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Research Article

Are Wildlife Recreationists Conservationists? Linking Hunting, Birdwatching, and Pro-Environmental Behavior

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ABSTRACT There is a widely held assumption that outdoor experiences are a key precursor to pro-environmental behavior (PEB). We tested the hypothesis that wildlife recreationists are more likely than non-recreationists to voluntarily engage in different types of PEB, grouped as conservation behaviors and environmental lifestyle behaviors. Via mail and web-based surveys of rural New York residents ($n = 941$), we compared the self-reported PEBs of 4 types of recreationists: hunters, birdwatchers, hunter–birdwatchers (i.e., individuals who regularly engaged in both activities), and non-nature-based recreationists. We statistically controlled for group differences in socio-demographic characteristics and environmental beliefs. We found wildlife recreationists—both hunters and birdwatchers—were 4–5 times more likely than non-recreationists to engage in conservation behaviors, which included a suite of activities such as donating to support local conservation efforts, enhancing wildlife habitat on public lands, advocating for wildlife recreation, and participating in local environmental groups. Moreover, effects were additive; hunter–birdwatchers had the greatest likelihood of engaging in all types of conservation behaviors. On the other hand, engagement in environmental lifestyle behaviors such as recycling, energy conservation, and green purchasing were roughly comparable among all types of wildlife recreationists and non-recreationists. Our findings of elevated rates of conservation behaviors among hunters and birdwatchers despite different demographic attributes and environmental beliefs highlight the similar conservation potential associated with different types of wildlife recreation. Diversified strategies that include programs to encourage both hunting and birdwatching are likely to bring about long-term gains for conservation.

KEY WORDS birding, birdwatching, citizen science, conservation behavior, human dimensions, hunters, recreation, rural lands, wildlife-based recreation.

Pro-environmental behaviors (PEB) are actions that generate positive environmental impacts, promote environmental quality, and result in sustainable use of natural resources (Stern 2000, Monroe 2003, Steg et al. 2014). Studies investigating factors associated with PEB have highlighted the importance of positive human–environment interactions and nature-based experiences (Cook and Berrenberg 1981, Dwyer et al. 1993, Kaplan 2000, Ehrlich and Kennedy 2005, Nisbet et al. 2009). With its enduring popularity and capacity to facilitate meaningful direct experiences within nature, wildlife-based recreation (e.g., hunting, birdwatching) may represent a particularly important precursor to PEB. Despite this potential, studies exploring links between wildlife recreation, environmental concern, and PEB have yielded inconclusive results, emphasizing the need for additional research to better understand the relationships between PEB and specific recreation activities (Dunlap and Heffernan 1975, Teisl and O'Brien 2003, Thapa 2010, Glowinski and Moore 2014). The purpose of this study was to characterize associations between participation in 2 different wildlife recreation activities (hunting and birdwatching) and engagement in a variety of types of voluntary PEB, including behaviors specifically focused on wildlife and habitat conservation.

Considering the sheer numbers of wildlife recreationists across the United States, their impact on conservation efforts could be substantial. Results of the most recent *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* revealed that about 90 million Americans age 16 or older participated in some form of wildlife recreation during 2011 (U.S. Fish and Wildlife Service 2012*a*). Trends in

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participation, however, vary by recreation activity. For example, despite a recently documented increase in hunting at the national level (U.S. Fish and Wildlife Service 2012*a*), participation in traditional forms of hunting has generally been declining for decades (Cordell et al. 2008, U.S. Fish and Wildlife Service 2013*a*, Outdoor Foundation 2014). On the other hand, evidence suggests that participation in non-consumptive bird-based recreation (e.g., watching, feeding) over that same time period is relatively stable (U.S. Fish and Wildlife Service 2013*b*) or rising (Cordell et al. 2008, Outdoor Foundation 2014). Depending on the degree to which these forms of wildlife recreation lead to PEB and conservation-oriented actions, the trends in participation may have important implications for wildlife management (Jacobson et al. 2010).

To date, little empirical research has explored links between participation in wildlife recreation, such as hunting and birdwatching, and adoption of PEB (Theodori et al. 1998, Teisl and O'Brien 2003, Thapa 2010). Nevertheless, assertions about the conservation value of hunting form the foundation of the North American Model of Wildlife Conservation (Mahoney and Jackson 2013), which emphasizes the financial contributions (e.g., license fees, duck stamps), management assistance, habitat conservation ethic, and general advocacy support that hunters provide for natural resource conservation (Heffelfinger et al. 2013, Vrtiska et al. 2013). Assumptions about the conservation value of birdwatching are based on a variety of factors including citizen science participation (Hvenegaard 2002, Scott 2013), positive economic impacts of birdwatchers and birding (Kerlinger 1993), and bird conservation advocates' allocation of money and time to environmental organizations (McFarlane and Boxall 1996, Scott 2013).

Although evidence suggests that different types of wildlife recreationists express different attitudes and beliefs about activity outcomes (Daigle et al. 2002), some scholars have noted that frameworks segregating non-consumptive and consumptive forms of wildlife recreation may not be particularly useful when considering motivations and ultimate conservation goals (Connelly et al. 1985, Schreyer et al. 1989). In fact, similarities among hunters and birdwatchers abound. In the aforementioned study by Daigle et al. (2002), all 3 groups studied (hunters, wildlife watchers, and other outdoor recreationist) placed a very high value on wildlife enjoyment. Additional research has shown that both hunters and birdwatchers are primarily motivated by being close to nature (Decker et al. 1980, McFarlane 1994, Adams et al. 1997, Reis 2009), and both hunters and birdwatchers are invested in preserving wildlife habitat and ecosystems that support their favorite recreation activities (U.S. Fish and Wildlife Service 2012*b*). Teisl and O'Brien (2003) discovered that wildlife watchers and hunters expressed similar levels of concern and behaviors for variables such as "interest in forest management" or "belonging or contributing to environmental organizations," challenging earlier assumptions that consumptive and appreciate forms of wildlife recreation were associated with different conservation orientations (Dunlap and Heffernan 1975). Is it possible that the similar interests and motivations that cultivate participation in birdwatching and hunting also lead to similar adoption of PEB? If so, what are the implications for wildlife management and conservation?

Public involvement in different forms of PEB can generate outcomes that benefit wildlife management and conservation in multiple ways. For example, behaviors such as voluntarily participating in habitat restoration and improvements may positively affect local ecosystems. Social activities such as active participation in environmental groups and informal wildlife advocacy (e.g., talking about the benefits of wildlife with friends and family) can also generate positive environmental impacts. Actions such as voting to support conservation-oriented policies and donating money to environmental organizations can benefit conservation efforts on broader scales. In addition to these conservation behaviors, another sphere of PEB includes lifestyle behaviors that are more generic and typically less focused on tangible impacts on local environmental quality (e.g., recycling, energy conservation, green purchasing; see Stern 2000, Nordlund and Garvill 2002, Steg and Vlek 2009). Although all forms of PEB undoubtedly have important conservation implications, conservation behaviors are generally most relevant to wildlife managers. Environmental lifestyle behaviors, on the other hand, have typically garnered the most attention from researchers. Few studies have simultaneously considered the full spectrum of PEB (L.R. Larson, R. Stedman, C.B. Cooper, and D. Decker, Cornell Lab of Ornithology, unpublished report), and even fewer have examined the influence of wildlife recreation on these behaviors (Teisl and O'Brien 2003). We hypothesized that people who regularly participate in either hunting or birdwatching would be more likely than non-recreationists to participate in all forms of PEB, including both conservation behaviors and environmental lifestyle behaviors. Furthermore, we hypothesized an additive effect, namely that individuals who participated in both hunting and birdwatching would be the most likely to engage in PEB.

STUDY AREA

Our study focused primarily on rural areas of 2 economically struggling counties of upstate New York. Because of insufficient numbers of birdwatchers in the 2 focal counties, we expanded the geographical range to include 8 additional rural counties in upstate New York with similar demographic trends such as relatively low population density (<70 people per square mile) and declining population size (<0% population growth) over the past 20 years (U.S. Census Bureau 2013). Although urban areas are growing and now support more than half of the global population (United Nations 2010), rural communities are a critical yet poorly understood component of the conservation landscape. A growing body of research has challenged traditional assumptions, revealing a strong and potentially expanding presence of rural environmentalism (McBeth and Foster 1994, Jones et al. 1999), but many questions remain. For example, what factors influence the expression of PEB in

rural communities? On one hand, rural regions contain substantial wildlife habitat and therefore support many diverse forms of wildlife recreation (U.S. Fish and Wildlife Service 2012*a*), which could foster a pro-environmental ethic and subsequent PEB. On the other hand, residents of rural areas experiencing economic and social decline may perceive conflicts between conservation and economic growth (Marvier et al. 2006), perhaps leading to diminished expression of PEB. This conservation-recreation dilemma led to our focus on individuals living in economically struggling rural communities; therefore, we excluded residents of the larger towns in each county (3 incorporated areas had populations over 5,000) from the sample.

METHODS

To examine the hypothesized links between wildlife recreation and PEB, we constructed a survey instrument that assessed participation in wildlife-based recreation, engagement in different types of PEB, and several other key behavioral correlates such as socio-demographic characteristics and environmental belief structures. The research protocols were approved by Cornell Institutional Review Board (1101001927).

Wildlife Recreation

We devised a 2-step process to classify individuals into 1 of 4 categories (hunter, birdwatcher, birdwatcher-hunter, and non-recreationist) based on 1) self-identified preferences and 2) self-reported activity levels. First, we asked respondents to "choose the ONE nature-based recreation activity that they enjoyed the most" from the following options: hunting, birdwatching, other nature-based activity, or no nature-based activity. This allowed respondents to identify with a particular group, with an emphasis on wildlife-based recreation categories. The mutually exclusive self-identification approach alone was inadequate in some cases, however, because it did not account for 1) respondents who participated in hunting AND birdwatching on a regular basis or 2) respondents who did not indicate it was their most enjoyable activity but still avidly engaged in hunting and/or birdwatching.

To account for alternative scenarios where the primary self-identification criterion was inadequate, we selected a threshold level of participation above which a birdwatcher or hunter might become classified as a dual activity participant (i.e., a hunter–birdwatcher) or above which a self-identified non-recreationist might be classified as an avid hunter, birdwatcher, or hunter–birdwatcher. We selected the avid participation thresholds for each activity based on the medians of self-reported participation in hunting, birdwatching, and other nature-based recreation within our sample (measured as the number of days in the past 12 months a respondent had spent at least some time participating in activity). Threshold levels for classification as a hunter or birdwatcher independent of the self-identification criterion were therefore the median values for the self-identified hunters (19 or more days of hunting per year) and birdwatchers (190 or more days of birdwatching per year). These median participation rates reported by respondents were nearly equivalent to the mean participation rates for hunters (18 days per year for big game hunters, which represented 97.1% of the hunters in our sample) and somewhat higher than the mean participation rate for birdwatchers (110 days per year) in the most recent iteration of the *National Survey of Fishing, Hunting, & Wildlife-Associated Recreation in the United States* (U.S. Fish and Wildlife Service 2012*a*). Such asymmetry in participation frequencies for hunting and birdwatching are not uncommon, particularly when the definition of birdwatching includes feeder watching from home. In this study, we used the term birdwatcher to refer to any form of bird viewing (defined as taking a trip 1 or more miles from home for the primary purpose of observing birds and/or closely observing birds around the home; U.S. Fish and Wildlife Service 2012*a*). By adopting the median cutoff point to identify avid birdwatchers and avid hunters who did not identify as such, we intentionally sought to minimize the influence of casual participants who may not be as invested in a particular activity.

Using these criteria, if a self-identified hunter also engaged in 190 or more days of birdwatching, we classified him/her as a hunter–birdwatcher. Similarly, if a self-identified birdwatcher also engaged in 19 or more days of hunting, we classified him/her as a hunter–birdwatcher. If a respondent who did not select a most enjoyable activity (i.e., no nature-based activity) participated in hunting and/or birdwatching at levels at or above the median thresholds, we classified him/her as a hunter, a birdwatcher, or both. We excluded from the analysis respondents who self-identified as other types of nature-based recreationists (e.g., anglers, hikers) and did not engage in avid hunting or birdwatching ($n = 36$). We classified the remaining individuals as non-recreationists. It should be noted that although there are many types of hunters based on level of specialization (Needham et al. 2007), equipment used, and types of species hunted (U.S. Fish and Wildlife Service 2012*a*), we did not partition hunters in this study. Similarly, we did not distinguish among the many types of recreational birdwatchers (Scott et al. 2005, Cooper and Smith 2010).

Socio-Demographic Attributes

We collected data on the following socio-demographic characteristics to understand better which are associated with individuals in each wildlife recreation group: gender, age, education (college degree or no college degree), and political orientation (scale: 1 = liberal, 4 = moderate, 7 = conservative). Previous research has shown that socio-demographic variables are strongly associated with pro-environmental beliefs, attitudes, and actions (Vaske et al. 2001, Theodori and Luloff 2002, Larson et al. 2011).

Environmental Beliefs

We also included 3 cognitive antecedents as covariates in models predicting PEB as a function of wildlife-based recreation: environmental concern, self-efficacy, and norms (Stern et al. 1999, Kaiser et al. 2005, Ajzen and Albarracin 2007). Each of these variables has been shown to play an

important role in behavior prediction, particularly in an environmental context (Fishbein and Ajzen 2010).

Environmental concern is closely linked to underlying values (Schultz 2001), and expression of concern may facilitate individuals' abilities to assess and evaluate consequences associated with particular actions (Poortinga et al. 2004, Schultz et al. 2005). Consequently, environmental concern is often an important precursor to PEB. We used items adapted from the "ecological crisis" and "balance of nature" constructs on the New Ecological Paradigm Scale (Dunlap et al. 2000) to assess participants' concerns about their local environment (2 items, Cronbach's $\alpha = 0.742$, scale: -2 = strongly disagree to 2 = strongly agree; e.g., "My local environment is currently suffering ecological damage").

Self-efficacy, also called locus of control or perceived behavioral control, is another essential element in behavior models (Hines et al. 1986, Oreg and Katz-Gerro 2006, Fishbein 2008), and may be particularly relevant when one is assessing the environmental impacts of a particular behavior. If an individual does not believe that he/she possesses the skills or ability to complete a task and achieve a desired outcome that benefits the natural environment, then it is unlikely he/she will participate in that behavior. We measured this environmental efficacy using items adapted from existing instruments assessing perceived behavioral control in an environmental context (Oreg and Katz-Gerro 2006; 2 items, Cronbach's $\alpha = 0.667$, scale: -2 = strongly disagree to 2 = strongly agree; e.g., "My actions can make a difference when it comes to preserving local environmental quality").

Norms depict social influence or the amount of pressure that people perceive they are under from significant others to perform a specific behavior (Smith and Louis 2008). Norms emerge from social networks and interactions and typically include injunctive (i.e., perceptions about how people ought to act) and descriptive (i.e., perceptions about how people actually act) components (Cialdini et al. 1991, Minato et al. 2010), including with respect to the natural environment (Kaiser et al. 2005). We measured environmental norms with items adapted from existing scales (e.g., Kaiser et al. 2005; 2 items, Cronbach's $\alpha = 0.832$; scale: -2 = strongly disagree to 2 = strongly agree; e.g., "Most people in my community think it is important to protect the natural environment").

Because of concerns regarding instrument length and the potential response-time burden for respondents, we used only 2 items to measure each construct. Though more items would undoubtedly lead to better construct representation, the observed values of Cronbach's α (a statistic that typically underestimates true reliability on small scales) suggests a high measurement reliability (Eisinga et al. 2013).

Pro-Environmental Behavior

For PEB outcome variables, we inquired about a suite of behaviors that promote or result in sustainable use of natural resources (Stern 2000, Monroe 2003, Halpenny 2010). To capture a range of PEB, we developed a scale with 9 behavior items, many of which were adapted from existing instruments (Stern 2000, Poortinga et al. 2004, Halpenny 2010, Steg et al. 2014). Respondents rated their frequency of carrying out each behavior on the following scale: 1 = never, 2 = rarely, 3 = occasionally, 4 = often, and 5 = very often. Principal components analysis revealed 2 main categories: 1) environmental lifestyle behaviors (3 items, Cronbach's $\alpha = 0.785$), and 2) conservation behaviors (6 items, Cronbach's $\alpha = 0.798$; Table 1). To facilitate interpretation and statistical analysis, we converted each item into a dichotomous scale. Because environmental lifestyle behaviors might reasonably be carried out daily (e.g., recycling, energy conservation), we classified responses with a mean score greater than or equal to 4 as frequent and less than 4 as infrequent. Because conservation behaviors might reasonably be carried out weekly, monthly, or at longer intervals (e.g., habitat enhancement, wildlife recreation advocacy), we classified responses with a mean score greater than or equal to 3 as frequent and responses with a mean score of less than 3 as infrequent. In addition to analyses predicting the 2 composite behavior scales, we also independently examined predictors for the 6 specific items on the conservation behavior subscale. We chose to focus on the specific conservation behaviors (and not the environmental lifestyle

Table 1. Factor loadings (*A* and *B*) based on Principal Components Analysis with Varimax rotation for items used to evaluate rural New York residents' adoption of pro-environmental behavior based on survey results from 2013. We extracted only factors with eigenvalues > 1; the 2-factor model accounted for 57.2% of the total variance.

Item code	Actual item text	Mean[a]	SD	*A*	*B*
Environmental lifestyle behaviors (Cronbach's $\alpha = 0.785$)		4.41	0.63		
Recycling	Recycled paper, plastic, metal	4.62	0.67	0.04	0.77
Resource conservation	Conserved water or energy in my home	4.40	0.76	0.10	0.87
Green purchasing	Bought environmentally friendly and/or energy-efficient products	4.22	0.83	0.16	0.82
Conservation behaviors (Cronbach's $\alpha = 0.798$)		2.57	0.83		
Private land habitat enhancement	Made my yard or my land more desirable to wildlife	3.95	1.04	0.48	0.36
Conservation policy support	Voted to support a policy or regulation that affects the local environment	2.70	1.29	0.66	0.25
Donation to conservation	Donated money to support local environmental protection	2.43	1.21	0.69	0.22
Wildlife recreation advocacy	Recruited others to participate in wildlife recreation activities	2.31	1.19	0.69	−0.04
Public land habitat enhancement	Volunteered to improve wildlife habitat in my community	2.12	1.16	0.78	0.06
Join environmental group	Participated as an active member in an environmental group	1.89	1.08	0.77	0.02

[a] Scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = very often.

behaviors) because conservation-oriented actions may be of particular interest to the wildlife management community.

Data Collection

In an effort to contact a range of nature-based recreationists while simultaneously focusing on hunters and birdwatchers, we used a hybrid approach implemented by mail and web-based survey (Carrozzino-Lyon et al. 2013) to target 3 populations: hunters, birdwatchers, and landowners (i.e., individuals who may or may not engage in hunting, birdwatching, or any form of nature-based recreation). We collected all survey data from April 2013 through May 2013 using a multiple mailing or e-mailing approach with 4 separate contacts at 1-week intervals (Dillman 2007). On the second week after initial contact, non-respondents received either a reminder postcard or email. On the third week, non-respondents received another copy of the initial questionnaire via mail or web link, followed by either a reminder postcard or email after 1 additional week.

We selected hunters by randomly identifying 699 individuals living in 2 focal counties (Cattaraugus and Chenango) from the 2012 hunting license records provided by the New York State Department of Environmental Conservation. We sent the questionnaire via the mail and received replies from 227 licensed hunters (32.5% response rate). We selected birdwatchers from the membership and citizen-science databases at the Cornell Lab of Ornithology, drawing from the 2 focal counties plus 8 additional rural counties in upstate New York with similar demographic characteristics. Then, via email, we sent a web-based questionnaire to 1,982 birdwatchers in the 10 rural New York counties comprising the study area. We received 758 completed surveys (38.3% response rate) and excluded 112 of these individuals because they did not reside in the focal counties (i.e., some were birdwatchers simply traveling through the study area), resulting in an effective sample of 646 birdwatchers. We selected landowners in the 2 focal counties by randomly identifying parcels in the 2010 GIS Clearinghouse database. We sent questionnaires via mail to 1,026 landowners, and received 388 (37.8% response rate).

After aggregating the hunter, birdwatcher, and landowner samples ($n = 1{,}261$), we deleted respondents with missing data on the PEB items ($n = 320$), resulting in an effective sample size of 941 respondents. To test for non-response bias, we randomly selected 50 non-respondents from each sample (hunter, birdwatcher, landowner) for follow-up telephone contact in June 2013. The telephone follow-up focused specifically on activity participation and demographics and represented a subset of the larger questionnaire. We found no statistically significant differences between respondents and non-respondents in terms of participation rates in the respective wildlife recreation activities. Demographic ratios among respondents and non-respondents in the hunter and landowner categories were comparable; in the birder sample, non-respondents were slightly older and significantly more likely to be male than respondents.

Statistical Analysis

We developed logistic regression models to examine factors predicting the likelihood of individuals carrying out PEB. In these models, we controlled for socio-demographic variables and environmental beliefs to isolate the effects of wildlife-based recreation on PEB. We examined specific comparisons between each type of wildlife-based recreationist and non-recreationists using odds ratios with a statistical significance level of $\alpha = 0.05$. We calculated the probability of adoption of PEB for the average individual in each recreation group using the basic logistic transformation (Menard 2002):

$$P_i = 1/[1 + e^{-(a+b1 \times X1+b2 \times X2\ldots)}];$$

where P_i is the probability of the behavior for group i and $(a + b1 \times X1 + b2 \times X2\ldots)$ are the value of log(odds) calculated based on logit model coefficients and mean X values for average respondent in group i.

We calculated the relative likelihood of wildlife recreationists' adoption of various behaviors (compared to non-recreationists) using the following equation developed by Zhang and Yu (1998) to estimate relative risk:

$$RL_i = \frac{OR_i}{(1 - P_0) + (P_0 \times OR_i)};$$

where RL_i is the relative likelihood (i.e., relative risk) of PEB for group i (compared to control group of non-recreationists), OR_i is the odds ratio for group i, and P_0 is the probability of condition (i.e., PEB) for average individual in control group (i.e., non-recreationists) using the calculation above.

RESULTS

Wildlife Recreation Groups

Our 2-step method for classifying individuals into mutually exclusive groups of wildlife recreationists was effective (Table 2). For example, 96% of hunters, and 96% of birdwatchers spent at least some time hunting and birdwatching in the past 12 months, respectively, with a mean of 29 hunting days per year and 201 birdwatching days per year. Hunters tended not to birdwatch, and birdwatchers tended not to hunt (with the small group of hunter–birdwatchers constituting a notable exception). Participation rates for hunting and birdwatching were highest among hunter–birdwatchers. Nearly 2 out of 3 hunter–birdwatchers listed hunting as the activity they enjoy most. On the other end of the spectrum, only a few people in the non-recreationist category spent any time birdwatching (14%) or hunting (5%) in the past year, providing additional support for the wildlife recreation classification system based on a combination of self-reported identity and a threshold of days participating.

Although the study did not attempt to estimate recreation activity participation rates among the general rural population (i.e., landowners), some inferences can be made based on the landowner-specific sample. When the population of randomly selected landowners was asked about the "ONE nature-based recreation activity they enjoyed the most," 40% listed hunting, 24% listed birdwatching 13% listed other

Table 2. Metrics of participation in hunting and birdwatching corroborate the classification of survey respondents in rural New York, 2013, into the 4 wildlife recreation groups assigned by the combination of self-identification and exceeding threshold levels of avid participation. Sample size for each group is listed in parentheses.

	Non-recreationist (74)	Hunter (290)	Birdwatcher (513)	Hunter–birdwatcher (64)
Hunting variables				
Favorite activity = hunting (%)	0	98	0	66
≥1 day/yr hunting (%)	5	96	8	98
≥19 days/yr hunting (%)	0	55	0	79
Mean hunting per year (days)	0.5	29.3	0.6	44.1
Median hunting per year (days)	0	0	19	29
Birdwatching variables				
Favorite activity = birdwatching (%)	0	0	97	30
≥1 day/yr birdwatching (%)	14	25	96	100
≥190 days/yr birdwatching (%)	0	0	55	86
Mean birdwatching per year (days)	3.5	9.7	201.1	296.5
Median birdwatching per year (days)	0	0	190	365

activities, and 22% indicated no activity as the preferred choice. When asked directly about activity participation in the past 12 months, 48% of rural landowners had hunted, 46% had participated in birdwatching, 53% had participated in other nature-based recreation activities (e.g., fishing, hiking), and 19% indicated they had not participated in nature-based recreation.

The socio-demographic characteristics of respondents (Table 3) who did not regularly participate in wildlife-based recreation generally reflected rural populations across much of upstate New York and the United States (U.S. Department of Agriculture Economic Research Service 2011). These non-recreationists tended to be relatively old (mean age = 63.5 years), well educated (42% had attained a college degree), somewhat conservative, and slightly more likely to be male (58%). Birdwatchers, though typically around the same age as non-participants (mean = 60.7 years), were even more educated (73% had attained a college degree), more liberal, and predominantly female (67%). On the other hand, hunters were younger (mean = 53.0 years), less educated (26% had attained a college degree), more conservative, and predominantly male (93%; Table 3). Socio-demographic attributes for hunter–birdwatchers were very similar to those in the hunter-only group. In terms of environmental beliefs, birdwatchers showed higher levels of environmental concern and environmental efficacy, suggesting they were more concerned about environmental quality and more likely to believe personal actions could make a difference with respect to the local environmental. However, birdwatchers scored lower on the environmental norm scale, indicating they were less likely to believe that environmental protection was valued by people in their local community.

Table 3. Mean values by wildlife-based recreation group from residents of rural New York surveyed in 2013.

Variable	Non-recreationist	Hunter	Birdwatcher	Hunter–birdwatcher
Socio-demographics				
Gender (male)	0.58	0.93	0.33	0.89
Age (mean in years)	63.50	53.00	60.70	60.70
Education (college degree)	0.42	0.26	0.73	0.36
Political ideology[a]	3.19	3.70	2.74	3.88
Environmental beliefs[b]				
Environmental efficacy	3.51	3.62	3.82	3.59
Environmental concern	3.16	3.02	3.43	3.09
Environmental norms	3.55	3.43	3.20	3.45
Pro-environmental behaviors[c]				
Environmental lifestyle behaviors	0.61	0.52	0.77	0.61
Recycling	0.92	0.89	0.98	0.94
Resource conservation	0.85	0.84	0.94	0.94
Green purchasing	0.73	0.70	0.90	0.78
Conservation behaviors	0.08	0.21	0.45	0.47
Private land habitat enhancement	0.74	0.86	0.97	0.98
Conservation policy support	0.46	0.46	0.70	0.70
Donation to conservation	0.23	0.36	0.61	0.56
Wildlife recreation advocacy	0.14	0.52	0.43	0.56
Public land habitat enhancement	0.11	0.30	0.42	0.47
Join environmental group	0.12	0.13	0.35	0.34

[a] Scale: 1 = liberal to 5 = conservative.
[b] Scale: 1 = strongly disagree to 5 = strongly agree.
[c] Reflects binary behavior variable where 0 = rare behavior and 1 = regular behavior.

Scores among the other groups were similar on all belief measures except level of concern for the condition of the environment, where hunters and hunter–birdwatchers scored lower than the birdwatchers and non-recreationists (Table 3).

The 4 types of wildlife recreationists varied in terms of self-reported adoption of PEB, with birdwatchers generally reporting higher levels of PEB than any of the other groups (Table 3). Although these numbers highlight bivariate relationships between wildlife recreation and PEB, they do not account for other variables, such as socio-demographic attributes and environmental beliefs. Logistic regression models helped to control for these known influences and isolated specific links between wildlife-based recreation and PEB.

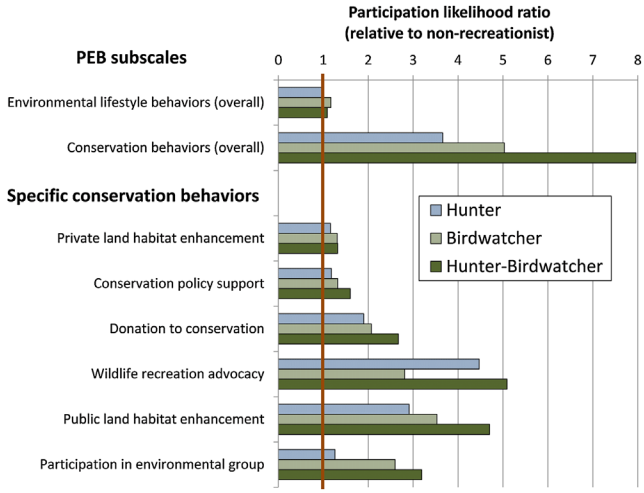

Figure 1. Wildlife-based recreationists' relative likelihood of participating in pro-environment behaviors (PEBs) compared to non-recreationists in rural New York, 2013. We derived relative likelihoods from odds ratios in logistic regression models. A ratio of 1 indicates no difference.

Factors Associated With Pro-Environmental Behavior

On average, only 35% of respondents frequently engaged in conservation behaviors and 67% frequently engaged in environmental lifestyle behaviors. Logistic regression models accounted for variation in conservation behaviors (Nagelkerke $R^2 = 0.246$; $\chi^2_{10} = 185.1$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 13.3$, $P = 0.103$) and environmental lifestyle behaviors (Nagelkerke $R^2 = 0.130$; $\chi^2_{10} = 92.2$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 4.4$, $P = 0.816$). Wildlife recreation was strongly and positively associated with conservation behaviors but not significantly associated with environmental lifestyle behaviors (Table 4). Compared to non-recreationists, hunters (odds ratio = 4.47, $P < 0.01$) and birdwatchers (odds ratio = 6.93, $P < 0.001$) were 4–5 times more likely to participate in conservation behaviors (Fig. 1). In distinction to participation in just 1 of the wildlife recreation activities, we observed strong synergistic effects of hunting and birdwatching. Hunter–birdwatchers were 8 times more likely to engage in conservation behaviors than non-recreationists (odds ratio = 15.07, $P < 0.001$; Fig. 1). These models showed that environmental concern and self-efficacy, but not environmental norms, were important antecedents to both environmental lifestyle and conservation behaviors (Table 4). Demographic variables were also linked to certain types of PEB (Tables 4 and 5). For example, education level was positively associated with both the aggregate environmental lifestyle behaviors (Table 4) and the subscale of conservation behaviors (Table 5).

Recreation status was also related to several specific conservation behaviors. On average, half of the respondents (50%) donated to conservation, and the model explained a significant portion of the variation ($R^2 = 0.205$; $\chi^2_{10} = 156.1$,

Table 4. Parameter estimates, standard errors, and odds ratios (OR) from binary logistic regression models examining factors predicting rural New York residents' adoption of 2 categories of pro-environmental behavior in 2013: conservation behaviors and environmental lifestyle behaviors.

	Conservation behaviors[a]			Environmental lifestyle behaviors[b]		
	β	SE	OR	β	SE	OR
Intercept	−8.09	0.96		−2.18	0.77	
Age	0.01	0.01	1.01	0.01	0.01	1.01*
Gender (male)	−0.11	0.18	0.90	−0.45	0.18	0.64*
Education (college)	0.58	0.18	1.79***	0.41	0.17	1.51*
Political ideology[c]	−0.06	0.07	0.94	−0.05	0.06	0.95
Self-efficacy[d]	0.79	0.11	2.20***	0.33	0.10	1.39***
Environmental concern[d]	0.51	0.10	1.66***	0.23	0.09	1.26**
Environmental norms[d]	0.11	0.10	1.11	0.07	0.09	1.08
Birdwatcher[e]	1.94	0.46	6.93***	0.44	0.28	1.55
Hunter[e]	1.50	0.49	4.47**	0.00	0.29	1.00
Hunter–birdwatcher[e]	2.71	0.54	15.07***	0.22	0.37	1.25

*, **, and *** denote significance of odds ratios at $\alpha = 0.05$, 0.01, and 0.001, respectively.

[a] Conservation behavior scale denotes regular levels of aggregate mean engagement in the following behaviors: private land habitat enhancement, conservation policy support, donation to conservation, wildlife recreation advocacy, public land habitat enhancement, involvement in an environmental group.

[b] Environmental lifestyle behavior scale denotes regular levels of aggregate mean engagement in the following behaviors: recycling, energy/water conservation, green purchasing.

[c] Scale: 1 = liberal to 5 = conservative.

[d] Scale: 1 = strongly disagree to 5 = strongly agree.

[e] Dummy variable for wildlife-related recreation group relative to non-recreationist.

Table 5. Parameter estimates, standard errors, and odds ratios (OR) from binary logistic regression models examining factors predicting rural New York residents' adoption of specific conservation behaviors with implications for wildlife conservation and management in 2013.

	β (SE) OR					
	Donate to conservation	**Private land habitat enhancement**	**Public land habitat enhancement**	**Wildlife recreation advocacy**	**Join environmental group**	**Conservation policy support**
Intercept	−3.88 (0.79)	−3.01 (1.28)	−5.45 (0.85)	−5.04 (0.82)	−8.28 (0.99)	−4.87 (0.80)
	NA	NA	NA	NA	NA	NA
Age	0.01 (0.01)	−0.01 (0.01)	0.00 (0.01)	−0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
	1.01	0.99	1.00	0.98**	1.02**	1.02**
Gender (male)	−0.46 (0.18)	−0.13 (0.36)	0.02 (0.18)	−0.07 (0.18)	0.47 (0.19)	−0.09 (0.18)
	0.63**	0.88	1.02	0.93	1.60*	0.91
Education (college)	0.34 (0.16)	0.01 (0.30)	0.19 (0.16)	0.42 (0.17)	0.58 (0.19)	0.57 (0.16)
	1.40*	1.01	1.20	1.52*	1.79**	1.76***
Political ideology[a]	−0.22 (0.06)	0.13 (0.11)	−0.02 (0.06)	0.06 (0.06)	−0.11 (0.07)	−0.09 (0.06)
	0.80***	1.14	0.98	1.06	0.90	0.92
Self-efficacy[b]	0.61 (0.10)	0.32 (0.18)	0.57 (0.11)	0.68 (0.11)	0.72 (0.12)	0.63 (0.10)
	1.83***	1.38	1.77***	1.98***	2.06***	1.89***
Environmental concern[b]	0.30 (0.09)	0.48 (0.16)	0.24 (0.09)	0.31 (0.09)	0.42 (0.10)	0.37 (0.09)
	1.34***	1.60**	1.28**	1.36***	1.52***	1.45**
Environmental norms[b]	−0.02 (0.09)	0.49 (0.17)	0.13 (0.09)	0.11 (0.09)	0.25 (0.10)	0.06 (0.09)
	0.98	1.63**	1.14	1.12	1.28*	1.06
Birdwatcher[c]	1.19 (0.31)	2.60 (0.43)	1.59 (0.40)	1.25 (0.37)	1.18 (0.39)	0.61 (0.28)
	3.30***	13.4***	4.91***	3.50***	3.24**	1.85*
Hunter[c]	1.02 (0.37)	0.76 (0.37)	1.31 (0.42)	1.97 (0.39)	0.26 (0.43)	0.35 (0.29)
	2.79**	2.13*	3.69**	7.14***	1.30	1.41
Hunter–birdwatcher[c]	1.85 (0.40)	3.14 (1.06)	2.07 (0.47)	2.21 (0.45)	1.47 (0.48)	1.25 (0.39)
	6.39***	23.1***	7.95***	9.10***	4.36**	3.47***

*, **, and *** denote significance of odds ratios at $\alpha = 0.05$, 0.01, and 0.001, respectively.
[a] Scale: 1 = liberal to 5 = conservative.
[b] Scale: 1 = strongly disagree to 5 = strongly agree.
[c] Dummy variable for wildlife-related recreation group relative to non-recreationist.

$P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 14.2$, $P = 0.077$). Those participating in wildlife recreation were 2–3 times more likely to donate than non-recreationists (Table 5 and Fig. 1). Private land habitat enhancement was common (carried out by 92.1% of respondents), and the model ($R^2 = 0.211$; $\chi^2_{10} = 87.7$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 11.6$, $P = 0.171$) indicated that wildlife recreationists were 1.2–1.3 times more likely to engage in private land habitat enhancement (Table 5). About 36% of respondents engaged in public land habitat enhancement, and the model accounting for variation in this behavior ($R^2 = 0.120$; $\chi^2_{10} = 85.1$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 13.9$, $P = 0.084$; Table 5) showed that wildlife recreationists were 3–5 times more likely to participate. On average, 45% of respondents engaged in wildlife recreation advocacy ($R^2 = 0.170$; $\chi^2_{10} = 125.8$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 10.1$, $P = 0.257$), and wildlife recreationists were 3–5 times more likely to do so than non-recreationists (Table 5 and Fig. 1). Models predicting the likelihood of joining an environmental group (self-reported by 26% of respondents; $\chi^2_{10} = 149.4$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 8.9$, $P = 0.349$; $R^2 = 0.216$) and supporting conservation policy (self-reported by 61% of respondents; $\chi^2_{10} = 134.5$, $P < 0.001$; Hosmer–Lemeshow $\chi^2_8 = 15.2$, $P = 0.056$; $R^2 = 0.181$) showed that birdwatchers and hunter–birdwatchers, but not hunters, were significantly more likely than non-recreationists to adopt these particular conservation behaviors (Table 5). Across all conservation behavior variables, effects appeared to be additive; hunter–birdwatchers were more likely to participate in each type of conservation behavior than any of the other groups (Fig. 2).

Subscale scores revealed that respondents who were female, older, and well-educated were more likely to participate in environmental lifestyle behaviors (Table 4). Demographic differences in overall conservation behavior were observed

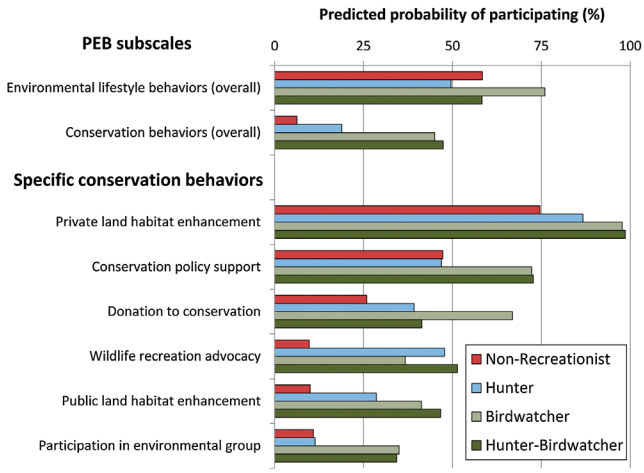

Figure 2. Predicted probability of participating (%) in different types of pro-environmental behaviors (PEBs) for individuals in each type of wildlife-based recreation group in rural New York, 2013. We calculated predicted probabilities from log(odds) in the logit model.

only for the education variable (Table 4), though differences were evident for specific conservation behavior items (Table 5). For example, females and individuals with higher education levels were more likely to donate to conservation. Males were more likely to participate in environmental groups. Political ideology was significantly linked to only 1 variable—donation to conservation—with liberals more likely to contribute. Demographic variables did not appear to affect habitat enhancement on either private or public lands (Table 5).

DISCUSSION

We extended past research that examined associations between wildlife recreation and PEB by incorporating a wider range of conservation-oriented behaviors and more concrete measures of recreation (Teisl and O'Brien 2003, Thapa 2010, Glowinski and Moore 2014). Respondents in our rural sample reported high rates of environmental lifestyle behaviors such as recycling, energy conservation, and green purchasing, but analyses did not reveal a significant link between wildlife recreation and these lifestyle behaviors. Although self-reported engagement in various forms of conservation behaviors (e.g., habitat enhancement, joining an environmental group, donation to conservation) occurred much more infrequently, our findings supported the hypothesized positive association between wildlife recreation and engagement in conservation-oriented activities. As concerns regarding low levels of public adoption of PEB—and conservation behaviors specifically—escalate, scholars attempting to identify interventions that effectively encourage PEB have uncovered a range of useful strategies including education, marketing, incentives, and other approaches aimed at building enduring commitment and self-efficacy (Hungerford and Volk 1990, De Young 1993, Heimlich and Ardoin 2008, Steg and Vlek 2009). Our data suggest that the promotion of wildlife-based recreation activities such as birdwatching and hunting could be an additional strategy. In rural areas where outdoor recreation opportunities abound (e.g., approx. 81% of our sample had engaged in some type of nature-based activity in the past 12 months) and conservation behavior participation rates are low (e.g., predicted participation rates for non-recreationists in our sample was at or below 10% for many behaviors), efforts to increase the number of avid wildlife recreationists might yield significant increases in PEB.

Results also provide evidence to support an additive effect of consumptive and non-consumptive wildlife recreation. Individuals who regularly go birdwatching and hunting were more likely to engage in conservation behaviors than individuals who did only 1 or neither of those activities. These findings advance understanding of the relationship between conservation and recreation, building upon previous studies that have revealed experience with nature is fundamental in influencing nature-related values (Kellert 1996), emotional affinity towards nature (Kals et al. 1999), environmental concern (Dunlap and Heffernan 1975), and PEB (Theodori et al. 1998, Teisl and O'Brien 2003, Zaradic et al. 2009, Halpenny 2010, Scannell and Gifford 2010, Larson et al. 2011).

We found that, in some cases, wildlife recreation can offset the strong influence of certain socio-demographic attributes (e.g., education level, political orientation) that are often associated with a decreased likelihood of participating in PEB. In other words, the frequency with which hunters engaged in conservation behaviors was high relative to non-recreationists with similar socio-demographic attributes. It is not clear, however, why recreation may effectively nullify some of these demographic differences. Perhaps wildlife recreation fosters connections with local landscapes that builds and/or reinforces attachment to place, ultimately leading to place-protecting actions (Stedman et al. 2008, Budruk and Wilhelm Stanis 2013). The causal nature of the relationships identified in this study is also unclear. For example, perhaps the significant relationship between conservation and recreation is driven by an unidentified, unmeasured covariate that may emerge through evolving behavior theory such as Fishbein and Ajzen's (2010) Reasoned Action Approach. Future research could explore this possibility and examine the complex relationships between wildlife recreation, demographic attributes, environmental beliefs, and PEB in more detail in other types of settings.

The synergistic effect of dual recreation was of particular interest; for individuals who participated in hunting and birdwatching (i.e., hunter–birdwatchers), the likelihood of carrying out conservation behaviors increased to 8 times that of non-recreationists. These additive effects have important implications for a wildlife conservation community that is constantly struggling to muster the financial and political support needed to make progress on urgent wildlife conservation issues. Nevertheless, a perceived dichotomy has persisted for decades, possibly because birdwatchers and hunters are typically viewed as different types of people and altogether different populations driven by distinct values and beliefs (Duffus and Dearden 1990, Daigle et al. 2002). Although our study supports other research showing the 2 groups differ by gender, education, and political orientation (Adams et al. 1997), our data also suggest that the environmental beliefs and conservation behaviors of birdwatchers and hunters might be more similar than many recognize. Earlier work revealed a similar pattern, showing substantial overlap in wildlife values among individuals associated with conservation organizations that were game-oriented, such as National Wild Turkey Federation and Ducks Unlimited, and non-game oriented, such as Defenders of Wildlife and National Audubon Society (Purdy et al. 1983). Later studies corroborated these findings, indicating similar rates of involvement in or contributions to environmental organizations for both wildlife watchers and hunters (Teisl and O'Brien 2003). For these reasons, as other scholars have noted, frameworks that segregate non-consumptive and consumptive forms of wildlife recreation may not be particularly useful—and even potentially damaging—when considering conservation goals (Connelly et al. 1985, Schreyer et al. 1989). In fact, our results support

earlier suggestions that wildlife recreation may transcend socio-demographic attributes when it comes to certain types of PEB (Theodori et al. 1998). Therefore, future efforts to generate additional support for conservation could emphasize the value of connecting with and fostering support for both birdwatching and hunting.

Notable differences in the relative likelihood of engaging in conservation-oriented actions were evident for several behaviors that may be of particular interest to the wildlife management community. For example, with other factors held constant, hunters were 1.9 times more likely, birdwatchers were 2.1 times more likely, and hunter–birdwatchers were 2.7 times more likely than non-recreationists to donate money to conservation. Earlier studies focused on hunters (Mahoney and Jackson 2013) and birdwatchers (McFarlane and Boxall 1996) have shown that wildlife recreation is commonly associated with political engagement in the conservation arena. Furthermore, hunters (Benson 2010) and birdwatchers (McFarlane and Boxall 1996, Scott 2013) are often members and regular contributors to local clubs and organizations focused on natural resource conservation. Conservation fundraising efforts that target dual participants (i.e., birdwatcher-hunters) may therefore be more effective than those that focus on a particular recreation group.

Similar patterns were observed for private and public land habitat enhancement. Although private land habitat enhancement was a relatively common practice in rural areas—even among respondents who were non-recreationists—participation in any form of wildlife recreation was associated with significant increases in the relative likelihood of carrying out habitat enhancement. Hunters were 2.9 times more likely, birders were 3.5 times more likely, and hunter–birdwatchers were 4.7 times more likely than non-recreationists to carry out these activities. The strong link between wildlife recreation and local habitat enhancement is not surprising, primarily because wildlife recreationists depend directly on healthy habitats and ecosystems to support the wildlife populations that sustain their recreation. Future research could investigate in more depth the specific types of habitat enhancement that appeal to both game- and non-game oriented recreationists.

Wildlife recreationists were also more likely to engage in wildlife recreation advocacy, with hunter–birdwatchers (5.1 times more likely than non-recreationists) and hunters (4.5) leading the way. This behavior may play a key role in shaping public perceptions of wildlife recreation and associated benefits. In rural areas, hunters have developed social systems that have enabled recruitment, retention, and communication about conservation-oriented activities (Stedman and Heberlein 2001). Our data confirm that, relative to non-recreationists and birdwatchers in rural areas, hunters tend to advocate more often for their preferred activity and articulate the beneficial outcomes it provides to local ecosystems and communities. These differences may be an artifact of longstanding efforts to counter anti-hunting sentiment and stimulate interest in hunting for wildlife management (vs. sport), but more research is needed to explore this possibility.

Although links between wildlife recreation and conservation behaviors were very clear, associations between hunting, birdwatching, and environmental lifestyle behaviors such as recycling, energy conservation, and green (eco-friendly) purchasing were much less pronounced. All respondents were more likely to participate in environmental lifestyle behaviors (and do so more frequently), but when controlling for socio-demographic characteristics their prevalence was unrelated to involvement in wildlife recreation. Our data therefore suggest that research focused primarily on environmental lifestyle behaviors, a common theme in many PEB studies (Stern 2000, Poortinga et al. 2004, Steg and Vlek 2009), may fail to detect associations between wildlife recreation and conservation. Researchers focused on understanding and predicting the relationship between wildlife-based recreation and PEB should therefore ensure that conservation-oriented actions with specific wildlife management implications are explicitly considered in PEB assessment.

As need for a broader appreciation of and support for conservation among Americans grows increasingly urgent, understanding the extent to which nature-based activities contribute to such appreciation and awareness has become a high priority within the wildlife conservation community (U.S. Fish and Wildlife Service 2012*b*). Our data highlight the conservation contributions of hunters and birdwatchers, showing that both groups are more likely to engage in conservation behaviors than individuals who do not participate in wildlife recreation. Conservation efforts may especially benefit from a more comprehensive understanding of the motivations and values of individuals who regularly participate in both birdwatching and hunting. Though the anticipated outcomes and benefits associated with each activity undoubtedly vary (Daigle et al. 2002), the broader implications of such engagement may be similar, particularly when these activities occur together (e.g., waterfowl hunting). Demographically, the hunter–birdwatchers in this study were more similar to hunters than birdwatchers, and future work on recreation and PEB could therefore attempt to segment hunters into groups that include those who engage in birdwatching and those who do not. Additional research aimed at characterizing and understanding different groups of wildlife-based recreationists could also inform conservation-oriented communication, messaging, and management, thereby fostering positive interactions that ultimately lead to productive conservation action.

MANAGEMENT IMPLICATIONS

Shifting patterns of wildlife-based recreation have created challenges for wildlife managers. Although birdwatching has reached nearly unprecedented highs (Cordell et al. 2008, Outdoor Foundation 2014), hunting continues to decline (U.S. Fish and Wildlife Service 2013*a*, Vrtiska et al. 2013). As debate surrounding the implications of these trends grows, the wildlife conservation community has become increasing interested in relationships between hunting, birdwatching, and conservation. Results of this study suggest

that both activities are significantly and positively associated with a range of pro-environmental behaviors, particularly actions that contribute directly to natural resource conservation. This is good news for the wildlife conservation community, where many people have concern that the decline in hunting among Americans inevitably will lead to a corresponding decline in conservation interest and activity. To the extent our findings are generalizable, they indicate that agency program investment supporting wildlife viewing has been, as hypothesized by proponents of such programs, a wise investment in developing citizen-conservationists. Diversified agency program portfolios that include programs to encourage hunting and wildlife viewing in their various forms would seem most likely to return long-term gains for conservation. Even in those states where wildlife agencies maintain the traditional stance that citizens who hunt are the primary focus of state wildlife programs, our study suggests that supporting those with hunting and birdwatching interests in their pursuit of both will yield greater conservation returns.

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