

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Nebraska Cooperative Fish & Wildlife Research
Unit -- Staff Publications

Nebraska Cooperative Fish & Wildlife Research
Unit

12-2019

Hunters and Their Perceptions of Public Access: A View from Afield

Joseph J. Fontaine

Alexis D. Fedele

Lyndsie S. Wszola

Lindsey N. Messinger

Christopher J. Chizinski

See next page for additional authors

Follow this and additional works at: <https://digitalcommons.unl.edu/ncfwrustaff>



Part of the [Aquaculture and Fisheries Commons](#), [Environmental Indicators and Impact Assessment Commons](#), [Environmental Monitoring Commons](#), [Natural Resource Economics Commons](#), [Natural Resources and Conservation Commons](#), and the [Water Resource Management Commons](#)

This Article is brought to you for free and open access by the Nebraska Cooperative Fish & Wildlife Research Unit at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Nebraska Cooperative Fish & Wildlife Research Unit -- Staff Publications by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Authors

Joseph J. Fontaine, Alexis D. Fedele, Lyndsie S. Wszola, Lindsey N. Messinger, Christopher J. Chizinski, Jeffery J. Lusk, Karie L. Decker, J. Scott Taylor, and Erica F. Stuber

Surveys

Hunters and Their Perceptions of Public Access: A View from Afield

Joseph J. Fontaine,* Alexis D. Fedele, Lyndsie S. Wszola, Lindsey N. Messinger, Christopher J. Chizinski, Jeffery J. Lusk, Karie L. Decker, J. Scott Taylor, Erica F. Stuber

J.J. Fontaine, A.D. Fedele, L.S. Wszola, L.N. Messinger, E.F. Stuber*

Nebraska Cooperative Fish and Wildlife Research Unit and School of Natural Resources, University of Nebraska, Lincoln, Nebraska 68583

C.J. Chizinski

School of Natural Resources, University of Nebraska, Lincoln, Nebraska 68583

J.J. Lusk

Nebraska Game and Parks Commission, Lincoln, Nebraska 68503

K.L. Decker

Rocky Mountain Elk Foundation, Missoula, Montana 59808

J.S. Taylor

Pheasants Forever Inc. & Midwest Association of Fish and Wildlife Agencies, Brookings, South Dakota 57006

Abstract

Declining hunter participation threatens cultural traditions and public support for conservation, warranting examination of the forces behind the downward trajectory. Access to lands for hunting, an often-cited reason for nonparticipation, may play a critical role in the retention and recruitment of hunters. Meeting the access needs of a diverse hunting constituency requires understanding how hunters use and perceive access opportunities, particularly public-access sites. Given that perceptions of access are entirely place based and degrade with time, traditional postseason survey methods may fail to adequately quantify the value of public access to the hunting constituency. To overcome the potential limitations of postseason surveys, we conducted on-site assessments of hunter perceptions of habitat quality, game abundance, ease of access, and crowding as well as whether the experience met the hunters' expectations and their likelihood to return to hunt. Over 3 y, we interviewed 3,248 parties of which 71.5% were hunting. Most parties (65.9%) reported having no private access within the region of Nebraska where they were interviewed. Parties (67.6%) were largely limited to two or fewer hunters, most of whom were adult males (84.3%) who were, on average, 41.2 y old. The perception of public-access sites was generally positive, but 43.1% of parties indicated that game abundance was below average despite 59.2% of parties seeing game and 37.3% harvesting at least one animal. Similar to other explorations of hunter satisfaction, we found game abundance, and in particular harvest success, had the most consistent relationship with hunter perception of public access. By surveying multiple types of hunters across sites that encompass a range of social and ecological conditions, we gained a broader understanding of how hunters perceive public access in real time, which will help to inform future management decisions to foster and improve public-access programs.

Keywords: hunter recruitment; hunter retention; hunter satisfaction; public access

Received: August 28, 2018; Accepted: April 4, 2019; Published Online Early: May 2019; Published: December 2019

Citation: Fontaine JJ, Fedele AD, Wszola LS, Messinger LN, Chizinski CJ, Lusk JJ, Decker KL, Taylor JS, Stuber EF. 2019. Hunters and their perceptions of public access: a view from afield. *Journal of Fish and Wildlife Management* 10(2):xx-xx; e1944-687X. doi: <https://doi.org/10.3996/082018-JFWM-077>

Copyright: All material appearing in the *Journal of Fish and Wildlife Management* is in the public domain and may be reproduced or copied without permission unless specifically noted with the copyright symbol ©. Citation of the source, as given above, is requested.

The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the



U.S. Fish and Wildlife Service.

* Corresponding author: jfontaine2@unl.edu

Introduction

State fish and wildlife agencies rely on hunters to fund conservation initiatives through license sales and excise taxes on outdoor equipment and in some cases to facilitate the management of wildlife populations through regulated harvest (Conover and Chasko 1985; Holsman 2000; Mehmood et al. 2003; Bhandari et al. 2006). The ongoing decline in hunter participation (Ryan and Shaw 2011; Larson et al. 2014) not only constitutes a threat to the longstanding cultural institution of hunting but also to vital conservation and management support (Enck et al. 2000; Li et al. 2003). Providing sufficient access is among the many constraints limiting participation in hunting (Wright and Kaiser 1986; Miller and Vaske 2003). For hunters, access, broadly defined as “the ability to derive benefits from things” (Ribot and Peluso 2003), translates to the ability to pursue game animals on a piece of land and gain the associated social, sustenance, and health benefits (Wright and Kaiser 1986; Miller and Vaske 2003). In the United States, private property plays a critical role in providing access for hunters (Brown et al. 1984; Wright and Kaiser 1986; Miller et al. 2002), but access to private lands is declining (Lauber and Brown 2000; Jagnow et al. 2006), in part due to demographic trends toward urbanization that have weakened the social ties that historically facilitated access to privately owned properties in rural areas where game is most common (Schulz et al. 2003; Stedman et al. 2008; Robison and Ridenour 2012). Disconnected from private landowners, hunters from urban communities increasingly rely on locations open to public hunting (Miller and Vaske 2003; Stedman et al. 2008).

Given the increasing importance of public hunting opportunities, there is a need to understand the hunters that use public sites as well as their perceptions of the opportunities provided. Wildlife agencies traditionally rely upon postseason mail or phone surveys to assess hunter perceptions and attitudes, but recollections and opinions of experiences change with time and setting, increasing the potential for introducing unintended biases when assessments are conducted independent of the experience (Bradburn et al. 1987; Marsh 2007; Lynch and Addington 2010). Moreover, postseason surveys are largely incapable of associating a hunter and his or her experience with a given location at a specific time, limiting the value of postseason surveys to understanding the general concept of satisfaction and leaving managers with limited detail on how to improve access programs.

Herein, we identified the users of public-access sites to quantify hunter perceptions of public-access hunting opportunities across nine socially and ecologically distinct regions of Nebraska, USA (Figure 1). Because

the perceptions of access are entirely place based and change with time (Bradburn et al. 1987; Marsh 2007; Lynch and Addington 2010), we interviewed hunters immediately following their hunting experience. We asked hunters to rate their perception of public-access site attributes related to satisfaction: habitat quality, game abundance, crowding, and accessibility. Furthermore, we inquired whether their experience met their overall expectations and whether they were likely to return to hunt the same property again. By recording factual (e.g., harvest) as well as perceptual information immediately following an experience, we aim to overcome some of the limitations of postseason surveys and collect place-based information that more adequately describes the hunting experience and hunter satisfaction (Smith 1984; Connelly et al. 2008). Looking across a diversity of measures, we provide a baseline for understanding of how public access shapes hunter satisfaction with the intent of helping managers develop more effective public-access programs.

Methods

Study system

Nebraska is ~97% privately owned (Bishop et al. 2011), and although it is possible to hunt most rural lands in Nebraska with landowner permission, access to private lands is often limited (Sigmon 2004), and even hunters with access to private lands often use public-access sites at some point during the hunting season (Nebraska Game and Parks Commission [NGPC] 2017a). Our study area included nine regions (Figure 1) that varied in the number and total land area of public-access sites, composition of public-access ownership, human population density and infrastructure, and game species availability and abundance (U.S. Census Bureau 2010; NGPC 2017b). We use the term “public access” to reference any location where hunting is open to the public at any time. Public-access sites included publically owned properties (e.g., state-owned Wildlife Management Areas, federally owned U.S. Fish and Wildlife Service Waterfowl Production Areas) and properties enrolled in the Nebraska Open Fields and Waters program, a public-private partnership whereby the state leases public access on private lands.

Hunter identity, success, and perceptions

To understand the value of public access to hunters in Nebraska, we opportunistically interviewed parties exiting public-access sites following a standardized creel survey protocol (Pollock et al. 1994). We interviewed hunters from September 1 to January 31 (upland, small game, waterfowl, deer, and fall turkey seasons) and from

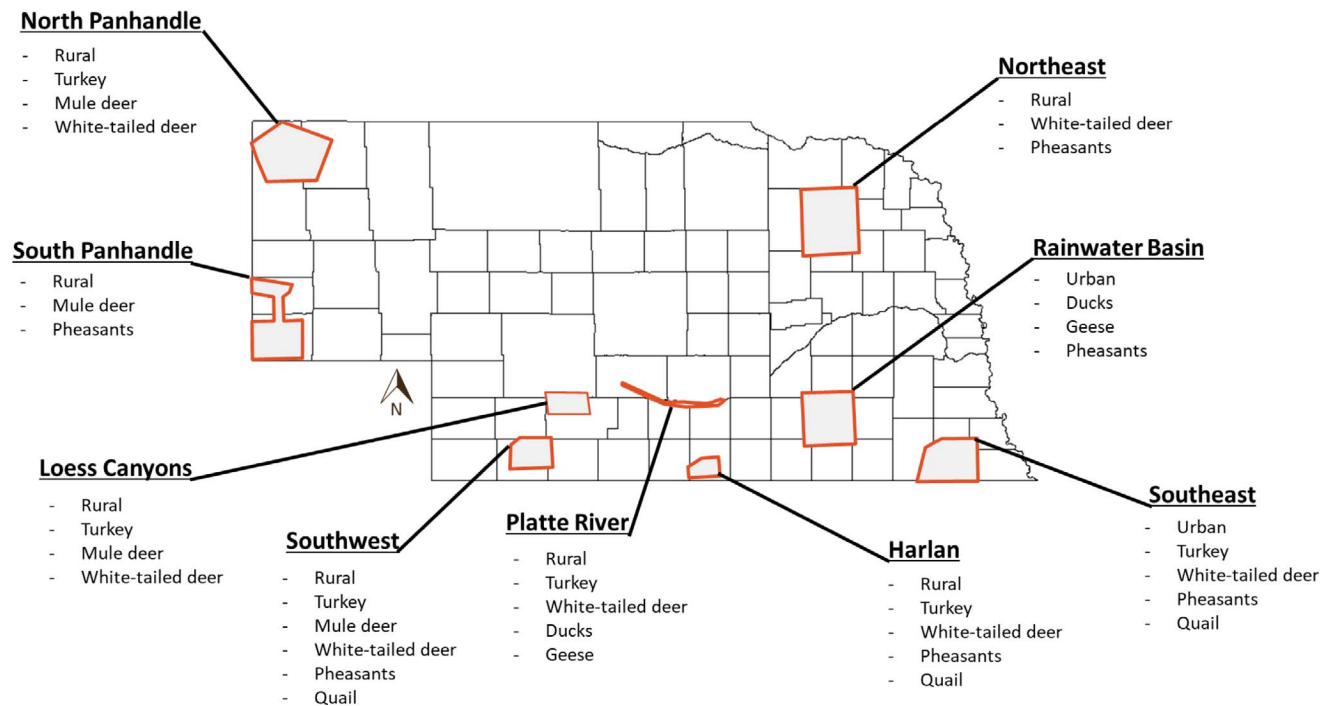


Figure 1. Survey regions where we conducted in-person interviews from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017). We selected survey regions to represent the diversity of available game and variation in the proximity to urban centers of public-access sites throughout Nebraska.

March 25 to May 31 (spring turkey season) of study years 2014 to 2015, 2015 to 2016, and 2016 to 2017. Because of logistical constraints, interview effort among regions was not equal, we did not conduct interviews in all regions during all possible seasons or study years, and questions relating to site perceptions were limited to the first two study years. We defined an access site as a Public Land Survey System section of land (i.e., square mile, or 259 ha; U.S. Geological Survey 2018) that included any land open to public hunting. All sampling locations were no larger than a single section, but multiple sampling locations could be adjacent to one another (NGPC 2017b).

Interviews (Appendix S1, *Supplemental Material*) aimed to ascertain what parties were doing on a public-access site (e.g., hunting, hiking); and for parties that were hunting, to identify party attributes that may affect perceptions of the hunting experience, including party size, age, and home zip code of party members, game animals seen and harvested, primary game animal being pursued, and whether parties had access to private hunting lands. We generated additional demographic data based on reported zip codes, including median income and population density (U.S. Census Bureau 2010, 2016, 2018). We used population density to categorize individuals as coming from urban (>313 people/km²; U.S. Census Bureau 2010, 2016, 2018) or rural communities. Parties identifying as hunters were asked why they chose the site they were hunting and how they found out about the site. We also asked hunters to rate their experience on a 5-point Likert-type

scale (1, below; 3, average; 5, above) regarding habitat quality, target game abundance, crowding, ease of access, likelihood of return, and whether their experience met their expectations. We only collected information on parties that agreed to be interviewed and included at least one member over the age of 19 y, per institutional human subjects' policy, and conducted all work under Institutional Review Board approval 20120912892EX.

Analysis

We used general descriptive analyses (SPSS 25.0, version 25.0; IBM Corp., Armonk, NY) to summarize information on party-level participation and composition for the various study regions and type of game animals pursued, as well as basic demographic characteristics for individual party members. To further understand how characteristics of the hunting party affect their level of satisfaction with their experience afield, we conducted a series of independent ordinal logistic regressions of party-level perceptions for six measures of their public-access hunting experience: habitat quality, game abundance, crowding, ease of access, likelihood to return, and met expectations. We included as predictors in each of the six separate models the categorical variables study region and species of game animal being pursued; binary responses (yes, no) for female, youth, or nonresident inclusion in the party; and the continuous covariates representing mean party age, median income, and home population density as well as party size and number of target game animals seen. We also included

Table 1. Representation of outdoor activities reported by parties interviewed on state, federal, and private properties open to public use in Nebraska, USA (2014–2017).

Activity	March–May			September–January		
	%	±SD	N	%	±SD	N
Angling	11.41	17.09	130	2.63	1.77	83
Camping	4.55	2.68	29	1.53	1.68	53
Exercise	2.64	2.42	16	1.15	0.41	32
Horse	1.67	2.68	4	0.03	0.05	1
Hunting	55.24	30.90	196	77.76	6.05	2,127
Mushrooming	4.86	5.89	49	0.00	0.00	0
Other	2.80	2.49	18	0.72	0.77	25
Nonrespondent	0.81	0.75	5	3.36	1.91	80
Picnic	0.49	0.85	1	0.15	0.13	5
Running dog	5.33	2.29	23	3.13	0.48	90
Scouting	4.01	3.70	33	5.04	2.53	159
Target shooting	1.10	0.95	8	1.47	0.42	44
Trapping	0.00	0.00	0	0.91	0.16	25
Water sport	1.34	1.23	11	0.03	0.05	1
Wildlife viewing	2.40	1.75	9	0.93	0.92	31
Working	1.34	1.23	11	1.17	0.25	34

harvest success, limited to a binary response (yes, no; anyone in the party harvest an animal) because of the significant differences in bag limits and likely expectations among game species pursued. For each parameter in the model, we calculated the parameter estimate (±SE), Wald statistic, and associated *P* value as well as odds ratios and associated 95% confidence intervals. For each model, we assessed four measures of model performance (Hair et al. 1998): 1) a χ^2 test for goodness

of fit, whereby a statistically significant value (i.e., *P* < 0.05) indicates that the final model is an improvement over an intercept-only model; 2) Pearson’s χ^2 , whereby a statistically significant value indicates that the observed data are inconsistent with the fitted model; 3) deviance, a measure of unexplained variation in the model such that higher values reflect a less accurate model; and 4) three measures of pseudo R-squared, whereby larger values indicate better model fit.

Results

Over 3 y, representing spring and fall hunting seasons, we approached 3,333 parties using public-access sites in Nebraska, and we successfully interviewed 3,248 (97.4% response rate). Hunting (71.5%, *n* = 2,323) was the predominant activity reported (Table 1), with parties interviewed in the fall (*n* = 2,127) primarily identifying as white-tailed deer *Odocoileus virginiana* hunters or ring-necked pheasant *Phasianus colchicus* hunters (Tables 2 and 3), and parties interviewed in the spring (*n* = 196) limited by regulation to hunting only wild turkey *Meleagris gallopavo*. Mean party age was 42.4 ± 13.6 y, and most parties were small, with 67.6% having two or fewer hunters. With the exception of the Southeast and Rainwater Basin regions, which had low female participation, and the Loess Canyons region, which had high youth participation, there was relatively little variation in party gender participation (10.8% of parties included an adult female hunter) or youth participation (15.7% of parties included a youth hunter; Tables 2 and 3). Parties

Table 2. Game pursued, demographics, success, and relationships with public access for hunting parties interviewed in different survey regions from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017). We selected survey regions to represent the diversity of available game and variation in the proximity to urban centers of public-access sites throughout Nebraska.

Region	<i>n</i>	Mode party size, no. (%)	Primary fall game	%	% of parties reporting								
					At least one member is a				Target game		“Public” as		
					Woman	Youth	Non-resident	Urbanite ^a	Seen	Harvested	Lacking private access	the primary reason for site selection	Site discovered through public outreach
North Panhandle	326	2 (39.3)	White-tailed deer ^b	44.4	9.8	14.4	61.0	18.6	51.5	35.9	74.8	21.2	42.9
South Panhandle	12	2 (50.0)	Mule deer ^c	41.7	25.0	16.7	25.0	8.3	66.7	25.0	50.0	0.0	41.7
Southwest	587	2 (33.0)	Pheasant ^d	60.5	12.9	17.4	65.8	41.2	66.1	32.9	62.9	23.9	50.1
Loess Canyons	139	2 (41.6)	White-tailed deer ^b	46.8	17.3	30.2	18.0	10.8	45.3	24.5	71.9	38.1	66.2
Harlan	219	1 (44.3)	White-tailed deer ^b	83.0	11.9	7.3	15.5	16.9	75.8	41.6	82.2	35.2	36.5
Platte River	103	1 (43.7)	White-tailed deer ^b	71.3	10.7	12.6	6.8	6.8	59.1	56.3	35.9	31.1	15.5
Northeast	19	1,2 (21.1)	Pheasant ^d	84.2	0.0	36.8	15.8	21.1	84.2	78.9	36.8	15.8	26.3
Rainwater Basin	357	2 (34.7)	Pheasant ^d	55.7	9.0	12.9	17.1	40.5	78.4	50.7	60.8	8.7	39.5
Southeast	561	2 (38.0)	White-tailed deer ^b	37.9	8.4	16.0	18.9	55.6	45.6	31.2	64.5	27.5	57.6

^a Based on U.S. Census Bureau data for reported home zip code of hunters.

^b *Odocoileus virginianus*.

^c *Odocoileus hemionus*.

^d *Phasianus colchicus*.

Table 3. Demographics, success, and relationships with public access for hunting parties pursuing different game that we interviewed from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Regulatory group	Game	n	Mode party size, no. (%)	% of parties reporting								
				At least one member is a				Target game		Lacking private access	“Public” as the primary reason for site selection	Site discovered through public outreach
				Woman	Youth	Non-resident	Urbanite ^a	Seen	Harvested			
Migratory birds	Dove ^b	47	2 (40.4)	4.3	19.1	6.5	28.3	83.0	46.8	74.5	21.3	38.3
	Ducks ^c	181	2 (37.0)	7.7	14.4	17.4	33.7	87.3	70.2	60.2	8.3	40.9
Upland birds	Geese ^c	7	2 (42.9)	14.3	0.0	0.0	28.6	85.7	42.9	42.9	28.6	42.9
	Grouse ^d	13	1,2 (38.5)	15.4	30.8	38.5	23.1	46.2	15.4	76.9	30.8	76.9
	Pheasant ^e	777	2 (32.2)	10.8	17.8	39.1	44.8	60.5	37.8	58.7	22.5	54.2
Small game	Quail ^f	80	2 (43.8)	2.5	3.8	38.5	41.0	66.3	47.5	66.3	23.8	61.3
	Rabbit ^g	20	1 (40.0)	15.0	30.0	25.0	55.0	80.0	55.0	50.0	30.0	50.0
Big game	Squirrel ^h	24	2 (41.7)	12.5	12.5	14.3	61.9	50.0	50.0	91.7	41.7	70.8
	Antelope ⁱ	18	2 (38.9)	22.2	5.6	38.9	16.7	77.8	0.0	72.2	33.3	55.6
	Elk ^j	9	2 (77.8)	11.1	22.2	0.0	22.2	11.1	11.1	33.3	22.2	44.4
	Mule deer ^k	163	2 (42.3)	16.6	16.6	44.8	16.6	49.1	17.8	71.8	28.2	54.0
	White-tailed deer ^l	739	1 (38.4)	11.8	15.0	29.6	32.2	50.5	23.5	71.4	26.3	39.0
	Fall turkey ^m	34	1 (35.3)	17.6	17.6	29.4	32.4	44.1	20.6	64.7	20.6	50.0
Furbearer	Spring turkey ^m	196	4 (44.9)	7.1	14.3	67.9	26.9	65.8	63.5	73.5	27.6	42.3
		10	1 (46.7)	6.7	6.7	13.3	13.3	20.0	20.0	33.3	60.0	26.7

^a Based on U.S. Census Bureau data for hunter reported home zip code.

^b *Columbidae* sp.

^c *Anatidae* sp.

^d *Tympanuchus* sp.

^e *Phasianus colchicus*.

^f *Colinus virginianus*.

^g *Leporidae* sp.

^h *Sciurus* sp.

ⁱ *Antilocapra americana*.

^j *Cervus canadensis*.

^k *Odocoileus virginianus*.

^l *Odocoileus hemionus*.

^m *Meleagris gallopavo*.

that included women were also more likely to also include youth hunters (21.5% youth participation in parties with women and 15.0% youth participation in parties without women).

Nonresidents were present in 35.6% of parties, but they were more common in parties in western Nebraska, primarily driven by high rates of nonresident participation among spring turkey hunters, upland bird hunters, and mule deer hunters (Tables 2 and 3). Parties with nonresidents were older on average (45.3 ± 13.3 y) but had similar party makeup (10.9% female, 13.6% youth) to parties in general. Urban participants were present in 35.5% of parties but were more likely to be found in parties in regions surrounding the metropolitan areas of Lincoln and Omaha, as well as the Southwest region (Table 2), which is relatively near Denver, Colorado. Based on the type of game animal hunters were pursuing, small game hunters had the highest participation rate among urban hunters, followed by pheasant hunters (Table 3). Parties including urban hunters were slightly older (43.7 ± 13.3 y) than parties on average, and the inclusion of urban participants in the party was not related to female (11.9%) or youth (14.2%) participation.

Because most of the parties consisted of one or two members, the demographics of individuals within the

party generally reflect the patterns seen at the party level. Most members of the hunting parties we interviewed were adult males (84.3%), with only 5.4% being adult females and 10.3% being youth (Tables 4 and 5). Hunters reported being, on average, 41.2 y old, but the most visited regions of Nebraska supported an older constituency (Table 4). Hunter age varied by the different type of game they were pursuing, with the oldest being quail hunters and the youngest duck hunters (Table 5). Similar to the party-level data, 65% of the individual hunters we interviewed were Nebraska residents (Tables 4 and 5). Although nearly 60% of Americans live in areas that would qualify as urban based on population density (>313 people/km²; U.S. Census Bureau 2010, 2016, 2018), only 30.1% of the hunters we interviewed lived in urban areas, a pattern that differed little by residency (nonresidents, 32.4%; residents, 29.2%). There were however regional differences across Nebraska, with the Southeast region having the greatest proportion of urban public-access hunters (50.3%; Table 4). With the exception of fall turkey hunters, big game hunters were less likely to be from urban areas than migratory and upland bird hunters, but small-game hunters included the highest participation rates by urbanites (Table 5). The regional differences we noted

Table 4. Demographics of hunters interviewed in different survey regions from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017). We selected survey regions to represent the diversity of available game and variation in the proximity to urban centers of public-access sites throughout Nebraska.

Region	n	Age (y)	±SD	Resident (%)	±SD	Median income ^a (US\$1,000)	±SD	Home density ^a (population/km ²)	±SD
North Panhandle	617	40.4	15.4	41.1	8.2	55.7	16.1	194.3	502.8
South Panhandle	26	35.0	15.5	76.5	0.0	51.3	9.3	41.0	105.2
Southwest	1,237	44.5	16.1	36.1	3.8	62.0	21.5	437.8	674.9
Loess Canyons	289	32.7	15.4	84.8	6.1	54.2	10.0	127.5	333.7
Harlan	347	42.3	14.7	83.0	5.0	51.3	13.2	257.2	656.2
Platte River	159	37.6	15.1	91.8	2.2	56.4	16.0	84.3	205.3
Northeast	60	36.5	15.2	90.9	8.7	52.5	11.6	101.0	305.2
Rainwater Basin	716	38.9	16.7	85.7	1.7	58.8	18.2	425.7	621.2
Southeast	946	42.4	15.3	81.8	2.9	62.6	19.9	565.6	626.0

^a Based on U.S. Census Bureau data for hunter reported home zip code.

in urban participants were also reflected in the median income, as urban hunters tended to have higher incomes (Table 4). This was not true across all types of hunters, as the most urban population of public-access hunters—small-game hunters—had among the lowest median incomes (Table 5).

Parties were generally successful in engaging with game animals: 59.2% reported seeing the game they were hunting and 37.3% reported harvesting at least one animal. Parties that successfully harvested an animal saw more game animals (successful, 116.6 ± 1,416.4; unsuccessful, 17.6 ± 213.0). Successful parties had a similar average age to parties in general (42.2 ± 13.4).

Parties with nonresident hunters (40.2% successful), urban hunters (39.4% successful), and youth hunters (44.7% successful) were more successful than average, but parties with female hunters were less successful (33.3% successful). The percentage of parties seeing game animals varied little among regions, but harvest tended to be lower in western Nebraska, and was highest among spring turkey hunters (Tables 2 and 3). With the exception of the Platte River and Northeast regions (Table 2), most parties (65.9%) reported having no private access within the region of Nebraska where they were interviewed (Table 3). Indeed, 24.1% of parties reported selecting a site simply because it was open to

Table 5. Demographics of hunters pursuing different game that we interviewed from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Regulatory group	Game	n	Age (y)	±SD	Resident (%)	±SD	Median income ^a (US\$1,000)	±SD	Home density ^a (population/km ²)	±SD
Migratory birds	Dove ^b	83	35.3	3.1	94.8	3.4	48.9	16.0	375.8	679.6
	Ducks ^c	379	33.7	1.7	87.4	1.8	58.8	17.7	363.3	600.0
	Geese ^c	14	41.1	10.1	100.0	0.0	48.5	9.9	375.2	640.0
Upland birds	Grouse ^d	20	37.8	3.7	64.7	27.0	58.6	18.9	426.3	627.5
	Pheasant ^e	1,607	44.2	1.1	60.5	5.0	60.8	20.4	457.4	657.5
	Quail ^f	151	51.9	3.1	64.3	7.9	64.3	20.6	369.3	539.2
Small game	Rabbit ^g	35	42.1	1.1	82.4	7.8	54.9	13.8	799.5	714.2
	Squirrel ^h	31	36.0	3.4	93.5	1.9	53.6	13.4	900.9	742.7
Big game	Antelope ⁱ	39	40.2	6.0	72.2	6.2	55.1	17.4	174.7	500.6
	Elk ^j	11	40.6	9.5	100.0	0.0	54.4	15.3	136.4	271.4
	Mule deer ^k	339	38.3	2.2	57.0	6.7	56.5	15.4	153.4	491.5
	White-tailed deer ^l	1,260	39.8	0.9	69.1	8.1	58.1	17.4	328.6	564.8
	Fall turkey ^m	61	42.0	5.3	74.0	11.6	62.7	24.1	425.5	560.7
	Spring turkey ^m	344	41.0	1.1	30.4	10.0	57.4	17.7	317.3	638.1
Furbearer		23	34.7	3.5	88.0	15.0	52.2	13.2	129.8	414.8

^a Based on Census Bureau data for hunter reported home zip code.

^b *Columbidae* sp.

^c *Anatidae* sp.

^d *Tympanuchus* sp.

^e *Phasianus colchicus*.

^f *Colinus virginianus*.

^g *Leporidae* sp.

^h *Sciurus* sp.

ⁱ *Antilocapra americana*.

^j *Cervus canadensis*.

^k *Odocoileus virginianus*.

^l *Odocoileus hemionus*.

^m *Meleagris gallopavo*.

Table 6. The perception (mode, response percentage) of public hunting sites by parties interviewed in different survey regions from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017). We selected survey regions to represent the diversity of available game and variation in the proximity to urban centers of public-access sites throughout Nebraska.

Region	Habitat quality ^a	Game abundance ^a	Crowding ^b	Ease of access ^c	Likely to return ^d	Met expectations ^e	n
North Panhandle	5 (42.0)	1 (29.5)	5 (60.0)	5 (62.5)	5 (64.5)	3 (43.0)	200
South Panhandle	4 (58.3)	1,2,4 (25.0)	5 (58.3)	5 (41.7)	5 (83.3)	3 (58.3)	12
Southwest	5 (43.8)	1 (24.1)	5 (58.6)	5 (77.7)	5 (64.9)	3 (41.7)	336
Loess Canyons	5 (61.1)	3 (26.4)	5 (54.2)	5 (69.4)	5 (77.8)	3 (36.1)	72
Harlan	5 (32.1)	2 (24.8)	1 (62.4)	5 (63.6)	5 (53.9)	1 (37.6)	165
Platte River	5 (48.5)	3 (36.4)	5 (31.8)	5 (63.6)	5 (64.1)	3 (53.0)	103
Northeast	4 (47.4)	5 (42.1)	4 (26.3)	5 (68.4)	5 (57.9)	4 (36.8)	19
Rainwater Basin	5 (39.5)	1 (23.7)	5 (57.7)	5 (67.4)	5 (69.3)	3 (45.1)	215
Southeast	4 (43.4)	1 (37.5)	5 (49.9)	5 (71.5)	5 (57.5)	3 (45.4)	355

^a Based on 5-point Likert-scale: 1, low; 3, average; 5, high.

^b Based on 5-point Likert-scale: 1, very crowded; 3, average; 5, not crowded at all.

^c Based on 5-point Likert-scale: 1, difficult; 3, average; 5, easy.

^d Based on 5-point Likert-scale: 1, not likely; 3, average; 5, very likely.

^e Based on 5-point Likert-scale: 1, below; 3, met; 5, exceeded.

the public, a fact they determined primarily by reading literature provided by NGPC (Tables 2 and 3).

Over the first 2 y of our study, we interviewed 1,477 parties concerning their perception of their public-access experience. We excluded elk *Cervus canadensis* (four parties) and goose *Anatida* sp. hunters (four parties) to facilitate robust comparison, as small sample sizes led to models that failed to converge. In general, hunter perceptions of public-access sites were positive (≥ 3 on a Likert-type scale): 93.4% rated the habitat quality as average to high quality, 83.8% thought crowding was average to uncrowded, 94.4% thought sites were average to easy to access, 93.8% said they were average to likely to return to hunt again, and 77.8% said the experience met or exceeded their expectations. Indeed, across the diversity of landscapes (Table 6) and game animals pursued (Table 7), we found very consistent and often relatively high levels of satisfaction with all our measures of hunter perceptions. The one region that appears to be an exception was the Harlan region, which was more likely to be rated poorly based on habitat quality and crowding, leading to lower fulfillment of expectations and reduced likelihood to return (Table 6). Among the different types of hunters, pheasant hunters tended to rate habitat quality, crowding, and access more favorably than other groups, but they were more likely to be dissatisfied with game abundance (Table 7). Among the hunters we interviewed, the perception of game abundance was the only attribute that consistently rated poorly across all regions (Table 6), as 43.1% of the hunters we interviewed perceived game abundance to be below average, and a full 27.3% indicated game abundance was very poor.

In our evaluation of the role of demographic and experiential parameters in affecting hunter perceptions of public access, the inclusion of predictor variables did improve our models, as indicated by the significant χ^2 estimates, but there is reason to question overall model performance (Table S1, *Supplemental Material*). Both the Pearson's χ^2 and

deviance tests suggest that our data fit poorly, leaving significant unexplained variation. However, for models with a large number of predictor variables, as we have here, Pearson's chi-square and deviance tests may be less informative because they are sensitive to missing data. In such cases Pseudo R-squared values may give better insight, but even then we still see generally limited model performance, with the possible exception of the game abundance model (Table S1, *Supplemental Material*).

Overall poor model performance suggests that results should be taken with caution; however, because the intent here is exploratory, individual parameter estimates are worth considering. Largely, we found that variables associated with party composition and demographics were unrelated to how public-access hunters perceived their experience (Table S2, *Supplemental Material*). The exception may be party size, as larger parties tended to have a better perception of habitat quality ($\beta = 0.10$; Wald = 4.39; $P = 0.04$) but perceived game abundance ($\beta = -0.09$; Wald = 4.19; $P = 0.04$) and crowding ($\beta = -0.17$; Wald = 13.63; $P < 0.001$) to be worse. Game abundance, and in particular harvest success, had the most consistent relationship with hunter perception of public access. Harvest success was associated with better perceptions of habitat quality ($\beta = 0.90$; Wald = 56.64; $P < 0.001$) and game abundance ($\beta = 1.79$; Wald = 221.80; $P < 0.001$), leading to more parties meeting the expectations of their trip ($\beta = 1.81$; Wald = 218.25; $P < 0.001$) and subsequently a higher likelihood of returning to the site to hunt again ($\beta = 1.17$; Wald = 73.16; $P < 0.001$). Harvest success was also associated with a greater perception of crowding ($\beta = -0.25$; Wald = 4.24; $P = 0.04$), potentially indicating public-access sites with greater potential for success were used more.

Discussion

Improving the availability and ease of public access is an increasingly important tool to combat reductions in



Table 7. Perception (mode, response percentage) of public hunting sites by parties pursuing different game that were interviewed from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Regulatory group	Game	Habitat quality ^a	Game abundance ^a	Crowding ^b	Ease of access ^c	Likelihood to return ^d	Met expectations ^e	<i>n</i>
Migratory birds	Dove ^f	4 (34.5)	1 (27.6)	5 (72.4)	5 (62.1)	5 (65.5)	3 (27.6)	29
	Ducks ^g	5 (44.8)	5 (38.8)	5 (54.3)	5 (53.4)	5 (72.0)	3 (42.2)	125
	Geese ^g	3 (100)	4 (66.7)	3 (66.7)	2,4,5 (33.3)	5 (75.0)	1,2,3 (33.3)	4
Upland birds	Grouse ^h	4 (45.5)	1 (54.5)	5 (81.8)	5 (54.5)	3 (36.4)	3 (54.5)	11
	Pheasant ⁱ	5 (45.5)	1 (31.8)	5 (58.9)	5 (80.0)	5 (58.9)	3 (37.6)	431
	Quail ^j	4 (39.1)	1 (32.6)	5 (78.3)	5 (84.8)	5 (65.2)	3 (43.5)	46
Small game	Rabbit ^k	5 (58.3)	3 (58.3)	5 (75.0)	5 (91.7)	5 (75.0)	4 (33.3)	12
	Squirrel ^l	3 (60.0)	2 (40.0)	5 (40.0)	5 (46.7)	3,5 (33.3)	3 (73.3)	15
Big game	Antelope ^m	4 (66.7)	4 (55.6)	5 (66.7)	5 (55.6)	3,5 (44.4)	3 (66.7)	9
	Elk ⁿ	5 (100)	2 (50.0)	5 (75.0)	5 (100)	5 (75.0)	3 (75.0)	4
	Mule deer ^o	5 (41.4)	1 (33.3)	5 (44.8)	5 (67.8)	5 (66.7)	3 (39.1)	87
	White-tailed deer ^p	5 (42.4)	1 (30.4)	5 (42.4)	5 (63.6)	5 (63.4)	3 (38.3)	508
	Fall turkey ^q	5 (45.8)	4 (29.2)	5 (66.7)	5 (62.5)	5 (66.7)	3 (62.5)	24
Furbearer	Spring turkey ^q	5 (40.1)	3 (30.2)	5 (72.2)	5 (71.0)	5 (67.3)	3 (39.5)	162
		5 (80.0)	1 (40.0)	5 (90.0)	5 (70.0)	5 (70.0)	3 (50.0)	10

^a Based on 5-point Likert-scale: 1, low; 3, average; 5, high.

^b Based on 5-point Likert-scale: 1, very crowded; 3, average; 5, not crowded at all.

^c Based on 5-point Likert-scale: 1, difficult; 3, average; 5, easy.

^d Based on 5-point Likert-scale: 1, not likely; 3, average; 5, very likely.

^e Based on 5-point Likert-scale: 1, below; 3, met; 5, exceeded.

^f *Columbidae* sp.

^g *Anatidae* sp.

^h *Tympanuchus* sp.

ⁱ *Phasianus colchicus*.

^j *Colinus virginianus*.

^k *Leporidae* sp.

^l *Sciurus* sp.

^m *Antilocapra americana*.

ⁿ *Cervus canadensis*.

^o *Odocoileus virginianus*.

^p *Odocoileus hemionus*.

^q *Meleagris gallopavo*.

hunter participation and ensure the future of the North American model of wildlife management. Evaluations of the hunting community consistently demonstrate the importance of public access (Brown et al. 1984; Wright and Kaiser 1986; Miller and Vaske 2003), but the relationship between public-access hunters and the specific properties they hunt is largely unknown because most surveys are conducted well after the hunting experience. Here, we engaged public-access hunters immediately following their experience afield and demonstrated that across a diverse social and ecological landscape, public-access hunters largely perceived their experience positively. The generally positive experiences that we documented may suggest that the available public-access sites are sufficient; however, it is worth noting that the population of hunters we encountered may be somewhat self-selected. Hunters who previously had an unfavorable experience on public-access sites may have stopped using public sites or simply stopped hunting altogether. Lapsed public-access hunters, and hunters that exclusively use private land, likely have different thresholds for hunter satisfaction than our sampled hunter population.

Understanding who uses public-access sites is vital to managing public-access programs. Unlike traditional postseason survey methods that can have significant nonresponse rates and associated biases, we successfully interviewed more than 97% of the participants we encountered. Not surprisingly, most of the hunters we interviewed did not have access to private property for the purposes of hunting in the region where they were interviewed (Tables 2 and 3). Indeed, when asked why they chose to hunt the site where they were interviewed, many parties simply stated that the site was “open to the public” (Tables 2 and 3). The lack of access to private property by such a large proportion of public-access hunters highlights the importance of public access to overall hunter participation. Importantly, however, by conducting on-site interviews we are able to separate the need for specific place-based access to pursue specific game animals from the more general need for access per se. Indeed, it was not uncommon for hunters to comment that they had access to hunt private lands, but that it was either not in the region where they were surveyed or not for the animal they were hunting that day. Postseason surveys that fail to quantify the need for access base on location and game species pursued, an

endeavor that adds significantly to survey length, can underestimate the true need for public access.

As is common throughout much of the Midwest and Plains states, most of the parties we interviewed were pursuing white-tailed deer and pheasants, a pattern that was consistent across almost all the regions of Nebraska we surveyed despite the diversity of available hunting opportunities in the state (Figure 1; Table 3). The dichotomy that most public-access hunters are pursuing pheasants or white-tailed deer represents one of the challenges of developing a successful public-access program. White-tailed deer and pheasants have nearly opposite habitat needs, making providing access opportunities for both species on one site inherently difficult. Adding additional species needs, regional differences in game abundance, annual fluctuations in game populations, and the provision of sufficient access for a diverse set of hunters across a large geographic area is exceedingly challenging. Although increasing access may overcome such challenges (Miller and Hay 1981), limitations to providing access (e.g., funding or land-owner partnerships) necessitate a strategic approach to public-access development that balances the costs of providing access with the diversity of access needs. By conducting a place-based assessment of public access, we were able to more directly inform managers where the need for public access is limited, making the decision process more strategic and presumably more successful.

Although our results do not show large differences in the game animals hunters are pursuing among regions, there are differences in party makeup, most notably use by nonresidents and urbanites. Western Nebraska, in particular the Southwest and North Panhandle regions, is a hotspot for nonresident hunting, with nonresidents often representing more than 60% of public-access hunters in any year (Table 2). By contrast, public-access sites in the eastern half of Nebraska are primarily used by Nebraska residents, and with increasing proximity to Omaha and Lincoln, more urban residents (Table 2). Ironically, the lowest participation by nonresidents was in the Platte River region in eastern Nebraska, which is bisected by Interstate 80, a highway that carries many thousands of nonresidents across Nebraska each year. The difference in party makeup across regions of Nebraska accentuates the variety of opportunities that public access provides and highlights another benefit of conducting on-site surveys. Postseason surveys are largely incapable of addressing questions of party composition, but given the social nature of hunting, party composition likely plays a significant role in hunter participation and satisfaction (Hendee 1974; Vaske et al. 1986; Hammitt et al. 1989, 1990). Knowledge concerning how regions differ in party composition thus can not only inform the development of public-access programs but also help to strategically inform larger social and economic initiatives to, for example, provide necessary infrastructure for nonresident hunters.

Like most studies of hunter participation (e.g., Duda et al. 2010), participation in public-access hunting was highly skewed toward males. Although participation rates of women hunters are increasing, women remain a

minority among hunters (Duda et al. 2010; Metcalf et al. 2016). In our data, women represented only 5% of the hunters we interviewed, an order of magnitude less than their representation in the population at large. Participation rates among women varied little among parties pursuing different game animals (Table 3) and had no effect on the party's perception of their hunting experience (Table 2). There were, however, some interesting regional differences, most notably the limited inclusion of women in parties using public-access sites in the regions near metropolitan areas (Table 2). The transition of American society to more urban environments is often suggested as one of the primary drivers of the decline in hunter participation (Stedman and Heberlein 2001; Schulz et al. 2003; Stedman et al. 2008). Providing public access is presumed to combat the loss of the social connections that historically provided access for hunting. The high rates of use by hunters on public-access sites around the metropolitan areas of Lincoln and Omaha may suggest that public-access sites are fulfilling that role, but apparently not for women. The limited use by women of public-access sites near metropolitan areas may suggest that women from metropolitan areas are more likely to participate in the multitude of alternative recreational opportunities provided by metropolitan areas (Kraus 2008; Pergams and Zaradic 2008; Robison and Ridenour 2012; Kesebir and Kesebir 2017). Assuming that public-access hunters are, on average, more casual hunters (Stedman and Heberlein 2001; Stedman et al. 2008; Duda et al. 2010), patterns in the use of public-access sites by women, who are themselves usually more casual hunters (Adams and Steen 1997; McFarlane et al. 2003; Heberlein et al. 2008; Rodriguez et al. 2016), may foreshadow the trajectory of public-access hunting in general.

Public-access hunting parties including women were more likely to also include youth; and although we did not collect information on familial relationships, it is reasonable to assume that the inclusion of women and youth in a party represents a larger family engagement in hunting (Decker et al. 1984; Purdy et al. 1989), as youth (Stedman and Heberlein 2001) and women (Adams and Steen, 1997; McFarlane et al. 2003; Heberlein et al. 2008; Boglioli 2009) tend to be introduced to hunting via male familial relationships. Social interaction is an important component of hunting (Hendee 1974; Vaske et al. 1986; Hammitt et al. 1989, 1990); thus, it may not be surprising that the inclusion of youth hunters in a party was one of the only factors affecting whether a hunting trip met the party's expectations (Table S2). Indeed, the inclusion of youth in a party had such a strong positive effect that it caused party age to have a negative effect on overall satisfaction (Table S2), a pattern that is uncommon in assessments of leisure satisfaction (Riddick 1986; Zabriskie and McCormick 2003), and may highlight some of the unique benefits of conducting real-time interviews.

Beyond the inclusion of youth, harvest was the most likely characteristic of the hunt to affect a party's perception of their public hunting experience (Table S2). Although there are many aspects of the hunting experience that shape hunter satisfaction (Hendee 1974),

success is usually among the most important (Vaske et al. 1986; Hammitt et al. 1989, 1990; Brunke and Hunt 2008; Schroeder et al. 2018). Even though harvest rates on our study sites were moderate, harvesting even one animal had a significant association with not just hunter satisfaction, but hunter perceptions of habitat conditions, game abundance, and the likelihood that members of a hunting party would come back to hunt again. The perception of public access is highly affected by each hunting experience, a finding that is difficult to ascertain from traditional postseason surveys that lack such specificity. Moreover, hunter perceptions appear region specific. Despite populations of migratory birds, upland birds, and big game varying widely across Nebraska (e.g., pheasants, Jorgensen et al. 2014), regional differences in game abundance did not translate into significant differences in party-level harvest (Table 2) or satisfaction (Table 6). Presumably hunters are setting expectations based on what they know of local game populations, yet another example of the complex relationship between hunter satisfaction, game abundance, and harvest (Vrtiska et al. 2013).

There is a growing need for public access, but like most public resources, the desired characteristics of public-access sites are diverse, making identifying the intricacies of providing sufficient and appropriately located access a difficult proposition. Even in Nebraska, where most hunters pursue only a few species, different regions of the state provided unique opportunities. Approaches to public access that only emphasize meeting the needs of the largest constituency, or maximizing harvest-related hunter satisfaction may fail to satisfy new and emerging hunting populations. Obviously, any public-access program must balance the needs of a diverse constituency and would benefit from an approach to access that strives to balance current and future recreational interests. Field-based surveys of public-access hunters can help managers and policy makers to develop effective and actionable objectives by improving the specificity of hunter use and perceptions of public-access programs. Using spatially explicit information, representing real-time perceptions, it is increasingly possible to develop an adaptive approach to public access that evolves to meet the ever-changing needs of the hunting community.

Supplemental Material

Please note: The *Journal of Fish and Wildlife Management* is not responsible for the content or functionality of any supplemental material. Queries should be directed to the corresponding author for the article.

Table S1. Model performance information for six ordinal logistic regression models explaining the perception of public hunting sites by parties interviewed from September to January and from March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S1> (44 KB DOCX).

Table S2. Parameter estimates and reported statistics for models assessing the perception of public hunting sites by parties interviewed from September to January and March to May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S1> (44 KB DOCX).

Appendix S1. Example script for in-person public-access user interview conducted from September–January and March–May on state, federal, and private properties open to public hunting in Nebraska, USA (2014–2017).

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S2> (15 KB DOCX).

Reference S1. Bhandari P, Stedman RC, Luloff AE, Finley JC, Diefenbach DR. 2006. Effort versus motivation: factors affecting antlered and antlerless deer harvest success in Pennsylvania. *Human Dimensions of Wildlife* 11:423–436.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S3> (174 KB PDF).

Reference S2. Bishop A, Barenberg A, Volpe N, Riens J, Grosse R. 2011. Nebraska Land Cover Dataset. Rainwater Basin Joint Venture, Grand Island, Nebraska, USA.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S4> (1.56 MB PDF).

Reference S3. Decker DJ, Provencher RW, Brown TL. 1984. Antecedents to hunting participation: an exploratory study of the social-psychological determinants of initiation, continuation, and desertion in hunting. Ithaca, New York: Outdoor Recreation Research Unit, Department of Natural Resources, Cornell University.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S5> (6.93 MB PDF).

Reference S4. Hammitt WE, McDonald CD, Noe FP. 1989. Wildlife management: managing the hunt versus the hunting experience. *Environmental Management* 13:503–507.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S6> (489 KB PDF).

Reference S5. Hende JC. 1974. A multiple-satisfaction approach to game management. *Wildlife Society Bulletin* 3:104–113.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S7> (243 KB PDF).

Reference S6. Jorgensen CF, Powell LA, Lusk JJ, Bishop AA, Fontaine JJ. 2014. Assessing landscape constraints on species abundance: does the neighborhood limit species response to local habitat conservation programs? *PLOS ONE* 9:e99339.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S8> (390 KB PDF).



Reference S7. Lauber TB, Brown TL. 2000. Hunting access on private lands in Dutchess County. Ithaca, New York: Human Dimensions Research Unit, Department of Natural Resources, Cornell University. HDRU Series No. 00-12, November 2000.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S9> (273 KB PDF).

Reference S8. Miller C, Campbell L, Yeagle J, Williams R. 2002. Hunter access to private lands in Illinois: results of studies of Illinois hunters, landowners, and participants in access Illinois. Human Dimensions Program, Report SR-02-01. Illinois Natural History Survey, Champaign.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S11> (737 KB PDF).

Reference S9. Miller JR, Hay MJ. 1981. Determinants of hunter participation: duck hunting in the Mississippi Flyway. *American Journal of Agricultural Economics* 63:677–684.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S10> (210 KB PDF).

Reference S10. Nebraska Game and Parks Commission. 2017a. Public access atlas.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S12> (80.64 MB PDF).

Reference S11. Nebraska Game and Parks Commission. 2017b. 2017 Upland game hunting outlook.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S13> (287 KB PDF).

Reference S12. Purdy KG, Decker DJ, Brown TL. 1989. New York's new hunters: influences on hunting involvement from beginning to end. Ithaca, New York: Human Dimensions Research Unit, Department of Natural Resources, Cornell University. Publication 89-3.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S14> (906 KB PDF).

Reference S13. Schroeder SA, Cornicelli L, Fulton DC, Merchant SS. 2018. Explicit versus implicit motivations: clarifying how experiences affect turkey hunter satisfaction using revised importance-performance, importance grid, and penalty-reward-contrast analyses. *Human Dimensions of Wildlife* 23:1–20.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S15> (1.68 MB PDF).

Reference S14. Schulz JH, Millspaugh JJ, Zekor DT, Washburn BE. 2003. Enhancing sport-hunting opportunities for urbanites. *Wildlife Society Bulletin* 2:565–573.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S16> (338 KB PDF).

Reference S15. Stedman RC, Bhandari P, Luloff AE, Diefenbach DR, Finley JC. 2008. Deer hunting on Pennsylvania's public and private lands: a two-tiered

system of hunters? *Human Dimensions of Wildlife* 13:222–233.

Found at DOI: <https://doi.org/10.3996/082018-JFWM-077.S17> (178 KB PDF).

Acknowledgments

We thank the many hunters and hunter survey technicians and NGPC employees who generated the hunter survey data, as well as the Associate Editor and editorial staff of *Journal of Fish and Wildlife Management* and anonymous reviewers. Funding for this project was received from Federal Aid in Wildlife Restoration project W-115-R, administered by the Nebraska Game and Parks Commission. C.J.C. was supported by Hatch funds through the Agricultural Research Division at the University of Nebraska–Lincoln and from Federal Aid in Wildlife Restoration project W-120-T, administered by the NGPC. The Nebraska Cooperative Fish and Wildlife Research Unit is supported by a cooperative agreement among the U.S. Geological Survey, the NGPC, the University of Nebraska–Lincoln, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute.

Any use of trade, product, website, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

References

- Adams CE, Steen SJ. 1997. Texas females who hunt. *Wildlife Society Bulletin* 4:796–802.
- Bhandari P, Stedman RC, Luloff AE, Finley JC, Diefenbach DR. 2006. Effort versus motivation: factors affecting antlered and antlerless deer harvest success in Pennsylvania. *Human Dimensions of Wildlife* 11:423–436 (see *Supplemental Material*, Reference S1).
- Bishop A, Barenberg A, Volpe N, Riens J, Grosse R. 2011. Nebraska Land Cover Dataset. Rainwater Basin Joint Venture, Grand Island, Nebraska, USA (see *Supplemental Material*, Reference S2).
- Boglioli M. 2009. A matter of life and death: hunting in contemporary Vermont. Amherst: University of Massachusetts Press.
- Bradburn NM, Rips LJ, Shevell SK. 1987. Answering autobiographical questions: the impact of memory and inference on surveys. *Science* 236:157–161.
- Brown TL, Decker DJ, Kelley JW. 1984. Access to private lands for hunting in New York: 1963–1980. *Wildlife Society Bulletin* 12:344–349.
- Brunke KD, Hunt KM. 2008. Mississippi waterfowl hunter expectations, satisfaction, and intentions to hunt in the future. *Human Dimensions of Wildlife* 13:317–328. <https://doi.org/10.1080/10871200802227422>
- Connelly NA, Brown TL, Knuth BA. 2008. Assessing the relative importance of recall bias and nonresponse bias and adjusting for those biases in statewide angler surveys. *Human Dimensions of Wildlife* 5:19–29. <https://doi.org/10.1080/10871200009359192>

- Conover MR, Chasko GG. 1985. Nuisance Canada goose problems in the eastern United States. *Wildlife Society Bulletin* 13:228–233.
- Decker DJ, Provencher RW, Brown TL. 1984. Antecedents to hunting participation: an exploratory study of the social-psychological determinants of initiation, continuation, and desertion in hunting. Ithaca, New York: Outdoor Recreation Research Unit, Department of Natural Resources, Cornell University (see *Supplemental Material*, Reference S3).
- Duda MD, Jones MF, Criscione A. 2010. Sportsman's voice: hunting and fishing in America. State College, Pennsylvania: Venture Publishing, Inc.
- Enck JW, Decker DJ, Brown TL. 2000. Status of hunter recruitment and retention in the United States. *Wildlife Society Bulletin* 28:817–824.
- Hair J, Anderson R, Tatham R, Black W. 1998. *Multivariate data analysis*. 5th edition. Upper Saddle River, NJ: Prentice-Hall International.
- Hammit WE, McDonald CD, Noe FP. 1989. Wildlife management: managing the hunt versus the hunting experience. *Environmental Management* 13:503–507 (see *Supplemental Material*, Reference S4).
- Hammit WE, McDonald CD, Patterson ME. 1990. Determinants of multiple satisfaction for deer hunting. *Wildlife Society Bulletin* 18:331–337.
- Heberlein TA, Serup B, Ericsson G. 2008. Female hunting participation in North America and Europe. *Human Dimensions of Wildlife* 13:443–458. <https://doi.org/10.1080/10871200802294265>
- Hendee JC. 1974. A multiple-satisfaction approach to game management. *Wildlife Society Bulletin* 3:104–113 (see *Supplemental Material*, Reference S5).
- Holsman RH. 2000. Goodwill hunting? Exploring the role of hunters as ecosystem stewards. *Wildlife Society Bulletin* 28:808–816.
- Jagnow CP, Stedman RC, Luloff AE, San Julian G, Finley JC, Steele J. 2006. Why landowners post their property against hunting: Insights from Pennsylvania. *Human Dimensions of Wildlife* 11:1–12. <https://doi.org/10.1080/10871200500470944>
- Jorgensen CF, Powell LA, Lusk JJ, Bishop AA, Fontaine JJ. 2014. Assessing landscape constraints on species abundance: does the neighborhood limit species response to local habitat conservation programs? *PLOS ONE* 9:e99339 (see *Supplemental Material*, Reference S6).
- Kesebir S, Kesebir P. 2017. A growing disconnection from nature is evident in cultural products. *Perspectives on Psychological Science* 12:258–269.
- Kraus R. 2008. *Recreation and leisure in modern society*. New York: Jones and Bartlett.
- Larson LR, Stedman RC, Decker DJ, Siemer WF, Baumer MS. 2014. Exploring the social habitat for hunting: toward a comprehensive framework for understanding hunter recruitment and retention. *Human Dimensions of Wildlife* 19:105–122. <https://doi.org/10.1080/10871209.2014.850126>
- Lauber TB, Brown TL. 2000. *Hunting access on private lands in Dutchess County*. Ithaca, New York: Human Dimensions Research Unit, Department of Natural Resources, Cornell University. HDRU Series No. 00-12, November 2000 (see *Supplemental Material*, Reference S7).
- Li CL, Zinn HC, Barro SC, Manfredo MJ. 2003. A cross-regional comparison of recreation patterns of older hunters. *Leisure Sciences* 25:1–16.
- Lynch JP, Addington LA. 2010. Identifying and addressing response errors in self-report surveys. Pages 251–252 in Piquero A, Weisburd D, editors. *Handbook of quantitative criminology*. New York: Springer.
- Marsh EJ. 2007. Retelling is not the same as recalling: implications for memory. *Current Directions in Psychological Science* 16:16–20.
- McFarlane B, Watson D, Boxall P. 2003. Women hunters in Alberta, Canada: girl power or guys in disguise? *Human Dimensions of Wildlife* 8:165–180. <https://doi.org/10.1080/10871200304309>
- Mehmood S, Zhang D, Armstrong J. 2003. Factors associated with declining hunting license sales in Alabama. *Human Dimensions of Wildlife* 8:243–262. <https://doi.org/10.1080/716100423>
- Metcalfe EC, Graefe AR, Trauntvein NE, Burns RC. 2015. Understanding hunting constraints and negotiation strategies: a typology of female hunters. *Human Dimensions of Wildlife* 20:30–46. <https://doi.org/10.1080/10871209.2015.957366>
- Miller C, Campbell L, Yeagle J, Williams R. 2002. Hunter access to private lands in Illinois: results of studies of Illinois hunters, landowners, and participants in access Illinois. *Human Dimensions Program, Report SR-02-01*. Champaign: Illinois Natural History Survey (see *Supplemental Material*, Reference S8).
- Miller CA, Vaske JJ. 2003. Individual and situational influences on declining hunter effort in Illinois. *Human Dimensions of Wildlife* 8:263–276. <https://doi.org/10.1080/716100421>
- Miller JR, Hay MJ. 1981. Determinants of hunter participation: duck hunting in the Mississippi Flyway. *American Journal of Agricultural Economics* 63:677–684 (see *Supplemental Material*, Reference S9).
- [NGPC] Nebraska Game and Parks Commission. 2017a. *Public access atlas* (see *Supplemental Material*, Reference S10).
- [NGPC] Nebraska Game and Parks Commission. 2017b. *2017 Upland game hunting outlook* (see *Supplemental Material*, Reference S11).
- Pergams ORW, Zaradic PA. 2008. Evidence for a fundamental and pervasive shift away from nature-based recreation. *Proceedings of the National Academy of Sciences of the United States of America* 105:2295–2300.
- Pollock KH, Jones CM, Brown TL. 1994. *Angler survey methods and their applications in fisheries management*. Bethesda, Maryland: American Fisheries Society Special Publication 25.



- Purdy KG, Decker DJ, Brown TL. 1989. New York's new hunters: influences on hunting involvement from beginning to end. Ithaca, New York: Human Dimensions Research Unit, Department of Natural Resources, Cornell University. Publication 89-3 (see *Supplemental Material*, Reference S12).
- Ribot JC, Peluso NL. 2003. A theory of access. *Rural Sociology* 68:153–181.
- Riddick CC. 1986. Leisure satisfaction precursors. *Journal of Leisure Research* 18:259–265.
- Robison KK, Ridenour D. 2012. Whither the love of hunting? Explaining the decline of a major form of rural recreation as a consequence of the rise of virtual entertainment and urbanism. *Human Dimensions of Wildlife* 17:418–436. <https://doi.org/10.1080/10871209.2012.680174>
- Rodriguez SL, Chitwood MC, Peterson MN, Jensen C, Gardner B, Hansen HP. 2016. Gender differences in hunter recruitment and dedication in Denmark. *Wildlife Biology in Practice* 12:1–10 <https://doi.org/10.2461/wbp.2016.12.5>
- Ryan EL, Shaw B. 2011. Improving hunter recruitment and retention. *Human Dimensions of Wildlife* 16:311–317. <https://doi.org/10.1080/10871209.2011.559530>
- Schroeder SA, Cornicelli L, Fulton DC, Merchant SS. 2018. Explicit versus implicit motivations: clarifying how experiences affect turkey hunter satisfaction using revised importance-performance, importance grid, and penalty-reward-contrast analyses. *Human Dimensions of Wildlife* 23:1–20 (see *Supplemental Material*, Reference S13).
- Schulz JH, Millspaugh JJ, Zekor DT, Washburn BE. 2003. Enhancing sport-hunting opportunities for urbanites. *Wildlife Society Bulletin* 2:565–573 (see *Supplemental Material*, Reference S14).
- Sigmon MR. 2004. Hunting and posting on private land in America. *Duke Law Journal* 54:549–585.
- Smith TW. 1984. Recalling attitudes: an analysis of retrospective questions on the 1982 GSS. *Public Opinion Quarterly* 48:639–649.
- Stedman RC, Heberlein TA. 2001. Hunting and rural socialization: contingent effects of the rural setting on hunting participation. *Rural Sociology* 66:599–617.
- Stedman RC, Bhandari P, Luloff AE, Diefenbach DR, Finley JC. 2008. Deer hunting on Pennsylvania's public and private lands: a two-tiered system of hunters? *Human Dimensions of Wildlife* 13:222–233 (see *Supplemental Material*, Reference S15).
- U.S. Census Bureau. 2010. 2010 Census: Nebraska profile. Available: https://www2.census.gov/geo/maps/dc10_thematic/2010_Profile/2010_Profile_Map_Nebraska.pdf (July 2018).
- U.S. Census Bureau. 2016. 2016 American Community Survey. Available: <https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2016/> (July 2018).
- U.S. Census Bureau. 2018. Annual estimates of the resident population: April 1, 2010 to July 1, 2017—United States—Metropolitan and Micropolitan Statistical Area; and for Puerto Rico. Available: <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk> (July 2018).
- U.S. Geological Survey. 2018. The public land survey system (PLSS). Available: <https://www.usgs.gov/core-science-systems/national-geospatial-program/national-map> (July 2018).
- Vaske JJ, Fedler AJ, Graefe AR. 1986. Satisfaction from a specific waterfowl hunting trip. *Leisure Sciences* 8:149–166.
- Vrtiska MP, Gammonley JH, Naylor LW, Raedeke AH. 2013. Economic and conservation ramifications from the decline of waterfowl hunters. *Wildlife Society Bulletin* 37:380–388.
- Wright BA, Kaiser RA. 1986. Wildlife administrator's perceptions of hunter access problems: a national overview. *Wildlife Society Bulletin* 14:30–35.
- Zabriskie RB, McCormick BP. 2003. Parent and child perspectives of family leisure involvement and satisfaction with family life. *Journal of Leisure Research* 35:163–189.