NS	1.31	1.60
Collected NTFP	1.08	NS	NS	NS
Leased	1.77	1.65	NS	3.00
Conveyed easement	1.40	2.46	NS	3.15
Ownership purpose				
Objective aesthetics	NS	NS	NS	NS
Objective timber	1.81	NS	2.09	3.27
Objective recreate	1.18	NS	NS	1.20
Concerns				
Development	NS	NS	0.68	NS
Keep land intact	NS	NS	NS	1.14
Future plans				
Sell	NS	1.97	1.83	NS
Harvest	2.44	NS	2.33	4.69
Subdivide	NS	NS	NS	NS
Afforestation	2.72	NS	3.18	3.74
Convert	1.53	NS	NS	NS
No plans	0.61	NS	NS	0.22
Collect NTFP	1.57	NS	1.59	1.38
<i>n</i>	2,848	2,291	2,329	2,470

Source: National Woodland Owner Survey (2006). The table only contains landowners owning one parcel between 10 and 10,000 acres. Relative probabilities are only reported when  $P \leq 0.05$ . Unassisted landowners are defined as landowners who have received no assistance (no management plan, no cost-share, or no advice). NS, no significant differences between assisted and unassisted landowners.

forest owners who have received cost-share assistance and advice and have a management plan (i.e., heavily assisted) are more (sometimes substantially more) likely to implement practices commonly associated with stewardship (e.g., improve habitat, plant trees, reduce fire hazard, and harvest timber) than landowners who only received one form of assistance. For example, a landowner receiving all three forms of assistance is 4.39 times as likely to improve forest wildlife habitat compared with a landowner who received no assistance. In contrast, the likelihood of undertaking wildlife habitat improvement is only 1.97–2.42 times for a landowner receiving only one form of assistance compared with that of an unassisted landowner. In other words, considerable differences in behavior between assisted and unassisted landowners becomes more apparent after the landowner has received three different types of assistance (having a forest management plan and receiving cost-share assistance *and* advice).

The analysis also shows that regardless of the type of assistance received, assisted landowners are generally no less likely to sell or subdivide their land than those who have not received assistance (Table 4). In fact, landowners whose only form of assistance was a forest management plan or cost-share are nearly twice as likely to have plans to sell their forestland as the unassisted family forest owners.

Also note that there are few distinctions between landowners whose only form of assistance has been a forest management plan and landowners who have received no form of assistance with respect to landowner behavior, concerns, and planned actions. Notable exceptions are having improved wildlife habitat, reduced fire hazard, and plans to sell their forestland. In these cases, landowners with a plan are approximately twice as likely to undertake (or have undertaken) these activities compared with landowners not receiving any assistance.

## Discussion

Our analysis of the landowner and forestland information contained in the 2006 NWOS data set provides several important insights into the similarities and differences between landowners who have received various types of assistance and those who have not. For example, when we compared different types of assistance, family forest owners receiving assistance are more likely to have implemented several types of forest management activities than those not receiving the assistance. These include having improved wildlife habitat, planted trees, and reduced wildfire risk. With respect to future actions, the analysis also shows that recipients of assistance are more likely to have intentions to harvest timber and plant trees in the future than those without the assistance. Many of these actions and intentions are explicit or implicit desired outcomes of federal and/or state forest landowner assistance programs (Comanor 1996, Gaddis 1996, Hamilton 1996).

Our analysis also found that assisted and unassisted family forest owners are generally not different with respect to concerns about development pressure or being able to pass their forestland on as a legacy to their heirs. This latter concern and its potential impact on the future of family forests have been linked to this estate planning issue (Broderick et al. 1994, Catanzaro et al. 2014). In addition, assisted family forest owners are no less likely to sell or subdivide their forestland than unassisted owners. In fact, our data indicate that in some cases landowners who have received assistance are actually more likely to have intentions to sell their forestland than those not receiving the assistance. We note that these findings could be influenced by the small percentage of respondents who have intentions to undertake selling or subdividing their forestland. Nonetheless, such activities are a fundamental issue in terms of the future of family forestland and the future ability to provide greater societal ecosystem service benefits (Sampson and DeCoster 2000, Stein et al. 2009).

With few exceptions, the analysis suggests that the specific form of assistance received by family forest landowners is often inconsequential. For example, when compared with landowners who have not received these forms of assistance, landowners are between 2 and 3 times as likely to improve wildlife habitat on their forestland re-

ardless of whether the assistance they received is a forest management plan, cost-share assistance, or advice. Similarly, assisted owners are more likely to plant trees and to have conducted wildfire hazard reduction projects than their unassisted counterparts. Yet the form of assistance also does not appear to influence landowner actions many might consider undesirable—selling or subdividing their forestland (Stein et al. 2009).

A heavily assisted landowner (one who has a plan and has received cost-share assistance and advice) is more likely to do things commonly associated with forest stewardship (e.g., improve habitat, plant trees, reduce fire hazard, and harvest timber) than those receiving only a single type of assistance. In other words, for some landowner actions, it takes three different assistance activities or an intensity of assistance activities to see large differences between assisted and unassisted owners compared with landowners receiving only a single form of assistance. Although the total benefits increase with additional assistance, what is not clear is how the marginal benefits change with additional assistance effort and type and how marginal benefits change in relation to the marginal cost of providing additional forest landowner assistance.

Finally, when we compared landowners who have a forest management plan (but who have not received cost-share assistance or advice) with those who have received no assistance, few distinctions between these two cohorts exist. For example, landowners who have only received cost-share assistance or advice are more likely to harvest timber and plant trees (both past and planned future activities) than landowners who have received no assistance. Yet landowners whose assistance consists of a forest management plan are no different from landowners who have received no assistance with respect to these same two activities. Recognizing that these findings do not suggest causation between the presence and/or form of assistance and landowner behavior and intentions, we found for unknown reasons that the distinction between assisted and unassisted landowners is greater for those who have received professional advice and cost-share funds than for those with a forest management plan.

## Conclusions

We view this research as making several contributions to the literature. The analysis was the first to use the NWOS database to

assess how various types of assistance are associated with landowner behavior and intentions. To our knowledge, this study was also the first to compare landowners who have received assistance with those who have not and provide the additional insight this comparison affords. In addition, the study examined whether one type of landowner assistance matters more than another—a first in the literature as far as we know. It has also made a contribution by identifying that the intensity or diversity of assistance activities can matter with respect to private forest landowner behavior.

Through this analysis, significant differences between assisted and unassisted landowners were identified, and these differences were found to be largely invariant, irrespective of the type of assistance received. They include characteristics of the owners and the forestland they own, land management practices undertaken, and reasons for forestland ownership. One implication of this finding on private forest management is that linking the landowner to some form of assistance or contact with a professional forester appears to matter, with the specific type less important. It also suggests that foresters may want to look for the most cost-effective way to provide landowners assistance, as well as deemphasize the long-held view that a management plan is needed for initiating family forest owner action (e.g., US Department of Agriculture 2014).

The study found no distinction between assisted and unassisted landowners with respect to their plans to subdivide or sell their land. By recognizing the small number of landowners indicating such plans, this finding is important, yet troubling, in that it signals that certain types of assistance may have minimal effects in stemming trends in forestland conversion, fragmentation, or parcelization. Acknowledging that our analysis did not examine causal relationships between assistance programs and landowner behavior or intentions, we think that such findings should be instructive to administrators of the public landowner technical and financial assistance programs.

The availability of assistance is an important factor motivating forest landowner decisions but certainly not the only one. Other factors found to influence decision-making include economic factors, the primary reasons for forest ownership, owner- and parcel-specific characteristics, and the type and extent of landowner networks (Amacher et al. 2003, Majumdar et al. 2009,

Kittredge et al. 2013). Consequently, to state that all management and stewardship activities occur as a result of assistance efforts or that the lack of actions/behaviors/intentions can be attributed to the absence of assistance, would be overstating the influence assistance programs have on landowner actions. There is a segment of family forest owners who are willing to undertake certain forest management or stewardship activities in the absence of assistance, as well as those who will not undertake these activities even if assistance is made available to them. Additional research is needed to better understand what influences the behaviors and intentions of these types of landowners.

Although the 2006 NWOS data set used in this analysis is the most comprehensive profile of family forest landowner attitudes and behaviors in the United States, it does not specifically identify whether the landowners were participants of specific assistance programs. Only surrogates for assistance program participation (e.g., having a forest management plan, participating in cost-share assistance programs, and receiving professional advice) are identifiable in the database. Consequently, although our analyses identified relationships between assisted and unassisted family forest owners, we were not able to explicitly identify landowners who had participated in specific state or federal assistance programs.

Another limitation of our analysis was the use of information contained in the NWOS data set, which we consider to be quite restrictive with respect to those factors we think could help explain relationships between various forms of assistance and landowner behavior and/or intentions. For example, several likely predictors of a landowner's decision to harvest timber are not contained in the NWOS data set (e.g., timber markets, available logging infrastructure, stand and property characteristics, and a landowner's need to generate significant revenue), which limited our ability to model landowner assistance-behavior relationships. Analysis of the relationship between assistance and landowner action that includes additional predictors of landowner behavior would be a logical next step.

Our analysis was limited to NWOS respondents who own a single forestland parcel, as single and multiple parcel owners in the NWOS data set were found to be distinct in several respects. Further research is suggested to explore why and how single and multiparcel forest landowners are different,

including how these two landowner cohorts respond to various forms of landowner assistance.

Finally, the causal factors that distinguish the behaviors and intentions of assisted and unassisted landowners could not be identified. Data limitations prohibited us from concluding whether receiving assistance, in fact, influenced a landowner's action such as the decision to harvest timber (or vice versa). What we can say is that when differences were found, a landowner's action and a specific type of assistance are correlated. Being able to identify forest landowners who have explicitly participated in private forest owner assistance programs would be a first important step in determining how assistance program participation influenced landowner behavior.

## Endnotes

1. Approximately one-half (~8,000) of all survey respondents did not indicate the number of wooded parcels owned. An additional approximately one-third (~5,400) of respondents indicated they owned two or more unconnected wooded parcels.
2. Landowners who responded 1 or 2 were coded important; all other responses were coded not important. We consider this to be a conservative approach for determining a landowner's response as being "important."

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