Applying Theory To Management: Assessing the Practicality of Leopold's Land Ethic and the Risk Information and Processing (RISP) Model for Wildlife Management

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Abstract

In the United States, natural resources are held in trust for the American people and future generations. Because managers make decisions on behalf of the public, this necessitates an understanding of their preferences, values, and opinions towards the resources being held in trust for them; understanding stakeholder groups helps managers make better decisions on their behalf. This presentation addresses two conceptually related but diverse topics in the realm of natural resource management pertaining to (1) the Risk Information Seeking and Processing behaviors of northwest Minnesota deer hunters after bovine tuberculosis (*Mycobacterium bovis*) was detected in the local whitetail deer population, and (2) farmers' attitudes towards and motivations for participation in federal conservation programs beneficial to wildlife. The first of these projects found that attitudes exerted the greatest influence on hunters' information seeking behaviors towards bovine tuberculosis in a model that included individual characteristics, personal impacts, trust in the DNR, norms, and information sufficiency. The research on farmers' beliefs about enrollment in conversation programs suggested that a model including knowledge, community, and behavioral obligation dimensions drawn from Leopold's Land Ethic explained 54% of the variance in farmers' perceived environmental responsibilities. Although these studies focus on unrelated topics, they concern the human dimensions of natural resource management, address current issues faced by managers and decision makers, and are theory directed research. Ultimately the

information gained through these projects will aid in the development of outreach efforts and design of conservation programs, as well as contribute to cumulative knowledge to better understand social psychological theory applied to resource management.

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CHAPTER 1: Introduction

"By the law of nature these things are common to mankind – the air, running water, the sea, and consequently the shores of the sea."

- Emperor Justinian

"Science is a tool, and we invent tools to do things we want. It's a question of how those tools are used by people."

- Margaret Atwood

Public Trust Doctrine and the Human Dimensions of Fish and Wildlife

Under the tenants of the Public Trust Doctrine in the United States, natural resources are held in trust for the American people and future generations. This foundational element of resource management implores managers and government employees and elected officials to care for and protect the environment for the present and future benefit of US citizens.

The Public Trust Doctrine was established in the United States through several legal precedents, some of which date back to Roman law and the Magna Carta (Frank, 2012). Under the Doctrine's constraints, the government cannot give certain resources over to private ownership, or prevent the public's use of these resources (Frank, 2012; Organ & Batcheller, 2009). The general public are trustees of the resource and are afforded special rights (Organ & Batcheller, 2009). Many of these rights relate to the use of wildlife.

Wildlife managers often consider members of the public stakeholders in the resources being held in trust for them. In this work, stakeholders are

considered individuals with an interest in management of resources (Davies & White, 2012). Stakeholder preferences often translate into management priorities.

This framework, in which managers make decisions on behalf of stakeholders, necessitates an understanding of the preferences, values, and opinions of those stakeholders towards the resources being held in trust for them. Understanding the American public and various stakeholder groups helps managers make better decisions on their behalf. In this sense, “wildlife management is aimed at production of value defined by and for society, where values or benefits are the outcomes (i.e., positive impacts created or negative impacts reduced) that are experienced by stakeholders as the result of wildlife management (e.g., values associated with biodiversity, recreation, and economic activity)” (Decker, Riley, & Siemer, 2013, p. 35). However, wildlife management challenges arise when benefits to one stakeholder group are considered negative impacts by another.

Likewise, the premise of the Public Trust Doctrine requires the public to understand their stake in natural resources in order for those resources to be protected and managed for their benefit. The public’s interest in natural resources insulates environmental protections from being eroded by other demands, such as economic pressure (Organ & Batcheller, 2009). Without public interest, the public trust cannot be maintained.

Role of Human Dimensions

The act of managing natural resources requires conflict management and mediation, relationship building and bridging, and communication with diverse groups (Decker, Riley, & Siemer, 2013; Lauber, Decker, Leon, Chase, & Schusler 2012). Historically, the hunting and angling community dominated the conversation - they appeared to have the strongest opinions about the management of wildlife resources. With the advent of environmentalism in the 1970s and onward, more stakeholder groups with a vested interest in natural resource management formed (Schuett, Scott, & O'Leary, 2009; Decker & Chase, 2001). An ideal situation is one in which there is mutual gain, but changes in the composition of stakeholder groups and an increase in the diversity of their priorities makes this outcome challenging.

Many resource decisions involve stakeholder groups with competing priorities, and effective communication in such situations requires careful consideration. The role of managers in this context is to find an intersection between biological science and social acceptability (Organ & Batcheller, 2009). Because numerous stakeholders have a vested interest in the management of the land and resources held in the public trust, a balance must be struck between conflicting factions. Due to the Public Trust Doctrine, state and federal resource managers play a central role in forging such decisions. These personnel use science and research to determine what is biologically possible while attempting

to stay within the limits of social acceptability (delineated by stakeholder preferences).

Aside from moderating the preferences of diverse stakeholder groups, recent, rapid changes to the environment also require that managers have the ability to quickly and effectively communicate with the public. Humans today have an overwhelming influence on the natural world. Impacts caused by climate change, the spread of invasive species and disease, and advances in technology have environmental ramifications that pose challenges for resource managers. In these circumstances, managers understand how to communicate with various groups to mitigate disasters or explain consequences of impacts that alter ecosystems and the environment.

Interdisciplinary Human Dimensions

Although the arena of human dimensions of wildlife centers on interactions between humans and the environment, the field did not develop in isolation from other sciences. Human dimensions of wildlife practitioners often adopt theories and techniques developed in the health, business, and communications sciences, adjusting them for use in the context of natural resource management (Pierce, Manfredo, & Vaske, 2001). Fields outside of wildlife management contribute a deeper understanding of it by expanding the minds of managers and exposing them to helpful theories and information to guide decisions (Pierce et

al., 2001). The research contained in this thesis especially relates to social psychology theory and health communication sciences.

Social psychology is “the scientific study of the way in which people’s thoughts, feelings, and behaviors are influenced by the real or imagined presence of other people” (Allport, 1985). We use social psychological methods to examine hunters’ reactions to bovine tuberculosis occurrence in northwest Minnesota and farmers’ attitudes towards conservation practices in the Midwest. Researchers and practitioners in the field of human dimensions of wildlife adapt these theories for improved application, building a subset of wildlife sciences knowledge around them.

Human Dimensions of Wildlife Disease Management

Wildlife diseases have great impacts on communities and stakeholders when they occur. In the United States, much past research has been conducted on the relationship between society and wildlife in instances of disease occurrence out outbreak (Heberlein, 2004; Dorn & Mertig, 2005; Decker et al., 2007). In the recent past, theories related to risk and wildlife disease in white-tailed deer have been applied to problems such as CWD and bovine tuberculosis (Vaske, Timmons, Beamon, & Petchenik, 2010). In instances of wildlife disease, managers seek learn how to communicate risks of disease to their stakeholders, and increase acceptability of various wildlife management strategies aimed at disease reduction (Muter, Gore, Riley, Lapinski, 2013). The public is an important

component of wildlife disease management, and managers seek their approval and input when communicating risks, developing disease management strategies and best practices.

The second chapter examines a recent occurrence of bovine tuberculosis in the state of Minnesota through the lens of the Risk Information Seeking and Processing (RISP) theory (Griffin et al., 1999). Detection of bovine tuberculosis in the wild deer herd affected the dynamics of the hunting and agricultural communities in the area, and posed a potential human health threat. Agricultural business interests sought to protect their livelihoods and members of the local community wanted to maintain the deer herd and preserve hunting culture in the area. As a result, natural resource managers faced many challenges related to communicating the effects, risks, and eradication strategies for the disease. The primary audiences of their efforts included farmers and deer hunters.

Using theories developed in the health communication sciences, we evaluated northwest Minnesota hunters' perceived RISP behaviors. The RISP theory used in the second chapter was originally developed for use in the realm of health sciences. Doctors needed information regarding the communication of threats of heart disease to their patients (Griffin et al, 1999). Specifically, researchers investigated the level of threat doctors should convey to patients in order to avoid making them feel helpless or apathetic (and thus less likely to take actions to improve their condition). We adapted this work and applied it to conveying threats of bovine tuberculosis to hunters in northwest Minnesota.

This research aided the DNR in understanding the appropriate levels of threat from bovine tuberculosis to convey to hunters and the sources of information most trusted by hunters. The DNR wanted to understand how hunters envisioned the occurrence of bovine tuberculosis so they could reduce human, environmental, and economic consequences of the disease by effectively communicating information about it with their stakeholders and motivating them to take action to help reduce transmission of the disease.

Human Dimensions and Conservation Behavior

The theories used in Chapter 3 were also originally borne out of the health communication sciences, but refined in a subset of human dimensions that seeks to understand conservation behavior. Understanding attitudes towards conservation behaviors has been extensively researched in the realm of human dimensions of natural resource management. Chapter 3 explores farmer attitudes and behaviors related to conservation practices on their farms and enrollment in Farm Bill conservation programs using a novel Land Ethic scale based on the writings of Aldo Leopold.

Farmers' conservation practices have been a primary target for attitude and behavior research in the past (Beedell & Rehman, 1999; Carr & Tait, 1991). Such research related to cognitive hierarchies may seek to predict and explain behavior (Fulton, Manfredo, & Lipscomb, 1996; Vaske & Manfredo, 2012). These cognitive hierarchy models systematically evaluate human thought processes

and behavior. This work may ultimately aid managers in communicating with their stakeholders and designing outreach efforts and conservation programs that resonate with stakeholders.

Environmental behavior research often measures the attitudes, norms and behavioral intentions of individuals towards conservation and conservation practices. It may also investigate individuals' values, concern for the environment, demographics, individuals' New Ecological Paradigm scores, and other variables (Schulz, et al., 2005). Often, it is used to design behavioral interventions in or explore citizens' energy conservation or recycling practices (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Abrahamse, Steg, Vlek, & Rothengatter, 2007; Steg, 2008). Similar research has ben conducted on place attachment and connectedness to nature (Gosling & Williams, 2010). This work revealed that most farmers indicated having a strong attachment to their properties and nature (Gosling & Williams, 2010). However, attachment to place did not explain variance in conservation behaviors (Gosling & Williams, 2010).

In this case, we adapted social psychological methods and scale development to test the predictive power of a novel Land Ethic scale based on the writings of Aldo Leopold. We used concepts and measurement approaches from the Theory of Reasoned Action and Theory of Planned Behavior (Fishbein & Ajzen, 2010) and Norm Activation Theory (Schwarz, 1977), to provide a contextual assessment of the Land Ethic scale.

The application of our work on farmer attitudes towards conservation programs and their perceived responsibility to the environment near their farms helps managers communicate conservation practices in a way that resonates with this audience. This research may be used to refine programs and messages to align with the preferences of the agricultural community, and is a first step in assessing the attitudes of farmers in the Midwest towards conservation and the relationship between them and their land.

Theory application

The information gained through these research projects goes beyond informing managers about local, or even regional, stakeholders, and contributes to the larger body of knowledge growing in the field of Human Dimensions of wildlife management. Certainly descriptive statistics and case studies provide managers with valuable information that aids their work, however examining the operation of interdisciplinary theories improves future work and advances the field as a whole. The role of researchers in Human Dimensions extends beyond fulfilling singular management objectives and completing projects for clients. The work needs to be disseminated and contextualized for the study of human dimensions of wildlife management to progress; extending findings beyond their immediate application and into the realm of theory application is vital to future success.

CHAPTER 2: Bovine tuberculosis management in northwest Minnesota & implications of the Risk Information Seeking and Processing (RISP) model for wildlife disease management

Introduction

Understanding the human dimensions of disease management in wildlife has increased in importance during the past two decades (Clarke 2009; Heberlein & Stedman, 2009; Holsman, Petchenik, & Cooney, 2010; Lyon & Vaske, 2010; Vaske, Shelby, & Needham, 2009). Following Clarke (2009), we used the Risk Information Seeking and Processing model (RISP) (Griffin, Dunwoody, & Neuwirth, 1999) as a core framework to better understand the key considerations for understanding and better communicating with stakeholders about disease management in wildlife. In this study, we were interested in better understanding the processes through which Minnesota deer hunters sought information about risks from bovine tuberculosis (*Mycobacterium bovis*, hereafter referred to as 'bovine TB'). Such information can aid managers in contextualizing individuals' perceived risks and communication best practices in instances of disease in wildlife. We addressed the following in this article:

1. How do hunters seek information about bovine tuberculosis?
2. What factors affect hunters' information seeking behaviors?
3. What are the implications for natural resource management agencies and professionals?

Background

Bovine TB is an infectious zoonotic disease that can spread among domestic cattle, wild deer, and, in rare cases, humans and other mammals. Zoonotic diseases like bovine TB threaten agricultural economies, pose health risks to humans and wildlife, and disturb the social, political, and economic environments where they transpire. In Minnesota, the occurrence of bovine TB engaged numerous stakeholder groups, management agencies, agricultural operations, and local residents.

Initial detection of bovine TB in Minnesota occurred at a beef cattle operation in 2005 (Carstensen, Pauly, DonCarlos, & Cornicelli, 2007). Upon further testing, the disease was discovered in several other beef cattle operations and detected in one wild white-tailed deer (*Odocoileus virginianus*) in 2005 (Carstensen et al., 2007). Epidemiological evidence indicated the disease was introduced into single beef cattle operation; from there it spilled over to the area's local deer herd (Carstensen & DonCarlos, 2011). Deer presumably served as a spillover host for the transmission of the disease among area livestock operations (Muter, Gore, Riley, & Lapinski, 2013; Carstensen & DonCarlos, 2011).

In response to the detection of bovine TB in cattle and deer, the Minnesota Department of Natural Resources (DNR) and the Minnesota Board of Animal Health took joint actions to first decrease the likelihood of disease

transmission and second, eradicate the disease from the state. These strategies centered on preventative measures to reduce the likelihood of disease transmission (such as the placement of deer exclusion fencing around livestock operations), prohibiting recreational deer feeding, and substantially reducing the local deer population through the use of liberal hunting seasons and aerial and ground sharpshooting (Castensen, O'Brien, & Schmitt, 2011; Muter et al., 2013; MN DNR, 2012). In addition to these preventative measures, the DNR also monitored deer for the disease.

Although the disease was successfully eradicated in cattle and reduced to an undetectable level in deer by 2011, many local residents and hunters considered the actions taken to achieve bovine TB-free status controversial (MN DNR 2012). Among the general public, lethal control of deer (sharpshooting) is often contentious (Fulton, Skerl, Shank, & Lime, 2004; Dougherty, Fulton, & Anderson, 2003; Carstensen et al., 2011). Further, in instances of zoonotic disease affecting game species, hunters show more concern than the general public about game management (Stafford, Needham, Vaske, & Petchenik, 2007; Vaske, 2010).

Conceptual Framework

The RISP model is the primary source for the conceptual framework used in our study, and data were collected following the methods outlined in Griffin's 1999 work on RISP and recent adaptations to that model (Clarke 2009). The

RISP model examines the relationship between information, knowledge, and risk perception (Griffin et al., 1999). Previous research in the field of risk and threat perception has shown that information seeking and processing is an important component of how an individual perceives and responds to a risk (Kahlor, 2010).

According to the RISP model (Figure 1), an individual's perception of risk is driven by the degree to which they are informed about a threat and how he or she seeks out and processes information about the risk (Griffin et al., 1999). Griffin's (1999) RISP model, like many other risk perception models, initially was used to study personal threats, specifically individual health risks. However, it has since been expanded to include environmental risks (Griffin et al., 2008; Kahlor, 2007; Kahlor, Dunwoody, Griffin, & Neuwirth, 2006) and also has been extended conceptually (Clarke 2009; Kahlor, 2010). Clarke (2009) presented a modified RISP framework, integrating values, to examine how individuals perceive zoonotic disease (such as bovine TB) as a threat to wildlife (see Figure 2**).**

A central component of the RISP model is "information sufficiency" (Griffin et al., 1999). In the process of developing the perception of a threat, an individual will assess how much information they currently have and evaluate that level based on how much information they think is necessary to understand the threat. If the individual has insufficient information, they will seek out and process additional information about the topic. Demographics and informational suggestive norms may influence individuals' information sufficiency thresholds.

An affective response may also be an important influence on information sufficiency, and the common affective responses studied by RISP frameworks are worry and anxiety (Griffin, Neuwirth, Dunwoody, & Giese, 2004). However, fear and anger are also possible responses that could apply (Griffin et al., 2008; Griffin et al., 1999). Subjective norms, an individual's assessment of whether his or her peers expect him or her to be informed, can also lead to the information sufficiency stage regarding the threat (Griffin et al., 1999). Even if an individual is not concerned about a risk, they may decide to learn more if they think it will give them more information to talk about with peers.

Another set of components, "perceived information gathering capacity", refers to whether the individual is able to understand (or comprehend), available information. Information that is too complicated or technical may discourage an individual from seeking more information about the risk. Relevant channel beliefs, which we did not collect data on, refer to the "channels," or sources of information, through which an individual learns about a risk (Griffin et al., 1999). In the model, relevant channel beliefs do not interact with other predictor variables and subsequent work on RISP excludes relevant channel beliefs (ter Huurne, Griffin, & Gutteling, 2009). The information sources or amount of information an individual has access to may help or hinder his or her desire to seek information about the source.

These variables encompass an individual's heuristic and systematic processing of information, and in the model are hypothesized to influence

information seeking behavior through the information sufficiency and perceived information gathering capacity variables, which share a direct relationship with information seeking (Clarke 2009; Griffin et al. 1999). Systematic processing refers to higher order processing, which requires effort on the part of the individual and, more likely than heuristic processing, may lead to attitudinal change (Ajzen, 1988; Eagley & Chaiken, 1993). Heuristic processing occurs at a comparatively shallow level and uses superficial cues for interpreting information (Eagley & Chaiken, 1993).

In addition to Griffin's (1999) RISP model, we adopted components of Clarke's (2009) zoonotic disease risk information seeking and processing (ZDRISP) framework. Following Clarke (2009), we measured hunters' perceptions of the impact of bovine TB to themselves, other people, and wildlife. Clarke's (2009) framework includes components that examine how the personal impact (health and financial costs to the individual) and impersonal impact (health and financial costs to other people, wildlife species, and society) can be included in a traditional RISP model. Clarke (2009) also emphasizes the importance of trust in the managing agency on information seeking and processing. Low trust of an agency might discourage, or frustrate people, from learning about the threat. Trust will also likely have an important role in whether an individual supports the agencies' policies to manage the threat. Kahlor (2010), building off similar communication processing frameworks, argued for a more integrated RISP model that was termed, "A Planned Risk Information

Seeking Model" (PRISM). The key aspect of PRISM is the integration of the core RISP model with conceptual components from the Theory of Planned Behavior (Ajzen, 1988; Fishbein & Ajzen, 2010). These components include: 1) positive/negative evaluations of a behavior (attitudes); 2) perceptions of social pressure to engage in a behavior (subjective norms); and 3) perceived ability to engage in a behavior (perceived behavioral control) (Kahlor 2010).

The RISP model hypothesizes that information sufficiency and perceived information gathering capacity directly influence information seeking behavior. Because of the proximity of these variables to information seeking in the model (see Figure 1), we expect them to demonstrate the greatest influence on information seeking behavior relative to other variables.

Methods

Instrument Design and Measurement

Previous studies conducted using the RISP framework and its variants (Griffin et al., 2008; Clarke 2009; Kahlor 2010) guided the development of the survey instrument used in this research. We collaborated closely with the Minnesota DNR to better understand their bovine TB strategy related to deer management, and the adoption of the RISP model for evaluating perceived threats from wildlife disease has been in collaboration with researchers at Michigan State University (Triezenberg, Gore, Riley, & Lapinski, 2014).

Dependent Variable. Following the RISP model, we wanted to understand what variables influenced the likelihood of individuals actively seeking out information pertaining to bovine TB. We used five items developed and tested in previous studies of the RISP framework to measure information seeking (Table 2.1). Respondents used a five-point Likert-style response scale ranging from "strongly disagree" to "strongly agree" to respond to each item. Avoidance questions were reversed coded for reliability and subsequent scale formation. A scale for "information seeking" was computed as the mean score of the scale items.

Independent variables. Independent variables in this analysis include: (1) individual characteristics including age, education, income, and hunting importance; (2) perceived hazard characteristics including personal impact of bovine TB, risk judgment, trust in the Minnesota DNR, and self-efficacy; (3) the affective responses of anger, worry, and fear; (4) felt social pressure, comprised of respondents' attitudes and informational subjective norms; (5) information sufficiency, a measure of where in the gap between current knowledge and information insufficiency an individual believes themselves to be; and (6) participants' personal capacity to learn new information about bovine TB.

Following Clarke (2009), we assessed survey respondents' perceptions of the impact of bovine TB to themselves, other people, deer and other wildlife using nine survey items. We used a five-point scale ranging from, "not at all" to "extremely" concerned (Table 2.2).

We measured the affective response of study participants to the discovery of bovine TB and the DNR's subsequent management of the disease in northwest Minnesota with an 11-point scale.ranging from, "none of this feeling" to, "a lot of this feeling" to assess reactions across ten positive and negative emotions. Affective responses relevant to the RISP model include anger, worry, and fear (Table 2.2).

We measured subjective norms using three items answered on a five-point scale. Specific items included the impacts of others' expectations and the likelihood that others would want to engage in conversations about bovine TB.

We used six items to define respondents' beliefs about their personal ability to get and understand information concerning bovine TB and its management in northwest Minnesota (Table 2.2). Responses related to information seeking capacity were recorded on a five-point style scale ranging from "strongly disagree" to "strongly agree" (Table 2.1).

We measured information insufficiency by asking respondents to self-report their *initial* level of knowledge about the topic of bovine TB and TB management and the level of knowledge (sufficiency threshold) they believed they would need to achieve a comfortable level of understanding of bovine TB and TB management. We asked survey recipients to rate each on a scale ranging from 0 (no information) to 100 (all available information). Following Griffin et al. (2008), we did not equate knowledge insufficiency as difference scores between these two measures, but rather regressed sufficiency threshold

scores on initial knowledge scores to identify “information insufficiency” (as delineated in Cohen & Cohen, 1983).

Following Fishbein and Ajzen (1975, 2010), we used semantic differential scales to assess the respondents’ evaluation of seeking information about bovine TB and management of bovine TB. Each potential respondent was asked to evaluate whether information seeking was worthless or valuable, foolish or wise, and unhelpful or helpful.

Finally, we asked how they felt when they first heard about the bovine TB outbreak and what their initial concerns were (Table 2.5). We inquired about recipients’ initial knowledge of bovine TB (when they first heard about the outbreak) and whether they thought information about bovine TB was important. We requested to know where individuals received information about bovine TB and asked about their information seeking behavior. These questions were adapted from existing RISP literature (Griffin et al. 2008, Kahlor 2007, Kahlor et al. 2006, Griffin et al., 1999).

We also asked survey recipients about their current knowledge and the amount of effort they dedicated to learning about bovine TB. Finally, participants answered a series of questions about whether they trusted the Minnesota DNR and whether they thought the DNR had similar concerns to theirs about bovine TB. After asking about trust, we asked recipients whether they thought it was likely that another outbreak of bovine TB will occur, and if so, how severe they thought the outbreak will be.

Sampling

The Minnesota DNR uses a series of deer hunting permit areas to regulate deer hunting and deer management, and we drew our sample from Minnesota's Electronic Licensing System license database. The study population for this research included all adult individuals who purchased a deer license and went hunting at least once in the selected deer permit areas during the 2011 deer season. The selected deer permit areas include the entire area in northwest Minnesota affected by the occurrence of bovine TB (Figure 2.3). We drew a proportional random sample from the Minnesota DNR database of all licensed hunters' names and addresses.

Data Collection

The survey was implemented following a modified version of the Tailored Design Method (Dillman, Smyth, & Christian 2008). We mailed survey instruments to the 2100 licensed hunters from the seven deer hunting permit areas, and used three waves of mailing to maximize the response rate. Data were collected during the late summer and fall of 2012.

Data Analysis

Data were analyzed using the Statistical Program for the Social Sciences (SPSS v. 20, 2013). We employed hierarchical multiple regressions to examine the relationship between explanatory variables and the predictor, information

seeking behavior.

We also employed hierarchical multiple regression in the RISP schematic to explore the ability of the RISP model to predict information seeking behaviors. We generated 7 separate models to test the effects of including each additional variable in the RISP framework, predicting information seeking behavior, with the exception of “relevant channel beliefs” as we did not collect information on this topic (Griffin et al., 1999).

Results

Response Rates & Respondent Characteristics

A total of 2100 hunters were contacted by mail; 134 were undeliverable. Of the 1966 remaining surveys, 745 were completed and returned, resulting in a response rate of 38%. The usable response rate for this analysis was 23% (n = 455) after removing individuals excluded due to incomplete responses to survey items. Of individuals excluded from analysis, the majority failed to respond to a survey item regarding income (n = 211), a component of personal characteristics in the RISP model. The majority of survey respondents were male (93%) and half had completed some college or a higher level of education (Table 2.1). We saw a wide range of distribution in the responses to survey items that comprise variables included in the models. This suggests that our findings are likely to be more representative of the sample population, which includes all hunters in the 7 permit areas affected by bovine TB. Furthermore, we believe these sample

demographics to be fairly representative of the sample population of hunters in northwest Minnesota.

Scale reliability results

We developed scales to measure several of the variables in the RISP framework and analyzed them for reliability and internal consistency (Table 2). Reliable indices were identified for perceived impacts (α = .71), informational subjective norms (α = .74), beliefs about information gathering capacity (α = .74), attitudes toward information seeking (α = .90), and information seeking behaviors (α = .77). We additionally developed a scale to measure trust in the DNR (α = .93), a component of perceived hazard characteristics.

Model results

Multiple regression analysis demonstrated significant effects of attitudes, subjective norms, information seeking capacity and information insufficiency on the information seeking behaviors of northwest Minnesota deer hunters (Tables 2.3 & 2.4). The final model in the hierarchical regression suggests that the RISP framework explains 46% of the variability in northwest hunters' information seeking behaviors in response to bovine TB occurrence (in the sample) (Table 2.4).

Model 1 includes only individual characteristics, and explains a small amount of the variability in information seeking behaviors, less than 7% (Table 2.4). The addition of variables pertaining to personal impact, risk judgment, trust

in DNR, and self-efficacy increases the model's overall explanatory power only 4.7% (Table 2.4). Affective response also does not substantially impact the amount of variation in information seeking behaviors explained – with its inclusion the total *R-square* value approaches only 15% (Table 2.4).

Subjective norms and attitudes substantially increase the amount of variability of the RISP model, which more than doubles (to 38%). Current knowledge and information insufficiency do not appear to affect the amount of variation appreciably. In all models the results are statistically significant.

Equation 1 describes the relationship of the RISP variables and information seeking behaviors in the final model:

$$\widehat{Information\ seeking\ behavior} = \quad (1)$$

$$.764 + .000(age) + 0.021(education) + .000(Income) +$$

$$.056(Hunting\ importance) - .047(Personal\ impact) +$$

$$.000(Risk\ judgment) + .008\ (Trust\ in\ DNR) - .005(Self -$$

$$efficacy) - .011(Anger) + 0.22(Worry) + .010(Fear) +$$

$$.143(Attidue) + .159(Subjective\ norm) +$$

$$.315\ (Information\ seeking\ capacity) +$$

$$.001\ (Current\ knowledge) + .003\ (Information\ Insufficiency)\ .$$

In model 7, findings suggest only attitude, subjective norm, information seeking capacity, and information insufficiency are statistically significant (p <.05)

predictors of information seeking behaviors in the RISP model (Table 2.4). Information seeking capacity ($p < .001$) and information insufficiency ($p = .019$) were significant predictors of information seeking behaviors of northwest Minnesota deer hunters after controlling for individual characteristics, perceived hazard characteristics, affective response, attitudes and informational subjective norms. As the variables most proximal to information seeking behavior in the RISP framework, the result is expected (Figure 2.1). However, while information insufficiency displays statistical significance ($p < .001$), the amount of additional variability it explains in the model is less than 1%. Changes in the amount of variability explained in the models are greatest with the addition of subjective norms and attitudes (22%) and information seeking capacity (6.8%) (Table 2.4).

In addition to the application of the RISP framework, we found that northwest Minnesota hunters reported family, friends, and social network as their greatest source of information about bovine TB and bovine TB management (Table 2.5). The sample population considered public meetings and the Minnesota Board of Animal Health the least-utilized information source (Table 2.5).

Discussion

This study aimed to better understand the operation of the RISP model in an applied setting; we investigated the relationships of individual variables on information seeking behavior in the model. To achieve this, we explored the results of a hierarchical multiple regression analysis utilizing the RISP framework.

Analysis revealed several discrepancies from the expectations of the RISP model and other studies using the RISP model. These include research on topics ranging from environmental risks to the health communication sciences (Griffin et al., 2008; Kahlor, 2010; Triezenberg, Gore, Riley, & Lapinski, 2014).

Similar to Triezenberg et al. (2014), who adopted a modified zoonotic disease risk perception model to examine perceptions of bovine tuberculosis and disease management in Michigan, we found a significant effect of attitudes and subjective norms. However, while attitudes and norms most profoundly influenced information seeking behaviors in our application of the RISP model, Triezenberg et al. (2014) saw the greatest effect from beliefs regarding the potential impact of bovine TB on deer hunting and culture.

Unlike the findings of Kahlor's PRISM research (2010), in our application of the RISP model information sufficiency was significant. However, its importance in predicting information seeking is diminished by its lack of predictive power. The addition of information sufficiency in the RISP model yielded almost no increase in variance in information seeking behavior explained (< 1%). Our finding differs from our original expectation, that those variables most proximal to information seeking behaviors in the model would explain the greatest proportion of variation in response.

In our model of information seeking behaviors, we found that attitudes explained the greatest amount of variability in information seeking behaviors of northwest Minnesota hunters. We believe this relates to the time that elapsed

between the survey implementation and the initial outbreak of bovine TB in MN. Bovine TB was originally detected in a wild deer in 2005, and this research was conducted in the summer of 2012. While attitudes and behavior explain the greatest proportion of variability in the model, they are more stable over time than some of the other variables, such as affective response (which is relatively fleeting) (Ajzen 1988).

Although information sufficiency and perceived information seeking capacity were statistically significant, they did not explain as much of the variability in response as attitudes. This suggests that they may be less important as a long-term predictor of information seeking behaviors than attitudes. The findings pertaining to attitude and social norms exerting a strong influence on risk behaviors of individuals are similar to other applications of the model in the context of zoonotic disease risk perception (e.g., Triezenberg et al., 2014).

Although Minnesota received classification as a bovine TB-free state in 2011, the possibility of future occurrence of bovine TB or other wildlife disease outbreaks remains. Understanding how hunters perceive bovine TB and bovine TB management, as well as what motivates them to attend to information concerning the risks and management of bovine TB, is integral in creating socially acceptable policy to manage for future occurrences of bovine TB or similar zoonotic diseases affecting humans and wildlife (Holsman et al. 2010; Ramsey, O'Brien, Cosgrove, Rudolph, Locher, & Schmitt, 2014).

Asking respondents to rate their affective responses when they initially

heard about the outbreak limits our findings; there may have been inaccuracies in participants' recollections of their emotions upon hearing of bovine TB. We also expect that survey participants used hindsight to inform their responses related to perceptions of threats from bovine TB.

In the survey instrument, we asked people to recall in the past how they perceived threats of bovine TB after it had already been eradicated from the state. If we had surveyed hunters immediately following the onset of bovine TB, rather than after Minnesota was declared bovine TB-free, respondents' likelihood of reporting perception of a threat from bovine TB may have been higher. Information about the extent of the disease was readily available by the time we surveyed hunters, and they were probably better informed about past risks (and the lack of present risk) from bovine TB.

Because the RISP model has been widely applied in other contexts and may be useful to natural resource managers in the future, it is important to understand its operation in an applied setting. This research suggests that using the RISP model to explain behaviors after the immediate onset of a threat, or once a threat has been eradicated, may be challenging. Model variables that are stable across time (demographics and attitudes) appear to be primary drivers (explain the greatest percentage of variability).

Future research

Diseases such as bovine TB and Chronic Wasting Disease (CWD) will likely prove to be increasing management challenges into the future. Now that

applied research in the human dimensions of disease management has been conducted on similar cases, such as in Minnesota and Michigan, much could be learned by substantive comparative analysis. In the future, parallels may be drawn between these and other applications of the RISP model and its variants. Research aimed at comparative analysis of the results of such studies increases the precision and accuracy of future measurements and informs conclusions drawn.

Because of the strong influence of attitudes and norms on information seeking behaviors, which are not most proximal to information seeking and processing behavior in the model, areas of future analysis include SEM and path analysis to better describe the relationship between framework variables.

Conclusion

Due to early detection of the disease and aggressive management actions, the occurrence of bovine TB in Minnesota never reached levels similar to those in Michigan, where bovine TB eradication from the wild population of white-tailed deer is unlikely (Ramsey, et al., 2014). As such, Minnesota provides a case study for successful bovine TB management (if “success” is considered elimination of the disease from the state).

This project explores the use of the RISP model in the context of wildlife disease and management. The findings about the operation of the RISP theory in an applied context inform future research and management, indicating that in this instance attitudes and norms exert greater influence on hunters’ information

seeking behaviors than the RISP framework appears to suggest.

Evidence suggests that successful natural resource management and policy implementation requires stakeholder support, especially from hunters and private landowners (Carstensen et al., 2011). Communicating zoonotic disease risks to the public, as in the case of bovine TB, proves challenging for mangers (Carstensen et al., 2011). When this research is contextualized in an applied setting, it may aid managers' decision-making related to risk communication, ultimately bettering relationships with stakeholders and policy outcomes.

Tables

Table 2.1 Respondent characteristics.

	N	%
Gender		
Male	675	93.0
Female	51	7.0
Education		
Grade School	7	1.0
Some high school	10	1.4
High school diploma or GED	151	20.9
Some vocational or technical school	65	9.0
Vocational or technical school (associate's)	126	17.5
Some college	118	16.4
Four-year college	164	22.7
Some graduate school	29	4.0
Graduate/professional degree	51	7.1

Table 2.2 Reliability and descriptive statistics of indices and items measuring model variables.

Index Item	Mean	SD	Alpha
Affective response[1]			
Anger	4.23	3.408	
Worry	4.65	3.357	
Fear	5.19	3.203	
Initial concerns[2]			
Economic impacts to cattle producers.	3.07	1.225	
Threats to the health of deer.	3.81	1.034	
Reducing the deer population in the area.	3.84	1.148	
Economic impacts to businesses that depend on deer hunting.	3.23	1.159	
Threats to the health of other deer hunters from infected deer.	2.74	1.32	
Reducing your deer hunting opportunity.	3.72	1.197	
Threats to your personal health or family members from infected deer.	2.68	1.398	
Financial costs to you personally.	2.08	1.278	
Attitude toward seeking information [3]			0.90
Worthless...valuable	5.18	1.353	
Foolish...wise	5.36	1.29	
Unhelpful...helpful	5.16	1.25	
Informational subjective norms[4]			0.74
People who are important to me thought I should stay on top of information about bovine TB and TB management.	3.07	0.962	
People close to me expected me to get information about bovine TB.	2.8	0.992	
Most of the people I know wanted to talk about bovine TB.	2.99	1.179	
Perceived information gathering capacity[4]			0.74
I knew what questions to ask of the experts.	2.77	0.956	
I knew where to go for information.	3.39	0.95	
I could take the time to gather any information I needed.	3.32	0.917	
Much of the information was too technical for me to understand. (reverse coded)	3.44	0.875	
I could separate fact from fiction.	3.86	0.856	
I could understand the information if I made the effort.	2.77	0.704	

Table 2.2. continued

Index Item	Mean	SD	Alpha
Information seeking behavior[4]			0.77
When the topic came up, I was likely to tune it out. (reverse coded)	3.79	0.895	
I'd go out of my way to avoid learning more about bovine TB management. (reverse coded)	4.08	0.838	
Gathering a lot of information about bovine TB management was a waste of time. (reverse coded)	3.83	0.927	
I tried to learn more about TB.	3.48	0.868	
I was likely to go out of my way to get more information about bovine TB management.	3.01	0.928	
Trust in DNR[4]			0.93
I trust the Minnesota DNR to manage bovine TB.	3.14	1.136	
DNR officials are concerned about minimizing the impacts of bovine TB on deer hunters.	3.43	1.094	
The Minnesota DNR does a competent job of minimizing the impacts of bovine TB.	3.22	1.062	
The DNR is open and honest in the things they do in say when managing bovine TB.	2.92	1.117	
The DNR makes decisions about managing bovine TB in a way that is fair.	2.87	1.078	
The DNR listens to deer hunters concerns when managing bovine TB.	2.76	1.133	
Concern about future occurrences[2]			
Economic impacts to cattle producers.	3.3	1.192	
Threats to the health of deer.	3.68	0.979	
Reducing the deer population in the area.	3.84	1.055	
Economic impacts to businesses that depend on deer hunting.	3.39	1.061	
Threats to the health of other deer hunters from infected deer.	2.92	1.291	
Reducing your deer hunting opportunity.	3.88	1.103	
Threats to your personal health or family members from infected deer.	2.89	1.408	
Financial costs to you personally.	2.44	1.371	
Threats to other species and ecosystems	3.1	1.186	

Table 2.2. continued

Index Item	Mean	SD	Alpha
Personal impact concerns[3]			0.71
Reducing the deer population in the area.	0.485	0.653	
Reducing your deer hunting opportunity.	0.583	0.594	
Threats to your personal health or family members from infected deer.	0.448	0.68	
Financial costs to you personally.	0.478	0.656	

Note.
[1] Scale ranged from 0 to 10, where '0' means 'none of this feeling' and '10' means a lot of this feeling'.
[2] Response options were "1" (not at all concerned), "2" (slightly concerned), "3" (moderately concerned), "4" (very concerned) and "5" (extremely concerned).
[3] Response options were "1" (extremely worthless/foolish/unhelpful), " 2" (quite), "3" (slightly), "4" (neither), "5" (slightly), "6" (quite), "7" (extremely valuable/wise/helpful).
[4] Response options were "1" (strongly disagree), "2" (disagree), "3" (feel neutral), "4" (agree), "5" (strongly agree).

Table 2.3 Summary of hypothesized influences on information seeking behaviors in northwest Minnesota hunters, data from summer 2012.

Independent variable	Hypothesized effect on information seeking behaviors	Results of preliminary regression analysis
Age	Negative	Not significant
Education	Positive	Not significant
Income	Positive	Not significant
Hunting Importance	Positive	Not significant
Personal Impact	Negative	Not significant
Risk Judgment	Positive	Not significant
Trust in DNR	Positive	Not significant
Self-efficacy	Negative	Not significant
Anger	Negative	Not significant
Worry	Positive	Not significant
Fear	Positive	Not significant
Attitude	Positive	Significant
Subjective Norm	Positive	Significant
Capacity	Positive	Significant
Current Knowledge	Positive	Not significant
Information Insufficiency	Positive	Significant

Table 2.4 RISP framework hierarchical regression models of self-reported information seeking behaviors in northwest Minnesota hunters, data from 2012.

Predictor	B	SE	Std. β	t	p	R^2	ΔR^2	F	p
Model 1						.065	0.065	7.87	<.001
Age	.002	.002	.048	1.037	.301				
Education	.059	.017	.175	3.573	.000				
Income	.000	.000	.041	.853	.394				
Hunting Importance	.138	.037	.172	3.750	.000				
Model 2						.112		7.04	<.001
							.047	5.68	<.001
Age	.001	.002	.032	.704	.482				
Education	.065	.016	.192	3.967	.000				
Income	.000	.000	.028	.582	.561				
Hunting Importance	.124	.038	.154	3.264	.001				
Personal Impact	.067	.033	.095	2.021	.044				
Risk Judgment	.000	.000	.134	2.969	.003				
Trust in DNR	.062	.031	.093	2.044	.042				
Self-efficacy	.049	.029	.077	1.702	.089				
Model 3						.165		7.96	<.001
							.053	4.65	<.001
Age	.001	.002	.031	.689	.491				
Education	.064	.016	.189	4.015	.000				
Income	.000	.000	.021	.452	.652				
Hunting Importance	.096	.037	.119	2.567	.011				
Personal Impact	-.014	.036	-.020	-.391	.696				
Risk Judgment	.000	.000	.105	2.359	.019				
Trust in DNR	.069	.030	.103	2.272	.024				
Self-efficacy	.051	.028	.080	1.830	.068				
Anger	.003	.010	.015	.269	.788				
Worry	.045	.016	.233	2.738	.006				
Fear	.005	.016	.029	.341	.734				

Table 2.4. continued

Predictor	B	SE	Std. β	t	p	R^2	ΔR^2	F	p
Model 4						.382		21.02	<.001
							.217	77.77	<.001
Age	-.002	.002	-.037	-.950	.343				
Education	.041	.014	.122	2.959	.003				
Income	.000	.000	.021	.527	.598				
Hunting Importance	.063	.032	.079	1.967	.050				
Personal Impact	-.068	.032	-.096	-2.143	.033				
Risk Judgment	.000	.000	.059	1.513	.131				
Trust in DNR	.010	.028	.015	.364	.716				
Self-efficacy	.016	.024	.025	.663	.508				
Anger	-.006	.009	-.032	-.663	.507				
Worry	.022	.014	.112	1.519	.130				
Fear	.004	.014	.020	.271	.786				
Subjective Norm	.206	.033	.276	6.153	.000				
Attitude	.205	.027	.352	7.537	.000				
Model 5						.450		25.80	<.001
							.068	54.68	<.001
Age	.000	.002	-.005	-.142	.887				
Education	.024	.013	.070	1.764	.078				
Income	.000	.000	.024	.639	.523				
Hunting Importance	.059	.030	.073	1.930	.054				
Personal Impact	-.048	.030	-.068	-1.605	.109				
Risk Judgment	.000	.000	.046	1.247	.213				
Trust in DNR	.002	.026	.003	.082	.935				
Self-efficacy	-.011	.023	-.017	-.463	.644				
Anger	-.009	.008	-.048	-1.072	.284				
Worry	.022	.014	.114	1.629	.104				
Fear	.011	.013	.057	.813	.416				
Subjective Norm	.151	.032	.202	4.641	.000				
Attitude	.174	.026	.299	6.694	.000				
Capacity	.328	.044	.295	7.394	.000				

Table 2.4. continued

Predictor	B	SE	Std. β	t	p	R^2	ΔR^2	F	P
Model 6						.453		24.25	<.001
							.002	1.84	.176
Age	.000	.002	-.008	-.223	.824				
Education	.024	.013	.069	1.756	.080				
Income	.000	.000	.023	.617	.537				
Hunting Importance	.056	.030	.069	1.835	.067				
Personal Impact	-.050	.030	-.070	-1.660	.098				
Risk Judgment	.000	.000	.042	1.148	.252				
Trust in DNR	.006	.026	.009	.228	.820				
Self-efficacy	-.011	.023	-.018	-.487	.627				
Anger	-.010	.008	-.056	-1.245	.214				
Worry	.021	.014	.111	1.588	.113				
Fear	.013	.013	.067	.964	.336				
Attitude	.143	.033	.191	4.323	.000				
Subjective Norm	.174	.026	.299	6.707	.000				
Capacity	.318	.045	.286	7.108	.000				
Current Knowledge	.001	.001	.052	1.355	.176				

Table 2.4. continued

Predictor	B	SE	Std. β	t	p	R^2	ΔR^2	F	P
Model 7						.459		23.31	<.001
							.007	5.52	.019
Age	.000	.002	-.004	-.103	.918				
Education	.021	.013	.061	1.557	.120				
Income	.000	.000	.027	.713	.476				
Hunting Importance	.056	.030	.069	1.832	.068				
Personal Impact	-.047	.030	-.066	-1.572	.117				
Risk Judgment	.000	.000	.031	.849	.396				
Trust in DNR	.008	.026	.012	.296	.768				
Self-efficacy	-.005	.023	-.007	-.204	.839				
Anger	-.011	.008	-.063	-1.390	.165				
Worry	.022	.013	.116	1.663	.097				
Fear	.010	.013	.056	.808	.420				
Attitude	.143	.033	.191	4.353	.000				
Subjective Norm	.159	.027	.274	5.986	.000				
Capacity	.315	.045	.283	7.055	.000				
Current Knowledge	.001	.001	.045	1.166	.244				
Information Insufficiency	.003	.001	.091	2.349	.019				

Table 2.5 Sources of information.

	N	Mean	SD
Family, friends, social network	719	2.86	0.888
Local newspapers	717	2.83	0.981
Minnesota DNR	716	2.74	1.005
Statewide newspapers and news magazines	714	2.56	1.005
Radio News	718	2.43	0.955
Television news	712	2.33	0.943
Internet sources	705	2.3	1.137
Minnesota Board of Animal Health	704	1.74	0.997
Public meetings	707	1.65	0.951

Note. Respondents were asked, "From what sources did you get information about TB and bovine TB management?"
Responses were "1" (Not at all), "2" (Slightly), "3" (Moderately), "4" (Very Much).

Figures

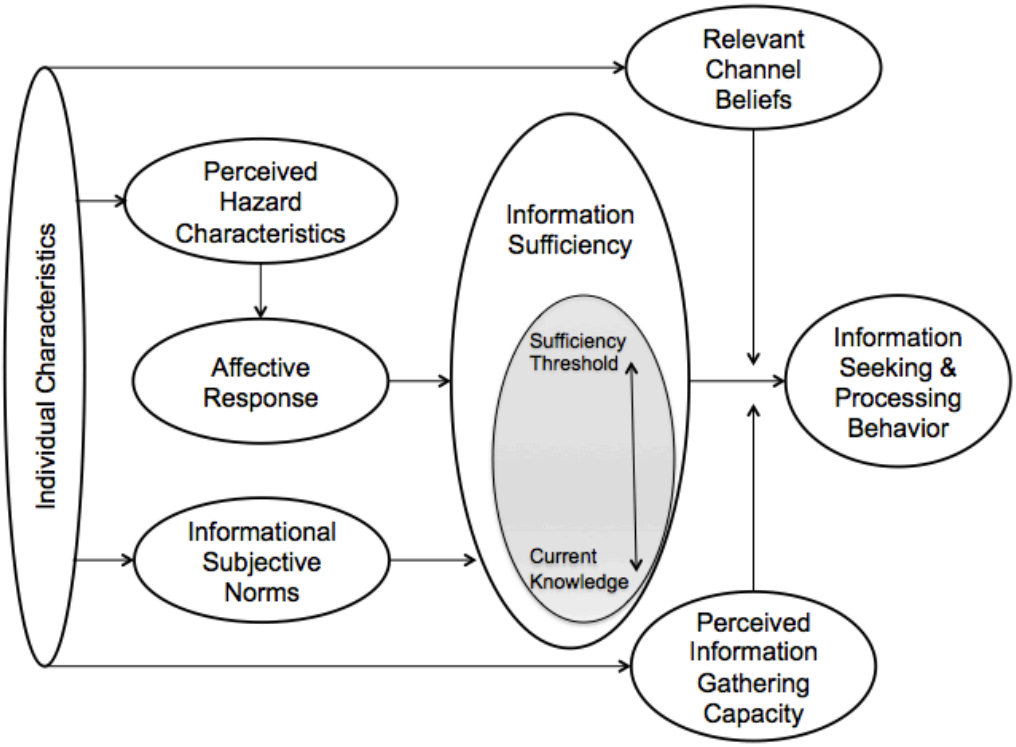

Figure 2.1. Risk Information Seeking and Processing Model (adapted from Griffin et al. 1999).

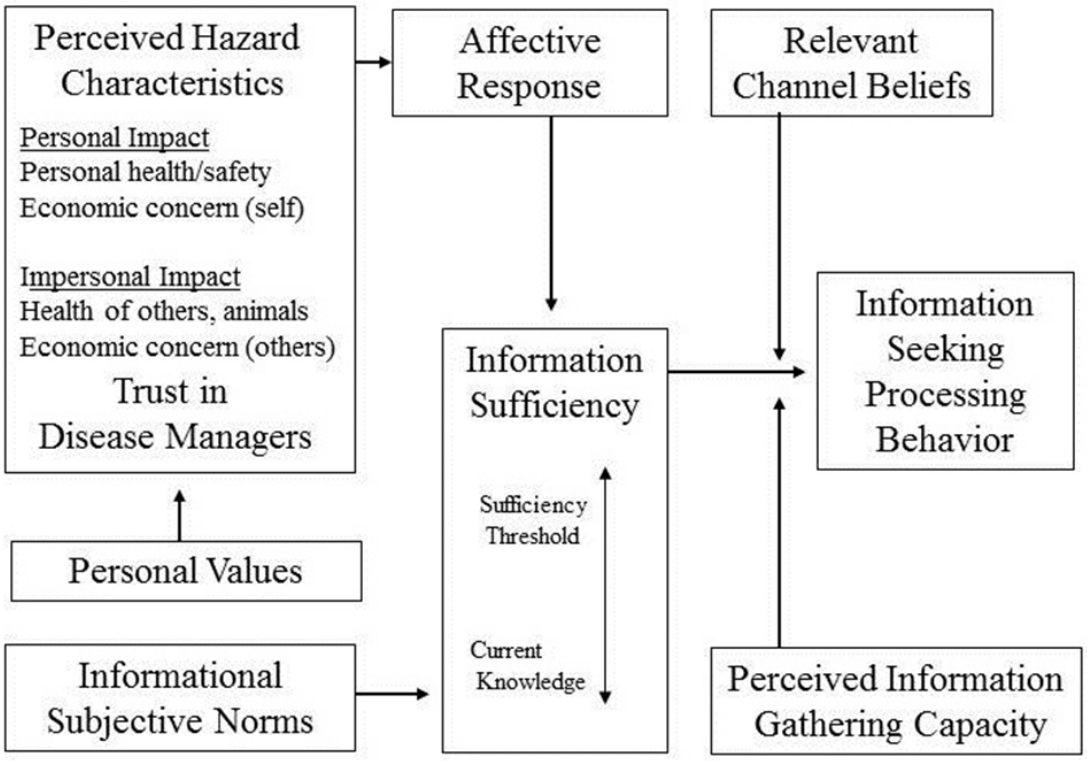

Figure 2.2 Clarke's RISP framework for zoonotic diseases (adapted from Clarke 2009).

CHAPTER 3: Assessing Leopold's Land Ethic: Does it influence producer attitudes towards and participation in Farm Bill conservation programs?

Introduction

Understanding the attitudes of farmers, especially in the Midwest, has concerned natural resource professionals since the genesis of the principles that guide wildlife management in the United States. Led by the writings and lessons contained in Aldo Leopold's *Land Ethic*, we developed a novel scale (referred to as the "Land Ethic Scale" throughout this paper) that captures dimensions of farm ownership and agricultural production related to community, knowledge, behavioral obligation and business. The writings of Leopold trnscend simply providing a snapshot of that time, and have helped define a conservation ethic that is still relevant to managers, farmers, and conservationists today (Leopold, 1948).

In addition to the development and partial refinement of a Land Ethic Scale, we measured the attitudes and behaviors of private landowners who are also agricultural producers in order to determine whether or not benefits for wildlife are a significant factor in their enrollment in federal conservation programs. We were interested in better understanding if the way farmers think and feel about their land influences their enrollment in Farm Bill conservation programs, such as the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), and Agricultural Reserve Easement Program (ACEP). As such, we also tested the ability of the Land Ethic scale to

predict farmer attitudes toward participation in Farm Bill conservation programs and their perceived environmental responsibility.

Background

The Midwest covers an area often referred to as the Corn Belt and is a prime location to target conservation efforts. In this area, most land is in private ownership, and impacts from agriculture have immense consequences for the surrounding environment. The actions taken by farmers in the upper Midwest exert influence beyond the immediate area, affecting migrating wildlife populations and several thousand square miles in the Gulf of Mexico in a hypoxic condition.

Agriculture in the Tallgrass Prairie causes nutrient loading in the Mississippi River, which results in hypoxia in the Gulf of Mexico. Gulf hypoxia is one of the major ecological disasters in the United States in the 21st century; low concentrations of oxygen in the Gulf of Mexico produce a zone characterized by a lack of aquatic animal and plant life. This “dead zone” is the result of nutrient loading, primarily nitrogen and phosphorus, along the Mississippi River (Boesch et al., 2009). The Gulf hypoxic zone is extensive - at 5,840 square miles, it spans the same area as the state of Connecticut (National Oceanic and Atmospheric Administration, 2013). The goal size for the hypoxic zone set by the Gulf of Mexico/ Mississippi River Watershed Task force in 2001 is 1,900 square miles,

less than half of the current area (National Oceanic and Atmospheric Administration 2013).

Wildlife populations are also affected by the design of the agricultural landscape. According to research by Freemark (1995), "agricultural landscapes with a greater diversity of noncrop habitats support a greater richness and abundance of wildlife species" (105). Conversely, large monoculture agricultural operations, prevalent throughout the Corn Belt, lack the diversity in habitat types that is necessary to support a variety of species. The size of native habitats is positively related with species diversity (Freemark, 1995). This relationship suggested that diverse habitats that comprise large areas are able to host the greatest number of species. Agricultural pesticides also affected the abundance of birds in agricultural areas (Freemark, 1995). For example, Murphy and Moore (2003) indicated that of the 63 migrating avian species analyzed in a study, 78% demonstrated "at least one statistically significant relationship between population trends and changes in farmland structure" (Murphy & Moore, 2003). Agriculture, which fragmented landscapes, negatively affected the diversity and prevalence of wildlife populations.

Most often, large productions employ the methods of industrial agriculture, and in recent history there has been a shift from small, family owned farms in favor of expansive industrial operations. The median farm size in America has almost doubled in the last 30 years (USDA, 2013). This increase in median farm size was accompanied by an increase in farm specialization; compared to the

past, producers have focused their efforts on fewer species of crops or livestock (USDA, 2013). Such farms have triggered negative effects on biological communities including, but not limited to, reductions in area biodiversity, effects on the genetics of local plant communities, a reduction in local wildlife populations, and especially the loss and fragmentation of native habitats.

Human activities have reduced the Tallgrass Prairie to less than 4% of its original range in the United States (US DOI, 2013). In Minnesota, where 1/3 of the land was historically prairie, less than 2% of the native prairie currently remains (Minnesota Prairie Plan Working Group 2011). This loss of habitat is extremely significant to the success of wildlife species. The greatest factor in causing wildlife to become endangered is habitat loss. Along with urbanization, agriculture, through habitat conversion, is a primary cause of this habitat loss (Czech et al., 2000).

In order to ensure that wildlife is adequately managed in this region, partnerships with private landowners, specifically agricultural producers, would be very helpful. In addition to partnerships, understanding the attitudes of agricultural producers in the Midwest enables managers to develop and expand conservation programs beneficial to wildlife while also furthering an understanding of how to convince producers to mitigate the negative ecological costs associated with modern food production systems.

Working with private landowners, specifically agriculture producers, is important to achieve protection of wildlife and other natural resources in the

Midwest because most of the rural land is owned by this relatively small proportion of the population. According to the NASS, less than 1% (993,881) of individuals in the US indicate that their primary occupation is farming and 1.2 million farm operators indicate their primary profession is “other” (NASS, 2012). These individuals manage over 920 million acres of farmland, which amounts to over 37% of land in the US (NASS, 2012).

In order to work effectively with these producers, managers need an understanding of their beliefs, thoughts and concerns related to the conservation of wildlife and environmental resources and the programs that have been designed to achieve conservation. A thorough understanding of producers’ thoughts about such issues and programs can help managers design conservation programs that are supported by producers and develop communication strategies about such programs that help producers navigate perceived constraints to the programs.

Conceptual framework

Our research was designed to better understand the producers’ attitudes and beliefs within a broader cognitive hierarchy, motivated by the intention of ultimately helping managers develop strategies to influence conservation behavior. This work is similar to past research on value orientations (Fulton et al., 1996). However, unlike value-orientations research in the realm of natural resources that largely focused on views towards wildlife (Fulton et al., 1996;

Manfredo, Teel, & Henry, 2009), we seek to measure the attitudes of farmers towards their land through this scale. While much work has been done on farmers and their attitudes, no scale that captures farmers' attitudes toward their land and its role in the surrounding community exists. We measured the domain of a farmer's relationship to land instead of wildlife.

In a cognitive hierarchy of values, attitudes, and beliefs, values are the least numerous and most rigidly held (Fulton et al., 1996). Values develop early in life, and prove difficult to change. Values exert influence on attitudes and beliefs. However, values do not directly influence behavior, and are moderated by attitudes and beliefs (Fulton et al., 1996). Two people with the same values may exhibit very different sets of behaviors. While values are not used to predict behavior, they may suggest an individual's attitudes.

Attitudes are more numerous than values and less deeply held. They are more likely to predict behavior and are easier to influence, although it is also possible for attitudes to be very strongly held (and unlikely to change) (Pierce, Manfredo, & Vaske 2001). However, it can be a challenge to alter behavior based on individuals' attitudes (Heberlein & Stedman, 2009; Heberlein, 2012). This scale seeks to predict farmers' attitudes towards future enrollment in Farm Bill conservation programs (based on their behavioral intention) and their felt environmental responsibility related to norm activation.

The text of Aldo Leopold's *Land Ethic* comprised the primary source for items included on the Land Ethic Scale. The *Land Ethic* investigated the

extension of moral considerations beyond humans and society, to land. Leopold discussed the importance of a Land Ethic and contemplated the role of humans in maintaining not just a livable environment for other people, but one friendly to animals, soil biota, and even ecosystem functions (Leopold, 1948). Three themes were drawn from these writings, of which each forms a dimension in the novel land ethic scale. These distinct dimensions included: (1) knowledge, (2) community, and (3) behavioral obligation. We also developed a business dimension not based on the *Land Ethic* because we assumed, based on prior research, that business is an integral component of how farmers make decisions regarding their farms. In a recent meta-analysis of conservation practice adoption literature, capital and income were significant to farmers' perceived capacity to engage in conservation behaviors (Baumgart-Getz, Prokopy, & Floress, 2012).

Knowledge formed the foundation of the scale. This dimension pertained to the importance of ecosystem functions and native species to farming. Leopold in his writing stated "an ethic to supplement and guide the economic relation to land presupposes the existence of some mental image of land as a biotic mechanism" (Leopold, 1948). From this idea we formed survey items related to the importance of farmers' knowledge of native plants and animals, ecosystem processes, and the effect of farming on natural systems (Leopold, 1948).

The community dimension captured the way farmers view the role of their agriculture operations in their overall community and helped to define how an individual views their community. For example, an individual may believe their

community consists only of their family, or perhaps their family and others who live in their town. For others, “community” extends beyond humans, to include animals, plants, or ecosystems. In the *Land Ethic*, Leopold surmised “all ethics so far evolved rest upon a single premise that the individual is a member of a community of interdependent parts…” (Leopold, 1948). Therefore, we sought first to establish whether or not survey respondents believed their community only included humans, or if the concept extended to plants, animals, and all else in the surrounding environment as well.

The behavioral obligation dimension integrated aspects of both community and knowledge, and measured how farmers believe that they *should* act. Leopold wrote that the existence of a “land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it” and this relationship with their land-community “implies respect for his fellow-members, and also respect for the community as such” (Leopold, 1948). Using this concept, we examined the degree to which farmers believed they are stewards of the environment surrounding their property, their moral commitments to water quality and wildlife habitat, and their role in the enhancement and maintenance of ecosystem services on and around their farmland.

In our work, the Land Ethic dimensions are drawn from the writings of Leopold, but variables relate closely to existing theories. Other theories have been used to analyze farmer decision-making and conservation behavior. These

include the Value-Belief-Norm model and Theory of Planned Behavior, among others (Kaiser, Hübner, & Bogner, 2006).

In addition to knowledge, community, and behavioral obligations, we asked farmers about the importance of business and economics in the management of their property. In his work, Leopold discussed an A-B cleavage that separated (A) producers who view their role as such to grow a specific commodity and (B) individuals who have a broader view of the function of land and all that inhabits it (Leopold 1949). However, in our conceptual framework this was included as an aside from the Land Ethic components. Items included in the business dimension examined the role of economics in determining farmers' priorities and the degree to which they would agree that they should focus on maximizing production even if there is environmental cost. The Business items were intended to offer an alternative to the Land Ethic dimensions, which relate farmers' decisions to consequences in the environment and awareness of a community that extends beyond their farm.

Predicting attitude towards Farm Bill conservation program participation with the Land Ethic Scale

To test the predictive power of the scale, we also measured individuals' attitudes toward participating in future Farm Bill conservation programs. The design of the survey items related to future behavior and attitude is based on

Fishbein and Ajzen's Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) (Ajzen 2005). The strength of the application of these theories relies upon measurements of attitude and behavior related to context and specificity of behavioral outcomes (Fishbein & Ajzen, 2009).

We asked respondents questions about their awareness of specific Farm Bill conservation programs, participation in specific Farm Bill conservation programs, attitudes toward participating in specific Farm Bill conservation programs, motivations for and beliefs about the outcomes of participating in specific conservation programs, normative beliefs about land stewardship, and property characteristics and agricultural production activities on the property (Table 1).

Questions pertaining to the TRA are gauged by an individual's stated intention to engage in a behavior (Eagley & Chakin, 1993). The formula that describes the model is:

$$\mathbf{B = BI = w_1 A_B + w_2 SN}$$

where B: behavior; BI: behavioral intention; A_B: attitude towards the behavioral act; w_1 and w_2: weights for the terms they are associated with and; SN: subjective norm.

In this model, attitudes are based on behavioral beliefs. Behavioral beliefs are the outcomes that an individual believes will result from their behavior (Fishbein & Ajzen, 2005). We followed this framework and used it to predict farmers' attitudes towards participation in Farm Bill conservation programs and

their felt levels of responsibility to protect environmental resources when they farm.

Past research on farmer attitudes and behaviors informed the development of the survey instrument (Baumgart-Getz et al., 2012). We also collaborated closely with natural resource managers to develop this scale and the items used to predict farmers' felt responsibilities and attitudes.

Methods

Instrument design & measurement

Land Ethic scale variables. We measured the knowledge, community, behavioral obligation, and business scale items with a seven-point scale. Participants were asked to rate their agreement with various statements related to each of the dimensions. Possible responses ranged from, "Strongly disagree (1)" to "Strongly agree (7)" (Table 1). We formed six knowledge items, six community items, six behavioral obligation items and four business items; in total we tested 22 items in the Land Ethic Scale (Table 1).

Attitudes toward and perceived responsibility to protect environmental resources.

Following previous research by Fishbein and Ajzen (1975, 2009), that measured individuals' attitudes regarding increasing participation in Farm Bill conservation programs, we used semantic differential scales. To gauge attitude, we asked participants to respond to whether they believed increasing their

participation in Farm Bill conservation programs to be negative or positive, harmful or beneficial, and foolish or wise (Table 3).

All questions regarding participation in Farm Bill programs were preceded by a short description of Farm Bill conservation programs that highlighted the programs in which producers were most likely to have enrolled. We asked specific questions about CRP, CREP, and ACEP. These questions informed landowners' current and predicted participation in those programs and landowners' decision-making process related to their participation.

We measured felt responsibility to protect environmental resources when farming by asking survey respondents to rate their agreement with survey items related to their responsibility towards water quality, wildlife habitat, farm chemicals, and the local environment (Table 3). These items were informed by and adapted from prior work on norm activation (Schwartz, 1977). We measured perceived environmental responsibility through the use of a 7-point scale. Scale response options ranged from "Strongly disagree" to "Strongly agree," and survey respondents rated their agreement with statements regarding their level of responsibility towards protecting the environment on and surrounding their farms (Table 3).

Sampling

We conducted this study in three locations in the Midwest: Richland County, North Dakota; Mower County, Minnesota; and Jasper County, Iowa. We

wanted to generalize results back to a county-specific level, as we believed that there might be geographic differences across the broader Eastern Tallgrass Prairie that could be masked with a sample drawn across the region. By conducting surveys in these places, we gained a depth of information about how producers made decisions regarding conservation behaviors. These areas are dispersed throughout the Eastern Tallgrass Prairie, however we do not hope to generalize findings back to the entire population of agricultural producers in the region. The Eastern Tallgrass Prairie encompasses portions of 11 states. Its eastern edge extends into Ohio, the most southern tip is found in Oklahoma, and Minnesota and Kansas include the most Northern and Eastern borders, respectively. The target population for this research included landowners who own 40 acres or greater of agricultural property in any one of our selected counties.

All of the counties selected for this research offered readily accessible land ownership information through local governments. The sample frame consisted of all landowners who own 40 acres of agricultural property or greater within the study area. Within each county, we stratified our sample by landowner participation in the CRP, which served as a surrogate for a landowner's participation in federal conservation programs to help ensure we had a well-rounded sample. The Environmental Working Group (EWG) maintains a public database of all landowners currently enrolled in CRP, and we stratified our

sample using these EWG-maintained lists of CRP participants in the counties in our sample area from 2012 (EWG, 2013).

The Conservation Reserve Program is the primary conservation-related program for private landowners in the United States. The program is "a voluntary long-term cropland diversion program" that uses economic incentives to encourage landowners to conserve their property for the use of wildlife or other ecosystem services (Johnson & Monke, 2010). Participation is achieved through the use of contracts, which span anywhere from 10-15 years. The land targeted for enrollment in CRP is frequently ecologically significant or environmentally sensitive. The Farm Bill determines the amount of money dedicated to CRP. As of November 2013, there were 25.6 million acres enrolled in CRP (USDA, 2013). However, the most recent Farm Bill reduced the number of acres eligible for enrollment in CRP from 32 million to 24 million by fiscal year 2018 (Stubbs, 2014).

Study locations

Richland County is a US county in southeast North Dakota, on the boundary between the Tallgrass Prairie and Plains and Prairie Potholes. In 2012, Richland County contained 854 farms, a -9% change from 2007 (USDA, 2012). The top crops produced in Richland County include soybeans, corn for grain, and wheat for grain (USDA, 2012).

Mower County is located in southeast Minnesota. In recent years its population has shown a slight increasing trend, and currently the county is estimated to have ~39,000 residents (US Census Bureau, 2013). The economy of Mower County is largely based on agriculture and meatpacking with as much as 90% of Mower County currently in agricultural production (Mower County, 2010). Mower County contains almost 1,000 miles of streams, and agriculture heavily influences its lacustrine system (Mower County 2010).

Jasper County, located in heart of the Iowa Corn Belt, collected the highest amount in commodity payments from 1995-2012 nationwide (Environmental Working Group, 2012). The greatest amount of money allotted in the form of these subsidies was for corn, followed by soybeans and the Conservation Reserve Program. Jasper County is also home to the Neal Smith National Wildlife Refuge. The refuge is over 8,000 acres and largely contains tallgrass prairie and oak savannah (U.S. Fish & Wildlife Service, 2015).

Data collection

We conducted this survey using a modified version of Dillman, Smyth, & Christian's Tailored Design Method (2008). To maximize response rate, we contacted individuals regarding participation in our survey three times. We contacted 3,788 individuals total: 1,172 in Jasper county, IA; 1,300 in Mower County, MN; and 1,316 in Richland county, ND.

Analysis

We conducted data analysis using the Statistical Program for the Social Sciences (SPSS v. 20, 2013) and program R. We examined Cronbach's alphas to assess the internal consistency of each scale dimension and the scale as a whole. We assessed collinearity statistics to determine how individual survey items contributed to scale performance and to gauge where there was overlap between measurements resulting from scale dimensions.

We formed the attitude, Land Ethic dimension, and responsibility scales by calculating the average responses to survey items related to those concepts. These scales were then used in subsequent regression analysis (Table 3.1).

We conducted simple linear regressions and hierarchical multiple regressions to assess the predictive power of the Land Ethic scale. These regressions tested the effects of scales on variability in response in a framework where knowledge was the first included in our model. We assume community to be an extension of knowledge, and behavioral obligation to stem from the community dimension. We assessed inter-item scale correlations in the linear regressions and the inter-dimension collinearity of the scale as a whole (Table 3.2).

Results

Response rates & respondent characteristics

We contacted a total of 3,788 individuals. Of those contacted, we identified 107 invalid addresses and 44 individuals who were deceased or

severely ill. Our final response rate was 20% (n = 744). County response rates varied (Jasper, IA = 16%; Mower, MN = 26%; Richland, ND = 19%). The average age of survey respondents was 67 years old, 30 years older than the US population average (US Census Bureau 2010). Approximately 89% of our sample identified as Caucasian, and most (73%) listed their gender as male (Table 3.4).

Scale reliability results

We tested the reliability of 22 variables drawn from the writings of Aldo Leopold (Tables 3.1, 3.2 & 3.5). All scales were assessed prior to their inclusion in subsequent analysis.

Based on individual scale Cronbach's alphas, three dimensions represented internally consistent, reliable indices: Knowledge (α = .76), Community (α = .83), and Behavioral Obligation (α = .85). We removed items from the Knowledge and Community scales because of their negative effect on scale Cronbach's alpha, and two items related to Knowledge and two items related to Community were deleted from the original scale tested. Removed items also displayed relatively low (< .40) inter-item correlations with other items in their respective scales (Table 3.1).

The Business items did not form a reliable index (α = .55), and because we only developed 4 items related to this concept we did not include it in subsequent regression analysis (Table 3.1). The Business dimension inter-tem

correlations and inter-dimension correlations were also low. The inter-item correlation matrix reveals that Business items two and three share a correlation of only .15 (Table 3.5). The inter-dimension correlations also depict business as unrelated to the Knowledge, Community, and Behavioral obligation dimensions (Table 3.2). If we excluded Business from a scale including all four dimensions, the scale Cronbach's alpha increases from .73 to .91 (Table 3.2). Furthermore, the correlations Business shares with the Knowledge, Community, and Behavioral obligation dimensions are very low, ranging from .086 to .186 (Table 3.2).

The Land Ethic scale, excluding business, revealed a high Cronbach's alpha ($\alpha = .909$). Inter-dimension correlations of the Land Ethic scale between dimensions, excluding business, ranged from .793 to .813 (Table 3.2). The dimension scales are formed by a mean score of corresponding survey items.

We also formed a scale for the dependent variables, attitude toward increasing participation in Farm Bill conservation programs ($\alpha = .91$) and responsibility to protect environmental resources ($\alpha = .82$) (Tables 3.3). Cronbach's alphas indicated these scales are internally consistent, and we scaled them based on mean responses to items indicated in subsequent regression analysis. The Cronbach's alpha for attitude toward increasing participation in Farm Bill conservation program would decrease if any of the three items were removed (Table 3.3). Likewise, Cronbach's if item were removed values for the responsibility to protect natural resources scale would decrease for

every item, except one that was reverse coded (Table 3.3). All were included in subsequent analysis.

Predicting attitudes towards participation in Farm Bill conservation programs

Simple linear regression analysis revealed significant relationships between individual scale dimensions and attitude. Behavioral obligation explained the greatest amount of the variability in farmer attitude towards enrollment in Farm Bill conservation programs, 10% (Table 3.6). The Community dimension explained the least, 6%, and the Knowledge dimension explained 9% of the variability in attitude (Table 3.6). Each of these dimensions, when regressed with attitude toward participation in Farm Bill conservation programs, is significant ($p < .001$).

Hierarchical multiple regression analysis using the Land Ethic scale helped to clarify how the dimensions operated within the larger framework (Table 3.7). With the addition of the Community dimension to a model of farmer attitudes towards participation in Federal conservation programs, controlling for the Knowledge dimension, R-square increased .002 (Table 3.7). A final model incorporating all three scale dimensions, explained 11% of the variability in farmers' attitudes toward participation in Farm Bill conservation programs (Table 3.7). In Model 3, we saw significant effects of the Knowledge and Behavioral obligation dimensions (Table 3.7).

The Knowledge dimension explained the greatest percentage of variability in farmers' attitudes towards participation in Farm Bill conservation programs (8.8%), and the addition of behavioral obligation increased the Land Ethic scale's explanatory power by 2.1% (Table 3.4). In a model that included knowledge, community, and behavioral obligation, 11% of variation in attitudes is explained (Table 3.7). However, community did not appear statistically significant (p = .26) (Table 3.7). The low change in R-square between Models 1 and 2 (ΔR^2 = .002) reinforced the insignificance of the Community dimension (Table 3.6).

Predicting perceived responsibility to protect environmental resources

We initially conducted simple linear regressions with each scale dimension and the explanatory variable, farmers' perceived responsibility to protect environmental resources (Table 3.6). In this case, Knowledge explained the least variability in perceived environmental responsibility (35%) and Behavioral obligation had the most predictive power, explaining 53% of the variance in the model (Table 3.6). The Community dimension explained 36% of the variability in farmers' perceived environmental responsibility (Table 3.6). All scale dimensions were significant predictors of felt environmental responsibility (p < .001) in the simple linear regression models (Table 3.6).

In hierarchical regression analysis, a final model that included Knowledge, Community, and Behavioral obligation explains 54% of the variability in farmers' perceived environmental responsibility (Table 3.8). The model is significant (p <

.001), but the Community dimension did not explain a significant amount of the variance in perceived environmental responsibility in a model that also controls for Knowledge and Behavioral obligation ($p < .53$) (Table 3.8).

Discussion

This research sought to develop a scale related to farmers' Land Ethic based on the writings of Aldo Leopold. We explored how to measure farmers' Land Ethic through this novel scale and its relationship with farmer attitudes towards participation in Farm Bill conservation programs and their perceived environmental responsibility. We worked to develop a Land Ethic scale based on the ideas of Aldo Leopold because we believe it will resonate with natural resource managers and farmers. We refined the Land Ethic scale and investigated hierarchical multiple regression results that tested the predictive power of the refined scale.

Scale performance of the Knowledge, Community, Behavioral obligation and Business dimensions varied. The Business dimension scale failed to operate, and therefore was not included in analysis. This dimension was formed with the fewest number of survey items, and should be expanded upon in the future.

The Land Ethic scale Cronbach's alpha and multicollinearity statistics reveal that our dimensions are highly correlated. These high correlations among scale dimensions support the argument that the Knowledge, Community, and Behavioral obligation dimensions are in fact sub-components of one larger scale

measuring a farmer's "Land Ethic." Our original intention was to capture this Land Ethic, and we conceived it as one measure. The results of regression analysis, therefore, may be problematic due to issues related to multicollinearity among scale dimensions. However, these results are still informative of the explanatory power of this scale.

The multiple regressions suggest that farmers' ideas regarding their Knowledge and Behavioral obligations toward community are most significant in their attitudes towards engaging in Farm Bill conservation programs. Knowledge and Behavioral obligations are also most predictive of farmers' perceived responsibility to the local environment on and surrounding their farms. Enhancing farmers' knowledge about ecological processes and native species may offer managers seeking to promote conservation behaviors an opportunity to affect factors that influence farmer attitudes.

Future research should be done to assess and refine the scale. In the future, reducing the number of items in the scale should be investigated. The Behavioral obligation dimension includes six items, some of which could perhaps be removed without affecting scale performance. Conversely, it would be interesting to develop additional business items and test their performance.

In addition, it would be useful to create a singular "Land Ethic scale" that does not delineate three separate variables for Community, Knowledge and Behavioral obligation. Rather, it would be of interest to analyze a Land Ethic scale that is one measure (perhaps a mean of all of the Land Ethic variables in

this analysis). Rather than excluding Business items from analysis, they could be included as three separate measures representing aspects of Business. In that case, there would be one measure of a Land Ethic scale, and then three additional items that measure variables related to Business, separate from the Land Ethic scale.

This application suggests that the scale may be a useful predictor of attitudes towards conservation programs and environmental responsibility. The scale may have further applications beyond these measures, related to conservation behavior. It would be useful to examine other variables related to the Land Ethic scale to better understand farmer attitudes toward conservation.

The information gained through this research offers insights to the development of programs, practices, and messages that encourage broader participation in conservation programs and sustainable practices in the agriculture community. Understanding producers' motivations to engage in conservation behaviors enables management to target messages encouraging participation. This work suggests that Leopold's Land Ethic may be especially applicable to farmers' perceived responsibilities toward the local environment around where they farm, which can be used by managers to help communicate benefits of conservation programs.

In the long term, this work will be one component of an initiative to study what motivates producers in the Midwest to participate in conservation programs that affect water quality and benefit wildlife habitat. It helps managers and future

researchers understand landowners' attitudes towards and motivations for participation in Farm Bill conservation programs that affect natural systems. The ultimate application of this project is to aid natural resource managers in finding the intersection between agricultural nutrient reduction, wildlife habitat, and a working (agricultural) landscape by increasing their ability to communicate with farmers.

Conclusion

The Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperative is located in a heavily agricultural area. In the Midwest, farmers exert an overwhelming influence on the landscape, and working with them to achieve positive outcomes for wildlife populations is necessary. A primary step in building this relationship is developing an understanding of farmers and their ideas about engaging in agricultural practices.

This project sought to enhance an understanding of the reasons farmers choose to participate in sustainable agriculture systems and their attitudes towards them, which assists managers in landscape level environmental planning and communication efforts. There has not been much research in the past to evaluate if wildlife benefits are a driving factor for producer enrollment in USDA programs that address the resource concern of water quality in terms of sedimentation and nutrient loading. The Land Ethic scale considers not just wildlife, but also the surrounding landscape, flows of energy, soil biota, water quality, human communities and other ecologically relevant factors. We tested

the scale in a geographic area where these issues are salient to wildlife management in not just the immediate region, but also the 1/3 of the country covered by the Mississippi watershed and areas affected by hypoxic conditions caused by nutrient loading.

The research addressed in this study also informs the larger body of knowledge in the field of human dimensions, providing a potential tool to assess farmers' relationships to their land. This scale may be used similarly to the New Ecological Paradigm (NEP) scale or measures related to Wildlife Value Orientations (WVOs). The NEP scale examines the degree to which individuals have ecological system views (Dunlap, Van Liere, Mertig & Jones, 2000; Dunlap & Van Liere, 1978). WVOs measure beliefs towards wildlife and predicted individuals' attitudes toward wildlife (Fulton et al., 1996). The Land Ethic scale addresses farmer attitudes and perceived responsibilities toward their property and community.

This research provides insights into the farmers' Land Ethic and may help decision-makers target efforts to expand conservation programs. Many farmers are familiar with or have participated in Farm Bill conservation programs in the past. Encouraging behaviors like those promoted in Farm Bill conservation programs improves conditions for wildlife, and understanding farmers' perceived responsibility towards the environment and land beyond the boundaries of their farms improves communication with them.

Tables

Table 3.1 Reliability and descriptive statistics of indices and items measuring model variables.

Index Item	Mean	SD	Cronbach's alpha	Cronbach's if item deleted
Knowledge			0.764	
It's important to know that the land I farm is a complex web of interconnected ecological processes.	5.48	1.30		0.683
The land I farm is more than just the soil and involves a complex chain of plants, animals and energy.	5.91	1.13		0.662
You DO NOT really need to know much about the native plants and animals to be a good farmer. (reverse coded) (removed)	4.69	1.88		-
The best farmers understand a lot about the complex natural systems that make up their farmland.	5.98	1.18		0.718
The quality of my farmland is positively influenced by the diversity of native plants and animals that live on or around it.	5.08	1.57		0.774
Native plants and animals have a hard time adapting to modern farming practices. (removed)	4.83	1.64		-
Community			0.832	
Farms should be thought of as a part of a larger natural community of soil, water, native plants and wildlife.	5.64	1.31		0.778
Farmers should respect the larger natural community on which they farm.	5.93	1.10		0.761
The idea that humans are just another part of a broader natural community is foolish. (reverse coded) (removed)	4.41	1.86		-
For human communities to stay healthy, we have to recognize that we depend on a larger community of plants and animals.	5.87	1.20		0.839
For me, the idea of community can only include people. (reverse coded) (removed)	4.36	1.85		-
Moral commitments to community should include commitments to the soil, water, plants and animals as well as people.	5.87	1.18		0.770

Table 3.1. continued

Index Item	Mean	SD	Cronbach's alpha	Cronbach's if item deleted
Behavioral Obligation				
Farmers should conserve soil, water, native plants and wildlife habitat as an important part of their farming practices.	5.72	1.36		0.831
Farming should be done in a way that conserves water quality and wildlife habitat.	6.07	1.04		0.811
Farmers should minimize the negative impacts of farming on water and wildlife habitat.	5.71	1.38		0.843
Farmers should farm in a way that maintains the function of natural ecosystems on their land.	5.80	1.19		0.817
Farmers have an obligation to protect water quality and wildlife habitat.	5.86	1.31		0.817
Farmers should be good stewards of the wildlife habitat around their farms.	6.13	1.08		0.823
Business			0.553	
Making a profit from farming should be most important to a successful farmer.	3.13	1.71		0.257
Farmers should focus on maximizing production on their farm, even if there is environmental cost.	5.07	1.72		0.471
Farms should primarily be thought of as a business.	2.57	1.64		0.587
Farmers have an obligation to other people to make sure their farms are economically successful. (removed)	2.94	1.64		-

Notes. Scale ranged from 1 (strongly disagree) to 7 (strongly agree) for all items.

Table 3.2 Land Ethic Scale inter-dimension correlations

Dimension	Knowledge	Community	Behavioral obligation	Business	Cronbach's alpha if item deleted
Land Ethic Scale, including all dimensions[1]					
Knowledge	1.000	0.758	0.738	0.105	0.583
Community	0.758	1.000	0.813	0.086	0.570
Behavioral obligation	0.738	0.813	1.000	0.186	0.540
Business	0.105	0.086	0.186	1.000	0.909
Scale dimensions, excluding business[2]					
Knowledge	1.000	0.759	0.739		0.897
Community	0.759	1.000	0.813		0.849
Behavioral obligation	0.739	0.813	1.000		0.862

[1] Scale Cronbach's Alpha = .730
[2] Scale Cronbach's Alpha = .909

Table 3.3 Reliability and descriptive statistics of indices and items measuring potential model variables.

Index Item	Mean	SD	Cronbach's alpha	Cronbach's if item deleted
Environmental belief			0.85	
Water quality around my farm	5.38	1.27		0.82
Long-term productivity of my farm	5.80	1.01		0.82
Wildlife habitat	5.29	1.27		0.84
Soil erosion on my farm	5.77	1.18		0.82
General environmental quality	5.53	1.06		0.80
The amount of nitrates and other farm chemicals in the surface and ground water in my area	5.17	1.31		0.83
Responsibility to protect environmental resources			0.82	
Water quality	6.12	1.00		0.77
Wildlife habitat	5.57	1.33		0.78
Minimize farm chemicals	5.90	1.19		0.77
Local environment	6.03	1.11		0.75
Protecting the environment is not my responsibility (reverse coded)	5.82	1.58		0.84
Other people you know would want you to increase participation in Farm Bill conservation programs			0.89	
Most other farmers in your area	-0.64	1.55		0.90
Most of your family members	-0.30	1.68		0.90
Local Soil & Water Conservation District	0.70	1.67		0.86
State wildlife and fisheries conservation agency	0.86	1.65		0.85
Hunters in your area	0.98	1.67		0.86
Environmentalists	1.15	1.78		0.86
Conservation groups	1.12	1.77		0.86
Attitude towards increasing participation in Farm Bill Conservation programs			0.91	
Negative… Positive	4.56	1.48		0.89
Harmful… Beneficial	4.81	1.29		0.88
Foolish… Wise	4.71	1.45		0.85

Table 3.4 Sociodemographics of respondents.

Variable	Percentage/average
Gender	73% male
Average age	66.5
Ethnicity	89% white
Hold a bachelor's degree or greater	37%
Political leanings:	
Extremely conservative	7%
Conservative	36%
Slightly conservative	14%
Moderate	22%
Slightly liberal	5%
Liberal	5%
Extremely liberal	1%

Table 3.5 Inter-item correlation matrix for scale dimensions.

Index Item	1	2	3	4	5	6
Knowledge						
1. It's important to know that the land I farm is a complex web of interconnected ecological processes.	1.00	0.60	-	0.43	0.44	-
2. The land I farm is more than just the soil and involves a complex chain of plants, animals and energy.	0.60	1.00	-	0.59	0.41	-
3. You DO NOT really need to know much about the native plants and animals to be a good farmer. (reverse coded) (removed)	-	-	-	-	-	-
4. The best farmers understand a lot about the complex natural systems that make up their farmland.	0.43	0.59	-	1.00	0.35	-
5. The quality of my farmland is positively influenced by the diversity of native plants and animals that live on or around it.	0.44	0.41	-	0.35	1.00	-
6. Native plants and animals have a hard time adapting to modern farming practices. (removed)	-	-	-	-	-	-
Community						
1. Farms should be thought of as a part of a larger natural community of soil, water, native plants and wildlife.	1.00	0.61	-	0.50	-	0.61
2. Farmers should respect the larger natural community on which they farm.	0.61	1.00	-	0.48	-	0.71
3. The idea that humans are just another part of a broader natural community is foolish. (reverse coded) (removed)	-	-	-	-	-	-
4. For human communities to stay healthy, we have to recognize that we depend on a larger community of plants and animals.	0.50	0.48	-	1.00	-	0.44
5. For me, the idea of community can only include people. (reverse coded) (removed)	-	-	-	-	-	-
6. Moral commitments to community should include commitments to the soil, water, plants and animals as well as people.	0.61	0.71	-	0.44	-	1.00

Table 3.5. continued

Index Item	1	2	3	4	5	6
Behavioral Obligation						
1. Farmers should conserve soil, water, native plants and wildlife habitat as an important part of their farming practices.	1.00	0.52	0.36	0.49	0.52	0.47
2. Farming should be done in a way that conserves water quality and wildlife habitat.	0.52	1.00	0.44	0.64	0.55	0.60
3. Farmers should minimize the negative impacts of farming on water and wildlife habitat.	0.36	0.44	1.00	0.46	0.49	0.40
4. Farmers should farm in a way that maintains the function of natural ecosystems on their land.	0.49	0.64	0.46	1.00	0.48	0.52
5. Farmers have an obligation to protect water quality and wildlife habitat.	0.52	0.55	0.49	0.48	1.00	0.50
6. Farmers should be good stewards of the wildlife habitat around their farms.	0.47	0.60	0.40	0.52	0.50	1.00
Business						
1. Making a profit from farming should be most important to a successful farmer.	1.00	0.42	0.31			
2. Farmers should focus on maximizing production on their farm, even if there is environmental cost.	0.42	1.00	0.15			
3. Farms should primarily be thought of as a business.	0.31	0.15	1.00			
4. Farmers have an obligation to other people to make sure their farms are economically successful. (removed)	-	-	-			

Table 3.6 Simple linear regression models of farmers' attitudes towards future participation in Farm Bill conservation programs and perceived responsibility to protect the local environment.

Predictor	B	SE	t	p	Model R^2	F	DF	p
Attitude towards participation in Farm Bill conservation Programs								
Knowledge	0.39	0.06	6.92	< .001	0.09	47.92	494	< .001
(intercept)	2.49	0.32	7.77	< .001				
Community	0.34	0.06	5.86	<.001	0.06	34.29	494	< .001
(intercept)	2.73	0.34	8.11	< .001				
Behavioral Obligation	0.43	0.06	7.39	< .001	0.10	54.65	494	< .001
(intercept)	2.14	0.35	6.16	< .001				
Perceived responsibility to protect the local environment								
Knowledge	0.57	0.03	18.37	< .001	0.35	337.40	623	< .001
(intercept)	2.70	0.18	15.34	< .001				
Community	0.59	0.03	18.80	< .001	0.36	353.30	624	< .001
(intercept)	2.46	0.18	13.38	< .001				
Behavioral Obligation	0.74	0.03	26.74	< .001	0.53	714.90	625	< .001
(intercept)	1.56	0.16	9.50	< .001				

Table 3.7 Hierarchical regression models of farmers' attitudes towards future participation in Farm Bill conservation programs.

Predictor	β	SE	t	p	R^2	ΔR^2	F	p
Model 1	2.49	0.32	7.77	< .001	0.088	0.088	47.92	<.001
Knowledge	0.39	0.06	6.92	<. .001				
Model 2	2.37	0.35	6.82	< .001	0.090	.002	24.40	<.001
Knowledge	0.33	0.09	3.69	< .001				<.001
Community	0.08	0.09	0.94	0.346				
Model 3	2.01	0.36	5.57	< .001	0.111	.021	20.40	<.001
Knowledge	0.23	0.09	2.47	0.014				
Community	-0.12	0.11	-1.14	0.255				
Behavioral obligation	0.36	0.11	3.37	0.001				

Table 3.8 Hierarchical regression models of farmers' perceived responsibility to protect environmental resources.

Predictor	B	SE	t	p	Model R^2	ΔR^2	F	p
Model 4	2.70	0.18	15.3	< .001	0.35		337.40	< .001
Knowledge	0.57	0.03	18.4	< .001				
Model 5	2.14	0.18	11.6	< .001	0.40	0.05	210.40	< .001
Knowledge	0.31	0.05	6.6	< .001				
Community	0.35	0.05	7.4	< .001				
Model 6	1.48	0.17	8.7	< .001	0.54	0.14	241.90	< .001
Knowledge	0.11	0.04	2.6	< .01				
Community	-0.03	0.05	-0.6	0.53				
Behavioral obligation	0.68	0.05	13.5	< .001				

CHAPTER 4: Conclusion

Citizens and stakeholders are central to the management of wildlife and their habitats. This management affects not only the natural world, but also human culture, communities, and economies. Wildlife managers and decision-makers determine goals on behalf of the public, but must regularly consider factors related to societal acceptability. This balancing act between wildlife biology and human communities necessitates input from and an understanding of stakeholders. As advances in technology increase the realm of scientific possibility, it becomes important that managers and decision-makers ask themselves not only what they can do, but also what they *should* do on behalf of stakeholders.

At its essence, the human dimensions of wildlife management helps foster relationships between decision-makers and the general public and partners, with the purpose of achieving the best possible outcome for society. In an ideal situation, collaboration occurs between state and federal agencies, nonprofits, members of the public, and other governments out of a deep care for the resource. However, not all circumstances lend themselves to a scenario in which mutual gain between all parties exists. Conflicts arise. The Human Dimensions of natural resource management have been an integral part of fostering relationships between managers, partners and the public.

These projects, funded by state and federal agencies, sought to find the intersection between agricultural land use, preservation of local cultures and

economies, habitat protection and environmental restoration. Examining the human dimensions of wildlife management helps managers engage in strategic actions and decision-making processes. Wildlife disease occurrences and conservation-related farming practices will continue to be pressing management issues in the future.

Wildlife disease applications

This research suggested avenues for better understanding hunting stakeholder groups in the Midwest. Chapter 2 found that attitudes exerted the greatest influence on hunters' information seeking behaviors towards bovine tuberculosis in a model that included individual characteristics, personal impacts, trust in the DNR, norms, and information sufficiency. In addition to these findings, it tested a potential theory for managers to use in instances of zoonotic disease occurrences or other risks to humans from wildlife. Bovine tuberculosis and CWD are present in white-tail deer populations in other areas of the Midwest, such as Michigan (Vaske 2010; Carstensen et al., 2011). In cases of future wildlife disease scenarios, this tool may be applied.

Other theories related to wildlife disease occurrences and environmental risks exist (Treizenberg et al., 2014; Kahlor 2007, 2010). This model reinforces findings about the importance of attitudes in predicting behavioral intentions. In this instance, the behaviors and support of hunters in disease management are

integral in successfully managing wildlife diseases (Carstensen et al., 2011). Minnesota provides an example of “successful” bovine TB management.

Future research may explore the role of the RISP model in other contexts, especially a comparative analysis with Michigan where bovine TB will likely never be eliminated from the deer herd. Structural equation modeling may also be employed to further explore the variables included in the model and relationships among them. These efforts would aid in deepening the understanding of the RISP model applications.

Leopold’s Land Ethic, farming practices and conservation behaviors

Chapter 3 suggests that concepts encapsulated in Aldo Leopold’s writings, especially related to farmers’ knowledge and behavioral obligations, still resonate in the Midwest conservation and farming communities today. A model that included knowledge, community, and behavioral obligation dimensions drawn from the *Land Ethic* explained 54% of the variance in farmers’ perceived environmental responsibilities.

This scale appears to measure one concept – a Land Ethic. This measure of farmers’ beliefs about their land and role in their communities may be used by managers and researchers to gauge farmer attitudes. The application of the Land Ethic scale may be similar to that of the NEP and WVO scales, but in the context of farmers’ relationship with their land.

Future research may explore the inclusion of Business items as an addition to the Land Ethic scale, perhaps capturing more variance in farmer behavioral intentions and perceived responsibility towards the environment. The scale could also use further refinement, perhaps in reducing the number of items and integrating the three dimensions into a single-dimension scale to measure the Land Ethic.

Management applications

These projects have theoretical implications for managers and researchers' future work. The project on RISP behaviors suggests that attitudes will likely explain the greatest amount of variance in the RISP model, especially if a significant duration of time elapses between the implementation of a research project and the threat being examined. This finding relates to the application of the theory in not only instances of disease outbreak, but also other scenarios where a significant amount of time elapses between the occurrence of a threat and survey implementation. The RISP theory may be used in many contexts, ranging from introductions of invasive species to threats of climate change.

The development of a novel Land Ethic Scale benefits managers beyond the Midwest. The scale, when refined, may offer researchers a tool to help measure and predict farmers' attitudes towards conservation and perceived environmental responsibility. Using the writings of Aldo Leopold helped us access concepts and ideas that have resonated throughout the conservation and

agricultural communities, and capture dimensions fundamental to management in this realm.

This work is relevant to managers and researchers interested in understanding hunters' perceived risks from environmental threats or farmers' choices to engage in conservation behaviors. Understanding these topics aids natural resource managers in refining their goals and improving stakeholder relations. Enhancing the ability of managers to effectively communicate with the public and build relationships with partners and stakeholders helps ensure that positive outcomes, benefitting the American public, are achieved. Fostering relationships and developing the best possible management outcomes has the power to reframe resource management for the betterment of the natural world and human society.

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APPENDICES

Appendix A: Bovine Tuberculosis survey instrument

BOVINE TB MANAGEMENT IN DEER IN NORTHWEST MINNESOTA

A cooperative study conducted by the University of Minnesota for the Minnesota Department of Natural Resources

Your help on this study is greatly appreciated!

Please return your completed questionnaire in the enclosed envelope. The envelope is self-addressed and no postage is required. Thanks!

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

Please read all the questions carefully and answer them to the best of your ability.

The first set of questions is designed to tell us about your deer hunting background in Northwest Minnesota.

Q1. In what year did you first hunt deer in Northwest Minnesota? (*Write in year*).

_____

Q2. How many total years have you hunted deer in Northwest Minnesota? (*Write in total years*).

_____

Q3. How important is deer hunting in Northwest Minnesota to you personally? (*Check only one*)

- ❑ **NOT AT ALL IMPORTANT**
- ❑ **SLIGHTLY IMPORTANT**
- ❑ **MODERATELY IMPORTANT**
- ❑ **VERY IMPORTANT**
- ❑ **EXTREMELY IMPORTANT**

Q4. Please indicate how much you agree or disagree with the following statements about deer hunting in Northwest Minnesota. (*Please circle <u>one</u> response <u>for each</u>):*

For all questions answer specifically for <u>deer hunting in Northwest Minnesota</u>	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Deer hunting is one of the most enjoyable things I do.	1	2	3	4	5
A lot of my life is organized around deer hunting.	1	2	3	4	5
Deer hunting has a central role in my life.	1	2	3	4	5
Most of my friends are in some way connected with deer hunting.	1	2	3	4	5
When I deer hunt, others see me the way I want them to see me.	1	2	3	4	5
Deer hunting is one of the most satisfying things I do.	1	2	3	4	5
Deer hunting is very important to me.	1	2	3	4	5
You can tell a lot about a person when you see them deer hunting.	1	2	3	4	5
When I am deer hunting I am really myself.	1	2	3	4	5
I enjoy discussing deer hunting with my friends.	1	2	3	4	5
Participating in deer hunting provides me with an opportunity to be with friends.	1	2	3	4	5
To change my preference from deer hunting to another recreation activity would require major rethinking.	1	2	3	4	5
Participating in deer hunting says a lot about whom I am.	1	2	3	4	5
I identify with the people and image associated with deer hunting.	1	2	3	4	5
When I'm deer hunting, I don't have to be concerned with how others see me.	1	2	3	4	5

Q5. Think back to when you first heard about the bovine TB outbreak in cattle and deer in northwest Minnesota. We would like to know how finding out about the bovine TB outbreak made you feel at the time. Please circle a number from 0 to 10, where "0" means "none of this feeling" and "10" means "a lot of this feeling".

	None of this feeling										A lot of this feeling
Anger	0	1	2	3	4	5	6	7	8	9	10
Hope	0	1	2	3	4	5	6	7	8	9	10
Fear	0	1	2	3	4	5	6	7	8	9	10
Worry	0	1	2	3	4	5	6	7	8	9	10
Disgust	0	1	2	3	4	5	6	7	8	9	10
Surprise	0	1	2	3	4	5	6	7	8	9	10
Happy	0	1	2	3	4	5	6	7	8	9	10
Sadness	0	1	2	3	4	5	6	7	8	9	10

Q6. When the outbreak of bovine TB occurred among cattle and deer in Northwest Minnesota, how concerned were you personally about the following outcomes? (*Circle one response for each*).

	Not at all concerned	Slightly concerned	Moderately concerned	Very concerned	Extremely concerned
Economic impacts to cattle producers.	1	2	3	4	5
Threats to the health of deer.	1	2	3	4	5
Reducing the deer population in the area.	1	2	3	4	5
Economic impacts to businesses that depend on deer hunting.	1	2	3	4	5
Threats to the health of other deer hunters from infected deer.	1	2	3	4	5
Reducing your deer hunting opportunity.	1	2	3	4	5
Threats to your personal health or family members from infected deer.	1	2	3	4	5
Financial costs to you personally.	1	2	3	4	5
Threats to other species and ecosystems.	1	2	3	4	5

Q7. Bovine TB was discovered in cattle and deer in 2005. Think back to when you first heard about the bovine TB outbreak in cattle and deer northwest Minnesota. We would like you to rate your INITIAL knowledge about the topic of bovine TB and TB management at that point in time. Please use a scale of zero to 100, where zero means knowing nothing and 100 means knowing everything you could possibly know about this topic. Using this scale, you much do you think you knew about bovine TB when the outbreak first occurred?

_____ (write in number from 0 to 100)

Q8. Think of that same scale again. This time, we would like you to estimate how much knowledge you would need to achieve a comfortable understanding of bovine TB and TB management. Using a scale of zero to 100, with zero being no information and 100 being all available information, how much information would be sufficient for you to understand bovine TB and TB management?

_____ (write in number from 0 to 100)

Q9. Using a scale of 1–7, with 1 being extremely worthless and 7 being extremely valuable, please indicate whether you feel that seeking information about bovine TB and TB management in Northwest Minnesota was worthless or valuable to you. *(Please circle one response below).*

WORTHLESS	1 extremely	2 quite	3 slightly	4 neither	5 slightly	6 quite	7 extremely	**VALUABLE**

Q10. Using a scale of 1–7, with 1 being extremely foolish and 7 being extremely wise, please indicate whether you feel that seeking information about bovine TB and TB management in Northwest Minnesota was wise or foolish for you. *(Please circle one response below).*

FOOLISH	1 extremely	2 quite	3 slightly	4 neither	5 slightly	6 quite	7 extremely	**WISE**

Q11. Using a scale of 1–7, with 1 being extremely unhelpful and 7 being extremely helpful, please indicate whether you feel that seeking information about bovine TB and TB management was unhelpful or helpful to you. *(Please circle one response below).*

UNHELPFUL	1 extremely	2 quite	3 slightly	4 neither	5 slightly	6 quite	7 extremely	**HELPFUL**

Q12. From what sources did you get information about TB and bovine TB management? *(Please indicate how much you depended on each as a source of information about bovine TB and TB management).*

	Not at all	Slightly	Moderately	Very Much
Radio News	1	2	3	4
Television news	1	2	3	4
Local newspapers	1	2	3	4
Statewide newspapers and news magazines	1	2	3	4
Internet sources	1	2	3	4
Minnesota DNR	1	2	3	4
Minnesota Board of Animal Health	1	2	3	4
Family, friends, social network	1	2	3	4
Public meetings	1	2	3	4

Q13. When it comes to the topic of bovine TB and TB management in deer and cattle in Northwest Minnesota… (*Please circle one for each*).

	Strongly Disagree	Disagree	Feel neutral	Agree	Strongly Agree
People who are important to me thought I should stay on top of information about bovine TB and TB management.	1	2	3	4	5
People close to me expected me to get information about bovine TB.	1	2	3	4	5
Most of the people I know wanted to talk about bovine TB.	1	2	4	5	5
I knew what questions to ask of the experts.	1	2	3	4	5
I knew where to go for information.	1	2	3	4	5
I could take the time to gather any information I needed.	1	2	3	4	5
Much of the information was too technical for me to understand.	1	2	3	4	5
I could separate fact from fiction.	1	2	3	4	5
I could understand the information if I made the effort.	1	2	3	4	5
When the topic came up, I was likely to tune it out.	1	2	3	4	5
I'd go out of my way to avoid learning more about bovine TB management.	1	2	3	4	5
Gathering a lot of information about bovine TB management was a waste of time.	1	2	3	4	5
I tried to learn more about TB.	1	2	3	4	5
I was likely to go out of my way to get more information about bovine TB management.	1	2	3	4	5
After I encountered information about bovine TB management, I stopped and thought about it.	1	2	3	4	5
The more viewpoints I got on bovine TB management the better.	1	2	3	4	5
When I encountered information about bovine TB management, I read or listened to most of it, even though I might not agree with its perspective.	1	2	3	4	5
After thinking about bovine TB management, I had a broader understanding.	1	2	3	4	5
When I saw or heard information about bovine TB, I rarely spent much time thinking about it.	1	2	3	4	5
There is far more information on bovine TB management than I personally need.	1	2	3	4	5
When I encountered information about bovine TB management, I focused only on a few key points.	1	2	3	4	5
For bovine TB management, the advice of one expert was enough for me.	1	2	3	4	5
It would be easy for me to do something that would minimize the effects of bovine TB in deer and cattle.	1	2	3	4	5

Q14. After bovine TB was detected in northwest Minnesota in 2005, the Minnesota DNR began to systematically sample and test deer harvested by hunters for bovine TB. To what extent did you think the DNR efforts to check for bovine TB in deer harvested by hunters was UNACCEPTABLE or ACCEPTABLE? (*Check only one*)

- ❑ **HIGHLY UNACCEPTABLE**
- ❑ **MODERATELY UNACCEPTABLE**
- ❑ **SLIGHTLY UNACCEPTABLE**
- ❑ **NEITHER**
- ❑ **SLIGHTLY ACCEPTABLE**
- ❑ **MODERATELY ACCEPTABLE**
- ❑ **HIGHLY ACCEPTABLE**

Q15. The DNR also employed a number of deer reduction strategies in and around the bovine TB Management Zone. In general did you personally find the goal of reducing deer numbers in the area UNACCEPTABLE or ACCEPTABLE ? (*Check only one*)

- ❑ **HIGHLY UNACCEPTABLE**
- ❑ **MODERATELY UNACCEPTABLE**
- ❑ **SLIGHTLY UNACCEPTABLE**
- ❑ **NEITHER**
- ❑ **SLIGHTLY ACCEPTABLE**
- ❑ **MODERATELY ACCEPTABLE**
- ❑ **HIGHLY ACCEPTAB LE**

Q16. We would also like to know whether or not you supported the specific strategies used by the DNR to try to reduce deer numbers in the area and prevent the spread of bovine TB among deer. For each of the following strategies, please tell us if you thought the strategy was UNACCEPTABLE or ACCEPTABLE. (*Circle one* for each).

	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
Landowner/tenant deer shooting permits	-3	-2	-1	0	1	2	3
Contracted ground sharpshooting.	-3	-2	-1	0	1	2	3
Contracted aerial sharpshooting.	-3	-2	-1	0	1	2	3
Encouraging more deer to be harvested by each hunter during the regular seasons.	-3	-2	-1	0	1	2	3
Special hunting seasons to reduce deer.	-3	-2	-1	0	1	2	3
Feeding ban on deer and elk.	-3	-2	-1	0	1	2	3

Q17. Next, we would like to know how effective you think the DNR's bovine TB management program was. Please indicate how effective you think each goal or strategy was for controlling TB. (*Circle one for each*).

	Very Ineffective	Somewhat Ineffective	Neither	Somewhat Effective	Very Effective
The deer surveillance program.	1	2	3	4	5
Reducing deer numbers in general.	1	2	3	4	5
Landowner/tenant deer shooting permits.	1	2	3	4	5
Contracted ground sharpshooting.	1	2	3	4	5
Contracted aerial sharpshooting.	1	2	3	4	5
Encouraging more deer to be harvested by each hunter during the regular seasons.	1	2	3	4	5
Special hunting seasons to reduce deer.	1	2	3	4	5
Feeding ban on deer and elk.	1	2	3	4	5

Q18. We want to know how **the management** of bovine TB in Northwest Minnesota made you feel over the past several years. Please circle a number from 0 to 10, where "0" means "none of this feeling" and "10" means "a lot of this feeling". When you think about how bovine TB was managed by the Minnesota DNR in Northwest Minnesota during the past several years how much do you feel….

	None of this feeling										A lot of this feeling
Anger	0	1	2	3	4	5	6	7	8	9	10
Hope	0	1	2	3	4	5	6	7	8	9	10
Fear	0	1	2	3	4	5	6	7	8	9	10
Worry	0	1	2	3	4	5	6	7	8	9	10
Disgust	0	1	2	3	4	5	6	7	8	9	10
Satisfaction	0	1	2	3	4	5	6	7	8	9	10
Happy	0	1	2	3	4	5	6	7	8	9	10
Sadness	0	1	2	3	4	5	6	7	8	9	10

Q19a). Now that the outbreak has passed, we would like you to rate your CURRENT knowledge about the topic of bovine TB and TB management at that point in time. Please use a scale of zero to 100, where zero means knowing nothing and 100 means knowing everything you could possibly know about this topic currently. Using this scale, you much do you think you knew about bovine TB when the outbreak first occurred?

_____ (write in number from 0 to 100)

Q19b). How much time and effort did you take to actually gather and understand information about bovine TB and TB management? Please use a scale of zero to 100, where zero means "none at all" and 100 means "as much as I possibly could".

_____ (write in number from 0 to 100)

Q20. We would like to better understand what you thought about the Minnesota DNR's management of bovine TB in deer in Northwest Minnesota (*Circle one for each*).

	Strongly Disagree	Disagree	Feel neutral	Agree	Strongly Agree
I trust the Minnesota DNR to manage bovine TB.	1	2	3	4	5
DNR officials are concerned about minimizing the impacts of bovine TB on deer hunters.	1	2	3	4	5
The Minnesota DNR does a competent job of minimizing the impacts of bovine TB.	1	2	3	4	5
The DNR is open and honest in the things they do in say when managing bovine TB.	1	2	3	4	5
The DNR makes decisions about managing bovine TB in a way that is fair.	1	2	3	4	5
The DNR listens to deer hunters concerns when managing bovine TB.	1	2	3	4	5
I thought the DNR had similar concerns to mine about the impact of bovine TB on deer.	1	2	3	4	5
I thought the DNR had similar concerns to mine about the impacts of bovine TB on other species and the larger ecosystem.	1	2	3	4	5
I thought the DNR had similar concerns to mine about the impact of bovine TB on deer hunters and deer hunting.	1	2	3	4	5
I thought the DNR had similar concerns to mine about the economic impacts to of bovine TB on businesses that depend on deer hunting.	1	2	3	4	5
I thought the DNR seemed concerned about potential impacts of bovine TB and management to people like me.	1	2	3	4	5
I thought the DNR had concerns similar to mine about the economic impact of bovine TB for cattle producers.	1	2	3	4	5

Q21. In your estimation, how likely is it that another outbreak of TB will occur in northwest Minnesota in the next few years? Please use a scale from zero to 100, where zero means that it would have absolutely no chance of occurring and 100 means that it is certain to.

_____ (write in number from 0 to 100)

Q22. If another outbreak of TB occurred, how serious would the impacts be? Please use a scale from zero to 100, where zero means not serious at all and 100 means it would be as serious as it can possibly be.

_____ (write in number from 0 to 100)

Q23. If another outbreak of bovine TB occurred among cattle and deer in Northwest Minnesota, how concerned would you personally be about the following outcomes? (*Circle one for each*).

	Not at all concerned	Slightly concerned	Moderately concerned	Very concerned	Extremely concerned
Economic impacts to cattle producers.	1	2	3	4	5
Threats to the health of deer even if it did not affect hunting.	1	2	3	4	5
Reducing the deer population in the area.	1	2	3	4	5
Economic impacts to businesses that depend on deer hunting.	1	2	3	4	5
Threats to the health of other deer hunters from infected deer.	1	2	3	4	5
Reducing your opportunity to hunt deer.	1	2	3	4	5
Threats to your personal health or family members from infected deer.	1	2	3	4	5
Financial costs to you personally.	1	2	3	4	5
Threats to other species and ecosystems from TB.	1	2	3	4	5

The final set of questions will address deer populations and management in northwestern Minnesota, specifically around the Bovine TB management zone. As you probably know, deer populations have been lowered below established goal levels as one method of limiting disease spread. Now that the State of Minnesota has regained its bovine TB -free status, there is an opportunity to reassess deer populations and management strategies in this area. DNR staff is interested in obtaining information regarding both desired population direction and strategies to achieve those population goals.

Q24. Which deer permit areas are you most familiar with? (*check all that apply*)

❒ 101 ❒ 105 ❒ 111 ❒ 203 ❒ 208 ❒ 267 ❒ 268

Q25. If you hunted deer in the 2011 season, how much of your hunting did you do on each of the following types of land. (*Circle one number for each item*).

	None	Some	Most	All	Don't Know
Private land that I own	1	2	3	4	9
Private land that I lease for hunting	1	2	3	4	9
Private land that I do **not** own or lease	1	2	3	4	9
Public land	1	2	3	4	9

Q26. What is your perception of the current deer populations in this group of deer permit areas? If you are unfamiliar with a deer permit area, please circle "don't know" (*Circle one for each*).

Deer Permit Area	Too High	Too Low	About Right	Don't Know
101	1	2	3	4
105	1	2	3	4
111	1	2	3	4
203	1	2	3	4
208	1	2	3	4
267	1	2	3	4
268	1	2	3	4

Q27. In your opinion, how should the deer population be managed in this group of deer permit areas? If you are unfamiliar with a deer permit area, please circle "don't know" (*Circle one number for each area*).

Deer Permit Area	Decrease 50%	Decrease 25%	Decrease 10%	Stay the Same	Increase 10%	Increase 25%	Increase 50%	Don't Know
101	1	2	3	4	5	6	7	9
105	1	2	3	4	5	6	7	9
111	1	2	3	4	5	6	7	9
203	1	2	3	4	5	6	7	9
208	1	2	3	4	5	6	7	9
267	1	2	3	4	5	6	7	9
268	1	2	3	4	5	6	7	9

Deer populations can be managed using a variety of tools. Historically, DNR has increased deer densities quickly by not allowing antlerless harvest, while letting people take any legal buck. That has the effect of a rapid population increase but a lower proportion of mature males. Another method would be to restrict buck harvest and provide for some antlerless harvest, which would allow the population to increase slower, yet more mature bucks would be in the population.

Q28. If you made a recommendation to significantly increase deer populations (at least 25%), please tell us how quickly you believe DNR should manage toward the new goal. Select the one option that best fits your personal preference. (*Check only one*).

- ❒ The goal population should be achieved as fast as possible (1 to 2 years). Some methods that would allow the fastest population increase include, 1) limiting the number of people who could hunt by using bucks only license lottery, or 2) closing the deer season entirely.
- ❒ The rate of population increase should be more moderate (2 to 3 years). This method would provide for annual buck hunting (everyone can participate) but few antlerless permits would be authorized.
- ❒ The rate of population increase should be slower (3 to 5 years). This method would provide for restricted buck hunting (i.e., antler point restriction) and a limited number of antlerless permits would be authorized.
- ❒ I do not think deer populations should be increased.

Q29. Please indicate your support or opposition to the following statements about potential deer management changes. Responses of 'neither' mean you neither support nor oppose the proposed regulation and would continue to hunt your traditional location if regulations were changed. *(Please circle one number on each line).*

	Strongly Oppose	Slightly Oppose	Neither	Slightly Support	Strongly Support
DNR **should** enact regulations that protect the majority of yearling bucks and increase the proportion of mature bucks in the deer population.	1	2	3	4	5
Eliminate buck cross-tagging. People would still be allowed to hunt as a party but hunters would be required to shoot and tag their own buck. Hunters would still be allowed to shoot and tag antlerless deer for each other. Current data suggests buck harvest would decline 7 – 10% if cross-tagging was eliminated.	1	2	3	4	5
Delay the firearm deer season one week. The deer season would open the Saturday closest to November 15th. Delaying the firearm season may have the effect of lowering buck harvest rates.	1	2	3	4	5
Delay the firearm deer season 2 weeks. The deer season would open the Saturday closest to November 22nd. Delaying the firearm season may have the effect of lowering buck harvest rates.	1	2	3	4	5
Institute an antler point restriction. An antler point restriction would be the most effective technique to protect yearling bucks while still allowing 2.5 year and older bucks to be harvested. Current data suggests the initial buck harvest would be reduced by about 35% as a significant portion of yearling bucks would be protected. This regulation would allow bucks to live longer and develop larger antlers	1	2	3	4	5

Demographics:

Q30. Are you male or female?

❒ Male
❒ Female

Q31. What is the highest level of education you have completed? (Please check one.)

❒ Grade school
❒ Some high school
❒ High school diploma or GED
❒ Some vocational or technical school
❒ Vocational or technical school (associate's)
❒ Some College
❒ Four-year college
❒ Some graduate school
❒ Graduate/professional degree

Q32. What was your total household income before taxes last year? $_____

Please write any additional comments or thoughts you might have on the TB management issue in the space below:

Appendix B: Midwest Farming Practices survey instrument

A Study of Farming Practices in the Midwest

Winter 2014-15

Please complete this survey and return it in the postage-paid return envelope.

University of Minnesota
Department of Fisheries and Wildlife
1980 Folwell Avenue
St. Paul, Minnesota 55108

First, we would like to know about your property.

Q1. How many total number of acres of agricultural property did you own in **Jasper County, IA; Richland County, ND or Mower County, MN** in 2014?

_____ Acres Owned

Q2. Of the total number of acres of agricultural property you own, on how many acres did you personally run an agricultural operation in 2014?

_____ Acres Operated

Q3. Of the total number of acres of agricultural property you own, on how many acres did you lease out to others for farm operations?

_____ Acres Leased to Others

Q4. How many total number of acres of agricultural property did you lease from other people for agricultural operations (crops/livestock) in **Jasper, Richland or Mower County** in 2014?

_____ Acres Leased from Others

Q5. For the agricultural property that you own, who has primary responsibility for making decisions about? (*Check only one box for each*).

	Check One		
Decisions	You and/or Co-owners	Farm Manager	Tenant/Lessee
Crops grown/rotation	☐	☐	☐
Crop inputs (fertilizer, seed, chemicals)	☐	☐	☐
Tillage practices	☐	☐	☐
Other conservation practices	☐	☐	☐
Participation in government conservation programs	☐	☐	☐

Q6. Please provide a "rough" estimate as to how many acres of the property you farm are in each of the following:

Crop	Acres grown, 2013	% of Farm Income	Did not grow
Corn	_____ acres	_____ %	☐
Soybeans	_____ acres	_____ %	☐
Wheat	_____ acres	_____ %	☐
Alfalfa	_____ acres	_____ %	☐
Other hay	_____ acres	_____ %	☐
Switch grass or other bioenergetics crops	_____ acres	_____ %	☐
Vegetables (produce)	_____ acres	_____ %	☐
Other Crops (List):_____	_____ acres	_____ %	☐

Q7. Please provide a "rough" estimate of the percent (%) of your farm income from each of the following:

Livestock	% of Farm Income	Did not raise
Cattle	_____ %	☐
Pigs	_____ %	☐
Poultry	_____ %	☐
Sheep/goats	_____ %	☐
Other Livestock List:_____	_____ %	☐

Q8. How much of your yearly income comes from farming? (*Circle one*).

<5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95+%

Q9. We are very interested in knowing what your farm means to you. Please indicate the extent to which you agree or disagree with the following statements. *(Circle one response for each statement).*

Statement	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
My farm represents my family history.	1	2	3	4	5	6	7
I'm proud of my family history on the farm.	1	2	3	4	5	6	7
My farm is an important part of my personal history.	1	2	3	4	5	6	7
Farming says a lot about who I am.	1	2	3	4	5	6	7
I consider myself a farmer.	1	2	3	4	5	6	7
Farming helps define who I am.	1	2	3	4	5	6	7
My farm is primarily a business.	1	2	3	4	5	6	7
My farm is a way for me to financially provide for my family.	1	2	3	4	5	6	7
My farm is an important source of income.	1	2	3	4	5	6	7

Q10. Next, we're interested in knowing how you think the environmental conditions around your farm have changed in recent years. *(For each condition below circle one response).*

Conditions	Greatly Decreased	Moderately Decreased	Slightly Decreased	Stayed the Same	Slightly Increased	Moderately Increased	Greatly Increased	Don't know
Water quality	1	2	3	4	5	6	7	DK
Wildlife habitat	1	2	3	4	5	6	7	DK
Soil conditions	1	2	3	4	5	6	7	DK
Productivity of farms	1	2	3	4	5	6	7	DK
Level of nitrates and other farm chemicals in surface and ground water	1	2	3	4	5	6	7	DK

Q11. Different individuals who farm view what is most important about farming differently. We are interested in knowing what you think is important. Please indicate the extent to which you agree or disagree with the following statements. *(Circle one response for each statement).*

Statement	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
Farms should primarily be thought of as a business.	1	2	3	4	5	6	7
For human communities to stay healthy, we have to recognize that we depend on a larger community of plants and animals.	1	2	3	4	5	6	7
Farmers should be good stewards of the wildlife habitat around their farms.	1	2	3	4	5	6	7
The quality of my farmland is positively influenced by the diversity of native plants and animals that live on or around it.	1	2	3	4	5	6	7
The idea that humans are just another part of a broader natural community is foolish.	1	2	3	4	5	6	7
Moral commitments to community should include commitments to the soil, water, plants and animals as well as people.	1	2	3	4	5	6	7
Farmers should respect the larger natural community on which they farm.	1	2	3	4	5	6	7
Farming should be done in a way that conserves water quality and wildlife habitat.	1	2	3	4	5	6	7
The best farmers understand a lot about the complex natural systems that make up their farmland.	1	2	3	4	5	6	7
The land I farm is more than just the soil and involves a complex chain of plants, animals and energy.	1	2	3	4	5	6	7
Farmers should farm in a way that maintains the function of natural ecosystems on their land.	1	2	3	4	5	6	7
Farms should be thought of as a part of a larger natural community of soil, water, native plants and wildlife.	1	2	3	4	5	6	7
Farmers have an obligation to other people to make sure their farms are economically successful.	1	2	3	4	5	6	7
It's important to know that the land I farm is a complex web of interconnected ecological processes.	1	2	3	4	5	6	7
For me, the idea of community can only include people.	1	2	3	4	5	6	7
Farmers should conserve soil, water, native plants and wildlife habitat as an important part of their farming practices.	1	2	3	4	5	6	7
You DO NOT really need to know much about the native plants and animals to be a good farmer.	1	2	3	4	5	6	7
Farmers should focus on maximizing production on their farm, even if there is environmental cost.	1	2	3	4	5	6	7

Q11. Continued (*Circle one response for each statement).*

Statement	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
Farmers have an obligation to protect water quality and wildlife habitat.	1	2	3	4	5	6	7
Farmers should minimize the negative impacts of farming on water and wildlife habitat.	1	2	3	4	5	6	7
Native plants and animals have a hard time adapting to modern farming practices.	1	2	3	4	5	6	7
Making a profit from farming should be most important to a successful farmer.	1	2	3	4	5	6	7

Q12. We would like to understand what level of responsibility you feel you have to protect environmental resources when you farm. *(For each statement below circle one response).*

Statement	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
I have a responsibility to implement farming practices that protect water quality.	1	2	3	4	5	6	7
I have a responsibility to implement farming practices that protect wildlife habitat.	1	2	3	4	5	6	7
I have a responsibility to minimize the level of nitrates and other farm chemicals I use.	1	2	3	4	5	6	7
I feel a strong obligation to protect the local environment where I farm.	1	2	3	4	5	6	7
Protecting the environment is not my responsibility.	1	2	3	4	5	6	7

Q13. Listed below are several potential ways that farming could affect environmental quality either positively or negatively. For your farm operations, please tell if you think the way you farm has a NEGATIVE or POSITIVE effect on each. (*Circle the number that best corresponds to your answer*).

I think that the way I farm has a Negative or Positive Effect on...	Extremely Negative	Quite Negative	Slightly Negative	Neutral	Slightly Positive	Quite Positive	Extremely Positive
Water quality around my farm	1	2	3	4	5	6	7
Long-term productivity of my farm	1	2	3	4	5	6	7
Wildlife habitat	1	2	3	4	5	6	7
Soil erosion on my farm	1	2	3	4	5	6	7
The amount of farm income I receive	1	2	3	4	5	6	7
General environmental quality	1	2	3	4	5	6	7
The amount of nitrates and other farm chemicals in the surface and ground water in my area	1	2	3	4	5	6	7

Q14. We would like to know how much of the land you own you consider to be marginal for farming. *(Circle one response for each statement).*

Some of my land is very marginal for farming because....	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree	If you agree→	How many acres would you characterize as "very marginal" for farming for this reason?
It has poor soil	1	2	3	4	5	6	7	→	_____acres
It is too wet	1	2	3	4	5	6	7	→	_____acres
It is too steep	1	2	3	4	5	6	7	→	_____acres

Q15. There are a number of farming practices that have been suggested to help reduce soil erosion, protect water quality and provide wildlife habitat. We'd like to know your experience with these practices.

FIRST, please indicate how effective you think each land management technique is in maintaining water quality.

SECOND, indicate if you have used this technique in the past, currently use this technique, or would use the technique in the future (Y = Yes/ N = No). *(Circle the number and letter that best corresponds to your answer).*

Farming Practice	Effectiveness							Use of technique		
	Not at all effective			Moderately effective			Greatly effective	I have used in the past	I currently use	I would use in the future
Planting grasses, trees, and shrubs to prevent soil erosion from wind and water.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Use of terracing and contour farming in hilly areas to reduce soil erosion.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Use of conservation tillage practices.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Planting and maintaining filter strips.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Conserving shallow wetlands by not placing drainage tile.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Restoring selected wetlands.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Taking precautions to prevent contamination (by fertilizers & pesticides) of groundwater.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Optimize nitrogen applications by using variable rate technology or other approaches.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Rotating crops like alfalfa that can help replenish nitrogen.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Planting alternative energy crops like switch grass.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Planting cover crops.	1	2	3	4	5	6	7	Y / N	Y / N	Y / N

Farm Bill Conservation Programs

The "Farm Bill" is a compilation of many different Acts that have been passed by the United State Congress to enhance agricultural productivity and conservation on private lands. The 2014 Farm bill was enacted on February 7, 2014. There are several conservation programs provided through the 2014 Farm Bill, and earlier farm bills, that address wildlife habitat as well as water and soil conservation. These programs are largely administered by the U.S. Department of Agriculture's Farm Service Agency (FSA) and Natural Resources Conservation Service (NRCS) with close collaboration with other agencies such as the U.S. Fish and Wildlife Service. Some of these programs are:

- **Conservation Reserve Program (CRP)**—a voluntary program administered by the FSA that provides annual rental payments and cost-share assistance to establish long-term, resource-conserving vegetative covers on eligible, environmentally sensitive land.
- **Conservation Reserve Enhancement Program (CREP)**—a CRP program administered by the FSA focused on helping retire farmland to protect and restore high priority wildlife habitat and protect environmentally sensitive land.
- **Agricultural Conservation Easement Programs (ACEP) (Formerly: Grassland Reserve Program (GRP)/Wetland Reserve Program (WRP)/and Farm and Ranch Land Protection Program)**— a new program administered by NRCS created by the 2014 Farm Bill, it provides financial and technical assistance to help conserve and restore grassland and wetland resources primarily through rental easements. It largely replaces the Grassland Reserve Program (GRP) and Wetland Reserve Program (WRP).

Q16. We would like to know how familiar you are with the conservation programs provided under the Farm Bill. For each program, please rate your personal level of knowledge concerning each program. (*Please circle one response for each).*

Farm Bill Program	No knowledge at all			Moderate amount of knowledge			Great deal of knowledge
Conservation Reserve Program (CRP)	1	2	3	4	5	6	7
Conservation Reserve Enhancement Program (CREP)	1	2	3	4	5	6	7
Agricultural Conservation Easement Programs (or old GRP or WRP)	1	2	3	4	5	6	7

Q17. We're interested in your opinions on land conservation programs. FIRST, please indicate how effective you think each land conservation program is in maintaining stream quality. SECOND, indicate if you have used this program in the past, currently use this program, or would use the program in the future (Y = Yes/ N = No). (*Circle the number or letter that best corresponds to your answer).*

Farm Bill Program	Effectiveness							Use of Program		
	Not at all effective			Moderately effective			Greatly effective	I have used in the past	I currently use	I would use in the future
Conservation Reserve Program (CRP)	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Conservation Reserve Enhancement Program (CREP)	1	2	3	4	5	6	7	Y / N	Y / N	Y / N
Agricultural Conservation Easement Programs (or old GRP or WRP)	1	2	3	4	5	6	7	Y / N	Y / N	Y / N

Participating in Farm Bill Programs

In the next few questions we would like to understand whether or not you are likely to increase your participation in Farm Bill Conservation Programs in the future and what you believe the outcomes of participation in the programs are likely to be for you.

Q18. First would you say increasing you participation in one or more of the Farm Bill conservation programs in the next couple of years is: (*Place an "X" in the space that best expresses what you believe*).

Negative	extremely	quite	slightly	neither	slightly	quite	extremely	**Positive**
Harmful	extremely	quite	slightly	neither	slightly	quite	extremely	**Beneficial**
Foolish	extremely	quite	slightly	neither	slightly	quite	extremely	**Wise**

Q19. How likely are you to increase your participation in Farm Bill Conservation Programs in the next couple of years? (*Place an "X" in the space that best expresses your intentions).*

Unlikely	extremely	quite	slightly	neither	slightly	quite	extremely	**Likely**

Q20. In which Farm Bill conservation programs would you be most likely to participate in the next couple of years? (*Check all that apply*).

- ❑ Conservation Reserve Program (CRP)
- ❑ Agricultural Conservation Easement Program (ACEP)
- ❑ Conservation Reserve Enhancement Program (CREP)
- ❑ Other→PLEASE DESCRIBE:

_____

Q21. Would you say, most people who are important to you think you should increase your participation in Farm Bill conservation programs in the next couple of years? (*Place an "X" in the space that best expresses your intentions. Note: if you do not have any area to restore do not answer).*

Unlikely	extremely	quite	slightly	neither	slightly	quite	extremely	**Likely**

Q22. How likely or unlikely do you believe the following outcomes are if you were to increase your participation in Farm Bill Conservation Programs. *(Please circle the ONE number that best represents your answer in each row).*

Increased participation in Farm Bill Conservation Programs would…	Extremely Unlikely	Quite Unlikely	Slightly Unlikely	Neutral	Slightly Likely	Quite Likely	Extremely Likely
increase my income.	-3	-2	-1	0	1	2	3
protect habitat for wildlife.	-3	-2	-1	0	1	2	3
give the government more control over what I do.	-3	-2	-1	0	1	2	3
decrease my options for using my property.	-3	-2	-1	0	1	2	3
increase my expenses.	-3	-2	-1	0	1	2	3
improve the water quality of in lakes and streams in my area.	-3	-2	-1	0	1	2	3
take a lot of time and effort.	-3	-2	-1	0	1	2	3
improve the productivity of my farm.	-3	-2	-1	0	1	2	3
improve the quality of the local environment.	-3	-2	-1	0	1	2	3
decrease soil erosion on the land I farm.	-3	-2	-1	0	1	2	3
remove marginal land from being farmed.	-3	-2	-1	0	1	2	3
decrease the amount of land that I farm.	-3	-2	-1	0	1	2	3

Q23. To what extent do you think the potential outcomes of increasing your participation in Farm Bill Conservation Programs are NEGATIVE or POSITIVE? *(Please circle the ONE number that best represents your answer in each row).*

	Extremely Negative	Quite Negative	Slightly Negative	Neutral	Slightly Positive	Quite Positive	Extremely Positive
increasing my income.	-3	-2	-1	0	1	2	3
protecting habitat for wildlife.	-3	-2	-1	0	1	2	3
giving the government more control over what I do.	-3	-2	-1	0	1	2	3
decreasing my options for using my property.	-3	-2	-1	0	1	2	3
increasing my expenses.	-3	-2	-1	0	1	2	3
improving the water quality of in lakes and streams in my area.	-3	-2	-1	0	1	2	3
taking a lot of time and effort.	-3	-2	-1	0	1	2	3
improving the productivity of my farm.	-3	-2	-1	0	1	2	3
improving the quality of the local environment	-3	-2	-1	0	1	2	3
decreasing soil erosion on the land I farm	-3	-2	-1	0	1	2	3
removing marginal land from being farmed	-3	-2	-1	0	1	2	3
decreasing the amount of land that I farm	-3	-2	-1	0	1	2	3

Q24. Next we would like to know how likely it is that other people you know would want you to increase your participation in Farm Bill Conservation Programs. *(Please circle the ONE number that best represents your answer in each row).*

How likely is it that the following think you SHOULD increase your participation in Farm Bill Conservation Programs	**Extremely Unlikely**	**Quite Unlikely**	**Slightly Unlikely**	**Neutral**	**Slightly Likely**	**Quite Likely**	**Extremely Likely**
Most other farmers in your area	-3	-2	-1	0	1	2	3
Most of your family members	-3	-2	-1	0	1	2	3
Your local Soil & Water Conservation District	-3	-2	-1	0	1	2	3
Your state wildlife and fisheries conservation agency	-3	-2	-1	0	1	2	3
Hunters in your area	-3	-2	-1	0	1	2	3
Environmentalists	-3	-2	-1	0	1	2	3
Conservation groups	-3	-2	-1	0	1	2	3

Q25. Next we would like to know how likely you are to do what other people you know would want you to do concerning increasing your participation in Farm Bill Conservation Programs. *(Please circle the ONE number that best represents your answer in each row).*

How likely is it that you want to do what…	**Extremely Unlikely**	**Quite Unlikely**	**Slightly Unlikely**	**Neutral**	**Slightly Likely**	**Quite Likely**	**Extremely Likely**
Most other farmers in your area think you should do.	-3	-2	-1	0	1	2	3
Most of your family members think you should do.	-3	-2	-1	0	1	2	3
Local Soil & Water Conservation District thinks you should do.	-3	-2	-1	0	1	2	3
State wildlife and fisheries conservation agency thinks you should do.	-3	-2	-1	0	1	2	3
Hunters in your area think you should do.	-3	-2	-1	0	1	2	3
Environmentalists think you should do.	-3	-2	-1	0	1	2	3
Conservation groups think you should do.	-3	-2	-1	0	1	2	3

Q26. If you wanted to increase your participation in Farm Bill Conservation Programs, how certain are you that you have the personal skills and abilities to do so? *(Circle one response for each statement).*

	Could not do at all			Moderately Certain could do			Completely Certain could do
Obtain and understand information about the programs	1	2	3	4	5	6	7
Work through any financial challenges in participating in the programs	1	2	3	4	5	6	7
Work through any weather challenges in participating in the programs	1	2	3	4	5	6	7
Work through any disagreements or challenges with others about participating in the programs	1	2	3	4	5	6	7
Work through any time challenges with participating in the programs	1	2	3	4	5	6	7
Work through any market challenges with participating in the programs	1	2	3	4	5	6	7

Q27. Listed below are possible reasons why individuals do not use Farm Bill Conservation Programs. Please indicate the degree to which you agree or disagree with each statement for yourself. *(Circle one response for each statement).*

Statement	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral	Slightly Agree	Moderately Agree	Strongly Agree
The financial incentives for participating in the conservation programs are too small for me.	1	2	3	4	5	6	7
I do not have farmland that qualifies for the conservation programs.	1	2	3	4	5	6	7
I do not have enough information about how to participate in the conservation programs.	1	2	3	4	5	6	7
There are not enough incentives to use conservation programs.	1	2	3	4	5	6	7
I do not have enough time to use conservation programs.	1	2	3	4	5	6	7
I do not know enough about conservation programs to use them.	1	2	3	4	5	6	7
There is too much "red tape" involved in conservation programs.	1	2	3	4	5	6	7
Market prices encourage growing crops instead.	1	2	3	4	5	6	7
Subsidies encourage growing crops instead.	1	2	3	4	5	6	7
Crop insurance makes it worth planting on more marginal land instead of placing it in conservation programs.	1	2	3	4	5	6	7
I want to farm all of the land I can even if it is not the best land for farming.	1	2	3	4	5	6	7

Q28. Are you

- ❑ MALE
- ❑ FEMALE

Q29. Would you describe yourself as: *(Please check one).*

- ❑ EXTREMELY CONSERVATIVE
- ❑ CONSERVATIVE
- ❑ SLIGHTLY CONSERVATIVE
- ❑ MODERATE
- ❑ SLIGHTLY LIBERAL
- ❑ LIBERAL
- ❑ EXTREMELY LIBERAL

Q30. What is your current age? _____

Q31. Which of the following best describes your race? *(Check all that apply).*

- ☐ African American/black
- ☐ Asian
- ☐ Pacific Islander
- ☐ American Indian or Alaskan Native
- ☐ Caucasian/white
- ☐ Other

Q32. Do you consider yourself Hispanic/Latino/Spanish? *(Check one).*

- ☐ Yes
- ☐ No

Q33. What is the highest level of education you have completed? *(Check one).*

- ☐ Some high school
- ☐ Graduated from high school or GED
- ☐ Some vocational or technical school
- ☐ Graduated from Vo-Tech school
- ☐ Some college
- ☐ Graduated from college
- ☐ Some postgraduate study
- ☐ Postgraduate degree(s)

Please write any comments you might have in the space below. Thank You!