



Small-Area Family Forest Ownerships in the USA

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Abstract

Sixty percent of family forest ownerships in the United States of America (USA) own between 0.4 and 4.0 ha (1–9 ac). Yet, little is known about this segment of family forest ownerships because they are often excluded from data collection or analyses. We utilized national data for the USA collected through the National Woodland Owner Survey to examine small-area ownerships, as well as compare attributes of this ownership group to larger-area ownerships. Small-area ownerships are less active than ownerships of greater than 4.0 ha, but not inactive. Approximately 60% of small-area ownerships have undertaken at least one of the following activities in the previous 5 years: harvesting for personal use, treating invasive plants, reducing fire hazards, and reducing unwanted insects/diseases. While 74% of small-area ownerships rate wildlife habitat protection as an important ownership objective, only 11% have undertaken a wildlife habitat improvement project in the previous 5 years. Both small- and large- (> 4.0 ha) area ownership classes are most interested in the amenity aspects of woodland ownership, but small-area ownerships are significantly less interested in ownership for firewood, timber, recreation and hunting on their land than larger ownerships. Neither ownership class is very likely to have received professional advice about their forestland in the previous 5 years, but the percentage of small-area ownerships who have done so is half that of larger-area ownerships. Both area ownership classes want their forestland to remain forested in the future. Our findings suggest needs and opportunities to engage small-area forest landowners, but likely in different ways and on different topics than when dealing with larger-area ownerships.

Keywords Cross-boundary cooperation · Invasive forest plant treatment · National Woodland Owner Survey (NWOS) · Nonindustrial private forest owner (NIPF) · Parcelization · Small-scale forestry

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Introduction

Small-scale forestry has different connotations for different geographies and authors (Harrison et al. 2002; Wiersum et al. 2005). In the United States of America (USA), small-scale forestry is typically interpreted as being synonymous with family forest owners. In reality, though, family forest owners in the USA have a broad range of size of holdings from less than one hectare to many 1000s of hectares. Ironically, the smallest holdings, those that may most be considered “small-scale,” are often excluded from analyses. For example, the focus of most of the results from the USDA Forest Service’s National Woodland Owner Survey (NWOS) has been on ownerships with four or more hectares (Butler et al. 2016a). The number of studies and articles focusing on truly small-scale forest ownerships in the USA is very limited. This manuscript is an effort to help address this shortcoming.

More forestland in the USA is owned by family forest owners than any other ownership group (Butler et al. 2016a, b). Specifically, 117 million hectares, or 36% of the total forest land in the USA, is owned by an estimated 10.6 million family forest ownerships. An important fact that is often overlooked when examining statistics of family forest ownership is that approximately 6.2 million, or 60%, of these are ownerships of between 0.4 and 4.0 ha (1–9 ac) of forestland (Butler and Snyder 2017).

Given that most family forest ownerships in the USA own fewer than 4.0 ha of forest land, and there is the potential for the number of small-area ownerships increasing in the future through processes like forestland parcelization, bequests, and amenity migration (e.g., Abrams et al. 2012; Hatcher et al. 2013; Markowski-Lindsay et al. 2017), we assert there is a growing need to better understand this ownership segment. The collective actions of this segment of forest owners has significant influence on forested lands throughout the country. Yet, our understanding of the attitudes, behaviors and needs of this segment of small-scale family forest owners in the USA is limited because very small acreage ownerships (i.e., fewer than 4.0 ha) are often excluded in data collection efforts or from analyses when examining family forest owners. While the NWOS (Butler et al. 2016c) collects information from family forest owners of at least 0.4 ha, reports and analyses of these data have most often excluded ownerships of fewer than 4.0 ha (e.g., Kilgore et al. 2015; Butler et al. 2016a, 2017). This focus on larger ownerships is not just a feature of research in the USA. For example, studies of family forest owners in Canada (Côté et al. 2015), Finland (Karppinen and Berghäll 2015), Norway (Sjølie et al. 2016), Slovenia (Poje et al. 2016) and Sweden (Lejon et al. 2011; Eggers et al. 2014) excluded ownerships of smaller holdings as well.

Various reasons have been given for excluding small-area ownerships from data collection and analyses, including arguments that they merely constitute large wooded backyards associated with homes, that timber harvesting and other forest management activities are not practical or applicable at this scale, or that this ownership group is not interested in managing their trees or land (Hatcher et al. 2013; Butler et al. 2016a). However, we argue, as have others (e.g., Tyson

et al. 1998; Hull et al. 2004; Downing et al. 2009, Meadows et al. 2018), that these ownerships are important for providing forest-based benefits to the landowners (e.g., opportunities for a rural lifestyle, source of firewood and non-timber forest products) as well as societal benefits (e.g., carbon sequestration, water purification, and access to nature for children).

Small-area ownerships often do not have the same access to government assistance programs or professional service providers as larger-area ownerships in the USA and abroad (e.g., Meadows et al. 2018). For example, the USDA Forest Service's Forest Stewardship Program (FSP) (16 U.S.C. §2103a), which is the primary federal assistance program for private forest owners in the USA, has a minimum acreage requirement of at least 4.0 ha in many states. Likewise, many of the state-level property tax programs for private forestland in the USA also have similar minimum acreage requirements (Kilgore et al. 2017). Finally, forestry service providers may not have the equipment, expertise, desire, business models or incentive to work on small-area ownership forest tracts (Hull et al. 2004; Hull and Nelson 2011).

Given this lack of focus on small-area ownerships in research, policies and service offerings in the USA, the professional forestry community is less equipped to understand and respond to the needs of this private forest ownership segment. To address this information gap, we utilize national data for the USA collected through the NWOS (Butler et al. 2016a, b) to examine characteristics and behaviors of small-area ownerships, as well as compare attributes of this ownership group to family forest ownerships of more than 4.0 ha. The information from this study will be useful to the professional forestry community as they think about how to best interface with this segment of family forest owners. Although the focus of this paper is on small-area family forest ownerships in the USA, the general findings may be applicable to other countries with similar ownership patterns. For ease of discussion, we term ownerships of fewer than 4.0 ha as 'small-area ownerships' and those owning 4.0 ha or more as 'larger-area ownerships' throughout the remainder of this paper.

Background

There is a limited body of literature focused exclusively on small-area family forest ownerships in the USA. One segment of this literature has been geared towards educating and informing small-area ownerships about the benefits, roles and opportunities for their forest land. The 'Woods in Your Backyard' initiative (Downing et al. 2009) provides workshops and a workbook to help small-acreage owners (0.4–4.0 ha) better understand stewardship practices and how they can implement forest and wildlife management on their properties, as well as how they can develop strategies to achieve their ownership goals. While not a formal program, the USDA Forest Service Northeastern Area State and Private Forestry division developed an information booklet and tip sheets ('Backyard Woods') targeted to small-acreage forest ownerships (fewer than 4.0 ha) to assist them in thinking about their forestland and the types of goods and services their lands might provide, and in developing plans and management approaches for their forest land (Majeski et al. 2005).

Another facet of the small-area ownership literature focuses on the service provider industry and the needs, opportunities, and challenges that working with owners of small parcels of forest land presents to foresters and loggers. L'Roe and Allred (2013) interviewed professional foresters in New York State to determine how declining private forest parcel size may be affecting their businesses and whether they are developing services and entrepreneurial approaches to working with small-area ownerships. Their analysis found that while many of the foresters recognized the potential to adapt their business practices to better serve small-area forest ownerships, many felt constrained in their ability to do so and/or disinterested.

Hull and Nelson (2011) examined the rise of a new type of service provider that focuses on providing assistance to small-area ownerships: wildland–urban interface (WUI) forest entrepreneurs. They found that successful WUI service providers tend to either be professionals with logging or forestry backgrounds who are finding creative ways to down-scale and diversify their service offerings or professionals from green industries such as arboriculture or landscaping that are up-scaling the types of services they provide. In either case, these providers are increasingly emphasizing services that highlight amenity, environmental and aesthetic outputs over timber revenues, as well as changing their billing structures, marketing strategies, equipment holdings, and suite of services provided to better meet the needs and circumstances of small-area ownerships.

Finally, there are only a few research studies that have directly queried small-area ownerships in the USA regarding their attitudes, behaviors, and intentions, with authors defining small-area ownerships with varying acreage thresholds. Hull et al. (2004) surveyed private forest owners who had recently purchased forest land of fewer than 20 ha in six urbanizing counties in Virginia, finding that these owners were more interested in the amenity and lifestyle aspects of forest ownership (e.g., seeing wildlife, enjoying the scenery, having privacy, living in a healthy place) than generating income from their land. Despite this emphasis on amenity values, a majority of respondents indicated they were not averse to cutting or pruning trees, or applying herbicides or pesticides on their land if these activities accomplished outcomes like improved wildlife habitat, forest health, or scenic views; privacy; or reduced pests.

Tyson et al. (1998) surveyed small acreage forest owners (1.6–10 ha) in Massachusetts, Connecticut and Rhode Island about their 'woodscaping' practices. Woodscaping was defined as service-oriented practices which included forestry, arboriculture, horticulture and wildlife conservation activities designed to enhance aesthetics, wildlife habitat and recreation rather than to generate wood products. They found that while half of the respondents had undertaken woodscaping-type activities such as cutting or pruning trees for aesthetics, forest health or firewood, only 20% had hired a professional for assistance with such activities, opting instead to undertake such activities themselves.

Outside of the USA, there is also a limited, but growing, body of research on small acreage forest landowners. For example, research in Australia has focused on the rise in ownership of small-acreage (0.5–10.0 ha) amenity properties by 'lifestyle landowners' who acquire rural lands for the scenery, biodiversity and recreational opportunities (e.g., Gill et al. 2010; Meadows et al. 2014, 2018). Often these

properties are purchased by urban or suburban-dwellers who have little experience or knowledge about natural resource and land management practices and who bring new ownership objectives, attitudes and practices that are changing the character and condition of the rural landscape (Meadows et al. 2014). Wiersum et al. (2005) surveyed small-scale forest owners in eight European countries to gather information about their ownership characteristics and management practices, also finding that this segment of landowners increasingly values their lands as an amenity or legacy asset rather than a livelihood resource. Mostegl et al. (in press) examined small-area ownerships across Austria. They found multiple segments of small-area owners, but a willingness across segments to actively manage their land, although mostly using methods that are sensitive to aesthetics and other amenity values. Some studies of small-scale ownerships in developing countries have also been conducted (e.g., Pulhin and Ramirez 2016; Baul et al. 2016; Pokorny and De Jong 2015). However, the differences in tenure, economic and other social systems in developing nations make the comparisons to small-area land owners in the USA and other developed countries less straightforward.

Our research fills a gap in the literature by providing the first nationwide, empirical analysis of behaviors, intentions, attitudes and demographics of small-area (0.4–4.0 ha) forest ownerships in the USA, as well as the first comparative analysis of small-area to larger-area private forestland ownerships.

Data and Methods

The USDA Forest Service Forest Inventory and Analysis (FIA) unit, in conjunction with the University of Massachusetts Amherst, Family Forest Research Center, conducted the 2011–2013 NWOS. A sample of private owners of at least 0.4 ha of forest in the USA were contacted in order to collect data on ownership characteristics, forest characteristics, reasons for owning, ownership history, forest/woodland use, recreation, sources of information, concerns, future intentions, and demographics (Butler et al. 2016a). The survey uses an area-based, probability-proportion-to-size sampling design (Dickinson and Butler 2013) based on the sample design FIA uses for its biophysical inventory (Bechtold and Patterson 2005). Across the USA, 10,092 family forest ownerships responded, with an overall cooperation rate of 52% (Butler et al. 2016a). Of the respondents (who indicated the amount of forestland they own), 8567 were family ownerships of at least 4.0 ha of forestland, and 1025 were family ownerships of less than 4.0 ha. Because the probability of an owner being sampled depended on the size of their ownership, the observations were weighted using state-specific and individual owner-specific data to produce population-level estimates. Butler et al. (2016c) provide a detailed discussion of the NWOS survey and estimation methods. Basic tabular summaries for family forest ownerships with 0.4–4.0 ha (1–9 ac) were published in Butler and Snyder (2017) and summaries for family forest ownerships with more than 4.0 ha (10+ ac) were published in Butler et al. (2016a).

Descriptive statistics and bivariate analyses comparing frequencies of each of the two ownership area classes for a variety of variables in the NWOS were computed.

These two area ownership classes were created from an NWOS question that asked how many acres of forestland the respondent currently owns in the state. Chi square tests, with a p value threshold of 0.05, were used to identify significant differences between area class categories for variables that included reasons for forestland ownership, land management behaviors, intentions, concerns, information needs, demographics, and professional assistance interactions.

Results

Reasons for Forestland Ownership

The primary reasons for small-area ownerships to own their forestland are related to amenity values: enjoyment of beauty, privacy, wildlife habitat and biological diversity (Fig. 1). Fewer than 20% of small-area ownerships rated each of the following ownership reasons as important or very important: hunting, firewood, timber products, or non-timber forest products. Larger-area ownerships likewise rated amenity values as most important. While recreation, hunting, firewood, timber products, and

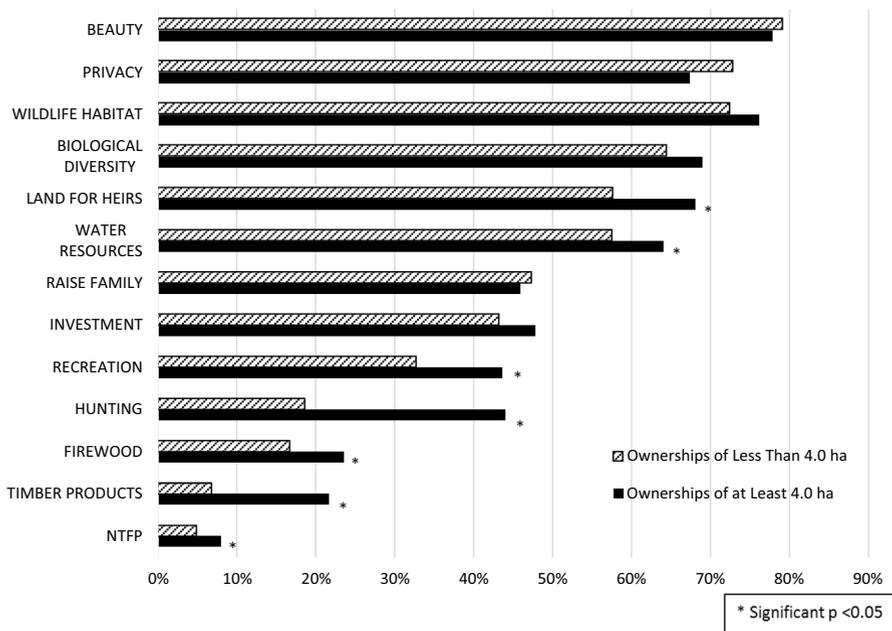


Fig. 1 Percentage of family forest ownerships in the USA by reasons for owning by ownership area class. The independent variables describing ownership objectives were created from an NWOS question which asked the respondent to rate the importance of each ownership objective on a 5-point Likert scale with response options ranging from very important to not important. For the bivariate analyses, a binary variable was created by combining those who who responded an ownership reason was very important or important (1) and comparing to the rest (0)

non-timber forest products objectives were less important ownership reasons than amenity reasons for larger-area ownerships too, they were still more likely to be rated as higher importance than by the small-area ownerships ($p < 0.05$). In sum, respondents in both ownership area classes hold multiple and diverse reasons for forestland ownership. Amenity-based ownership reasons rate highly regardless of ownership area class, but ownership reasons related to products from and recreational use of the forestland are rated as important more often by the larger-area ownerships.

Land Acquisition, Land Tenure and Attitudes Towards Forestland Retention

For small-area ownerships, acquisition through purchase was the most common way they acquired their forestland, with fewer than 20% having inherited any of their forestland (Table 1). Small-area ownerships have tended to own their forestland for a considerable amount of time, with 1987 being the average year of land acquisition, and 60% having owned their land for at least 30 years. Their forestland is important as a place of residence, with approximately three-quarters of small-area ownerships

Table 1 Bivariate analyses of characteristics related to land acquisition, tenure, residences and attitudes towards forestland retention: percentage of family forest ownerships in the USA

Independent variable	n	Ownerships of less than 4.0 ha (%)	Ownerships of at least 4.0 ha (%)	<i>p</i>
<i>Land acquisition and tenure</i>				
Purchased forestland	9490	82	75	0.0122
Inherited forestland	9490	17	31	<0.0001
Owned forestland at least 30 years	8988	60	57	0.4114
<i>Residence type</i>				
Primary residence on forestland	9531	76	63	<0.0001
Cabin on forestland	9587	10	16	<0.0109
Own land that is farmed/ranched within 0.4 ha of forestland	9568	12	32	<0.0001
<i>Attitudes towards forestland retention</i>				
Likely to sell or transfer land in next 5 years ^a	9479	13	14	0.6205
Want my forestland to stay forested ^b	9380	86	86	0.8907
Would sell my land if offered a reasonable price ^b	9219	27	23	0.1038

^aThe NWOS question asked the respondent how likely they were to sell or give away their forestland in the next 5 years. The 5-point response scale ranged from extremely likely to extremely unlikely. For the bivariate analyses, the extremely likely and likely responses were combined (1) and compared to the remaining 3 response options which were also combined (0)

^bThe NWOS question asked the respondent how much they agreed with statements about keeping their forestland wooded and selling their land if offered a reasonable price. The 5-point response scale ranged from strongly agree to strongly disagree. For the bivariate analysis, the strongly agree and agree responses were combined (1) and compared to the remaining 3 response options which were also combined (0)

having a primary residence on their land and 10% reporting a vacation home on their forestland. A minority of small-area ownerships (12%) own a farm or ranch near their forestland. Nearly 90% have a desire to keep their forestland forested, rather than selling or transferring it in the near-term. Approximately one quarter of small-area ownerships report that they would sell their forestland if offered a reasonable price, and 12.7% indicate a likelihood of selling or transferring their land in the next 5 years.

The percentage of larger ownerships which had acquired forestland through inheritance was almost twice as large when compared to the small-area ownerships ($p < 0.0001$). As with the small-area ownerships, the forestland of larger ownerships is also very important as a place of residence, but not as common as for the small-area ownerships. Specifically, the percentage of larger ownerships with their primary residence on their forestland was 14 percentage points lower ($p < 0.0001$) than small-area ownerships, while the percentage of larger ownerships with a ranch or farm near their forestland was more than double that of the small-area ownerships ($p < 0.0001$). Both ownership area classes share similar attitudes with regard to their desire to keep their wooded land wooded and low likelihood of selling or transferring their wooded land in the near term.

Land Management Activities

Respondents were presented a list of 11 land management activities and asked to indicate which, if any, they had undertaken in the previous 5 years (harvested trees for personal use, reduced invasive plants, reduced fire hazard, reduced insects or disease, improved wildlife habitat, collected non-timber forest products, conducted trail work, grazed livestock, conducted roadwork, conducted a controlled burn, conducted a commercial timber harvest). Although there was not a single activity that had been undertaken by a majority of small-area ownerships, most had done at least one of these 11 activities in the past 5 years. In general, rates of implementation of each activity were fairly low across all of the queried activities for both ownership area classes. Only two activities had both been undertaken by more than 20% of the small-area ownerships, and three by the larger ownerships (Fig. 2). The most frequently reported activity by small-area ownerships was harvesting trees for personal use (36%). Approximately one-quarter of small-area ownerships undertook removal or treatment of invasive plants. Aside from these two activities, small-area ownerships reported low rates of implementation for the rest of the activities, ranging from 16% who reduced fire hazard to 4% who undertook a commercial timber harvest. Further, approximately one-third of small-area ownerships reported that they had not undertaken any of the 11 management activities in the past 5 years.

As with the small-area ownerships, the two most commonly implemented activities by larger-area ownerships were harvesting trees for personal use and invasive plant removal and treatment activities. Higher percentages of larger ownerships than small-area ownerships had undertaken seven of the activities, including improving wildlife habitat ($p < 0.0001$), gathering non-timber forest products ($p = 0.0097$), trail work ($p < 0.0001$), grazing ($p < 0.0001$), road work ($p < 0.0001$), conducting a

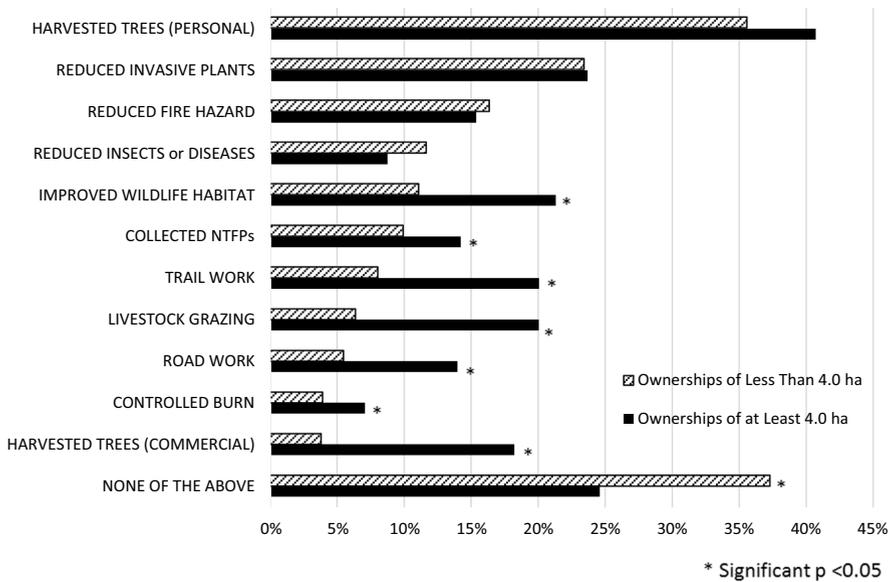


Fig. 2 Percentage of family forest ownerships in the USA who undertook management activities in the previous 5 years by ownership area class

controlled burn ($p=0.0115$) and commercial timber harvest ($p<0.0001$). The percentage of larger ownerships that were inactive; e.g., had not undertaken any of the activities, was approximately 25%, which was less than the percentage of inactive small-area ownerships ($p<0.0001$).

Recreational Use

A majority of ownerships in both area classes have pursued recreational activities on their forestland in the previous 5 years (Table 2). Specifically, more than half of small-area ownerships report that they or their spouse have recreated on their forestland in the past 5 years. Recreational opportunities on small-area ownerships are also extended to other groups, in percentages ranging from 42% of the ownerships' children to 24% of their neighbors. The two highest-reported recreational activities that occurred on small-area ownerships (by the owners and/or anyone permitted to use the forestland) were hiking (73%) and hunting (46%). Rates of occurrence of the other queried activities were considerably lower, ranging from 15% of small-area ownerships which had participated in/allowed either camping or off-highway vehicle (OHV) use to 6% for skiing.

Greater percentages of larger-area ownerships recreated on their land and/or allowed others to recreate on their land than small-area ownerships. For example, two-thirds of owners and their spouses recreated on their forestland ($p=0.0003$) and more than half of the ownerships' children ($p<0.0001$) and friends ($p<0.0001$) did as well. The

Table 2 Bivariate analyses of family forest ownerships who have recreated on their forest land in the previous 5 years and the type of recreation pursued: percentage of family forest ownerships in the USA

Independent variable	n	Ownerships of less than 4.0 ha (%)	Ownerships of at least 4.0 ha (%)	<i>p</i>
<i>Who has recreated</i>				
Owner or spouse	9621	56	66	0.0003
Children of owner	9251	42	56	<0.0001
Friend of owner	9251	37	53	<0.0001
Family member of owner	9251	30	43	<0.0001
Neighbor of owner	9251	24	33	0.0015
<i>Type of recreation</i>				
Hiking	7356	73	64	0.0143
Hunting	7356	46	79	<0.0001
Camping	7356	15	19	0.1298
OHV riding	7356	15	35	<0.0001
Fishing	7356	13	24	<0.0001
Horseback riding	7356	11	14	0.2651
Biking	7356	9	7	0.2292
Skiing	7356	6	10	0.0132

activity that the highest percentage of large-area ownerships participated in/allowed was hunting (79%), which was a significantly higher rate of participation than for small-area ownerships ($p < 0.0001$). Rates of participation were also higher for larger-area ownerships for four other activities (hunting, fishing, OHV riding, skiing) and lower for one activity (hiking). Thus, while some recreational pursuits may require or benefit from larger forest holdings, others may be invariant to holding size.

Participation in and Attitudes Towards Government-Sponsored Programs

Neither ownership area class reported high levels of participation in government-sponsored landowner assistance programs, although the percentage of participating small-area ownerships was significantly less than the percentage of larger-area ownerships for all of the programs (Table 3). Fewer than 3% of small-area ownerships participated in any of the queried programs, with enrollment in a preferential property tax program garnering the highest percentage of participation (2.8%) and green certification the lowest (0.4%). The highest rate of participation in any of the programs by larger-area ownerships was in preferential property tax programs (17.4%), with green certification garnering the lowest rates of participation (2.3%).

Professional Advice and Information

Less than 10% of small-area ownerships had received information or advice on the care, management or protection of their forestland in the previous 5 years (Fig. 3).

Table 3 Bivariate analysis of family forest ownerships that have participated in a government assistance program by ownership area class: percentage of family forest ownerships in the USA

Independent variable	n	Ownerships of less than 4.0 ha (%)	Ownerships of at least 4.0 ha (%)	p
Enrolled in a preferential property tax program for wooded lands	8270	3	17	<0.0001
Placed an easement on wooded land	8485	1	3	0.0386
Used a cost-share program to establish or manage wooded land	9089	1	9	<0.0001
Green certified wooded land	7007	0.4	2	0.0362
Management plan	9366	4	13	<0.0001

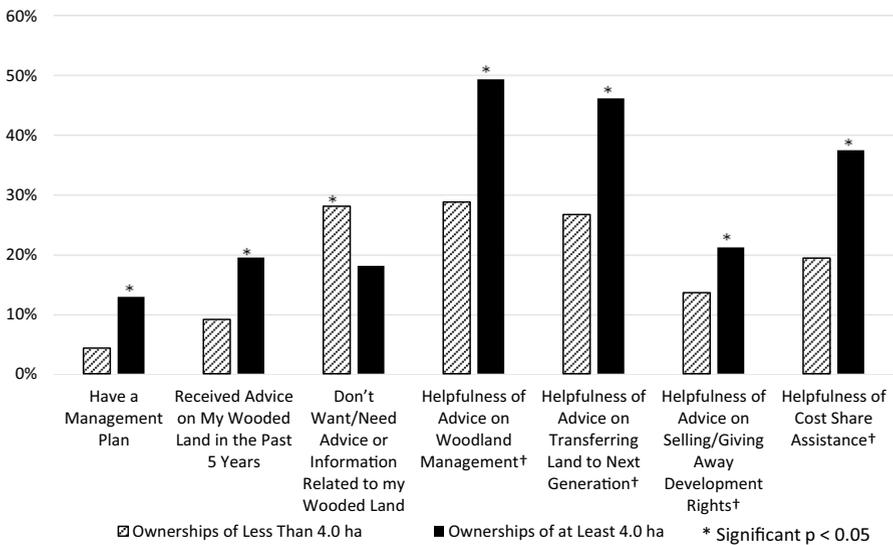


Fig. 3 Bivariate analysis of percentage of family forest ownerships in the USA on questions related to receipt of and helpfulness of advice, information, and assistance on their forestland. †The NWOS question asked the respondent how helpful each of the following advice or assistance topics would be to them. The response scale ranged from very helpful to of no help. For the bivariate analysis, the very helpful and helpful responses were combined (1) and compared to the other 3 response options (0)

Further, approximately one-quarter of small-area ownerships indicated that they do not want or need information or advice for their forestland, and <5% have a written management plan for their forestlands. When queried about the helpfulness of different assistance or advice topics, small-area ownerships reported fairly low levels of interest. For example, the percentage of small-area ownerships who indicated an assistance topic was helpful or very helpful ranged from a high of 29% for advice on woodland management to a low of 14% for advice on selling or giving away development rights.

In comparison, a greater percentage, but still a minority, of larger-area ownerships had received advice (20%, $p < 0.0001$), have a management plan (13%, $p < 0.0001$), and view various topics to be potentially helpful to them than small-area ownerships. For example, approximately 50% rate both advice on woodland management and advice on transferring land to the next generation to be helpful to them ($p < 0.0001$), while 21% view advice on selling/giving away development rights to be helpful ($p = 0.0071$). Overall, small-area ownerships have received less professional advice and information and perceive the queried advice topics for their forestland to be less helpful than larger-area ownerships, although this could be a function of the specific topics that were included on the survey. However, small-area ownerships *did* show willingness to receive information about their forestland, given that just 25% indicated they had no need or interest in such information.

Demographics

Of the demographic variables examined, no statistically significant differences were found between the two ownership area groups (Table 4). Specifically, both groups tend to be older, affluent, white males. Approximately half of both ownership area classes have a college degree (associate's degree or higher), and the majority have a household income of at least \$50,000.

Discussion

Not Passive Owners

In general, small-area ownerships are less active than larger-area ownerships, but not inactive. Approximately 60% of small-area ownerships had undertaken at least one of the following activities in the previous 5 years: harvesting for personal use, invasive plant treatment, reducing fire hazard, and reducing unwanted insects/diseases. Thus, it is a misconception to assume that small-area ownerships are not doing any land management or that they should be ignored when developing programs, assistance and outreach activities designed to promote management of their forestlands.

Table 4 Bivariate analysis of family forest ownerships associated with demographic characteristics: percentage of family forest ownerships in the USA

Independent variable	n	Ownerships of less than 4.0 ha (%)	Ownerships of at least 4.0 ha (%)	<i>p</i>
Associate degree or higher	7514	49	48	0.7344
Income of \$50,000 or more	6683	66	60	0.0880
GE 65 years old	7435	39	44	0.1833
Retired	7539	45	52	0.0639
Male	7504	74	79	0.1026
White	7393	97	96	0.7737

Our findings are consistent with research on small amenity ownerships in Australia which found that owners are often interested in being environmental stewards and actively managing their lands in order to improve the property's aesthetics and value, control weeds and erosion, enhance habitat, and create recreational opportunities (e.g., Meadows et al. 2018). However, as was found by Meadows et al. (2018), some of the activities that small amenity ownerships undertake, such as the planting of non-native or invasive species, either inadvertently or purposefully, may not have ecologically desirable outcomes. They further note that some actions that amenity landowners undertake are borne out of a lack of knowledge or experience with forest management (e.g., poor site selection or preparation when planting), while other activities are motivated by values and ethics shaped by urban and suburban experiences (e.g., clearing understory vegetation to create 'tidy' appearance). So while it is encouraging that small-area ownerships are willing to undertake land management activities, it is important to encourage and enable them to seek and utilize credible sources of ecological information so that their land management activities have beneficial and successful outcomes. Our findings are also consistent with research from Austria (Mostegl et al. in press) where owners were not adverse to management, but the activities needed to be compatible with their overriding ownership objectives, such as aesthetics.

Of note was that the second most-common activity, among both ownership area classes, was treatment or removal of invasive plants. Given that ownerships are undertaking invasive plant activities in higher percentages than many other management activities, it would be important to learn more about what motivates ownerships to undertake this specific activity and whether treatment of invasive plants is or could serve as a gateway for additional learning and stewardship of their forestland. Invasive plants also have important implications for cross-border cooperation due to limitations of treating invasives on only one side of a property boundary.

The activity that the smallest percentage of small-area ownerships had undertaken was commercial harvesting, with 4% of these ownerships having harvested in the past 5 years. This finding is partially due to the fact that there are often long intervals between harvests and the more forestland owned, the more likely it is to have mature timber, but another reason posited is that it may be difficult to attract the services of professional foresters and loggers on small tracts of forestland. As has been documented in the literature, harvesting costs per acre increase as tract size decreases (Cubbage 1982, 1983; Greene et al. 1987). While research has found that some logging companies may be making efforts to adapt to working on smaller parcels (Rickenbach and Steele 2006; Moldenhauer and Bolding 2009), little empirical data exist to indicate whether loggers are able or willing to cost-effectively provide services for parcels of less than 4.0 ha. The viability of commercial harvesting remains an important topic of inquiry relative to small-area ownerships.

While our data suggest there is greater unmet opportunity to encourage small-area ownerships to be active forest owners, there also may be greater resistance and challenges. As noted by Dwyer and Childs (2004), owners of small forestland holdings may not recognize their land as a natural resource to be managed or even identify themselves as a forest landowner. Absent this recognition, it may be harder to motivate small-area forest owners to see themselves as having a specific role as a

forestland steward. Research is needed to explore this question, as well as what catalyzes a small-area ownership to first begin to take actions to manage and steward their forestland and to persist in these activities.

Disconnect Between Ownership for Habitat Protection and Actions to Improve Habitat?

A majority of both ownership area classes value their forestland for the wildlife habitat it provides. However, small-area ownerships are not doing much, or nearly as much, as larger-area ownerships to support or improve wildlife habitat. That is, while 74% of small-area ownerships reported that protection of wildlife habitat was an important forest ownership objective for them, only 11% of them have undertaken a wildlife habitat improvement project in the previous 5 years and 27% intend to do so in the next 5 years. These findings suggest a potential disconnect between habitat ownership objectives and habitat enhancement activities by small-area ownerships. Reasons for this lack of activity around habitat could be many; e.g., small-area ownerships may not know what to do to improve or support wildlife habitat, may not think they actively need to do any forest management in order to support wildlife habitat, may not consider habitat improvement projects as viable or cost-effective on small properties, or may not be aware of or eligible for cost share assistance to undertake habitat improvement. As Eriksen and Gill (2010) document, in spite of professed environmental attitudes, a behavioral gap can occur between awareness and actions where a landowner's (lack of) actions are inconsistent with their stated knowledge, awareness or concern about an issue. Regardless of the reason(s), small-area ownerships may benefit from the development and/or marketing of services, outreach materials and assistance programs for wildlife habitat improvement projects specifically focused on small tract sizes. Moreover, consideration could be given to whether small-area ownerships have interest in participating in programs designed to encourage habitat conservation on their lands, and identifying the features and benefits that they might desire from such programs. As an example, it was found that participants of the Land for Wildlife program, a voluntary conservation program in Australia that encourages private landowners to provide wildlife habitat on their properties, are not necessarily seeking financial assistance to undertake habitat activities. Rather, they find personal satisfaction in posting signage on their property indicating they are a participant in the program as a visual cue to others of their stewardship ethic (Prado et al. 2018).

Less Interest in Information, Assistance or Services?

While ownerships across both area classes are not very likely to have received professional advice about their forestland in the previous 5 years, the percentage of small-area ownerships who have done so is half that of the larger-area ownerships. However, only 25% of small-area ownerships indicate they have *no* information or advice needs about their forestland. Several things might explain the small percentage of small-area ownerships who have availed themselves of professional advice,

information and assistance despite their apparent interest in information and assistance. One explanation for the low incidence of seeking professional advice is that small-area ownerships may not be interested in the types of services and information typically being offered by the professional forestry community. Forest management plans, with their focus on commercial harvesting, which are often the cornerstone of services offered by forestry professionals, may be of little appeal or relevance to small-area ownerships. Mistrust of government is another factor that can dissuade some landowners from seeking professional assistance specifically from government organizations and its representatives (e.g., Meadows et al. 2018). Further, a segment of small-area ownerships, and likely larger-area ownerships as well, are 'do-it-yourselfers' who do not want assistance or to employ service providers (Tyson et al. 1998; Meadows et al. 2018). Research increasingly has indicated that peer networks are primary sources of information and channels for learning for family forest landowners (Kueper et al. 2013; Ikutegbe et al. 2015). If traditional professional forestry services do not appeal to segments of small-area ownerships, they might still engage in and benefit from information exchange through their peer networks, peer-mentoring, experiential learning, field days, or visits to demonstration projects on small-acreage ownerships (Cooke and Lane 2015; Meadows et al. 2014, 2018).

Davis and Fly (2010) found there can be conceptual mismatches in how forest owners view the types of activities they undertake on their land versus how forestry professionals view such activities. That is, some owners may believe they are undertaking forest management when they conduct activities such as individual tree removal to enhance aesthetics; planting of fruit trees; or building fences, drainage ditches or ponds; activities that Davis and Fly (2010) characterize as property maintenance rather than forest management. They surmise that the segment of forest owners with these views may be uninterested or resistant to traditional forestry outreach, education and programming if they already feel they are undertaking activities that constitute forest management. Moreover, we suggest that the types of activities Davis and Fly (2010) identified, as well as actions like planting food plots or pollinator gardens, constitute important acts of stewardship and connection with one's forestland which could serve as entry points to further learning and management of their forestlands and engagement with professionals.

Program Participation: Less Opportunity or Less Interest?

Participation in government landowner assistance and conservation programs is low for both ownership area classes, but lower for the small-area ownerships. Part of the explanation for lower rates of participation in programs by the small-area ownerships is that they are ineligible for some of the programs based on their area of forestland owned (Kilgore et al. 2017). Thus, we cannot readily discern from these data whether participation is lower due to ineligibility, as opposed to a greater lack of awareness or disinterest in participation. However, previous research has suggested that small-area owners might not find the focus, benefits and/or program elements very appealing or in alignment with their ownership goals (e.g., D'Amato et al. 2010).

Only a small percentage of family forest ownerships have a management plan for their forestland. While the percentage of larger-area ownerships with a management plan is also fairly low, it is nonetheless higher than the percentage of small-area ownerships who have a plan. It could be argued that typical forest management plans, with a focus on harvesting, may not appeal to most small-area ownerships and some may argue that they are not particularly germane for many of the larger-area ownerships either given high landowner interest in amenity ownership reasons. Moreover, small-area ownerships may not see the benefits of a plan justifying the expense or requirements of obtaining one. Another explanation for low rates of management plan development for small-area ownerships may be that service foresters are not targeting them as a segment to work with to develop a plan. One of the main emphases of the Forest Stewardship Program (FSP) in the USA is assisting landowners in developing management plans, with a trend towards targeting larger forestland ownerships for plans (Butler et al. 2014), which allows for impacts on a greater acreage per ownership contacted. Thus, it is unlikely that small-area ownerships would be a primary focus of FSP plan writers. Given that having a management plan is often a requirement to receive financial and technical assistance, small-area ownerships are at a disadvantage to avail themselves of government-funded assistance programs.

Since small-area ownerships do not have access to the same assistance or service provider opportunities as larger-area ownerships, nor have they availed themselves of professional advice to the same degree, it raises the question of whether small-area ownerships could be enticed to undertake a broader suite of land management and stewardship activities if they had more assistance, outreach and educational offerings targeted specifically to them? However, Eriksen and Prior (2011) assert that it is important to recognize that “predictable changes in behavior do not necessarily result from increased knowledge or community education.” Thus, it is too naive to simply assume that ‘educating’ a small-area ownership about what they should or could do on their land will result in behaviors that are ecologically, economically or societally optimal. While both of these issues are in need of additional study, we suggest that simply providing more of the same type of information and program offerings through the same methods of delivery as that developed for larger-area ownerships is unlikely to achieve significant success.

Conclusions

Our analyses show that small-area ownerships in the USA are similar in some important ways to larger-area ownerships; e.g., they are more interested in the amenity aspects of owning forestland, they have not participated in government-assistance programs to a great degree, and they do not often seek advice or the services of forestry professionals, however, they care about their forestland and would like it to remain forested in the future. It may be tempting as a professional forestry community to focus our attention on larger-area ownerships because we can achieve a bigger impact on the landscape with these landowners. However, with increasing pressures associated with forestland parcelization, conversion, development, and landscape-scale disturbance factors, we argue that greater

attention to and interaction with ownerships across the continuum of size classes by forestry professionals could help maintain the flow of goods, services, and benefits from these lands. Given the large number of small-area ownerships on the landscape, the ramifications of not actively focusing attention on them as an important segment of forestland owners in the USA could be substantial. While individual small-area ownerships may not support the same magnitude of benefits as larger-area ownerships, the loss of forest-based benefits, such as recreational pursuits and access, that would occur in aggregate if small-area ownerships are lost to conversion are substantial. For example, where would these individuals and their children, friends, and neighbors recreate if small-area forestlands were lost? Would this signal increased demand and crowding on public lands or simply a loss of opportunity to spend time in nature and its associated physical and mental health benefits?

We also suggest that there are areas in the landscape in which concentrations of these small-area ownerships are likely to be found (e.g., rural amenity areas) where the ability to accomplish landscape-scale goals may increasingly require interfacing with this segment of forestland owners and where cross-boundary collaboration may be vital. To be sure, dealing with small-area ownerships has its challenges and may call for unique outreach approaches, niche service providers, and assistance tools and programs focused specifically on small-area ownerships. Work is also needed to help small-area ownerships view themselves as owners and stewards of a natural resource that can be managed for the benefit of themselves as well as society.

A segment of entrepreneurial forest service providers is emerging that focuses on small-area forest owners. As suggested by several authors (Tyson et al. 1998; Hull et al. 2004; Hull and Nelson 2011), to be successful in working with this type of landowner, forestry service providers need to be able to provide 'boutique' forestry services that require a willingness to adopt a different business model and undertake a different array of activities that blend arboriculture and landscaping with traditional forest management activities. Challenges remain though, and these entrepreneurial forest providers are far from the norm. We suggest analyses such as ours that are specifically focused on small-area ownerships could assist service providers in better understanding these landowners.

Small-area ownerships have an important role to play in the provision of ecosystem services at the landscape scale. However, fulfilling this role will call for significant cross-boundary cooperation and/or a shift in perspective on the role that small-area ownerships could play in supporting landscape-level benefits. Research on collective action among family forest owners, however, suggest that challenges exist related to differences in landowner capacity, ownership goals, trust, social capital and desire for privacy and individuality (Kittredge 2005; Rickenbach et al. 2011; Fischer and Charnley 2012; Meadows et al. 2013). Yet, opportunities may exist, too, in that owning small tracts of forestland and living on one's land, as small-area ownerships are likely to do, may afford greater familiarity with their neighboring landowners, as well as potentially more manageable individual tasks in addressing landscape-scale issues. Our research shows that small-area ownerships are not averse to undertaking invasive plant treatments or reducing wildfire risk on their own properties. Thus, an important step will be to

explore how these individual actions might be catalyzed into broader, landscape-level approaches to address threats and pests through coordination with other forest owners, small and large.

Future Research

There is much we have yet to learn about small-area family forest owners. As one example, little is known about the spatial distribution of the small-area ownerships across the landscape in the USA. It is likely that assemblages of small-area ownerships may be found in specific places on the landscape: around urban and urbanizing areas as a consequence of increasing development, fragmentation and parcelization; and proximate to amenity features on the landscape such as lakes, rivers, and open spaces (Abrams et al. 2012). Where spatial clusters of small-area ownerships do exist, then this may present opportunities for service providers to aggregate services and activities across neighboring ownerships which could potentially reduce costs to both landowners and service providers. Moreover, it would be instructive to evaluate whether areas on the landscape with concentrations of small-area ownerships have different ecological conditions (e.g., land cover, dominant tree species, presence of invasive species) than surrounding properties in the landscape matrix to examine the question of whether small-area ownerships are agents of change on the landscape and/or are engaging in ecologically desirable and effective land management activities (Meadows et al. 2018). Research that explores what facilitates and inhibits provision of cross-boundary services to small-area forest owners; whether the rise of entrepreneurial, small-scale forestry service providers has been effective at filling the perceived service gap; and whether small-area ownerships are actually utilizing the services of these professionals would all provide insight into supply-side issues.

Given the development of outreach programs focused on small-area family forest owners (e.g., Backyard Woods, Woods in Your Backyard), research that examines participation and outcomes associated with these programs could be useful in furthering our understanding of whether such targeted programs are meeting the needs of this segment of family forest owners.

Finally, our findings relative to small-area ownerships are embedded within the political, ecological and cultural landscape of the USA. Complementary studies conducted in Australia (Meadows et al. 2014) and Austria (Mostegl et al. in press) suggest implications are consistent, but parallel and comparative analyses which explore behaviors, attitudes, intentions and values of small-area forest ownerships in additional countries would be valuable and add to our collective understanding of what it means to be a small-area family forest owner.

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