

Peer-Reviewed Articles

What Predicts Support for Antler Point Restrictions?

SUSAN A. SCHROEDER,¹ LOUIS CORNICELLI,²
DAVID C. FULTON,³ AND MARRETT D. GRUND⁴

¹Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, St. Paul, Minnesota, USA

²Minnesota Department of Natural Resources, Division of Fish and Wildlife, St. Paul, Minnesota, USA

³U.S. Geological Survey, Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, St. Paul, Minnesota, USA

⁴Minnesota Department of Natural Resources, Division of Fish and Wildlife, Madelia, Minnesota, USA

*Although considerable research has focused on satisfaction with recreation experiences, limited work has examined factors related to regulatory support. In 2005, an antler point restriction (APR) regulation was introduced for hunting white-tailed deer (*Odocoileus virginianus*) in Minnesota's Itasca State Park. Hunter surveys were conducted following the 2005, 2006, 2007, and 2009 seasons. We modeled how (a) satisfaction with the deer seen, (b) type of deer pursued, (c) agency trust, and (d) years of deer-hunting experience, influenced support for the APR, and compared the model over the four survey years. Type of deer pursued and agency trust were the strongest predictors of APR support, followed by satisfaction with deer seen, and years of hunting experience. Hunters who targeted big bucks, had more trust in the agency, and expressed more satisfaction with deer seen in the field, were more supportive of the APR. Hunters who had more deer-hunting experience were less supportive.*

Keywords agency trust, antler point restrictions, bucks, deer hunting, regulations, regulatory support, satisfaction

Introduction

In 2005, the Minnesota Department of Natural Resources (MNDNR) introduced an experimental antler point restriction (APR) regulation on white-tailed deer (*Odocoileus virginianus*) at Minnesota's Itasca State Park. This type of regulation is based on the principles

Address correspondence to Susan A. Schroeder, Ph.D., Minnesota Cooperative Fish and Wildlife Research Unit, University of Minnesota, Department of Fisheries, Wildlife, and Conservation Biology, 200 Hodson Hall, 1980 Folwell Ave., St. Paul, MN 55108, USA. E-mail: sas@umn.edu

of quality deer management, which are regulations that protect younger bucks while focusing harvest pressure on antlerless deer to achieve management objectives (Hamilton, Knox, & Guynn Jr., 1995). Concerns with implementing an APR as a mandatory hunting regulation include increased illegal activity (Carpenter & Gill, 1987), reduced regulatory support (Lauber & Brown, 2000), decreased hunter satisfaction (Fulton & Manfredo, 2004), questions about long-term effectiveness (Wallingford, 2012), and ethical and social considerations (Green & Stowe, 2000).

Although considerable research has focused on satisfaction with recreation experiences (Applegate & Clark, 1987; Arlinghaus, 2006; Decker, Brown, & Gutierrez, 1980; Gigliotti, 2000; Heberlein & Kuentzel, 2002; Schroeder, Fulton, & Lawrence, 2006), limited work has examined the factors that relate to regulatory support. Focus on satisfaction with recreation experiences is important and may help agencies gain public and political support (Manning, 1999; Riley et al., 2003), but support for regulations and other agency decisions can also be key to long-term agency effectiveness. If the public does not support regulations, they might become politically active and seek to alter agency decisions through political means. Further, public efforts to change unsupported regulations and other decisions could decrease public trust in the agency's efficacy. For example, implementation of deer hunting regulations has led to severe backlash from the hunting public in some states (Frye, 2006), suggesting the importance of understanding support for particular regulations as part of efforts to study global- and transaction-level measures of both satisfaction and agency performance (Cole, Crompton, & Willson, 2002). Our research examines the specific issue of deer hunting regulations, but this issue is certainly not limited to the management of deer hunting. Natural resource agencies make a wide array of policy decisions similar in scope to hunting regulations, and developing approaches for understanding support for such policy has broad applicability.

Deer Management in Minnesota

White-tailed deer are the most abundant big game species in Minnesota, and have been managed through regulated hunting since the late 1800s (Cornicelli, 2009). Historically, the state's deer management framework offered maximum opportunities to harvest bucks, but restricted doe harvest through limited harvest permits for antlerless deer (Berner & Simon, 1993). Over time, this approach led to high exploitation rates on adult bucks, a greater proportion of adult does, and an overall increase in deer numbers. Beginning in the 1990s, the MNDNR began attempting to increase the antlerless deer harvest by increasing antlerless permit quotas and individual bag limits with the intent to reduce deer populations throughout much of the state (Cornicelli, 2009).

By 2004, harvest data indicated that simply providing hunters with more opportunities to harvest antlerless deer was not applying sufficient harvest pressure to reduce deer population growth rates. Consequently, a research study was initiated to evaluate hunter support for, and the potential effectiveness of, a suite of hunting regulations designed to increase antlerless deer harvest (Cornicelli, 2009). The study examined regulations including: antler point restrictions, earn-a-buck (where the hunter must take an antlerless deer before they can take an antlered buck), early antlerless seasons, prohibition of cross-tagging (i.e., party hunting) for all deer, prohibition of cross-tagging for bucks only, a buck license lottery, and moving the deer season out of the rut (Cornicelli, 2009). An APR was instituted at Itasca State Park, which is a 33,235 acre park consisting primarily of pine forests and lakes at the headwaters of the Mississippi River in northern Minnesota. The APR in the park limits adult hunters to harvesting antlerless deer or one buck with at least one 3-point antler, and

was tested as one of the experimental deer regulations because the deer management goal at the park was to manage for low deer densities to minimize their impacts on the forest ecosystem. In addition to the biological impacts of the APR, the study evaluated: (a) if the APR changed hunters' willingness to harvest antlerless deer due to fewer antlered deer being legal to harvest and (b) hunter attitudes toward the APR at the park. APR regulations have been employed in other states with the primary goal of reducing harvest pressure on young bucks to affect the age structure of bucks in the population (e.g., Strickland et al., 2001; Wallingford, 2012). Although the MNDNR goal was to increase the antlerless harvest through the APR, the regulation was implemented at Itasca State Park using similar biological rationale that would be used as if the goal was to reduce harvest pressure on young bucks (Jacobson & Guynn Jr, 1995).

Theoretical Framework

A variety of factors may influence hunters' support for regulations, particularly for an APR regulation. Specifically, support may depend on: (a) satisfaction with game seen in the field and perceived likelihood of harvest (Decker et al., 1980; Gigliotti, 2000; Schroeder et al., 2006), (b) the type of deer pursued (e.g., big bucks, antlerless), (c) agency trust (Needham, Vaske, & Manfredo, 2004; Vaske, Needham, Stafford, Green, & Petchenik, 2006), (d) hunting experience, and (e) the length of time the regulation has been in place (Schroeder, Fulton, Lawrence, & Cordts, 2014). Because the APR at Itasca State Park has remained in place since 2005 and hunter surveys were conducted following the 2005, 2006, 2007, and 2009 hunting seasons, we had the opportunity to model how important these factors were to hunter support for the APR and to replicate the model over multiple study years. We were particularly interested in examining if the same model would fit equally well across all study years.

Satisfaction With Deer Seen and Type of Deer Pursued. Hunter satisfaction, and specifically satisfaction with perceived opportunity to harvest game, has been linked to regulatory acceptance (Fulton & Manfredo, 2004). Non-harvest based motivations often rate higher than harvest-based motivations, but results generally suggest that game abundance, perceived opportunity to harvest animals, and harvesting animals, relate closely to satisfaction (Decker et al., 1980; Gigliotti, 2000; Heberlein & Kuentzel, 2002; Schroeder et al., 2006). Indeed, recent studies of hunting and fishing underscore the importance of seeing and harvesting fish and game to satisfaction (Arlinghaus, 2006; Schroeder et al., 2006). Therefore, satisfaction with the number of deer seen during the season may relate to support for APRs. In addition, the specific types of deer pursued (e.g., big bucks, legal bucks, antlerless deer) may be another important predictor of support for APRs. We expected that hunters who were more satisfied with the number of deer they saw in the field, and those who were more interested in harvesting big bucks, would express stronger support for the APR.

Agency Trust. Agency trust may affect support for regulations, and specifically deer hunters' trust in the MNDNR may influence their support for the APR. Studies have found that trust can influence support of agency goals and objectives (Needham & Vaske, 2008; Vaske, Timmons, Beaman, & Petchenik, 2004). Specifically, hunters who trust an agency may be more likely to support its management actions (Needham et al., 2004; Vaske et al., 2006). However, despite calls to examine correlates of trust for natural resource issues (Needham & Vaske, 2008), little research has examined how trust relates to satisfaction and regulatory support related to natural resources agency actions. We expected that Itasca

hunters who reported greater trust in the MNDNR would report increased support for the APR.

Years Hunting. Although little published research has examined how years of hunting experience influences hunting satisfaction or support for regulations, numerous Minnesota studies have found a negative relationship between age or years of participation and hunting satisfaction (Cornicelli, 2006; Fulton, 2011; Schroeder & Cornicelli, 2013; Schroeder, Fulton, & Lawrence, 2004; Schroeder, Fulton, Lawrence, & Cordts, 2007, 2008, 2012a, 2012b). Satisfaction with hunting experiences and regulations likely relates to the congruence or incongruence between expectations and outcomes, which has been understood as expectancy disconfirmation (Brunke & Hunt, 2007, 2008; Burns, Graefe, & Absher, 2003; Madrigal, 1995). Limited work has applied expectancy disconfirmation from the marketing and customer satisfaction literature to hunting or other forms of outdoor recreation (Brunke & Hunt, 2007, 2008; Burns et al., 2003; Madrigal, 1995). Years of hunting experience may be correlated with higher expectations for seeing and harvesting game (Brunke & Hunt, 2008), because older hunters with more years of participation may have experienced exceptionally good seasons with memorable game numbers and harvest success. Therefore, more experienced hunters may report reduced satisfaction with all seasons, and with all regulations, that do not equal their “best-ever” season. Consequently, we expected a negative relationship between years of hunting experience and support for the APR.

Time the Regulation Has Been in Place. Although hunters may initially resist new regulations, limited research suggests that new regulations may become legitimized as time passes after enactment (Schroeder et al., 2014; Wallingford, 2012). Hunters may accept regulations as being derived through the scientific, expert, and/or authoritative decision making of agency management (Schroeder et al., 2014). However, acceptance of new regulations likely depends on perceived effectiveness over time, the constituency or constituencies involved, the management environment, scientific support for the regulation, and more. New regulations that are perceived as effective and supported by science and expert authority may be accepted as legal norms within a few seasons (Schroeder et al., 2014). Therefore, we wanted to examine support for the APR and compare models predicting support over multiple seasons.

Study Rationale

There is a need to understand the factors that influence support for hunting regulations. Limited work has clarified how: (a) satisfaction with game seen, (b) the type of game pursued, (c) agency trust, and (d) hunter experience, relate to regulatory support. However, no research has modeled the relative importance of different factors related to regulatory support for APRs, and compared models over multiple seasons. Based on previous research, we hypothesized that stronger support for the APR would be related to:

- H₁: Greater satisfaction with the deer seen in the field,
- H₂: Greater focus on targeting big bucks,
- H₃: Greater trust in the MNDNR, and
- H₄: Fewer years of deer hunting experience.

Our study design allowed us to replicate the same model of support for regulations across multiple study years to test whether it was robust over time, not an artifact of cross-sectional data from a single hunting season.

Methods

Data Collection

Four surveys of Itasca State Park deer hunters were conducted following the 9-day seasons in 2005, 2006, 2007, and 2009.¹ Itasca State Park (deer area 287) is open during the regular 9-day firearm deer season, and any person with a statewide firearms deer license may hunt in the park. In Minnesota, when hunters purchase a firearm deer-hunting license, they are asked to indicate which deer area they intend to hunt most often. Although hunters are not obligated to remain in that area, most successful firearm deer hunters harvest at least one deer in the area they hunt most often (MNDNR, unpublished data). The entire population of adult hunters who indicated they intended to hunt in the park was surveyed each year. Initial sample sizes were 557, 488, 452, and 584 for 2005, 2006, 2007, and 2009, respectively. We implemented three mailings for each study year, including personalized cover letter, survey and business-reply envelope in each mailing. Data were collected using mail-back surveys generally following the process outlined by Dillman (2000) to enhance response rates. The surveys were 12 pages in length, including 10 pages of questions. A total of 336, 296, 269, and 303 surveys were returned in 2005, 2006, 2007, and 2009, respectively, for overall response rates of 64%, 64%, 63%, and 53%.

Measurement of Variables

Dependent Variable. Support for the APR was measured using a single survey item, which included a description of the regulation:

The antler point restriction regulation was put in place at Itasca State Park to protect approximately 50% of the 1½ year old buck population, which should put more harvest pressure on antlerless deer. The intent of the regulation is to lower deer populations at the Park but a byproduct may be an increase in the proportion of mature bucks. After hunting under this regulation at Itasca State Park, do you support or oppose the antler point restriction regulation?

Response was on a 5-point scale ranging from *strongly oppose* to *strongly support*. Although research in psychology and marketing has underscored the need for multiple-item measures for reliability and validity (Churchill, 1979; Nunnally & Bernstein, 1994; Peter, 1979), recent work has supported the use of single-item measures (Bergkvist & Rossiter, 2007; Drolet & Morrison, 2001; Rossiter, 2002). Bergkvist and Rossiter (2007) concluded that for constructs that consist of a concrete attribute (attitude) that “single-item measures should be used” (p. 175). Support or opposition to the antler point restriction at Itasca State Park is arguably such a construct.

Independent Variables. Satisfaction with deer seen in the field was based on satisfaction with: (a) the number of legal bucks, (b) the quality of bucks, (c) the total number of antlerless deer, and (d) the total number of deer I saw while hunting, and (e) “I heard about or saw legal bucks while hunting.” Satisfaction items were rated on a 5-point scale ranging

from *strongly disagree* to *strongly agree*. Respondents were asked to select the type of deer they targeted from the following options: (a) hunted for large antlered bucks during the entire season, (b) hunted for large antlered bucks early season and shoot any legal deer later, (c) shoot any antlered buck, (d) shoot the first legal deer (either antlered or antlerless) that offered a good shot, and (e) shoot only antlerless deer. Although type of deer targeted was technically a nominal variable, it was analyzed as an ordinal variable, with lower numbers indicating stronger preference for big bucks and higher numbers indicating stronger preference for antlerless deer. Agency trust was measured using six items related to deer management using a 5-point response scale from *strongly disagree* to *strongly agree*. Finally, deer-hunting experience was based on respondents' reported number of years hunting for deer in Minnesota.

Data Analysis

We measured differences among study years using one-way Analysis of Variance (ANOVA), with eta as a measure of effect size. Values for eta of 0.1 were interpreted as minimal, 0.3 as typical, and 0.5 or greater as substantial effect sizes (Vaske, 2008). Structural equation modeling from Lisrel 8.80² describes the relationships among observed and latent variables, and among independent and dependent latent variables (Diamantopoulos & Siguaw, 2000; Jöreskog & Sörbom, 1996; Raykov & Marcoulides, 2006).

We used structural equation modeling (SEM) to examine the relationship of the four independent factors described above to support for the APR. SEM provides a number of advantages over traditional "measured variable only" techniques, including the ability to use latent constructs and examine model consistency and fit across different groups (Farrell, 1994; Ullman & Bentler, 2004). The ability of SEM to allow assessment of model fit across study groups was important to our study design, as we wanted to determine whether the same model explained variable relationships across multiple study years with different study samples.

In this study, agency trust and satisfaction were latent constructs, while deer-hunting experience, type of deer pursued, and support for the APR were single-indicator latent variables. Because scores from single indicators are unlikely to be free of measurement error, we estimated measurement errors for these variables as the products of 0.15 by the variance of the measured variables based on the recommendations of Jöreskog and Sörbom (1996). For model fit, we reported the comparative fit index (CFI), normed fit index (NFI), and root mean square error of approximation (RMSEA). For the CFI and NFI measures, values close to 1.0 represent a good fit. RMSEA values less than .05 suggest good model fit, between .05 and under .08 reasonable fit, between .08 and .10 mediocre fit, and greater than .10 poor fit (Diamantopoulos & Siguaw, 2000; Raykov & Marcoulides, 2006).

We compared structural equation models among study years to examine whether models remained consistent over time. We compared a model with parameters constrained to equality over study years to models with freed factor loadings and structural regression parameters. A chi-square comparison test between constrained and free models was used to assess significant differences. Samples for different study years were not independent because of hunter fidelity to hunting location.³ However, cases are not correlated in samples for each year, and we replicate the model over study years to examine the strength and consistency of the model.

Results

Descriptive Results

The average age of respondents was 46, 47, 44, and 48 years for respondents to the 2005, 2006, 2007, and 2009 seasons, respectively. With the exception of 2007, respondents were significantly older than individuals who indicated at the time of license purchase they intended to hunt Itasca State Park. Overall, there were no differences (among study years) in the years respondents had hunted in Minnesota ($M = 25.7$, $F = 2.30$, $p = .08$), or at Itasca State Park specifically ($M = 15.8$, $F = 1.51$, $p = .21$), or the number of days they hunted ($M = 3.65$, $F = 0.66$, $p = .58$). Among study years, 78% of respondents indicated they typically hunted the same location every year ($\chi^2 = 10.3$, $p = .33$).

On average, respondents were largely neutral in their opinion of the APR, and their mean level of support did not change significantly over the study years (Table 1). Respondents were slightly dissatisfied with the deer seen in the field, and satisfaction declined significantly over the study years. On average, respondents were slightly trusting of MNDNR deer management. Two of six trust measures declined significantly over the study years. Satisfaction and trust measures may have declined over the study years because of declines in deer populations, while the level support for the APR may have remained relatively unchanged because some hunters see the regulation providing potential for big bucks. In all study years, about three-fourths of respondents targeted the first legal deer (antlered or antlerless) that offered a good shot, with 17–23% targeting big bucks, 2–5% targeting any antlered buck, and less than 2% targeting only antlerless deer. Among study years, there was no significant difference in the mean ($M = 3.5$, $F = 1.65$, $p = .22$) or distribution ($\chi^2 = 10.40$, $p = .58$) for type of deer targeted.

Modeling Support for the APR

The initial structural equation model had reasonable fit (CFI = .95, NFI = .92, RMSEA = .08). Examination of theoretically consistent modification indices suggested adjustments to improve model fit. We correlated error terms between two pairs of satisfaction items because of potential shared measurement error between items as a consequence of similarities in item wording, item placement, and respondent fatigue. Model fit was substantively improved with the addition of two correlated error terms^{4,5} (CFI = .99, NFI = .96, RMSEA = .03). Results from structural equation modeling (Table 2, Figure 1) suggest that items related well with factors, and—in support of our four hypotheses—all predictive factors were significantly related to support for the APR. The type of deer pursued and agency trust were most strongly related to APR support, followed by satisfaction with deer seen in the field, and years of hunting experience. The model had good fit to the data, and explained 34% of the variance in support for the APR. Greater support for the APR was related to pursuit of big bucks, greater trust in the agency, more satisfaction with deer seen in the field, and fewer years of hunting experience.

The chi-square difference test between the model constrained to equality for all groups and the completely free model produced a statistically significant difference ($\chi^2 = 86.3$, 63 df, $p < .05$; CFI = .99 for both constrained and free models). Despite this statistically significant chi-square difference, results were fairly similar across the study years. All independent factors were significantly related to support across all years, with the type of deer pursued and agency trust being the strongest predictors of support for the APR, followed by satisfaction and experience. Explained variance in support for the APR ranged

Table 1
Descriptive statistics of model variables

Factor-Items	Means				<i>F</i>	<i>p</i>	η
	2005	2006	2007	2009			
Support for APR ¹							
- After hunting under this regulation at Itasca State Park, do you support or oppose the antler point restriction regulation?	2.78	2.96	2.94	2.86	0.82	.48	.05
Satisfaction ²							
- I was satisfied with the number of legal bucks	2.31	2.31	2.36	2.04	3.19	.02	.10
- I was satisfied with the quality of bucks	2.78	2.62	2.59	2.32	5.35	<.01	.13
- I heard about or saw legal bucks while hunting	3.22	3.11	3.15	2.61	9.20	<.01	.16
- I was satisfied with the total number of antlerless deer	2.96	2.66	2.82	2.21	13.53	<.01	.19
- I was satisfied with the total number of deer I saw while hunting	2.81	2.46	2.60	1.91	19.61	<.01	.23
Type of deer pursued ³							
- Hunted for large antlered bucks during the entire season; hunted for large antlered bucks early season and shoot any legal deer later; shoot any antlered buck; shoot the first legal deer (either antlered or antlerless) that offered a good shot; shoot only antlerless deer	3.57	3.63	3.48	3.47	1.65	.22	.06
Agency trust ⁴							
- The MNDNR does a good job of managing deer in Minnesota	3.46	3.54	3.46	3.23	6.09	<.01	.13
- When deciding about deer management in Minnesota, the MNDNR will be open and honest in the things they do and say	3.41	3.54	3.35	3.27	4.26	<.01	.10

(Continued)

Table 1
(Continued)

Factor-Items	Means				<i>F</i>	<i>p</i>	η
	2005	2006	2007	2009			
- The MNDNR can be trusted to make decisions about deer management that are good for the resource.	3.36	3.39	3.35	3.26	1.00	.39	.05
- The MNDNR will make decisions about deer management in a way that is fair.	3.39	3.44	3.38	3.26	2.07	.10	.07
- The MNDNR has deer managers and biologists who are well-trained for their jobs.	3.50	3.59	3.53	3.45	1.27	.29	.06
- The MNDNR listens to deer hunters' concerns	3.25	3.21	3.19	3.07	1.91	.14	.07
Minnesota deer hunting experience ⁵							
- Number of years hunting deer in MN	24.79	25.32	25.26	27.56	2.30	.08	.08

¹ 1 = *strongly oppose*, 2 = *oppose*, 3 = *neutral*, 4 = *support*, 5 = *strongly support*.

² 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*.

³ 1 = *big bucks, all season*, 2 = *big bucks, early*, 3 = *any buck*, 4 = *first legal deer*, 5 = *only antlerless*.

⁴ 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, 5 = *strongly agree*.

⁵ 1 = open ended response on years deer hunting in Minnesota.

from 29–40%, highest in 2005 and lowest in 2006 (Table 2). One trend observed in the relationships between the independent factors and support for the APR, was a decline in the correlation between type of deer pursued and support.

Discussion

The type of deer pursued was the strongest predictor of support for the APR. Respondents who specifically targeted large antlered bucks were more supportive of the APR. In addition, satisfaction with deer seen in the field was another significant predictor of support for the APR. These results provide additional support for previous research that has underscored the importance of seeing and harvesting game to hunters (Decker et al., 1980; Gigliotti, 2000; Schroeder et al., 2006). This study extends previous research, which has linked seeing and harvesting game to satisfaction, to examine how these factors influence regulatory support. Our results demonstrate the importance of seeing and harvesting game, along with the specific type of animal pursued, to support for APR regulations. Although previous research has demonstrated the importance of non-harvest motivations to hunters, the opportunity to bag game has an important influence on support for regulations. Despite

Table 2
Structural equation models predicting support for APR in Itasca State Park

Factor-Items	Standardized factor loadings				
	Model constrained with equal parameters for all seasons ¹	Completely free model ²			
		2005	2006	2007	2009
Structural Model R^2	0.34	0.40	0.29	0.36	0.33
- Satisfaction	0.22	0.19	0.18	0.27	0.23
- Type of deer pursued	-0.34	-0.40	-0.35	-0.33	-0.27
- Trust	0.30	0.35	0.26	0.27	0.32
- Minnesota deer hunting experience	-0.06	-0.10	-0.08	-0.01	-0.05
Measurement Model					
- Satisfaction					
- I was satisfied with the number of legal bucks	0.95	0.95	0.95	0.95	0.95
- I was satisfied with the quality of bucks	0.83	0.75	0.85	0.88	0.86
- I heard about or saw legal bucks while hunting	0.73	0.69	0.71	0.71	0.80
- I was satisfied with the total number of antlerless deer	0.62	0.60	0.67	0.60	0.60
- I was satisfied with the total number of deer I saw while hunting	0.62	0.63	0.71	0.63	0.53
- Type of deer pursued					
1 = hunted for large antlered bucks during the entire season,	0.92	0.92	0.92	0.92	0.92
2 = hunted for large antlered bucks early season and shoot any legal deer later,					
3 = shoot any antlered buck,					
4 = shoot the first legal deer (either antlered or antlerless) that offered a good shot,					
5 = shoot only antlerless deer					
- Agency trust					
- The MNDNR does a good job of managing deer in Minnesota	0.78	0.78	0.78	0.78	0.78

(Continued)

Table 2
(Continued)

Factor-Items	Standardized factor loadings				
	Model constrained with equal parameters for all seasons ¹	Completely free model ²			
		2005	2006	2007	2009
- When deciding about deer management in Minnesota, the MNDNR will be open and honest in the things they do and say	0.81	0.75	0.81	0.82	0.86
- The MNDNR can be trusted to make decisions about deer management that are good for the resource.	0.88	0.85	0.91	0.86	0.90
- The MNDNR will make decisions about deer management in a way that is fair.	0.87	0.86	0.88	0.83	0.90
- The MNDNR has deer managers and biologists who are well-trained for their jobs.	0.72	0.79	0.71	0.64	0.75
- The MNDNR listens to deer hunters' concerns	0.77	0.69	0.83	0.81	0.77
- Minnesota deer hunting experience					
- Number of years hunting deer in Minnesota	0.92	0.92	0.92	0.92	0.92

¹Model fit: $\chi^2 = 553.79$, 383 *df*, CFI = .99, NFI = .96, RMSEA = .03.

²Model fit: $\chi^2 = 467.46$, 320 *df*, CFI = .99, NFI = .97, RMSEA = .04.

results indicating that most hunters target the first legal deer that offers a good shot, the hunters who specifically target big bucks reported substantively more support for the APR. This relationship, however, declined slightly over the years of the study.

This study reinforced the relationship between agency trust and support for regulations. Previous research has demonstrated how agency trust affected support for management actions specifically related to chronic wasting disease (Needham & Vaske, 2008; Needham et al., 2004; Vaske et al., 2004, 2006). Our results demonstrated that trust relates to support for APR, second only to the relationship with type of deer pursued. We concur with others (e.g., Needham & Vaske, 2008) who have emphasized the need to examine other correlates to increase understanding of how agency actions may foster or impair agency trust. This study makes an important step in relating agency trust to regulatory support. However, we recognize that general agency trust may not bring about support for a specific regulation,

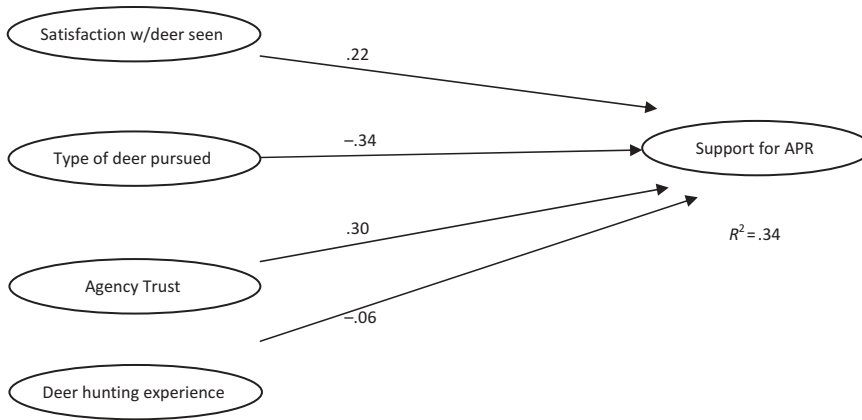


Figure 1. Significant ($p < .05$) standardized coefficients and R^2 for structural equations for path model relating satisfaction, type of deer pursued, agency trust, and deer hunting experience to support for antler point restriction ($n = 909$). Model fit: $\chi^2 = 553.79$, 383 *df*, CFI = .99, NFI = .96, RMSEA = .03.

just as support for a regulation may not produce agency trust. An individual may not trust the agency, but may support a specific regulation. Likewise an individual may trust the agency and oppose a certain regulation. However, the relationship between agency trust, or distrust, and support or opposition to regulations may be self-reinforcing. Hunters who trust an agency may be more likely to support a new regulation, and hunters who support a regulation may be more trusting of the regulatory agency. Additional research is needed to increase understanding of the relationship between these global- and transaction-level constructs (Cole et al., 2002).

Our results underscore the need for applications of expectancy disconfirmation for hunting, angling and other types of outdoor recreation. Limited research (Brunke & Hunt, 2007, 2008; Burns et al., 2003; Madrigal, 1995) has introduced this concept to outdoor recreation, but future research could quantify differences in expectations and outcomes for hunters pursuing different types of game, anglers pursuing different types of fish, and other outdoor recreationists who pursue specific goals related to their endeavors. Quantifying the relative influences of various components (e.g. harvest goals accomplished, social benefits achieved) of expectancy disconfirmation on satisfaction and support for regulations for different activities could provide insight into what components are most influential. For example, how do expectations related to the size of deer seen versus the number of deer seen play into satisfaction and support for regulations? And what is the relative influence of these harvest-related expectations versus non-harvest expectations for different activities, and how do they influence satisfaction and regulatory support?

We documented a small inverse relationship between years of hunting experience and support for the APR. This finding lends additional support to the premise that years of hunting experience may be correlated with higher expectations for seeing and harvesting game (Brunke & Hunt, 2008). Increased expectations among more experienced hunters are likely more difficult to achieve—regardless of the specific regulations currently in place—which likely colors the perceived outcomes of more experienced hunters.

Our model using satisfaction, agency trust, type of deer pursued, and hunting experience provides some insight into the factors related to hunter support for an APR over

four seasons. Models predicted 29 to 40% of the variance in support for the APR at Itasca State Park across the four study years. The observed variability in explained variance suggests other unexplored factors (e.g., non-harvest motivations, recreation specialization or involvement, political orientation, general trust in government) may influence support for deer regulations. The relationship between the type of deer pursued and support for the APR declined over the time the regulation was in place. Hunters pursuing big bucks may have been more supportive of the new regulation as a means to produce large bucks, but the regulation may not have met what might be unrealistic expectations for seeing and bagging large bucks in the field. Alternatively, the relationship between satisfaction and support for the APR increased somewhat over time, which suggests that support for the APR may be increasing among hunters who have had more success bagging deer under the new regulation. However, mean satisfaction ratings with the deer seen in the field declined over the study years, likely because the regulation has reduced the size of the deer herd in the park. Although hunters may like the idea of deer management that increases the proportion of large bucks, they likely still prefer seeing high numbers of deer in the field along with successful harvest.

Hunters may—to a degree—accept regulations as being developed and implemented by agency experts (Schroeder et al., 2014). However, acceptance of new regulations will likely be moderated by hunters' personal experiences with the regulation and the nature of the regulation itself. Our results do not show any significant change in support for the APR. Hunters who do not personally observe desired changes in the deer population as a result of the regulation (i.e., increased proportions of big bucks) may become disillusioned with and less supportive of the regulation. Hunters dissatisfied with the APR may displace from the area or potentially drop out of deer hunting altogether, which could falsely inflate support for the regulation. The more-restrictive APR is a special regulation for a park that is surrounded by land managed under less-restrictive regulations. Increased restriction, in an environment offering less restriction, will likely face greater challenge to gaining legitimacy.

Future research is needed to document the stability or volatility of support for the continued use of an APR at Itasca State Park. With continued use, the APR may become an accepted "legal norm" (Schroeder et al., 2014). Most Minnesota deer hunters hunt the same location every year (Cornicelli, Fulton, Grund, & Fieberg, 2011), and continued use of the APR could bring additional support (i.e., legitimacy) or increased discontent among the majority of hunters who do not specifically target large bucks and who may compare the more-restrictive regulation in the park to the less-restrictive regulations outside of it.

Conclusions, Limitations, and Implications

Management and personal factors interact to affect satisfaction with experiences and perceptions of management actions. In this study, personal preferences and experiences, along with global feelings of trust for management, influenced deer hunters' support for an antler-point restriction.

This study faced limitations common to survey research in general, and recurring surveys in particular. Specifically, hunters who responded may not perfectly represent Itasca State Park deer hunters. Respondents may be somewhat more avid and indeed were slightly older than the population. However, because the study population was small and response rates were strong, we are confident that the results largely reflect the hunter population for each of the study years. A more substantive limitation of our study may be our use of a repeated cross-sectional sampling approach with a small population, which generated

repeat respondents among study years. Recurring surveys (i.e., repeated cross-sectional surveys, panel surveys, hybrid designs) face common issues, which are magnified with a small, not closed population (Gumy et al., 2012; Tourangeau, 2003; Yee & Niemeier, 1996). Repeated cross-sectional surveys (e.g., those that aim to include respondents only once, but field similar surveys on a periodic time schedule) provide a more accurate picture of changing populations and allow for multi-level models that may vary across time periods, but do not allow measurement of change at an individual level (Tourangeau, 2003; Yee & Niemeier, 1996). Panel studies (e.g., those that involve interviewing members of the same sample repeatedly) are valuable for understanding changes at the individual level, yet suffer from attrition and conditioning bias, and may not reflect changes in a population (Steel, 2008; Tourangeau, 2003; Yee & Niemeier, 1996). Our respondents, which include about half who completed only one survey and half who completed surveys in more than one year, manifest “partial sample overlap” (Cantwell, 2008) reflective of the small, relatively stable, yet not unchanging population of deer hunters at Itasca State Park. Although responses from repeat respondents over different study years may be correlated at an individual level, this study was focused on population-level changes not repeated measures/panel assessment of individual respondents.

This study established an important foundation for modeling support for recreation regulations. These results may help direct future studies to clarify the factors that influence satisfaction and support for management. We found deer-type preferences and satisfaction with the deer seen in the field were predictive of support for the APR regulation. Game populations and harvest opportunity have been found to relate to satisfaction and regulatory support among hunters and anglers (Arlinghaus, 2006; Decker et al., 1980; Gigliotti, 2000; Heberlein & Kuentzel, 2002; Schroeder et al., 2006). Likewise, for other recreation activities, how conditions and management actions affect recreationists’ opportunity to reach goals (e.g., climb summits, ski slopes, hike trails) likely influences satisfaction and management support. Although consumptive recreation activities may focus somewhat more on products, while nonconsumptive activities emphasize experiences (Wager, 1969), activities fall on a continuum with desired experiences and goals important to all types of recreation (Vaske, Donnelly, Heberlein, & Shelby, 1982). Preferences, expectations, and goal attainment all relate to satisfaction (Applegate & Clark, 1987), and may also relate to support for regulations and management. Cole et al. (2002) examined transaction and global measures of satisfaction and service quality. We found agency trust predicted support for the APR. Agency trust might be considered a global level measure of performance (i.e., service quality), while support for regulations (which are seemingly subject to change) might be considered a more transient (i.e., transaction) level of performance. Cole et al. (2002) examined the cumulative effect of transaction-level performance on global perceptions of service quality, but emphasized that that transaction- and global-level measures of satisfaction and management performance were likely interrelated. Our results underscore how transaction-level preferences and expectations, as well as global measures of agency performance, related to a transaction-level measure of performance. Further research is needed to clarify the interrelationships among global- and transaction-level measures of satisfaction and management performance. Future research along these lines could provide a clearer understanding of public expectations for agency interaction with stakeholders and suggest more effective means to respond to stakeholder concerns.

Managers may have more ability to affect some factors that influence support for regulations than others. It may be difficult to persuade recreationists to adjust their preferences for certain types of products or experiences or to change their expectations of an outing, which may be based on a “best-ever” experience from their past. However, managers might

actively communicate current conditions (such as game populations) to moderate what might be unrealistic expectations. Similarly, it may prove difficult to increase constituent trust in the management agency. However, transaction-level actions, like taking steps to increase transparency in the development and implementation of regulations, and actions to increase positive, non-enforcement interactions between managers and constituents may help increase agency trust and subsequent support for regulations. These steps could be employed for recreation managers in a variety of settings, but could be particularly effective for a stable population of hunters like the one at Itasca State Park, who predominantly hunt the same area year after year.

Notes

1. The original study design provided for three consecutive years of surveys, but additional funding was available in 2009 to survey hunters for one additional year. Potentially, experiences in 2008 might have differed substantively from other study years, but harvest rates remained the same which suggests that 2008 data likely would be similar to the other four study years.
2. Mention of trade names or commercial products does not imply endorsement by the U.S. government or the U.S. Geological Survey.
3. Sixty-five individuals completed all four surveys; 117 individuals completed three surveys; 130 individuals completed two surveys; and 326 individuals completed one survey.
4. Researchers must exercise prudence when modifying measurement models in structural equation modeling. Several authors have expressed concern over the use of within-factor correlated measurement error (Gerbing & Anderson, 1984; Netemeyer, 2001). Others have suggested that worry about correlated errors may be overblown (Cote, Netemeyer, & Bentler, 2001) and that the theoretical effects of model overspecification are quite minimal (Fan & Hancock, 2006). We correlated error terms within constructs based on our acceptance that shared measurement error between items may exist because of similarities in item wording, item placement, and respondent fatigue. The addition of correlated errors did not significantly alter the structural parameter estimates of a model, and it did not significantly alter the measurement parameters of the model.
5. The accepted model included two correlated error terms, which were added to the original model in the following order: (a) "I was satisfied with the total number of antlerless deer" and "I was satisfied with the total number of deer I saw while hunting," (b) "I was satisfied with the number of legal bucks" and "I heard about or saw legal bucks while hunting."

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