



Does having a hunter identity influence land management behaviors of family forest owners?

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ABSTRACT

Hunters are often assumed to possess conservation and stewardship values. Research on whether these values translate into active land management is scant and inconclusive, particularly as it relates to family forest landowners (FFOs). We examined how strength of deer hunter identity is associated with land management behaviors and intentions of FFOs in Wisconsin. While identity as a construct has been found to inform behavior, the relationship between hunter identity and land management behaviors has not been examined. We found higher average hunter identity scores were associated with respondents who had cut trees for personal use, planted native seeds, developed/maintained trails or roads, have a management plan, participated in state landowner programs, and those with intentions to cut trees for sale, personal use, or to improve forest conditions; remove built-up plant material; conduct trail or road work; and jointly plan with others to enhance habitat for game species or motorized recreation.

KEYWORDS

Forest management; human dimensions; identity theory; non-industrial private forest (NIPF); stewardship

Introduction

Hunters are often framed as having a conservation or stewardship ethic beyond their own self-interests in hunting. This belief assumes that hunting “promotes stewardship values in individuals through exposure to, and interaction with, wild things and wild places” (Holsman, 2000, p. 808). Hunters implicitly support wildlife and habitat management through their purchases of hunting licenses, which provide most fish and wildlife agency budgets in the United States (Holsman, 2000). Hunting participation has been included in numerous wildlife value orientation studies that support agency planning processes in the United States (e.g., Bright et al., 2000; Whittaker et al., 2006) and beyond (e.g., Kaczensky, 2007). These studies are usually wildlife-action specific, however, and pertain mostly to wildlife management actions for different segments of the public. Hunting, or having a positive attitude toward hunting, can help predict what public policies, management actions or interventions are deemed acceptable (e.g., Jacobs et al., 2014). Because wildlife conservation program budgets and conservation goals are dependent upon hunting and hunters, research examining motivations for participating (or not) in hunting is also prevalent (e.g., Enck et al., 2000; Ryan & Shaw, 2011).

The literature has not examined whether family forest owners (FFOs) who participate in hunting engage in stewardship (conservation or land management activities) on their own land,

although there are exceptions. Given that FFOs control 36% or 117.4 million ha of forestland in the United States (Butler et al., 2016b), and 54% of that woodland area is controlled by owners with hunting ownership objectives (Butler et al., 2016a), their land management behaviors have an important imprint on the landscape. In this exploratory research, we examined the relationship between the strength of self-reported deer hunter identity among Northern Wisconsin FFOs and their land management and stewardship behaviors and intentions. Wisconsin is a good geographic context to study this topic, as 64% of FFOs (who control 69% of the family forest-owned wooded area) rate hunting as an important reason for woodland ownership (Butler et al., 2016a). Understanding prevalent land management behaviors among FFOs with a hunter identity can inform the development, framing and delivery of programs and services designed to encourage forest management and conservation activities.

Literature Review

Framing: Hunters as Stewards

Holsman (2000, p. 811) critiqued the framing of hunters being more stewardship-oriented than others, stating that economic support of wildlife agencies is not really a result of “a conscious and willing donation made by hunters to support wildlife management . . . To draw a comparison, I do not renew [my] vehicle registration . . . because of my desire to be a steward of road maintenance and construction: I do it because it’s the law.” To engage in self-interested behavior (hunting), hunters have no choice but to support conservation programs. Holsman (2000) reviews studies of hunters’ attitudes and behaviors, along with a comparison of stewardship values among three groups – including hunters – based on his own survey research. Hunters had similar stewardship values to non-consumptive wildlife recreationists. There was a positive correlation between hunters’ participation in non-consumptive recreational activities and their stewardship values. What role do hunters play, then, when land management and conservation choices are optional and apply to one’s own land? The literature is sparse and the findings inconsistent. For example, Brook et al. (2003) found that consumptive recreationists were less likely to allow actions on their land related to protecting an endangered species than those who were not. When self-interested behaviors are examined, however, private landowners in North Carolina who hunted, or had family members who hunted, engaged in wildlife management activities on their land more than those who did not (Golden et al., 2013). Even regarding self-interested behaviors related to managing populations and the landscape supporting game animals, Gamborg et al. (2019) found few differences between landowners with consumptive values and others. In contrast, Primdahl et al. (2012) found that non-hunters in Denmark managed their land in more “game-friendly” ways than hunters. The relationship between hunting and land management activities including those that were not wildlife-related was also examined in Denmark (Lund & Jensen, 2017). Those who hunt or lease land to hunters owned larger parcels and engaged in more land management activities per hectare than those who did not (Lund & Jensen, 2017).

Family Forest Owners with Hunting Objectives

The influence of being a hunter, or being supportive of hunting, has been studied via FFO typologies. While evidence of a discrete hunter-FFO type in the literature was not found, owning land to actively hunt on it or generate income from hunting lease fees is an element

in many FFO typologies (e.g., Boon et al., 2004; Butler et al., 2007; Hujala et al., 2013; Janota & Broussard, 2008; Majumdar et al., 2008; Ross-Davis & Broussard, 2007; Salmon et al., 2006). For example, Ross-Davis and Broussard (2007) found that ‘passive forest owners’ had lower forestland ownership motivations related to hunting and fishing than the other two identified owner types in their typology (‘forest managers’ and ‘new forest owners’). However, none of these segmentation or clustering studies directly examined relationships between hunting/hunter characteristics of FFOs and their land management behaviors.

When hunting/hunter characteristics have been included as explanatory variables in models predicting FFO behaviors or intentions, they have most often been represented through an ownership objective. In the Floress et al. (2019) meta-analysis of FFO behavior, owning land for hunting purposes was not a statistical predictor of behavior in most of the studies. When it was significant, it tended to be positively rather than negatively associated with an action.

The sparse literature on the influence of hunting as an ownership objective on behaviors or intentions of FFOs has all related to the provision of access to one’s wooded land for others to hunt or recreate. For example, when FFOs indicated that land for hunting is important for woodland ownership, owners were more likely to post their land against public access (Snyder et al., 2008), less likely to allow recreational access (Snyder & Butler, 2012) and less likely to enroll their woodlands in government-sponsored hunter access programs (Kilgore et al., 2008).

Related research has examined how FFO attitudes and concerns about interference with their own hunting or potential property damage were related to the provision of public recreational access to one’s forested land. Specifically, FFOs with concerns about hunting interference or hunter damage had a higher likelihood of posting their land against access (Snyder et al., 2008) and a lower likelihood of allowing public off-highway vehicle access (Becker et al., 2010). Snyder et al. (2009) modeled the likelihood that FFOs who currently post their land to public trespass would grant permission to hunters to use their land if they sought permission from them. Landowners with concerns about personal hunting interference or property damage were less likely to provide access to other hunters on their posted land.

Aside from the provision of public recreational access, we are not aware of research that has examined relationships between FFO hunting ownership objectives and other forest land management behaviors, intentions, attitudes, or concerns. We are also not aware of any research specific to FFOs that has examined how one’s identity as a hunter, as opposed to a hunting ownership reason, may be associated with land management behaviors or intentions. Identity has been found to influence behavior (Walton & Jones, 2018), and predict behavior more than salient attitudes (Stets & Biga, 2003). Individuals have multiple identities (e.g., scientist, deer hunter, woman), and these identities are primarily formed through self-categorization as a member of a given social group (Stets & Burke, 2003). Others have explored the relationship between identity and degree of recreation specialization (Jun et al., 2015; Schroeder et al., 2013) and environmental behavior (Stets & Biga, 2003). Schroeder et al. (2013) examined identification with waterfowl hunting and behaviors associated with specialization with that sport (e.g., investing in equipment, knowledge of the sport). Their identity measure included four potential responses representing the degree of hunter identity, ranging from no identification as a waterfowl hunter to current identification as a waterfowl hunter. Our research sought to determine whether the strength

of an FFO's identification as a deer hunter was associated with select stewardship and land management behaviors. We followed Holsman (2000) in considering land management actions like habitat restoration to be "stewardship," along with multiple other land management actions that can improve ecological conditions. The general research question that we examined was whether FFOs with a stronger hunter identity were more active woodland owners. We examined a variety of forestland management behaviors and intentions to test this hypothesis. Given the lack of existing research, we did not posit specific hypotheses for each of the activities, but rather examined the more general question of whether the strength of hunter identity is associated with land management behaviors in consistent ways.

Methods

Study Area and Sampling

We investigated the relationship between FFO deer hunter identity and land management behaviors and intentions through a four-wave hybrid survey of landowners across 13 counties in the Wisconsin Department of Natural Resources (WDNR) Northern Region (Figure 1). The study area contained all the counties in the USDA Forest Service Forest Inventory and Analysis' northwestern survey unit and six (of 10) counties in the northeastern survey unit. Approximately one-third of the forestland area in the state is in the northwestern unit, with an additional 25% in the northeastern unit (Perry, 2016). The Northern region has the highest percentage of private forest parcels (~87%) that are 8.09 ha or more (Virginia Tech Center for Natural Resources Assessment and Decision Support (VTCENRADS), 2016). Addresses of FFOs with at least 4.05 ha of forest land were obtained through county tax and GIS records, and 2000 were randomly selected from 19,861 owners. Two thousand were selected as we aimed for a 40% response rate and a $\pm 5\%$ margin of error. Of these, 106 were undeliverable or the recipient was deceased, and 53 did not have any wooded land (initial sample = 1,841).

Survey Item Development

Survey items were developed through interviews conducted with FFOs and natural resources management professionals. Other items were replicated from the National Woodland Owner Survey (Butler et al., 2016b) and a similar survey of landowners conducted in the Wisconsin Driftless Area (Gorby et al., 2016). We interviewed 18 professionals and FFOs. Professionals represented an array of organizations including extension, consultants, and non-governmental organizations (NGOs). Landowners were in four counties of the project area. Interviews identified common constraints to engaging in management and factors contributing to action. Survey items included several related to property characteristics (total and wooded area, permanent or seasonal residence, years owned, time spent on the property), benefits and concerns related to their property, barriers to land management activities, past and planned activities, outreach and communication preferences, identity questions, and socio-demographics (gender, education, income, race/ethnicity, and income from wooded land). A pretest of the survey was conducted in

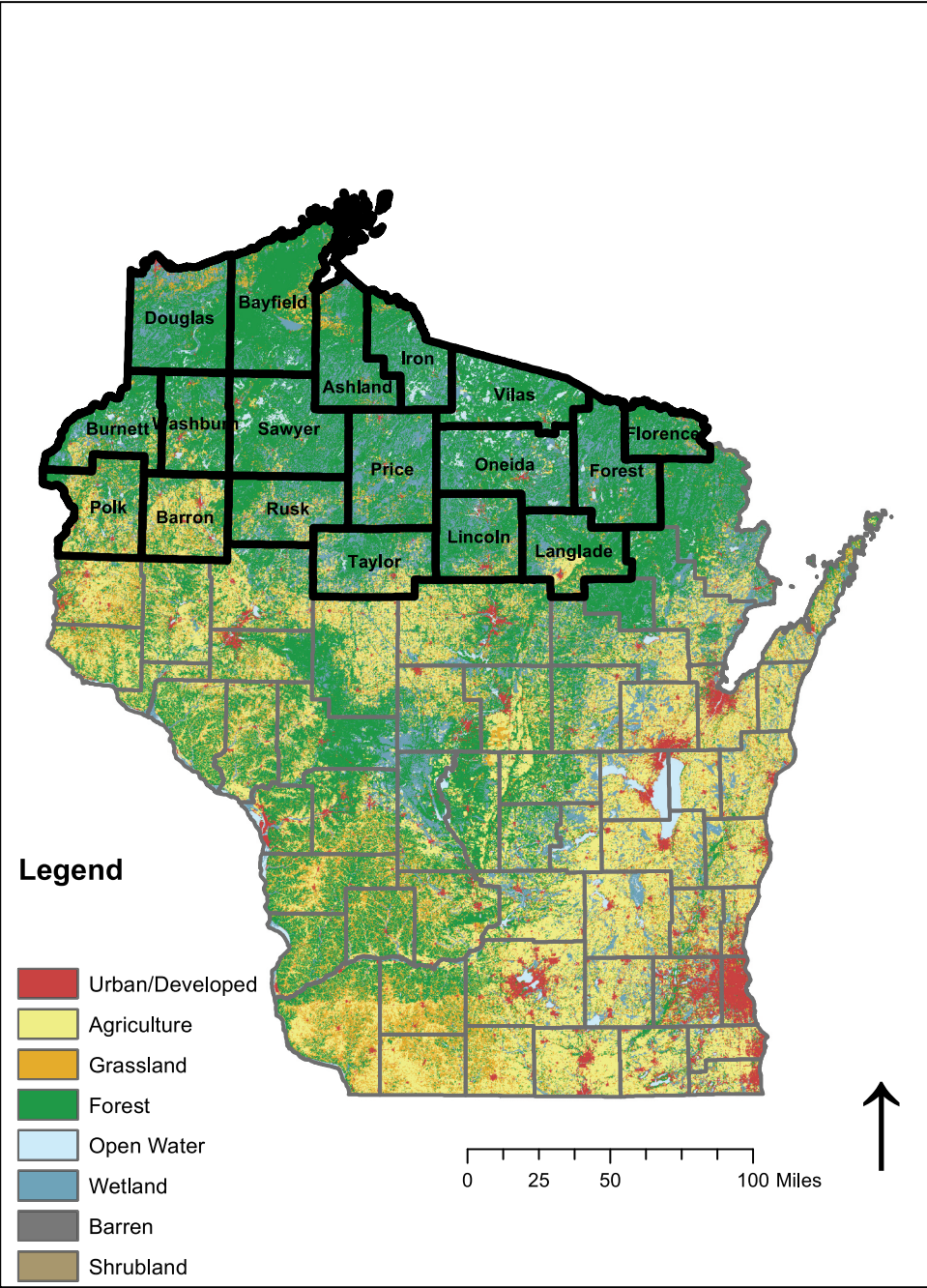


Figure 1. Counties in Wisconsin DNR Northern Region outlined in black overlaid on Wisconsin Land Cover Data (level 2) downloaded January 2020.

June 2016 with a random sample of 75 landowners. Questions were modified to improve clarity based upon feedback from respondents.

Survey Implementation

Four waves of the survey were conducted during August and September of 2016. Potential respondents were first sent an advance notice letter that included the option to complete the survey online. Two weeks later, those who had not responded online were sent a survey packet including a cover letter and the eight-page survey. A reminder postcard was sent 2 weeks later to those who had not yet responded, and a replacement survey was sent 2 weeks after that. Respondents were given the option to respond online for all four waves. The online survey was administered using Snap Survey software.

Statistical Analyses

Hunter Identity Variable Creation

Respondents were asked to indicate how much they would describe themselves as a deer hunter as measured on a 5-point scale that ranged from a value of zero (not at all) to four (thoroughly).¹ For analysis, deer hunter identity was treated as a continuous variable per Vaske (2019). This variable was created from a survey question revised from Gorby et al. (2016) that asked respondents how much they would describe themselves as a deer hunter.

Activities Pursued, Undertaken or Planned

Respondents checked all that apply from a list of 10 potential actions they could have taken on their wooded land in the past 5 years to support the benefits they receive from their wooded land (cut/remove trees for sale; cut/remove trees to improve forest conditions; cut/remove trees for own use; conduct prescribed burns; planted native seeds or seedlings; removed plants, shrubs or small trees by hand or with tools; used herbicides to remove non-native or invasive plants; removed built-up material from the ground; maintained or constructed trails; or maintained or constructed roads). These binary variables were assigned a value of 1 if they indicated they had undertaken the activity and 0 otherwise (Table 1). Four additional variables were created from a question which asked respondents to indicate how willing they would be to undertake an action, with one response option indicating they currently do this. For the following activities (participate in a local woodland owner group, write a management plan, participate in state landowner programs through the WDNR, participate in a federal landowner program), binary variables were created with a value of 1 if they indicated they currently participate in these activities, and 0 otherwise (Table 1). Respondents were asked their intentions to undertake the same set of past activities queried about above. Binary variables were created with a value of 1 if they selected response options 'I am planning to do this' or 'Decided to do it, but haven't started planning', and 0 otherwise (selected response option 'Decided not to do this', 'Considered it but haven't decided' or 'Never considered it') (Table 2).

Finally, respondents were asked about their interest in cooperating with others to accomplish mutually beneficial landscape goals. The question asked about eight different land management objectives, and respondents were asked to select from a list of organizations or entities that they would consider jointly planning land management activities with, including neighbors, local groups, NGOs, county agencies, state agencies or federal agencies. The land management objectives included habitat for game species, habitat for non-game species, habitat for rare or threatened species, fire risk, water quality, invasive species,

Table 1. T-test comparisons of average hunter identity scores for landowner activities.

Forest landowner activities	Average hunter identity score		t-Value	p	Hedge's g
	(M, SD)				
	Yes	No			
<i>Action undertaken in past 5 years</i>					
Cut/remove trees for sale	2.55 (1.50)	2.30 (1.53)	−1.70	.089	.164
Cut/remove trees to improve forest conditions	2.46 (1.53)	2.28 (1.52)	1.35	.177	.120
Cut/remove trees for own use*	2.52 (1.48)	2.11 (1.56)	2.93	.004	.270
Conduct prescribed burn	2.12 (1.65)	2.39 (1.52)	0.72	.475	.176
Planted native seeds or seedlings*	2.63 (1.45)	2.23 (2.24)	2.77	.006	.255
Removed plants, shrubs, small trees by hand or with tools	2.30 (1.60)	2.44 (1.45)	−1.07	.284	.094
Used herbicides to remove non-native/invasive plants	2.66 (1.41)	2.34 (1.54)	−1.61	.107	.127
Removed built-up plant material from ground	2.34 (1.62)	2.38 (1.51)	0.18	.856	.025
Maintained or constructed trails*	2.53 (1.46)	1.89 (1.61)	−4.15	<.001	.431
Maintained or constructed roads*	2.60 (1.48)	2.28 (1.53)	2.17	.030	.210
<i>Activities currently undertake/participate in</i>					
Participate in a local woodland owner group	2.25 (1.58)	2.35 (1.53)	0.18	.856	.065
Management plan*	2.84 (1.25)	2.26 (1.55)	−3.52	<.001	.385
Participate in state landowner program through WDNR*	2.76 (1.30)	2.29 (1.54)	−1.99	.047	.307
Participate in federal landowner program	2.27 (1.42)	2.33 (1.53)	0.13	.898	.039

Hunter identity scores range from a value of 0 (respondent does not at all describe themselves as a deer hunter) to 4 (respondent thoroughly describes themselves as a deer hunter).

* Significant at $p \leq .05$.

Table 2. t-Test comparisons of average hunter identity scores for landowner activities planned in next 5 years.

Planned land management activity	Average hunter identity score (<i>M</i> , <i>SD</i>)		<i>t</i> -Value	<i>p</i>	Hedge's <i>g</i>
	Yes	No			
Cut/remove trees for sale*	2.73 (1.33)	2.09 (1.56)	−4.79	<.001	.435
Cut/remove trees to improve forest conditions*	2.55 (1.44)	2.05 (1.58)	−3.68	<.001	.338
Cut/remove trees for own use*	2.58 (1.45)	1.96 (1.54)	4.37	<.001	.418
Conduct prescribed burn	2.23 (1.68)	2.24 (1.53)	0.03	.973	.006
Plant native seeds or seedlings	2.47 (1.53)	2.21 (1.52)	−1.78	.076	.165
Remove plants, shrubs, small trees by hand or with tools	2.33 (1.55)	2.31 (1.51)	0.09	.928	.006
Use herbicides to remove non-native/invasive plants	2.35 (1.62)	2.28 (1.52)	−0.33	.740	.040
Remove built-up plant material from ground*	1.95 (1.63)	2.40 (1.50)	2.39	.017	.298
Maintain or construct trails*	2.52 (1.46)	1.77 (1.58)	4.48	<.001	.506
Maintain or construct roads*	2.60 (1.45)	2.02 (1.56)	3.75	<.001	.383

Hunter identity scores range from a value of 0 (respondent does not at all describe themselves as a deer hunter) to 4 (respondent thoroughly describes themselves as a deer hunter).

*Significant at $p \leq .05$.

non-motorized recreation, or motorized recreation. Binary variables were created for each of the objectives, with a value of 1 if they selected at least one of the entities they were willing to plan with, and 0 if they selected the 'Not Interested' option (Table 3).

Data Analysis

Two-sample *t*-tests were used to compare the average self-assessed level of deer hunter identity of respondents who had undertaken or plan to undertake the behaviors queried about versus those who had not or do not intend to (significance value of $p \leq .05$). Effects sizes were computed using Hedge's *g*. We followed recommendations by Cohen (1988) in interpreting .20 as a small effects size, .50 as a medium effects size, and .80 as a large effects

Table 3. *t*-Test comparisons of average hunter identity scores for forest benefits respondents would consider jointly planning land management activities with others.

Forest benefit	Average hunter identity score (<i>M</i> , <i>SD</i>)		<i>t</i> -Value	<i>p</i>	Hedge's <i>g</i>
	Yes	No			
Habitat for game species*	2.61 (1.41)	1.80 (1.58)	−5.97	<.001	.548
Habitat for non-game species	2.43 (1.46)	2.21 (1.57)	−1.66	.098	.148
Habitat for rare or threatened species	2.34 (1.51)	2.31 (1.53)	0.22	.827	.020
Reduce fire risk	2.26 (1.54)	2.47 (1.47)	−1.48	.140	.135
Protect or improve water quality	2.33 (1.51)	2.34 (1.54)	−0.09	.931	.008
Prevent or control invasive species	2.33 (1.53)	2.32 (1.52)	0.10	.921	.010
Non-motorized recreation opportunities	2.22 (1.53)	2.37 (1.53)	1.06	.291	.096
Motorized recreation opportunities*	2.60 (1.41)	2.24 (1.55)	−2.34	.020	.240

Hunter identity scores range from a value of 0 (respondent does not at all describe themselves as a deer hunter) to 4 (respondent thoroughly describes themselves as a deer hunter).

*Significant at $p \leq .05$.

size. To examine relationships between the hunter identity score and continuous variables (number of wooded ha, years of woodland ownership), Pearson's *r* correlations were computed. Binary logistic regression models were run for the behavior and intention variables which had a statistically significant difference ($p \leq .05$) in average hunter identity scores between those who did versus did not undertake the activity. A common set of independent variables was used in the 14 logit models, including the hunter identity variable and select demographic and ownership characteristics. The logit models determined if hunter identity was a significant predictor of the various behaviors and intentions when controlling for other factors, statistical significance and sign of variables in the models. SAS software version 9.4 was used for all analyses.

Results

A non-response bias check compared responses from the first and second survey mailing wave ('earlier' responders) to the fourth survey mailing ('later' responders) to approximate differences between respondents and non-respondents. All the respondent demographic variables (Table 4) were compared. Results indicated that earlier respondents owned more wooded hectares on average than the later respondents (29 vs. 22 ha). Survey results and analyses should be interpreted with this difference in mind.

Table 4. *t*-Test comparisons of average hunter identity scores for select demographic characteristics of respondents.

Landowner characteristics	Average hunter identity score (<i>M</i> , <i>SD</i>)		<i>t</i> -Value	<i>p</i>	Hedge's <i>g</i>
	Yes	No			
Permanent residence on my wooded land	2.27 (1.55)	2.34 (1.54)	0.54	.591	.045
Female	1.98 (1.58)	2.24 (1.51)	1.50	.134	.175
White	2.22 (1.52)	1.50 (1.43)	1.49	.136	.476
Bachelor or graduate degree	2.15 (1.53)	2.25 (1.52)	0.72	.473	.065
Annual household income GE \$50,000	2.23 (1.50)	2.03 (1.60)	1.34	.181	.133
Retired*	2.11 (1.60)	2.55 (1.43)	−3.44	<.001	.292
Farmer	2.28 (1.62)	2.32 (1.52)	0.17	.862	.021

Hunter identity scores range from a value of 0 (respondent does not at all describe themselves as a deer hunter) to 4 (respondent thoroughly describes themselves as a deer hunter).

*Significant at $p \leq .05$.

Table 5. Logit model coefficients of select landowner actions.

	Cut trees for own use	Planted native seeds	Built/main- tained trails	Built/main- tained roads	Management plan	Enrolled in state program
Intercept	−0.568	−1.323*	1.539*	−1.591*	−3.252*	−4.535*
Deer hunter identity	0.112	0.144	0.254*	0.071	0.300*	0.313*
Wooded acres	0.002	0.003*	0.012*	0.004*	0.006*	0.002
Retired	−0.351	0.461*	−0.312	−0.016	−0.299	0.174
Tenure	0.007	−0.011	−0.044*	0.026*	0.030*	0.034*
Bachelor/grad degree	0.202	−0.017	0.687*	−0.225	0.608	0.904*
Income of at least \$50,000	0.471	0.264	−0.780*	−0.017	−0.481	−0.080
Female	−0.099	0.174	0.523	0.065	−1.035	−0.270
Permanent residence	0.937*	0.137	0.283	−0.579*	−0.704*	−0.472
<i>n</i>	372	372	372	372	388	391
Tjur's R^2	.077	.041	.168	.080	.131	.068
LR S^2	28.89	15.53	60.99	29.69	42.47	21.26
df	8	8	8	8	8	8
<i>p</i>	<.001	.050	<.001	<.001	<.001	.007

*Significant at $p \leq .05$.**Table 6.** Logit model coefficients of select landowner intentions.

	Cut trees for sale	Cut trees own use	Cut trees improve conditions	Remove built-up plant material	Build or main- tain trails	Build or main- tain roads
Intercept	−2.345*	−0.564	−0.414	−1.197*	1.056*	−0.933*
Deer hunter identity	0.337*	0.200*	0.230*	−0.166	0.187*	0.237*
Wooded acres	0.010*	0.006*	−0.001	0.000	0.010*	0.003
Retired	−0.223	−0.475	−0.241	−0.289	−0.508	0.031
Tenure	0.360*	−0.001	0.003	0.006	−0.022*	0.011
Bachelor/grad degree	0.523	−0.010	0.223	−0.430	−0.173	−0.226
Income of at least \$50,000	−0.511	0.185	0.358	0.438	0.237	−0.062
Female	−1.246*	0.025	−0.290	1.00*	0.428	−0.161
Permanent residence	−0.161	0.908*	0.4223	−0.786*	0.317	−0.246
<i>n</i>	339	346	369	318	360	282
Tjur's R^2	.221	.107	.052	.061	.082	.068
LR χ^2	79.13	38.66	19.21	17.48	30.62	19.90
df	8	8	8	8	8	8
<i>p</i>	<.001	<.001	.014	.026	<.001	.011

*Significant at $p \leq .05$.

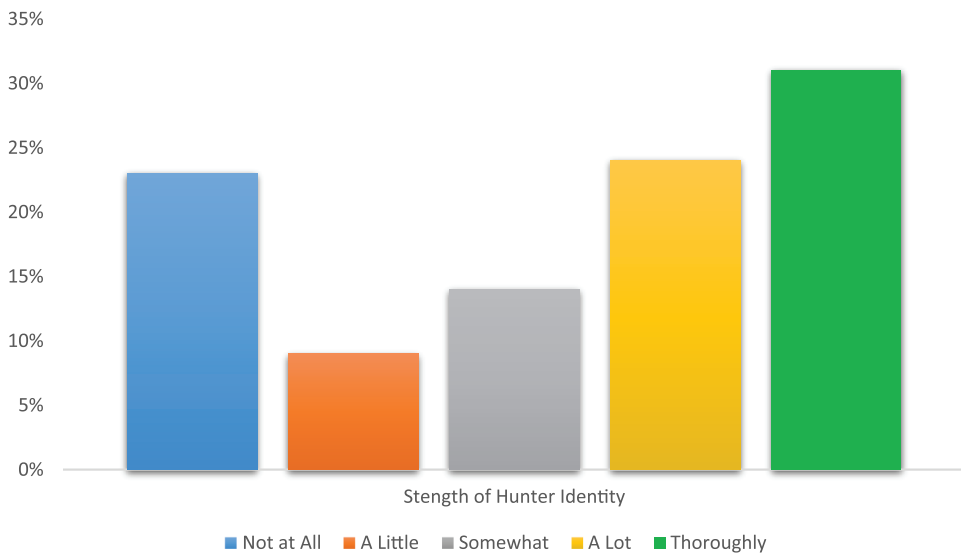
Respondent Description

There were 587 completed responses to the survey (response rate = 32%). Our response rate is similar to other recent surveys of FFOs (e.g., Bell et al., 2019; Kelly et al., 2016). Five-hundred and seventy-six respondents answered the deer hunter identity question ($M = 2.31$, $SD = 1.57$). More than half of respondents strongly identified with a deer hunter identity, while approximately one-quarter indicated they did not view themselves as a deer hunter at all (Figure 2).

Of the demographic variables examined, only one was statistically significant. Non-retired respondents reported a higher deer hunter identity than those who were retired ($M = 2.55$ vs. $M = 2.11$) $t(556) = 3.44$, $p < .001$ (Table 4). A positive correlation was found between deer identity score and wooded acreage owned $r(568) = .18$, $p < .001$, while no

Table 7. Logit model coefficients of landowner interest to jointly plan to achieve desired goals.

	Enhance habitat for game species	Enhance motorized recreation opportunities
Intercept	0.531	−0.816*
Deer hunter identity	0.318*	0.112
Wooded acres	0.003	0.000
Retired	−0.055	−0.255
Tenure	−0.012	−0.008
Bachelor/grad degree	0.219	0.047
Income of at least \$50,000	−0.549*	−0.243
Female	0.208	−0.235
Permanent residence	−0.173	−0.190
<i>n</i>	381	379
Tjur's R^2	.078	.018
LR χ^2	30.06	10.18
df	8	8
<i>p</i>	<.001	.253

*Significant at $p \leq .05$.**Figure 2.** Distribution of deer hunter identity scores (percentage of respondents, $N = 576$).

significant correlation was found between deer identity and length of woodland ownership $r(540) = .02$, $p = .60$.

Respondents who had undertaken several of the queried management activities in the past 5 years had higher average deer hunter identity than those who had not, including cutting trees for personal use, planting native seeds/seedlings, trail maintenance or development, and road maintenance or development (Table 1). The Hedges's g effect size ranged from .21 to .43 for these four activities, suggesting 'small' differences in deer hunter identity scores among those who did versus did not undertake the activities.

Compared to respondents who did not currently have a management plan ($M = 2.26$, $SD = 1.55$), those who did ($M = 2.84$, $SD = 1.25$) had higher average deer hunter identity scores $t(539) = 3.01$, $p < .001$ (Table 1). Similarly, respondents who currently participated in a state landowner program also had higher hunter identity scores than those who did not t

(543) = 1.99, $p = .047$. Effects sizes are in the ‘small’ range for both activities (.385 for a management plan and .307 for program participation).

Respondents who planned to undertake several activities in the next 5 years had higher hunter identity scores than those who did not. These activities included: cutting trees for sale $t(473) = 4.79$, $p < .001$, cutting trees to improve forest health $t(498) = 3.68$, $p < .001$, cutting trees for personal use $t(474) = 4.37$, $p < .001$, trail work $t(497) = 4.48$, $p < .001$, and road work $t(385) = 3.75$, $p < .001$ (Table 2). However, respondents who had plans to remove built-up plant materials in the next 5 years had lower deer hunter identity than those who did not have this intention $t(439) = 2.39$, $p = .017$. The effects sizes were in the ‘small’ to ‘medium’ range for these activities, ranging from .298 for removal of plant material to .506 for trail work.

Respondents who were willing to consider jointly planning land management activities with other landowners and organizations to enhance either habitat for game species $t(527) = 5.97$, $p < .001$ or motorized recreation opportunities $t(525) = 2.34$, $p = .020$ had higher deer hunter identity than those who were not interested in collaboration for these benefits (Table 3). Effects size was in the ‘medium’ range for the game habitat benefit (.548) and the ‘small’ range for the motorized recreation benefit (.240).

In 9 of the 14 binary logistic regression models (Tables 5–7), the deer hunter identity variable was a statistically significant predictor of one of the land management behaviors or intentions examined ($p < .05$). Those with a stronger deer hunter identity were more likely to have conducted past trail or road activities or participated in a state landowner program and to have intentions to cut trees for either sale, personal use, or forest health; undertake trail work or road activities, or jointly plan for game habitat benefits. Signs and significance of the other explanatory variables varied over the logit models, with acreage the only other variable that was consistently positively related to several behaviors.

Discussion

Holsman (2000) questioned whether the perception that hunters were more stewardship-oriented than others is correct. While we cannot determine whether the actions of our respondents were driven by self-interest, altruism, or both, we found some evidence in support of our research hypothesis that having a stronger deer hunter identity was positively associated with more active management of one’s personal wooded lands. The activities that were positively associated with stronger hunter identities were a mix of actions which may have had differing underlying motivations. For some, their land management actions may be required because of participating in landowner programs through the WDNR that incentive sustainable forest practices (e.g., Managed Forest Law, Wisconsin Forest Landowner Grant Program),² or were suggested in their management plan. For others, activities may be undertaken to enhance personal hunting access or opportunities on one’s land (i.e., road and trail work, or partnering with others to enhance motorized recreational opportunities). Still other activities could be viewed as stewardship, such as enhancing forest conditions and/or habitat for desired game species (e.g., planting native seedlings, planning future harvests to enhance forest conditions, or jointly planning to enhance game habitat). Finally, the positive association with stronger hunter identities and intentions to undertake commercial timber harvests could be associated with financial ownership objectives. Higher hunter identity scores were associated with respondents who intend to undertake tree work in the next 5 years for a variety of different purposes (sale, improving forest conditions, or personal use). It is possible that

hunter FFOs may be interested in improving their forested land because they sell hunting leases, as suggested by Macaulay (2016), but we did not ask respondents this question. However, we only found a small positive correlation between deer hunter identity and respondents' desire to generate income from their wooded land $r(494) = .09, p = .043$.

Trail and road work were positively associated with higher hunter identity scores. Given that roads and trails and the recreationists who use them were potential vectors for invasive plant introduction and spread (Anderson et al., 2015; Buckley et al., 2003; Mortensen et al., 2009), we suggest that hunter FFOs are an important cohort of woodland owners to work with regarding invasive species education and control measures. Enhancing awareness of the ways in which invasive species can adversely impact game species habitat or hunting quality might be a means of spurring more invasive species control activities among hunter FFOs (<https://content.govdelivery.com/accounts/MNMDA/bulletins/26a4414>). Similarly, hunter FFOs could be targeted for outreach and assistance for young forest management when this habitat type is desirable for local conservation goals (Seng & Case, 2019).

Deer hunter identity was not found to be associated with activities that could serve to enhance wildlife habitat and potentially hunting opportunities, such as prescribed fire or use of herbicides to support early successional habitat. This could suggest a lack of awareness among FFOs of the role that specific forest management techniques play in supporting wildlife habitat.

Private forest land plays an important role in supporting wildlife habitat (Buffum et al., 2014). Encouraging and assisting FFOs to engage in forest management behaviors that enhance habitat for species of conservation concern or game species could have landscape-level benefits. FFOs in our study with higher deer hunter identities expressed interest in jointly planning with others to enhance habitat for game species. This interest among this cohort of FFOs, regardless of whether it was motivated by personal benefits or public conservation goals, should be further explored and leveraged given that cross-boundary collaboration among FFOs has not often been practiced or embraced (Rickenbach et al., 2011). Our findings contribute to the understanding of factors that may facilitate collaboration among FFOs (i.e., having a hunter identity), and identify that FFOs may be very selective in the benefits they would consider collaborating with others to enhance.

Conclusions

Our research provided some support for the assertion that having a hunter identity positively influences certain land management behaviors on FFO lands. To fully explore this question of hunter identity influence on FFO conservation, stewardship, and land management behaviors, additional research is needed which examines a broader suite of management activities than our current study did, including activities such as tree planting (for mast producing species or food plots) and wildlife habitat improvement projects. Research to explore whether the type(s) of game that are hunted influence the specific type of land management behaviors pursued would add more clarity to this exploration of FFO hunter identity. Finally, research on the underlying motivations for activities (as well as the linkages between hunter values, motivations, and behaviors) would also expand our understanding of the influence and interplay of having a hunter identity and management of one's woodlands.

On the topic of identities, future research to examine whether and how FFOs (both hunter and non-hunter alike) think they are fulfilling or contributing to their identity through their land management efforts could be useful in further understanding the value of an identity lens

in understanding FFO behaviors. Identity is linked to behavior (Devine-Wright & Clayton, 2010), and thus it may be an important angle to more deeply explore in FFO research.

Notes

1. A separate survey question, with the same response scale, asked respondents to indicate the degree to which they would describe themselves as a turkey hunter. The relationship between deer hunter identity and turkey hunter identity was significant and positive ($r(523) = .34$, $p = <.001$). Seventy-seven percent of respondents identified as some degree of deer hunter identity, while 49% reported some level of turkey hunter identity. The average hunter identity score was higher for deer versus turkey (2.23 ($SD = 1.54$) versus 1.17 ($SD = 1.40$)). Given this, some of the findings in this analysis may be confounded by respondents' strength of turkey hunter identity. Results should be interpreted with this point in mind.
2. Note that participation in either the Managed Forest Law or Wisconsin Forest Landowner Grant Program requires applicants to have a management or stewardship plan (<https://dnr.wi.gov/topic/ForestLandowners/tax.html>), which could, in part, explain the joint higher incidences of management plans and participation in forest landowner programs.

Funding

This research was supported by the USDA/CSREES McIntire Stennis Cooperative Forestry Research Program Funds under Grant [Accession # 1003780]; and in-kind support from the USDA Forest Service, Northern Research Station.

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