DISSERTATION

HUNTERS' RESPONSES TO CHRONIC WASTING DISEASE: SPECIALIZATION, SOCIAL TRUST, AND PERCEIVED RISK

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY MARK DAVID NEEDHAM ENTITLED HUNTERS' RESPONSES TO CHRONIC WASTING DISEASE: SPECIALIZATION, SOCIAL TRUST, AND PERCEIVED RISK BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

HUNTERS' RESPONSES TO CHRONIC WASTING DISEASE: SPECIALIZATION, SOCIAL TRUST, AND PERCEIVED RISK

Chronic wasting disease (CWD) is found in deer, elk, and moose in several states and provinces. CWD causes abnormal behavior, emaciation, and death in all infected animals. Although CWD has not caused human health problems, transmission to humans cannot be dismissed. Little is known about the extent to which hunters: (a) would hunt in other states or quit hunting in response to CWD and whether this behavior differs among subgroups of hunters, and (b) perceive personal risks from CWD and the influence of trust in wildlife agencies as a determinant of risk. This dissertation presents three articles that address these knowledge gaps using data from surveys (n = 9,567) of resident and nonresident deer and elk hunters in eight states.

Hunters were presented with hypothetical scenarios of CWD prevalence and human risks. The first article shows that at current prevalence levels, few hunters would change behavior. As conditions worsen (e.g., 50% prevalence, human death), up to 18% would switch states and 37% would quit. Residents were likely to quit; nonresidents would switch states. Arizona and North Dakota hunters were most likely to change behavior. Given that CWD is not found in these states, it may pose a new risk. In Wisconsin, where hunting is a tradition, hunters were least likely to change behavior. CWD testing and herd reduction were acceptable; taking no action was unacceptable.

The second article examines responses to these scenarios among subgroups of hunters based on their specialization. Cluster analysis revealed four specialization groups (casual, intermediate, focused, veteran). Casual hunters were most likely to quit; veterans were least likely. Veteran residents were most likely to switch states; casual residents were least likely. For nonresidents, there were few differences among specialization groups regarding intention to switch states.

The third article shows that hunters trusted agencies to manage CWD, but still perceived risk from the disease. Structural equation models showed that perceptions of similarity positively influenced trust, explaining up to 49% of the variance in trust. Hunters who trusted agencies perceived less CWD risk, but trust only explained up to 8% of the variance in risk. Research and management implications are discussed.

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CHAPTER I. INTRODUCTION

Chronic wasting disease (CWD) is a neurological disease of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) (CDOW, 2005; Williams, Miller, Kreeger, Kahn, & Thorne, 2002; Williams & Young, 1980, 1982). In all infected animals, the disease causes abnormal behavior, loss of coordination and body functions, excessive salivation, emaciation, and death (Williams et al., 2002). Evidence suggests that CWD is caused by a prion (i.e., infectious protein without associated nucleic acids) (Miller, Wild, & Williams, 1998; O'Rourke et al., 1999; Salman, 2003; Schauber & Woolf, 2003). As a prion disease, CWD is similar to other transmissible spongiform encephalopathies (TSE) such as scrapie in sheep, bovine spongiform encephalopathy in cattle (i.e., BSE, mad cow), and Creutzfeldt-Jacob disease in humans (McKintosh, Tabrizi, & Collinge, 2003). CWD is not thought to be naturally transmissible to humans, but hunters, agencies, and researchers are concerned about the possibility of human infection from the disease (e.g., Belay et al., 2004; Needham, Vaske, Green, Petchenik, & Timmons, 2005; Salman, 2003). Officials are quick to point out that they are not absolutely certain that meat from infected animals is safe to eat (Belay et al., 2004; Raymond et al., 2000).

CWD was identified in captive deer and elk in the 1960s and 1970s (Williams & Young, 1980, 1982) and free-ranging deer and elk in the 1980s and 1990s (Spraker et al., 1997) in both Colorado and Wyoming. The disease has also been discovered in free-ranging herds in Alberta, Illinois, Nebraska, New Mexico, New York, Saskatchewan,

South Dakota, Utah, West Virginia, and Wisconsin. CWD was recently found in free-ranging moose in Colorado (CDOW, 2005). Although extensive research has been conducted on the pathology, epidemiology, transmission, and clinical signs of CWD (see Belay et al., 2004; Salman, 2003; Schauber & Woolf, 2003; Williams & Miller, 2002; Williams et al., 2002 for reviews), research on the human dimensions of CWD is limited.

Human Dimensions of CWD

Wildlife agencies are concerned that hunters' perceptions of potential unknown risks associated with CWD may erode their confidence and willingness to hunt in areas where the disease is found (Heberlein, 2004). A decrease in the number of hunters due to CWD could exacerbate the current hunting decline in North America (Brown, Decker, Siemer, & Enck, 2000; Heberlein & Thompson, 1996). Hunting participation in some states has already decreased up to 10% as a result of CWD (Bishop, 2004; Heberlein, 2004; Vaske, Timmons, Beaman, & Petchenik, 2004).

Hunting declines attributable to CWD are problematic because they can reduce revenue from hunters' expenditures, including from license sales that support agency operating costs (Fix, Pierce, Manfredo, & Sikorowski, 1998; Mehmood, Zhang, & Armstrong, 2003). In Wisconsin, for example, negative economic impacts of CWD were estimated at $45 – 79 million between 2002 and 2003 (Bishop, 2004). A decrease in hunting due to CWD may also: (a) impact wildlife management programs (e.g., pheasant stocking) if funds are diverted to manage CWD, (b) limit an agency's ability to use hunters to control wildlife populations, (c) erode public support for hunting, and (d) constrain cultural traditions and the social and economic stability of communities dependent on hunting (Needham, Vaske, & Manfredo, 2004).

Given these potential consequences, research has focused on hunters' reactions and behavior in response to CWD. Results have been mixed. In 2002, for example, 83% of Illinois hunters were unconcerned about CWD and the majority did not have their deer tested for the disease (Miller, 2003). Less than 10% of Illinois hunters would stop hunting deer if CWD was in or adjacent to the county where they hunted (Miller, 2004). In South Dakota, 15% of hunters would stop hunting in their unit if 5% of its deer were infected with CWD (Gigliotti, 2004). Ten percent of Wisconsin hunters would stop hunting deer if conditions worsened (e.g., CWD in unit, 20% infected, no testing) (Vaske, Needham, Newman, Manfredo, & Petchenik, 2006; Vaske et al., 2004). Conversely, Needham et al. (2004) reported that 49% of deer and elk hunters across several states would quit hunting if the majority of deer or elk had CWD. Declines would be even greater (e.g., 65%) if high prevalence is combined with human health threats such as death from CWD.

Common approaches for managing CWD and mitigating its impacts include testing and herd reduction. To control the spread of CWD in Wisconsin, for example, managers established a goal of eradicating the entire free-ranging deer population where the disease is found. Across several states, hunters believed that CWD testing and herd reduction in affected areas were acceptable strategies; taking no action and allowing the disease to take its natural course were unacceptable (Needham et al., 2004).

Dissertation Purpose and Organization

Despite this recent research on the human dimensions of CWD, little is known about the extent to which hunters: (a) would hunt in other states or quit hunting in response to CWD and whether this behavior differs among subgroups of hunters, and (b) perceive personal risks from CWD and the influence of trust in wildlife agencies as a

determinant of this risk. This dissertation contains three separate articles that address these knowledge gaps using data from mail surveys of resident and nonresident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming).

This dissertation extends the literature on the human dimensions of CWD in three ways. First, the relatively small sample of hunters from each state (n = 57 to 129) in the Needham et al. (2004) study limited the ability to explore possible differences in hunters' behavior and acceptance of management actions among states and between deer and elk hunters. In addition, Needham et al. (2004) measured the extent to which potential CWD prevalence levels (e.g., 30%, 50%) and human health risks (e.g., human death) would influence hunters to stop hunting deer or elk in their state; not examined was whether hunters would quit hunting these species altogether or travel to other states to hunt them.

The first article in this dissertation (chapter two) builds on the Needham et al. (2004) study by using more extensive data (n = 9,567) to examine: (a) the extent to which CWD may influence individuals to hunt deer or elk in other states or stop hunting these species permanently; (b) hunters' acceptance of various lethal and non-lethal strategies for managing the disease; and (c) whether hunters' responses differ by the state in which they hunted, residency (resident, nonresident), and species hunted (deer, elk).

Second, the concept of recreation specialization has been used extensively to differentiate recreationists into meaningful homogeneous subgroups and to explain why they vary in behavior (see Scott & Shafer, 2001; Appendix A of this dissertation for reviews). The specialization concept, however, has not been applied in human dimensions of CWD research. Specialization involves classifying recreationists into

subgroups along a "continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences" (Bryan, 1977, p. 175). Compared to novices or newcomers, hunting is more central to specialized hunters who devote more time and effort to the sport (Kuentzel & Heberlein, 1992; Miller & Graefe, 2000). It is possible that specialized hunters are less likely to change their hunting behavior because of CWD.

This dissertation's second article (chapter three) builds on the first article by: (a) segmenting hunters according to their degree of specialization in the activity, and (b) examining whether hunter displacement (i.e., hunt in other states) and desertion (i.e., stop hunting permanently) in response to CWD differs among specialization subgroups.

Finally, theory suggests that hunters' behavior may be influenced by perceptions of risk regarding a hazard such as CWD. These risk perceptions may be shaped by the extent to which hunters trust the managing agency (Bord & O'Connor, 1992; Viklund, 2003). Shared goals, values, thoughts, and opinions (i.e., perceived similarity) are thought to constitute foundations of trust; if the agency is perceived as similar to the individual, it tends to be viewed as trustworthy by the individual (Siegrist, Cvetkovich, & Roth, 2000). Appendix B reviews the literature on perceived similarity, trust, and risk.

The third article in this dissertation (chapter four) examines the extent to which hunters perceive personal risks associated with CWD and the influence of perceived similarity and trust in state wildlife agencies as determinants of this risk. This article is followed by a brief integrative summary and discussion of the three articles presented in this dissertation (chapter five).

CHAPTER II. STATE AND RESIDENCY DIFFERENCES IN HUNTERS' RESPONSES TO CHRONIC WASTING DISEASE

Introduction

Chronic wasting disease (CWD) is a neurological disease of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) (CDOW, 2005; Williams, Miller, Kreeger, Kahn, & Thorne, 2002). CWD belongs to a family of transmissible spongiform encephalopathy (TSE) diseases such as bovine spongiform encephalopathy in cattle (i.e., BSE, mad cow), scrapie in sheep, and Creutzfeldt-Jakob disease in humans (McKintosh, Tabrizi, & Collinge, 2003). Animals infected with CWD exhibit abnormal behavior, loss of coordination, emaciation, and excessive salivation (Williams & Young, 1980). There is no known treatment for CWD and the disease is always fatal (Williams et al., 2002). No evidence exists to suggest that CWD poses a human health risk, but transmission to humans cannot be dismissed (Belay et al., 2004; Raymond et al., 2000; Salman, 2003).

CWD has been found in free-ranging deer and elk in 10 states (Colorado, Illinois, Nebraska, New Mexico, New York, South Dakota, Utah, West Virginia, Wisconsin, Wyoming) and two provinces (Alberta, Saskatchewan), and was recently detected in moose in Colorado (CDOW, 2005). If CWD conditions worsen, hunting participation may substantially decrease. Needham, Vaske, and Manfredo (2004), for example, reported that approximately 50% of hunters across several states would stop hunting in their state if the majority of deer or elk are infected with CWD. The decline would be

even greater (e.g., 65%) if high prevalence is combined with threats to human health such as death from CWD. Hunters also believed that CWD testing and herd reduction in affected areas were acceptable management actions; letting CWD take its natural course was unacceptable. Small sample sizes in the Needham et al. (2004) study, however, limited the ability to examine differences among states and between deer and elk hunters.

This article builds on Needham et al. (2004) by using more extensive data to explore: (a) the extent to which CWD may influence individuals to hunt in other states or stop hunting permanently; (b) hunters' acceptance of lethal and non-lethal strategies for managing the disease; and (c) whether hunters' responses differ by the state in which they hunted, residency (resident, nonresident), and species hunted (deer, elk).

Human Dimensions of CWD

Participation in big game hunting has decreased in many states (Brown, Decker, Siemer, & Enck, 2000; Heberlein & Thompson, 1996). Given the similarities between CWD and related diseases that can cause human death (e.g., Creutzfeldt-Jakob) and that CWD is increasing in prevalence and spreading to new locations, wildlife agencies are concerned that this hunting decline could be exacerbated by potential unknown risks associated with CWD eroding hunters' willingness to hunt in areas where the disease is found (Vaske, Timmons, Beaman, & Petchenik, 2004). Hunting participation in some states has already decreased as a result of CWD (Heberlein, 2004; Vaske et al., 2004).

A hunting decline due to CWD is problematic for several reasons. First, decreased hunting reduces agency revenues from license sales that support operating costs (Fix, Pierce, Manfredo, & Sikorowski, 1998; Mehmood, Zhang, & Armstrong, 2003). Second, wildlife management programs (e.g., stocking programs) may be affected when funds are

redirected to address CWD (Heberlein, 2004). Third, a decrease in participation limits an agency's ability to use hunters to control wildlife populations (Backman & Wright, 1993; Enck, 1996). Fourth, a decline in hunting may impact cultural traditions and the social and economic stability of communities dependent on hunting (Herman, 2003; Lamar & Donnell, 1987). Direct economic impacts would be significant to restaurants and motels, and a lack of turnover spending in communities would impact residents (Loomis & Walsh, 1997; Seidl & Koontz, 2004). Fifth, fewer hunters would weaken wildlife agencies' traditional constituent base, resulting in a loss of public support for hunting (Mehmood et al., 2003; Miller & Vaske, 2003). Finally, concerns about CWD may influence hunters to substitute deer and / or elk hunting with alternative types of hunting (e.g., pheasant), which increases demand on different hunting species and locations (Vaske, Donnelly, & Shelby, 1990).

Given these potential ramifications, researchers have examined the extent to which hunters might change their behavior in response to CWD (Gigliotti, 2004; Miller, 2003, 2004; Vaske, Needham, Newman, Manfredo, & Petchenik, 2006; Vaske et al., 2004). Studies have presented hunters with hypothetical scenarios depicting manipulated levels of CWD prevalence (e.g., 1% or 5% deer or elk infected). Hunters reported their behavioral intentions in response to each scenario (e.g., continue hunting, stop hunting). Between 10% and 20% of South Dakota and Wisconsin deer hunters, for example, would stop hunting in their unit if 5% to 20% of its deer were infected with CWD (Gigliotti, 2004; Vaske et al., 2006). Less than 10% of Illinois deer hunters would stop hunting if CWD was in or adjacent to the county where they hunted (Miller, 2004).

Conceptual Foundation and Research Questions

Relatively low CWD prevalence levels were manipulated in previous studies and most hunters would not change their behavior. Research on perceived risk, however, has identified two primary determinants of human behavior in response to judgments of risk: (a) high probability of a hazard occurring, and (b) consequences / severity associated with the hazard (Adams & Smith, 2001; Sjöberg, 1999; Stonehouse & Mumford, 1994; Thompson & Dean, 1996). In some free-ranging herds, the probability of encountering a deer or elk infected with CWD is relatively high with prevalence rates exceeding 20% (Gross & Miller, 2001; Miller et al., 2000; Wolfe et al., 2002). Higher prevalence (e.g., 90%) has been noted in captive herds (Williams & Young, 1980). Although there are no known cases of human illness directly attributable to CWD (Salman, 2003; World Health Organization, 2000), researchers suggest that this risk cannot be dismissed with certainty (Belay et al., 2004; Raymond et al., 2000). Laboratory experiments, for example, have shown that transmission of CWD to humans may occur, but only rarely and inefficiently (Raymond et al., 2000). In addition, CWD is similar to related diseases (e.g., Creutzfeldt-Jacob) that can cause human health impacts including death (McKintosh et al., 2003).

Needham et al. (2004) presented hunters with hypothetical scenarios depicting potential human health consequences (e.g., death from CWD) and low to high CWD prevalence levels (e.g., 10% to 50% deer or elk infected). Across several states, 5% of hunters reported that they would stop hunting deer or elk in their state at low prevalence levels, but up to 65% would stop if CWD ever caused human death and prevalence rates increased dramatically. Nonresident hunters were more likely than residents to report that they would stop hunting deer or elk in the state. Hunters also believed that CWD testing

and herd reduction in affected areas were acceptable strategies for managing CWD; taking no action and allowing the disease to take its natural course were unacceptable.

There were, however, limitations of the Needham et al. (2004) study. Given the relatively small sample of hunters from each state (n = 57 to 129), generalizations could only be made about the combined deer and elk hunter population across states. Little is known about whether hunters' behavior in response to CWD may differ among states and between deer and elk hunters. Needham et al. (2004) also measured the extent to which hypothetical CWD prevalence levels and human health risks would influence hunters to stop hunting deer or elk in their state; not examined was whether hunters would quit hunting these species altogether or travel to other states to hunt them.

This article addresses these knowledge gaps by exploring three research questions. First, to what extent will hypothetical levels of CWD prevalence, distribution, and human health risks influence hunters to permanently stop hunting deer / elk or travel to other states to hunt? Second, to what extent will these CWD conditions influence hunters' acceptance of strategies for managing CWD? Finally, will desertion, displacement, and acceptance of management actions differ by state, species hunted (deer, elk), and residency (resident, nonresident)?

Methods

Data Collection

Data were obtained from mail surveys of nonresident and resident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming), yielding a total of 22 strata (Table 2.1). CWD had been identified in free-ranging deer

and / or elk in each of these states except Arizona and North Dakota. The wildlife / game and fish government agency of each participating state provided names and addresses of random samples of hunters 18 years of age or older who purchased a nonresident or resident license to hunt deer or elk with a gun in 2003.

Table 2.1 Completed surveys and response rates for each stratum

Strata	Mailed	Undeliverable	Completed (*n*)	Response rate
Arizona nonresident deer hunters	988	37	444	47%
Arizona resident deer hunters	1025	36	396	40%
Colorado nonresident deer hunters	1025	13	509	50%
Colorado resident deer hunters	1025	41	459	47%
Colorado nonresident elk hunters	1025	17	564	56%
Colorado resident elk hunters	1025	34	472	48%
Nebraska nonresident deer hunters	1025	17	524	52%
Nebraska resident deer hunters	1025	13	423	42%
North Dakota nonresident deer hunters	1025	23	509	51%
North Dakota resident deer hunters	1025	23	346	35%
South Dakota nonresident deer hunters	1025	10	557	55%
South Dakota resident deer hunters	1025	10	423	42%
Utah nonresident deer hunters	1025	47	439	45%
Utah resident deer hunters	1025	45	328	34%
Utah nonresident elk hunters	832	51	337	43%
Utah resident elk hunters	1025	73	331	35%
Wisconsin nonresident deer hunters	1025	80	465	49%
Wisconsin resident deer hunters	1025	30	378	38%
Wyoming nonresident deer hunters	1025	19	475	47%
Wyoming resident deer hunters	1025	79	308	33%
Wyoming nonresident elk hunters	1025	18	506	50%
Wyoming resident elk hunters	1025	57	374	39%
Total	22320	773	9567	44%

Three mailings were used to administer the survey beginning in July 2004.[1] Hunters were sent a survey, postage-paid return envelope, and letter explaining the study. Reminder postcards were sent to non-respondents two weeks after this initial mailing. A

second full mailing (i.e., survey, return envelope, letter) was sent to non-respondents three weeks after the postcard reminder (Needham, Vaske, & Manfredo, 2005).

Surveys were mailed to a total of 22,320 hunters. With the exception of Arizona nonresident deer hunters and Utah nonresident elk hunters, 1,025 hunters in each stratum were sent a survey (Table 2.1). For these two strata, the full population of hunters was sent a survey because less than 1,025 licenses were sold. Across all 22 strata, 773 surveys were undeliverable (e.g., moved, incorrect address) and 9,567 completed surveys were returned, yielding a 44% response rate (9,567 / 22,320 – 773). Among the strata (Table 2.1), sample sizes ranged from 308 (33% response rate, Wyoming resident deer hunters) to 564 (56% response rate, Colorado nonresident elk hunters).

To check for non-response bias, hunters who completed the mail survey were compared to those who did not. A sample of 785 non-respondents (approximately 100 per state) was telephoned in November 2004 and asked nine survey questions. Responses to five questions were statistically different ($p < .001$) between respondents and non-respondents, but statistical significance is inflated by large sample sizes (Vaske, Gliner, & Morgan, 2002). Effect sizes (V, r_{pb}) were less than .15, indicating weak (Cohen, 1988) or minimal (Vaske et al., 2002) differences between the two groups. Non-response bias, therefore, was not considered to be a problem and data were not weighted based on the non-response check. In each state, however, there were more residents than nonresidents who purchased a license to hunt deer or elk with a gun in 2003. Given that more surveys were received from nonresident hunters, data were weighted to reflect the population proportions of hunters for comparisons among states and between deer and elk hunters.[2]

Analysis Variables

Maps in the surveys depicted hypothetical scenarios of CWD human health risks and increasing prevalence among deer or elk in three zones across each state (Figure 2.1). With the exception of maps in the Arizona and North Dakota surveys, zone A represented the area where CWD had been discovered in free-ranging herds and had the highest prevalence. For Arizona and North Dakota, zone A represented the most likely area for CWD to be detected, if ever. Zone B either represented the area where CWD had been found but with lower prevalence than zone A, or was considered by the agency to be the area where CWD would spread to first from zone A. Zone C was considered by each agency to represent the least likely location for high CWD prevalence levels to occur. All three zones for each state were based on hunt management units and the decision of where to situate the zones was made by the state's wildlife / game and fish agency.

Survey maps for all eight states depicted four separate hypothetical scenarios of increasing CWD prevalence and distribution: (a) 10% prevalence in zone A, 0% in zones B and C; (b) 30% in zone A, 10% in zone B, 0% in zone C; (c) 50% in zone A, 30% in zone B, 10% in zone C; and (d) 50% in all three zones (i.e., across entire state).

Surveys for four states (Arizona, North and South Dakota, Wisconsin) included two additional hypothetical scenarios related to CWD prevalence and human health risks: (a) 10% prevalence in zone A, 0% in zones B and C, and "evidence shows that CWD can be transmitted to humans and hunters in the state have died from CWD;" and (b) 50% in all three zones and "evidence shows that CWD can be transmitted to humans and hunters in the state have died from CWD." The scenarios reflected the two primary determinants of behavior in response to risk – probability of encountering a hazard and consequences /

severity associated with the hazard (e.g., Sjöberg, 1999; Thompson & Dean, 1996).[3] To emphasize the hypothetical nature of the scenarios, respondents were assured in the mail survey that they did not necessarily reflect current conditions or consequences to humans.

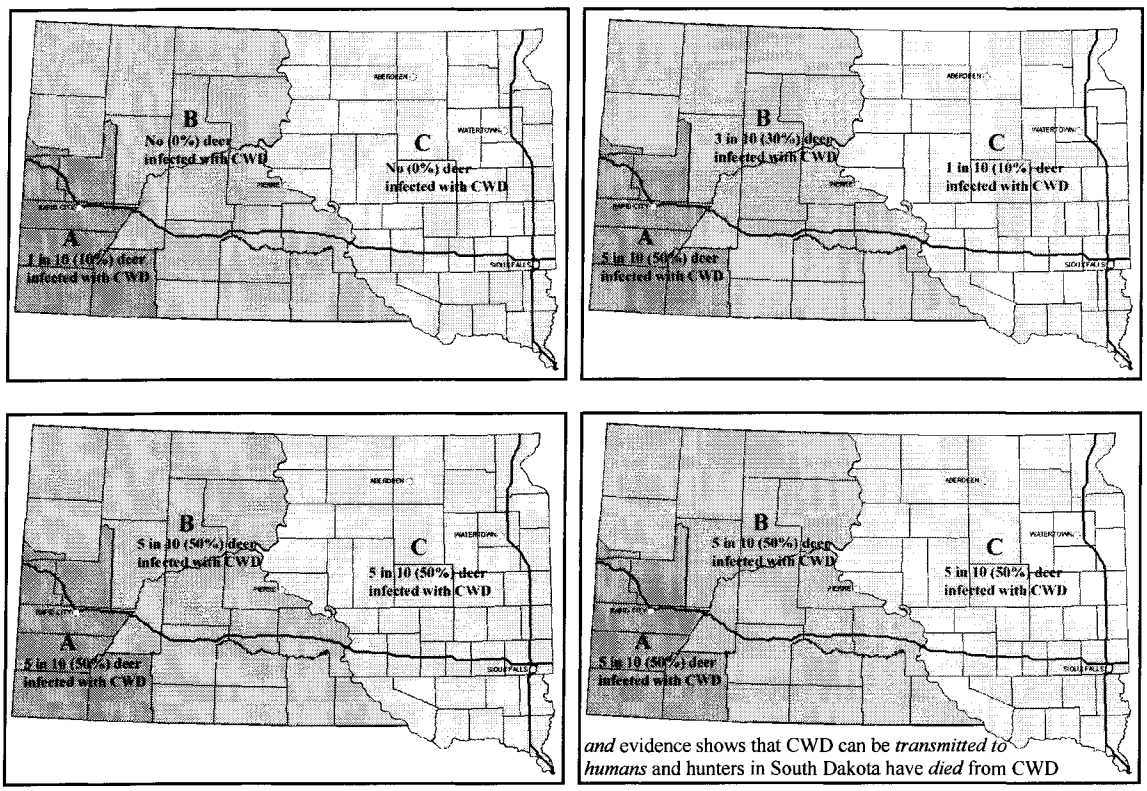

Figure 2.1 Sample maps depicting hypothetical scenarios of CWD prevalence, distribution, and human health risks

Note. These maps were used in the surveys for South Dakota and are provided here as an example. For six of the states, zone A represented the area where CWD had already been detected and had the highest prevalence. For Arizona and North Dakota, zone A represented the opinions of the state wildlife / game and fish agencies regarding the most likely region for CWD to be first detected, if ever. All three zones were based on hunt management units, which often transect county borders (thin lines) and interstate highways (thick lines).

To measure the extent to which CWD prevalence and human health risks may influence hunters to stop hunting or travel to other states to hunt, respondents evaluated each scenario and indicated if they would: (a) "hunt deer in the zone in the state that they hunt deer in most often;" (b) "hunt deer in the state, but switch to a different zone;" (c) "give up deer hunting in the state, but hunt deer in another state;" or (d) "give up deer

hunting altogether." The respective state name was provided in responses for each survey and elk hunting was substituted for deer hunting in surveys of elk hunters. Given that few hunters (< 10%) reported that they would switch to a different zone in the state for each scenario, the first two responses were collapsed into a single category labeled "still hunt in the state."

Following each hypothetical scenario, hunters rated their acceptance of four non-lethal and lethal CWD management actions that their state wildlife / game and fish agency might take. The two non-lethal actions were: (a) take no action and allow CWD to take its natural course, and (b) continue to test deer / elk for CWD. The two lethal actions were: (a) use *trained agency staff*, and (b) use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading. Hunters rated each action for each scenario on a 7-point scale of –3 "highly unacceptable" to +3 "highly acceptable."

Results

Hunters' Behavioral Intentions in Response to CWD

In total, 98% of hunters reported that they would continue hunting in the state if 10% of the deer or elk in zone A and 0% in the rest of the state had CWD (scenario 1; Table 2.2). At this prevalence level, which is consistent with current conditions in some states (e.g., Colorado, Wyoming), few hunters would travel to other states to hunt deer / elk (1%) or quit the activity (1%). The percentage of hunters that would stop hunting deer or elk in the state or altogether increased as CWD conditions worsened. For example, if prevalence was 50% in zone A, 30% in zone B, and 10% in zone C (scenario 3), 9% of hunters would switch to another state and 11% would quit. Up to 18% of hunters would hunt in other states and 21% would give up altogether if prevalence increased to 50%

Table 2.2 Differences among states and between residents and nonresidents in hunters' reported behavioral intentions for each CWD scenario

	State total (%) [1]			Nonresidents (%)			Residents (%)					
	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	$\chi^2(2)$ - value [2]	p - value	V
Scenario 1												
Arizona	96	2	2	97	3	1	96	2	2	3.27	.195	.06
Colorado deer	98	1	1	96	4	0	98	1	1	14.85	.001	.12
Colorado elk	97	2	1	96	3	1	98	1	2	5.13	.077	.07
Nebraska	98	1	1	95	5	0	99	1	1	19.25	< .001	.13
North Dakota	93	1	5	94	5	1	93	1	6	25.10	< .001	.17
South Dakota	99	0	1	97	3	0	99	0	1	22.28	< .001	.13
Utah deer	97	1	2	94	5	1	97	1	2	12.75	.002	.12
Utah elk	95	3	2	89	9	2	95	2	3	15.45	< .001	.15
Wisconsin	99	0	0	99	1	0	100	0	0	1.41	.494	.04
Wyoming deer	97	2	1	97	3	0	97	1	1	9.38	.009	.10
Wyoming elk	99	1	1	97	3	1	99	0	1	10.11	.006	.10
Total	98	1	1	97	3	1	98	1	1	74.84	< .001	.09
Scenario 2												
Arizona	89	6	6	91	8	2	89	6	6	11.59	.003	.12
Colorado deer	94	4	3	89	11	1	96	1	3	48.87	< .001	.21
Colorado elk	91	6	4	88	10	2	92	4	5	21.59	< .001	.14
Nebraska	96	2	3	88	12	1	96	1	3	54.11	< .001	.22
North Dakota	88	3	9	85	12	3	88	2	10	42.40	< .001	.22
South Dakota	96	1	3	89	11	1	96	1	3	61.22	< .001	.23
Utah deer	89	5	7	83	15	2	89	4	7	35.94	< .001	.21
Utah elk	90	5	5	78	19	3	91	4	5	37.29	< .001	.23
Wisconsin	96	2	2	96	3	1	96	2	2	4.54	.103	.07
Wyoming deer	95	4	2	92	8	0	96	1	2	25.15	< .001	.17
Wyoming elk	97	2	2	92	7	1	98	0	2	32.01	< .001	.17
Total	94	3	3	90	9	1	94	2	4	260.57	< .001	.16

Table 2.2 Differences among states and between residents and nonresidents in hunters' reported behavioral intentions for each CWD scenario *(continued)*

	State total (%) [1]			Nonresidents (%)			Residents (%)					
	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	$\chi^2(2)$ - value [2]	*p* - value	*V*
Scenario 3												
Arizona	78	12	10	76	22	2	78	12	10	32.38	< .001	.20
Colorado deer	74	16	10	67	31	2	76	11	13	92.74	< .001	.30
Colorado elk	70	18	12	65	29	6	72	12	15	57.82	< .001	.24
Nebraska	83	7	10	67	30	3	84	5	11	115.67	< .001	.33
North Dakota	75	7	18	67	26	6	75	6	19	76.54	< .001	.29
South Dakota	82	7	11	70	29	1	83	5	12	136.69	< .001	.36
Utah deer	73	13	14	60	37	3	74	11	15	88.53	< .001	.34
Utah elk	74	14	13	57	35	7	75	12	13	49.49	< .001	.27
Wisconsin	84	5	11	82	14	4	84	5	11	31.64	< .001	.19
Wyoming deer	81	12	7	74	25	1	85	4	10	92.96	< .001	.33
Wyoming elk	83	8	9	72	24	4	86	4	11	79.27	< .001	.29
Total	80	9	11	70	26	4	81	7	12	767.17	< .001	.28
Scenario 4												
Arizona	61	22	17	60	37	3	61	21	17	61.10	< .001	.27
Colorado deer	55	28	17	46	52	2	58	20	21	157.22	< .001	.39
Colorado elk	51	28	21	43	46	11	55	19	26	92.87	< .001	.30
Nebraska	63	15	23	53	43	4	63	13	24	150.51	< .001	.39
North Dakota	58	14	28	50	39	11	58	13	28	87.94	< .001	.32
South Dakota	64	16	21	51	46	3	64	14	22	166.46	< .001	.41
Utah deer	56	22	22	43	53	3	57	19	24	129.22	< .001	.41
Utah elk	58	23	20	42	48	10	59	21	21	57.76	< .001	.30
Wisconsin	65	13	23	56	33	10	65	11	23	68.34	< .001	.28
Wyoming deer	62	26	13	53	46	2	67	13	20	142.43	< .001	.42
Wyoming elk	62	19	19	48	45	6	65	13	22	125.44	< .001	.38
Total	61	18	21	48	44	8	62	14	24	1201.79	< .001	.35

Table 2.2 Differences among states and between residents and nonresidents in hunters' reported behavioral intentions for each CWD scenario *(continued)*

	State total (%) [1]			Nonresidents (%)			Residents (%)					
	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	Still hunt in state	Switch to another state	Give up altogether	$\chi^2(2)$ - value [2]	*p* - value	*V*
Scenario 5												
Arizona	72	12	16	75	20	5	72	11	17	37.35	< .001	.21
North Dakota	74	6	20	69	20	11	75	5	20	48.78	< .001	.23
South Dakota	82	4	14	77	17	6	83	3	15	72.20	< .001	.26
Wisconsin	80	5	15	83	10	7	80	5	16	19.17	< .001	.15
Total	79	6	16	81	12	7	79	5	16	93.29	< .001	.16
Scenario 6												
Arizona	39	30	32	35	57	8	39	29	33	102.52	< .001	.35
North Dakota	40	17	44	33	46	21	40	15	45	98.31	< .001	.34
South Dakota	45	17	38	33	56	11	46	15	40	205.76	< .001	.46
Wisconsin	48	16	36	37	44	19	49	14	38	97.59	< .001	.34
Total	46	17	37	36	46	18	47	15	38	415.13	< .001	.34

[1] Based on weighted data. Differences among states: scenario 1 $\chi^2(20) = 119.59, p < .001, V = .09$; scenario 2 $\chi^2(20) = 210.59, p < .001, V = .11$; scenario 3 $\chi^2(20) = 238.39, p < .001, V = .12$; scenario 4 $\chi^2(20) = 218.57, p < .001, V = .11$; scenario 5 $\chi^2(6) = 58.27, p < .001, V = .10$; scenario 6 $\chi^2(6) = 74.02, p < .001, V = .11$.

[2] Represents differences between nonresident and resident hunters.

across the state (scenario 4). If this prevalence level is combined with human death from CWD (scenario 6), 17% would switch states and 37% would quit; 46% of hunters would continue hunting in the state under these conditions. Across most scenarios, hunters were more likely to give up deer or elk hunting permanently than travel to other states to hunt.[4]

Differences in Behavioral Intentions among States

At relatively low to moderate CWD prevalence levels (scenarios 1, 2), Arizona, North Dakota, and Utah hunters were most likely to change their hunting behavior; South Dakota and Wisconsin hunters were least likely to change (Table 2.2). For example, if prevalence was 30% in zone A, 10% in zone B, and 0% in zone C (scenario 2), 3% of North Dakota hunters would switch states and 9% would give up altogether. In Arizona, 6% would travel to other states and an additional 6% would quit. Conversely, only 2% of Wisconsin hunters would switch states or give up permanently.

When CWD prevalence was higher (e.g., 50% in a zone), Colorado hunters were most likely to report that they would hunt in other states; North Dakota hunters were most likely to quit permanently. Wisconsin hunters were least likely to report that they would alter their behavior (e.g., 65% would continue hunting in the state if 50% of the deer had CWD [scenario 4]). If hunters died from CWD at this prevalence level (scenario 6), 62% of Arizona hunters (30% switch states, 32% quit) compared to 52% of Wisconsin hunters (16% switch states, 36% quit) would change their behavior.

Across most scenarios: (a) Wisconsin and South Dakota hunters were most likely to stay in the state and not alter their behavior, (b) North Dakota hunters were most likely to quit permanently, and (c) Arizona and Colorado hunters were most likely to go to other states to hunt. Responses were statistically different among states for each scenario, $\chi^2 \leq$

238.39, $p < .001$. These differences, however, were "weak" (Cohen, 1988) or "minimal" (Vaske et al., 2002) with effect sizes of $V \leq .12$.

Differences in Behavioral Intentions between Residents and Nonresidents

Responses from residents and nonresidents differed for all six scenarios, $\chi^2(2) \leq 1201.79, p < .001$, $V \leq .46$ (Table 2.2). Across most scenarios and states, residents were more likely to stay in their state and not change their behavior. If prevalence was 50% in all three zones (scenario 4), for example, 62% of all residents and 48% of nonresidents would continue hunting deer or elk in the state. For most scenarios and states, however, residents were more likely to report that they would give up altogether; nonresidents were more likely to travel to other states to hunt. For example, if 50% of deer or elk were infected with CWD and the disease caused human death (scenario 6), 15% of all residents would travel to other states and 38% would give up permanently. Conversely, 46% of all nonresidents would switch states and only 18% would quit under these conditions.

Differences in Behavioral Intentions between Deer and Elk Hunters

Both deer and elk hunters were surveyed in Colorado, Utah, and Wyoming. For each of these states, however, behavioral intentions in response to each hypothetical scenario were not significantly different at $p < .001$ between deer and elk hunters, $\chi^2(2) = 0.64$ to 11.00, $p = .004$ to .728. In addition, effect sizes ($V \leq .08$) showed "weak" (Cohen, 1988) or "minimal" (Vaske et al., 2002) differences between these two groups.

Acceptance of Management Actions in Response to CWD

Hunters' acceptance of the four CWD management actions (e.g., continue to test, use hunters to reduce herds in affected areas) was analyzed using the potential for conflict index (PCI) and a related graphic approach for communicating results (see Manfredo,

Vaske, & Teel, 2003; Vaske et al., 2006 for reviews). PCI ranges from 0 to 1; a large PCI indicates high potential for conflict regarding acceptance of a management action.

Non-lethal actions. Across all six hypothetical scenarios of CWD prevalence, distribution, and human health risk, hunters in each state believed that agency testing of deer and elk for CWD is moderately to highly *acceptable* (Figure 2.2). The small PCI values (.03 to .15) across states and scenarios revealed little potential for conflict among hunters regarding this strategy. Conversely, hunters reported that it would be moderately to highly *unacceptable* for agencies to take no action and allow CWD to take its natural course. Hunters in each state generally agreed (PCI = .06 to .21) that this strategy was unacceptable for all scenarios. For these two non-lethal management actions, differences among states, residents and nonresidents, and deer and elk hunters were relatively "weak" or "minimal" (r_{pb}, $\eta \leq .14$) across scenarios (Cohen, 1988; Vaske et al., 2002).

Lethal actions. On average, hunters in each state believed that it would be slightly to moderately acceptable for agencies to allow *hunters* to dramatically reduce deer and / or elk populations in affected zones to lower the potential for CWD spreading (Figure 2.3). Acceptance of this action slightly increased as prevalence and human health risks increased. For most scenarios, this action was slightly more acceptable in some states (e.g., Nebraska, Wisconsin) than others (e.g., Utah, Wyoming). State, residency (resident, nonresident), and species (deer, elk hunters) differences, however, were relatively "weak" or "minimal" (r_{pb}, $\eta \leq .17$) across the six scenarios (Cohen, 1988; Vaske et al., 2002).

Hunters' acceptance of allowing *trained agency staff* to reduce herds in affected zones was close to neutral for scenarios depicting low to moderate CWD prevalence. Acceptance of this action, however, substantially increased as CWD prevalence and

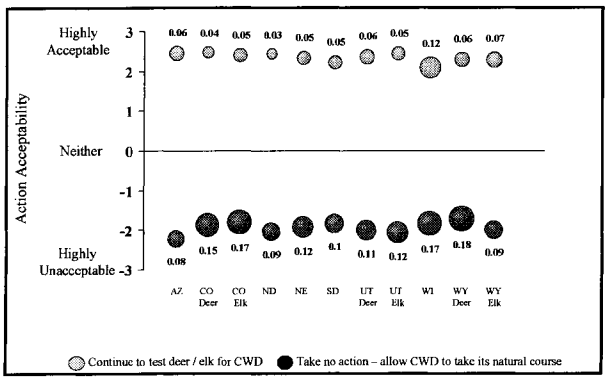

Figure 2.2a Scenario 1

Continue to test: $F(10, 9305) = 8.61, p < .001, \eta = .10$
Take no action: $F(10, 9229) = 7.33, p < .001, \eta = .09$

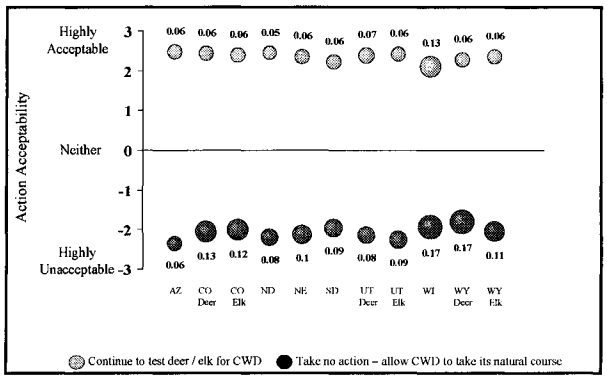

Figure 2.2b Scenario 2

Continue to test: $F(10, 9179) = 6.97, p < .001, \eta = .09$
Take no action: $F(10, 9180) = 8.71, p < .001, \eta = .10$

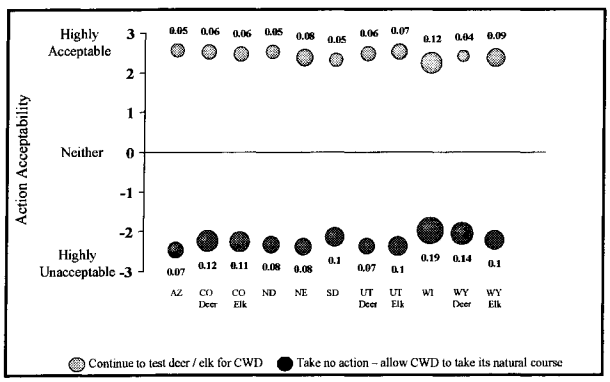

Figure 2.2c Scenario 3

Continue to test: $F(10, 9028) = 5.23, p < .001, \eta = .08$
Take no action: $F(10, 9097) = 8.69, p < .001, \eta = .10$

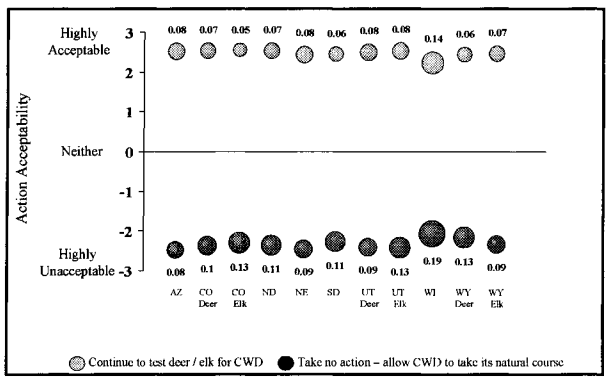

Figure 2.2d Scenario 4

Continue to test: $F(10, 9023) = 4.43, p < .001, \eta = .07$
Take no action: $F(10, 9073) = 5.63, p < .001, \eta = .08$

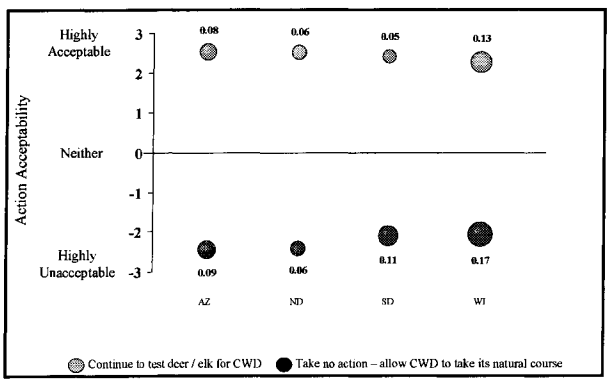

Figure 2.2e Scenario 5

Continue to test: $F(3, 3302) = 7.56, p < .001, \eta = .08$
Take no action: $F(3, 3309) = 15.27, p < .001, \eta = .12$

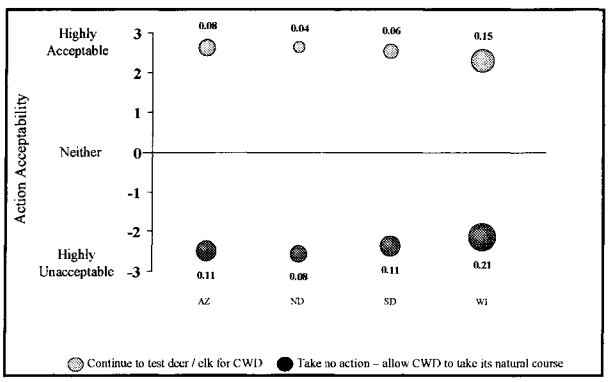

Figure 2.2f Scenario 6

Continue to test: $F(3, 3287) = 11.97, p < .001, \eta = .10$
Take no action: $F(3, 3313) = 12.89, p < .001, \eta = .11$

Figure 2.2 Hunters' acceptance of *non-lethal* management actions for each CWD scenario

Note. Numbers for each bubble are the potential for conflict index (PCI). The center of each bubble is the mean acceptability of the scenario. AZ = Arizona, CO = Colorado, ND = North Dakota, NE = Nebraska, SD = South Dakota, UT = Utah, WI = Wisconsin, WY = Wyoming. Residents' and nonresidents' acceptance of "taking no action" was not significantly different for 47 of the 52 tests across scenarios and states; statistically significant differences were observed for 5 tests, but effect sizes were minimal ($r_{pb} \leq .11$). Residents' and nonresidents' acceptance of "continue to test" was not significantly different for 46 of the 52 tests across scenarios and states; statistically significant differences were observed for 6 tests, but effect sizes were minimal ($r_{pb} \leq .14$). Deer and elk hunters' acceptance was not significantly different across scenarios and states ($r_{pb} \leq .06$).

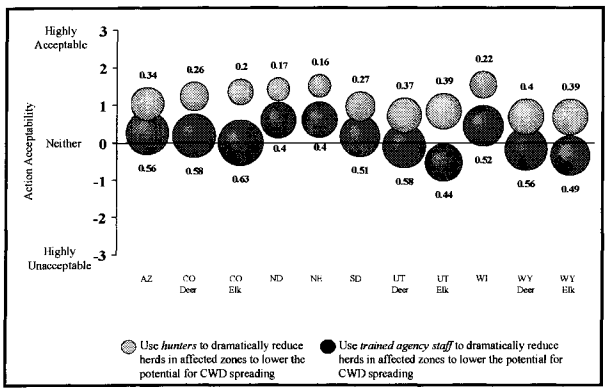

Figure 2.3a Scenario 1

Use hunters: $F(10, 9316) = 26.81$, $p < .001$, $\eta = .17$
Use agency staff: $F(10, 9305) = 25.68$, $p < .001$, $\eta = .16$

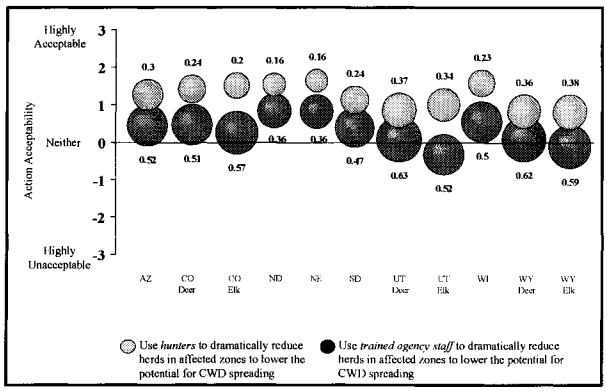

Figure 2.3b Scenario 2

Use hunters: $F(10, 9272) = 24.60$, $p < .001$, $\eta = .16$
Use agency staff: $F(10, 9243) = 23.13$, $p < .001$, $\eta = .16$

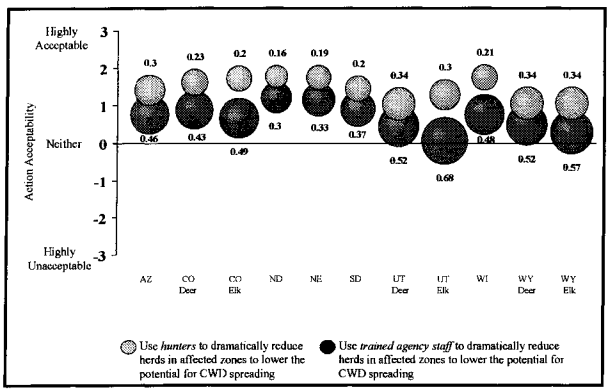

Figure 2.3c Scenario 3

Use hunters: $F(10, 9167) = 20.64$, $p < .001$, $\eta = .15$
Use agency staff: $F(10, 9143) = 20.20$, $p < .001$, $\eta = .15$

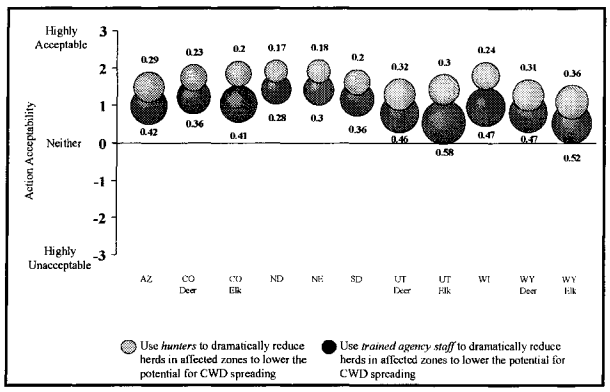

Figure 2.3d Scenario 4

Use hunters: $F(10, 9119) = 17.65$, $p < .001$, $\eta = .14$
Use agency staff: $F(10, 9090) = 15.44$, $p < .001$, $\eta = .13$

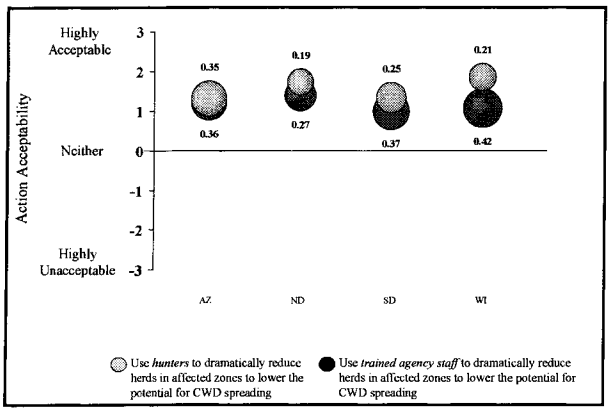

Figure 2.3e Scenario 5

Use hunters: $F(3, 3325) = 16.87$, $p < .001$, $\eta = .12$
Use agency staff: $F(3, 3334) = 5.64$, $p < .001$, $\eta = .07$

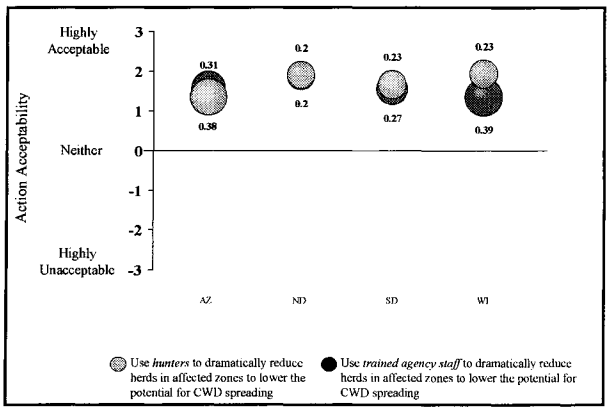

Figure 2.3f Scenario 6

Use hunters: $F(3, 3324) = 15.04$, $p < .001$, $\eta = .12$
Use agency staff: $F(3, 3336) = 9.12$, $p < .001$, $\eta = .09$

Figure 2.3 Hunters' acceptance of *lethal* management actions for each CWD scenario

Note. Numbers for each bubble are the potential for conflict index (PCI). The center of each bubble is the mean acceptability of the scenario. AZ = Arizona, CO = Colorado, ND = North Dakota, NE = Nebraska, SD = South Dakota, UT = Utah, WI = Wisconsin, WY = Wyoming. Residents' and nonresidents' acceptance of "use agency staff" was not significantly different for 38 of the 52 tests across scenarios and states; statistically significant differences were observed for 14 tests, but effect sizes were minimal ($r_{pb} \leq .14$). Residents' and nonresidents' acceptance of "use hunters" was not significantly different for 49 of the 52 tests across scenarios and states; statistically significant differences were observed for 3 tests, but effect sizes were minimal ($r_{pb} \leq .13$). Deer and elk hunters' acceptance was not significantly different across scenarios and states ($r_{pb} \leq .10$).

human health risks increased. This action was slightly less acceptable in some states (e.g., Utah, Wyoming) compared to others (e.g., Nebraska, North Dakota), but differences among all strata (states, species, residency) were relatively "weak" or "minimal" (r_{pb}, $\eta \leq .16$) for each scenario (Cohen, 1988; Vaske et al., 2002).

Given the larger PCI values, these two lethal actions (PCI = .16 to .68) were more controversial than the two non-lethal actions (PCI = .03 to .21). PCI values in most states also suggested that using trained agency staff to reduce herds in affected zones to lower the probability of CWD spreading (PCI = .20 to .68) had a greater potential for conflict among hunters than allowing hunters themselves to perform this task (PCI = .16 to .40). In most states, however, these lethal actions were more acceptable and had a lower potential for conflict as CWD conditions (prevalence, distribution, human risk) worsened.

Discussion

This article described the extent to which CWD prevalence, distribution, and human health risks could influence hunters': (a) willingness to hunt deer or elk in other states or give up the activity altogether, and (b) acceptance of strategies for managing CWD. At relatively low CWD prevalence levels (scenario 1), which are similar to current conditions in some states (e.g., Colorado, Wyoming), almost all hunters would continue hunting deer or elk in their state. This is consistent with other studies (Gigliotti, 2004; Miller, 2004; Vaske et al., 2006) and suggests that wildlife agencies will likely suffer only minor declines in revenues from license sales if CWD conditions do not worsen.

Contrary to some human dimensions research on CWD (Gigliotti, 2004; Miller, 2003, 2004; Vaske et al., 2006), however, this article also demonstrated that potential conditions related to CWD could influence a large proportion of deer and elk hunters to

change their behavior. Although unlikely to occur, CWD can reach high prevalence levels in deer and elk populations (Gross & Miller, 2001; Miller et al., 2000; Williams & Young, 1980), and the potential for human susceptibility to CWD may exist (Belay et al., 2004; Raymond et al., 2000). Consistent with Needham et al. (2004), the majority of hunters would not hunt in their state if CWD prevalence levels and human health risks dramatically increased (e.g., 50% prevalence, human death).

Among hunters who would change their behavior, most would give up deer or elk hunting permanently rather than travel to other states to hunt. This suggests that CWD could have a serious impact on the future of big game hunting. In states where CWD has not been found (Arizona, North Dakota), hunters were most likely to alter their behavior. Humans often attribute high risk to hazards that are new or unknown (e.g., CWD) and this risk can influence behavior (e.g., Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Sjöberg, 2000; Slovic, 1987). In Wisconsin, where deer hunting has a culturally significant history (Heberlein, 2004; Vaske et al., 2004), hunters were least likely to change their hunting behavior.

North Dakota hunters were most likely to give up deer hunting altogether, whereas Arizona and Colorado hunters were among the most likely to switch to other states. These findings may be partially explained by income. Arizona and Colorado hunters had the highest annual household incomes (48% $\geq$ \$70,000 per year); North Dakota hunters had the lowest (30% $\geq$ \$70,000 per year). Arizona and Colorado hunters may be more willing to switch states because they have the financial capability of affording the necessary expenditures (e.g., lodging, travel, nonresident license fee). Many North Dakota hunters may quit because they are unable to afford to hunt in other states.

Identical to Needham et al. (2004), nonresident hunters were less likely than residents to continue hunting deer or elk in the state as CWD conditions worsened. Many nonresidents would travel to other states to hunt. Declining numbers of nonresident hunters would significantly reduce agency revenues because nonresidents pay higher fees for hunting licenses. In addition, residents were more likely to permanently quit deer or elk hunting. Although residents pay less for hunting licenses than nonresidents, a decline in resident hunters could also impact agency revenues because residents constitute the largest proportion of hunters in most states.

Taken together, findings suggested that if CWD prevalence increases dramatically, deer and / or elk hunting participation will significantly decrease in several states. If high prevalence is combined with threats to human health, hunting declines could be even greater. Although high prevalence and human death from CWD are unlikely, agencies should anticipate some decline in license revenues, reduced support for wildlife management, negative impacts on cultural and family traditions, and economic instability of communities dependent on hunting (Needham et al., 2004). These potential consequences of a hunting decline due to CWD suggest the need for agencies and other stakeholders to engage in long-term proactive CWD planning and management efforts.

Results also showed that hunters in all strata (state, species, residency) believed that irrespective of CWD prevalence levels and human health risks, taking no action and letting CWD take its natural course are unacceptable. CWD testing and allowing hunters to reduce herds in affected areas to lower the potential for CWD spreading are acceptable strategies for managing the disease. There was disagreement among hunters regarding the acceptability of using trained agency staff to reduce herds, especially at low to moderate

CWD prevalence levels (scenarios 1, 2). Acceptance of this action, however, increased as prevalence and human risks increased. Given the slow rate of natural expansion and long incubation period of CWD, these surveillance and eradication efforts can be expensive, time consuming, controversial, and draw resources from other wildlife issues (Heberlein, 2004; Williams et al., 2002). These complications provide rationale for determining the extent to which various lethal and non-lethal actions may provide long-term solutions for managing CWD, and whether these actions are logistically and politically feasible.

There was similarity across states in hunters' responses to CWD, highlighting the value of researching issues on a regional scale whenever possible. Given this consistency, broad strategies across states (i.e., regional, national level) could be appropriate for responding to CWD. Any response to CWD, however, requires careful planning and considerable input from stakeholders with economic, recreational, governmental, and ecological interests in hunting and CWD (Decker, Brown, & Siemer, 2001).

It is important to emphasize that these results are based on hypothetical scenarios depicting CWD conditions that do not necessarily reflect current prevalence levels or threats to humans. Increased testing of harvested animals (i.e., postmortem sampling), advancements in lymphoid and tonsillar biopsy procedures for testing live animals (i.e., antemortem sampling), and continued in-vitro laboratory experiments of CWD in human cells may provide a more realistic assessment of CWD prevalence levels and human health risks (Raymond et al., 2000; Sigurdson et al., 1999; Wild, Spraker, Sigurdson, O'Rourke, & Miller, 2002). Long-term research is needed to determine the extent to which hunters actually change their behavior in response to actual CWD conditions.

Findings are also limited to resident and nonresident hunters in eight states that purchased a license to hunt deer or elk with a gun in 2003. Results may not generalize to people involved in other types of hunting (e.g., archery) or other species with CWD (e.g., moose). Moreover, hunters may choose alternative behaviors in response to CWD (e.g., hunt other species) and support other management actions (e.g., selectively harvest animals that appear to have CWD) that were not examined here. Research on the human dimensions of CWD, however, is still in its infancy. Researchers are encouraged to examine these issues and further understand the human dimensions of CWD.

Notes

1. The mail survey was pre-tested in each state in 2003 with hunters who purchased a license to hunt in 2002 ($n = 659$). Details are reported in Needham et al. (2004).
2. The non-response check contained several questions used here for measuring hunters' behavior and acceptance of management actions in response to hypothetical CWD conditions. See Needham et al. (2005) for weighting details.
3. Further support for using prevalence and human health risks as determinants of hunter behavior in response to CWD was obtained from open-ended questions in the pre-test that asked hunters to list circumstances related to CWD that would cause them to give up deer / elk hunting in the state or permanently. The most dominant responses were related to CWD prevalence (89%) and potential human health risks / death (77%).
4. Ancillary analyses of hunters in each state, residents and nonresidents, and deer and elk hunters showed no substantial relationship between zones in which respondents hunted in 2003 / in their life and behavioral intentions in response to each scenario.

CHAPTER III. HUNTER SPECIALIZATION AND DECLINING PARTICIPATION IN RESPONSE TO CHRONIC WASTING DISEASE

Introduction

Chronic wasting disease (CWD) has generated considerable concern among biologists, wildlife managers, hunters, and other stakeholders (Williams, Miller, Kreeger, Kahn, & Thorne, 2002). CWD is a neurological disease of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) (CDOW, 2005; Williams & Young, 1980, 1982). In all infected animals, the disease causes excessive salivation, loss of coordination, abnormal behavior, emaciation, and death. CWD belongs to a family of transmissible spongiform encephalopathy (TSE) diseases such as bovine spongiform encephalopathy in cattle (i.e., BSE, mad cow), scrapie in sheep, and Creutzfeldt-Jakob disease in humans (McKintosh, Tabrizi, & Collinge, 2003). No evidence exists to suggest that CWD is a human health risk, but transmission to humans cannot be dismissed (Belay et al., 2004; Raymond et al., 2000; Salman, 2003).

CWD has been found in free-ranging deer and elk in 10 states (Colorado, Illinois, Nebraska, New Mexico, New York, South Dakota, Utah, West Virginia, Wisconsin, Wyoming) and two provinces (Alberta, Saskatchewan). The disease was recently discovered in moose in Colorado (CDOW, 2005). Hunting declines attributable to CWD have occurred in some states (Heberlein, 2004; Vaske, Timmons, Beaman, & Petchenik, 2004). If CWD conditions continue to worsen, several states may experience a substantial

decrease in hunting participation (Needham, Vaske, & Manfredo, 2004). Little is known, however, about whether changes in participation may differ among subgroups of hunters.

Compared to novices or newcomers, hunting is more central to the lifestyle of specialized hunters who devote more time and effort to the sport (Kuentzel & Heberlein, 1992; Miller & Graefe, 2000). It is possible that specialized hunters are less likely to be distracted by CWD or allow it to alter their hunting behavior. This article examines the extent to which CWD may influence hunters to hunt in other states or stop hunting permanently, and whether this displacement and desertion differ among subgroups of hunters based on their degree of recreation specialization in the activity.

Review of Literature

Human Dimensions of CWD

In North America, hunting participation has decreased (Brown, Decker, Siemer, & Enck, 2000; Heberlein & Thompson, 1996). Some of this decline can be attributed to personal (e.g., age, lack of time) and situational (e.g., lack of available land to hunt, too many regulations) constraints (Miller & Vaske, 2003). Wildlife agencies are concerned that hunters' perceptions of possible unknown risks associated with CWD may erode their confidence and willingness to hunt in states where the disease is found (Gigliotti, 2004). Declines in hunting due to CWD are problematic because they can: (a) reduce revenues from license sales, (b) limit an agency's ability to manage game species, (c) decrease support for wildlife agencies, (d) affect wildlife management programs (e.g., pheasant stocking) if funds get diverted to address CWD, and (e) constrain cultural traditions and the social and economic stability of communities dependent on hunting (Needham et al., 2004).

Given these potential consequences, research has focused on the extent to which hunters might alter their behavior in response to CWD (Gigliotti, 2004; Miller, 2003, 2004; Needham et al., 2004; Vaske, Needham, Newman, Manfredo, & Petchenik, 2006; Vaske et al., 2004). Studies have presented hunters with hypothetical scenarios depicting manipulated levels of CWD prevalence (e.g., 1% or 5% of deer or elk infected). Hunters reported their behavioral intentions for each scenario (e.g., continue or stop hunting). Between 10% and 20% of Wisconsin and South Dakota deer hunters, for example, reported that they would stop hunting in their unit if 5% to 20% of its deer had CWD (Gigliotti, 2004; Vaske et al., 2004). Less than 10% of Illinois deer hunters would stop hunting if CWD was in or adjacent to the county where they hunted (Miller, 2004).

These studies manipulated relatively minor CWD prevalence levels and most hunters would not change their hunting behavior. Risk researchers, however, have identified two primary determinants of human behavior in response to risk judgments: (a) high probability of a hazard occurring, and (b) consequences / severity associated with the hazard (e.g., Adams & Smith, 2001; Sjöberg, 1999; Stonehouse & Mumford, 1994; Thompson & Dean, 1996). In some free-ranging deer and elk herds, the probability of encountering an animal infected with CWD is relatively high with prevalence rates exceeding 20% (Gross & Miller, 2001; Miller et al., 2000; Wolfe et al., 2002). Higher prevalence (e.g., 90%) has been documented in captive herds (Williams & Young, 1980). Although there is no evidence of human health consequences naturally attributable to CWD, laboratory research has shown that transmission of the disease to humans may occur (Belay et al., 2004; Raymond et al., 2000). In addition, CWD is similar to other TSE diseases that cause human death (e.g., Creutzfeldt-Jakob) (McKintosh et al., 2003).

Needham et al. (2004) found that if CWD prevalence ever increased dramatically (e.g., 50% infection rate), up to 49% of hunters would stop hunting deer or elk in several states. The decline would be even greater (e.g., 65%) if high prevalence is combined with threats to human health such as death from CWD. Nonresident hunters were more likely than residents to report that they would stop hunting. Little is known, however, about the extent to which CWD may differentially influence other subgroups of hunters to change their behavior. This article addresses this knowledge gap by examining the influence of CWD on displacement and desertion among hunters of varying degrees of specialization.

Recreation Specialization

Hunters are heterogeneous, exhibiting a range of skills and behavior (Kuentzel & Heberlein, 1992; Miller & Graefe, 2000). Given the diversity among participants in a single activity, researchers have emphasized the importance of differentiating users into meaningful homogeneous groups (Manfredo & Larson, 1993; Vaske, Beaman, Stanley, & Grenier, 1996). Recreation specialization is a concept for segmenting recreationists into subgroups based on "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences" (Bryan, 1977, p. 175). At one end of the continuum are novices or infrequent participants who do not consider the activity to be a central life interest or show strong preferences for equipment and technique. The other end includes more avid participants who are committed to the activity and use sophisticated methods. Recreationists are thought to progress to higher stages along the continuum, reflected by increasing skill and commitment (Bryan, 1977).

The specialization concept has been examined relative to individuals engaged in a variety of activities in different settings (see Manning, 1999; Scott & Shafer, 2001 for

reviews). Highly specialized recreationists can differ from their less specialized counterparts on attributes such as motivations (e.g., Chipman & Helfrich, 1988; McFarlane, 1994; Scott, Menzel Baker, & Kim, 1999), management and setting preferences (e.g., Martin, 1997; Scott & Thigpen, 2003; Virden & Schreyer, 1988), crowding evaluations (Graefe, Donnelly, & Vaske, 1985; Needham, Rollins, & Vaske, 2005), and place attachment (Bricker & Kerstetter, 2000).

Research on the relationship between specialization and behavior has provided mixed results. Kuentzel and Heberlein (1992), for example, found specialization to be unrelated to hunters' participation behavior, concluding that participation may be a function of constraints such as proximity and social role identity. Conversely, Barro and Manfredo (1996) reported that experienced hunters were less likely to allow regulations to influence participation. This article explores whether displacement (i.e., participate in other areas due to adverse changes such as CWD) and desertion from hunting due to CWD differs among subgroups of hunters based on their degree of specialization.

There is little consensus among researchers about how best to measure recreation specialization (Scott & Shafer, 2001). Both single-item (e.g., frequency of participation; Ditton, Loomis, & Choi, 1992) and multidimensional approaches have been employed to segment recreationists (e.g., Bricker & Kerstetter, 2000; Donnelly, Vaske, & Graefe, 1986; Lee & Scott, 2004). Researchers generally agree, however, that specialization is a multidimensional concept consisting of behavioral, cognitive, and affective components (McFarlane, 2004; Scott & Shafer, 2001). Behavioral indicators include experience (e.g., Kuentzel & McDonald, 1992; McFarlane, Boxall, & Watson, 1998) and equipment investment (e.g., Donnelly et al., 1986; Martin, 1997; McFarlane & Boxall, 1996).

Cognitive indicators include skill (e.g., Needham et al., 2005; Ninomiya & Kikuchi, 2004; Vaske, Dyar, & Timmons, 2004) and knowledge (e.g., Kerstetter, Confer, & Graefe, 2001; Lee & Scott, 2004). Indicators of affective attachment / commitment include enduring involvement (McFarlane, 2004; McIntyre & Pigram, 1992), and centrality (e.g., Chipman & Helfrich, 1988; Scott & Thigpen, 2003).

Researchers are not always clear about relationships among these dimensions and whether indicators measure one dimension or another (Scott, Ditton, Stoll, & Eubanks Jr., 2005). Centrality, for example, has been measured by whether a participant belongs to organizations associated with an activity and / or owns related magazines and books (e.g., Donnelly et al., 1986; McFarlane, 1994). Others, however, have defined centrality as the extent to which a person's life is centered around an activity, measured by items such as "my life is organized around this activity" (Barro & Manfredo, 1996; McIntyre, 1989).

The majority of specialization studies have situated recreationists along a linear continuum using single items (Ditton et al., 1992) or the sum of standardized scores from various dimensions (e.g., Donnelly et al., 1986; Dyck, Schneider, Thompson, & Virden, 2003; Kerstetter et al., 2001). The continuum is treated as continuous (Virden & Schreyer, 1988) or subdivided into halves, thirds, or quartiles to represent degrees of specialization (e.g., low, medium, high) (e.g., Dyck et al., 2003; Kerstetter et al., 2001).

Although this summative approach has merits in its simplicity, it is based on researcher-determined groups, assumes that dimensions covary, and obscures explanatory detail of each dimension (McIntyre & Pigram, 1992; Scott et al., 2005). Confirmatory factor analyses revealed that single-item summative approaches may be inappropriate (Lee & Scott, 2004). Researchers have suggested that dimensions be examined separately

for their individual effects because they may not always increase linearly in "lock step" fashion (Kuentzel & McDonald, 1992; Scott et al., 1999; Scott & Thigpen, 2003). Some recreationists, for example, may have a propensity to participate regularly and become highly committed to an activity but exhibit low skill; others may partake infrequently yet display attributes of skill and commitment (Scott et al., 2005; Scott & Shafer, 2001).

Contrary to single-item and summative approaches, the use of cluster analysis to empirically segment groups of participants in an activity introduces less researcher bias and does not assume that individual dimensions of specialization covary (Scott et al., 2005; Scott & Thigpen, 2003). Cluster analysis, therefore, may be a more appropriate method for classifying and describing types of participants within a given activity (Lee & Scott, 2004; McFarlane, 1994, 2004; Scott et al., 2005).

This article examines the relationship between hunters' specialization and their behavioral intentions in response to CWD. Two questions are addressed. First, to what extent may potential CWD prevalence levels and human health risks influence hunters to permanently stop hunting or travel to other states to hunt? Second, could this desertion and displacement differ among subgroups of hunters based on their specialization?

Methods

Data Collection

Data were obtained from mail surveys of nonresident and resident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming). CWD had been detected in free-ranging deer and / or elk in each of these states except Arizona and North Dakota. The study population consisted of hunters who were 18 years of age or

older and purchased a nonresident or resident license to hunt deer or elk with a gun in 2003. Random samples of names and addresses were obtained from the wildlife / game and fish government agency of each participating state.

Three mailings were used to administer the surveys beginning in July 2004.[1] Hunters were sent a survey, postage-paid return envelope, and cover letter. Non-respondents were sent a postcard reminder two weeks after the initial mailing. A second full mailing (i.e., survey, return envelope, letter) was sent to non-respondents three weeks after the postcard reminder. Surveys were mailed to 22,320 hunters. In total, 773 surveys were undeliverable (e.g., moved, incorrect address) and 9,567 completed surveys were returned, yielding a 44% response rate (9,567 / 22,320 – 773). Sample sizes were 5,329 for nonresident hunters (50% response rate) and 4,238 (39% response rate) for residents (Needham, Vaske, & Manfredo, 2005).

To check for non-response bias, hunters who completed a survey were compared to those who did not. A sample of 785 non-respondents (376 nonresidents, 409 residents) was telephoned in November 2004 and asked nine questions from the survey. Responses to five questions were statistically different ($p < .001$) between respondents and non-respondents, but statistical significance is inflated by large sample sizes (Vaske, Gliner, & Morgan, 2002). Effect sizes (V, r_{pb}) were < .15, indicating weak (Cohen, 1988) or minimal (Vaske et al., 2002) differences between the two groups. Non-response bias was thus not deemed a problem and data were not weighted based on the non-response check. In each state, however, there were more residents than nonresidents who purchased a license to hunt deer or elk with a gun in 2003. Given that more surveys were received from nonresidents, data were weighted to reflect the population proportions of hunters.[2]

Independent Variables

Consistent with previous research (e.g., McFarlane, 2004; McIntyre & Pigram, 1992; Scott et al., 2005; Scott & Shafer, 2001; Scott & Thigpen, 2003), specialization was measured in terms of affective, cognitive, and behavioral dimensions.

Affective measures. Five variables were used to measure *centrality*. Hunters reported the extent to which they disagreed or agreed with four statements: (a) If I stopped deer hunting, an important part of my life would be missing; (b) Deer hunting is an annual tradition that has become important to me; (c) Participation in deer hunting is a large part of my life; and (d) Given the amount of effort that I have put into becoming a deer hunter, it would be difficult for me to find another activity to replace deer hunting. Responses were coded on 7-point scales from 1 "strongly disagree" to 7 "strongly agree." In addition, respondents were asked: If you could not participate in deer hunting, would you: 0 "not miss it at all," 1 "miss it slightly," 2 "miss it more than most of your other activities," or 3 "miss it more than all of your other activities?" These items are similar to those used in past studies of centrality (e.g., Bricker & Kerstetter, 2000; McIntyre, 1989).

Cognitive measures. Three variables measured hunters' *skill level and knowledge*. Respondents reported the extent to which they disagreed or agreed with: (a) Given the deer hunting skills / knowledge that I have developed, it is important that I continue to hunt deer; (b) Testing / improving my deer hunting skills is more important to me than harvesting a deer; and (c) I would describe my skill level in deer hunting as advanced or expert. Responses were coded from 1 "strongly disagree" to 7 "strongly agree."

Behavioral measures. Two variables were used to measure *equipment*. Hunters reported the extent to which they disagreed or agreed with two statements: (a) I have

accumulated a lot of deer hunting equipment, and (b) I have invested a lot of money in deer hunting equipment. Responses were coded on the same 7-point agreement scale.

Hunting *experience* was measured with a single variable. Respondents were asked how many years in total that they have hunted deer in their life. To control for age, experience was expressed as a percentage and calculated with the following equation:

Number of years hunted deer in life / age * 100 = proportion of life hunted deer (1)

For all of these specialization variables, elk hunting was substituted for deer hunting in surveys of elk hunters. Variables are consistent with those in Barro and Manfredo (1996).

Dependent Variables

Maps in the surveys depicted hypothetical scenarios of CWD human health risks and increasing prevalence among deer or elk in three zones across each state (Figure 3.1). With the exception of maps in the Arizona and North Dakota surveys, zone A represented the location where CWD had been detected in free-ranging herds and had the highest prevalence. For Arizona and North Dakota, zone A represented the most likely area for CWD to be detected, if ever. Zone B either represented the location where CWD had been found but with lower prevalence than zone A, or was considered by the agency to be the area where CWD would spread to first from zone A. Zone C was considered by each agency to represent the least likely location for high CWD prevalence levels to occur. All three zones for each state were based on hunt management units and the decision of where to situate the zones was made by the state's wildlife / game and fish agency.

Survey maps for all eight states depicted four separate hypothetical scenarios of increasing CWD prevalence and distribution: (a) 10% prevalence in zone A, 0% in zones

B and C; (b) 30% in zone A, 10% in zone B, 0% in zone C; (c) 50% in zone A, 30% in zone B, 10% in zone C; and (d) 50% in all three zones (i.e., across the entire state).

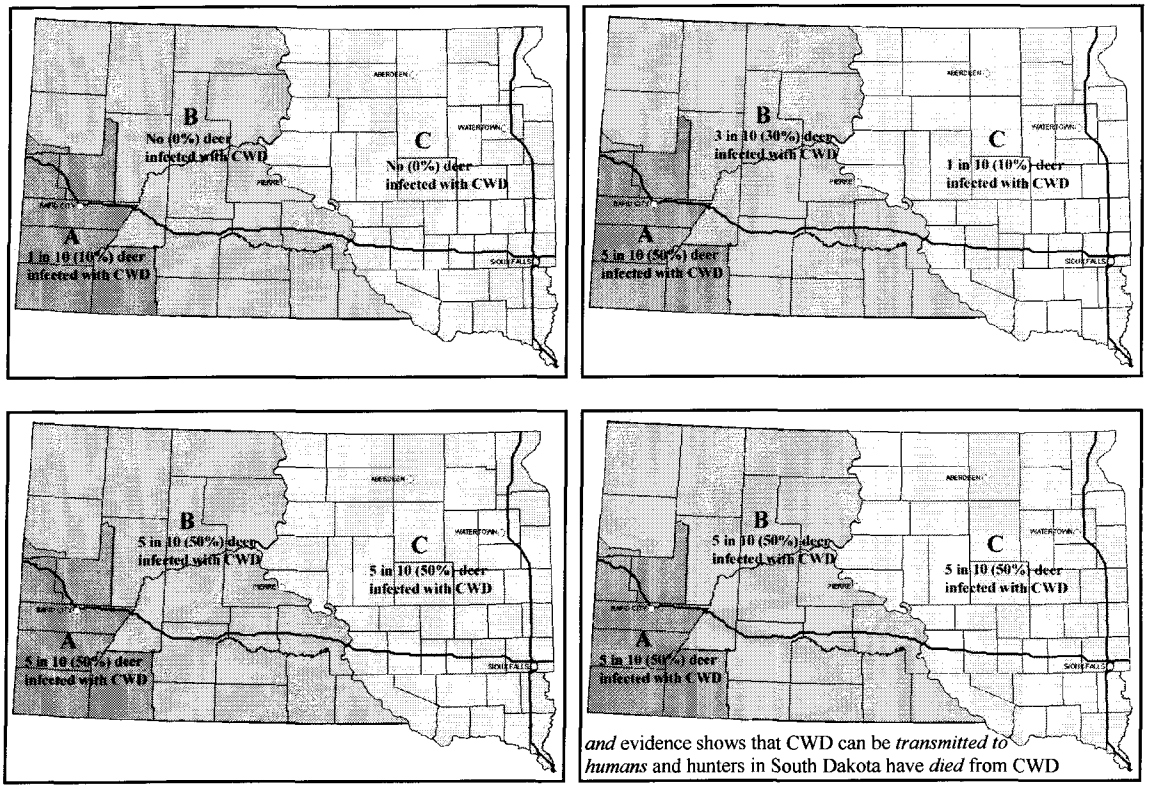

Figure 3.1 Sample maps depicting hypothetical scenarios of CWD prevalence, distribution, and human health risks

Note. These maps were used in the surveys for South Dakota and are provided here as an example. For six of the states, zone A represented the area where CWD had already been detected and had the highest prevalence. For Arizona and North Dakota, zone A represented the opinions of the state wildlife / game and fish agencies regarding the most likely region for CWD to be first detected, if ever. All three zones were based on hunt management units, which often transect county borders (thin lines) and interstate highways (thick lines).

Surveys for four states (Arizona, North and South Dakota, Wisconsin) included two additional hypothetical scenarios related to CWD prevalence and human health risks: (a) 10% prevalence in zone A, 0% in zones B and C, and "evidence shows that CWD can be transmitted to humans and hunters in the state have died from CWD;" and (b) 50% in all three zones and "evidence shows that CWD can be transmitted to humans and hunters in the state have died from CWD." The scenarios reflected the two primary determinants

of behavior in response to risk – probability of encountering a hazard and consequences / severity associated with the hazard (e.g., Sjöberg, 1999; Thompson & Dean, 1996).[3] To emphasize the hypothetical nature of the scenarios, respondents were assured in the survey that they did not necessarily reflect current conditions or consequences to humans.

To measure behavioral intentions in response to CWD, hunters evaluated each scenario and indicated if they would: (a) "hunt deer in the zone in the state that they hunt deer in most often;" (b) "hunt deer in the state, but switch to a different zone;" (c) "give up deer hunting in the state, but hunt deer in another state" (i.e., displacement); or (d) "give up deer hunting altogether" (i.e., desertion). The respective state name was provided in responses for each survey and elk hunting was substituted for deer hunting in surveys of elk hunters. Given that few hunters (< 10%) reported that they would switch to a different zone in the state for each scenario, the first two responses were collapsed into a single category labeled "still hunt in the state."

Data Analysis

Construct validity of the variables measuring the latent dimensions / factors of hunter specialization (i.e., centrality, skill, equipment, experience) was assessed using second-order confirmatory factor analysis (CFA) models. Second-order CFAs were performed for nonresidents and residents to test the extent to which: (a) the variables measuring these first-order factors provided a good fit, and (b) these first-order factors are explained by a higher second-order latent factor (i.e., hunter specialization).

EQS 6.1 software and robust estimation to correct for multivariate non-normality were used, as data skewness and kurtosis indicated violations of the normal distribution assumption (Byrne, 1994; Chou & Bentler, 1995). Evaluation was based on the Satorra-

Bentler scaled chi-square (S-B χ^2). Large sample sizes inflate this statistic. Model fit was assessed with robust corrected: comparative fit index (CFI*), non-normed fit index (NNFI*), and root mean square error of approximation (RMSEA*). RMSEA values $\leq .08$ and CFI and NNFI values $\geq .90$ indicate acceptable fit (Browne & Cudeck, 1993). Robust standard errors were used to calculate test statistics. Errors were not correlated.

Responses to the variables were converted to standardized z-scores ($M = 0$, $SD = 1$). Internal consistency of the variables measuring the centrality, skill, and equipment dimensions was examined using Cronbach's alpha reliability coefficients. Mean composite indices were computed for centrality, skill, and equipment. K-means cluster analysis was performed on these indices and the experience variable to segment hunters into specialization groups. Bivariate analyses (e.g., χ^2) then compared responses to the CWD scenarios among these groups. Given that Needham et al. (2004) reported that nonresidents and residents can differ in their responses to CWD, analyses were performed separately for these two groups. Due to the large sample sizes, a significance level of $p \leq .001$ was selected and effect size measures (e.g., V, η) were reported. SPSS 13.0 software was used for these analyses.

Results

Validity and Reliability of Specialization Dimensions

Second-order confirmatory factor analyses demonstrated that the data provided an acceptable fit for nonresidents and residents (Figure 3.2). First-order factor loadings ranged from .67 to .92 for centrality, .46 to .89 for skill, and .91 to .97 for equipment. Centrality (loadings = .86 nonresidents, .84 residents) and skill (.83, .81) dimensions represented hunter specialization (i.e., second-order factor) better than equipment (.74,

.68) and experience (.51, .40). All loadings were significant at $p < .001$. S-B χ^2 values were significant at $p < .001$, but this is a function of sample size. Acceptable fit indices demonstrated construct validity (CFI* = .93, .94; NNFI* = .91, .92; RMSEA* .08).[4]

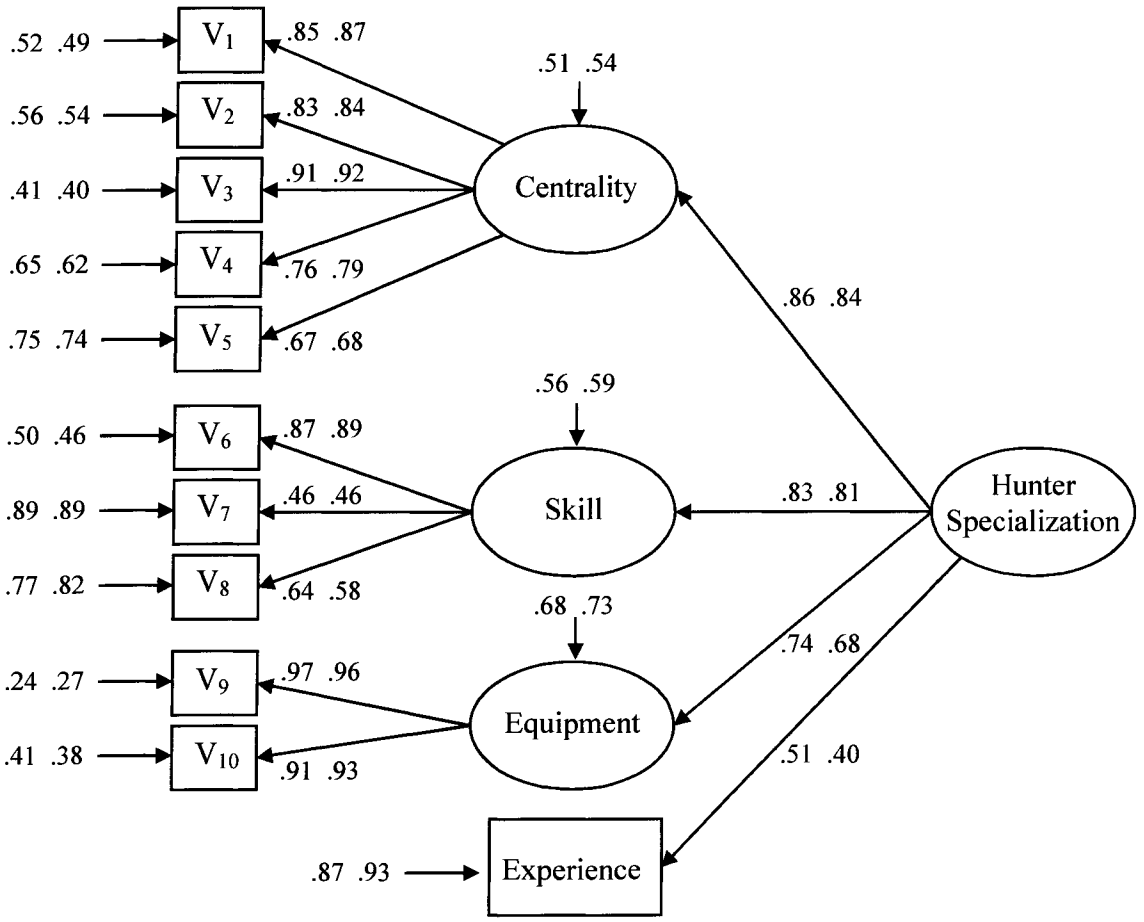

Figure 3.2 Second order CFA of four-dimensional measurement model of hunter specialization

Note. First path loadings / coefficients = *nonresidents*, second path loadings / coefficients = *residents*. All loadings / coefficients are standardized. All loadings $p < .001$. Based on Satorra-Bentler robust estimation for multivariate non-normality, model fit indices: *Nonresidents*: S-B $\chi^2(42) = 1360.32$, $p < .001$, NNFI* = .91, CFI* = .93, RMSEA* = .08; *Residents*: S-B $\chi^2(42) = 1140.09$, $p < .001$, NNFI* = .92, CFI* = .94, RMSEA* = .08. See Tables 3.1 and 3.2 for variables / items corresponding to the codes (e.g., V_1).

Additional support for combining the variables into their associated dimensions was evident from reliability analyses. Tables 3.1 and 3.2 show the reliability coefficients for nonresidents and residents, respectively. The Cronbach alpha values were .91 (residents and nonresidents) for centrality, .68 (residents) to .70 (nonresidents) for skill,

and .94 (residents and nonresidents) for equipment. Deletion of any variable from its respective dimension did not improve reliability. Reliability of the overall specialization indices was high (α = .85 nonresidents, .81 residents).

Table 3.1 Reliability analyses of specialization dimensions for *nonresident* hunters

Specialization dimensions and items	Item code	*M*	*SD*	Item total correlation	Alpha (α) if deleted	Cronbach's alpha (α)
Centrality						.91
If I stopped deer / elk hunting, an important part of my life would be missing [1]	V_1	6.01	1.42	.80	.87	
Deer / elk hunting is an annual tradition that has become important to me [1]	V_2	6.11	1.40	.76	.88	
Participation in deer / elk hunting is a large part of my life [1]	V_3	5.66	1.57	.85	.86	
Given effort I have put into deer / elk hunting, it would be difficult to find a replacement activity [1]	V_4	5.15	1.80	.72	.89	
If I could not deer / elk hunt, I would ... [2]	V_5	1.93	0.70	.64	.90	
Skill [1]						.70
Given the deer / elk hunting skills / knowledge I have developed, it is important I continue to hunt	V_6	5.90	1.39	.57	.52	
Testing / improving my deer / elk hunting skills is more important to me than harvesting an animal	V_7	5.42	1.51	.45	.68	
I would describe my skill level in deer / elk hunting as advanced or expert	V_8	4.95	1.56	.51	.60	
Equipment [1]						.94
I have accumulated a lot of deer / elk hunting equipment	V_9	5.76	1.45	.88	--	
I have invested a lot of money in deer / elk hunting equipment	V_{10}	5.79	1.44	.88	--	
Experience [3]	V_{11}	40.6	26.6	--	--	--
Overall specialization index						.85

[1] Items coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[2] Item coded on 4-point scale: 0 = not miss it at all, 1 = miss it slightly, 2 = miss it more than most of my other activities, 3 = miss it more than all of my other activities.

[3] Item calculated as: (number of years hunted deer or elk in life / age * 100) = proportion of life hunted deer or elk (%).

Table 3.2 Reliability analyses of specialization dimensions for *resident* hunters

Specialization dimensions and items	Item code	*M*	*SD*	Item total correlation	Alpha (α) if deleted	Cronbach's alpha (α)
Centrality						.91
If I stopped deer / elk hunting, an important part of my life would be missing [1]	V_1	5.88	1.49	.82	.88	
Deer / elk hunting is an annual tradition that has become important to me [1]	V_2	6.19	1.22	.78	.89	
Participation in deer / elk hunting is a large part of my life [1]	V_3	5.61	1.57	.86	.87	
Given effort I have put into deer / elk hunting, it would be difficult to find a replacement activity [1]	V_4	5.10	1.85	.75	.90	
If I could not deer / elk hunt, I would ... [2]	V_5	1.84	0.75	.66	.91	
Skill [1]						.68
Given the deer / elk hunting skills / knowledge I have developed, it is important I continue to hunt	V_6	5.81	1.43	.56	.48	
Testing / improving my deer / elk hunting skills is more important to me than harvesting an animal	V_7	5.25	1.63	.44	.64	
I would describe my skill level in deer / elk hunting as advanced or expert	V_8	4.95	1.55	.47	.61	
Equipment [1]						.94
I have accumulated a lot of deer / elk hunting equipment	V_9	5.56	1.57	.89	--	
I have invested a lot of money in deer / elk hunting equipment	V_{10}	5.51	1.62	.89	--	
Experience [3]	V_{11}	49.3	21.4	--	--	--
Overall specialization index						.81

[1] Items coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.
[2] Item coded on 4-point scale: 0 = not miss it at all, 1 = miss it slightly, 2 = miss it more than most of my other activities, 3 = miss it more than all of my other activities.
[3] Item calculated as: (number of years hunted deer or elk in life / age * 100) = proportion of life hunted deer or elk (%).

Cluster Analysis of Specialization Dimensions

Having demonstrated reliability and construct validity, standardized scores were combined to create an index for each dimension. Cluster analysis of these dimensions revealed four distinct groups of hunters labeled: (a) casual hunters, (b) intermediate hunters, (c) focused hunters, and (d) veteran hunters.[5] Table 3.3 shows the distribution of these groups for nonresidents and residents. The distributions differed significantly, $\chi^2(3,$

$N = 9387) = 194.77, p < .001$. Proportions of casual and veteran hunters were similar, but there were more intermediate hunters among residents and more focused hunters among nonresidents. This difference among groups, however, was relatively "minimal" (Vaske et al., 2002) or "weak" (Cohen, 1988), as the Cramer's V effect size was .14. Similar to past research, the largest proportion of hunters (39% to 41%) was classified as highly specialized (i.e., veterans) (e.g., Barro & Manfredo, 1996; Miller & Graefe, 2000).

Table 3.3 Specialization cluster group membership for nonresident and resident hunters [1]

	Nonresidents		Residents	
	Sample size (n)	Percent (%)	Sample size (n)	Percent (%)
Casual	838	16	635	15
Intermediate	688	13	1120	27
Focused	1640	32	722	17
Veteran	2058	39	1686	41

[1] $\chi^2(3, N = 9387) = 194.77, p < .001, V = .14$.

These four groups were compared in terms of their responses to the original unstandardized specialization variables. Nonresident and resident casual hunters reported the lowest mean scores on all variables measuring centrality, skill, equipment, and experience; veterans had the highest mean scores (Tables 3.4, 3.5). Intermediate hunters' responses fell in between the casual and veteran groups. This pattern among casual, intermediate, and veteran hunters is consistent with a continuum of specialization, as hypothesized by Bryan (1977). Focused hunters, however, had the second highest mean scores on all variables except for experience, as they only hunted deer or elk an average of 19% (nonresidents) and 28% (residents) of their lives. By comparison, intermediates and veterans hunted an average of 60% and 64% of their lives, respectively. ANOVA and Tamhane's T2 post-hoc tests showed that responses differed substantially among the four groups for nonresidents, $F(3, 4969 \text{ to } 5220) \leq 6001.79, p < .001, \eta \leq .88$, and residents,

Table 3.4 Specialization items by *nonresident* hunter cluster groups

Specialization dimensions and items	Cluster group [1]				*F*-value [2]	df	Effect size (η)
	Casual	Intermediate	Focused	Veteran			
Centrality							
If I stopped deer / elk hunting, an important part of my life would be missing [3]	3.95 [a]	5.58 [b]	6.20 [c]	6.85 [d]	1711.43	3, 5215	.70
Deer / elk hunting is an annual tradition that has become important to me [3]	3.96 [a]	5.96 [b]	6.26 [c]	6.92 [d]	1884.01	3, 5177	.72
Participation in deer / elk hunting is a large part of my life [3]	3.25 [a]	4.99 [b]	5.84 [c]	6.72 [d]	2488.33	3, 5216	.77
Given effort I have put into deer / elk hunting, it would be difficult to find a replacement activity [3]	2.75 [a]	4.09 [b]	5.34 [c]	6.32 [d]	1759.42	3, 5208	.71
If I could not deer / elk hunt, I would ... [4]	1.14 [a]	1.63 [b]	1.88 [c]	2.37 [d]	1068.89	3, 4969	.63
Skill [3]							
Given the deer / elk hunting skills / knowledge I have developed, it is important I continue to hunt	3.91 [a]	5.14 [b]	6.15 [c]	6.76 [d]	1982.98	3, 5185	.73
Testing / improving my deer / elk hunting skills is more important to me than harvesting an animal	3.94 [a]	4.72 [b]	5.60 [c]	6.12 [d]	650.83	3, 5210	.52
I would describe my skill level in deer / elk hunting as advanced or expert	2.86 [a]	4.74 [b]	4.78 [b]	6.01 [c]	1563.79	3, 5170	.69
Equipment [3]							
I have accumulated a lot of deer / elk hunting equipment	3.47 [a]	5.33 [b]	5.92 [c]	6.69 [d]	2354.74	3, 5191	.76
I have invested a lot of money in deer / elk hunting equipment	3.62 [a]	5.30 [b]	6.04 [c]	6.65 [d]	1935.54	3, 5208	.73
Experience [5]	11.4 [a]	59.5 [b]	18.6 [c]	63.9 [d]	6001.79	3, 5220	.88

[1] Cell entries are means; means with different letter superscripts differ at $p < .001$ using Tamhane's T2 post-hoc tests for unequal variances.

[2] All *F*-values significant at $p < .001$.

[3] Items coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[4] Item coded on 4-point scale: 0 = not miss it at all, 1 = miss it slightly, 2 = miss it more than most of my other activities, 3 = miss it more than all of my other activities.

[5] Item calculated as: (number of years hunted deer or elk in life / age * 100) = proportion of life hunted deer or elk (%).

Table 3.5 Specialization items by *resident* hunter cluster groups

Specialization dimensions and items	Cluster group [1]				*F*-value [2]	df	Effect size (η)
	Casual	Intermediate	Focused	Veteran			
Centrality							
If I stopped deer / elk hunting, an important part of my life would be missing [3]	3.80 [a]	5.46 [b]	6.19 [c]	6.82 [d]	1356.92	3, 4155	.70
Deer / elk hunting is an annual tradition that has become important to me [3]	4.57 [a]	5.91 [b]	6.39 [c]	6.90 [d]	1034.05	3, 4124	.66
Participation in deer / elk hunting is a large part of my life [3]	3.39 [a]	5.03 [b]	5.87 [c]	6.71 [d]	1649.09	3, 4146	.74
Given effort I have put into deer / elk hunting, it would be difficult to find a replacement activity [3]	2.61 [a]	4.27 [b]	5.40 [c]	6.44 [d]	1703.28	3, 4141	.74
If I could not deer / elk hunt, I would ... [4]	1.08 [a]	1.46 [b]	1.94 [c]	2.32 [d]	903.72	3, 3975	.64
Skill [3]							
Given the deer / elk hunting skills / knowledge I have developed, it is important I continue to hunt	3.82 [a]	5.25 [b]	6.18 [c]	6.78 [d]	1610.06	3, 4143	.73
Testing / improving my deer / elk hunting skills is more important to me than harvesting an animal	3.88 [a]	4.62 [b]	5.58 [c]	6.04 [d]	456.33	3, 4149	.50
I would describe my skill level in deer / elk hunting as advanced or expert	3.02 [a]	4.64 [b]	4.71 [b]	5.97 [c]	1031.46	3, 4166	.66
Equipment [3]							
I have accumulated a lot of deer / elk hunting equipment	3.20 [a]	5.16 [b]	5.84 [c]	6.60 [d]	1644.20	3, 4133	.74
I have invested a lot of money in deer / elk hunting equipment	3.20 [a]	5.08 [b]	5.85 [c]	6.52 [d]	1365.64	3, 4142	.71
Experience [5]	23.4 [a]	59.7 [b]	27.6 [c]	61.6 [d]	2191.93	3, 4159	.78

[1] Cell entries are means; means with different letter superscripts differ at $p < .001$ using Tamhane's T2 post-hoc tests for unequal variances.

[2] All *F*-values significant at $p < .001$.

[3] Items coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.

[4] Item coded on 4-point scale: 0 = not miss it at all, 1 = miss it slightly, 2 = miss it more than most of my other activities, 3 = miss it more than all of my other activities.

[5] Item calculated as: (number of years hunted deer or elk in life / age * 100) = proportion of life hunted deer or elk (%).

$F(3, 3975 \text{ to } 4166) \leq 2191.93, p < .001, \eta \leq .78$. Among the four groups, there were "minimal" (Vaske et al., 2002) or "weak" (Cohen, 1988) differences in age, state, education, income, and urban / rural residency, as shown by the effect sizes (V, $\eta \leq .12$).

Hunters' Behavioral Intentions in Response to CWD

Almost all nonresident (96%) and resident (98%) hunters reported that they would continue hunting in the state if 10% of the deer or elk in zone A and 0% in the rest of the state had CWD (scenario 1; Tables 3.6, 3.7). At this prevalence level, which is consistent with conditions in some states (e.g., Colorado, Wyoming), few hunters would give up deer or elk hunting in the state or altogether. More hunters, however, would alter their behavior as CWD conditions worsen. Up to 44% of nonresidents would switch states and 8% would give up altogether if prevalence increases to 50% across the state (i.e., scenario 4). Compared to nonresidents, residents were more likely to quit (23%) than switch states (14%) under these conditions. If high prevalence is combined with human death (scenario 6), declines could be even greater, as 46% of nonresidents and 15% of residents would switch states, and 18% of nonresidents and 38% of residents would quit.

Differences in Behavioral Intentions among Specialization Subgroups

Nonresident hunters' behavioral intentions in response to the CWD scenarios differed significantly among the four specialization groups, $\chi^2(6, N = 1{,}123 \text{ to } 5{,}093) \leq 195.28, p < .001$ (Table 3.6). Across all scenarios, the percentage that would quit deer or elk hunting altogether was highest for casual hunters followed by the intermediate, focused, and veteran groups. For example, 41% of casual hunters compared to 31% of intermediate, 19% of focused, and 10% of veteran hunters would quit if 50% of deer or elk across the state had CWD and humans died from the disease (scenario 6). Except for

Table 3.6 Behavioral intentions of *nonresident* hunter specialization cluster groups in response to CWD [1]

Hypothetical scenarios and hunter specialization cluster groups	Behavioral intention			$\chi^2(6)$	Effect size (V)
	Still hunt in state	Switch to another state	Give up altogether		
Scenario 1 (10% A, 0% B, 0% C; no death)				53.68	.08
Casual	95	2	3		
Intermediate	95	4	1		
Focused	97	3	0		
Veteran	97	3	0		
Total	96	3	1		
Scenario 2 (30% A, 10% B, 0% C; no death)				50.20	.07
Casual	88	9	3		
Intermediate	89	9	2		
Focused	90	9	1		
Veteran	92	8	0		
Total	90	9	1		
Scenario 3 (50% A, 30% B, 10% C; no death)				164.05	.13
Casual	60	29	11		
Intermediate	70	23	7		
Focused	70	26	4		
Veteran	75	24	1		
Total	70	26	4		
Scenario 4 (50% A, 50% B, 50% C; no death)				195.28	.15
Casual	36	46	18		
Intermediate	45	45	10		
Focused	48	45	7		
Veteran	54	43	3		
Total	48	44	8		
Scenario 5 (10% A, 0% B, 0% C; death) [2]				35.43	.13
Casual	76	4	20		
Intermediate	77	11	12		
Focused	85	9	6		
Veteran	83	13	4		
Total	81	11	8		
Scenario 6 (50% A, 50% B, 50% C; death) [2]				83.07	.20
Casual	26	33	41		
Intermediate	32	37	31		
Focused	37	44	19		
Veteran	39	51	10		
Total	36	46	18		

[1] Cell entries for behavioral intentions are percents (%); all χ^2-values significant at $p < .001$.
[2] Only asked in surveys of Arizona, North Dakota, South Dakota, and Wisconsin hunters.

Table 3.7 Behavioral intentions of *resident* hunter specialization cluster groups in response to CWD [1]

Hypothetical scenarios and hunter specialization cluster groups	Behavioral intention			$\chi^2(6)$	Effect size (V)
	Still hunt in state	Switch to another state	Give up altogether		
Scenario 1 (10% A, 0% B, 0% C; no death)				31.39	.07
Casual	97	0	3		
Intermediate	98	0	2		
Focused	99	1	1		
Veteran	99	1	0		
Total	98	1	1		
Scenario 2 (30% A, 10% B, 0% C; no death)				68.00	.09
Casual	91	1	8		
Intermediate	93	2	5		
Focused	95	2	3		
Veteran	96	2	2		
Total	94	2	4		
Scenario 3 (50% A, 30% B, 10% C; no death)				203.63	.16
Casual	71	4	25		
Intermediate	77	6	17		
Focused	83	8	9		
Veteran	86	9	5		
Total	81	7	12		
Scenario 4 (50% A, 50% B, 50% C; no death)				365.56	.21
Casual	48	7	45		
Intermediate	55	12	33		
Focused	65	16	19		
Veteran	71	18	11		
Total	63	14	23		
Scenario 5 (10% A, 0% B, 0% C; death) [2]				174.35	.19
Casual	70	2	28		
Intermediate	72	4	24		
Focused	83	5	12		
Veteran	87	7	6		
Total	79	5	16		
Scenario 6 (50% A, 50% B, 50% C; death) [2]				275.88	.24
Casual	33	6	61		
Intermediate	36	12	52		
Focused	54	18	28		
Veteran	58	19	23		
Total	47	15	38		

[1] Cell entries for behavioral intentions are percents (%); all χ^2-values significant at $p < .001$.
[2] Only asked in surveys of Arizona, North Dakota, South Dakota, and Wisconsin hunters.

this worst case scenario where veterans were slightly more likely to switch states (51%) followed by focused (44%), intermediate (37%) and casual (33%) hunters, few differences existed among groups regarding their intentions to hunt in another state.

Table 3.7 shows that resident hunters' behavioral intentions in response to CWD also differed significantly among the four specialization groups, $\chi^2(6, N = 2425 \text{ to } 4072) \leq 365.56, p < .001$. Like nonresidents, the percentage that would give up deer or elk hunting altogether for each scenario was highest for casual hunters followed by the intermediate, focused, and veteran groups. In response to the sixth scenario (i.e., 50% across state, death), for example, casual hunters were more likely to quit (61%) followed by intermediate (52%), focused (28%), and veteran (23%) hunters. Unlike nonresidents, however, there were clear differences among groups in their intentions to switch to other states to hunt. Across all scenarios, the percentage that would switch states was highest for veterans followed by the focused, intermediate, and casual groups. For example, 18% of veterans compared to 16% of focused, 12% of intermediate, and 7% of casual hunters would travel to other states to hunt if 50% of deer or elk across the state had CWD (i.e., scenario 4). Effect sizes ($V = .07$ to .24) indicated "minimal" or "weak" to "typical" or "medium" relationships among nonresident and resident hunters' specialization and behavioral intentions in response to CWD conditions (Cohen, 1988; Vaske et al., 2002).[6]

Discussion

This article examined relationships between hunter specialization and behavioral intentions in response to CWD. Results showed that if potential CWD prevalence and human health risks increase, deer / elk hunting participation would substantially decrease. Nonresident hunters would be more inclined to travel to other states to hunt; residents

were more likely to give up the activity permanently. Among nonresidents and residents, casual hunters were most likely to give up the activity and veterans were least likely to quit. Veteran residents would be most inclined to switch to other states to hunt; casual residents were least likely to be displaced. For nonresidents, however, there were few differences among specialization groups regarding intentions to travel to other states to hunt. Findings have implications for application, theory, and research.

Management Implications

At current CWD prevalence levels (i.e., scenario 1) in some states (e.g., Colorado, Wyoming), almost all hunters would continue hunting deer / elk in their state. This suggests that agencies may experience only minor declines in revenue from hunting license sales if CWD conditions do not worsen. Serious ramifications may occur, however, if conditions deteriorate; 64% of nonresidents and 53% of residents would switch to other states or give up hunting altogether if half of the deer or elk have CWD and human death occurs from the disease (scenario 6). Although high prevalence and human death from CWD are unlikely, agencies should anticipate some decline in license revenues, reduced support for wildlife programs and management, negative impacts on cultural and family traditions, and economic instability of communities dependent on hunting (Needham et al., 2004).

When specialization is considered, nonresident and resident newcomers / novice hunters (i.e., casual) were most likely to stop hunting permanently in response to CWD (i.e., up to 61%). Hunting participation has declined in North America (Brown et al., 2000) with hunters stopping due to constraints such as age, health, and limited access to some hunting areas (e.g., Miller & Vaske, 2003). If CWD influences a greater proportion

of newcomers / casual hunters to quit, impacts on the future of deer and elk hunting and hunter recruitment could be catastrophic. Findings, however, showed that only 15% to 16% of hunters were classified as casual; the most (39% to 41%) were veterans. These veterans were least likely to give up deer or elk hunting. Although focused hunters may be relatively new to the activity, they were also less likely to report that they would quit compared to casual hunters. This suggests that desertion from hunting due to CWD may be greater among casual hunters, but this group represents a minority of hunters. The majority of respondents were focused or veterans and less than 30% of these hunters would quit even if CWD ever reaches 50% prevalence and causes human death.

Although veterans were least likely to give up deer or elk hunting, they were most likely to travel to other states to hunt. Casual hunters were least likely to report that they would be displaced. This pattern was more pronounced for resident hunters. For nonresidents, there were few differences in displacement among specialization groups. This is predictable because nonresidents have already hunted in other states regardless of their specialization. These results suggest that if CWD conditions deteriorate in a state, the wildlife agency could expect: (a) highest desertion among resident and nonresident casual hunters, (b) highest displacement among resident veteran hunters, and (c) relatively high displacement among nonresidents irrespective of specialization. Taken together, the potential consequences of hunting declines and displacement attributable to CWD suggest the need for agencies and other stakeholders to engage in long-term, proactive efforts to address the disease.

Theoretical Implications

Results both reinforce and contradict findings of past studies and suggest other issues that require exploration. For example, unlike recent human dimensions research on CWD (e.g., Gigliotti, 2004; Miller, 2004), this article showed that potential CWD conditions could influence a large percentage of hunters to change their hunting behavior. Moreover, displacement and desertion in response to CWD differed between residents and nonresidents, and among subgroups of hunters based on their specialization.

Past research on relationships between specialization and behavior has reported mixed results. Kuentzel and Heberlein (1992), for example, found few relationships between hunter behavior and specialization. Consistent with other studies, however, findings here suggest that the specialization concept is useful for segmenting users and predicting potential behavior in response to changes in recreation opportunities and resources (Barro & Manfredo, 1996; McFarlane, 2004; McFarlane et al., 1998).

Identical to recent research, specialization was treated as a multidimensional concept consisting of affective, cognitive, and behavioral components (Lee & Scott, 2004; McFarlane, 2004). Second order CFAs showed that the affective (i.e., centrality) and cognitive (i.e., skill) dimensions represented hunter specialization better than the behavioral dimensions (i.e., equipment, experience). Results are similar to Lee and Scott (2004), suggesting that specialization is multidimensional and best understood in terms of activity importance and skill; experience and equipment are less useful. This model was superior to a summative approach, suggesting that a single index may be imprudent.

Cluster analyses of the specialization dimensions (i.e., centrality, skill, equipment, experience) suggested that the trajectories of dimensions are not identical and progress in

each dimension does not always increase linearly from low to high in "lock step" fashion (Lee & Scott, 2004; Scott & Thigpen, 2003). Focused hunters, for example, have spent a small proportion of their lives hunting, but are almost as skilled and committed as veterans. Given that specialization groups did not differ in age, focused hunters may have recently taken up and become immersed in hunting by purchasing necessary equipment and developing requisite skills. Socialization factors could have contributed, as focused hunters may have learned skills from friends or guides who are more specialized. A more probable explanation, however, is that hunting careers for some individuals may be characterized by multimodal participation patterns. Most hunters become involved in hunting as a child or youth and learn from their parents (O'Leary, Behrens-Tepper, McGuire, & Dottavio, 1987). Participation may decline when attending college or starting a career or family, but increase again later in life when teaching their children to hunt or when financial resources are available to afford costs associated with hunting. Specialization, therefore, may be best suited for revealing styles of involvement and career stages in an activity rather than a continuum of progression (Scott & Shafer, 2001).

Future Research

To increase the generalizability of these findings, the following future research considerations are offered. First, response categories for the hypothetical CWD scenarios ascertained whether hunters would continue hunting deer or elk in the state, switch to another state, or give up permanently. Hunters, however, may choose to hunt a different species instead. Research should examine other possible behavioral responses to CWD.

Second, identical to most research on both recreation specialization and the human dimensions of CWD, this article is quantitative and cross-sectional in nature.

Although the hypothetical scenarios described CWD prevalence and human health risks that may occur in the future, this study measured hunter specialization at one point in time. Longitudinal and panel design studies are needed to determine whether: (a) the four specialization groups progress to more advanced stages in hunting, and (b) hunting displacement and desertion in response to CWD conditions actually follow similar trends to those identified here. Qualitative approaches may provide depth and detail necessary for delineating underlying influences of hunter specialization and behavior in response to CWD (Scott & Shafer, 2001).

Third, focused hunters exhibited low experience, but high skill and centrality. Explanations of this group are speculative; survey questions were not asked to determine hunters' socialization or participation patterns. Research is required to understand this group in more detail and determine whether similar groups exist in other activities.

Fourth, this study employed a single-item measure of experience (i.e., proportion of life hunted). Researchers should use multi-item measures of specialization dimensions whenever possible. Caution, however, should be exercised when adopting some measures of experience used in previous studies. More days of participation, for example, may not imply high specialization. Hunting regulations often permit only one or two animals to be harvested in a given year. Given their skill and ability, specialized hunters may reach their limit earlier, thus could have lower participation compared to unsuccessful hunters.

Fifth, recreation studies, including the study reported here, are often bound by human subject protocols that require participants to be over a certain age (e.g., 18 years). This may result in a lower proportion of novice or casual participants in a sample than what may exist in the population because younger participants may have lower rates of

experience and lack the financial ability to purchase equipment for the activity. Research is needed to determine if such sampling issues significantly bias studies of specialization.

Sixth, the hypothetical CWD scenarios in this study do not necessarily reflect current prevalence levels or consequences to humans. Increased testing of harvested animals (i.e., postmortem sampling), advancements in lymphoid and tonsillar biopsy techniques for testing live animals (i.e., antemortem sampling), and continued in-vitro laboratory experiments of CWD in human cells may provide a more realistic assessment of possible current and future CWD prevalence levels and human health risks (Raymond et al., 2000; Sigurdson et al., 1999; Wild, Spraker, Sigurdson, O'Rourke, & Miller, 2002).

Finally, the findings presented here are limited to resident and nonresident hunters across eight states that purchased a license to hunt deer or elk with a gun in 2003. Results may not generalize to hunters participating in different forms of hunting (e.g., archery) or other species that have CWD (e.g., moose). The applicability of these findings to other activity groups remains a topic for further empirical investigation.

Notes

1. The mail survey was pre-tested in each state in 2003 with hunters who purchased a license to hunt in 2002 (n = 659). Details are reported in Needham et al. (2004).
2. The non-response check contained several questions used here for measuring hunters' specialization in hunting and behavior in response to CWD conditions. See Needham et al. (2005) for weighting details.
3. Further support for using prevalence and human health risks as determinants of hunter behavior in response to CWD was obtained from open-ended questions in the pre-test that asked hunters to list circumstances related to CWD that would cause them to give

up deer / elk hunting in the state or permanently. The most dominant responses were related to CWD prevalence (89%) and potential human health risks / death (77%).

4. Ancillary analyses tested single factor models (i.e., all 11 observed variables forced to load on one factor). These models did not withstand any criteria for reasonable fitting models (CFI*, NNFI* = .73 to .79; RMSEA* = .14 to .15), suggesting that traditional single item or summative approaches to measure specialization may be inappropriate.
5. A series of cluster analyses was performed ranging from two to seven clusters. The four-group solution provided the best fit for the data. To validate this solution, data were randomly sorted and a cluster analysis was conducted after each of three random sorts. All of these additional cluster analyses supported the four-group solution.
6. A similar proportion of: (a) nonresident and resident; and (b) casual, intermediate, focused, and veteran hunters participated in zone A, zone B, and / or zone C in 2003 and in their life. Ancillary analyses showed no substantial relationship between zones in which respondents hunted and behavioral intentions in response to each scenario.

CHAPTER IV. HUNTERS' RESPONSES TO CHRONIC WASTING DISEASE: PERCEIVED SIMILARITY, SOCIAL TRUST, AND PERSONAL RISK

Introduction

Chronic wasting disease (CWD) is a neurological disease of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and moose (*Alces alces*) (CDOW, 2005; Williams, Miller, Kreeger, Kahn, & Thorne, 2002). CWD is a transmissible spongiform encephalopathy (TSE) disease similar to scrapie in sheep, bovine spongiform encephalopathy in cattle (i.e., BSE, mad cow), and Creutzfeldt-Jakob disease in humans (McKintosh, Tabrizi, & Collinge, 2003). Infected animals exhibit abnormal behavior, emaciation, and excessive salivation. There is no known treatment for CWD and it is always fatal (Williams et al., 2002). Although there is no evidence to suggest that CWD poses a human health risk, transmission to humans cannot be dismissed (Belay et al., 2004; Raymond et al., 2000).

CWD was identified in captive deer and elk in the 1960s and 1970s (Williams & Young, 1980, 1982) and free-ranging herds in the 1980s and 1990s in both Colorado and Wyoming (Spraker et al., 1997). The disease has also been found in free-ranging herds in Alberta, Illinois, Nebraska, New Mexico, New York, Saskatchewan, South Dakota, Utah, West Virginia, and Wisconsin. CWD was recently discovered in free-ranging moose in Colorado (CDOW, 2005). Some of these states have experienced hunting declines attributable to CWD (Heberlein, 2004; Vaske, Timmons, Beaman, & Petchenik, 2004).

Theory suggests that hunters' behavior may be influenced by perceptions of risk regarding a hazard such as CWD, and these risk perceptions may be shaped by the extent to which hunters trust the managing agency (Bord & O'Connor, 1992; Flynn, Burns, Mertz, & Slovic, 1992; Viklund, 2003).[1] Shared goals, values, thoughts, and opinions (i.e., perceived similarity) are thought to constitute foundations of trust; if the agency is perceived as similar to the individual, it tends to be viewed as trustworthy by the individual (Siegrist, Cvetkovich, & Roth, 2000). This article examines the extent to which hunters perceive personal risks associated with CWD and the influence of perceived similarity and trust in state wildlife agencies as determinants of this risk.

Review of Literature

Human Dimensions of CWD

Big game hunting participation has decreased in North America (Brown, Decker, Siemer, & Enck, 2000; Heberlein & Thompson, 1996) and this decline could be exacerbated by hunters' perceptions of risk regarding CWD (Vaske et al., 2004). Hunting declines attributable to CWD may: (a) reduce revenues from license sales, (b) impact wildlife management programs (e.g., stocking programs) if funds get diverted to address CWD, (c) limit an agency's ability to manage game species, (d) erode support of wildlife agencies, and (e) constrain cultural traditions and the social and economic stability of communities dependent on hunting (Needham, Vaske, & Manfredo, 2004).

Given these potential ramifications, researchers have examined hunters' behavioral responses to CWD. If CWD conditions continue to worsen, several states may witness substantial changes in hunters' behavior (e.g., hunt in other areas, stop hunting) (Gigliotti, 2004; Miller, 2003, 2004; Needham et al., 2004; Vaske et al., 2004). Needham

et al. (2004), for example, reported that 49% of hunters across eight states could stop hunting in their state if a majority of deer or elk are infected with CWD. Wisconsin residents who stopped hunting deer because of CWD perceived more risk associated with the disease compared to those who continued hunting (Vaske et al., 2004). Little is known, however, about the extent to which: (a) hunters in several states feel that CWD poses a personal risk, and (b) hunters' trust in state wildlife agencies influences these risk perceptions. This article addresses these knowledge gaps.

Perceived Risk

Perceived risk is the degree to which individuals believe that they are or may be exposed to a hazard (Kunreuther & Slovic, 1996; Sjöberg, 2000a). Risk perceptions can influence decision making and behavior (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Siegrist, Gutscher, & Earle, 2005). Hunters concerned about CWD, for example, may decide to stop hunting or consuming deer, elk, or moose (Miller, 2004).

Risk perception is subjective and people differ in judgments (Siegrist et al., 2005). For example, people seldom make the same estimates when assessing risk to themselves (i.e., personal risk) versus society (i.e., societal / general risk); people often believe that they are at less risk compared to others (Sjöberg, 2000a; Slovic, Fischhoff, & Lichtenstein, 1981). Researchers have identified other characteristics of perceivers that help to explain variation in risk judgments including differences between males and females (Flynn, Slovic, & Mertz, 1994), and experts (i.e., scientists, agencies) and the lay public (Sjöberg, 1999b; Slovic, 1987; Thompson & Dean, 1996). There is little consensus among researchers about how to measure risk perceptions (Sjöberg, 2002).

Social Trust

There is increasing evidence of the importance of social trust as a determinant of perceived risk (Siegrist & Cvetkovich, 2000; Sjöberg, 2001). Training and experience likely provide experts with more knowledge about hazards. Lacking this knowledge, lay public judgments of risks may be based more on trust in the agencies responsible for managing the hazard, as opposed to the actual hazard (Siegrist & Cvetkovich, 2000).

Social trust is the willingness to rely on those with formal responsibility for making decisions and taking actions related to management of technology, medicine, environment, or other realms of public health and safety (Earle & Cvetkovich, 1995; Siegrist et al., 2000). Individuals or agencies being trusted or distrusted may or may not be personally known to the person making the trust attribution (Siegrist et al., 2000).

Trust may be especially important in the absence of knowledge about a particular hazard (Siegrist et al., 2005). Hunters' knowledge about CWD is low, as demonstrated by survey responses to a series of true / false questions (Needham, Vaske, Green, Petchenik, & Timmons, 2005). Less than 5% of hunters answered all questions correctly; the largest proportion failed to answer more than half of the questions correctly.

Across most studies, people who trust the agency in charge of managing the hazard perceive less risk regarding the hazard compared to those who do not (e.g., Bord & O'Connor, 1992; Flynn et al., 1992; Pijawka & Mushkatel, 1991; Sandman, Miller, Johnson, & Weinstein, 1993; Siegrist & Cvetkovich, 2000; Siegrist et al., 2000; Siegrist, Cvetkovich, & Gutscher, 2001). Examination of the strength of relationship between social trust and perceived risk, however, has provided mixed results. In some studies, up to 70% of the variance in perceived risk is explained by trust (Flynn et al., 1992; Siegrist

et al., 2000). Many studies, however, report that 5% to 20% of perceived risk is explained by trust (e.g., Sjöberg, 2000b; Trumbo & McComas, 2003; Viklund, 2003). Weak to moderate relationships between trust and perceived risk may suggest that people believe there are clear limits to how much agencies and other experts know. People may trust a managing agency, but feel that potential risks are beyond agency control (Sjöberg, 2001).

There are inconsistencies in the operationalization of social trust. First, variables used in past studies (Siegrist et al., 2000) such as "the responsible authorities accurately control whether legal regulations and restrictions are upheld" arguably measure perceptions of how well risks are managed by an agency, not the extent to which the agency is trusted (Frewer, Scholderer, & Bredahl, 2003). Second, the independent (i.e., social trust) and dependent (i.e., perceived risk) variables should be measured at similar levels of contextual specificity (e.g., state wildlife agencies, CWD) for results to be most meaningful (Sjöberg, 2001; Viklund, 2003). Finally, one line of research suggests that trust is multidimensional and consists of dimensions such as competence, caring, fairness, responsibility, and confidence (e.g., Johnson, 1999; Poortinga & Pidgeon, 2003). This view presumes that processes underlying social trust are complex and a requisite level of knowledge about the managing agency's actions is necessary to make a cognitively detailed judgment of trust (Siegrist et al., 2000; Winter, Palucki, & Burkhardt, 1999).

An alternative view proposes that social trust is unidimensional and consists of trust or distrust (Cvetkovich & Winter, 2003; Siegrist, 2000; Siegrist & Cvetkovich, 2000; Siegrist et al., 2000; Siegrist et al., 2001; Siegrist et al., 2005; Winter et al., 1999). The lay public often lacks the knowledge or time to make complex trust attributions. As a result, decisions regarding whether to trust the agency involve a link between perceptions

of the agency and trust in its actions (Siegrist, 2000; Winter et al., 1999). Social trust is influenced by shared goals, values, thoughts, and opinions. People trust agencies that are perceived to share similar views (Cvetkovich & Winter, 2003; Siegrist et al., 2000).

Perceived Similarity

Researchers suggest that social trust is based on perceived similarity rather than carefully reasoned attributions of trust or direct knowledge of the managing agency (Earle & Cvetkovich, 1995; Siegrist et al., 2000; Siegrist et al., 2001). People base their trust judgments on whether they feel that the agency shares the same goals, values, thoughts, and opinions. This approach is known as salient value similarity (SVS), but it has also been referred to as attributes of salient similarity, perceived shared values, and perceived similarity (e.g., Cvetkovich & Winter, 2003; Earle, 2004; Siegrist et al., 2001).

Perceived similarity frequently predicts social trust; people who perceive that they share similar views as the managing agency trust the agency more than those who do not (e.g., Cvetkovich & Winter, 2003; Poortinga & Pidgeon, 2003; Siegrist et al., 2000; Walls, Pidgeon, Weyman, & Horlick-Jones, 2004). Trust in agencies managing recreation user fees and endangered species, for example, was highly correlated with judgments of similarity (Cvetkovich & Winter, 2003; Winter et al., 1999). Multiple-item semantic differential (Siegrist et al., 2000) or agree / disagree (Poortinga & Pidgeon, 2003) scales are typically used to measure this concept (e.g., thinks like me – thinks unlike me).

Seigrist et al. (2000) used data from students to examine relationships among perceived similarity, social trust, and risk perception for pesticides, artificial sweetener, and nuclear power. Substantial positive relationships between similarity and trust, and

negative relationships between trust and risk were observed. Perceived similarity led to higher social trust, which led to lower perceptions of risk.

Based on this literature, this article uses data from eight states to examine the extent to which resident and nonresident deer and elk hunters perceive personal risks associated with CWD and trust state wildlife agencies to manage the disease. The following hypotheses are advanced (Figure 4.1):

H_1: There will be a positive relationship between perceived similarity and social trust. Hunters who perceive that they share similar goals, values, thoughts, and opinions as the agency will be more likely to trust the agency to manage CWD compared to those who do not share similar views.

H_2: There will be a negative relationship between social trust and personal risk. Hunters who trust the agency to manage CWD will be less likely to perceive that the disease poses a personal risk compared to those who do not trust the agency.

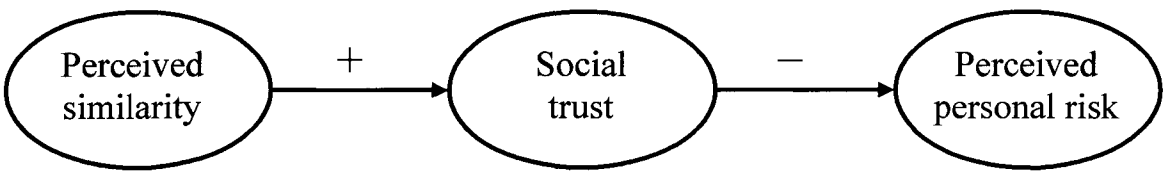

Figure 4.1 Hypothesized model for hunters' perceptions of personal risk related to CWD

Methods

Data Collection

Data were obtained from mail surveys of nonresident and resident deer hunters in eight states (Arizona, Colorado, Nebraska, North Dakota, South Dakota, Utah, Wisconsin, Wyoming) and elk hunters in three states (Colorado, Utah, Wyoming), yielding a total of 22 strata (Table 4.1). CWD had been found in free-ranging deer and /

or elk in each of these states except Arizona and North Dakota. The wildlife / game and fish government agency of each participating state provided names and addresses of random samples of hunters 18 years of age or older who purchased a nonresident or resident license to hunt deer or elk with a gun in 2003.

Table 4.1 Completed surveys and response rates for each stratum

Strata	Mailed	Undeliverable	Completed (*n*)	Response rate
Arizona nonresident deer hunters	988	37	444	47%
Arizona resident deer hunters	1025	36	396	40%
Colorado nonresident deer hunters	1025	13	509	50%
Colorado resident deer hunters	1025	41	459	47%
Colorado nonresident elk hunters	1025	17	564	56%
Colorado resident elk hunters	1025	34	472	48%
Nebraska nonresident deer hunters	1025	17	524	52%
Nebraska resident deer hunters	1025	13	423	42%
North Dakota nonresident deer hunters	1025	23	509	51%
North Dakota resident deer hunters	1025	23	346	35%
South Dakota nonresident deer hunters	1025	10	557	55%
South Dakota resident deer hunters	1025	10	423	42%
Utah nonresident deer hunters	1025	47	439	45%
Utah resident deer hunters	1025	45	328	34%
Utah nonresident elk hunters	832	51	337	43%
Utah resident elk hunters	1025	73	331	35%
Wisconsin nonresident deer hunters	1025	80	465	49%
Wisconsin resident deer hunters	1025	30	378	38%
Wyoming nonresident deer hunters	1025	19	475	47%
Wyoming resident deer hunters	1025	79	308	33%
Wyoming nonresident elk hunters	1025	18	506	50%
Wyoming resident elk hunters	1025	57	374	39%
Total	22320	773	9567	44%

Three mailings were used to administer the survey beginning in July 2004.[2] Hunters were initially mailed a survey, postage-paid return envelope, and cover letter explaining the study. Reminder postcards were sent to non-respondents two weeks after

the initial mailing. A second complete mailing (i.e., survey, return envelope, cover letter) was sent to non-respondents three weeks after the postcard reminder.

Surveys were mailed to a total of 22,320 hunters. With the exception of Arizona nonresident deer hunters and Utah nonresident elk hunters, 1,025 hunters in each stratum were sent a survey (Table 4.1). For these two strata, the full population of hunters was sent a survey because less than 1,025 licenses were sold. Across all strata, 773 surveys were undeliverable (e.g., incorrect address, moved) and 9,567 completed surveys were returned, yielding a 44% response rate (9,567 / 22,320 – 773). Among the strata (Table 4.1), sample sizes ranged from 308 (33% response rate, Wyoming resident deer hunters) to 564 (56% response rate, Colorado nonresident elk hunters).

To check for non-response bias, hunters who completed the mail survey were compared to those who did not. A sample of 785 non-respondents (approximately 100 per state) was telephoned in November 2004 and asked nine questions from the mail survey. Responses to five questions were statistically different ($p < .001$) between respondents and non-respondents, but tests of statistical significance are highly sensitive to large sample sizes (Vaske, Gliner, & Morgan, 2002). Effect sizes (V, r_{pb}) were less than .15, indicating weak (Cohen, 1988) or minimal (Vaske et al., 2002) differences between the two groups. Non-response bias was not deemed a problem, thus data were not weighted.

Model Variables

Perceived similarity. Hunters' perceptions of similarity with the agencies were determined by the extent to which they disagreed or agreed with five statements: I feel that the state wildlife agency: (a) shares similar values as me, (b) shares similar opinions as me, (c) shares similar goals as me, (d) thinks in a similar way as me, and (e) takes

similar actions as I would. The respective agency name (e.g., Nebraska Game and Parks Commission, Colorado Division of Wildlife) was included in the statements. These variables are identical to past research (e.g., Poortinga & Pidgeon, 2003; Siegrist et al., 2000; Winter et al., 1999). Consistent with Poortinga and Pidgeon (2003), responses were measured on 7-point scales from 1 "strongly disagree" to 7 "strongly agree."

Social trust. Six statements measured hunters' trust in the agencies to manage CWD: I trust the state wildlife agency to: (a) provide the best available information on CWD issues, (b) provide me with enough information to decide what actions I should take regarding CWD, (c) provide truthful information about human safety issues related to CWD, (d) provide timely information regarding CWD issues, (e) make good deer / elk management decisions regarding CWD issues, and (f) properly address CWD in the state. Respective agency and state names were included in the statements, and responses were coded on the same scale used to measure the perceived similarity variables.

Perceived risk. Personal risk perception regarding CWD was examined with four variables. Hunters reported how much risk they felt was associated with two incidents happening to them during or as a consequence of their hunt: (a) inadvertently eating meat from an animal infected with CWD, and (b) becoming ill as a result of contracting a disease caused by CWD. Consistent with Cheron and Ritchie (1982) and McComas and Trumbo (2001), responses were measured on 9-point scales from 1 "no risk" to 9 "extreme risk." Respondents were also asked: Because of CWD, how concerned are you about your own personal health? This variable was coded on a 9-point scale from 1 "not at all concerned" to 9 "extremely concerned." Finally, hunters were asked to respond to

the statement: Because of CWD, I have concerns about eating deer / elk meat. Responses were measured on a 7-point scale from 1 "strongly disagree" to 7 "strongly agree."

Data Analysis

For each stratum, the mean response for each variable was examined to reveal the extent to which hunters perceive similarity with and trust in the agency, and perceive personal risk associated with CWD. Internal consistency of the perceived similarity, social trust, and risk perception concepts was examined using Cronbach's alpha reliability coefficients.

Confirmatory factor analysis was performed for each stratum to test whether the variables measuring the three latent concepts (similarity, trust, risk) provided a good fit. Structural equation path analysis was then used to test the hypotheses for each stratum. EQS 6.1 software and robust estimation to correct for multivariate non-normality were used because data skewness and kurtosis indicated violations of the normal distribution assumption (Byrne, 1994; Chou & Bentler, 1995). Evaluation was based on the Satorra-Bentler scaled chi-square (S-B χ^2). Large sample sizes inflate this statistic. Model fit was assessed with robust corrected: comparative fit index (CFI*), non-normed fit index (NNFI*), and root mean square error of approximation (RMSEA*). RMSEA values .08 or less and CFI and NNFI values .90 or more indicate acceptable fit (Browne & Cudeck, 1993). Robust standard errors were used to calculate test statistics.

Results

Descriptive Findings

On average, nonresident hunters in each state slightly to moderately agreed that they share similar values, opinions, goals, actions, and thoughts as the state wildlife

agencies (Table 4.2). Mean similarity ratings among resident hunters were also relatively high, but slightly lower than those provided by nonresidents (Table 4.3). Across all strata, hunters agreed that they trust the agencies to manage CWD. Mean ratings among the six trust variables ranged from 4.5 (slightly agree) to 5.9 (moderately agree; Tables 4.2, 4.3). Resident hunters reported marginally lower trust ratings than nonresidents. On average, nonresident and resident hunters in each state felt slightly at risk of consuming meat from animals infected with CWD and becoming ill from CWD. Hunters in all strata were slightly concerned about their health because of CWD, but were divided in their concern about consuming deer or elk because of the disease (Tables 4.2, 4.3).

Measurement Models

The confirmatory factor analysis for each stratum demonstrated that the data provided an acceptable fit to the three concepts. Tables 4.2 and 4.3 show the standardized factor loadings associated with each multi-item concept for nonresidents and residents in each state, respectively. Factor loadings ranged from .81 to .96 for perceived similarity, .78 to .94 for social trust, and .42 to .96 for risk perception. All loadings were significant at $p < .001$. Reliability coefficients indicated high internal consistency, ranging from .94 to .97 for similarity and trust, and .77 to .85 for perceived risk. Deletion of any variable from its respective concept did not improve reliability. The S-B χ^2 values were significant at $p < .001$ for all strata, but indices (CFI* .90 to .95, NNFI* .89 to .94, RMSEA* .06 to .09) demonstrated acceptable fit. Errors were not permitted to correlate.

Table 4.2 Variable means, concept reliabilities, and factor loadings for *nonresident* hunters for each stratum [1]

	Variable means (*M*)											Standardized factor loadings (all $p < .001$)										
Concepts and variables	AZ D	CO D	CO E	ND D	NE D	SD D	UT D	UT E	WI D	WY D	WY E	AZ D	CO D	CO E	ND D	NE D	SD D	UT D	UT E	WI D	WY D	WY E
Perceived similarity – I feel (agency): [2]																						
Shares similar values as me	5.5	5.6	5.5	5.3	5.5	5.3	5.3	5.1	5.0	5.4	5.3	.85	.87	.87	.91	.90	.88	.91	.92	.91	.88	.85
Shares similar opinions as me	5.2	5.3	5.3	5.1	5.3	5.1	5.1	5.0	4.8	5.3	5.1	.93	.86	.92	.94	.96	.91	.92	.94	.93	.90	.88
Shares similar goals as me	5.4	5.4	5.4	5.2	5.4	5.2	5.2	5.1	5.0	5.4	5.2	.89	.89	.89	.90	.89	.88	.89	.88	.89	.91	.89
Thinks in a similar way as me	5.0	5.2	5.2	5.0	5.2	5.0	4.9	4.9	4.6	5.1	5.0	.93	.92	.91	.91	.93	.91	.93	.92	.90	.93	.91
Takes similar actions as I would	4.9	5.2	5.1	5.0	5.1	4.9	4.9	4.7	4.6	5.0	4.9	.86	.86	.83	.87	.85	.87	.90	.89	.84	.83	.84
Cronbach's alpha (α)	.95	.94	.95	.96	.96	.95	.96	.96	.95	.95	.94											
Social trust – I trust (agency) to: [2]																						
Provide best available information on CWD issues	5.7	5.9	5.8	5.7	5.8	5.6	5.5	5.5	5.3	5.7	5.5	.84	.85	.90	.88	.87	.90	.87	.90	.85	.90	.87
Provide enough information to decide what actions to take regarding CWD	5.6	5.9	5.8	5.6	5.7	5.5	5.5	5.4	5.3	5.6	5.5	.87	.90	.93	.90	.88	.92	.91	.92	.86	.92	.90
Provide truthful information about human safety issues related to CWD	5.9	5.9	5.8	5.8	5.8	5.7	5.7	5.7	5.4	5.8	5.6	.90	.87	.93	.91	.89	.92	.90	.90	.88	.90	.91
Provide timely CWD information	5.7	5.8	5.7	5.6	5.7	5.5	5.5	5.4	5.2	5.6	5.4	.91	.92	.90	.92	.90	.94	.94	.93	.89	.93	.92
Make good deer / elk management decisions regarding CWD issues	5.7	5.7	5.7	5.6	5.7	5.5	5.4	5.5	5.0	5.6	5.5	.89	.78	.84	.88	.88	.87	.86	.91	.86	.84	.86
Properly address CWD in (state)	5.7	5.7	5.7	5.7	5.7	5.6	5.5	5.5	5.1	5.7	5.5	.89	.79	.87	.90	.89	.90	.87	.92	.86	.87	.88
Cronbach's alpha (α)	.96	.94	.96	.96	.95	.97	.96	.97	.95	.96	.96											
Perceived personal risk																						
Inadvertently eat meat from animal infected with CWD [3]	3.3	3.5	3.4	3.2	3.6	3.4	3.7	3.7	3.5	3.4	3.4	.74	.76	.87	.80	.81	.84	.82	.84	.83	.84	.81
Become ill as a result of contracting a disease caused by CWD [3]	3.0	3.2	3.1	2.9	3.2	3.1	3.6	3.4	3.2	3.2	3.1	.92	.93	.90	.92	.89	.91	.93	.90	.93	.95	.91
Because of CWD, how concerned are you about your own health [4]	3.4	3.4	3.4	3.1	3.3	3.2	3.8	3.7	3.5	3.3	3.2	.62	.61	.64	.62	.67	.67	.72	.61	.63	.62	.61
Because of CWD, I have concerns about eating deer / elk meat [2]	4.1	4.3	4.1	3.8	4.1	4.0	4.6	4.3	4.1	4.1	3.9	.45	.51	.52	.49	.59	.51	.48	.46	.54	.55	.49
Cronbach's alpha (α)	.77	.80	.83	.80	.83	.82	.83	.80	.84	.83	.80											

[1] AZ = Arizona, CO = Colorado, ND = North Dakota, NE = Nebraska, SD = South Dakota, UT = Utah, WI = Wisconsin, WY = Wyoming, D = deer hunters, E = elk hunters.
[2] Variables coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.
[3] Variables coded on 9-point scale: 1 through 2 = no risk, 3 through 4 = slight risk, 5 through 7 = moderate risk, 8 through 9 = extreme risk.
[4] Variable coded on 9-point scale: 1 through 2 = not at all concerned, 3 through 4 = slightly concerned, 5 through 7 = moderately concerned, 8 through 9 = extremely concerned.

Table 4.3 Variable means, concept reliabilities, and factor loadings for *resident* hunters for each stratum [1]

	Variable means (*M*)											Standardized factor loadings (all $p < .001$)										
Concepts and variables	AZ D	CO D	CO E	ND D	NE D	SD D	UT D	UT E	WI D	WY D	WY E	AZ D	CO D	CO E	ND D	NE D	SD D	UT D	UT E	WI D	WY D	WY E
Perceived similarity – I feel (agency): [2]																						
Shares similar values as me	5.3	5.1	5.1	5.4	5.1	4.9	4.4	4.1	4.4	4.9	5.0	.85	.92	.86	.88	.88	.87	.91	.91	.92	.90	.90
Shares similar opinions as me	5.0	4.8	4.8	5.1	4.9	4.6	4.2	4.0	4.1	4.6	4.8	.90	.94	.91	.91	.92	.92	.94	.91	.93	.94	.91
Shares similar goals as me	5.1	5.1	5.0	5.3	5.0	4.7	4.3	4.1	4.3	4.8	4.9	.89	.90	.89	.84	.90	.90	.88	.90	.88	.89	.89
Thinks in a similar way as me	4.8	4.7	4.6	4.9	4.7	4.4	4.0	3.8	3.9	4.4	4.6	.94	.92	.92	.92	.90	.95	.93	.93	.93	.93	.92
Takes similar actions as I would	4.7	4.5	4.6	5.0	4.7	4.5	4.0	3.7	3.9	4.3	4.5	.88	.81	.87	.91	.87	.89	.88	.88	.84	.84	.87
Cronbach's alpha (α)	.95	.95	.95	.95	.95	.96	.97	.96	.95	.96	.95											
Social trust – I trust (agency) to: [2]																						
Provide best available information on CWD issues	5.5	5.4	5.4	5.7	5.4	5.3	4.7	4.8	4.8	5.2	5.3	.92	.89	.90	.87	.91	.91	.90	.88	.91	.91	.87
Provide enough information to decide what actions to take regarding CWD	5.4	5.4	5.4	5.6	5.4	5.2	4.7	4.7	4.9	5.2	5.2	.94	.92	.92	.90	.90	.90	.90	.89	.90	.91	.89
Provide truthful information about human safety issues related to CWD	5.7	5.4	5.3	5.8	5.5	5.5	5.0	4.9	4.8	5.3	5.4	.93	.91	.89	.90	.89	.86	.90	.87	.90	.90	.92
Provide timely CWD information	5.4	5.3	5.2	5.6	5.3	5.2	4.8	4.6	4.7	5.1	5.2	.93	.88	.91	.92	.93	.90	.91	.89	.92	.92	.94
Make good deer / elk management decisions regarding CWD issues	5.3	5.0	5.0	5.6	5.2	5.1	4.5	4.5	4.5	4.9	5.2	.87	.86	.82	.86	.86	.84	.86	.88	.84	.88	.90
Properly address CWD in (state)	5.4	5.2	5.1	5.6	5.3	5.2	4.6	4.6	4.5	5.0	5.3	.91	.89	.87	.90	.90	.91	.88	.90	.83	.92	.92
Cronbach's alpha (α)	.97	.96	.96	.96	.96	.96	.96	.96	.96	.96	.97											
Perceived personal risk																						
Inadvertently eat meat from animal infected with CWD [3]	3.6	3.8	3.7	3.6	3.6	3.6	4.0	3.7	3.4	4.0	3.8	.87	.76	.80	.82	.81	.89	.85	.88	.81	.88	.83
Become ill as a result of contracting a disease caused by CWD [3]	3.5	3.5	3.4	3.3	3.3	3.3	3.8	3.5	3.1	3.6	3.8	.96	.91	.92	.91	.86	.91	.87	.92	.90	.93	.89
Because of CWD, how concerned are you about your own health [4]	3.8	3.6	3.7	3.6	3.3	3.3	3.9	3.9	3.2	3.7	3.8	.58	.73	.71	.61	.69	.63	.67	.65	.66	.65	.65
Because of CWD, I have concerns about eating deer / elk meat [2]	4.5	4.4	4.3	4.2	4.2	4.1	4.6	4.3	3.8	4.3	4.1	.42	.57	.53	.48	.48	.56	.58	.50	.64	.62	.58
Cronbach's alpha (α)	.80	.83	.83	.80	.81	.83	.83	.83	.83	.85	.83											

[1] AZ = Arizona, CO = Colorado, ND = North Dakota, NE = Nebraska, SD = South Dakota, UT = Utah, WI = Wisconsin, WY = Wyoming, D = deer hunters, E = elk hunters.
[2] Variables coded on 7-point scale: 1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neither, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree.
[3] Variables coded on 9-point scale: 1 through 2 = no risk, 3 through 4 = slight risk, 5 through 7 = moderate risk, 8 through 9 = extreme risk.
[4] Variable coded on 9-point scale: 1 through 2 = not at all concerned, 3 through 4 = slightly concerned, 5 through 7 = moderately concerned, 8 through 9 = extremely concerned.

Structural Models

As predicted by Hypothesis 1, a positive relationship between perceived similarity and social trust was observed across all 22 strata (Table 4.4). Standardized coefficients ranged from $\beta = .45$ to .70 and were significant at $p < .001$ for all strata. Hunters' perceptions of similarity with the state wildlife agencies explained between 21% and 49% of the variance in trust of the agencies to manage CWD. Across all strata (i.e., state, residency, species hunted), hunters who perceived that they share similar goals, values, thoughts, and opinions as the agencies were more trusting of the agencies in managing CWD compared to those who perceived that they do not share similar views.

Table 4.4 also shows a negative relationship between social trust and personal risk across all 22 strata. Standardized coefficients ranged from $\beta = -.01$ to $-.28$ and were statistically significant for 14 strata ($p < .05$ or $p < .001$). Coefficients for the remaining eight strata were in the hypothesized negative direction, but failed to reach statistical significance. Hunters' trust in agencies to manage CWD explained 8% or less of the variance in perceptions of risk associated with the disease. These findings partially support Hypothesis 2. For most strata, hunters who trusted the agencies to manage CWD were less likely to perceive that the disease poses a personal risk compared to those who were less trusting, but there are clearly additional attributes that influence this risk.

For all 22 strata, overall structural model fit was acceptable. The S-B χ^2 values were significant at $p < .001$, but this is likely a function of sample size. Fit indices were acceptable, ranging from .89 to .95 for CFI* and NNFI*, and .06 to .09 for RMSEA*.[3]

Table 4.4 Summary of structural model analyses and fit indices for each stratum [1]

Strata	Perceived similarity → Social trust β	R^2	Social trust → Personal risk β	R^2	S-B $\chi^2(88)$	NNFI*	CFI*	RMSEA*
Arizona nonresident deer hunters	.63 ***	.40	- .06	.00	377.42 ***	.90	.91	.08
Arizona resident deer hunters	.50 ***	.25	- .21 ***	.05	351.48 ***	.91	.92	.08
Colorado nonresident deer hunters	.47 ***	.22	- .25 ***	.06	341.73 ***	.91	.92	.07
Colorado resident deer hunters	.65 ***	.42	- .05	.00	354.92 ***	.92	.94	.08
Colorado nonresident elk hunters	.54 ***	.29	- .28 ***	.08	336.89 ***	.92	.94	.07
Colorado resident elk hunters	.63 ***	.40	- .11 *	.02	324.58 ***	.93	.94	.07
Nebraska nonresident deer hunters	.62 ***	.38	- .14 *	.02	481.06 ***	.89	.90	.09
Nebraska resident deer hunters	.61 ***	.37	- .14 *	.02	289.38 ***	.93	.94	.07
North Dakota nonresident deer hunters	.60 ***	.36	- .01	.00	343.84 ***	.93	.94	.07
North Dakota resident deer hunters	.52 ***	.27	- .02	.00	217.41 ***	.95	.95	.06
South Dakota nonresident deer hunters	.45 ***	.21	- .16 *	.03	551.78 ***	.89	.91	.09
South Dakota resident deer hunters	.56 ***	.32	- .14 *	.02	406.64 ***	.91	.93	.08
Utah nonresident deer hunters	.56 ***	.31	- .08	.01	393.12 ***	.91	.93	.08
Utah resident deer hunters	.64 ***	.40	- .11 *	.02	302.82 ***	.93	.94	.08
Utah nonresident elk hunters	.61 ***	.37	- .13 *	.02	241.13 ***	.93	.95	.07
Utah resident elk hunters	.65 ***	.43	- .03	.00	312.60 ***	.93	.94	.08
Wisconsin nonresident deer hunters	.66 ***	.44	- .11 *	.02	424.78 ***	.91	.92	.08
Wisconsin resident deer hunters	.70 ***	.49	- .07	.01	325.30 ***	.94	.95	.08
Wyoming nonresident deer hunters	.63 ***	.39	- .19 ***	.04	336.51 ***	.91	.93	.07
Wyoming resident deer hunters	.68 ***	.46	- .04	.00	295.35 ***	.92	.94	.08
Wyoming nonresident elk hunters	.50 ***	.25	- .13 *	.02	484.82 ***	.89	.90	.09
Wyoming resident elk hunters	.67 ***	.45	- .16 *	.03	270.05 ***	.94	.95	.07

[1] Based on Satorra-Bentler robust estimation for multivariate non-normality; β = standardized path coefficients; * $p < .05$, *** $p < .001$.

Discussion

Theory suggests that risk perceptions are influenced by trust in managing agencies, and shared goals, thoughts, and values are foundations of trust (Earle & Cvetkovich, 1995; Siegrist et al., 2000). This article generally supported these conceptual relationships. Consistent with Hypothesis 1, hunters' perceptions of similarity with the state wildlife agencies positively influenced trust in these agencies to manage CWD, explaining up to 49% of the variance in trust. Hypothesis 2 predicted that hunters who trust the agencies to manage CWD perceive less risk associated with the disease. This was supported across most strata, but trust only explained up to 8% of the variance in risk. Hunters perceived slight to moderate similarity with and trust in the agencies, but still perceived some risk associated with CWD. These findings have implications for application, theory, and future research.

Management Implications

From an applied perspective, results showed relatively weak but consistent negative relationships between trust in wildlife agencies and perceived risk associated with CWD. Studies of other issues such as nuclear power have shown a much stronger relationship between trust and risk (Flynn et al., 1992; Siegrist et al., 2000). Nuclear power, however, is a technology created and controlled by humans, whereas CWD is a naturally occurring wildlife disease that continues to spread to new locations (Miller, Williams, Hobbs, & Wolfe, 2004). Perhaps hunters trust the agencies to manage CWD, but feel there are limits to how much the agencies know and that potential risks associated with the disease are beyond agency control. To mitigate hunters' risk

perceptions associated with CWD, agencies may need to do more to inform and educate hunters about strategies for managing the disease (e.g., testing, herd reduction).

Findings also revealed that, on average, hunters agreed that they share similar views as the wildlife agencies and trust these agencies to manage CWD. This is important for several reasons. First, trust and perceived similarity can influence support of agency goals, objectives, and management (Earle, 2004). For example, hunters who trust the wildlife agencies may be more likely to support management strategies such as CWD testing and herd reduction (Needham et al., 2004).

Second, persuasion models (e.g., elaboration likelihood, heuristic systematic) suggest that similarity and trust are important determinants of effective communication / persuasion campaigns (Chaiken, Wood, & Eagly, 1996; Petty & Cacioppo, 1986). Hunters who trust an agency may be more motivated to attend to its information about CWD. Campaign effectiveness, however, may be slightly lower with resident hunters because they are less trusting of the agencies compared to nonresidents.

Third, trust had an influence, albeit minor, on hunters' risk perceptions regarding CWD. Research has shown that perceived CWD risk can directly influence hunters to stop hunting (Vaske et al., 2004). Given the potential consequences of hunting declines attributable to CWD (e.g., revenue loss), agencies should maintain trust by fostering positive relationships and dialogue with hunters (Needham et al., 2004).

Finally, agencies should strive to understand constituents' opinions, values, and goals (Manfredo, Teel, & Bright, 2003). To preserve trust and a strong constituent base, management should be tailored to reflect these views whenever feasible. If constituents'

views are not reflected in management, reasons for inconsistencies should be shared so they can be weighed in relation to considerations of trust (Cvetkovich & Winter, 2003).

Despite relatively high trust, hunters are concerned about their health because of CWD and feel at risk of consuming meat from animals infected with CWD and becoming ill from the disease. Perhaps hunters are concerned about CWD because of its similarity to related diseases that can cause human death (e.g., Creutzfeldt-Jakob) (McKintosh et al., 2003). These findings contradict most agency information campaigns and messages stating that there is no evidence to suggest that CWD poses a human health risk (World Health Organization, 2000). These same messages, however, also advise hunters to take precautions due to CWD (e.g., test animals for CWD, wear gloves when processing animals), which may increase perceptions of CWD risk. Agencies, therefore, may need to emphasize the differences between CWD and related diseases, and the current lack of scientific evidence showing any direct connection between CWD and human health.

Theoretical Implications

From a theoretical perspective, the finding of strong positive relationships (β = .45 to .70) between similarity and trust was consistent with past research. Siegrist et al. (2000), for example, reported comparable results (β = .58 to .64). Researchers should continue to examine measures of perceived similarity, as they seem to be important determinants of social trust. Given the factor loadings and reliabilities, variables used here and in other studies appear to be appropriate for measuring perceived similarity.

The association between social trust and personal risk is less clear. Some studies have reported strong negative relationships between these concepts (Flynn et al., 1992; Siegrist et al., 2000). Findings here, however, are consistent with research reporting

relatively weak, but systematically negative relationships (e.g., Sjöberg, 2000b, 2001; Viklund, 2003). Given that most of the variance in risk remains unexplained by trust, it is possible that other risk attributes such as knowledge, control, dread, and newness also contribute to hunters' perceptions of CWD risk (Fischhoff et al., 1978; Sjöberg, 2000a).

There is inconsistency in the conceptualization and measurement of trust. Some researchers contend that trust is multidimensional and consists of dimensions such as caring, responsibility, competence, fairness, and confidence (Johnson, 1999; Poortinga & Pidgeon, 2003). Factor loadings and reliabilities reported here, however, support the unidimensional interpretation of social trust (e.g., Siegrist et al., 2000; Siegrist et al., 2001; Winter et al., 1999).

Findings showed striking similarity across states and other strata (i.e., residency, species) in hunters' responses to perceived similarity, social trust, and risk. CWD prevalence / distribution and management, however, differ among states. Perhaps hunters' risk judgments are similar across states because hunters recognize that CWD transcends borders and continues to be discovered in new locations. Findings here begin to generalize across states and strata, highlighting the value of researching issues on a regional scale whenever possible.

Future Research

To increase the generalizability of these findings, the following research considerations are offered. First, this article examined hunters' personal risks associated with CWD (e.g., becoming ill from CWD); not examined were CWD risks that hunters may attribute to other hunters or the lay public. People tend to believe that they are at less

risk than others (i.e., risk denial) (Sjöberg, 2000a; Slovic et al., 1981). Research is needed to assess whether hunters make similar risk estimates for themselves versus others.

Second, this article investigated hunters' perceptions of similarity, trust, and risk. Research has shown that experts (i.e., scientists, agencies), constituent / interest groups, and the lay public can differ in their perceptions. Experts, for example, tend to judge risks differently and as less severe compared to others (Sjöberg, 1999b). Researchers should consider exploring possible differences in CWD risk judgments among stakeholders.

Third, most studies investigating relationships among risk, social trust, and perceived similarity have focused on the limited number of agencies that are usually responsible for managing a hazard. This scope, however, may be too narrow. Risk perceptions may be influenced by additional sources such as interest groups, media, friends, and family. Perhaps this may be a partial explanation for the mixed results in studies examining relationships between trust and risk (Siegrist et al., 2000; Viklund, 2003; Walls et al., 2004). Effects of other diverse information sources on judgments of risk related to CWD and other natural resource issues warrant research consideration.

Fourth, hunters' perceptions of CWD risk were only partially influenced by trust in wildlife agencies to manage the disease. Researchers have identified various additional determinants of perceived risk including dread, knowledge, control, and newness (see Fischhoff et al., 1978; Sjöberg, 2002; Slovic, 1987 for reviews). In addition, Sjöberg (2002) suggested that risk sensitivity, the predisposition to rate all risks as large, influences perceptions of specific risks. Survey questions were not asked to determine these possible additional dimensions of hunters' perceptions of CWD risk. Research is required to explore the dimensionality of perceived CWD risk.

Fifth, the variables measuring social trust focused on hunters' trust in the agencies to provide CWD information and manage the disease. Future research, however, should consider additional issues that may influence hunters' trust in agencies to address CWD (e.g., trust agencies to provide accurate and timely CWD test results, eradicate CWD by reducing herds) and the extent to which results may be similar to those observed here.

Sixth, identical to most previous research on perceived similarity, social trust, and risk, this article is quantitative and cross-sectional in nature. It is likely, however, that these concepts are dynamic, not static. Longitudinal or panel design studies are needed to obtain time-series data. Studies have found utility in applying qualitative methods to examine these concepts (e.g., Cvetkovich & Winter, 2003; Earle, 2004; Winter et al., 1999). These approaches may be useful for providing depth and detail necessary for delineating underlying influences and dimensions of perceived similarity, trust, and risk.

Finally, the concepts of perceived similarity, social trust, and risk have generated considerable interest in the risk literature, but have received scant attention in natural resource fields. Given the contentious nature of many natural resource issues such as CWD, drawing on the risk literature may facilitate a better understanding of challenges faced by resource managers. This study should be viewed as a starting point in that direction. Researchers are encouraged to address the research needs identified here and to further understand the human dimensions of CWD.

Notes

1. Most risk perception studies involve technologies or activities, which have benefits and negative consequences (e.g., nuclear power provides electricity, but accidents cause human death). Hazards have no obvious benefits (Sjöberg, 1999a). Given that CWD is

similar to TSE diseases that can cause human death, is always fatal in animals, and prevalence is higher among large male animals (i.e., trophy), few hunters would likely contend that CWD has benefits. CWD, therefore, is considered a hazard in this article.

2. The mail survey was pre-tested in each state in 2003 with hunters who purchased a license to hunt in 2002 ($n = 659$). Details are reported in Needham et al. (2004).
3. In addition to tests of direct effects, mediation analyses were conducted (Baron & Kenny, 1986). Mediation was not present in 21 of the 22 strata, as the predictor (similarity) was not initially related significantly to the criterion (CWD risk). Social trust fully mediated the relationship between similarity and CWD risk for Colorado nonresident elk hunters, but the significant initial relationship between the predictor and criterion was weak, $\beta = -.09$, $t = 2.07$, $p < .05$, $R^2 = .01$. Mediation, therefore, was generally not present in this study. For most strata, similarity had a direct effect on trust, which had a direct effect on risk. Similarity was not substantially related to risk.

CHAPTER V. CONCLUSION

The three preceding chapters extended the literature on the human dimensions of chronic wasting disease (CWD) by: (a) describing differences in hunters' behavior and acceptance of management actions in response to potential CWD conditions by state, species, and residency; (b) examining differences in responses among subgroups of hunters based on their degree of hunting specialization; and (c) revealing the extent to which hunters perceive personal risks associated with CWD and the influence of trust in wildlife agencies as a determinant of this risk. This chapter briefly summarizes the major findings of this dissertation and their management, theoretical, and research implications.

Summary of Findings

Human dimensions of CWD research has primarily examined whether hunters would change their behavior in response to CWD by presenting them with hypothetical scenarios depicting relatively low levels of CWD prevalence (e.g., 1%, 5% deer infected) and asking hunters to report their behavioral intentions for each scenario (e.g., continue or stop hunting) (Gigliotti, 2004; Miller, 2004; Vaske, Needham, Newman, Manfredo, & Petchenik, 2006). Few hunters (< 20%) would alter their behavior. Needham, Vaske, and Manfredo (2004), however, found that a large proportion of hunters (up to 65%) across several states would change their behavior if CWD prevalence and human health risks increased. There were, however, limitations of the Needham et al. (2004) study including

a small sample from each state (n = 57 to 129 hunters) that only permitted generalizations to be made about the combined deer and elk hunter population across states.

The second chapter in this dissertation extended the Needham et al. (2004) study by using more extensive data (n = 9,567) to describe: (a) the extent to which CWD influenced people to hunt in other states or quit hunting; (b) hunters' acceptance of lethal and non-lethal strategies for managing CWD; and (c) whether hunters' responses differed by state, residency (resident, nonresident), and species hunted (deer, elk).

Results showed that at current CWD prevalence levels, few hunters would switch states or quit hunting deer or elk. The majority of hunters, however, would change their behavior if prevalence ever reached 50% and humans died from CWD (17% would switch states, 37% would quit). More hunters would give up deer or elk hunting than travel to other states to hunt. Arizona and North Dakota hunters were among the most likely to alter their behavior; Wisconsin hunters were least likely to change. Nonresident hunters were less likely than residents to continue hunting in the state as CWD conditions worsened. Nonresidents would hunt in other states; residents would quit. Deer and elk hunters did not differ in their behavioral responses to CWD. Across strata (state, species, residency), hunters believed that regardless of CWD prevalence and human health risks, testing and herd reduction in affected areas were acceptable strategies for managing the disease; taking no action and allowing CWD to take its natural course were unacceptable.

Chapter three built on the second chapter by segmenting hunters according to their degree of specialization in the activity and examining differences in behavioral responses to CWD among these specialization subgroups. Given that hunting is central to the lifestyle of specialized hunters because they devote more time and effort to the sport,

it was thought that they would be less likely to quit hunting in response to CWD. Hunters were segmented into four specialization groups (casual, intermediate, focused, veteran). Casual hunters were most likely to give up deer or elk hunting; veterans were least likely to quit. Veteran residents were most likely to travel to other states to hunt these species; casual residents were least likely to switch states. For nonresidents, there were few differences among specialization groups in their intention to switch states.

These two chapters examined differences among subgroups of hunters (e.g., state, residency, specialization) in their behavioral responses to hypothetical CWD prevalence and human health risks; not examined was the extent to which hunters actually perceived personal risks associated with the disease. The fourth chapter addressed this knowledge gap. Across states, hunters perceived some personal risks associated with CWD (e.g., become ill from CWD). Theory suggests that risk perceptions are partially influenced by trust in managing agencies, and shared goals, thoughts, and values are foundations of this trust (Earle & Cvetkovich, 1995; Siegrist, Cvetkovich, & Roth, 2000). Hunters perceived slight to moderate similarity with and trust in state wildlife agencies to manage CWD. Perceptions of similarity with the agencies positively influenced trust in these agencies, explaining up to 49% of the variance in trust. Hunters who trusted the agencies perceived less risk associated with CWD, with trust explaining up to 8% of the variance in risk.

Management Implications

Findings in this dissertation provide a better understanding of potential impacts of CWD and offer several implications for management of the disease. First, chapters two and three suggested that because most hunters would continue hunting at relatively low CWD prevalence levels (e.g., $\leq$ 10% deer or elk infected), agencies may experience only

minor declines in revenues from hunting license sales if CWD conditions do not worsen. The majority of hunters, however, would switch states or give up deer or elk hunting if CWD prevalence ever increases dramatically and the disease becomes a threat to human health. Although high prevalence and human death from CWD are unlikely, fewer hunters would cause declines in license revenues, reduced support for wildlife programs and management, negative impacts on cultural and family traditions, and economic instability of communities dependent on hunting (Needham et al., 2004).

Second, these two chapters revealed that among hunters who would change their behavior, most would give up deer or elk hunting permanently rather than travel to other states to hunt these species. This suggests that CWD could have a serious impact on the future of deer and elk hunting if prevalence and / or human health impacts increase.

Third, nonresident hunters were more likely than residents to report that they would travel to other states in response to CWD; residents were likely to quit deer or elk hunting altogether. A decrease in the number of nonresident hunters in a state would substantially impact agency revenues because nonresidents pay higher fees for hunting licenses. Fewer resident hunters would also impact agency revenues from license sales because residents constitute the largest proportion of hunters in most states.

Fourth, chapter three showed that when specialization was considered, up to 61% of newcomers / novice (i.e., casual) hunters would stop hunting permanently in response to CWD (i.e., desertion). This could have dramatic impacts on the future of deer and elk hunting and hunter recruitment. This group, however, represented a minority of hunters. Veterans constituted the largest proportion of hunters and were least likely to quit, but were most likely to travel to other states to hunt (i.e., displacement). Results suggested

that if CWD conditions worsen in a state, the wildlife agency should expect: (a) highest desertion from deer or elk hunting among resident and nonresident casual hunters, (b) highest displacement among resident veteran hunters, and (c) high displacement among nonresident hunters regardless of their specialization in the activity. Taken together, consequences (e.g., revenue decrease, economic instability of communities) of these potential hunting declines and displacement suggest the need for agencies and other stakeholders to engage in long-term proactive CWD planning and management efforts.

Fifth, although hunters agreed that CWD testing and herd reduction in affected areas were acceptable and taking no action was unacceptable (chapter two), surveillance and eradication efforts can be expensive, time consuming, controversial among other stakeholders, and draw resources from other wildlife issues (Heberlein, 2004; Williams, Miller, Kreeger, Kahn, & Thorne, 2002). Managers, therefore, should determine the extent to which various non-lethal and lethal strategies may provide long-term solutions for managing CWD and whether these strategies are logistically and politically feasible.

Sixth, results presented in chapter four showed that hunters shared similar views as state wildlife agencies and trusted these agencies to manage CWD. Hunters, therefore, may be supportive of agency initiatives to manage CWD (e.g., testing, herd reduction) and motivated to attend to agency information campaigns regarding the disease.

Seventh, hunters trusted the state wildlife agencies, but were concerned about their health because of CWD and felt at risk of consuming meat from infected animals and becoming ill from the disease. These findings contradict some agency information campaigns and point to the importance of reinforcing the differences between CWD and

related diseases (e.g., BSE / mad cow, scrapie) and current lack of scientific evidence showing any direct connection between CWD and human health problems.

Finally, results in chapter four revealed relatively weak negative relationships between trust in wildlife agencies and perceived risk associated with CWD. Given that CWD is a wildlife disease that continues to spread to new locations, perhaps hunters trust agencies to manage CWD yet feel there are limits to how much they know and potential risks associated with the disease are beyond agency control. To mitigate hunters' risk perceptions associated with CWD, agencies may need to do more to inform and educate hunters about strategies for managing the disease (e.g., testing, herd reduction).

Theoretical and Future Research Implications

This dissertation's findings also have theoretical implications and highlight issues that warrant future research attention. For example, unlike recent human dimensions of CWD research (e.g., Gigliotti, 2004; Miller, 2004), chapters two and three showed that potential CWD conditions would influence a large percentage of hunters to change their hunting behavior. Moreover, displacement and desertion in response to CWD differed between resident and nonresident hunters, and among subgroups of hunters based on their degree of hunting specialization and the state in which they hunted.

In states where CWD has not been discovered (Arizona, North Dakota), hunters were most likely to travel to other states or stop hunting altogether if CWD prevalence increased dramatically and / or the disease was a threat to human health. Theory suggests that humans attribute high risk to hazards that are new or unknown (e.g., CWD) and this risk can influence behavior (e.g., stop hunting) (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Sjöberg, 2000; Slovic, 1987). In Wisconsin, where hunting has a more

culturally significant history and CWD was found several years ago, hunters were least likely to change their behavior. Research is needed to empirically examine whether state differences in hunters' responses to CWD can be explained by the newness of the disease and the extent to which hunting is a strong tradition in some states.

Chapter three demonstrated that the concept of recreation specialization is useful for segmenting participants in an activity and predicting their behavior (e.g., quit hunting) in response to changes in recreation opportunities and resources (e.g., increasing CWD prevalence). Consistent with past research (Lee & Scott, 2004; McFarlane, 2004), results showed that specialization is multidimensional and best understood in terms of affective (i.e., activity centrality and importance) and cognitive (i.e., skill) dimensions; experience and equipment were less useful specialization measures. Findings also suggested that trajectories of the dimensions are not identical and progress in each dimension does not always increase linearly from low to high in "lock step" manner (Scott & Thigpen, 2003). Focused hunters, for example, spent a small proportion of their lives hunting, but were almost as skilled and committed as veterans. Researchers is required to determine the extent to which comparable groups exist in other recreation pursuits and whether specialization dimensions behave in a similar fashion in studies of other activities.

Results in chapter four were consistent with others studies showing strong positive relationships between perceived similarity and social trust (Siegrist et al., 2000), and relatively weak but systematically negative relationships between trust and personal risk (Sjöberg, 2001; Viklund, 2003). Researchers have identified various additional determinants of perceived risk including dread, knowledge, control, and risk sensitivity (Fischhoff et al., 1978; Sjöberg, 2002; Slovic, 1987). Research is required to explore the

dimensionality of perceived risk associated with CWD. In addition, the concepts of perceived similarity, trust, and risk have received scant attention in the natural resource literature. This dissertation should be viewed as a starting point in that direction.

In chapters two and four, hunters' behavior, acceptance of management strategies, trust in state wildlife agencies, and risk perceptions related to CWD were similar across states. Prevalence, distribution, and management of CWD, however, differ among states. Perhaps responses were similar because hunters recognized that CWD transcends borders and continues to be discovered in new locations. Researchers should examine reasons why responses are consistent across states. Findings begin to generalize across states, highlighting the value of researching issues on a regional scale whenever possible.

Identical to most research on specialization, trust, risk, and the human dimensions of CWD, the three articles in this dissertation were quantitative and cross-sectional in nature. It is likely, however, that these issues are dynamic, not static. Longitudinal or panel design studies are needed to obtain time-series data. Qualitative data may be useful for providing the depth and detail necessary for delineating underlying influences and dimensions of hunters' specialization and their behavior, trust, and risk related to CWD.

The scenarios used to depict CWD prevalence and human health risks were hypothetical and did not necessarily reflect current conditions or consequences to humans. Increased testing of harvested animals (i.e., postmortem sampling), lymphoid and tonsillar biopsy techniques for testing live animals (i.e., antemortem sampling), and in-vitro laboratory experiments of CWD in human cells may provide a more realistic assessment of prevalence levels and human risks (Raymond et al., 2000; Sigurdson et al., 1999; Wild, Spraker, Sigurdson, O'Rourke, & Miller, 2002). Long-term research is

needed to determine the extent to which hunters actually change their behavior in response to actual CWD conditions.

Findings in this dissertation are limited to resident and nonresident hunters in eight states that purchased a license to hunt deer or elk with a gun in 2003. Results may not generalize to individuals involved in other forms of hunting (e.g., archery) or other species with CWD (e.g., moose). The applicability of the results to other activity groups remains a topic for further empirical investigation.

Other theoretical and research implications specific to each of the three articles presented in this dissertation were discussed in each chapter. Overall, this dissertation described the extent to which hunters: (a) would hunt in other states or stop hunting in response to potential CWD conditions, (b) supported various strategies for managing the disease, (c) perceived risks associated with CWD and the influence of trust in wildlife agencies as a determinant of risk, and (d) differed in responses based on specialization, residency, species hunted, and state in which they hunted. This information provided a more comprehensive understanding of the influence of CWD on hunters and should aid managers in addressing the effects of CWD on hunting participation and choosing acceptable strategies for managing the disease. Researchers are encouraged to examine the research needs identified in this dissertation and to implement various theoretical and methodological techniques to further understand the human dimensions of CWD.

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APPENDIX A. IS SPECIALIZATION RESEARCH SPECIALIZED? REVIEW OF LITERATURE ON RECREATION SPECIALIZATION

Introduction

Research on activities such as hiking, angling, wildlife viewing, and camping has revealed a diversity of activity styles, motivations, experiences, and preferences sought by recreationists. This diversity was noted over 35 years ago when Shafer (1969) challenged the myth of the "average camper." Recognizing this diversity, researchers have emphasized the importance of differentiating activity participants into meaningful homogeneous subgroups. The concept of recreation specialization has received considerable attention as a segmentation tool to identify, describe, and plan for these subgroups (see Manning, 1999; Scott & Shafer, 2001 for reviews). This article reviews the specialization literature, summarizes applications and methodological techniques used to investigate the concept, and offers recommendations for future research.

Recreation Specialization Defined

Few lines of recreation and leisure research can trace their roots to a beginning as clearly as recreation specialization. Bryan's (1977) seminal article set the stage for a research agenda that has generated hundreds of journal articles, theses and dissertations, book chapters, and articles in conference proceedings. Recreation specialization is commonly defined as "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences"

(Bryan, 1977, p.175). Using interviews and participant observation, Bryan (1977) identified four types of anglers: occasionalists, generalists, technique specialists, and technique-setting specialists. One end of the continuum included newcomers or infrequent participants who did not consider the activity to be an important life interest and did not show strong preferences for equipment and technique (i.e., occasionalists). At the other end of the continuum were avid participants who were committed to the activity and used sophisticated techniques and equipment (i.e., specialists). Specialization is a developmental process accompanied by skill and knowledge refinement, increasing commitment, shifts in views toward the resource and management, and changes in social group affiliation (McFarlane, 1996).

After more than two decades of empirical attention, Scott and Shafer (2001) slightly revised the definition and argued that specialization be understood in terms of: (a) a focusing of behavior, (b) the acquiring of skills and knowledge, and (c) a tendency to become committed to the activity such that it becomes a central life interest. This approach emphasizes the multidimensional nature of specialization by suggesting that it involves cognitive (i.e., skill level), affective (i.e., involvement), and behavior (i.e., past experience) components (McFarlane, 2004).

Applications of Specialization

Activities

Researchers have applied the tenets of recreation specialization to various activities. The concept has been useful for understanding and segmenting the diversity of recreationists participating in non-consumptive activities including: *hiking* (Graefe, Donnelly, & Vaske, 1985; Heberlein & Dunwiddie, 1979; McFarlane, Boxall, & Watson,

1998; Needham, Rollins, & Vaske, 2005; Virden & Schreyer, 1988; Watson, Roggenbuck, & Williams, 1991; Williams & Huffman, 1985), *boating / river recreation* (e.g., Bricker & Kerstetter, 2000; Cottrell, Graefe, & Confer, 2004; Donnelly, Vaske, & Graefe, 1986; Hammitt & McDonald, 1983; Kuentzel & Heberlein, 1997; Kuentzel & McDonald, 1992; Schreyer & Lime, 1984; Tarrant, Cordell, & Kibler, 1997; Wellman, Roggenbuck, & Smith, 1982; Williams, Schreyer, & Knopf, 1990), *climbing and mountaineering* (Dyck, Schneider, Thompson, & Virden, 2003; Ewert, 1993, 1994; Ewert & Hollenhorst, 1989, 1994; McIntyre, 1992), *running* (Bloch, Black, & Lichtenstein, 1989), *horseback riding* (Hammitt, Knauf, & Noe, 1989), *camping* (McFarlane, 2004; McIntyre, 1989; McIntyre & Pigram, 1992), *contract bridge* (Scott & Godbey, 1994; Scott & Godbey, 1992); *tennis* (Siegenthaler & Lam, 1992), *wildlife viewing / birdwatching* (Cole & Scott, 1999; Hvenegaard, 2002; Lee & Scott, 2004; Manfredo & Larson, 1993; Martin, 1997; McFarlane, 1994, 1996; McFarlane & Boxall, 1996; Scott, Ditton, Stoll, & Eubanks Jr., 2005; Scott, Menzel Baker, & Kim, 1999; Scott & Thigpen, 2003), *snowboarding and skiing* (Ormiston, Gilbert, & Manning, 1998; Thapa & Graefe, 2003; Vaske, Dyar, & Timmons, 2004), *mountain biking* (Needham et al., 2005), *golfing* (Petrick, Backman, Bixler, & Norman, 2001), *windsurfing* (Ninomiya & Kikuchi, 2004), and *heritage tourism* (Kerstetter, Confer, & Graefe, 2001).

Applications of the recreation specialization concept to consumptive activities include *angling* (Bryan, 1977; Chipman & Helfrich, 1988; Choi, Loomis, & Ditton, 1994; Ditton, Loomis, & Choi, 1992; Fisher, 1997; Hammitt, Backlund, & Bixler, 2004; Oh, Ditton, Anderson, Scott, & Stoll, 2005; Salz & Loomis, 2005; Salz, Loomis, & Finn,

2001; Sutton & Ditton, 2001; Vitterso, 1997) and *hunting* (Barro & Manfredo, 1996; Kuentzel & Heberlein, 1992; Miller & Graefe, 2000).

Evaluations

Regardless of the activity examined, researchers have primarily considered specialization to be an indicator of intensity of involvement in the activity and have treated it as an independent variable to examine variation in recreationists' motivations, behavior, and preferences for setting attributes (i.e., dependent variables).

Motivations. Recreation specialization has been frequently applied to examine differences in motivations among subgroups of activity participants. Motivations are specific reasons for visiting an area or participating in an activity at a given time (Iso-Ahola, 1999; Manfredo, Driver, & Tarrant, 1996). Bryan (1977) postulated that more specialized anglers pursued the activity because of intrinsic qualities of the experience such as the natural setting and engaging in the activity with peers who have similar interests and skills. For generalists, however, intrinsic qualities may have been overridden by a concern with the ease of catching a fish. Research on the relationship between specialization and motivations, however, has provided mixed results.

Some studies have supported the notion that more specialized recreationists are motivated to participate because of a complex array of "non-activity specific" reasons (e.g., learning, nature appreciation, experiential), whereas novices are driven simply by "activity specific" motivations (e.g., harvesting animals) (e.g., Ewert, 1994; Kerstetter et al., 2001; Kuentzel & Heberlein, 1992; McIntyre, 1992; Williams et al., 1990). Other research has demonstrated the opposite trend; less specialized users are motivated by appreciation (e.g., to enjoy nature) and affiliation (i.e., to be with others), whereas more

advanced recreationists pursue activities to achieve certain goals and objectives specific related to the activity (e.g., life bird lists, challenge, trophy animal, expertise) (Chipman & Helfrich, 1988; Ewert, 1985; Hvenegaard, 2002; McFarlane, 1994; Petrick et al., 2001; Scott et al., 1999). Scott et al. (2005) recently reported that highly specialized users rated all activity and non-activity specific motivations as more important than casual users did.

Behavior. Studies examining relationships between specialization and behavior have also reported somewhat contradictory results. Research on site choice behavior, for example, has shown that specialists are more likely to choose remote, rugged, and undeveloped trails and sites, whereas less specialized users select easily accessible areas (Heberlein & Dunwiddie, 1979; McFarlane, 2004; McFarlane et al., 1998; McIntyre, 1989). Kuentzel and Heberlein (1992), however, found that specialization was not associated with hunting site choices, concluding that site choice may be a function of constraints (e.g., proximity, family / social role identity, resource availability).

Moreover, specialized participants are less likely to engage in commercially guided trips (Schreyer, Lime, & Williams, 1984) and allow regulations and management actions to stop their participation (Barro & Manfredo, 1996). Specialists are also more likely to practice conservation related behavior (e.g., volunteer, donate, memberships, leave no trace, catch-and-release) (Dyck et al., 2003; Hvenegaard, 2002; McFarlane & Boxall, 1996; Sutton & Ditton, 2001).

Management and setting preferences. Bryan (1977) suggested that management concerns differ among specialization groups. Generalists, for example, supported fish stocking policies; specialists favored habitat management and catch-and-release policies. Some studies of anglers have supported these findings (Chipman & Helfrich, 1988;

Fisher, 1997), but others have found relatively few relationships among specialization and fisheries management strategies (Salz & Loomis, 2005).

Across most studies, specialists tend to prefer primitive and few facilities, as well as regulations that control disturbances such as noise and crowding (e.g., Cole & Scott, 1999; Hammitt & McDonald, 1983; Manfredo & Larson, 1993; Martin, 1997; Schreyer et al., 1984; Virden & Schreyer, 1988; Williams & Huffman, 1985). Casual users, on the other hand, desire facilities / conveniences such as ease of access and maintained trails. Some groups such as campers and whitewater users prefer few regulations and facilities regardless of specialization (Kuentzel & McDonald, 1992; McIntyre & Pigram, 1992).

Crowding and conflict. Studies of relationships between specialization and crowding and conflict have provided mixed results. Researchers have reported that specialists tend to be more sensitive to and report higher levels of crowding and conflict (Graefe et al., 1985; Needham et al., 2005; Vaske et al., 2004). Others, however, have found little association between crowding and specialization, with specialists being among the least likely to care about crowding (Kuentzel & McDonald, 1992; Tarrant et al., 1997). Ninomiya and Kikuchi (2004), for example, reported that windsurfers of all specialization levels enjoyed crowded conditions. In a study of skiers and snowboarders, less skilled users reported the most conflict (Thapa & Graefe, 2003).

Other dependent variables. The concept of recreation specialization has been applied to understand other aspects of recreationists and their experiences such as place attachment, substitutability, willingness to pay, and sociodemographic characteristics. Dimensions of place attachment, especially place identity (i.e., emotional / affective bond

between an individual and a place), can be positively related to degree of specialization (Bricker & Kerstetter, 2000; Williams, Patterson, Roggenbuck, & Watson, 1992).

It could be expected that because specialists have developed skills, are committed to an activity, and have more invested in related equipment, they would be less likely to identify substitute activities that would provide the same satisfaction (Ditton & Sutton, 2004). Studies, however, have found weak relationships between specialization and activity substitutability (Choi et al., 1994; Ditton & Sutton, 2004; Hammitt et al., 2004). Vaske (1980) observed that as hunting commitment increased, participants were more likely to substitute settings than activities. This, however, contradicts Bryan's (1977) suggestion that specialists resist setting changes due to a dependence on a resource.

A study of anglers found a positive relationship between specialization and willingness to pay for angling opportunities; specialists valued trips more and perceived that they had more to lose if opportunities were relinquished (Oh et al., 2005). Research has also shown that highly specialized recreationists are often slightly younger and more educated than their less specialized counterparts (Kerstetter et al., 2001; Martin, 1997; McFarlane, 1996). In a related study, McFarlane (1996) reported that birdwatchers initiated into the activity during childhood tended to be more specialized, suggesting that socialization may be an important determinant of specialization.

Degree and Range of Specialization

One line of specialization research has examined the notions of degree and range of specialization. According to Donnelly et al. (1986), *degree* of specialization refers to a characteristic of an individual and places participants in an activity or subactivity along a continuum from low to high specialization. *Range* of specialization, typically measured

with standard deviations, is the length of specialization continuum (i.e., distance between lowest and highest categories of individuals) A single individual cannot have a range of specialization for an activity, although each contributes to the range. It is hypothesized that degree and range of specialization are inversely related (Donnelly et al., 1986).

A study investigating a typology of boating sub-activities showed that, as hypothesized, sail racers had the highest degree of specialization; motor day-boaters exhibited the lowest (Donnelly et al., 1986). A recent replication of this study reported similar findings (Cottrell et al., 2004). The hypothesized decrease in range of specialization as degree increased, however, was generally not supported in either study.

Examination of hikers and mountain bikers supported the conceptual relationship between degree and range of specialization (Needham, 2002). Visitors at backcountry sites exhibited a high degree and narrow range of specialization in their activity, whereas frontcountry users were less specialized (i.e., degree) and the range of specialization was wider. In other words, backcountry visitors were a homogeneous group of specialized individuals; frontcountry visitors were diverse with varying, but often low specialization.

Among hunting subgroups, archery hunters exhibited the highest degree of specialization; rifle hunters had the lowest (Miller & Graefe, 2000). These results are predictable because most archery hunters consider extensive shooting practice essential for success, engage in preparation activities, and use sophisticated equipment. Rifle hunters, on the other hand, often undertake the sport with less extensive equipment, skill, and preparation. Archery hunting also had the widest range of specialization likely because it requires extensive practice and may take longer to achieve success. Not all hunters are willing to devote the time and effort needed to pursue archery hunting to the

fullest extent, which may explain why they fall at the low end of the specialization continuum. Muzzleloaders had the narrowest range likely because less variation exists in type or amount of equipment and manner of hunt (Miller & Graefe, 2000). Understanding degree and range of specialization is important because it provides evidence of Bryan's (1977) supposition that specialization differences can be found among subtypes of related activities that fall under the umbrella of a larger activity heading (Miller & Graefe, 2000).

Methodological Considerations

Dimensionality of Specialization

Despite this body of specialization research, there remains little consensus about how best to conceptualize and measure the concept (Manning, 1999; Scott & Shafer, 2001). Bryan (1977) himself was not even straightforward on this issue. His commonly cited definition emphasized behavior, but elsewhere he noted the importance of skill and commitment (Bryan, 1977). Recently, Bryan (2000) suggested that specialization involves behavior (i.e., experience) and the centrality of an activity to one's identity.

Since Bryan's (1977) original conceptualization, most studies have measured specialization with behavioral (e.g., experience / years participated) and / or cognitive (e.g., skill) variables. Since McIntyre and Pigram (1992), however, the importance of an affective component (i.e., enduring involvement) has gained recognition as an additional dimension of specialization. Both single-item (e.g., experience; Ditton et al., 1992) and multiple-item approaches to specialization have been employed to segment recreationists. It is generally accepted, however, that specialization is multidimensional, consisting of behavioral (e.g., experience), cognitive (e.g., skill), and affective (e.g., involvement)

dimensions (McFarlane, 2004). No single item is a perfect measure in and of itself (Lee & Scott, 2004). Few studies have measured all three dimensions (McFarlane, 2004).

Common dimensions used to measure specialization include: *skill* (e.g., Cole & Scott, 1999; Donnelly et al., 1986; Lee & Scott, 2004; McFarlane, 2004; Needham et al., 2005; Vaske et al., 2004), *commitment* (Bloch et al., 1989; Kuentzel & Heberlein, 1992; Scott et al., 1999), *investment and equipment* (e.g., Bricker & Kerstetter, 2000; Heberlein & Dunwiddie, 1979; Hvenegaard, 2002; McFarlane, 1994, 1996; McFarlane & Boxall, 1996; Miller & Graefe, 2000; Siegenthaler & Lam, 1992), *centrality* (e.g., Bricker & Kerstetter, 2000; Chipman & Helfrich, 1988; Donnelly et al., 1986; Dyck et al., 2003; Kuentzel & McDonald, 1992; McIntrye, 1989; Wellman et al., 1982), and *involvement* (e.g., Bricker & Kerstetter, 2000; McIntyre, 1989; McIntyre & Pigram, 1992).

One behavioral dimension that has been included in most specialization studies is *past experience* (e.g., Bricker & Kerstetter, 2000; Chipman & Helfrich, 1988; Choi et al., 1994; Ditton et al., 1992; Donnelly et al., 1986; Graefe et al., 1985; Hammitt & McDonald, 1983; McFarlane & Boxall, 1996; McFarlane et al., 1998; Scott & Thigpen, 2003; Wellman et al., 1982). Experience is a measure of exposure to and familiarity with activities and settings (Hammitt & McDonald, 1983), and is often measured with items such as years participated in the activity and times participated in the past 12 months.

Experience use history (EUH), a concept often treated separately from specialization, uses variables to measure recreationists' experience. EUH is defined as the amount and extent of participation by the individual in recreation pursuits; it represents the amount, type, and diversity of information available to the individual through past participation (Schreyer et al., 1984). EUH involves dichotomizing and cross-tabulating

experience variables (e.g., number of visits to area, visits to similar recreation areas, trips made to participate in the activity, years of experience) to reveal subgroups such as: novices, beginners, locals, collectors, visitors, and veterans. EUH has been applied to river activities (Hammitt & McDonald, 1983; Schreyer & Lime, 1984; Schreyer et al., 1984; Williams et al., 1990), horseback riding (Hammitt et al., 1989), hiking (Ewert & Hollenhorst, 1994; Watson et al., 1991; Williams et al., 1992), angling (Hammitt et al., 2004), and golfing (Petrick et al., 2001). It is important to recognize, however, that EUH does not contain several dimensions common to specialization (e.g., skill, equipment).

Specialization research is not always clear about relationships among dimensions and whether variables measure one dimension or another (Kuentzel & Heberlein, 1992; Scott et al., 2005). Involvement, commitment, and centrality, for example, have been considered as separate in some studies (e.g., Dyck et al., 2003; Hvenegaard, 2002; Kuentzel & McDonald, 1992), but synonymous in others (McIntrye, 1989; McIntyre & Pigram, 1992). Centrality to lifestyle has been measured by whether a participant subscribes to activity related magazines, holds memberships in related organizations, and / or owns books related to the activity (e.g., Donnelly et al., 1986; McFarlane, 1994). Others, however, have considered centrality to be related to the extent to which a person's life is organized around an activity (McIntyre, 1989). This has been regarded as a component of involvement in other studies (Bricker & Kerstetter, 2000). Skill has been considered both a single dimension (Needham et al., 2005; Vaske et al., 2004) and has been combined with other dimensions such as past experience (McFarlane, 1994, 1996).

Classification Approaches

The majority of specialization studies have situated recreationists along a single linear continuum using single-items (Ditton et al., 1992) or the sum of standardized *z*-scores of various dimensions (Donnelly et al., 1986; Dyck et al., 2003; Kerstetter et al., 2001; Wellman et al., 1982). This continuum is treated as either continuous (Virden & Schreyer, 1988; Williams & Huffman, 1985) or is subdivided into halves (i.e., median split), thirds, or quartiles to reveal specialization groups (e.g., Donnelly et al., 1986; Dyck et al., 2003; Kerstetter et al., 2001; Tarrant et al., 1997).

Although this summative approach has merits in its simplicity, it is analyzed according to researcher-determined subgroups, assumes that dimensions are related, and obscures variation among and explanatory detail of the separate dimensions (McIntyre & Pigram, 1992; Scott et al., 2005). A single factor confirmatory factor analysis suggested that additive, single item approaches to specialization may be inappropriate (Lee & Scott, 2004). Researchers have proposed that specialization dimensions should be measured separately and examined for their individual, not additive or combined effects on the dependent variables in question (Bricker & Kerstetter, 2000; Kuentzel & Heberlein, 1992; Kuentzel & McDonald, 1992; Scott et al., 1999; Scott & Thigpen, 2003). A study of birdwatchers, for example, showed that behavior, skill, and commitment do not always progress linearly in "lock step" fashion (Scott & Thigpen, 2003). Some recreationists may have a propensity to participate regularly and become committed to an activity, but exhibit little evidence of skill; others may participate infrequently yet display attributes of skill and commitment (Scott & Shafer, 2001). This is important because Bryan's (1977)

original conceptualization of recreation specialization implies a *progression* in behavior, not just a measure of intensity of activity involvement (Scott & Shafer, 2001).

Most specialization studies are quantitative and cross-sectional in nature. One-shot case studies limit the ability to empirically examine progression in an activity over time. Qualitative research on contract bridge players, however, suggests that many participants do not even desire or strive to progress in an activity (Scott & Godbey, 1992, 1994). Given that the trajectory of all specialization dimensions is not always in a "lock step" fashion from low to high, coupled with the lack of desire of some users to progress, the primary utility of the concept may be its ability to reveal styles of involvement and career stages / paths in an activity (Scott & Thigpen, 2003).

Contrary to summative or other single dimension approaches, the use of cluster analysis to create empirically based subgroups of participants in an activity introduces less researcher bias and does not assume that individual dimensions of specialization covary. It is, therefore, a more effective approach for identifying and describing types of recreationists within an activity (McFarlane, 1994, 1996, 2004; Scott et al., 2005; Scott & Thigpen, 2003). Multivariate statistical techniques, however, often demand a certain amount of analytical training and expertise, and necessitate multiple survey items that may increase respondent burden.

Recent research, therefore, has explored the utility of a self-classification measure of recreation specialization. Scott et al. (2005), for example, provided definitions of "committed," "active," and "casual" birders and asked respondents to select the category that they felt was most representative of their birding specialization. Results suggest that

the method was successful and stronger in predicting motivations compared to other common approaches (e.g., additive, cluster analysis).

Related Concepts

Studies have conceived specialization in terms of related concepts such as involvement, loyalty, commitment, social worlds, serious leisure, and flow. Each of these concepts overlaps with specialization and has been treated as both separate from and synonymous with specialization. McIntyre (1989), for example, considered involvement and commitment to be the same. Others, however, have treated these as separate and used them as dimensions in specialization indices (Siegenthaler & Lam, 1992). This section briefly defines and summarizes these related concepts; readers are directed to other sources for more detailed reviews (e.g., Buchanan, 1985; Iwasaki & Havitz, 1998; Kim, Scott, & Crompton, 1997; Kyle, Graefe, Manning, & Bacon, 2004).

Involvement

Social-psychological involvement. Leisure involvement (i.e., ego, enduring) is often defined and operationalized in social-psychological terms. Involvement is typically defined as an unobservable state of motivation, arousal, or interest toward an activity or associated product (Havitz & Dimanche, 1997). It is an internal state that indicates the amount of arousal, interest, or drive evoked by a stimulus or situation (Kim et al., 1997). In lay terms, for example, we often speak of people who are "really into golf" or "live to ski" when describing involved individuals (Havitz & Mannell, 2005).

Disagreement exists regarding important dimensions, but most researchers suggest that components or antecedents of involvement include: (a) attraction / importance / pleasure (importance / interest in activity or product and pleasure derived

from participation or use; e.g., "hunting is a pleasure for me," "I attach great importance to hunting"), (b) sign value (unspoken statements that participation conveys about a person; e.g., "hunting gives others a glimpse of the type of person I am"), (c) centrality to lifestyle (central role of activity in an individual's life and social contexts such as friends / family centered around the activity; e.g., "hunting is a large part of my life"), (d) risk probability (perceived probability of making a poor choice in participation; e.g., "when choosing a place to go hunting, I feel at a loss to make the right choice"), and (e) risk consequence (negative consequence in the case of making a poor choice; e.g., "it upsets me if I go hunting somewhere that is not suitable"). Although there are numerous sources of risk (e.g., social, financial, physical), these risk dimensions have consistently proven to be among the weakest determinants of activity involvement (Iwasaki & Havitz, 1998).

In a study of camper specialization, McIntyre and Pigram (1992) measured involvement with attraction (i.e., interest, enjoyment), self expression (i.e., identity affirmation from participation), and centrality (i.e., position activity occupies within the context of an individual's lifestyle) dimensions. An activity is a central life interest if the individual's lifestyle, identity, and social networks are constructed around it (Kim et al., 1997; Scott & Shafer, 2001). Although an individual may be highly involved in an activity (i.e., the activity is attractive to an individual, a central life interest, and he or she worries about making poor participation decisions), they may or may not be highly skilled or progressing to specialized stages in the activity (Havitz & Dimanche, 1997).

Behavioral involvement. Specialization and behavioral loyalty (discussed below) are forms of behavioral involvement. Behavioral involvement is defined as the time and / or intensity of effort expended in pursuing an activity (Kim et al., 1997). Measures of

behavioral involvement include experience related items such as those common to EUH, as well as activity related subscriptions, books, and memberships. Unlike the social-psychological interpretation of centrality (i.e., central role of activity in life), these items have often been treated as measures of centrality to lifestyle in recreation specialization indices (e.g., Donnelly et al., 1986; McFarlane, 1994).

Commitment

There is little agreement in the literature regarding relationships between involvement and commitment (Kim et al., 1997). Involvement may be an antecedent of commitment, and commitment may lead to behavioral loyalty (Iwasaki & Havitz, 1998). Commitment is defined as "personal and behavioral mechanisms that bind individuals to consistent patterns of leisure behavior" (Kim et al., 1997, p. 323). Commitment can be understood in terms of dedication, conviction, centrality, costs, and social considerations (Buchanan, 1985; Kim et al., 1997). In other words, commitment entails social and financial investments made by recreationists that may bind them to certain activities (i.e., side bets) (Kyle et al., 2004). Kim et al. (1997), for example, measured commitment with survey items such as "because of birding, I do not have time to spend participating in other leisure activities" and "I would rather go birding than do most anything else." It can be argued that commitment is somewhat analogous to the centrality dimension of activity involvement. Scott and Shafer (2001) suggested that "people who develop strong personal and behavioral commitment to a leisure activity probably regard the activity as a central life interest" (p. 330). Regardless, commitment may be thought of as occurring as a result of involvement, and commitment, in turn, may lead to loyal behavior.

Loyalty

Originating in the marketing literature, loyalty can be defined as biased behavior expressed over time by an individual with respect to one or more alternatives; it is considered to be a two dimensional construct comprised of psychological / affective attachment and behavioral consistency dimensions (Backman & Crompton, 1991). Highly loyal individuals exhibit strong affective and behavioral responses. Spuriously loyal individuals have strong behavioral consistency, but weak affective attachment. Latent loyalty describes those with strong affective attachment, but weak behavioral loyalty. Weak loyalty refers to individuals with low affective and behavioral responses. Resistance to change is an important antecedent of loyalty (Iwasaki & Havitz, 1998; Kyle et al., 2004). Loyalty research is often centered on participants' patronage of specific recreation facilities or loyalty to selected activities, not necessarily progression of skill and behavior as implied by the recreation specialization concept (Backman & Shinew, 1994; Bryan, 1977). Not surprisingly, loyalty is related to place attachment dimensions such as place identity (i.e., emotional bond between an individual and a place) and place dependence (i.e., aspects of a place that satisfy needs and goals) (Kyle et al., 2004).

Social Worlds

An element of Bryan's (1977) conceptualization of specialization suggested the role of "leisure social worlds." Unruh (1979) defined a social world as "an internally recognizable constellation of actors, organizations, events, and practices, which have coalesced into a perceived sphere of interest and involvement" (p. 115). A leisure social world is a reference group of participants who share a common degree of specialization and help to define preferences, norms, and meanings of behaviors and experiences

associated with such levels of specialization (Manning, 1999). Social worlds: (a) are enacted and arise through effective yet often informal communication (e.g., guide books, equipment catalogues); (b) vary in size, shape, amount of personal interaction, stability, and level of formal organization; (c) can be differentiated into smaller, specific sub-worlds; and (d) contain people that belong to other social worlds in their life (Kyle & Chick, 2002; Scott & Godbey, 1992). According to Bryan (1977), recreationists evolve along the specialization continuum, in part, as a function of assimilating the specialized nature and shared expectations of the related social world. Ditton et al. (1992) suggested that specialization be reconceptualized as a process whereby recreation social worlds and sub-worlds segment and intersect into new sub-worlds that can then be ordered along a continuum from least to most specialized. Given the complex nature of specialization and social worlds, and the difficulty in measuring these concepts, it is unlikely that such a linear trajectory of social worlds exists or could be measured (Scott & Thigpen, 2003).

Ditton et al. (1992) used a single item of past experience (i.e., frequency of participation) in their conceptualization of social worlds. Recognizing limitations of a single item approaches, Salz et al. (2001) developed a four question index (four responses per question) to measure angler specialization in a social worlds context. These questions addressed dimensions including: (a) orientation toward the activity (e.g., "I am an outsider; I do not really feel like I am part of the fishing scene"), (b) experience (e.g., "I am a facilitator in the sport; I encourage, teach, and enhance opportunities for others"), (c) relationships with other participants (e.g., "I have personal and close relationships with other anglers; these friendships often revolve around fishing"), and (d) commitment (e.g., "I am totally committed to fishing"). Responses to each item are summed to create

a single index (from 4 to 16). This index has been used in a recent study of anglers (Salz & Loomis, 2005). Given the limitations of single continuous indices (e.g., dimensions may not covary or progress in a similar linear fashion), caution should be exercised when interpreting and generalizing results from studies using this approach. Research should examine the individual effects of each item on the dependent variables in question. Regardless, this is one approach for measuring specialization in a social worlds context.

Serious Leisure

Serious leisure is closely related to recreation specialization, as it is typically defined as "the systematic pursuit of an amateur, hobbyist, or volunteer activity that participants find so substantial and interesting that, in the typical case, they launch themselves on a career centered on acquiring and expressing its skills, knowledge, and experience" (Stebbins, 1999, p. 69). Conversely, casual or unserious leisure is an immediately intrinsically rewarding and relatively short-lived pleasurable activity that necessitates little or no special expertise or training to enjoy (Stebbins, 1999). Serious leisure is defined by: (a) need to persevere, (b) finding a career in the activity even though it can be shaped by turning points and stages of achievement, (c) personal effort acquired through training and skill, (d) benefits and rewards (e.g., self-actualization, self-expression), (e) personal identification with the activity, and (f) a unique ethos / social world that develops around the individual's pursuit of the activity (Stebbins, 1999).

A qualitative study of University of Florida football fans (Gibson, Willming, & Holdnak, 2002) confirmed these characteristics of serious leisure: (a) perseverance (e.g., being a fan means persisting in support of the team through winning and losing, not leaving the stadium early in the face of defeat, and not jumping on / off the bandwagon);

(b) careers (e.g., most respondents were fans for over 20 years, graduating from casual fans without season tickets to season ticket holders); (c) personal effort (e.g., organizing tailgate parties, being knowledgeable about the team, traveling long distances to games); (d) benefits (e.g., family time and friendships made over the years, being ecstatic and jubilant over a win); (e) identification (e.g., decoration of clothes and vehicles in team colors, resentment for supporters of other teams); and (f) unique ethos (e.g., belonging to regional clubs, following the media closely). However, unlike specialization where the individual has a certain degree of control over behavioral components such as equipment purchases and skill acquisition, serious leisure tends to be uncontrollable.

Flow

Flow is defined as a state of optimal or peak experience, as determined by a balance of challenges offered by an activity and skill / specialization in the activity without indication of anxiety, boredom, or worry (Csikszentmihalyi & Kleiber, 1991; Jones, Hollenhorst, & Perna, 2003; Manfredo & Driver, 2002). Elements of flow include: (a) complete attention given to the activity at the present moment and actions become automatic, (b) goals of participation are defined and feedback is immediate, (c) full concentration on the task, (d) control over actions and the setting, (e) loss of self-consciousness in which an individual becomes one with the activity, and (f) time is transformed where it is altered by the rhythm of activity rather than reference to time of day. Indicators of flow include positive mood, freedom of choice, intrinsic motivation, concentration, competence, and awareness. The four channel flow model predicts a match of challenges and skills: (a) flow (high challenge and skill), (b) anxiety (high challenge, low skill), (c) boredom (high skill, low challenge), and (d) apathy (low challenge and

skill). Flow is measured using the experience sampling method (ESM), which involves prompting subjects to complete a form several times a day for a duration of time to capture immediate experiences (Csikszentmihalyi & Kleiber, 1991). Flow may be related to specialization in that it may indicate the optimal experience where specialization in an activity matches the challenges offered by the activity and / or setting in which it occurs.

Management Applications, Limitations, and Future Research

Management Applications

Recreationists are heterogeneous; they are characterized by diverse activity styles, motivations, experiences, and preferences. Recognizing this diversity, researchers have found utility in the concept of recreation specialization to differentiate users into smaller, homogeneous, and more meaningful subgroups (McFarlane, 2001; Scott & Shafer, 2001).

For managers, the primary use of specialization is that it can assist in developing (or not developing) programs, facilities, activities, and experiences specific to a target clientele group (Manfredo & Larson, 1993; McFarlane, 1994). In other words, a variety of experiences can be understood and accounted for, and management and marketing can be tailored to meet these needs. Martin (1997) suggested that results from specialization studies can be used to allocate, develop, and manage recreation opportunities to provide a spectrum of settings and ensure that the needs of diverse publics are met. Ski area managers, for example, segment ski runs in the winter according to skill (e.g., green runs for "novices," black diamond runs for "experts"). Separating use in this fashion allows: (a) the potential for reducing conflict between highly skilled and less experienced participants, and (b) recreationists of differing specialization levels to engage in their activity in the type of setting desired (Needham et al., 2005). Data from specialization

studies can be used to inform management planning frameworks such as the recreation opportunity spectrum (ROS), which identifies a range of settings across a spectrum from, for example, primitive to semi-primitive motorized to urban (Driver, Brown, Stankey, & Gregoire, 1987). ROS is a zoning classification scheme defined by opportunities that reflect diversity in settings and recreationists' activities, preferences, and experiences.

According to Bryan (2000), the majority of recreationists in many activities define the middle or lower end of the specialization continuum; these people may have little knowledge and sensitivity about resource management issues. Managers need to be aware of pressures from this majority public opinion versus the views of specialists possibly advocating different actions. In other words, popular opinion may be at odds with sound management. "The larger numbers of occasional and generalist sportsmen thus may advocate fish and game stocking over habitat management, while specialists argue the reverse; managers risk charges of unwise policy on one hand and pandering to the wishes of elite constituencies on the other" (Bryan, 2000, p. 20).

Assuming that recreationists do progress in activities, as suggested in Bryan's (1977) original conceptualization of specialization, it may have pronounced impacts on management. Williams (1988), for example, suggested that if specialization increases, the public will become more sophisticated in activities and use of related settings. As a result, people may be more demanding about what they expect from settings and management, and may expect a greater voice in decision making. Williams (1988) contends that the silver lining is that a more committed, specialized, or sophisticated clientele may behave more appropriately in recreation settings such as parks and wilderness, and may be more

receptive to management information designed to make users aware of the consequences of their actions. Long-term research is needed to determine if these assertions are correct.

Limitations and Future Research

Despite the management utility of specialization, there are limitations associated with the concept. First, there is inconsistency in dimensions used to measure the concept and approaches employed to segment respondents. There has also been a dearth of qualitative research on specialization (Bryan, 1977; Heberlein & Dunwiddie, 1979; Kyle & Chick, 2002; Scott & Godbey, 1994; Scott & Godbey, 1992). Perhaps qualitative data could provide the depth and detail necessary for delineating underlying dimensions of specialization. Comparing self-classification measures to traditional researcher-based segmentation approaches (e.g., cluster, summative) is a promising avenue for researchers examining segmentation approaches (Scott et al., 2005). More research is needed to substantiate and generalize findings from studies using self-classification measures.

Second, it is recognized that the original conceptualization of specialization implied a developmental process (Bryan, 1977). In 1986, Donnelly et al. suggested that "the progression of recreationists through levels of specialization over time represents another topic for future study" (p. 93). Research, however, has yet to be undertaken to test the extent to which recreationists may progress to more advanced levels of skill and involvement over time (Scott & Shafer, 2001). Specialization studies tend to be cross-sectional. Longitudinal and panel design studies, as well as the funding necessary to conduct research on progression are required (McFarlane, 2001). This may reveal the extent to which recreationists may or may not progress along a specialization continuum in both directions depending on circumstances (Manning, 1999).

Researchers, however, suggest that recreationists in some activities may not desire to progress over time and may maintain involvement at a relatively fixed level or actually decrease their participation over time (Scott & Godbey, 1994; Scott & Shafer, 2001). This casts some doubt on the original conceptualization of specialization. Moreover, the assumption that underlies many specialization studies is that dimensions used to measure the concept are positively correlated and rise and fall in a predictable linear fashion (Manning, 1999). If this was true, the summative indices calculated in these studies would be appropriate. Researchers have shown, however, that dimensions do not behave in "lock step" fashion (e.g., Bricker & Kerstetter, 2000; Kuentzel & McDonald, 1992; Lee & Scott, 2004; Scott & Thigpen, 2003). A hunter, for example, might report low participation rates due to family obligations or other constraints. This hunter may still be committed, skilled, and report high equipment expenditures. This suggests the need to continue examining the influence of individual measures and dimensions that comprise recreation specialization indices (Manning, 1999).

Kuentzel (2001) suggested that the notion of progression in an activity may be too rigid to apply in contemporary society. He stated that modernity emphasizes leisure diversification over standardization. Novice and expert users may renegotiate and modify meanings of competence and desired outcomes of experiences. Commercialization of leisure uses marketing and technologies to make activities reproducible for a wider array of participants, thus possibly redefining an activity's specialization continuum and diluting the importance attached to expert status. These forces also generate branches of traditional activities. Instead of progressing through stages of participation in certain activities, participants may sample from an increasingly diverse number of opportunities.

Participants may favor diversity of experiences across activities rather than improved experiences with each repeat engagement in a single activity; others may create their own variation of a traditional activity based on the specific engagement context and setting.

Moreover, Kuentzel (2001) suggests that specialization implies that participants pass through a progression of behavior and levels of commitment where competence at one stage leads to behavior at the next. It implies a pinnacle of progress achieved by few, but perceived by those "below" as the ultimate target. Recreation and leisure, however, may be characterized by diversity and expanding opportunity. If so, participation does not always imply progress toward an ultimate pre-established objective. Instead, participation may be characterized by multiple trajectories from a single starting point. He states that some anglers may progress from worm fishing to fly fishing, but it may be possible to specialize in worm fishing. This may not be a lack of commitment or desire that is stalling an individual on an activity's specialization continuum; it may be a rejection of the existing continuum in favor of an alternative trajectory. Kuentzel's (2001) ideas are interesting and suggest avenues for future research related to recreation specialization.

Third, the concept may be confounded by attempts to determine specialization in activities that are hard to define or overlap. For example, hiking, photography, wildlife viewing, and climbing are related and may overlap on a single recreation outing. Asking recreationists a battery of specialization questions pertaining to each activity increases survey length and the chance for respondent burden and confusion. Creating appropriate specialization measures that sort through overlapping activities warrants attention.

Fourth, specialization and similar / related concepts such as involvement, serious leisure, commitment, and flow have typically been examined and treated separately.

Perhaps more should be done to integrate research on these related concepts. Recent studies have moved in this direction, which is encouraging (e.g., Bricker & Kerstetter, 2000; Havitz & Mannell, 2005; Iwasaki & Havitz, 1998; Kyle, Bricker, Graefe, & Wickham, 2004). Integrative approaches may enrich our understanding of these concepts.

Fifth, some variables and dimensions used to measure specialization may be problematic. Equipment, for example, is perceived to be of high interest and importance to highly specialized participants. Bloch et al. (1989), however, found little relationship between equipment investment and specialization. More specialized recreationists may wish to use older or less sophisticated equipment, perhaps to increase the challenge or demonstrate their skill. Conversely, novices or casual users may choose modern and expensive equipment for safety reasons or to make the task easier. Depending on socio-economic status, these individuals may also purchase elaborate equipment to improve their sign value or status among peers and other social world members.

Experience is often measured by "years of participation in an activity" (e.g., Hammitt & McDonald, 1983; Schreyer et al., 1984). There is, however, a collinearity problem between years of participation and age, which researchers often fail to account for. Age should be controlled in these experience measures (e.g., years participated / age * 100 = proportion of life participated). In addition, more "days of participation" may not imply a high degree of specialization. Hunting regulations, for example, often permit only one or two animals to be harvested in a given year. Skilled or specialized hunters may reach their limit earlier, thus would have a lower participation rate compared to unsuccessful hunters. Furthermore, asking recreationists specialization questions related to the activities in which they participated in most often automatically biases the sample

toward specialized participants. Finally, concerns regarding EUH measures include: (a) dichotomizing continuous variables constrains their variance, (b) the cutpoints used to dichotomize the variables are researcher-determined and often arbitrary, and (c) a person may be categorized as a novice at the study location and a veteran somewhere else, but research has not examined EUH in the same individuals across various settings.

Sixth, many recreation studies, especially those employing survey methods, require participants to be 16 or 18 years of age and older (Manning, 1999). This sampling strategy may influence the distribution of participants classified into different recreation specialization groups, as it is likely that the proportion of novices or casual participants in the sample is lower than what actually exists in the population. Younger people may have lower rates of experience and due to financial constraints, may lack the ability to purchase necessary equipment. Research is needed to determine the extent to which these sampling strategies may bias results of specialization studies.

Finally, the title of this article asks "is recreation specialization research specialized?" There is no clear answer to this question. Since Bryan's (1977) seminal article, the concept has received considerable attention. Researchers have applied specialization to many activities and found it useful for explaining recreationists' diverse motivations, preferences, and experiences. New dimensions of specialization continue to be discovered and new methodological techniques applied. Based on the discussion here, however, it is likely that much work remains before researchers would agree that our understanding of this complex topic is "specialized."

Summary of key empirical articles addressing recreation specialization

Authors	Date	Activities	Specialization measures	Segmentation strategy	Dependent variables	Major findings
Bryan	1977	Anglers	Equipment, species, management, social groups, activity history, resource orientation	Qualitative: interviews, observations	NA	Specialized over time; specialists more preservation and conservation oriented and want particular resources and settings
Heberlein & Dunwiddie	1979	Anglers, hikers	Equipment, age, behavior	Qualitative: observations	Behavior: site selection	Specialists select more remote sites
Wellman et al.	1982	Canoeists	Investment, experience, centrality indices	Additive; high, low quartiles	Depreciative behavior	Specialization unrelated to depreciative behavior norms
Hammitt & McDonald	1983	River floaters	EUH: years floated, times floated / summer	Additive; low, medium, high	Impacts, management	Specialists sensitive to impacts, want management not facilities
Schreyer et al.	1984	River users	EUH: times floated, rivers floated, trips made	Additive; novice, begin, local, collector, visitor, veteran	Behavior, motives, management, conflict	Differences among groups: behavior (guided), motives (novice: new things), conflict (novice: low), management (veteran: prefer)
Schreyer & Lime	1984	River floaters	EUH: floated river, trips on other rivers	Additive; low, medium, high	Motives, experiences	Experienced users less tolerant of encounters
Ewert	1985	Climbers	Single item: skill level	Single item: skill level groups	Motives	Experienced motives: challenge, control; novices: socialization
Graefe et al.	1985	Hikers	Years hiking, skill, times hiking per year	Additive; low, medium, high	Crowding, encounters	Specialists more crowded, preferred to see fewer
Williams & Huffman	1985	Hikers	Equipment, experience, centrality (10 items)	Additive; high, low quartiles	Trail use redistribution	Specialists prefer difficult, less marked, accessible trails

Summary of key empirical articles addressing recreation specialization (*continued*)

Donnelly et al.	1986	Boating sub-groups (indep.)	Experience, skill, equipment, centrality	Additive; low, medium, high	Specialization for each sub-activity	Differences in degree of specialization, not range of specialization among boating activities (e.g., sail, racers, day boaters)
Chipman & Helfrich	1988	Anglers	Resource use, experience, investment, centrality indices	Cluster analyzed dimensions	Motives, management	Specialists: trophy, catch / release, low catch limits; Novices: socialization, high catch limits
Virden & Schreyer	1988	Hikers	General and recent experience, equipment investment, centrality	Additive, not segmented	Setting attribute preferences	Specialist: rugged terrain, primitive, wildlife, no noise/encounters, re-vegetation. Novices: access, maintained trails, conveniences
Bloch et al.	1989	Runners	Commitment, experience	Structural equation modeling	Equipment	Equipment not related to specialization, experience, involvement
Hammitt et al.	1989	Horse riders	EUH: years ride, ride / year, ride 5 years; skill	Additive, weighted by site	Facility preferences	EUH better than skill; indices better than self-reported skill
McIntyre	1989	Campers	Involvement: attraction, expression, centrality	Factor scores	Behavior: site selection	Involvement related to behavioral choice of site selection
Williams et al.	1990	River users	EUH: total river trips, rivers run; trips on river	Additive: EUH groups	Motives	Increasing and more complex motives as EUH increases
Watson et al.	1991	Hikers	EUH: experience, trips / year general and site	No index, analyzed separately	Setting attributes	Fewer but broader attributes for experienced users
Ditton et al.	1992	Anglers	Single item: annual frequency of angling	Single item: quartiles	Resources, motives, media	Specialized: high use of media, more non-activity specific motives
Kuentzel & Heberlein	1992	Hunters	Experience, commitment, centrality, technique, media involvement indices	Factor analysis, composite indices, analyzed separately	Behavior: site selection; Motives / satisfaction	Specialization did not predict site selection (constraints predicted site choice); novices: bagging game, specialists: intrinsic qualities

Summary of key empirical articles addressing recreation specialization (*continued*)

Kuentzel & McDonald	1992	River users	Experience, centrality, importance indices	Factor analysis, composite indices, analyzed separately	Motives, crowding, management	Specialization increases, preferences for management drops; no relationship to crowding; dimensions do not traject in same way
McIntyre & Pigram	1992	Campers	Experience, familiarity, attraction, expression, centrality indices	Cluster analyzed dimensions	Management, detracting experiences	Centrally involved / experienced most familiar with area and critical of fees, regulations, vehicle-based access
McIntyre	1992	Climbers	Climb routes, skill, importance of involvement	No index, analyzed separately	Motives	Intrinsic motives increased with involvement, not skill or expertise
Scott & Godbey	1992	Bridge players	Social versus serious reference frames	Qualitative: interviews	Recruitment, setting, game	Group / individual differences better as dichotomy, not continuum
Siegenthaler & Lam	1992	Tennis players	Skill, experience, equipment	No index, analyzed separately	Commitment, involvement	Equipment not skill related to commitment / involvement
Williams et al.	1992	Hikers	EUH: experience measures	Additive	Place attachment	Place attachment and EUH strongly and positively related
Ewert	1993	Climbers	Climb routes, skill	No index, analyzed separately	Motives, group type	Solo climbers more motivated by risk and are more specialized
Manfredo & Larson	1993	Wildlife viewers	Motivations	Cluster analysis	Constraints, management, media, setting preferences	Clusters called high involvement, creativity, generalist, occasionalist based on differences reflected in items measured
Choi et al.	1994	Anglers	Single item: annual frequency of angling	Single item: quartiles	Substitutability, social group	No relationship between substitutability and specialization, except for non-family anglers: more specialized less substitutes
Ewert	1994	Climbers	Climb routes, skill	No index, analyzed separately	Motives	Experienced: less mechanical (learning), more intrinsic motives

Summary of key empirical articles addressing recreation specialization (*continued*)

Ewert & Hollenhorst	1994	Climbers, boaters	EUH experience measures, skill, involvement, locus of control	No index, analyzed separately	Setting attributes	Specialists: natural / remote, solitude, small groups, reliance on equipment, risk taking,
McFarlane	1994	Birdwatchers	Experience, centrality, equipment	Cluster analyzed dimensions	Motives	Advanced: achievement motives, Casual: appreciative motives
Scott & Godbey	1994	Bridge players	Social versus serious reference frames	Qualitative: interviews	Recruitment, setting, game	Resisted, did not desire becoming specialized; progress debated
Barro & Manfredo	1996	Hunters	Centrality, skill, equipment, social, experience	Composite indices	Behavior: participation	Experienced / specialized: more likely to hunt after regulations
McFarlane	1996	Birdwatchers	Experience, centrality, equipment	Cluster analyzed dimensions	Initiation age, social group	Advanced: started younger; socialization drives specialization
McFarlane & Boxall	1996	Birdwatchers	Experience, centrality, equipment	Cluster analyzed dimensions	Behavior: conservation	Advanced: teaching, donations, memberships, time increased
Fisher	1997	Anglers	Experience: years, days; resource preference	Cluster analysis	Club member, tournament participation, management	Years experience did not increase with specialization, dimensions do not traject in same way. Specialists: clubs, tournaments
Kuentzel & Heberlein	1997	Sailors	Participation, experience, behavior, commitment	Factor analysis, composite indices, analyzed separately	Social status, development	Developmental continuum of specialization supported (not own boat to membership); specialization unrelated to social status
Martin	1997	Wildlife viewers	Experience, studied / made notes about wildlife, equipment, wildlife survey count	Criteria 1 item: intermediates; 2 items: specialists	Demographics, site attributes, trip definition	Specialists: stay longer, spend more, younger, educated, visited to see wildlife, interest in low profile species, few people / facilities
Tarrant et al.	1997	River users	Experience, skill, private / commercial	Additive; low, medium, high	Crowding, encounters	Specialists least likely to care about encounters or crowding

Summary of key empirical articles addressing recreation specialization (*continued*)

Vitterso	1997	Anglers	Single item: river importance in offering challenging fishing opportunities	Single item: thirds	Characteristics of perfect experience, flow	Specialists: experienced, equipment, big fish, habitat management, solitude, stayed longer, positive and intense feelings / flow
McFarlane et al.	1998	Hikers	Site experience, general experience	Additive, analyzed separately	Behavior: site selection	Experienced used choose more difficult, less managed trails
Ormiston et al.	1998	Skiers	Single item: skill	Single item: skill level groups	Norms	Skilled: less sensitive to lift ticket costs
Cole & Scott	1999	Birdwatchers	Skill, experience, expenses, behaviors	No index, analyzed separately	Media, setting preferences	Specialists discriminating in resource orientations, preferences
Scott et al.	1999	Birdwatchers	Involvement, commitment: skill, birds seen	No index, analyzed separately	Motives	Involvement, commitment related; specialists: search birds, social
Bricker & Kerstetter	2000	River users	Experience, skill, centrality, involvement, equipment	Additive for each dimension; analyzed separately	Place attachment	Specialists more likely to agree with importance of place identity and lifestyle, but not place dependence
Jones et al.	2000	Park visitors	EUH: first trip, times / year, visits last 3 years	Additive: EUH groups	Preferences, belonging	Regulars, locals higher sense of belonging
Miller & Graefe	2000	Hunter sub-groups (indep.)	Experience / participation, skill, equipment, lifestyle	Additive for each sub-activity	Specialization for each sub-activity	Archery: highest degree and range of specialization; rifle: lowest degree, muzzleloaders: lowest range
Kerstetter et al.	2001	Heritage tourists	Experience, involvement, investment	Additive; low, medium, high	Demographics, behavior, motives, satisfaction	Specialists: educated, repeat visitors, more sites, learning, authenticity important, visit other sites, more satisfied
Petrick et al.	2001	Golfers	EUH: rounds played, courses played	Additive: EUH groups	Constraints, motives	Locals: leisure motives, Veterans: competition; Visitors: status

Summary of key empirical articles addressing recreation specialization (*continued*)

Salz et al.	2001	Anglers	4 social world questions: orientation, experiences, relationships, commitment	Additive	Participation, experience	Results provide strong support for social worlds specialization scale developed here
Sutton & Ditton	2001	Anglers	EUH, skill, centrality	Additive, analyzed separately	Behavior: catch / release	Specialists: catch and release conservation behavior and attitudes
Hvenegaard	2002	Birdwatchers	Equipment, experience, proportion trip birding	Cluster analysis	Behavior: conservation; demographics, motives	Specialists: members of groups, higher conservation fees, older, wealthier, male, interested in only birding (activity-specific)
Dyck et al.	2003	Climbers	Experience, equipment, skill, centrality	Additive; low, medium, high	Environmental attitudes, behavior: leave no trace	Specialists: low impact practice behavior, no differences in environmental NEP attitudes by specialization
Scott & Thigpen	2003	Birdwatchers	Experience, skill, commitment	Cluster analysis	Birder, trip characteristics	Skilled / active: travel far, more trips, more spent, bird list; casual: other activities, places, access; dimensions not traject in same way
Thapa & Graefe	2003	Skiers, snow-boarders	Single item: skill	Single item: dichotomized to high, low	Conflict, tolerance	Less skilled: experienced more conflict, less tolerant. Contradicts past research
Cottrell et al.	2004	Boating sub-groups (indep.)	Experience, skill, equipment, centrality	Additive; low, medium, high	Specialization for each sub-activity	Differences in degree of specialization, not range of specialization among boating sub-activities (e.g., sail, racers, day boaters)
Ditton & Sutton	2004	Anglers	Experience, skill, equipment	No index, analyzed separately	Substitutability	No relationship between activity substitutability and specialization
Hammitt et al.	2004	Anglers	EUH: years, times on study river, other rivers	Additive: EUH groups	Place, substitutability	Veterans, locals: place; no relationship EUH and substitutability

Summary of key empirical articles addressing recreation specialization (*continued*)

Lee & Scott	2004	Birdwatchers	Experience, skill, commitment	Confirmatory factor analyses	Specialization	Additive index poor fit; 1st, 2nd order good fit; skill best predictor, commitment worst; dimensions not traject in same way
McFarlane	2004	Campers	Experience, skill, involvement	No index, analyzed separately	Behavior: site selection	More specialized dimensions predicted primitive / random sites
Ninomiya & Kikuchi	2004	Windsurfers	Skill, participation, type of sub-activity	Qualitative: observation	Wind, season, crowding	Low specialized: season; High: wind velocity; all like crowding
Vaske et al.	2004	Skiers, snow-boarders	Single item: skill	Single item: skill level	Conflict	More in and out group conflict for highly skilled in both activities
Needham et al.	2005	Hikers, bikers	Single item: skill	Single item: skill level	Encounter norms	Hikers: acceptance drops as skill increases; Bikers: no differences
Oh et al.	2005	Anglers	Experience, skill, equipment, tournament, club	Cluster analysis	Willingness to pay	Specialized pay more, value trips more, perceive more to loose
Salz & Loomis	2005	Anglers	4 social world questions: orientation, experiences, relationships, commitment	Additive	Attitudes toward marine protected areas	No difference in catch-and-release, no fishing policies; Specialists: agree fishing has impact, anglers harvest too many fish
Scott et al.	2005	Birdwatchers	Self-classification: committed, active, casual; additive, cluster: behavior, skill, commitment	Self-classification, additive, cluster analysis	Motives	Self-classification strongest predicting motives, little differences among measures; commitment, skill best predictors of self-classify

APPENDIX B. REVIEW OF LITERATURE ON RISK PERCEPTION, SOCIAL TRUST, AND PERCEIVED SIMILARITY

Introduction

Research has demonstrated that an individual's perceptions of risk regarding a technology or hazard can be influenced, in part, by the extent to which he or she trusts the managing agency (Boholm, 1998; Viklund, 2003). Shared goals, values, and beliefs (i.e., perceived similarity) are thought to constitute foundations of this trust; if an agency's behavior is judged to reflect the individual's goals, values, and thoughts, the agency will be seen as trustworthy (Siegrist, 2000; Siegrist, Cvetkovich, & Roth, 2000). Although the concepts of perceived risk, trust, and perceived similarity have received considerable attention in the risk literature, they have seldom been applied to natural resource issues (Cvetkovich & Winter, 2003; Vaske, Timmons, Beaman, & Petchenik, 2004; Winter, Palucki, & Burkhardt, 1999). This article reviews these concepts and the relationships among them, and summarizes empirical applications to technology / hazard (e.g., nuclear waste, nuclear power) and natural resource (e.g., endangered species) issues.

Risk Perception

Perceived risk is the degree to which individuals believe that they are or may be exposed to some hazard or danger (e.g., Kunreuther & Slovic, 1996; Sjöberg, 2000a). Studies of risk perception examine judgments that people make when they characterize and evaluate hazards, activities, and / or technologies (Slovic, 1987). *Technologies* and

activities can have both benefits and negative consequences (e.g., nuclear power provides electricity, but accidents can result in human death), whereas *hazards* (e.g., being struck by lightening) have no obvious benefits (Sjöberg, 1999a). Perceived risk can influence decision making and behavior under uncertainty (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). People afraid of pesticide residues, for example, might purchase organic food (Siegrist, 2000). In addition, perceptions of risk can influence acceptance of technologies such as nuclear power (Hunt, Frewer, & Shepherd, 1999).

Probability and Severity

Risk judgments are often influenced by two factors: (a) the *probability* of a possible outcome, and (b) the *severity* (i.e., magnitude, disutility, consequences) of the outcome (Adams & Smith, 2001; Baron, Hershey, & Kunreuther, 2000; Stonehouse & Mumford, 1994; Thompson & Dean, 1996). A risk increases as the probability of a negative event increases and as the potential or expected consequences worsen (Sjöberg, 1999a). One of these factors may account for more variance in a risk attribution than the other depending on the individual and hazard / technology (Baron et al., 2000). Despite the best available information, however, estimation of a probability of a possible outcome is somewhat arbitrary (Sjöberg, 1999a) and the severity of a risk is often subjective and can rarely be measured fully (Adams & Smith, 2001). In addition, unpredictable accidents are not considered in probability estimates (Kunreuther & Slovic, 1996).

Heuristics and Risk Targets

To date, most risk perception research has focused on catastrophic / fatal risk targets that tend to be characterized by small probabilities and large consequences (e.g., nuclear fallout). In addition, relatively small probability risks (e.g., airplane crash) tend to

be overestimated and high risks (e.g., health effects from unhealthy diet) underestimated. In other words, individuals do not make valid intuitive judgments of probabilities; they are often influenced by other factors such as media attention (Sjöberg, 1998).

Based on research conducted in the 1970s and early 1980s on heuristics and risk probability judgment biases (e.g., Fischhoff et al., 1978; Kahneman & Tversky, 1984; Starr, 1969), it was argued that *availability bias* and *anchoring bias* influence risk perception estimates based on probabilities and consequences. *Availability bias* refers to risks that are currently prominent in people's minds being overestimated compared to those that are less easily recalled (Adams & Smith, 2001; Boholm, 1998). *Anchoring bias* generally refers to challenges that people have when interpreting ranges of probabilities over which risks may extend (Kahneman & Tversky, 1984). In the 1970s, for example, risks regarding nuclear power being conveyed as small probabilities coupled with constant media attention caused confusion among people. The problems were that: (a) frequent media exposure gave rise to a high level of perceived risk (i.e., availability heuristic), and (b) people did not form a correct impression of how small the probabilities of an incident actually were (i.e., anchoring heuristic) (Sjöberg, 1998, 2000a).

In addition to making risk judgments based on heuristics / biases, individuals often do not make the same estimates when they assess risk to themselves (i.e., *personal risk*) versus society in general (i.e., *societal / general risk*) (Sjöberg, 2000a; Slovic, Fischhoff, & Lichtenstein, 1981). People tend to believe that despite probability and severity estimates, they are at less risk compared to others. This is known as *risk denial*, which can be influenced by the degree of control that individuals feel they have in protecting themselves against a hazard (Bronfman & Cifuentes, 2003). Research has also

shown that males are more likely to base their risk judgment on probability estimates, whereas females tend to stress the consequences / severity (Sjöberg, 1999a). Given challenges in understanding public risk perceptions based on probability and severity estimates, researchers have attempted to explain other social and psychological factors that contribute to people's judgments about risk. The *psychometric paradigm* approach has received the most empirical attention to reveal these factors (Fischhoff et al., 1978).

Psychometric Paradigm

The psychometric paradigm is one approach for understanding how individuals perceive risks and what dimensions underlie their risk perceptions (Lion, Meertens, & Bot, 2002). In the first study to utilize this approach (Fischhoff et al., 1978), survey respondents rated 30 hazards, activities, and technologies (e.g., nuclear power, pesticides, prescription antibiotics, x-rays) on nine semantic differential scales (e.g., voluntary – involuntary, new risk – old risk, certain to be fatal – certain not to be fatal). Factor analyses identified two dimensions: (a) *dread* of the risk (i.e., how uncontrollable, potentially catastrophic, dangerous to future generations, new, involuntary), and (b) *knowledge* of the risk (i.e., how chronic, known to those exposed, old). Since this study, the tenets of the psychometric paradigm have been applied to many empirical studies of risk perception (e.g., Barnett & Breakwell, 2001; Baron et al., 2000; Bronfman & Cifuentes, 2003; Lion et al., 2002; Sjöberg, 1998; Slovic et al., 1981; Slovic, Flynn, & Layman, 1991). These studies have shown that the public has broad, multidimensional conceptions of risk for hazards / technologies that incorporate considerations such as uncertainty, dread, newness, and controllability (Kunreuther & Slovic, 1996).

In addition to the variables that psychometric studies have shown to influence risk perceptions, researchers have emphasized the importance of other somewhat unobvious, *distal factors* in risk perception (Sjöberg, 1998, 2002). Studies have shown, for example, that anxiety / worry (Baron et al., 2000), sensation seeking (Allen, 1987), personal effect (Bronfman & Cifuentes, 2003), and scales measuring values (Dunlap & Van Liere, 1978; Inglehart, 1997; Schwartz & Huismans, 1995) are only weakly to moderately useful in explaining risk perception (Sjöberg, 2000a). Sjöberg (2002), however, has shown that *risk sensitivity* (i.e., an inherent predisposition to judge all potential risks as large) and attitudes toward a hazard / technology tend to explain more variation in risk perceptions than dimensions common to the psychometric model.

The psychometric paradigm represents a landmark for research into public perceptions of risk. There are, however, criticisms of the approach (Sjöberg, 1998, 2000a, 2002). According to Sjöberg (2000), the model is not as powerful as its proponents have claimed because: (a) factor analysis of only nine scales is bound to give few factors and the fact that these factors account for approximately 80% of the variance in some studies is not surprising and does not imply that they can account for the perceived level of risk to the same extent, (b) there are several important dimensions of risk not included in the psychometric model (e.g., sensitivity), and (c) the finding that a large share of the variance of perceived risk could be explained by the dimensions (dread, knowledge) is because mean / aggregate ratings, not raw data are often analyzed. Regardless, the large body of research that has employed the psychometric approach has revealed important issues pertaining to risk perception, especially consistent differences in risk perceptions between the lay public and technical experts.

Experts versus Lay Public

Much of the literature on risk perception has been driven by the finding that experts (i.e., scientists, agency officials) and non-experts (i.e., lay public) differ in their perceptions of risk (Slovic, 1987). When experts judge risk, their responses tend to correlate highly with technical estimates of probability and annual mortality (Fischhoff, Slovic, & Lichtenstein, 1982; Slovic, 1987). Conversely, risk perceptions provided by lay people are related more to other characteristics of the hazard or technology (e.g., dread, catastrophic potential, newness). Experts see themselves as providing risk estimates that are objective, analytic, wise, and rational based on "real" risks; the public relies on risk perceptions that are subjective and often thought of by experts as somewhat emotional and irrational (Kunreuther & Slovic, 1996). According to Trautman (2001), "scientists become frustrated with non-scientists because they fail to see the data; non-scientists become frustrated with scientists because they fail to see beyond the data" (p. 1131).

The difference between experts and the public regarding perceptions of risk can be conceptualized as the *probabilist* versus *contextualist* positions (Thompson & Dean, 1996). The *probabilist* position tends to mirror experts' views of risk, as it exemplifies the probability of an event occurring as essential to any risk judgment. Conversely, the *contextualist* position, similar to the lay public view of risk, reflects the multidimensional and subjective nature of risk perceptions. This conception places probabilities and consequences on a list of relevant risk attributes along with dread, catastrophic potential, voluntariness, controllability, uncertainty, and newness (Kunreuther & Slovic, 1996).

Differences between experts / scientists and the public are evident in studies of reactions to potential risks associated with nuclear power, toxic waste, food additives,

and pesticides. In most cases, experts judge risks to be minor or non-existent, whereas the public tends to be concerned and perceive them as high risks (Sjöberg, 1999b). These differences can hamper risk communication and persuasion efforts (Fessenden-Raden, Fitchen, & Heath, 1987; Kasperson, 1986; Zimmerman, 1987).

Although experts and lay people often differ in their perceptions of risks, experts' training and experience is likely to provide them with more knowledge about hazards / technologies that are not available to the average citizen. Lacking this knowledge, public judgments of risks may be based on appraisals of agencies responsible for managing the hazards, as opposed to actual hazards (Siegrist & Cvetkovich, 2000).

Social Trust

The influence of trust as a determinant of public risk perceptions has been recognized in the literature (Siegrist, Gutscher, & Earle, 2005). In general, *trust* is defined as confidence and beliefs that people have in the ability of assigned agencies and officials to control and minimize hazard, technology, and / or activity related risks (Flynn, Burns, Mertz, & Slovic, 1992). Similarly, Seigrist et al. (2000) define the concept of *social trust* as the willingness to rely on those with responsibility for making decisions and taking actions related to the management of technology, environment, medicine, or other realms of public health and safety. Individuals being trusted or distrusted have formal responsibilities within organizations and may or may not be personally known to the individual making the trust attribution (Siegrist et al., 2000). Studies investigating the influence of trust on risk perceptions focus less on the personal attributes of risk common to approaches such as the psychometric paradigm and more on the managing agency.

In North America, data has shown that, in general, there is declining public trust in government (Chanley, Rudolph, & Rahn, 2000). Researchers suggest, however, that the public has relatively high trust in governmental agencies tasked to manage natural resource and environmental issues (Cvetkovich & Winter, 2002, 2003). According to Slovic (1993), trust is fragile; it is created slowly and can be destroyed rapidly by a single mishap or mistake. Once initiated, distrust tends to reinforce and perpetuate distrust.

Research has shown that trust in a managing agency influences risk perceptions. Across most studies, people who trust the managing agency tend to perceive less risk compared to those who do not (Bord & O'Connor, 1990, 1992; Flynn et al., 1992; Pijawka & Mushkatel, 1991; Sandman, Miller, Johnson, & Weinstein, 1993; Siegrist, 2000; Siegrist & Cvetkovich, 2000; Siegrist et al., 2000; Siegrist, Cvetkovich, & Gutscher, 2001; Sjöberg, 1999b; Trumbo & McComas, 2003). Many of these studies have investigated the relationship between social trust and perceived risk for nuclear waste repository siting (e.g., Bord & O'Connor, 1992; Flynn et al., 1992; Groothuis & Miller, 1997; Pijawka & Mushkatel, 1991; Slovic et al., 1991), but studies have also examined gene technology (Poortinga & Pidgeon, 2003; Siegrist, 2000), food irradiation (Bord & O'Connor, 1990), and artificial sweeteners (Siegrist et al., 2000).

Examination of the strength of relationships between social trust and perceived risk, however, has provided mixed results. In some studies that often use small samples of students, up to 70% of the variance in perceived risk can be explained by trust (e.g., Siegrist et al., 2000). Many studies of the public in various geographical regions, however, report correlations that translate to between 5% and 20% of perceived risk being explained by trust (Siegrist et al., 2005; Sjöberg, 2000b, 2001; Sjöberg &

Wåhlberg, 2002; Trumbo & McComas, 2003; Viklund, 2003). Researchers have suggested that weak to moderate relationships between trust and risk imply that people believe that there are limits to how much scientists and experts know (Sjöberg, 2001). Citizens may trust a managing agency, but feel that risks are beyond agency control.

Although some studies have demonstrated that social trust can be a strong predictor of perceived risk (e.g., Flynn et al., 1992; Siegrist, 2000; Siegrist et al., 2000), there are several conceptual issues to consider. First, as Frewer, Scholderer, and Bredahl (2003) point out, trust variables used in some studies such as "the responsible authorities accurately control whether legal regulations and restrictions are upheld" (Siegrist et al., 2000) arguably measure respondents' perceptions of how well risks are managed by the agency, not the extent to which the agency is trusted. This suggests that conceptualization of social trust requires further clarification. Second, the closer in contextual specificity the independent (i.e., trust) and dependent (i.e., perceived risk) variables are to each other, the greater likelihood for a strong negative relationship (Viklund, 2003). Sjöberg (2001), for example, reported that trust in politicians in general was a weak predictor of perceived risk regarding specific technologies such as nuclear power.

Third, there is little consensus among researchers about how to measure social trust and debate continues regarding the use of unidimensional versus multidimensional measures of the concept (Earle, 2004; Frewer et al., 2003; Johnson, 1999; Sjöberg, 2001). One line of research suggests that trust is multidimensional consisting of dimensions such as competence, fairness, confidence, and caring (Johnson, 1999; Poortinga & Pidgeon, 2003; Siegrist et al., 2005). This view presumes that the processes underlying trust are

complex and a requisite level of knowledge about the managing agency is needed to make a cognitively detailed judgment of trust (Siegrist et al., 2001; Winter et al., 1999).

An alternative view proposes that social trust is a unidimensional construct and consists of trust or distrust (Cvetkovich & Winter, 2002; Siegrist, 2000; Siegrist & Cvetkovich, 2000; Siegrist et al., 2000; Siegrist et al., 2001; Siegrist, Earle, & Gutscher, 2003; Siegrist et al., 2005; Winter et al., 1999). The lay public often lacks the knowledge or time to make complex trust attributions and as a result, decisions to trust involve a simple bridge between perceptions of an agency and trust in its actions (Siegrist, 2000; Winter et al., 1999). Trust is quantified in terms of shared goals, values, thoughts, and opinions, which constitute the foundations of trust. An agency will be judged to be trustworthy if it reflects the citizen's goals, values, and thoughts.

Perceived Similarity

Recent research has suggested that social trust is based on perceived similarity and agreement rather than carefully reasoned attributions of trust or direct knowledge (Earle, 2004; Siegrist et al., 2000; Siegrist et al., 2001). People base their trust judgments on whether they feel that the agency shares the same goals, values, and thoughts (Poortinga & Pidgeon, 2003). This approach is known as the *salient value similarity* (SVS) model, but has also been referred to as attributes of salient similarity, perceived shared values, and perceived similarity (Cvetkovich & Winter, 2002; Earle, 2004; Siegrist et al., 2000; Siegrist et al., 2001).

Studies have shown that perceived similarity is a strong predictor of social trust; people who perceive that they share similar goals, values, and thoughts as the managing agency tend to have more trust in the agency compared to those who do not (Cvetkovich

& Winter, 2002, 2003; Poortinga & Pidgeon, 2003; Siegrist et al., 2000; Siegrist et al., 2001; Walls, Pidgeon, Weyman, & Horlick-Jones, 2004). Siegrist et al. (2000), for example, reported strong positive coefficients from similarity to trust for pesticides (.64), artificial sweetener (.58), and nuclear power (.65). Siegrist et al. (2003) reported similar findings for electromagnetic fields, whereas Poortinga and Pidgeon (2003) showed slightly weaker results for genetic testing and mobile telephone use.

The SVS / perceived similarity model contains two components. First, *salient values* are defined as the individual's sense of what the important goals (ends) and / or processes (means) are that should be followed in a particular situation (Siegrist et al., 2000). It can be argued that this definition is somewhat analogous to *modal salient norms*, an array of norms about what behaviors that people think should be followed in a given situation that also emerge as important for the situation (Ajzen & Fishbein, 1980; Basman, Manfredo, Barro, Vaske, & Watson, 1996). To avoid confusion with more common approaches to examining values (e.g., Inglehart, 1997; Rokeach, 1973), Siegrist et al. (2000) state that "the construct of salient values contrasts to the more common social science practice of categorizing an individual as believing in one or a single set of dominant values that are applied across most situations" (p. 355). The second component, *value similarity*, involves a comparison of the similarity of values, goals, and thoughts of the perceiver and the entity being judged (Siegrist et al., 2000; Siegrist et al., 2001).

Studies that have measured SVS / perceived similarity employ multiple-item semantic differential (e.g., Siegrist et al., 2000; Winter et al., 1999) or agree – disagree (Poortinga & Pidgeon, 2003) scales that include items such as: shares the same values – different values, has same goals – different goals, and thinks like me – thinks unlike me.

Relationships among perceived similarity, social trust, and risk perception were examined by Siegrist et al. (2000). Data on students' perceptions of trust and risk associated with nuclear power, pesticides, and artificial sweeteners showed strong and positive relationships between similarity and trust, and strong negative relationships between trust and risk. In other words, similarity led to high levels of trust, which led to lower perceptions of risk. As stated above, however, the empirical relationship between social trust and perceived risk has varied across studies (Sjöberg, 2001; Viklund, 2003).

Natural Resource Applications

Although typically applied to management of technologies and hazards such as nuclear power, pesticides, nuclear waste repository siting, and genetically modified foods, the concepts of risk, trust, and perceived similarity have received some attention among natural resource researchers. Needham, Vaske, and Manfredo (2004), for example, reported that as the probability of harvesting a deer or elk infected with chronic wasting disease (CWD) increases, up to 49% of hunters could stop hunting in their state. This decline could be even greater (e.g., 60%) if high probabilities are combined with threats to human health (i.e., risk severity / consequence). In addition, this study showed that as probability and severity of CWD increased, acceptance of management actions such as testing and deer / elk herd reduction increased, whereas acceptance of allowing the disease to take its natural course decreased. These findings are similar to those reported in a study of risk perceptions regarding the recent foot and mouth outbreak in the United Kingdom (Poortinga, Bickerstaff, Langford, Niewöhner, & Pidgeon, 2004).

A popular line of recreation research has incorporated measures of risk probability and consequence in scales designed to measure activity involvement profiles

(IP) (e.g., Dimanche, Havitz, & Howard, 1991; Havitz & Dimanche, 1990; Havitz, Dimanche, & Bogle, 1994; Iwasaki & Havitz, 1998; Kyle & Chick, 2002). The perceived risk dimension of activity involvement is often measured by the: (a) *probability* of making a poor choice (e.g., highly involved and skilled golfer selecting an easy golf course), and (b) *consequences* of making the poor choice (e.g., golf course offers little challenge, thus the green fee paid is deemed a waste of money). A body of research has shown, however, that these risk measures are weak determinants of activity involvement (Havitz & Mannell, 2005). Other recreation researchers have demonstrated that perceived risk influences participation in activities such as climbing and mountaineering (Ewert, 1985, 1994; Ewert & Hollenhorst, 1989; McIntyre, 1992; Robinson, 1992).

Studies applying the concepts of trust and similarity to natural resource issues (e.g., wildfire, endangered species, willingness to pay fees) have demonstrated that: (a) public trust highly correlates to assessments of similarity with natural resource agencies, and (b) trust is positively related to support of agency management practices such as protection of endangered species and introduction of user fees (Cvetkovich & Winter, 2003; Winter & Cvetkovich, 2004; Winter et al., 1999). Vaske et al. (2004) found that trust in the managing agency and perceived risk regarding CWD were significantly related to hunters' behavioral responses to the disease (i.e., stop hunting). Finally, social trust influenced civic action (i.e., volunteer / donate time, resources) and place attachment in wildlife refuges (Payton, Fulton, & Anderson, 2005).

Management Implications and Future Research

It is important for managers / agencies to understand their clienteles' perceptions of risk, trust, and similarity. Perceptions of risk can influence decision making, behavior,

and acceptance of management (Hunt et al., 1999; Siegrist, 2000). As demonstrated in dual-process models of persuasion (e.g., elaboration likelihood, heuristic systematic), high levels of similarity and trust are important because they can help communication and persuasion campaigns be more effective (Chaiken, Wood, & Eagly, 1996; Frewer et al., 2003; Petty & Cacioppo, 1986). Trust and similarity can also influence constituent support and understanding of agency goals, objectives, and actions (Earle, 2004).

A decline in trust and perceived similarity of an agency's clientele can have major consequences, as the public can: (a) become suspicious of management, (b) interpret actions in light of past negative experiences with the agency, and (c) turn to other sources that may be less credible (e.g., media, friends, family). Despite best efforts of scientists and other experts, risks of many hazards and technologies are clouded in uncertainty. Communication attempts can become more challenging if citizens' views are distorted by preconceptions and distrust (Slovic et al., 1991). When public values and opinions are not reflected in management, reasons for inconsistencies should be shared so that citizens can weigh their views in relation to considerations of trust (Cvetkovich & Winter, 2003).

The concepts of perceived risk, trust, and similarity have a rich tradition in the risk literature (Sjöberg, 2000a; Slovic, 1987; Starr, 1969). These concepts, however, have only recently been used to investigate natural resource issues (e.g., Cvetkovich & Winter, 2002; Vaske et al., 2004; Winter et al., 1999). To extend this research, the following considerations are offered. First, there is inconsistent conceptualization and operationalization of these concepts, especially perceived risk and social trust. Conceptualization / measurement of these concepts require further clarification.

Second, most studies of risk, trust, and similarity are quantitative and cross-sectional in nature. Given evidence of increasing distrust in government in general, it is obvious that these concepts are dynamic, not static (Chanley et al., 2000). Longitudinal and panel design studies, as well as the funding necessary to conduct such research are required. A few studies have already found utility in applying qualitative methods to examine risk, trust, and similarity (Cvetkovich & Winter, 2002; Earle, 2004; Poortinga et al., 2004; Winter et al., 1999). These approaches may provide more depth and detail necessary for delineating underlying influences of these concepts.

Third, Sjöberg (2002) has suggested that risk sensitivity, a predisposition to rate all risks as large, influences perceptions of specific risks. Little research, however, has been conducted to ascertain the extent to which study respondents exhibit this trait. This issue warrants future research attention.

Fourth, most studies investigating relationships among risk, trust, and similarity have focused on the limited number of agencies responsible for managing a technology or hazard. This scope, however, may be too narrow. Risk judgments may be heavily influenced by other sources such as special interest groups, media sources, friends, and family. Perhaps this may be a partial explanation for the mixed results in relationships between risk and trust (Viklund, 2003; Walls et al., 2004). The effects of other diverse information sources on judgments of risk warrant future research consideration.

Fifth, it is possible that most of the lay public does not have a solid impression of the particular agencies that are tasked to manage specific technologies or hazards. This may make it difficult for citizens to respond to questions about trust and similarity (Walls et al., 2004). As a result, people may erroneously base their judgments on more general,

well-known elected officials (e.g., president, prime minister), not the specific managing agency. These inferences may impede the findings and generalizability of empirical studies examining relationships among risk, trust, and similarity for specific issues. It remains a question of future research to determine the extent to which these inferences are made and the effects that they may have on study findings.

Finally, the concepts of perceived risk, social trust, and perceived similarity have generated a considerable volume of research in the risk literature, but they have received scant attention in natural resource related disciplines. These concepts may prove to be useful for researchers and practitioners that are tackling issues related to natural resources and their management.

APPENDIX C. MAIL SURVEY INSTRUMENT ADMINISTERED TO HUNTERS

(SOUTH DAKOTA EXAMPLE)

Hunters' Responses to Chronic Wasting Disease in South Dakota

Important Questions for South Dakota Deer Hunters

All Responses Are Confidential

Please Complete This Survey. Thank You For Your Cooperation

Postage-Paid Return Envelope Provided

A Study Conducted Cooperatively By:

SOUTH DAKOTA GAME, FISH & PARKS

Colorado State University

Knowledge to Go Places

WESTERN ASSOCIATION OF FISH AND WILDLIFE AGENCIES

Most of the questions in this survey ask about your views regarding Chronic Wasting Disease (CWD) in deer in South Dakota. Before asking these questions, we would like to know a little bit about you as a hunter and your deer hunting experiences. The questions on this page ask about your deer hunting (mule deer and / or white-tailed deer) experiences in South Dakota.

1 Our records show that you purchased a license to hunt deer in South Dakota during the **2003** deer hunting season (fall / winter 2003). Did you go deer hunting in South Dakota during the **2003** deer hunting season? **(check ONE)**

☐ No → if no, skip to question 6 below
☐ Yes

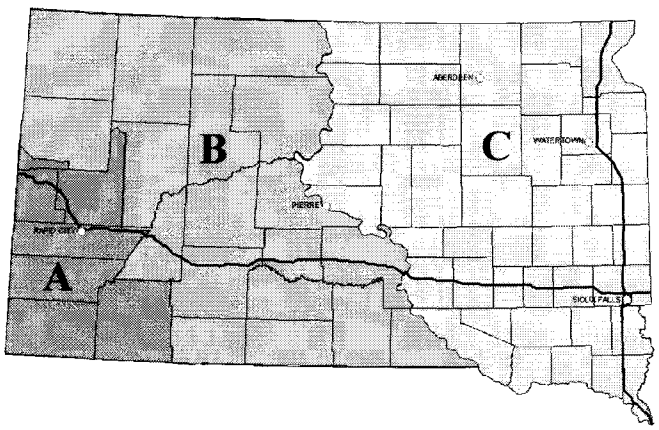
2 Did **you** harvest any deer during the **2003** deer hunting season in South Dakota? **(check ONE)**

☐ No
☐ Yes → if yes, how many bucks and / or does did you harvest during the **2003** deer hunting season in South Dakota? **(write responses)**

Number of **bucks** harvested _____ Number of **does** harvested _____

3 Taking everything into consideration, how would you rate the quality of your **2003** deer hunting season in South Dakota? **(check ONE)**

☐ Poor ☐ Fair ☐ Good ☐ Very good ☐ Excellent ☐ Perfect



The above map of South Dakota contains three separate zones, with Zone A shaded the darkest and Zone C shaded the lightest. Zone A includes the Black Hills plus some of the West River units to the east and south of the Black Hills. Zone B includes all the rest of the West River units. Zone C includes all of the East River units. Please answer Questions 4 through 7 on this page while looking at the above map of South Dakota.

4 In which zone(s) did you hunt deer during the **2003** deer hunting season? **(check ALL THAT APPLY)**

☐ Zone A ☐ Zone B ☐ Zone C

5 About how many **DAYS** did you hunt deer in each zone during the **2003** deer hunting season? **(write responses; PLEASE PUT "0" IF YOU DID NOT HUNT IN THE ZONE)**

Number of days in Zone A _____ Number of days in Zone B _____ Number of days in Zone C _____

6 In which zone(s) have you ***ever*** hunted deer in your life? **(after looking at the above map, check ALL THAT APPLY)**

☐ Zone A ☐ Zone B ☐ Zone C ☐ I have never hunted deer in South Dakota

7 In which ***one*** zone have you hunted deer the most often in your life? **(check ONE)**

☐ Zone A ☐ Zone B ☐ Zone C ☐ I have never hunted deer in South Dakota

Now we would like to ask about your involvement in deer hunting. The questions on this page ask about your deer hunting experiences (mule deer and / or white-tailed deer) in South Dakota and any other areas where you have hunted deer in your life.

1 In total, about how many years have you hunted deer ***in South Dakota***? **(write response)**
Number of years _____

2 In total, about how many years have you hunted deer ***in your life***? **(write response)**
Number of years _____

3 To what extent do you disagree or agree with each of the following statements related to your level of involvement in deer hunting? **(circle one number for *each* statement that most closely matches your response)**

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
If I stopped deer hunting, an important part of my life would be missing.	1	2	3	4	5	6	7
Deer hunting is an annual tradition that has become important to me over the years.	1	2	3	4	5	6	7
Participation in deer hunting is a large part of my life.	1	2	3	4	5	6	7
Given the deer hunting skills and knowledge that I have developed over the years, it is important that I continue to hunt deer.	1	2	3	4	5	6	7
Testing / improving my deer hunting skills is more important to me than harvesting a deer.	1	2	3	4	5	6	7
I would describe my skill level in deer hunting as advanced or expert.	1	2	3	4	5	6	7
Given the amount of effort I have put into becoming a deer hunter, it would be difficult for me to find another activity to replace deer hunting.	1	2	3	4	5	6	7
Over the years, I have accumulated a lot of deer hunting equipment.	1	2	3	4	5	6	7
Over the years, I have invested a lot of money in deer hunting equipment.	1	2	3	4	5	6	7
If I quit deer hunting, the effort I have put into accumulating the right deer hunting equipment would be wasted.	1	2	3	4	5	6	7
I mainly hunt deer only to bring the meat home to eat.	1	2	3	4	5	6	7
A hunting trip can be successful to me even if no deer are harvested.	1	2	3	4	5	6	7
I mainly hunt deer only to harvest a trophy deer.	1	2	3	4	5	6	7

4 Do you intend to hunt deer in South Dakota during the **2004** deer hunting season (fall / winter 2004)? **(check ONE)**
☐ No ☐ Yes ☐ Unsure

5 If you are able to obtain a tag / license, do you intend to hunt deer in South Dakota during the **2005** deer hunting season (fall / winter 2005)? **(check ONE)**
☐ No ☐ Yes ☐ Unsure

Chronic Wasting Disease (CWD) is a brain disease found in deer and elk. It is believed to be caused by an abnormal protein called a prion. In the early stages of the disease, infected animals may appear healthy. In later stages, infected animals may display one or more symptoms such as weight loss, lack of energy, "droopy" appearance, and excessive salivation. Infected animals always die. The origin and transmission of CWD are not well understood. The questions on this page and on most of the remaining pages of this survey ask about your opinions regarding CWD, especially in South Dakota.

1 To what extent do you disagree or agree that you had enough information about each of the following CWD related topics ***prior to receiving this survey*****? (circle one number for *each* statement that most closely matches your response)**

I feel that I had enough information about...	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
...A. when CWD was first identified in deer in South Dakota.	1	2	3	4	5	6	7
...B. how CWD first got to South Dakota.	1	2	3	4	5	6	7
...C. how many deer with CWD have been found in South Dakota.	1	2	3	4	5	6	7
...D. where deer with CWD have been found in South Dakota.	1	2	3	4	5	6	7
...E. what states have deer with CWD.	1	2	3	4	5	6	7
...F. what type(s) of wildlife species can have CWD.	1	2	3	4	5	6	7
...G. what causes CWD in wildlife.	1	2	3	4	5	6	7
...H. possible livestock health risks associated with CWD.	1	2	3	4	5	6	7
...I. possible human safety risks associated with CWD.	1	2	3	4	5	6	7
...J. precautions that hunters should take because of CWD.	1	2	3	4	5	6	7
...K. what the South Dakota Department of Game, Fish and Parks is doing about CWD in South Dakota.	1	2	3	4	5	6	7

2 From the list of CWD related topics in Question 1 (above), please state ***three*** **topics** that you would want more information about. **(write up to *three letters* that match your responses; leave lines blank if you would not want more information)**

Letter(s) _____ _____ _____

3 To what extent do you disagree or agree with each of the following statements related to CWD?
(circle one number for *each* statement that most closely matches your response, NA = not applicable)

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree	
The threat of CWD has been exaggerated.	1	2	3	4	5	6	7	
Effort should be taken to eliminate CWD from the wild deer population.	1	2	3	4	5	6	7	
CWD poses a risk to deer, but not to humans.	1	2	3	4	5	6	7	
CWD may pose a risk to humans, but not enough is currently known to be sure.	1	2	3	4	5	6	7	
CWD may cause disease in humans if they eat meat from animals infected with CWD.	1	2	3	4	5	6	7	
Because of CWD, I have concerns about eating deer meat.	1	2	3	4	5	6	7	NA
Because of CWD, members of my family (for example: spouse, children) have concerns about eating deer meat.	1	2	3	4	5	6	7	NA

4 How much risk do you think is associated with each of the following happening to you during or as a consequence of your deer hunt? **(circle one number for *each* statement that most closely matches your response)**

	No Risk		Slight Risk		Moderate Risk			Extreme Risk	
Being in a car accident traveling to / from the hunting site.	1	2	3	4	5	6	7	8	9
Getting lost while hunting.	1	2	3	4	5	6	7	8	9
Getting shot by another hunter.	1	2	3	4	5	6	7	8	9
Accidentally shooting yourself.	1	2	3	4	5	6	7	8	9
Having a heart attack while hunting.	1	2	3	4	5	6	7	8	9
Inadvertently eating meat from an animal infected with CWD.	1	2	3	4	5	6	7	8	9
Contracting a disease ***caused by CWD***.	1	2	3	4	5	6	7	8	9
Becoming ill as a result of contracting a disease ***caused by CWD***.	1	2	3	4	5	6	7	8	9
Death as a result of contracting a disease ***caused by CWD***.	1	2	3	4	5	6	7	8	9

5 ***Because of CWD***, how concerned are you about each of the following issues? **(circle one number for *each* statement that most closely matches your response)**

Because of CWD, how concerned are you about...	Not at all Concerned		Slightly Concerned		Moderately Concerned			Extremely Concerned	
...your own personal health?	1	2	3	4	5	6	7	8	9
...the health of the deer population in South Dakota?	1	2	3	4	5	6	7	8	9
...not having enough healthy deer left to hunt in South Dakota?	1	2	3	4	5	6	7	8	9
...CWD spreading throughout the entire deer population in South Dakota?	1	2	3	4	5	6	7	8	9
...the potential for CWD to dramatically reduce the deer population in South Dakota?	1	2	3	4	5	6	7	8	9
...the potential for CWD to kill the entire deer population in South Dakota?	1	2	3	4	5	6	7	8	9

6 We would like to know how concerned you would be about eating meat from a wild deer harvested by you or another hunter in a management unit where **CWD ***HAD NOT*** previously been found in other wild deer**. How concerned would you be about eating meat from this deer? **(circle one number for *each* statement that most closely matches your response)**

How concerned would you be about eating meat from this deer if it...	Not at all Concerned	Slightly Concerned	Moderately Concerned	Extremely Concerned (I would not eat the meat)	Unsure
...was not tested for CWD?	1	2	3	4	5
...was tested and evidence suggested that the deer *did not* have CWD?	1	2	3	4	5
...was tested and evidence suggested that the deer *did* have CWD?	1	2	3	4	5

7 Now we would like to know how concerned you would be about eating meat from a wild deer harvested by you or another hunter in a management unit where **CWD *HAD* previously been found in other wild deer**. How concerned would you be about eating meat from this deer? **(circle one number for *each* statement that most closely matches your response)**

How concerned would you be about eating meat from this deer if it…	Not at all Concerned	Slightly Concerned	Moderately Concerned	Extremely Concerned (I would not eat the meat)	Unsure
…was not tested for CWD?	1	2	3	4	5
…was tested and evidence suggested that the deer *did not* have CWD?	1	2	3	4	5
…was tested and evidence suggested that the deer *did* have CWD?	1	2	3	4	5

8 During the **2003** deer hunting season in South Dakota, were ***any*** of ***your*** deer submitted for CWD testing? **(check ONE)**

☐ No, but I did not harvest any deer in **2003** in South Dakota → if no, skip to question 12 below
☐ No, I harvested deer in **2003** in South Dakota, but it was not tested for CWD → if no, skip to question 11 below
☐ Yes

9 If any of your deer ***were*** submitted for testing **(checked "yes" to question 8 above)**, did you wait until you had the test results before you and / or other people ate the deer meat? **(check ONE)**

☐ No, but I and / or other people do not eat meat from deer that I harvest
☐ No, I did not wait until I had the test results before I and / or other people ate the deer meat
☐ Yes

10 If any of your deer ***were*** submitted for testing **(checked "yes" to question 8 above)**, was CWD detected in any of the deer? **(check ONE)**

☐ No ☐ Yes

11 If any of your deer ***were not*** submitted for testing **(checked "no" to question 8 above)**, please tell us why your deer was not tested for CWD. **(check ALL THAT APPLY)**

☐ I did not hunt in an area where CWD had been detected in deer
☐ I did not know that CWD testing was available in South Dakota
☐ I did not know enough about CWD testing in South Dakota
☐ I did not think that CWD posed any risk to me
☐ I trusted my own butchering skills
☐ Notification of the test results took too long
☐ The test was too costly
☐ Other **(write response)** _____

12 To what extent do you disagree or agree with each of the following statements related to your participation in the **2003** deer hunting season in South Dakota? **(circle one number for *each* statement that most closely matches your response)**

In the **2003** deer hunting season in South Dakota, I…	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
…hunted more often than in past years.	1	2	3	4	5	6	7
…hunted about the same amount as I always do.	1	2	3	4	5	6	7
…hunted less often than in past years because of concerns about CWD.	1	2	3	4	5	6	7
…did not hunt deer in South Dakota because of concerns about CWD.	1	2	3	4	5	6	7
…hunted in a different unit because of concerns about CWD in the unit that I usually hunt in.	1	2	3	4	5	6	7
…was more careful to make sure the deer did not show signs of CWD before harvesting it.	1	2	3	4	5	6	7

13 How do you normally process the deer that you harvest? **(check ONE)**

- ☐ I process the entire deer myself
- ☐ A friend or family member processes the deer for me
- ☐ I give the deer away and therefore do not process it myself
- ☐ I do some of the processing, but pay money to have some of the tasks done (for example: sausages, grinding the burger)
- ☐ I take the entire deer somewhere and pay money to have it processed

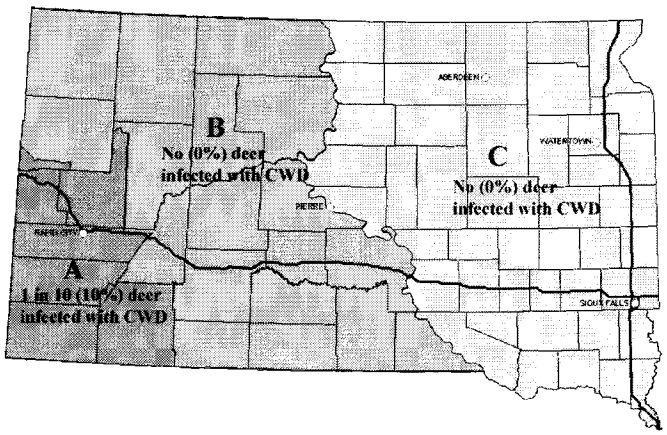
Please read this information before answering the questions on the next page: In South Dakota, CWD was first identified in wild deer in 2001. To date, 14 wild deer and 1 wild elk have tested positive for CWD in the state (out of 3,859 animals tested), mostly in Fall River, Custer, and Pennington counties, and in Wind Cave National Park (southwest corner of the state).

The six situations described in the following pages are **IMAGINARY** (hypothetical). **They do not reflect current conditions or consequences to humans**. There is no evidence to suggest that CWD poses a health risk to humans. However, your responses to each of these **IMAGINARY** situations are important for understanding what hunters would do in response to CWD in South Dakota if conditions changed or CWD spread to new areas. None of these situations are the same (each situation is different), so please read each situation and look at each map very carefully. **Please respond to *each* question for *each* of the following situations as if the conditions had existed during your most recent deer hunting season in South Dakota (for example: the 2003 deer hunting season in South Dakota).**

Please read each situation carefully, look at the map, and then answer all of the questions that follow each situation.

Imaginary Situation 1

Map 1 South Dakota



Imaginary Situation 1. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 1 in 10 (10%) deer in Zone A, but in no (0%) deer in Zones B and C**
- **There is no evidence that CWD poses a health risk to humans**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 1 **(see map 1)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 1, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 1, how concerned would you be for ***your own personal health***? **(check ONE)**

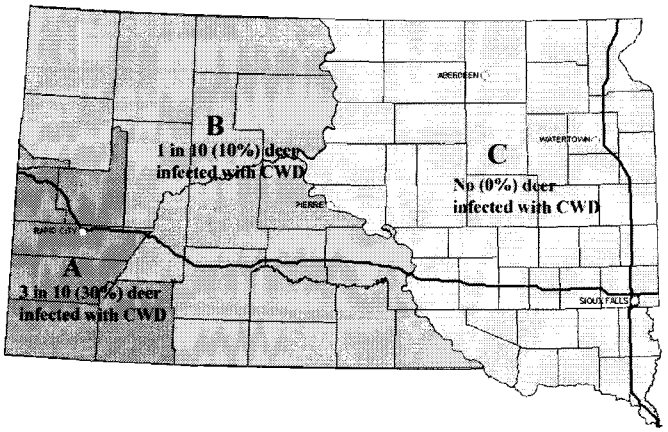
☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 1, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

Imaginary Situation 2

Map 2 South Dakota



Imaginary Situation 2. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 3 in 10 (30%) deer in Zone A, 1 in 10 (10%) deer in Zone B, but in no (0%) deer in Zone C**
- **There is no evidence that CWD poses a health risk to humans**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 2 **(see map 2)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 2, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 2, how concerned would you be for ***your own personal health***? **(check ONE)**

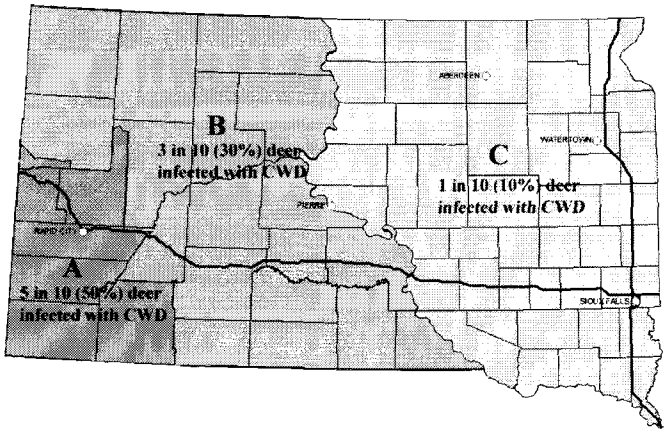
☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 2, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

Imaginary Situation 3

Map 3 South Dakota



Imaginary Situation 3. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 5 in 10 (50%) deer in Zone A, 3 in 10 (30%) deer in Zone B, and 1 in 10 (10%) deer in Zone C**
- **There is no evidence that CWD poses a health risk to humans**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 3 **(see map 3)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 3, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 3, how concerned would you be for ***your own personal health***? **(check ONE)**

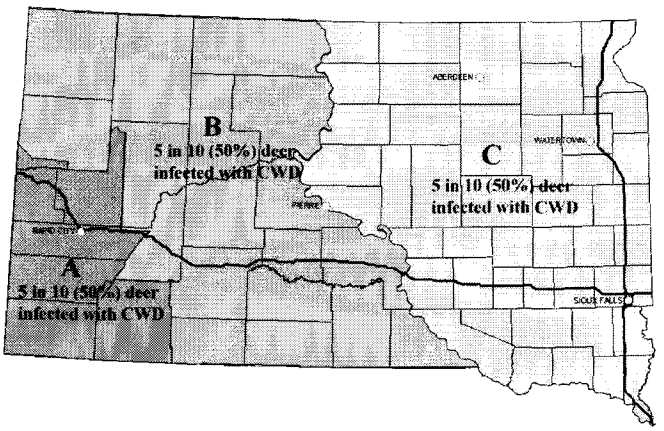
☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 3, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

Imaginary Situation 4

Map 4 South Dakota



Imaginary Situation 4. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 5 in 10 (50%) deer across the entire state (in Zones A, B, and C)**
- **There is no evidence that CWD poses a health risk to humans**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 4 **(see map 4)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 4, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 4, how concerned would you be for ***your own personal health***? **(check ONE)**

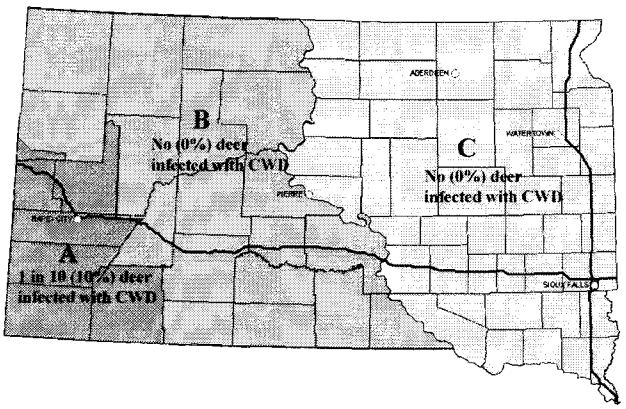
☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 4, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

Imaginary Situation 5

Map 5 South Dakota



***and* evidence shows that CWD can be *transmitted to humans* and hunters in South Dakota have *died* from CWD**

Imaginary Situation 5. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 1 in 10 (10%) deer in Zone A, but in no (0%) deer in Zones B and C**
- **Evidence shows that CWD can be transmitted to humans and hunters in South Dakota have died from CWD**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 5 **(see map 5)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 5, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 5, how concerned would you be for ***your own personal health***? **(check ONE)**

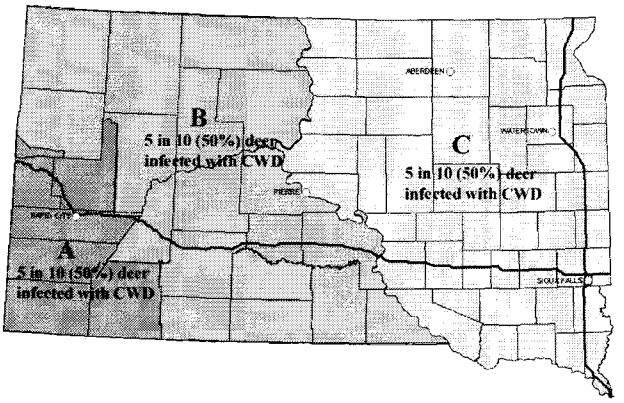
☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 5, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

Imaginary Situation 6

Map 6 South Dakota



***and* evidence shows that CWD can be *transmitted to humans* and hunters in South Dakota have *died* from CWD**

Imaginary Situation 6. Imagine these conditions existed in South Dakota, when you were considering whether or not to go deer hunting:

- **CWD had been found in: 5 in 10 (50%) deer across the entire state (in Zones A, B, and C)**
- **Evidence shows that CWD can be transmitted to humans and hunters in South Dakota have died from CWD**

It is known that testing deer for CWD is available in South Dakota, but it is not 100% accurate

1 Given Situation 6 **(see map 6)**, what would you do? **(check *ONE*)**

- ☐ Hunt deer in the zone in South Dakota that I hunt deer in most often
- ☐ Hunt deer in South Dakota, but switch to a different zone – which zone(s)? **(check all that apply)** ☐ A ☐ B ☐ C
- ☐ Give up deer hunting in South Dakota, but hunt deer in another state
- ☐ Give up deer hunting altogether

2 Given Situation 6, how concerned would you be about the ***health of the deer population in South Dakota***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

3 Given Situation 6, how concerned would you be for ***your own personal health***? **(check ONE)**

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

4 Given Situation 6, how unacceptable or acceptable would it be for the South Dakota Department of Game, Fish and Parks to take each of the following actions? **(circle one number for *each* statement that most closely matches your response)**

How acceptable is it for the South Dakota Department of Game, Fish and Parks to...	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
...take no action and allow CWD to take its natural course.	1	2	3	4	5	6	7
...continue to test deer for CWD.	1	2	3	4	5	6	7
...use *trained agency staff* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7
...use *hunters* to dramatically reduce herds in affected zones to lower the potential for CWD spreading.	1	2	3	4	5	6	7

1 The South Dakota Department of Game, Fish and Parks is responsible for managing South Dakota's wildlife resources. To what extent do you disagree or agree with each of the following statements regarding the South Dakota Department of Game, Fish and Parks? **(circle one number for *each* statement that most closely matches your response)**

I feel that the South Dakota Department of Game, Fish and Parks...	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
...shares similar values as me.	1	2	3	4	5	6	7
...shares similar opinions as me.	1	2	3	4	5	6	7
...shares similar goals as me.	1	2	3	4	5	6	7
...thinks in a similar way as me.	1	2	3	4	5	6	7
...takes similar actions as I would.	1	2	3	4	5	6	7
...has not given CWD enough attention.	1	2	3	4	5	6	7

2 To what extent do you disagree or agree with each of the following statements regarding your **trust** in the South Dakota Department of Game, Fish and Parks? **(circle one number for *each* statement that most closely matches your response)**

I **trust** the South Dakota Department of Game, Fish and Parks to...	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
...provide the best available information on CWD issues.	1	2	3	4	5	6	7
...provide me with enough information to decide what actions I should take regarding CWD.	1	2	3	4	5	6	7
...provide truthful information about human safety issues related to CWD.	1	2	3	4	5	6	7
...provide timely information regarding CWD issues.	1	2	3	4	5	6	7
...make good deer management decisions regarding CWD issues.	1	2	3	4	5	6	7
...properly address CWD in South Dakota.	1	2	3	4	5	6	7

3 How believable would you rate each of the following types of CWD information provided by the South Dakota Department of Game, Fish and Parks? **(circle one number for *each* statement that most closely matches your response)**

	Not at all Believable		Slightly Believable		Moderately Believable			Highly Believable		Unsure
Biological information about CWD.	1	2	3	4	5	6	7	8	9	0
Information about human safety issues related to CWD.	1	2	3	4	5	6	7	8	9	0
Information about deer management strategies due to CWD.	1	2	3	4	5	6	7	8	9	0

4 Taking everything into consideration, how would you grade the South Dakota Department of Game, Fish and Parks for handling CWD in South Dakota? **(check ONE)**

☐ A+ ☐ A ☐ A- ☐ B+ ☐ B ☐ B- ☐ C+ ☐ C ☐ C- ☐ D ☐ F

5 In South Dakota, funding for CWD research and management is limited and there is a need for new funds. What is the maximum amount that you would be willing to contribute (pay funds) **per year *in addition* to your hunting license fee** to help the South Dakota Department of Game, Fish and Parks **research** and /or **manage** CWD in the state? **(write responses; please put "0" if you feel that you would not be willing to contribute funds)**

In addition to my hunting license fee...

...I would be willing to contribute _____ dollars for **CWD research** (for example: testing / monitoring)

...I would be willing to contribute _____ dollars for **CWD management** (for example: herd reduction)

We would like to ask a few more questions about your hunting experiences. The questions on this page ask about your deer hunting experiences (mule deer and / or white-tailed deer) in South Dakota and any other areas where you have hunted deer in your life.

1 What ***ONE*** type of deer hunting do you do ***most often*** in South Dakota? **(check ONE)**

☐ Gun (for example: rifle, shotgun) ☐ Bow / Archery

☐ Muzzleloading ☐ I have never hunted deer in South Dakota

2 People go deer hunting for many reasons. Listed below are several reasons why deer hunting may be important to you. Please indicate how important each of these reasons is in influencing you to go deer hunting.
(circle one number for *each* statement that most closely matches your response)

	Not at all Important	Slightly Important	Moderately Important	Extremely Important
Harvesting a deer.	1	2	3	4
Bringing deer meat home for me to eat.	1	2	3	4
Bringing deer meat home for my family to eat.	1	2	3	4
Harvesting only a trophy deer.	1	2	3	4
Controlling the number of deer in the herd.	1	2	3	4
Controlling the ratio of male to female deer in the herd.	1	2	3	4
Helping to control the spread of CWD.	1	2	3	4
Being in nature.	1	2	3	4
Experiencing solitude.	1	2	3	4
Being with friends or family.	1	2	3	4
Experiencing the challenge of the hunt.	1	2	3	4
Testing / improving my hunting skills.	1	2	3	4
Having / using the right hunting equipment.	1	2	3	4
Getting physical exercise.	1	2	3	4

3 For some people, deer hunting may be one of the most important interests in their lives. For others, it may be just one of a number of interests they have; something that they enjoy, but to which they are not strongly committed. If you could ***not*** participate in deer hunting, would you: **(check ONE)**

☐ Not miss it at all ☐ Miss it more than most of your other activities

☐ Miss it slightly ☐ Miss it more than all of your other activities

4 Considering all of your other ***wildlife-oriented activities***, how many substitutes do you have for deer hunting? In other words, if you could ***not*** participate in deer hunting, how many other different wildlife-oriented activities are there that you enjoy doing just as much or more? **(check ONE)**

☐ I have **no** wildlife-oriented substitutes for deer hunting

☐ I have only **a few** wildlife-oriented substitutes for deer hunting

☐ I have **some** wildlife-oriented substitutes for deer hunting

☐ I have **many** wildlife-oriented substitutes for deer hunting

5 If you could never go deer hunting again, what ***ONE*** **wildlife-oriented activity** would you likely do instead? Please be as specific as possible (for example: duck hunting, bear hunting, fishing, wildlife viewing).

The ***ONE*** wildlife-oriented activity that I would do instead is **(write response)** _____.

Is this an activity that you currently participate in? **(check ONE)** ☐ No ☐ Yes

6 Is the ***one activity*** that you listed in Question 5 (above) a substitute that would give you the same level of satisfaction or benefit that you get from deer hunting? **(check ONE)**

☐ Definitely no ☐ Probably no ☐ Probably yes ☐ Definitely yes

Please turn over to the back cover to complete the final few questions of this survey. Thank you.

Finally, we would like to ask you a few questions about yourself to help us understand the different characteristics of hunters and to allow us to compare your answers with those of other hunters. **Your answers are totally confidential.**

1 Are you: **(check ONE)** ☐ male ☐ female

2 How old are you? **(write response)** _____ years old

3 What is your **current** marital status? **(check ONE)**
- ☐ Married or living with partner
- ☐ Not married or not living with a partner (for example: divorced, separated, widowed, single)

4 ***Including yourself***, how many people are **currently** living in your household? **(write response)** _____ person(s)

5 How many people ***under 18 years of age*** are **currently** living in your household? **(write response)** _____ person(s)

6 How would you describe **your current** residence or community? **(check ONE)**
- ☐ Large city with 250,000 or more people
- ☐ City with 100,000 to 249,999 people
- ☐ City with 50,000 to 99,999 people
- ☐ Small city with 25,000 to 49,999 people
- ☐ Town with 10,000 to 24,999 people
- ☐ Town with 5,000 to 9,999 people
- ☐ Small town / village with less than 5,000 people
- ☐ A farm or rural area

7 What is the **highest** level of education that **you** have achieved? **(check ONE)**
- ☐ Less than high school diploma
- ☐ High school diploma or GED
- ☐ 2-year associates degree or trade school
- ☐ 4-year college degree (for example: bachelors degree)
- ☐ Advanced degree beyond 4-year degree (for example: masters, Ph.D., medical doctor, law degree)

8 Finally, which of the following broad categories best describes your **current** approximate ***annual household*** income before taxes? **(check ONE)**
- ☐ Less than $10,000
- ☐ $10,000 - $29,999
- ☐ $30,000 - $49,999
- ☐ $50,000 - $69,999
- ☐ $70,000 - $89,999
- ☐ $90,000 - $109,999
- ☐ $110,000 - $129,999
- ☐ $130,000 - $149,999
- ☐ $150,000 or more

THANK YOU FOR COMPLETING THIS SURVEY, YOUR INPUT IS VERY IMPORTANT

PLEASE RETURN THE COMPLETED SURVEY AS SOON AS POSSIBLE IN THE ENCLOSED ADDRESSED AND POSTAGE-PAID ENVELOPE

If you have questions about this survey, please contact Mark Needham (970 491 4865, mneedham@cnr.colostate.edu) or Jerry Vaske (970 491 2360, jerryv@cnr.colostate.edu) of the Human Dimensions in Natural Resources Unit at Colorado State University.

If you have questions or would like information about Chronic Wasting Disease or other hunting-related issues in South Dakota, please contact the Department of Game, Fish and Parks website: www.state.sd.us/gfp or Larry Gigliotti (605 773 4231, larry.gigliotti@state.sd.us).

APPENDIX D. TELEPHONE NON-RESPONSE SURVEY ADMINISTERED TO HUNTERS (SOUTH DAKOTA EXAMPLE)

Hunters' Responses to CWD Non-Response Script (South Dakota Deer)

ID number: _____

Opening Script

Hello, my name is _____. I'm calling from Colorado State University. Is _____available please?

If no, they are not available:

Is there a better time to reach him / her? (record time). Thank you; have a good evening. (hang up)

If yes: I'm calling regarding a survey of hunters' views on Chronic Wasting Disease (CWD) in South Dakota that was sent to you several weeks ago. We have noticed that you have not responded to the survey, but your input is very valuable. Would you be willing to answer a few quick questions, which will take less than 2 minutes to complete?

If no (refusal): Have a good evening. (hang up; record response)

If yes: Thank you. I will read a brief description of CWD and then ask you a few short questions.

CWD is a brain disease of deer and elk that has been detected in South Dakota's herds. Although infected animals always die, the origin and transmission of CWD is not well understood. Scientists do not believe that CWD can be transmitted to humans.

(1). Prior to this phone call, had you ever heard of CWD before?

☐ No ☐ Yes

(2). Because of CWD, are you: not at all concerned, slightly concerned, moderately concerned, or extremely concerned about the health of the deer population in South Dakota?

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

(3). Because of CWD, are you: not at all concerned, slightly concerned, moderately concerned, or extremely concerned about your own personal health?

☐ Not at all concerned ☐ Slightly concerned ☐ Moderately concerned ☐ Extremely concerned

(4). Hypothetically, if a situation were ever to exist where 50% of the deer (5 out of every 10) in all areas of South Dakota were infected with CWD, what would you do?

☐ Hunt deer in the area in South Dakota that you hunt deer in most often
☐ Hunt deer in South Dakota, but switch to a different area in the state
☐ Give up deer hunting in South Dakota, but hunt deer in another state
☐ Give up deer hunting altogether

I will now read you four short questions and ask if you:

Strongly disagree	Moderately disagree	Slightly disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

with each question.

(5). The first question is: To what extent do you disagree or agree that *CWD may pose a risk to humans, but not enough is currently known to be sure*?

Strongly disagree	Moderately disagree	Slightly disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

(6). The second question is: To what extent do you disagree or agree that *you trust the South Dakota Department of Game, Fish and Parks to properly address CWD in South Dakota*?

Strongly disagree	Moderately disagree	Slightly disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

(7). The third question is: To what extent do you disagree or agree that *the South Dakota Department of Game, Fish and Parks takes similar actions as you would*?

Strongly disagree	Moderately disagree	Slightly disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

(8). The fourth question is: To what extent do you disagree or agree that *participation in deer hunting is a large part of your life*?

Strongly disagree	Moderately disagree	Slightly disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

(9). Finally, what is your age? _____ years old

Ending Script (after survey is completed).

That's all the questions that I have. Thank you for your time; have a great evening.