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Original Article

Factors Shaping Private Landowner Engagement in Wildlife Management

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ABSTRACT The changing demographics of rural landowners have the potential to affect wildlife management on private land and therefore, there is a need to determine what factors influence landowner participation in wildlife management. We surveyed 1,368 North Carolina, USA, private landowners to determine socio-demographic factors predicting participation in a variety of wildlife management practices. Wildlife management practices most commonly implemented by landowners were providing supplemental feed (21.8%), mowing to improve habitat (16.2%), erecting nesting boxes (14.7%), and planting food plots (14.6%). Ecologically valuable management activities such as prescribed burning (2.3%) were among the least practiced. Hunting or having a family member that hunted was the most consistent predictor of participation in wildlife management practices. Landowners who hunted, resided on their property, were younger and were male were more likely to implement wildlife management practices than their counterparts. Resident landowners, especially those who hunt, may be the most receptive to outreach efforts promoting wildlife habitat management on private lands. Our results indicate outreach efforts should target habitat management practices with longer term wildlife benefits (e.g., prescribed fire, controlling invasive plants), because practices with immediate short-term benefits (e.g., food plots, supplemental feeding, mowing) are currently 3–4 times more prevalent. © 2012 The Wildlife Society.

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Private lands constitute a significant portion of landholdings (73%) in the United States and have potential to protect and improve wildlife habitat (Birch 1996, Alig et al. 2003). During the past 2 decades, rapid rural population growth, driven in part by urban migrants seeking a relaxed lifestyle (Davis and Nelson 1994, Deller et al. 2001), has transformed property ownership in many rural areas. The exurban migrants purchased land with abundant natural amenities (e.g., aesthetic views and recreation opportunities) and affluent professionals, young families, and urban retirees were most representative of this new conglomeration of landowners (Davis and Nelson 1994, Johnson and Beale 1998, Kendra and Hull 2005). Additionally, these landowners brought new values to rural areas because they often had a more protective view of wildlife than did longer term rural residents (Manfredo and Zinn 1996).

The shifting values and demographics may correspond with changes in wildlife management on private land. Currently, 90% of landowners in the United States own <40.5 ha, and intergenerational transfer of land could accelerate parcelization (Birch 1996, Sampson and DeCoster 2000, Mehmood and Zhang 2001). Further, older landowners were less willing to engage in wildlife management practices associated with federal programs (e.g., Conservation Reserve Program; Kurzejeski et al. 1992, Langpap 2004). As these landowners continue to age, they may sell or subdivide land for income or pass the land onto heirs who have different plans for the property (Mehmood and Zhang 2001, Best 2002, Alig et al. 2003). Women are increasingly recipients of land inheritance (Effland et al. 1993), and their values may progressively influence wildlife habitat management on private land. Women landowners often have a more holistic interest in the health of the land they own (Eells 2010). Changing landowner demographics highlight a need to better understand factors shaping wildlife management activities on private land (Joshi and Arano 2009, Poudyal and Hodges 2009). Past research has focused on landowner attitudes and preferences (Bowman et al. 2004, Daley et al. 2004), but not on predictive factors of participation in management. We began to address this research need by identifying the wildlife

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management practices most commonly implemented on private lands in North Carolina and which socio-demographic factors influenced participation in those wildlife management practices.

We hypothesized that residing on the property and hunting, or having a family member who hunts, would be the key factors affecting landowner participation, but accounted for several other variables based on findings from previous literature. We used the variable of whether or not a landowner or family member hunted because it could highlight different belief patterns relating to wildlife management (Zinn et al. 2002). We included the parcel size variable, surmising that economies of scale would make wildlife management practices more affordable for landowners with larger properties. Further, Zhang et al. (2006) demonstrated that tract size influenced participation in leasing for hunting access by landowners in Alabama, USA. We included the "lease for hunting" variable because previous research suggested landowners often lease to hunters to help with management practices (Lynch and Robinson 1998). We included gender because it is known to influence beliefs regarding wildlife (Bowman et al. 2004). We included "distance to city" because landowners closer to a city hold beliefs about specific types of management practices that often vary from rural landowners (Mankin et al. 1999, Teel et al. 2002). Resident and absentee landowners often have dissimilar management practice objectives or views (Feldpausch and Higginbotham 2006). Finally, we controlled for effects of annual household income and age of landowners (Langpap 2004, Joshi and Arano 2009).

METHODS

After developing an initial questionnaire, we used cognitive interviews with 10 landowners to improve clarity of questions. The final questionnaire included questions about participation in several wildlife management practices (Table 1), and results were coded as dependent binary variables (no = 0, yes = 1). Also, the questionnaire included questions about: gender (M = 0, F = 1), age, annual household income in U.S. dollars (1 = <$25,000; 2 = $25,001–$45,000; 3 = $45,001–$65,000; 4 = $65,001–$85,000; 5 = $85,001–$125,000; 6 = $125,001–$175,000; 7 = >$175,001), distance to nearest city (distance to city in km; landowners were asked to select from a list of cities and estimate driving distance from their largest tract of land to the selected city; we selected cities that fell within the primary metropolitan or micropolitan statistical area in each district [Brown et al. 2004]), education level achieved (1 = did not complete high school; 2 = high school; 3 = associates degree or some college; 4 = 4-year college degree; 5 = graduate degree), whether their land was used to earn income (no = 0, yes = 1), whether the landowner lived on the land (no = 0, yes = 1), whether the landowner or an immediate family member hunted (no = 0, yes = 1), and size of largest tract owned.

Table 1. Participation by North Carolina, USA, private landowners in wildlife management practices, 2007.

Wildlife management practice	% Participating
Supplemental feeding (e.g., feeders)	21.8
Mowing to maintain wildlife habitat	16.2
Erecting nesting boxes (e.g., wood ducks, blue birds)	14.7
Wildlife food plot establishment and/or maintenance	14.6
Kept records of the no. of animals harvested on the property	7.2
Predator management (e.g., coyote, fox removal)	7.0
Controlling invasive plants	5.9
Disking for wildlife purposes	5.7
Un-harvested crops left in agricultural fields for wildlife	5.1
Pest species management (e.g., beaver, wild hog, mole and/or vole removal)	5.1
Timber thinning and/or harvesting for wildlife purposes	3.4
Herbicides for wildlife purposes	2.5
Prescribed burning for wildlife purposes	2.3
Conducting wildlife sex and age population counts	1.8
Winter flooding for waterfowl (pumping or catching rainfall and/or runoff)	0.8

We randomly selected four counties from each of the seven 2006 North Carolina Cooperative Extension Service Districts to stratify the sample across the state. Landowner mailing addresses were acquired from county tax rolls, and we removed duplicate listings to avoid oversampling landowners who owned multiple tracts. Industrial businesses, real estate developments, contracting businesses, and timber companies were omitted, but we retained limited liability corporations to prevent exclusion of hunt clubs and farms (Cecil et al. 1995). We randomly selected 300 landowners from each of the 28 counties except Dare and Jackson counties, where only 202 and 232 landowners, respectively, owned the minimum acreage required for inclusion in the sample (≥4 ha). Four hectares was determined to be sufficient area, based on previous research that indicated most landowners owned property between 4 ha and 40 ha in the Southeastern United States (Birch 1994).

Surveys were printed with pre-paid postage and a business reply address. We sent each landowner a cover letter explaining the project, a survey, and a sticker to seal the survey for return mailing. We mailed a reminder postcard to all landowners after the initial survey mailing. Budget constraints prevented a second questionnaire mailing, but a second questionnaire was mailed if a landowner lost or misplaced the initial survey and requested another. Eighty-six replacement surveys were mailed to landowners who requested another copy after receiving the postcard.

A total of 1,368 usable surveys were returned for an overall response rate of 17%. We randomly selected 60 non-respondents who were asked a shortened version of the survey over the phone to detect potential bias between respondent and non-respondent populations (Chaves et al. 2005). We used 2-sample z-tests to detect potential bias between respondents and non-respondents. Variables tested for non-respondent bias included whether the landowner resided on their property, the distance to their property if they did not reside on the property, size of their largest tract of land, distance to closest city, whether the landowner or an immediate family member hunted, whether they participated in leasing for fee-hunting, whether landowners were interested

in allowing future wildlife access, whether landowners were interested in offering future fee-hunting leases, gender, age, level of education achieved, and annual household income. We achieved a 69% response rate from the non-respondent sample and no significant differences ($P \leq 0.05$) were detected between respondents and non-respondents, which suggested that our sample was representative of North Carolina landowners owning $\geq$4 ha.

We used binary logistic regression to predict landowner participation in a variety of wildlife management practices. Population counts, prescribed burning, harvesting timber to create wildlife habitat, application of herbicides, and flooding during the winter for waterfowl were not modeled because of low participation by respondents. We used a log10 transformation to normalize parcel size, and we used a square-root transformation to normalize distance to city (Zar 1999).

RESULTS

Mean age of respondents was 60.9 (SE = 0.34) years old, and 68% of the respondents were male. Median household income was $65,001–$85,000. Seventy-seven percent of respondents had at least an associate's degree or some college. The median tract size owned was 15 ha, with 80% of landowners having tracts under 40.5 ha. Less than half of landowners participated in wildlife habitat management, and supplemental feeding, mowing for wildlife, erecting nest boxes, and planting food plots were the most common practices (Table 1). Winter flooding for waterfowl, wildlife population monitoring, prescribed burning, and herbicide use were the least common wildlife habitat management practices used (Table 1).

Being a hunter, or having a family member that hunted, increased the likelihood that the landowner participated in all wildlife management activities except controlling invasive plants (Table 2). Landowners that hunted had a greater predilection for keeping harvest records (11.4%) than non-hunting landowners (0.8%). Also, hunters had higher participation levels in planting food plots (27.8%) and disking (11.2%) than non-hunting landowners (3.2% and 0.8%, respectively). Landowners who leased land for hunting were more likely to install nest boxes, but leasing was not a significant variable in any other models (Table 2). Landowners residing on the property were more likely than non-resident landowners to participate in all activities except keeping animal harvest records and disking for habitat improvement (Table 2). Resident landowners participated more in mowing (20.0%) and providing nesting boxes (23.9%) as compared with non-resident landowners, with 12.7% and 6.2% participation, respectively.

Landowner education level was positively correlated with participation in controlling invasive species, and landowner gender and age and property size influenced the likelihood of participation in several management practices. Male landowners had greater participation in planting food plots (19.6%), leaving un-harvested crops (6.7%), and providing supplemental feed (25.2%), whereas women had low levels of participation in the same management activities (planting food plots [3.9%], leaving un-harvested crops in the field for wildlife [1.4%], and providing supplemental feed [14.9%]). As landowners aged, the likelihood they participated in most habitat management practices decreased (Table 2). As property size increased, landowners were more likely to conduct predator management, disk and mow for habitat improvement, plant food plots and leave un-harvested crops in fields for wildlife (Table 2).

DISCUSSION

Our results suggest that whether a landowner or family member hunted was the most important variable driving wildlife management practices in North Carolina. Hunting participation may predict engagement in wildlife management activities because hunters feel an obligation to conserve wildlife as part of the role of being a good sportsperson (Burger and Sanchez 1999, Holsman 2000) and because hunters may conduct management to improve their own hunting success (Geist et al. 2001). Satisfaction for many hunters may stem not just from harvesting an animal, but from the experience of seeing wildlife or seeing wildlife benefit from management practices (Decker et al. 1980, Hammitt et al. 1990, Tynon 1997). Although previous research suggests hunters may not have more conservation-oriented attitudes than do other stakeholder groups (Holsman 2000) and may be less supportive of conserving large predators such as wolves (Treves and Martin 2011), our findings suggest that hunters are more likely than other landowners to implement some practices that benefit target wildlife species. Further, regardless of the hunters' intent, some of these activities benefit a wide range of species in addition to those targeted by landowners (e.g., maintaining early succession habitat).

Mass media and some government agencies may influence hunters' perceptions of several key wildlife management practices. Hunters may provide supplemental feed and maintain food plots, two of the most common activities identified in this study, because advertising suggests the activities increase overall fitness of wildlife populations or improve the chance of harvesting an animal (Schultz and Johnson 1992, Gray et al. 2004). Food plots are promoted to hunters through hunting magazines and television shows as a means to improve quality and abundance of wildlife (Madison et al. 2002, Moorman et al. 2006, Smith et al. 2007).

Given the importance of hunting found in this study, future research should address the extent participation in other forms of wildlife-related recreation (e.g., photography, watching) influences wildlife management activities among landowners. Previous research does suggest non-consumptive recreation (e.g., bird watching) may promote some forms of wildlife management (e.g., feeding birds), but householders with the highest density of bird feeders and bird houses were the least likely to plant and maintain vegetation beneficial to birds (Lepczyk et al. 2004). Accordingly, non-consumptive wildlife recreationists may exhibit the same phenomenon existing among hunters, where short-term management practices with minimal benefits for wildlife (e.g., providing supplemental food) are more common than other practices. By identifying the specific management

Table 2. Binary logistic-regression models predicting participation in wildlife management practices by private landowners in North Carolina, USA, 2007.

Independent variables	Predator management	Pest species management	Animal harvest records	Supplemental feeding	Nesting boxes	Wildlife food plots	Mowing for wildlife	Disking for wildlife	Controlling invasive plants	Leaving un-harvested crops
Coeff. (odds ratio) [standardized odds ratio]										
Land used to earn income	0.50 (1.65) [1.28]	0.57 (1.77) [1.33]	−0.02 (0.98) [0.99]	−0.17 (0.84) [0.92]	0.06 (1.06) [1.03]	−0.07 (0.93) [0.97]	−0.33 (0.72) [0.85]	−0.50 (0.61) [0.78]	−0.06 (0.94) [0.97]	0.70 (2.02) [1.42]
Live on land	0.92*** (2.51) [1.56]	0.91** (2.49) [1.58]	0.47 (1.60) [1.26]	1.52*** (4.52) [2.14]	1.84*** (6.27) [2.51]	0.51* (1.67) [1.29]	0.72*** (2.06) [1.43]	0.44 (1.55) [1.25]	1.35*** (3.84) [1.96]	1.07** (2.90) [1.71]
Hunt	1.27*** (3.57) [1.88]	0.71* (2.03) [1.43]	2.62*** (13.76) [3.70]	1.07*** (2.91) [1.71]	0.53** (1.71) [1.30]	2.27*** (9.64) [3.10]	0.81*** (2.25) [1.50]	2.30*** (9.97) [3.15]	0.32 (1.38) [1.17]	0.93* (2.53) [1.59]
Gender	−0.65 (0.52) [0.74]	−0.63 (0.54) [0.75]	−0.86* (0.42) [0.67]	−0.45* (0.64) [0.81]	−0.08 (0.94) [0.96]	−1.25*** (0.29) [0.56]	−0.57** (0.57) [0.77]	−1.23* (0.29) [0.56]	−0.11 (0.90) [0.95]	−0.94 (0.39) [0.65]
Education	0.07 (1.08) [1.08]	0.28 (1.33) [1.37]	0.02 (1.02) [1.02]	0.06 (1.06) [1.07]	0.12 (1.13) [1.14]	−0.21* (0.81) [0.79]	0.10 (1.10) [1.12]	−0.05 (0.96) [0.95]	0.40** (1.48) [1.57]	−0.06 (0.94) [0.93]
Distance to city	0.08 (1.08) [1.15]	0.06 (1.06) [1.11]	0.06 (1.06) [1.11]	0.05 (1.05) [1.09]	0.02 (1.02) [1.04]	0.03 (1.04) [1.05]	0.04 (1.04) [1.07]	0.01 (1.01) [1.02]	−0.13 (0.88) [0.79]	0.27** (1.31) [1.61]
Age	−0.03** (0.97) [0.68]	−0.01 (0.99) [0.88]	−0.02* (0.98) [0.78]	−0.02** (0.98) [0.78]	−0.01 (0.99) [0.88]	−0.02** (0.98) [0.78]	−0.01 (0.99) [0.88]	−0.03* (0.98) [0.68]	−0.02* (0.98) [0.78]	−0.03* (0.97) [0.68]
Annual household income	−0.06 (0.94) [0.90]	0.09 (1.09) [1.18]	0.08 (1.08) [1.16]	0.16** (1.17) [1.34]	0.07 (1.08) [1.14]	0.07 (1.07) [1.14]	0.05 (1.05) [1.10]	−0.08 (0.92) [0.86]	0.10 (1.10) [1.20]	0.02 (1.02) [1.04]
Largest tract acreage	1.52*** (4.58) [2.10]	0.80** (2.22) [1.48]	0.81** (2.25) [1.48]	0.13 (1.13) [1.07]	−0.07 (0.93) [0.97]	0.89*** (2.44) [1.54]	0.66*** (1.93) [1.38]	1.13*** (3.10) [1.73]	0.36 (1.43) [1.19]	1.19*** (3.29) [1.79]
Lease for hunting	−1.03 (0.36) [0.80]	−0.49 (0.62) [0.90]	−0.11 (0.90) [0.98]	0.42 (1.52) [1.10]	0.88* (2.42) [1.22]	0.51 (1.67) [1.12]	0.63 (1.88) [1.15]	0.68 (1.97) [1.16]	−0.05 (0.96) [0.99]	−0.32 (0.73) [0.93]

* $P \leq 0.05$.
** $P \leq 0.01$.
*** $P \leq 0.001$.

practices impacted by residency, our research adds to earlier work showing that non-resident landowners were less likely to participate in wildlife management (Kendra and Hull 2005, Feldpausch and Higginbotham 2006, Joshi and Arano 2009). Not residing on the property likely precludes landowners from conducting management activities that require frequent or extended oversight because they live too far away and do not have sufficient time to travel to and from the property. Conversely, resident landowners may be more apt to conduct wildlife management because they are more directly and consistently involved with their land and may experience immediate satisfaction from the management activities they conduct. For example, resident landowners are more likely to observe bird use of nest boxes or white-tailed deer (*Odocoileus virginianus*) use of food plots.

An increasing percentage of acreage in the South and Midwest is owned by women, because women are more likely than men to acquire land through inheritance (Effland et al. 1993, Eells 2010). Gender-specific value orientations may explain why women in our study were less likely to implement wildlife management activities on their properties than were men (Manfredo 2008). Women tend to have protectionist and moralistic views of wildlife and place greater emphasis on wildlife conservation compared with men (Kellert and Berry 1987, Czech et al. 2001, Dougherty et al. 2003). However, our study measured participation in wildlife management, not interest in or support for wildlife management. Women may have supported habitat management on their properties, but may not have been in a position to conduct or direct the practices themselves. During the past 40 years, women have entered the workforce to supplement incomes on small working farms, thus removing them from the actual implementation of land management practices (Bokemeier et al. 1983, Coughenour and Swanson 1983, Shortall 2006).

Age-related impacts on wildlife management activities can be explained by age-related engagement in farming practices and conservation attitudes. Many management activities included in our study may have been conducted as part of ongoing farming practices (e.g., disking, mowing) by younger landowners. Joshi and Arano (2009) demonstrated that younger landowners in West Virginia, USA, were more likely to be involved in conducting wildlife management, whereas other studies have shown conservation attitudes to be more prevalent among younger people (Corral-Verdugo et al. 2003, Langpap 2004). When older landowners retire they may no longer maintain the land or participate in management as they did historically. Also, changes in physical ability can impair older landowners and prevent them from conducting management (Hootman et al. 2003). The intergenerational transfer of land predicted in the next decade (Sampson and DeCoster 2000, Best 2002) may provide opportunities to work with new landowners on implementing wildlife management practices.

During our study, the overall level of participation in wildlife management activities was low, and the most commonly implemented practices had limited influence on plant community composition or structure. The most common wildlife management practices (e.g., planting food plots) are promoted in the popular media (e.g., hunting magazines, television shows) and generally yield short-term results that benefit a narrower range of species than the less frequently conducted practices such as prescribed burning (Moorman et al. 2006). Prescribed burns improve forage and cover for wildlife, and conservation of wildlife diversity in the southeastern United States is dependent upon maintaining prescribed fire as a management practice on private lands (Brennan et al. 1998, Moorman et al. 2002, Harper 2007). Southern landowners may be hesitant to allow prescribed burns because of media portrayal of western wildfires, concern about liability, or fear of fire (Moorman et al. 2002).

MANAGEMENT IMPLICATIONS

Hunter recruitment programs can play a role in increasing participation in wildlife management, because landowner participation in hunting was the most important predictor of whether wildlife management occurred. Because a combination of conservation agency efforts and private industry advertising likely has made supplemental feeding, mowing, erecting nesting boxes, and wildlife food-plot establishment relatively common, wildlife managers should focus future efforts on promoting the less common, and arguably more important, management activities, including prescribed fire, controlling invasive plants, and forest thinning. Finally, wildlife management assistance programs should be tailored to females because they are a growing proportion of landowners and tend to have different orientations toward wildlife and conservation than men.

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