USING MULTIPLE REGRESSION ANALYSIS TO ASSOCIATE EDUCATION LEVELS AND FINANCIAL COMPENSATION WITH LIVESTOCK PRODUCERS' TOLERANCE FOR GRIZZLY BEARS IN THE NORTHERN CONTINENTAL DIVIDE ECOSYSTEM

by

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A dissertation submitted in partial fulfillment
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of

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ABSTRACT

The study area is the Northern Continental Divide Ecosystem located in north central and northwest Montana. The problem addressed in the study is that wildlife managers need to know if tolerance for grizzly bears can be predicted based upon education levels (formal education and self-initiated education) and financial compensation to livestock producers living in or near the Northern Continental Divide Ecosystem. A survey questionnaire was mailed to a sample of 700 livestock producers with a response rate of 55.4%. Relationships were computed using multiple regression, bivariate analysis, t-tests, and chi-square. Results indicate there is statistical significance when correlating formal education and financial compensation with tolerance. However, there was no correlation between self-initiated education and tolerance. Three of the four null hypotheses were rejected, concluding that formal education and financial compensation (for losses of livestock only and losses of livestock plus other costs) are predictors of tolerance for grizzly bears.

INTRODUCTION TO THE STUDY

Statement of the Background

The U.S. Fish and Wildlife Service (USFWS) is the governmental agency charged with protection and management of grizzly bears (*Ursus arctos horribilis*) on federal lands (Endangered Species Act, 1973; U.S. Fish and Wildlife Service [USFWS], 1993). The agency has identified grizzly bear populations in five ecosystem recovery zones (Appendix A): Northern Continental Divide Ecosystem (NCDE), Yellowstone, Cabinet-Yaak, Selkirk, and North Cascades (USFWS, 1993). Additionally, a sixth recovery zone, the Bitterroot ecosystem, is regarded as unoccupied grizzly bear habitat (USFWS, 2000). The six recovery zones are largely comprised of public lands (national parks, national forests, and state lands). However, the NCDE contains approximately 855,000 acres of private land, which includes portions of two Indian reservations (Busch, 2000; Montana Department of Fish Wildlife and Parks [MDFWP], 1986) and which support economies oriented to livestock production.

The NCDE private land areas support economies oriented to livestock production. Conflicts occasionally arise when grizzly bears depredate on livestock (Brown, 1993). In an attempt to resolve these conflicts, government officials are challenged to mitigate such consequences through positive public education (USFWS, 1993). Since the early 1990s, wildlife managers have become increasingly aware of the importance of private land and how that land provides necessary habitat for grizzly bears (Frost, 1985). Grizzly bears in the lower 48 states are protected as a “threatened” species under the Endangered Species

Act (ESA, 1973). Because of this necessary protection and the potential for contention, wildlife managers have recognized the need to foster tolerance and positive attitudes toward grizzly bears (USFWS, 1993) from landowners and livestock producers (LPs). Private land contributes to grizzly habitat and, therefore, is critical to the goal of maintaining and increasing grizzly bear populations to the extent that they become fully recovered and sustainable.

In the last several years, wildlife managers, non-governmental organizations (NGOs), politicians, and livestock producers have examined viable alternatives for developing a program to compensate livestock producers for livestock losses (Montag, J., & Patterson, M., 2001). Additionally, governmental agencies and interested non-governmental organizations are suggesting that financial compensation may be a factor for increasing livestock producer tolerance for grizzly bears (USDA Forest Service [USFS], 2001). This study will examine both formal and self-initiated education along with financial compensation and their affect on livestock producer tolerance for grizzly bears.

Working Definition of Tolerance

Tolerance is a complex concept. In its simplest definition, "tolerance is putting up with something you do not like - often in order to get along better with others" (Vogt, 1997, p. 1). Vogt discusses the complexities of the concept of tolerance and reformulates the definition: "Tolerance is intentional self-restraint in the face of something one

dislikes, objects to, finds threatening, or otherwise has a negative attitude toward - usually in order to maintain a social or political group or to promote harmony in a group" (Vogt, 1997, p. 3). In discussing the concept of tolerance with regard to biological diversity, Stephen Kellert (1996) asserts, "Support for endangered species conservation will emerge when people believe this effort enhances the prospects of a more materially, emotionally, and spiritually worthwhile life for themselves, their families, and communities" (Kellert, 1996, p. 178).

Blending definitions from Vogt and Kellert provides substance on which to advance a working definition of tolerance. The definition of tolerance for this study is the following: intentional self-restraint demonstrated by livestock producers' attitudes or behavior toward grizzly bears when considering perceived threats toward their material, emotional, or spiritual well-being. Clarifying and defining tolerance thus improves the scope and direction of the study.

Problem Statement

The problem addressed in the study is that wildlife managers need to know if tolerance for grizzly bears can be predicted based upon education levels and financial compensation to livestock producers living in or near the Northern Continental Divide Ecosystem.

Significance of the Problem

The U.S. Forest Service, another major agency involved in grizzly bear recovery efforts, maintains, “In many of the most critical wildlife linkage habitats, tolerance of grizzly bears, wolves and other wildlife by local people is perhaps the most important factor in conserving them” (USFS, 2001). The problem of tolerance is important because it is one of the major determinants in the recovery of grizzly bears in the NCDE.

Purpose of the Study

The purpose of this quantitative relational study is to discover if tolerance for grizzly bears can be predicted based upon education levels and financial compensation to livestock producers living in or near the Northern Continental Divide Ecosystem.

Research Question

Does a relationship exist between, education levels and financial compensation to livestock producers living in or near the Northern Continental Divide Ecosystem and tolerance for grizzly bears?

Significance of the Study

The study will regard tolerance as a dependent variable since wildlife managers purport that various factors can influence tolerance. Since tolerance is a desired outcome, other factors will be defined and tested to determine if tolerance can be influenced.

The USFWS has identified education as a major factor in grizzly bear recovery (USFWS, 1993). Formal education is the first independent variable for the study. Typically, formal education indicates years spent in K-12 public or private educational systems and years spent in post secondary institutions such as colleges and universities. Since formal education is generally recognized as structured and institutionally-based, it is not the sole basis for determining an individual's education-based responses to livestock losses due to grizzly bear depredation. In short, life's educational experiences transcend the boundaries of the classroom. It is, therefore, significant to the study to incorporate self-initiated education (the second independent variable) as a recognized form of education complimenting the life-long learner in any occupation. In particular, the livestock producer is applying self-initiated learning as she or he resides and earns a living in occupied grizzly bear habitat.

Additionally, governmental agencies and non-governmental entities have identified financial compensation (the third independent variable) as a potential solution for increasing tolerance for grizzly bears (Montag, J., & Patterson, M., 2001; Montag, J.M., & Patterson, M.E., 2001). All three independent variables are significant to the study because they have been purported as having the greatest effect on tolerance.

Generically, education is considered effective because, as Maneli argues "reasonable, well educated people . . . should be tolerant" (Maneli, 1984, p. 32). More specifically, Vogt concludes from his analysis of various studies, that, "In most studies of adults' attitudes, education level is one of the strongest correlates of tolerance level, even

after the effects of other demographic variables, such as age, income, religion, gender, and region of residence, are controlled for" (Vogt, 1997, p. xxvi). Furthermore, there appears to be foreseeable benefits from the study to fulfill the government's desire to evaluate and improve public attitudes about grizzly bears (USFWS, 1993).

Financial compensation is significant to the study because it has a track record of being used in the NCDE by two NGO entities: The Great Bear Foundation and the Defenders of Wildlife (Defenders of Wildlife, 2001, 2002, & 2003b). It is somewhat speculative whether their record of compensatory actions ever resulted in tolerance. In the case of the Great Bear Foundation, their late payments (Downey, 1995) left the question of tolerance open ended. The benefits of financial compensation provided by the Defenders of Wildlife are not grounded in research, but rather are largely speculative as to whether compensation increases tolerance (Montag, J.M., & Patterson, M.E., 2001). In order for financial compensation to become a viable option for increasing tolerance for grizzly bears, additional research would add useful information to the repertoire of management strategies available to government wildlife managers in their attempts to foster tolerance for grizzly bears.

Ultimately, the research should provide decision support by making available an appropriate balance of qualitative and quantitative information (Howard & Borland, 2001) from which decisions can be applied to "initiate appropriate information and education programs" (USFWS, 1993, p. 37). The study could provide valid and reliable data from which wildlife managers could base decisions.

Conceptual Model

The concept of the research design can best be illustrated through the use of a model that demonstrates the interconnectedness of three independent variables with one dependent variable.

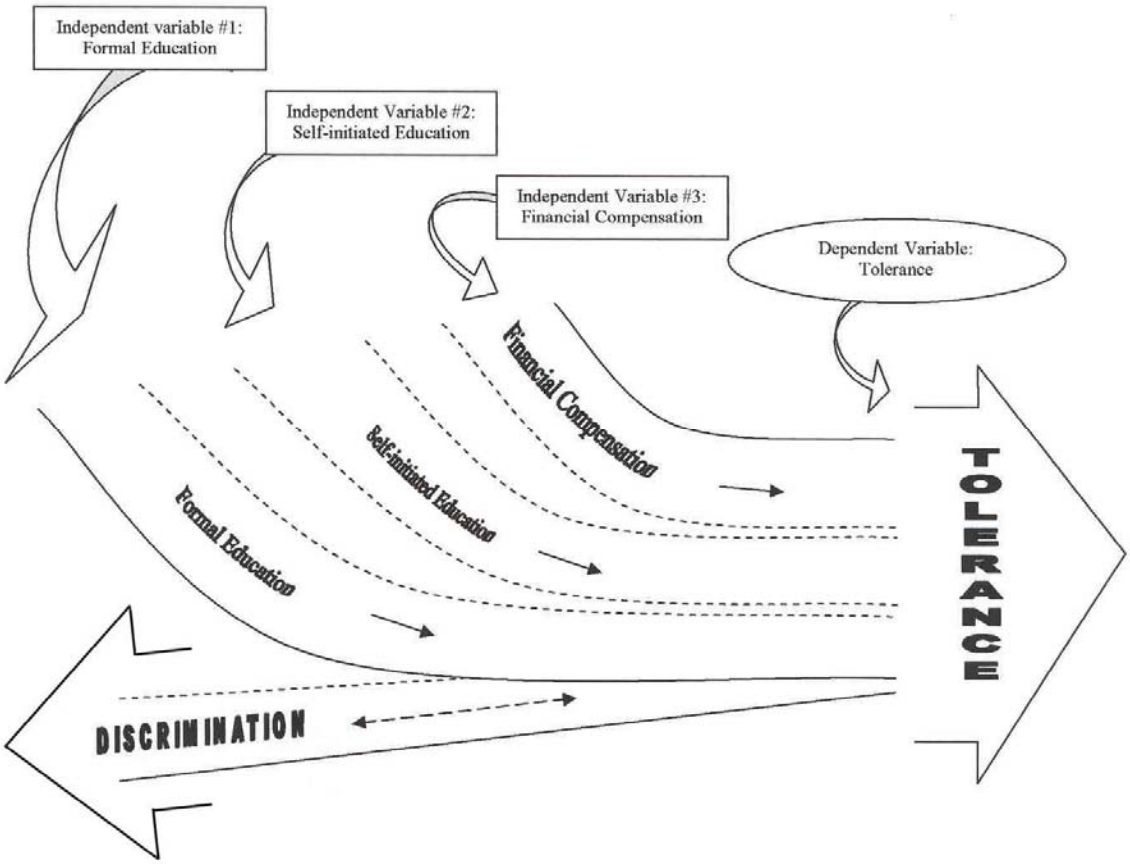


Figure 1. Conceptual (Theoretical) Model

The above figure illustrates how three independent variables merge to accomplish movement toward tolerance. Tolerance should ultimately result from an increase in formal education, self-initiated education, and financial compensation. Even with a solid definition of tolerance, it can be expected that defining its opposite may be somewhat

difficult. In that regard, Vogt (1997) rationalizes that an act of intolerance is best described as discrimination. As the three independent variables move (increase) toward tolerance, discrimination should decrease. Even under the best circumstances, some, or even all, of the benefits of education and financial compensation could be nullified, and a reversal toward discrimination could occur. For example, an otherwise tolerant livestock producer may become intolerant of grizzly bears if she or he were to sustain livestock losses from a depredating grizzly bear.

Figure 1 is theoretically based and supports the best results of the research hypothesis. However, prudent research needs to consider all possible "real-world" outcomes when livestock depredation occurs, and that discrimination is possible regardless of the strengths of education and financial compensation.

Limitations of the Study

Funding

All funding for research was provided by the researcher. Ideally, the research would expand into the Yellowstone Ecosystem (Appendix A) which contains another large population of grizzly bears. However, the cost of mailing questionnaires and travel expenses for expert validation of the questionnaire was prohibitive.

One mitigating factor is that outside researchers may find the outcomes of this NCDE study to have generalizability to the Yellowstone Ecosystem. There are many

similarities that other researchers may recognize as common to all LPs in both ecosystems.

Access

Access to additional mailing lists helped verify accuracy and currency of the mailing list obtained from the USDA Farm Services for the study's questionnaire. The principle list of LPs was received from the USDA under a Freedom of Information Act (FOIA) request. The Montana Wool Growers Association—an NGO—would help complete the list; however, their policy would not allow them to provide a list of LPs. One governmental agency, the USDA Agricultural Statistics Service, is the holder of a list of LPs that is continuously updated. They too were not able to supply a list of LPs.

LP participation in government programs is rather high and one could expect that the list provided by USDA Farm Services would include at least 95% of all LPs (D. Deschamps, USDA Farm Services, personal communication, December 19, 2003).

Delimitations of the Study

There were three factors to be considered as delimiters to the study. Each factor had the potential of affecting external validity or generalizability to the population.

First Factor

The first factor is the target population. A question that begs addressing is: What population of Montana livestock producers is affected by grizzly bears that inhabit the

NCDE? Considering the mobility of grizzly bears, environmental factors (e.g., berry crop fluctuations) and changing environs precipitate fluctuations as to which livestock producers are affected.

Three approaches were incorporated in the study design to mitigate this question. The first approach was to use maps (Appendices B and C) that delineate an expansion of the original NCDE area since the original map of 1993 (USFWS, 1993). The second approach was to include the term "in or near the NCDE" in the definition pertaining to the target population. The "in or near the NCDE" phrase is explained further in this chapter. The third approach was to bring the population current by gleaning agency news releases, agency websites, and daily and weekly newspapers to determine new areas near the NCDE that were affected by grizzly bears outside the map boundary of Appendix B. If a conflict was noted involving a livestock producer not in the intended zip code selection for the study, that zip code was added to the list of affected communities. All livestock producers within that zip code become part of the target population. Even though these corrective measures are in the study design, the target population still remains a moving target.

Second Factor

The second factor would be the selection of livestock producers for expert validity. In addition to wildlife managers, LPs from the Yellowstone area were used to provide expert validity to the questionnaire. The reasons for this are explained in detail

in the instrumentation portion of this study. As such, LPs can be expected to express similar responses to the questionnaire as would LPs of the NCDE. However, their experiences could be considerably varied because of their association with diverse wildlife managers in different national forests. Their experiences could also vary because of being located near Yellowstone rather than Glacier National park or in a state MDFWP region considerably distant from the NCDE.

Third Factor

The third factor is the problem of generalizability of the sample to the population. The sample of LPs is defined as "in or near the NCDE." For example, if predation occurs just west of Choteau, Montana (Appendix B), then the LPs of that community's zip code are included in the target population. However, Choteau is situated right on the eastern-most boundary of the NCDE. The question then arises: Do all the LPs in all directions of the community fairly represent the target population when considering those living further to the east (Great Plains area) may be less likely to experience grizzly depredations? Can data collected from the sample be fairly generalized to the population?

Intervening Conditions

Another limiting factor to the effectiveness of the study would be intervening conditions: those outside factors that can sabotage the best of designs. An example would be an event of notoriety that could potentially sway the attitudes of respondents. If

LPs received the questionnaire about the same time a person is reported as mauled or killed by a grizzly bear, respondents may report differently, thereby skewing the data. If such an occurrence actually takes place and it appears to have resulted in a very low return of questionnaires, then additional measures should be taken to determine if outside factors actually affected the response level. One way to interpret the low response would be to interview livestock producers in the community. Interviews would help determine if an outside factor had a bearing on the responses.

Definition of Terms

Association or Associational Inferential Statistic
: The statistic that tests for associations or relationships between variables and uses a type of correlation or multiple regression analysis.

Compensation
: Financial indemnity for direct and indirect livestock losses.

Depredate
: To engage in plundering or ravaging prey specie. Prey, including livestock, can die or become seriously maimed from such action by a predator.

Depredation
: The act of a predator to despoil or devour prey specie.

Depredator
: An animal that engages in depredation or the plundering of prey.

Financial Compensation
: Cash payment for livestock losses, or the provision of materials, personnel, or equipment for the purpose of pro-active measures to abate the potential loss of livestock.

Livestock
: Cattle, sheep, bees (apiaries).

Livestock Losses

Losses of livestock (death or injury) attributable to grizzly bear predation.

Livestock producer

A person (individual, partnership, corporation) that has sales—or expects this year to have sales—of livestock (cattle, sheep) and/or honey in the amount of $1000 or more per year.

Northern Continental Divide Ecosystem (NCDE)

The NCDE is predominated by Glacier National Park; parts of the Flathead and Blackfeet Indian reservations; parts of five national forests (Flathead, Helena, Kootenai, Lewis and Clark, and Lolo); Bureau of Land Management lands; and significant amounts of state and private lands (Appendices B and C). Within the above land ownerships there is a grizzly bear recovery zone specifically defined by the U.S. Fish and Wildlife Service in their recovery plan (USFWS, 1993, p. 11-12) which contains 24,800 square kilometers (9,600 square miles) of occupied grizzly bear habitat. Additionally, and within the above land ownerships, there are four wilderness areas (Bob Marshall Wilderness, Mission Mountains Tribal Wilderness, Great Bear Wilderness, and the Scapegoat Wilderness) and one wilderness study area (Deep Creek North in the Lewis and Clark National Forest). The ecosystem also embraces a narrow strip of the Great Plains along the eastern slopes of the Rocky Mountain Front. An ecosystem is intrinsically obscure by definition and has no specific geographic boundary. For the purposes of this study, the NCDE is a general description that is comprised of the above resource areas to delineate it from other major ecosystems. The NCDE is a term commonly used by land management entities.

Public Education

Education directed toward the general population who live, work, or recreate in grizzly bear habitat. The target group, livestock producers, would be the recipients of public education for this study because they are the most involved human occupants in grizzly bear habitat that could result in conflicts with grizzly bears.

Recovery Zone

Those areas within which grizzly bears and grizzly bear habitat will be managed for recovery and within which population parameters will be monitored (U.S. Fish and Wildlife Service, 1993, p. 167).

Region One

Counties in the south and eastern parts of the NCDE characteristic of ranches with large acreages. Those counties include: Glacier, Lewis and Clark, Missoula, Pondera, Powell, and Teton (Appendix D).

Region Zero

Counties in the western part of the NCDE characteristic of ranches with small acreages. Those counties include: Flathead, Lake, and Lincoln (Appendix D).

Self-initiated education

Self-initiated learning in a generally non-formal educational setting, using resources to expand ones depth in knowledge, skills, and abilities in the pursuit of a point of interest that contributes to personal, social, or economic survivability.

Threatened Species

Species that are likely to become an endangered species within the foreseeable future throughout all or significant portion of its range (U.S. Fish and Wildlife Service, 1993, p. 15).

Tolerance

Tolerance is intentional self-restraint demonstrated by livestock producers' attitudes or behavior toward grizzly bears when considering perceived threats to their material, emotional, or spiritual well-being.

Wildlife Managers

Those government (federal, state, tribal, county, city) officials involved in formulating or implementing policy oriented to educating and/or compensating livestock producers for losses of livestock as a result of grizzly bear predation.

Abbreviations

BLM	Bureau of Land Management
FOIA	Freedom of Information Act
IGBC	Interagency Grizzly Bear Committee
IRT	Item Response Theory
LP	Livestock Producer
MDFWP	Montana Department of Fish, Wildlife, and Parks
NCDE	Northern Continental Divide Ecosystem
NGO	Non-governmental Organization

RMF	Rocky Mountain Front
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WGFG	Wyoming Game and Fish Department
YES	Yellowstone Ecosystem

Chapter Summary

In chapter one, I delineate the research area as being restricted to the NCDE. I target the population as being specific LPs that that are producers of cattle, sheep, and/or honey. Further, the focus of research is directed at conflicts that develop between LPs and a single species, grizzly bears, as opposed to conflicts that historically are of nearly equal importance and occur between LPs and, for instance, wolves, mountain lions, black bears, and coyotes.

The chapter points to education and financial compensation as predominant mitigative strategies to reduce conflict and increase tolerance for grizzly bears. Since the concept of tolerance could contain tenuous meaning for diverse individuals, a specific definition has been developed to help direct the consumer of the research to a well-directed concept of the term.

A conceptual model was developed to provide a visual representation of how education and financial compensation can lead to tolerance and to a corresponding reduction in discrimination toward grizzly bears. Discrimination is the term used by one author that defines overt acts of intolerance.

The chapter concludes with an articulation of limitations and delimitations inherent to the study, as well as a list of terms and acronyms used throughout the study.

REVIEW OF RELATED LITERATURE

Introduction

This chapter is organized under six major themes: (a) formal education; (b) self-initiated education; (c) financial compensation; (d) bear biology, landscapes, and conflict; (e) tolerance, behavior, and attitudes; and (f) control variables. It should be noted that "education," referred to in chapter one has two parts as far as this study is concerned: formal education and self-initiated education. Chapter three will explain the themes in terms of variables; meaning that formal education, self-initiated education, and financial compensation are independent variables. Tolerance (composed of attitudes and behavior) is the dependent variable. The organization of the literature review will consistently refer to the above four themes (three independent variables and one dependent variable).

A discussion of the themes provides the consumer of the study with a comprehensive understanding of the major research conducted in each theme; and the interrelationship of variables relating to the prediction of whether education (both formal and self-initiated) and financial compensation make a difference in livestock producers' tolerance for grizzly bears.

Before investigating each theme, it is important to objectively examine how the literature portrays a current understanding of the problem. A clearer understanding of the variables should emerge from a comprehensive discussion of the literature, based on how professionals and academicians articulate the depth and breadth of the problem.

Current Understanding of the Problem

Livestock producers can be directly affected by the presence of grizzlies, which can impose economic risks (Brown, 1993). Educational awareness that involves resident landholders is a necessity to obtain holistic protection of grizzly habitat on private, as well as federal lands (Frost, 1985).

Kellert (1996) asserts that a tolerance-based assessment of peoples' values may equate to successful coexistence with wildlife. In a more specific sense, a study such as the one proposed in the current research design is needed to help quantify the association between education, economic risk (mitigated through financial compensation) and tolerance.

Formal Education

Vogt (1997) presents a framework appropriate for in-depth examination of how formal education correlates with tolerance. His book will serve as a guidepost for this section of the literature review. Vogt's examination of the pros and cons of the criticisms leveled against education's role with tolerance leaves him to contend that, ". . . no one has ever persuasively argued that education in general systematically decreases tolerance as a whole; nor has anyone ever demonstrated that education in the United States usually has no effect on tolerance" (Vogt, 1997, p. 60). Vogt's confidence and excitement about education's influence on tolerance is profusely supplemented with references to research primarily in the area of political rights which ". . . tend to cut across other sorts of group boundaries (ethnic, racial, religious, or moral) . . ." (Vogt, 1997, p. 92).

An appropriate starting point in the Vogt framework would be to connect the current research to some of the more mechanical components of basic survey research. Vogt describes several basics of survey research: social desirability hypothesis, nonattitude theory, and acquiescence bias. I will discuss each of the three areas because the context of each is critical to understanding possible outcomes of the questionnaire. Vogt's framework handily provides a self-critiquing analysis of current research results which will better inform the reader of the current research and why outcomes may or may not be a basis for accomplishing true results when rejection or non-rejection of the null hypotheses occurs.

After connecting some of the mechanical nuances of Vogt's framework to the current research, I will conclude this section by comparing the research of a variety of authors in the literature. Their research compliments Vogt's framework.

Mechanical Components of the Research

As mentioned in the above introduction, the three areas to be examined are: social desirability hypothesis, nonattitude theory, and acquiescence bias. Following is a brief discussion of each.

Social Desirability Hypothesis. Vogt points out, "There are many reasons for assuming that people do not tell researchers what they really think or feel or believe, or what they would do or have done. The particular kind of skepticism about survey research most important for those who claim that highly educated people do not really tend to be more tolerant is one version or another of the social desirability hypothesis" (Vogt, 1997, p. 47). In the current study, a criticism could be what Vogt describes as:

"Well educated people are good at taking tests, at giving the 'right,' or socially desirable (in this case, tolerant), answers; but this does not mean that educated individuals are in fact more genuinely committed to tolerant norms" (Vogt, 1997, p. 47-48). Although Vogt subsequently discounts this possibility, it makes the structure of the research design and the sampling procedure even more important.

Nonattitude Theory. A secondary consideration, nonattitude theory, is described by Vogt as, ". . . they [survey respondents] may not know how they feel or what they believe about particular issues, but they will answer questions about them anyway" (Vogt, 1997, p. 51). Again, survey results could be skewed. But, again, the sampling procedure (truly random) and the size of the sample should hedge against skewed results.

Acquiescence Bias. Vogt describes this as, ". . . the inclination of some respondents to say yes to all questions so as to appear agreeable" (Vogt, 1997, p. 53). The questionnaire in the current survey will use questions that can be answered positively and, when re-worded, would be worded negatively (Suskie, 1996). When calculating the reliability coefficient (Gay & Airasian, 2000), I should be able to detect whether acquiescence bias has occurred.

At this point, an obvious question would be: if social desirability hypothesis, nonattitude theory, and acquiescence bias are accounted for, does education become a predictor of tolerance? When reflecting on the purpose of the current study, it is important to again reflect on the definition of tolerance as defined in chapter one: tolerance is intentional self-restraint demonstrated by livestock producers' attitudes or

behavior toward grizzly bears when considering perceived threats to their material, emotional, or spiritual well-being.

Here again, Vogt is helpful in focusing the discussion point. Since the research is based upon the results of data collected from a questionnaire, Vogt's perspective is important in the three following areas.

Attitudes, Beliefs, Behaviors

Vogt presents the question: do attitudes and beliefs influence behaviors? In response to his own question, he states, "Most researchers are agreed that the more specific the attitude, the more likely it is to influence an action" (Vogt, 1997, p. 54). The quantitative study by Ajzen and Fishbein (1977) provides similar concurrence. Although they do admit that there are studies that provide disappointing research results when attempting to use attitudes to predict behavior, they assert that, "A person's attitude has a consistently strong relation with his or her behavior when it is directed at the same target and when it involves the same action" (Ajzen & Fishbein, 1977, p. 912). The current study questionnaire is designed to collect data to determine attitudes toward grizzly bears and behavior toward grizzly bears. It is difficult from the literature survey—in lieu of actual research results—to intimate whether the strength of the relationship is positively or negatively measurable.

The responses by Vogt and Ajzen and Fishbein are not all that distant from the reality of the current study. The committee on predators and compensation—described in Miller & Bury (2003)—has the same concern. The committee, composed of wildlife managers and decision makers, is dealing with the issue of compensation for losses due

to predators (mountain lions, wolves, black bears, and grizzly bears). Ed Bangs, FWS official in charge of wolf reintroduction, questioned research provided to the committee when he stated, “Carnivore conservation is: what will rancher[s] tolerate. Where is the crossover—the line from not liking carnivores, but tolerating them—as opposed to not liking carnivores and not tolerating and killing them?” (Bangs, 2002).

On page 68, Vogt (1997) presents a simple illustration that visually describes a process that he sees developing when discussing the conversion from tolerance to actions.

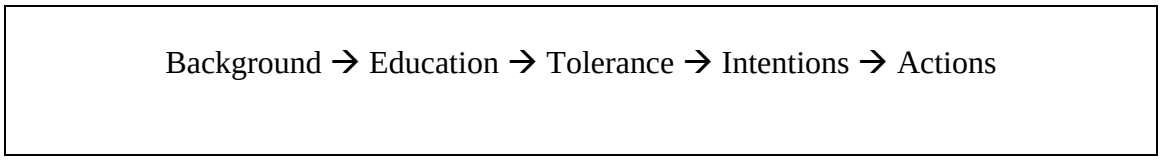


Figure 2. Background, Education, Tolerance, Intentions, Actions

Vogt (1997, p. 68) explains the relationship from background to actions thusly:

> A large range of background variables—such as gender, religion, ethnicity, personality type, intelligence, and parents' income—surely influence the amounts and kinds of education people receive and thus indirectly influence tolerance through education. Such background characteristics sometimes also influence tolerance directly, a claim most frequently made about personality types (Adorno, Frenkel Brunswick, Levinson, & Sanford, 1950; Young Bruehl, 1996). But in most studies, the indirect effects of background, through education, are much stronger than the direct effects of background.
> At the other end of the causal chain, there is the question of whether tolerant attitudes and beliefs influence intentions and actions or behaviors. Intentions are inserted here because they are often seen as a crucial link between attitudes and behaviors, and because they have frequently been used as a proxy measure for actions, because actions are notoriously difficult to study directly. Although there is strong evidence that tolerant attitudes and beliefs influence "behavioral intentions" and individuals' responses to questions about how they would act in hypothetical situations (Marcus et al., 1995), intentions are not our focus. Nonetheless, it is important to note that tolerant attitudes and beliefs are not without influence on intentions. We also need to remember that tolerance most often means inaction or behavioral self restraint, which is another reason the link with actions is problematic for the particular attitudes we are studying.

It is important to note that in the above last sentence, Vogt states that, ". . . tolerance most often means inaction or behavioral self-restraint . . ." Therein lies the link to education, the strength of which is subject to the current research results. As difficult as it may be to uncover literature that will link education and tolerance between species (carnivores/grizzly bears and humans), Vogt appears confident that there is abundant research that links education with tolerance among a single species (humans) when he states, ". . . it is clear that the effects of education can vary: all levels of education are not always related to all kinds of tolerance to exactly the same degree. But there are no studies whatsoever that show on balance a negative association between education level and tolerance level. It is not even easy to find studies that show no relationship one way or the other" (Vogt, 1997, p. 99).

Education/Tolerance in Human Research

It is a simpler task to locate research that links education to tolerance in the realm of political, social or moral tolerance (Vogt, 1997); however, one researcher, Chong (1993), focused his research on determining how citizens think and reason about controversial political issues involving rights and liberties. Chong interviewed 30 persons in the San Francisco Bay Area with a broad cross section of respondents. He selected persons from a telephone directory. His findings on page 891 stated that,

> . . . the responses to this series of questions suggest strong differences by educational level in the way that considerations are balanced and weighed. First, the primary or lead response to nine of the 15 noncollege graduates to the initial question about the right of Nazis to demonstrate related the issue of their feelings about Nazis, whereas 11 of the 15 college graduates were immediately disposed to framing the issue in terms of broader values and democratic rights.

Chong's research is consistent with Vogt (1997) and Ajzen and Fishbein (1977) in that there seems to be a correlation between education and tolerance. The downside of Chong's research is that he does not delineate years of education. He only refers to those that are college graduates and those that are not college graduates.

Section Summary—Formal Education

The above section regarding formal education has provided a framework that renders certain theories and evidences by Vogt and others that support the direction of the current study. One author (Vogt, 1997) argues the connectedness between education, tolerance, and action. He seems convinced that the research overwhelmingly points to education as the strongest and most positive influence on tolerance. His evidence is hardly causal since the research methodologies he has examined cannot provide such evidence. However, he remains convinced that education is a strong indicator of tolerance.

Resultant actions or reactions from a tolerant person are not easily predicted. Even in a focused study, such as this one, tolerant attitudes and beliefs are not without influence on intentions. A review of the conceptual model in chapter one (Figure 1) reinforces the notion that positive influences on tolerance may not be strong enough to rebuke a reversal in tolerance under some circumstances. This is appropriately termed as discrimination. The literature review brings this caution to the forefront.

As one author asserted, we also need to remember that tolerance most often means inaction or behavioral self-restraint. This is one basis on which this study will find

some detectable level of tolerance for grizzly bears under the circumstances framed by the three independent variables.

Self-Initiated Education

Defining self-initiated education carries its own challenge when examining the literature and the various descriptions authors attach to numerous and obscure processes that seem to fall under a notion, or category, called self-education. It is the desire of the researcher to discern—as well as blend—the concepts of self-education (as it is colloquially regarded in the literature) with a specific definition of self-initiated education as it applies to the research design.

Self-Initiated Education as Defined for the Study

Self-education is not a universal term used by the referenced authors as they describe their concepts or semblance of self-education. Rather, many of them use hazy or loosely self-formulated phraseology to describe a self-educating or self-learning process. The literature reveals numerous relevancies to self-education. Often the term is used without any kind of definition. The table below illustrates a multitude of references to some concept of self-education.

Table 1. Terminology That Refers To Some Concept of Self-education.

Terminology	**Reference(s)**
Informal learning	(Anderson, Lucas & Ginns, 2003; Brody et al., 2002)
Informal education	(Brody et al., 2002)
Informal science learning	(Crane, Nicholson, Chen & Bitgood, 1994; Dierking et al., 2003)
Informal science education Learning in freechoice situations	(Dierking et al., 2003)
Free-choice science learning Free-choice learning settings Free-choice learning field	(Falk & Adelman, 2003)
Student-directed	(Gibbons & Phillips, 1978)
Self-directed	(Gibbons & Phillips, 1978; Gibbons & Phillips, 1979; Gibbons & Phillips, 1982; Hamm, 1982; Knowles, 1975)
Self-initiated Self-directing learners	(Gibbons & Phillips, 1982)
Self-education	(Gibbons & Phillips, 1982; Pautler, Tan, Dugas, Pus, Ferri, Hardie, & Chin, 2001)
Self-made man Self-taught man Self-teaching Self-learning	(Hamm, 1982)
Self-directedness Pro-active learning	(Knowles, 1975)
Free-choice environments	(Rennie, Feher, Dierking, & Falk, 2003)
Intuitive dnowledge “Gut” knowledge Naive knowledge	(West & Pines, 1985)

Within his text, Knowles (1975) refers to other labels found in the literature to describe the self-directed learning process. He listed them (without accompanying

citations) as “self-planned learning,” “inquiry method,” “independent learning,” “self-education,” “self-instruction,” “self-teaching,” “self-study,” and “autonomous learning” (Knowles, 1975, p. 18).

It can be noted that some authors have used a variety of terms to refer to self-education, even within the same writings—illustrating a lack of consistency. Hamm (1982) is one of those. Because of his lack of consistency, the consumer of his research may question the credibility of his research. Hamm (1982) states that the suggestion of three of these (self-teaching, self-learning, and self-direction) are activities under the “rubric of ‘self-education’” (Hamm, 1982, p. 88). He conveniently lumps some of these together and expresses apparent confidence in calling them self-education.

The literature review revealed only one author (Table 1) that made a specific effort at defining some useful concept of informal education. Valerie Crane (1994) guides the reader to a specific—and much appreciated—definition to better understand what informal education means in the context of her research, which is informal science learning. She states, “For the purposes of this book, informal science learning refers to activities that occur outside the school setting, are not developed primarily for school use, are not developed to be part of an ongoing school curriculum, and are characterized by voluntary as opposed to mandatory participation as part of a credited school experience” (Crane, 1994, p. 3). Borrowing from Crane an appreciation for defining and clarifying terminology, the current research contains enhanced clarity when discussing the problem, purpose, and research question.

In arriving at a term—and an appropriate definition for some workable concept of self-initiated education for this study—the researcher has analyzed the works of several authors. Two perspectives emerge as having the most rational approach to creating a term and definition for the study. These two perspectives are authored by M.S. Knowles (1975) and Dierking, L.D., Falk, J.H., Rennie, L., Anderson, D. & Ellenbogen, K. (2003).

First Perspective. The first perspective is advanced by Knowles (1975), an author recognized as having popularized the concept of andragogy, the practice of helping adults learn (Merriam & Cunningham, 1989, p. 155). Knowles's andragogical model of instruction "is the best-known learner-centered or learner-directed model of instruction" (Merriam & Caffarella, 1999, p. 37). With this level of recognition, it seems appropriate to recognize the works of Knowles and to understand his meaning of self-directed learning. In his book, *Self-Directed Learning,* Knowles (1975) discusses his concepts of the andragogical model (although Knowles does not use the term "model" as suggested by Merriam & Caffarella, 1999) as it connects to self-directed learning.

Knowles (1975) defines learners as being proactive or reactive. Proactive learners "take the initiative in making use of resources, rather than simply react to transmissions from the resources" (Knowles, 1975, p. 105), whereas reactive learners are "people who sit at the feet of teachers passively waiting to be taught" (Knowles, 1975, p. 14). Knowles further asserts that "what adults learn on their own initiative they learn more deeply and permanently than what they learn by being taught" (Knowles, 1975, p. 129).

The Knowles androgogical model, as mentioned above, emphasizes the use of resources. He further defines resources as books (primarily textbooks, reference books,

manuals, and anthologies), institutions, government agencies, as well people in many walks of life (Knowles, 1975, p. 16). The essence of Knowles's recognition of resources is to not overlook any resource that may take the self-directed learner closer to finding an answer to a problem.

Perhaps one of Knowles's strongest conclusions is his statement, "To sum up: the 'why' of self-directed learning is survival—your own survival as an individual, and also the survival of the human race" (Knowles, 1975, p. 16). Knowles's statement is strong, and appears to extend to a component (human race) that is beyond the realm of his research. However, the reader should be impressed at the importance Knowles puts on self-directed learning.

What the reader can appreciate about Knowles is his emphasis on self-initiated learning, the use of appropriate resources, and that the impetus and outcome of self-directed learning is pure survival. These are important factors in the formulation of an appropriate definition for self-initiated education, the term predominantly used throughout the current study.

Second Perspective. This important perspective is advanced by Dierking, Falk, Rennie, Anderson, & Ellenbogen, (2003). Dierking and Falk are prominent authors in science education literature (Anderson, Lucas, & Ginns, 2003; Brody, Tomkiewicz, & Graves, 2002; Rennie, Feher, Dierking, Falk, 2003). Dierking and Falk are in agreement with Knowles (1975) in that they both sanctify informal learning as occurring primarily outside formal learning institutions, but the effort is not entirely devoid of institutional influence. This concept is best exemplified in the following argument: "Informal science

learning is the most commonly applied term for the science learning that occurs outside the traditional, formal schooling realm (precollege, university, and advanced degrees). Although widely used, the term has significant limitations because it artificially delimits efforts to describe the type of real-world learning that humans engage in daily: learning what occurs across a broad spatial and temporal context, both inside and outside of schooling" (Dierking et al., 2003, p. 108).

On a second point, Dierking and Falk further define contemporary resources; again, a major component that is quite harmonious with Knowles (1975). The authors assert:

> . . . learning in general, and science learning in particular, is cumulative, emerging over time through myriad human experiences, including but not limited to experiences in museums and schools; while watching television, reading newspapers and books, conversing with friends and family; and increasingly frequently, through interactions with the Internet. The experiences children and adults have in these various situations dynamically interact to influence the ways individuals construct scientific knowledge, attitudes, behaviors, and understanding (Dierking et al., 2003, p. 109).

A third defining point that Dierking and Falk make is their statement that relates to Gibbons & Phillips (1982) and their assertion of self-initiated learning. The relationship can be seen when they state: "Informal science education [is] . . . learning that is self-motivated, voluntary, and guided by the learner's needs and interests, learning that is engaged in throughout his or her life" (Dierking et al., 2003, p. 109).

Working Definition of Self-Initiated Education.

It appears logical that self-initiated education is a term that can suffice as reflecting both perspectives of two well-recognized authorships in adult education and

science education. The term is graced with four components that logically fit the study design. The first component is the self-initiating action that starts with the learner and occurs generally outside formal institutions of learning. Second, are the resources the learner uses to describe and solve a problem. Third, is that self-initiated learning is believed to motivate the learner in his or her subject to learn in depth and in permanence. The fourth component is survival, the catalyst that motivates learning.

With an analysis of the above, it seems appropriate that a well-crafted definition for self-initiated education would apply to the current study as follows: self-initiated education is self-initiated learning in a generally non-formal educational setting, using resources to expand one's depth in knowledge, skills, and abilities in the pursuit of a point of interest that contributes to personal, social, or economic survivability.

Self-Initiated Education as Described in the Literature

As defined above, and for the purpose of this study, the term "self-initiated education" is the best descriptor for the study. However, a review of the literature necessarily requires the reader to understand that—as explained above—related terminology (Table 1) is encountered in the literature that entertains a variety of expressions and phrases that relate to some variation of self-initiated education. As the reader proceeds through the literature review, many of the relationships of self-education will closely resemble the researcher's definition of self-initiated education.

Several major themes emerge in the realm of self-initiated education when examining historic and contemporary perspectives of various authors over the last twenty-five years. These themes are discussed in the following sub-paragraphs.

Formal Education versus Self-Initiated Education. Most authors attempt to discern differences between formal education and self-initiated education (Anderson, Lucas, & Ginns, 2003; Brody, Tomkiewicz, & Graves, 2002; Dhingra, 2003; Dierking, Falk, Rennie, Anderson, & Ellenbogen, 2003; Gibbons, Bailey, Comeau, Schmuck, Seymour, & Wallace, 1980; Vogt, 1997). They generally state that self-initiated education is more experience-based and occurs outside of what is commonly referred to as the traditional, formal schooling realm (Dierking et al., 2003).

Commonly, authors will argue that one source of learning (self-initiated education) is complimented by another source of learning (formal education). Rarely do the authors argue that one form of learning is better than the other. One noted exception in the literature emanates from West & Pines (1985). Although not contrasting in their comparison of formal and self-initiated education, their unceremonious treatment of self-initiated education carries a condescending tone, as noted in the following quote (West & Pines, 1985, p. 2-3).

> There is the knowledge that a child acquires from interaction with the environment. We might call this intuitive knowledge, 'gut' knowledge, naive knowledge. It is influenced by language, by culture, by other individuals, and so on. Such knowledge is a person's own sense making of the environment she observes, tempered and manipulated by her interaction with parents, peers, television, and other influences. It[s] primary characteristic is that it constitutes the person's reality. It is something she believes. Another characteristic is that this type of knowledge is acquired in a rather haphazard fashion, over considerable time, and without any particular direction.

If the literature reveals the position of West and Pines (1985) to be an anomaly, then there should be sufficient literature to give self-initiated education a more transcendent appeal. Such literature does exist; and is rather profuse.

Self-Initiated Education Approaches Expertise. Contemporaries of West and Pines have given considerable historic perspective to the importance of self-initiated education (Gibbons et al., 1980; Gibbons, Norman, Phillips, 1980; Gibbons, & Phillips, 1978; Gibbons & Phillips, 1979). One author (Gibbons et al., 1980) specifically encourages the self learning adult professional to become an expert.

More importantly, at least one author, more recent than West and Pines, has placed greater dignity on the role of self-initiated education as a learning source that can advance a person toward some level of proficiency in a chosen field or subject (Falk & Adelman, 2003). However, the authors caution that, "Rarely do people enter free-choice learning situations with a desire to become an expert in the subject or with an explicit agenda to affect more active behavior" (Falk & Adelman, 2003, p. 165). Arriving at some level of expertise may not be the eventual goal of every adult learner, it is important to note from the literature that self-initiated learning is a frequent quest of adult learners, whether they identify it in that manner or not.

Self-Initiated Education as a Frequent Activity. According to Gibbons, Bailey, Comeau, Schmuck, Seymour, & Wallace (1980), ". . . nearly all adults conduct ambitious self-directed learning projects every year, analyzing their duration, nature, and purpose." From the author's statement, one could conclude that for many individuals, self-initiated education doesn't necessarily have to be the result of a specific decision to become more educated about a certain subject. It may be as casual as wanting to learn more about something that is convenient or interesting, and could occur sporadically and frequently (Ballantyne & Packer, 1996). Or, self-initiated education may be the natural follow-

through with decision making processes that occur when an individual needs to solve a specific once-in-a-lifetime problem requiring, for instance, a greater need for health information (Pautler, Tan, Dugas, Pus, Ferri, Hardie, & Chin, 2001).

Depth of Self-Initiated Education. A review of the literature attracts the researcher to certain fields of learning. It is evident that in-depth concepts of self-initiated education are well developed and appreciated in science education (Anderson et al., 2003; Brody et al., 2002; Crane, Nicholson, Chen, & Bitgood, 1994; Dhingra, 2003; Dierking et al., 2003; Durant, Evans, & Thomas, 1989; Falk & Adelman, 2003; Miller, J.D., 2001; Rennie et al., 2003), environmental education (Ballantyne & Packer, 1996), and health information (Pautler et al., 2001).

Writers in the science education field state that people commonly learn from observing the outdoors and connecting various sensations through sight, sound, smell, and touch. Researchers in Yellowstone National Park noted higher order thinking (Bloom, 1956) when noting how park visitors were capable of ". . . complex, integrated and multidisciplinary understanding of natural phenomena . . ." (Brody et al., 2002, p. 1124). Recent publications such as Brody (2002) credit informal learning in outdoor and museum settings with higher regard than do authors of many years ago. It is this elevation of importance attributed to self-initiated education that encourages this researcher to examine research that is founded more on quantitative paradigms than the more common constructivist paradigms that dominate the literature.

Connecting Formal Education and Self-Initiated Education. Miller (2001) addresses the issue of society keeping abreast of technological change. He posits,

> There is broad agreement that the pace of scientific and technological change will continue to increase in the decades ahead and that a higher level of scientific understanding—or literacy—will be required for effective participation in the economy and in our democratic political system. The issue is to identify the approach or approaches that will produce this result (Miller, 2001, p. 94).

Miller continues to articulate his response to the issues by stating, ". . . the growing array of free-choice science resources and programs in the United States can provide a short-term bridge to compensate for inadequate formal schooling and perhaps a longer-term source of scientific and technical understanding for citizens and consumers" (Miller, 2001, p. 94). Miller defines free-choice science resources as: newspapers, magazines, television, museums, technology centers, radio, and the World Wide Web. Miller develops an analysis of the various free-choice resources by asking 2,000 respondents to quantify their use of the resources. He asked respondents to quantify numbers of visits (to libraries and museums), the number of television shows watched, and the number of newspaper and magazine articles that were read, all on subjects related to science. It appears that Miller was so focused on the quantitative use of his research that he quantified the results, which forms the basis for his comment, "Factor scores were converted to a zero-to-100 index, with zero reflecting no use of any free-choice learning resource and 100 indicting high-level use of virtually every kind of free-choice learning resource" (Miller, 2001, p. 101).

Miller determined that ". . . education is strongly and positively associated with the use of free-choice science-education resources, and better educated Americans with some college-level science courses are significantly more likely than other Americans to use these resources. This strong positive relationship between education and free-choice

science-education resource use suggests that free-choice experiences are being used to update and enrich an individual's understanding of science" (Miller, 2001, p. 105).

In the research, Miller makes the point that he used the Item Response Theory (IRT) test construction technique in a National Science Board (1998) study—a study to which he was a contributor. The study measured peoples' understanding of biomedical constructs and space science constructs. The IRT was used by Miller to scale responses to selected questions pertaining to peoples' knowledge of biomedicine and space science. In a general sense, the IRT statistical technique is used to express the association between an individual's response to an item and the underlying latent variable (often referred to as "traits" or "abilities") being measured by the instrument (Hambleton & Swaminathan, 1985, p. 9). It is apparent from Rennie et al. (2003) that research in social sciences has expanded its appeal and application through the use of non-parametric (nominal and ordinal) data (Glass & Hopkins, 1996).

IRT enhances the comparative values obtained from non-parametric data analysis. The IRT procedure in the Miller research could be considered an example of a break from traditional methods of research. This is affirmed by Rennie, Feher, Dierking & Falk (2003) when the authors state, ". . . early quantitative research was often limited by the statistical methods in common use, such as analysis of variance and multiple linear regression" (Rennie et al., 2003, p. 117). Results from analysis of variance and multiple linear regression are best accomplished through the use of parametric (interval and ratio) data (Gliner & Morgan, 2000; Schroeder, Sjoquist & Stephan, 1986), as will be the

situation in the current study using three independent variables and one dependent variable.

The results from Millers' research positively associate the connection between formal education, self-initiated education and the use of resources to acquire knowledge. This is significant not only in his approach, but in the outcome as well. Miller's approach exercised the use of non-parametric data to generate associations between variables. The current study will exercise the use of parametric data to generate associations between variables in and through the use of multiple regression analysis—a more traditional standard—and as some would agree, a more powerful statistic (Glass & Hopkins, 1996).

Additionally, it is hypothesized that the outcome of the current study will positively associate formal education and self-initiated education with the resources used for learning. Similarly, the study should gain from the results of Miller's research in that there is some association between formal education and self-initiated education.

Resources for Self-Initiated Education. Miller (2001) specifically articulates resources used in his research. The resources for self-initiated education—in the current study—are listed in Part II of the survey instrument (Appendix E). All resources in the Miller research are incorporated in the current study, except for technology centers. It is not clearly understood from the Miller research what a technology center is or how it would be accessed by the general public. Whereas Miller used the number of visits to museums or number of shows watched on television, the current study will use the number of hours devoted to each resource category. In only one instance of the Miller

research were respondents asked to respond by putting down the number of hours, which was for home computer use.

When authors refer to self-initiated educational resources (informal learning resources) they are generally specific about which resource they would see—or their research would reveal—as the most usable to qualify as bona-fide avenues for learning. It is from the resources identified in the literature that the current survey uses to determine all possible avenues where self-initiated education may occur. Appendix F presents a table of self-initiated education resources from the literature and how those resources are adapted to the survey questionnaire (Appendix E). The authors listed in Appendix F represent a sampling of the many authors that refer to the identified resources.

It should be noted from Appendix F that references to “School: K–12" and “School: College” are relational references. Authors of informal education frequently define informal education in relation to formal education. Authors also refer to informal education in a complimentary sense, which is to say, informal education is complimented by some level of formal education. In the current research questionnaire, I am providing another option for the respondent by including formal education in that section of the survey that deals with self-initiated educational resources in an effort to fine tune formal education attributes toward grizzly bears. The pilot questionnaire (Appendix G) indicated that there were very few hours attributed to college, and even less to K-12. One obvious answer to this response is that the questionnaire asks the respondent to indicate the number of hours spent educating him or herself about grizzly bears in the past five

years. Since livestock owners are generally an older population, it would be expected that their self-initiated education would less likely stem from their K-12 or college experience.

Section Summary—Self-Initiated Education

Crafting a specific definition for self-initiated education was necessary to the current study. In doing so, it helped focus direction for the literature survey. Informal education—a term frequently used in the literature—needed to be focused for the purposes of research. Informal education has a multitude of meanings and applications. I therefore developed a definition based on the concepts of prominent authors such as Knowles and Crane.

Additional emphasis was directed at the uses of self-initiated education. Certain authors liken self-initiated education to something that transcends classroom learning and takes on the role of a major contributor to one's expertise. This concept is valuable to the questions selected for the questionnaire because the recipients of the questionnaire are likely to be from an older age group; thus, a clientele that has been away from formal education for a significant length of time.

As the literature in self-initiated education unfolds, it becomes a much better understood contributor to identifying specific resources that adults use to learn. This factor alone contributes immeasurably to the identification of resources used by livestock producers to learn about grizzly bears.

Financial Compensation

Background and History

A pioneering effort by University of Montana researchers recently culminated a two-year study in an attempt to provide qualitative and quantitative data for decision-makers contemplating compensation programs for livestock owners that suffer losses to predators (Montag, Patterson, & Sutton, 2003). Theirs' as well as other recent survey results indicate a strong desire by ranchers to receive compensation for livestock losses. For well over a century, ranchers in the American west have dealt with predator issues. In the case of the gray wolf (*Canis lupus*), government agencies, trappers, and early western settlers almost exterminated the entire population in the lower 48 states (Fischer, 1995). The only remaining population resided in northern Minnesota (Mech, 1970). In the case of grizzly bears, the effort was not as effective, but brought predation levels down to acceptable limits through extirpation efforts. The extirpation measures resulted in reducing populations and range of distribution to scattered areas of Idaho, Montana, Washington, and Wyoming (Mattson & Merrill, 2002).

Now that the American public wants predators returned to original habitats, there has been an upswing in federal government reintroduction and preservation efforts to bring endangered species back—particularly through standards established under the Endangered Species Act (ESA) (Hadlock & Beckwith, 2002b).

The transition to bringing predators back to historic habitats has not been widely accepted (Montag et al., 2003), especially by the livestock industry. Because full protection of the species almost always involves habitat that overlaps private property,

the ESA has been as much of a hindrance to private property owners (Hadlock & Beckwith, 2002a) as it has been championed by the general public for its restorative effects.

As Grumbine (1994) points out, there are complex issues that go beyond individual species management that incorporate appreciation of the larger context. The larger holistic approach is commonly referred to as ecosystem management (Grumbine, 1994). As the issues become increasingly complex so do involvements of several main actors: scientists, policymakers, managers, and citizens (Grumbine, 1994). There is no stronger evidence of this than the issue surrounding grizzly bear predation of livestock on private property. In some cases this also means property owned by government agencies that is leased to livestock operators (Montana Fish, Wildlife, & Parks [MDFWP], 2003).

The State of Montana is in the process of developing strategies to manage grizzly bears. One of the efforts is manifest in the Southwest Montana grizzly environmental impact statement (EIS) (MDFWP, 2002). An EIS is expected to be developed for the NCDE sometime in the near future. The southwest EIS–which covers the Montana portion of the greater Yellowstone ecosystem (Appendix A)–provides a glimpse into how the state will manage grizzly bears once the delisting process evolves and the MDFWP takes on the lead role for grizzly bear management.

A very important component of the management structure is determining if the State of Montana should be involved in compensating livestock producers for losses to predators, and, if so, to what extent. The MDFWP acknowledges the fact that compensation may be beneficial to livestock producers for losses to grizzly bears.

However, from the following statement one can sense unwillingness on the part of MDFWP to commit fully to the compensation effort: ". . . FWP encourages private groups (notably Defenders of Wildlife through the Bailey Grizzly Compensation Trust) to continue compensating operators . . ." (MDFWP, 2003, p. 42). Additionally, the MDFWP indicates skepticism that compensation will achieve desired results in the long term. The agency report states, "Fundamentally, however, it [compensation] deals with a problem after it has occurred. If Montana can implement a program that provides landowners flexibility within reason and with some constraints, MFWP believes it will build broader public support" (MDFWP, 2003, p. 42). Again, as Grumbine (1994) indicates, management decisions need to include a broader perspective of time and with multiple actors.

Compensation for What and for Whom

For the purposes of this study, livestock losses would include livestock such as cattle, sheep, and bees (apiaries). This determination is based on a compensation survey by Montag et al. (2003). The survey was directed at livestock producers in those parts of Montana, Wyoming, and Idaho that are subject to predation by predators such as grizzly bears, black bears, wolves, and mountain lions. Montag and others from the University of Montana designed a survey to examine land owners' attitudes, management recommendations, and compensation preferences for livestock losses caused by the above mentioned predators.

The compensation survey (Montag et al., 2003) holds that cattle and sheep are the main livestock losses sustained from predator attacks. The third livestock item (bees) is

akin to poultry in its level of importance for compensation, 71 % and 72% respectively (Montag et al., Appendix: Montana Livestock Owner Survey, 2003). However, when comparing amounts of compensation paid to livestock producers by the Defenders of Wildlife (Defenders of Wildlife, 2003b) and the pro-active amounts paid for deterrent measures (Defenders of Wildlife, 2001), it can be appreciated that damage and pro-active protections for bee yards far outdistance damage to poultry (by grizzly bears) by many thousands of dollars. Additionally, the Edwards (2003) NCDE attractant survey indicates low to high priority rankings for apiaries in terms of specific attractant issues, whereas poultry is not mentioned in the survey. Therefore it is appropriate that the focus of the current survey and questionnaire (Appendix E) be directed at livestock which include cattle, sheep, and bees (apiaries).

The recent compensation study (Montag et al., 2003) demonstrates a concern by livestock producers that compensation should be based on fall market prices and should include collateral damage (other associated costs) that extends beyond just the loss of livestock only. The compensation survey indicates that 89% of the Montana livestock owners agreed, “The program should pay fall market value for verified losses” (Montag et al., Appendix: Montana Livestock Owner Survey, 2003). Additionally, approximately 70% agreed there should be compensation for property losses and indirect costs.

Section Summary—Financial Compensation

The recent research by Montag, Patterson, and Sutton (2003) has contributed substantially to the literature and to the subject of livestock producer compensation. Their three-state quantitative and qualitative effort has contributed to the current study in

its treatment of financial compensation and its affect on tolerance. Additionally, there has been a remarkable track record for compensation to LPs over a number of years (Appendix C) by the Defenders of Wildlife. Yet critics maintain that compensation and tolerance are not necessarily related.

Recent literature such as the Southwestern Montana Grizzly Bear EIS suggests that agencies are taking a hard look at compensation programs. There appears to be enough pressure for them to do so, especially now that grizzly bears appear to be approaching recovery levels and states are gearing up to take over grizzly bear management from the federal government.

Whereas the Montag, et al. (2003) research takes in a very broad area, there appears to be room for a focused quantitative study on the NCDE. The design of the current study will bring new data into the equation for decision-makers to consider. When considering intervening factors from chapter one as well as the multitude of deeply ingrained attitudes about predators in general, the literature is still not strong enough to suggest that financial compensation significantly affects tolerance levels. It is expected that this study will contribute to that knowledge base.

Bear Biology, Landscapes, and Conflict

It may be an important contingency in the literature review to address the issues that create the need—or, at least, a consideration—for financial compensation. What contextual circumstances need to be in place to set the tone for grizzly bear/livestock conflict? What is it about grizzlies, landscapes, and livestock production that bring the conflict issue into play? Perhaps a cursory review of each component (bear biology,

landscapes, and livestock production) would help explain how these components result in negative interplay and sometimes devastating consequences to the bear, and, occasionally, near-devastating economic consequences to livestock producers.

Bear Biology

The general public is frequently targeted by sensationalized accounts of grizzly bears as being large dreadful animals that hunt, kill, and eat other animals. Regrettably, these accounts are sometimes overly dramatized and grizzly bears are depicted as killers that eat human beings (Jonkel, J.J., 1984). True, grizzly bears are known to attack humans, and—on rare occasions—even eat human beings (Herrero, 1985). As morbid as that may sound, it might be a relief to understand that grizzly bears are not big consumers of human flesh, nor are they of any kind of meat in general. What the general public may not realize is that the grizzly's dietary habits include more plant material than meat. The grizzly bear's diverse dietary adaptations establish vegetative material as the pinnacle of consumptive food sources throughout its expansive range from Wyoming to Alaska. As reported in *Beef in B.C.*, author and 34-year observer of bear behavior, Gary Shelton, spoke to a group of British Columbia ranchers saying, "They [grizzly bears] are vegetarian first, omnivore second and predator third . . . , for example, 65 percent of the grizzly bear's annual diet is plants, even though there is an abundance of readily available fish. Most of the year, bears eat plants, but they still have the digestive system of predators" (DeMarni, 2000, p. 6).

Landscapes.

Landscapes provide habitat for both grizzly bears and livestock, and frequently in the same locale. Wildlife managers are continually challenged to determine how to best mitigate competing uses of the land. How do they accomplish the best mix between competing uses, given the limitations of jurisdiction? How do state and federal officials do their jobs to manage grizzly bears while still maintaining acute sensitivity to the rights of property owners when grizzly bears occupy private property (Robbins, 1986)? This balancing act can create barriers as well as bridges. Land managers need to be skilled in rangeland knowledge and wildlife habitat knowledge. When range conditions are flexible, scheduling times for grassland to be grazed can abate potential conflicts. Often, improved protection for calving or lambing areas can be worked out with LPs to safeguard livestock. Communication between wildlife specialists and ranchers is an element in solving some of the conflict problems (Jonkel, 1980).

Conflict.

Basically, conflicts between grizzlies and livestock occur when both occupy the same habitat. Horejsi (2002) indicates how conflict can occur when, "Cattle and sheep compete with grizzly bears for forage, particularly in riparian areas. All select the most nutritious and digestible forage available . . ." (Horejsi, 2002, p. 224). Lee & Jonkel, 1981) reinforce the importance of forage in riparian and wetland areas to grizzly bears as they point to the two major wetland systems along the Rocky Mountain Front: Pine Butte Swamp and Antelope Butte Swamp. They stress that the two wetlands constitute "some of the most complex and diverse vegetation in the mountain west" (Lee & Jonkel, 1981,

p. 27). They establish that the same areas (containing over 4200 acres) are also valuable for livestock grazing except for dense shrub thickets and bog sites. To the livestock producer, the value of riparian areas for grazing purposes is somewhat obvious. But the value of these areas for grizzly bear use may require additional analysis.

A comprehensive study, conducted in 1980, focused on comparing the use of various foods in occupied grizzly habitats of the Northern Continental Divide Ecosystem (Jonkel, Lee, Zager, Schallenberger, Servheen, & Mace, 1980). The study described collecting and analyzing grizzly bear scat samples (N = 1156) from four areas in or near the NCDE: Mission Mountains, North Fork of Flathead River, South Fork of Flathead River, and the Rocky Mountain East Front.

The three- to four-year study (depending on the area) attempted to discern the composition of the scat samples, thereby determining how grizzlies utilized available food sources. The study determined that the greatest amount of bulk consumed was in the form of succulent vegetation—the leaves and stems of forbs, grasses, and sedges. Interestingly, insect consumption exceeded small mammal and large mammal consumption in all four areas in terms of frequency. Insects also exceeded mammal consumption in terms of importance value (IV) percent. Briefly, IV is computed as the sum of multiplying the frequency percent times the percent of diet volume, divided by the sum of all importance values times one hundred. The IV percent was a frequently-used comparative value in the study narrative. This is most likely because the IV illustrated the percent of every respective bear food item, with the sum of all food items equaling 100%.

Additionally, the study confirmed that riparian areas and wet sites were used by grizzlies as travel corridors and places yielding succulent bear foods. This latter observation was confirmed by Horejsi (2002). Such corridors and sites produced valuable food items as well as protection for both livestock and grizzly bears. The authors (Jonkel, et al., 1980) of the study state, "An obvious and direct conflict for space occurs when livestock bed in riparian areas used by grizzlies. Predation well may be enhanced or even encouraged under such circumstances . . ." (Jonkel, et al., 1980, p. 4).

The South Fork of the Flathead does not have cattle grazing in that particular study area and very few cattle graze the North Fork study area. But the areas were valuable for describing similarities in bear food use. However, there are considerable numbers of cattle grazing in the Mission Mountain and Rocky Mountain East Front study areas. The authors point out that along the Rocky Mountain East Front, lowland riparian areas are used by grizzlies and can extend 10 miles onto the prairie. The Rocky Mountain East Front is an area ripe for conflicts to occur on property owned by private landowners.

The Rocky Mountain Front is a remarkable study area for examining the history of grizzly/livestock conflicts. Appendix C illustrates the level of predation that occurs on the RMF. Where there are vast acreages of shared habitat (similar to the Mission Mountain area), varied land ownerships, and various jurisdictional components, mitigation measures become a challenge for wildlife managers. Financial compensation for livestock losses (Olsen, 1991) is not among the least effective of mitigative measures; and is a measure believed to contribute to livestock producer tolerance for grizzly bears.

One mitigative measure used by the Montana Department of Fish, Wildlife, and Parks (MDFWP) to reduce conflicts, is the livestock carcass redistribution program (Aune & Kasworm, 1989). The intent of the program is to redistribute livestock carcasses (from livestock that died during the winter and spring) into areas that are away from cattle and sheep herds and away from ranch buildings (Madel, 1996). The livestock carcasses provide a high protein food source for grizzly bears after they emerge from den sites in the spring. The program appears to be successful and was publicly reported as reducing grizzly bear conflicts with humans by 50 to 60 percent ("Montana Bears," 2002). However the program is not without criticism.

Sometimes when attempting to solve potential conflict problems, other collateral problems arise. Craighead, Sumner, and Mitchell (1995) state that the distribution of livestock carcasses on the RMF creates disbursed "ecocenters" much like those developed in Yellowstone National Park after the closing of garbage dumps in the 1970s. Craighead et al. do not provide specifics as to possible consequences of the redistribution program. However, Horejsi (2002) refers to Wyoming Game and Fish management guidelines and claims that ". . . the presence of domestic livestock carcasses creates an unnatural distribution and concentration of bears, leading to increased [grizzly bear] mortality rates and greater danger to long-term population viability. The unnatural presence of livestock and livestock carcasses beginning in spring and continuing though fall exposes young cubs to scavenging, and perhaps preying on, livestock" (Horejsi, 2002, p. 223). Horejsi also states that the concentration of livestock carcasses is one of several livestock-related impacts that push bears to a state he refers to as "ecological

overload" (Horejsi, 2002, p. 223). Horejsi's assertion does not specifically target the MDFWP livestock redistribution program, but the inference is clear that the mere presence of livestock carcasses could contribute to negative impacts to grizzly bears. The Madel (1996) report seems to counter the Horejsi assertion in that conflicts were reduced during the reporting period from 1991 to 1994. The report further indicates there is ". . . no correlation between grizzlies feeding on livestock carcasses and the same bears being prone to prey on livestock" (Madel, 1996, p. 12). The above quotation on page 12 of the report may be somewhat subjective since the term "correlation" does not refer to specific data correlated.

Since the current study regards bees as livestock, the study by Jonkel et al. (1980), emphasized that "Bee apiaries have caused conflicts with bears, and some [Rocky Mountain East] Front hives are located in riparian sites which are near optimum habitat for grizzly bears" (Jonkel et al., 1980, p. 20). One of the presumed reasons for placement of hives in riparian areas would be for protection from the winds that frequently occur at all seasons of the year along the East Front chinook zone (Cordell, 1982).

Another mitigative measure is to surround bee yards with electric fencing to keep the bears out. The Defenders of Wildlife (2001) has developed a funding source that defrays the cost of electric fences. Such pro-active measures—expensive as they are—may help to increase tolerance for grizzly bears by not having to displace the bee yards, and by not increasing economic impacts to the bee keepers (Defenders of Wildlife, 2001). Such pro-active measures probably reduce the need for compensation measures since compensation is designed for property destruction that has already occurred.

The above arguments illustrate that livestock/grizzly bear conflicts are complicated issues. Financial compensation for livestock losses may only be a superficial means of trying to abate a problem that has a much deeper connection to biological factors and/or management strategies.

Regardless of the mitigative measures or compensation programs in place, there is still an increasing need for information and education programs to be in place for the advancement of tolerance for grizzly bears. Current Montana grizzly recovery plans and strategies—as well as the Wyoming and Idaho plans—have strong components emphasizing information and education. In the development and implementation of such educational programs, the current study would provide wildlife managers with helpful quantitative data regarding a multitude of tested variables.

Tolerance, Behavior, and Attitudes

The term tolerance in the current study is regarded as the dependent variable to be tested. Three independent variables will be used to associate their effects on tolerance. As discussed in chapter one, the independent variables are formal education, self-initiated education, and financial compensation. This section of the literature survey will analyze research relevant to the variables. Then I will group related bodies of thought that associate the independent variables with the dependent variable.

At the outset, I would assert there is far more research that measures human beings' tolerance for other humans, but limited research that measures human tolerance for other species—especially those protected under the ESA. The appropriateness of the aforementioned statement hinges on a "measured" standard of tolerance. I would further

assert that one goal of the literature survey is to produce quantifiable results that enlighten communities of scientists, social scientists, and decision-makers of the association—or lack of association—between livestock producers and their tolerance for a certain species (grizzly bears) in a specific geographic area (NCDE). The presentation of a focused literature survey should establish a deeper understanding of the research results and how it applies to two competing species, humans and grizzly bears.

Financial Compensation and Tolerance

One non-governmental organization and one governmental agency currently have programs that compensate livestock producers for livestock losses attributed to grizzly bear depredation. The Defenders of Wildlife, a non-governmental organization that compensates livestock producers throughout occupied grizzly bear country in the lower 48 states, has paid for livestock losses since 1997 (Appendix C) through their Bailey Wildlife Foundation Grizzly Compensation Trust (Defenders of Wildlife, 2002). The state of Wyoming also compensates livestock producers for livestock losses (Wyoming Game and Fish Department, 2002).

The state of Montana currently does not provide compensation for livestock losses (MDFWP, 2002) due to grizzly bear depredation. However, with the possible delisting of wolves (MDFWP, 2003) and grizzly bears (MDFWP, 2002), considerable effort has been directed at the possibility of coming up with a suitable compensation plan as part of an overall management schematic (Miller & Bury, 2003). Such is the effort for anticipated delisting of the grizzly bear in the Yellowstone Ecosystem from federal management to state management (MDFWP, 2002). But then again, the Montana

Department of Fish, Wildlife, and Parks is encouraging the use of compensation such as that currently offered by the Bailey Wildlife Foundation Grizzly Compensation Trust. Montana state authorities have specifically declared in the Southwestern Montana Grizzly Plan (MDFWP, 2002) that the state of Montana is not to become involved in compensating for losses. However, state authorities—through their sustained participation in a long-term compensation study—are knowledgeable that some research has indicated financial compensation for livestock losses may increase tolerance for grizzly bears (Montag, Patterson, & Sutton, 2003). In their research, Montag et al. (2003) assert, "The survey results indicated that for a majority of the livestock owner sample, that tolerance for wolves and bears would decrease if compensation was not available" (Montag et al., 2003, p. 19). The researchers caution that compensation is not a "fix all" solution and point out, ". . . even though compensation helps increase tolerance, it isn't a problem solver and that compensation plays a role in that it can make trying nonlethal alternatives first more palatable" (Montag et al., 2003, p. 19).

The aforementioned study (Montag et al., 2003) is directed toward predators such as mountain lions, wolves, black bears, and grizzly bears. In the study, and related literature, it can be inferred that many of the same predominant emotional responses directed toward grizzly bears may be equally applicable to the four predators of the study; and visa-versa. However, one should be cautious about such inferences because it is apparent from the research (Montag et al., 2003) that tolerance levels may fluctuate between predators, depending on the predator being discussed. Research consultants illustrate this dilemma in their assertion that, "The report on rancher interviews indicates

they are more tolerant of grizzly bears and mountain lions than wolves, because wolves are seen as more ruthless killers, a different type of predator" (Miller & Bury, 2003, p. 3).

Critics of Compensation

Critics of compensation assert that payments to livestock producers may not increase tolerance. At least one critic has flaunted an opinion that fuels debate over a related endangered species, the gray wolf. A writer for the *Salt Lake Tribune* wrote, "Defenders of Wildlife currently pays for wolf killed livestock, and it is a major fund raising tool for them. The question is how long they will be able to sustain the program once people realize that the payments are buying dead cattle and sheep, not tolerance?" (Foster, 2001). Although not research-based, articles such as Foster's could influence public opinion about wolves. Montag and Patterson (2001) point out that tolerance for an endangered species is strongly influenced by public opinion and perceived perceptions of damage. It is these perceived influences that qualify newspapers as appropriate resources for self-initiated education. Newspapers are listed as a check-list item in the questionnaire (Part II, Appendix E).

Measuring Tolerance

Stephen Kellert is one of the foremost—and most frequently referenced—researchers in the area of public attitudes and cultural connections to wildlife (Kellert, 1979, 1981, 1982a, 1982b, 1982c, 1983, 1996, 1997; Kellert, Black, Rush, & Bath, 1996). Over the past two decades Kellert has published massive amounts of statistical data in his area of expertise. It is from one of this author's studies (Kellert, 1982c, p. 49-51) that many of the questions for the current study's questionnaire were devised to

measure tolerance levels (Part IV, Appendix E). The above list of publications indicates Kellert's expertise. From this list, several specific references indicate attitudes and education levels worthy of discussion.

For the purpose of a general overview of Kellert's research on endangered species, a glimpse at the following analogy indicates the positive values of education as related to tolerance. Kellert states, "Table 11 [to protect eastern indigo snake by selected education groups], for example, indicates a strong relationship to education, with a majority of those having a high school education or less opposed to protecting the eastern indigo snake, while, in contrast, nearly 70 percent of those with some graduate education were in favor of protecting this animal" (Kellert, 1979, p. 22). Continuing along the lines of education as related to animals, Kellert asserts, "Of all demographic variables, education was the most sensitive indicator of appreciation, concern, affection, knowledge and respect for animals. Indeed, the relationship of education to attitudes and knowledge of animals was strong, direct and linear" (Kellert, 1982c, p. 71). Kellert (1996) impresses the reader with the effectiveness of education when he states, "Education generally is far more strongly associated than income with emotional and intellectual perspectives of animals and the natural world. Education, in fact, emerges as the most powerful force shaping perspectives of nature and living diversity" (Kellert, 1996, p. 54). Furthermore, Kellert (1996) takes the impact of education a step further when he distinguishes different levels of education in his statement, "People with less than a high school education reveal significantly less understanding, more exploitive attitudes, and generally less sympathy toward nature and its conservation" (Kellert, 1996, p. 54).

In the context of Kellert's research it should be pointed out that even though there is an appearance of increased tolerance with education, his research does not specifically address livestock producers and their attitudes about grizzly bears, least of all in a specific region of the United States such as the NCDE.

Dierking et al. (2003) make an observation regarding the transition from motivation to action when they state, "Neuroscience research also demonstrates the importance of motivation, interest, and emotion in the learning process itself, suggesting that when people are interested and curious about something, there is a high possibility that they will follow up on that feeling with action, resulting in meaningful learning" (Dierking et al., 2003, p. 110). This bolsters the notion that at some point a rancher will use the opportunity to capitalize on an emotional issue, such as grizzly bears becoming bothersome to livestock, and put those emotions into play.

Control Variables

There are two categories of control variables that will be discussed in this section of chapter two. The principle control variables (see definition, chapter 1) in the research questionnaire (Part I, Appendix E) are: gender, ethnicity, and age. Secondary control variables are: whether livestock production is the primary source of income; years as a livestock producer in the county; if livestock producers received compensation for livestock losses due to grizzly bear predation; and if they have sustained livestock losses from grizzly bear predation in years past. Each of the three principle control variables is discussed below.

Principle Control Variables

Gender. Being a student of the teachings of Pascarella and Terenzini (1991), I can appreciate the effects of gender on research outcomes. According to Pascarella and Terenzini, research that focuses on educational attainment and gender indicate that attitudes about gender roles and educational attainment change over time. The authors were considering comparisons directed toward the durability of college on students of both sexes. However, when relating to tolerance, Pascarella and Terenzini (1991) state, ". . . the attitudes and values of women were consistently shown to be more liberal and less sexist than those of men" (Pascarella & Terenzini, 1991, p. 319).

Ethnicity. Ethnicity is specifically targeted because of potential cultural influences that some Native Americans may attribute to wildlife, in general, and grizzly bears in particular. When considering that two Indian reservations are part of the NCDE, it would make the research more complete if correlations could be associated with this single control variable. In short, do ranchers who identify themselves as Native American indicate stronger positive tolerances for grizzly bears than do non-Native Americans?

The literature that describes Native American connections to wildlife is vast. In an attempt to narrow the connection between Native American culture and grizzly bears, I located limited amounts of literature that dealt with these historic and pre-historic relationships. Two publications, discussed further in this section, emerged as significant to the study (Rockwell, 1991; Shepard & Sanders, 1985). The search was not exhaustive by any means since this is not the focus of the study. But I wanted to determine if there

is a special connection that would serve as an associational basis if the quantitative results indicate a noticeable difference in tolerance levels when comparing Native Americans and non-Native Americans.

The Flathead Indian Reservation is on the west side of the NCDE (Appendix C). Tribal members are principally Salish and Kootenai (Bryan, 1985). The Flathead Reservation has a total Indian and non-Indian population of approximately 22,000 people. Six thousand of the total population are of Indian descent (Salish Kootenai College, 2005). According to Bryan (1985), approximately one-half of the reservation's 1.2 million acres is privately owned. Bryan states, "Most of the land owned by tribal members and the tribe is forested and most of the non-tribal land is in agricultural land in the valley" (Bryan, 1985, p. 121). Of particular note, there is considerable privately owned agricultural property existing in that transition zone extending between higher elevation forest lands and low-land areas; an area ripe for considerable livestock/grizzly conflict. Interestingly, the Flathead tribal government created the Mission Mountain Tribal Wilderness, ". . . the first such wildland dedication by any tribe on its own" (Cunningham, 1990, p. 35). The wilderness is fully regulated by the tribal government and is habitat to a population of grizzly bears (Confederated Salish & Kootenai Tribal Council, & Bureau of Indian Affairs, 1981).

The 1.4 million acre Blackfeet Indian Reservation is located on the east side of the NCDE (Appendix C) and is the home to approximately 7,000 enrolled Blackfeet residents (Blackfeet Tribe, 2005). Approximately 38% of the reservation is owned by non-Indians (Bryan, 1985). The reservation offers excellent seasonal habitat for grizzly

bear populations (MDFWP, 1986). The reservation also provides excellent grass lands suitable for livestock grazing. The tribe has an extensive program that leases grass land to non-Indians and a few tribal members are directly involved in cattle grazing as well (Bryan, 1985).

When examining the meaning of grizzly bears to the natives of the Flathead and Blackfeet reservations, we can appreciate the connectedness people have to the land, simply because it is part of their ancestral domain (Rockwell, 1991; Shepard & Sanders, 1985). Few tribes in the United States enjoy the right to claim their reservation as part of their ancestral lands. The obvious question is: how does the connection between the native peoples and animals demonstrate itself in the literature?

Rockwell (1991) relates a story about a young Flathead (Salish) girl that was lost and then brought back to her people by a family of bears. She was bestowed with certain powers to be used in the future to help her people. Shepard and Sanders (1985) describe a Kootenai story whereby shamans would use effigies to invoke the destructive energy of the grizzly against their enemy. Regarding the Blackfeet, Rockwell (1991) asserts an interesting perspective when he states, “Of the Great Plains tribes, only the Plains Cree, Plains Ojibwa, and Assiniboine hunted bears for food. The Blackfeet had a strong taboo against killing, eating, or using the hide of the animal, although their shamans could use hides for ceremonial purposes and warriors could possess claws” (Rockwell, 1991, p. 54-55).

Considering the long-time Native American cultural connections to the grizzly bear, there are other—more contemporary—formal connections that both reservations

exercise in managing grizzly bears. Representatives from each reservation in the NCDE have a formal position at the table of a core governmental unit that is charged with regulating the future of the grizzly bear in the lower 48 states (Interagency Grizzly Bear Committee [IGBC], 2003). The IGBC is a multi-agency unit that meets regularly and discusses research and decisions about grizzly bear management. Even though tribes are part of the unit, their formal participation has been nearly non-existent (IGBC, 2003). However, individual tribes play a strong role by actively participating, and sometimes leading, management control actions to abate grizzly/livestock problems within their own reservation settings.

Each reservation has varying degrees of infrastructure and personnel to effect nuisance grizzly bear control measures. The Flathead Reservation operates under guidelines adopted in 1981 (Confederated Salish & Kootenai Tribal Council, & Bureau of Indian Affairs, 1981). However, the older guidelines and lack of the tribe's involvement with the IGBC should not be construed as ineffective. The Confederated Salish & Kootenai Tribal Wildlife Department manager was hailed as wildlife biologist of the year by the Montana Chapter of the Wildlife Society ("Becker Named," 2004). The newspaper article stated that the tribal wildlife program consists of four biologists with master's degrees, three biologists with bachelor degrees, and two tribal-member trainees who are working towards their master's degrees. Additionally, wildlife programs from both the Flathead and Blackfeet reservations carry on continuous liaison measures with state and federal grizzly bear managers.

The Blackfeet tribe developed a grizzly management plan in 1998 that incorporates extensive remarks from elders regarding Blackfeet cultural and grizzly bears (Blackfeet Fish and Wildlife Department, 1998). The plan has a separate appendix devoted to interviews of Blackfeet elders as they described the importance of bears to the Blackfeet culture. The person performing the interviews, Gayle Skunk Cap, Jr., reported: ". . . the most common belief was that the Blackfeet were reluctant to kill, eat, process or use the bear or its parts. The Blackfeet aversion is thought to be due to the belief that the bear is a sacred animal, akin to man . . ." (Blackfeet Fish and Wildlife Department, 1998, Appendix A, p. 1).

Age. According to the results of Montag and Patterson (2001), the average age of LP respondents was 57 years. To the casual observer this would not be an unexpected result. However, this suggests a strong tradition in a particular occupation. The age factor needs to be compared to other control variables as to how it measures up to tolerance, especially when considering the words of Pascarella and Terenzini (1991), ". . . that tolerance increased at each successive educational level (except one) across cohorts, that younger people were more tolerant than older ones at each level of education, and that the relation between education and tolerance held even when occupational status was controlled" (Pascarella & Terenzini, 1991, p. 291).

Chapter Summary

A multitude of factors are at play when considering the scope of the study and the use of the data. It is critical at the outset to examine how the focus must be maintained to

conduct a literature survey that considers four primary variables. It was advantageous to take an approach consistent with the variables to be tested. Three independent variables and one dependent variable are discussed in the literature review at depth. These variables will generate inferential data to reject or not reject the null hypothesis. Then the literature review focused on the control variable. The control variables are ancillary and not crucial to the hypothesis, but instead, describe the sample and possibly add to interpretation of the multivariate analysis.

The literature review initially focused on formal education. This variable is expected to produce the most revealing results as it correlates with tolerance. The most prominent researcher in education and tolerance is Paul Vogt. The literature connects very well with Vogt's assertions that formal education is a predictor of tolerance in our social environment. He returns to this assertion again and again. Also, numerous articles support similar conclusions.

The second focus was on the variable self-initiated education. In this area the literature is older, but seems to be rather well corroborated among the leaders in informal education. Knowles (1975) and, more recently, Crane (1994) seem particularly confident in their assertions about informal education. Knowles is a proponent of informal education and realizes how informal education can compliment, as well as transcend, formal education. Crane is particularly astute in defining informal education for her particular research and thus keeps the reader of her research narrowly contained in the direction she desires. I found that by defining tolerance for the purpose of this study, I should be able to more directly focus the literature search, as well as develop a

questionnaire that takes the consumer of the study into a particular direction. Her research helps guide the reader, rather than take the reader on tangents of what tolerance means. I discovered that the concept of tolerance is so vast that it is important to stay on track by using a clear and concise definition. Her model helped the direction and interpretation of my investigation.

The third focus was to explore the domain of more scientific literature and connect the consumer with how I intend to use financial compensation as a third variable. Compensation for losses due to grizzly bear compensation is not without controversy. I probed beyond the anecdotal evidence to find those authors that truly delved into the ramifications of using financial compensation and how it influenced attitudes and behavior. Again, the team of Montag, Patterson, and Sutton (2003) came across as leaders in the field. It was from their research that credible insights were used for the questionnaire.

Another component to the literature survey that more or less evolved while examining independent and dependent variables was the notion of conflict. In talking to both professional and lay persons about my research, it became obvious there was a certain amount of "connecting" that needed to be understood before going forward with writing results or recommendations. The "connecting" is my attempt to bridge knowledge of why grizzly bear/livestock conflicts occur and how the independent and dependent variables are affected. As rudimentary as this may seem, the endeavor brought to the forefront those literature-based elements about bear biology, landscapes, and conflict that would interest the non-science consumers of the research. Again, in this

area, the research is vast. But I was able to find numerous professional articles on bear biology, landscapes, and conflicts that have the Northern Continental Divide Ecosystem as their research area.

The last component to the literature survey was to investigate the primary control variables: gender, ethnicity, and age. Gender influences may suggest different tolerance levels when comparing females with males. It is expected in the livestock industry that females may be in the minority in terms of ranch ownership. Pascarella and Terenzini (1991) suggest that gender differences and education have an influence on perspectives.

Another control variable, ethnicity, may have a strong role in the research depending upon response rate. The literature, again, suggests there may be strong connections between Native American culture and grizzly bears, and possibly to the extent that the investigation may find correlation. Two Indian reservations have land within the NCDE. They are the Flathead and Blackfeet reservations. The literature suggests that bears in general had ancient influences on tribes that currently reside on both reservations. In a very broad sense it seems to be a worthy endeavor to see if ethnicity influences tolerance for grizzly bears.

The third control variable to investigate is age. The literature review was shallow in this regard. I focused on the Montag and Patterson (2001) research results on average age. Their findings were not demonstrable other than to indicate the average age of their respondents was 57 years. However, Pascarella and Terenzini (1991) suggest that younger people are more tolerant.

METHODOLOGY

Wildlife managers need to know if tolerance for grizzly bears is a predictable relationship that depends on the education levels of, and financial compensation to, livestock producers. I concluded in chapter two that human tolerance for other humans can be predicted from levels of formal and self-initiated education. Similarly, there is a small amount of evidence that education is related to tolerance for other species. The literature also indicates that tolerance for grizzly bears that depredate on livestock may be influenced by financial compensation to livestock producers. Chapter three describes the research design and data collection instrument that were used to determine whether an association exists between three independent variables (formal education, self-initiated education, and financial compensation) and one dependent variable (tolerance) as they apply to non-human species, grizzly bears.

The quantitative paradigm is popularly referred to as the positivist research design (Gliner & Morgan, 2000), because of its characteristic framework that establishes a detailed plan prior to the study. In chapter three, I detail the guidelines that are used to accomplish the research investigation. At the marrow of the study is a questionnaire-type survey that is the foundational tool for the collection of objective quantitative data.

Research Design

The study is a one-time survey-based investigation of the relationship of formal education, self-initiated education and financial compensation to livestock producers' tolerance for grizzly bears. A questionnaire was mailed to randomly selected livestock

producers that raise livestock in grizzly bear habitat in or near the Northern Continental Divide Ecosystem (NCDE). The validity of the questionnaire was strengthened by expert review of professionals familiar with the topic.

Population and Sample

The population of this study is livestock producers residing or operating in nine north-central and northwestern Montana counties, whose livestock are in recognized grizzly bear habitat (Appendices B and D). Key terminology is critical in defining the target population. The study makes repeated use of the term, "in or near the Northern Continental Divide Ecosystem (NCDE)." This term refers to: a) livestock producers that operate inside the NCDE Grizzly Bear Recovery Zone as defined by the geographical boundaries established by the USFWS (Appendix B), and, b) livestock producers that operate outside and contiguous to the NCDE and who are potentially subject to grizzly bear depredation activities by bears that travel beyond the boundaries of the NCDE. I established the membership of the latter group of livestock producers by searching government records and newspaper articles over the last five years. If the search revealed pertinent sightings, reported depredations, or encounters between livestock producers and grizzly bears then the nearest town or city was included on the list of towns and cities to be considered in or near the NCDE (Appendix B). A second consideration to help establish the "in or near the NCDE" criteria is the action by government officials, based upon actual sightings and removal operations, to officially extend the boundary of grizzly bear activity beyond the original boundary of the NCDE Grizzly Bear Recovery Zone (Appendices B and C). As localities outside the NCDE were determined—either by

reporting of occurrences or by boundary changes—livestock producers within those zip code localities (outside the NCDE Grizzly Bear Recovery Zone) became part of the sampling frame. A complete list of counties with corresponding towns and cities that constitute "in or near the NCDE" is located in Appendix H. Livestock producers with zip codes from the towns and cities on the list were eligible to receive questionnaires as part of the randomly selected sample.

The U.S. Department of Agriculture provided a list of livestock producers based upon my analysis of geographical location. This list became the sampling frame and included a total population of livestock producers (N = 1,065) living in or near the NCDE. A randomly selected sample of livestock producers (N = 700) from the sampling frame received questionnaires. Those livestock producers that responded to the questionnaire represent the sample (N = 388), a response rate of 55.4%.

Instrumentation

A specific data collection instrument (Appendix E) was developed to collect data for testing the hypotheses. The current study was based upon the results of a pilot study conducted in 2001 (Appendix G). The pilot survey administered to a sample of livestock producers in Park County, north of Yellowstone National Park, was valuable in developing the questionnaire for the current study. The pilot study is described in detail at the end of this chapter.

Variables

Dependent Variable. The dependent variable in this study is tolerance. Part IV of the data collection instrument asked livestock producers a series of twelve questions. The questions were selected from a review of numerous reports by Kellert (1979, 1981, 1982a, 1982b, 1982c, & 1983) and were revised based upon review and subsequent recommendations from validity experts. The tolerance scores are based upon a Summated Likert Attitude Scale (Gliner & Morgan, 2000). The higher the score, the higher the tolerance level for grizzly bears.

Table 2. Likert Scale Numerical Values (Suskie, 1996, p. 337-338)

Respondent's selection	Numerical Value
Strongly Disagree (SD)	1
Disagree (D)	2
Neutral (N)	3
Agree (A)	4
Strongly Agree (SA)	5

Gliner and Morgan (2000) state that when computing a summated scale, the negatively-worded question should be reversed in terms of the weighting. This reverse-wording procedure was a favorable procedure in the study. The technique was utilized to single out inconsistent responses, especially from respondents that had a desire to perhaps skew their tolerance score by responding to all 12 questions in a certain way (either all strongly disagree or all strongly agree) without closely reading individual questions (Suskie, 1996). In the final analysis, the reverse-wording, and corresponding reverse-

scaling had a favorable result. There was no indication that individual respondents tried to skew their tolerance score, but rather answered questions earnestly and consistently.

Independent Variables. Three independent variables are considered in the study. Each independent variable is discussed in the context of where it will be answered in the data collection instrument.

First Independent Variable Question. Is there an association between formal education levels of livestock producers in or near the NCDE and their tolerance for a threatened species such as the grizzly bear? The first part of the questionnaire (Part I, Respondent Information, question 10) asks for the highest grade attained.

Second Independent Variable Question. One question was constructed to obtain data to answer how much self-initiated education was obtained over a period of time. The first question (question 14, Part II) asks how many hours have been devoted to educating oneself about grizzlies in the past five years. As a prelude to question 14, it is important to note that question 13 asks the respondent to select the resources from which she or he acquired knowledge about grizzly bears. The purpose of question 13 is to assist the respondent to more accurately quantify a response to question 14. By having the respondent go through the mental exercise of considering all possible sources of self-initiated education, it was expected that a more accurate estimate of hours would occur.

Third Independent Variable Question. Recent research (Montag, J. & Patterson, M. 2001; Montag, J.M. & Patterson, M.E. 2001; and Montag & Patterson, 2003) suggests that financial compensation to livestock producers that sustain losses to grizzly bears may

or may not evoke tolerance for grizzly bears. Responses to questions 17 and 18 were used to determine livestock producers' views on financial compensation. Questions 15 and 16 provided evidence of whether the LP has personally experienced losses due to grizzly bear depredation.

Control variables. All the questions dealing with control variables appear in Parts I and II of the questionnaire. All the questions in Part I contribute to using and evaluating control variables. The only exceptions would be questions 12 (knowledge about grizzly bears) and 13 (how knowledge was acquired about grizzly bears). Answers to these two questions were critical to gathering data for the first independent variable (formal education), and contributed substantive nominal data for the inferential statistic (regression).

The remaining questions in Part I were answered by circling simple yes/no responses or by circling one response in a series of multiple choice answers. I anticipated that some of the multiple choice answers would not address all possible responses, so I provided an "other" option. In these questions the respondent simply indicated "other" and wrote in a suitable answer.

Questions 1 through 6 of the questionnaire are directed at determining categories in which to place respondents. This information would be useful as a descriptive statistic for comparative purposes. For instance, after all data was tallied, it was relevant to know whether cattle producers are more tolerant of grizzly bears than are sheep producers, or vice versa. This kind of statistic may not be relevant to the research focus (prediction

analysis), but may be relevant for educational program development or for curriculum development.

Questions 7, 8, and 9 provided information pertinent to those researchers interested in comparisons involving gender, ethnicity and age factors. Of particular importance were the responses from American Indian respondents since the NCDE is part of two Indian reservations.

Questions 15 and 16 (compensation received and compensation not requested) hold higher relevance than do some of the other descriptive statistics. For instance, the study by Montag, Patterson, & Sutton (2003) suggested that many members in the livestock business did not claim compensation even though they sustained livestock losses due to grizzly bear depredation. The current study assisted in confirming that particular statistic. Again, responses to questions 15 and 16 of the current study are informative to program development and educational foci.

Instrument Validation

To validate the questionnaire, I personally interviewed thirteen individuals (Table 3), either in person or by telephone. Input from these thirteen experts provided expert validity to the final questionnaire (Appendix E).

Table 3. Numbers of Individuals Interviewed for Expert Validity

Officials	# interviewed
Livestock producer	5
U.S. Fish and Wildlife Service official	1
Tribal wildlife official	2
U.S. Forest Service official	2
State of Montana wildlife official	2
Academic	1
TOTAL	13

I selected five livestock producers to interview that ranched in Park County and were situated inside the Yellowstone Ecosystem (YES). Their names were obtained from the USDA office in Park County. The livestock producers were selected from the Yellowstone Ecosystem (YES) because ranching practices and incidences of grizzly bear conflicts are the same kinds of circumstances experienced by livestock producers in the NCDE. One representative from the U.S. Fish and Wildlife Service (USFWS) and one wildlife official from each of the two Indian reservations in the NCDE were selected for interview. The USFWS is the agency charged with Endangered Species Act enforcement while the two reservations were the Flathead Indian Reservation and Blackfeet Indian Reservation.

Two federal wildlife officials from the two major national forests within the NCDE were interviewed. One official was from the Flathead National Forest (west side of the NCDE) and one official from the Lewis and Clark National Forest (east side of the NCDE).

One field biologist from the Montana State Department of Fish, Wildlife, and Parks was interviewed. This person was one of several biologists from the agency that deals with grizzly bear conflicts and one-on-one educational efforts with livestock producers. MDFWP is the principle state agency that operates as a first respondent to grizzly bear conflicts and these individuals are intimately involved with mitigating livestock conflict problems as well as educating livestock producers and the general public about grizzly bears. A second MDFWP official that deals with the agency's grizzly bear management programs was also interviewed.

One professor affiliated with the biology department at Montana State University who provided ongoing input to the study is the academic validity expert. This individual has extensive expertise in livestock and grizzly bear conflicts as well as first-hand knowledge of the Northern Continental Divide and Yellowstone ecosystems.

All individuals interviewed were selected based on their knowledge and experience with livestock/grizzly bear conflicts. The field of expertise ranged across the spectrum from livestock producers to university and agency officials.

The interview process was guided by a semi-structured interview protocol (Appendix I). I conducted the interviews, mostly by telephone, and took notes from interviewees. Following formal interviews, I analyzed responses and fine-tuned the questionnaire to its final form (Appendix E). The formal process of interviewing experts generated a more valid questionnaire. The effort was effective at focusing questions more directly at gathering data that answers the research hypotheses.

Instrument Reliability

Reliability is the degree to which a test consistently measures whatever it is measuring (Gay & Airasian, 2000, p. 169). After the data from Part IV of the returned questionnaires were entered into SPSS, the Cronbach's alpha (reliability coefficient) was calculated. The reliability coefficient for all 12 questions in Part IV was .814. This is a respectable level of reliability when considering that coefficients are most reliable as they approach 1.0 on a 0 to 1 continuum. The result strengthens the assertion that all 12 questions to determine a tolerance score were measured in a consistent manner.

Several combinations of the 12 questions were tested for a higher coefficient. No other combination produced a higher coefficient. Additionally, the computations were analyzed to determine if a higher coefficient would result from the elimination of one or more questions. Again, elimination of even one question did not result in a significant difference.

Data Analysis

Data from the respondents were entered into the Statistical Package for Social Sciences (SPSS) computer program. In addition to a variety of summary statistics, I used simple linear regression (bivariate analysis), multiple regression, t-tests, and chi-square to explore relationships within the data.

Descriptive Statistics

The data collection instrument provided information that supported certain descriptive statistics. Informal discussions with professionals suggested that collecting

descriptive statistics was productive to the research effort. The data collection instrument was designed to collect additional data for the purpose of describing and comparing certain control variables such as demographics, years in business, past compensation, and knowledge about grizzly bears. For the purposes of this study, the peripheral data is referred to as control variables, even though at times they were not specifically used as a statistical control.

Inferential Statistics

Numerical responses to the three primary independent variables (described in the data analysis section) were entered into the SPSS computer program to determine linear relationships to the dependent variable. The inferential statistic, simple regression, was used to determine whether statistical significance did or did not exist; thus, determining whether any of the three research hypotheses were rejected. Another inferential statistic, multiple regression, was also used to determine if there was a relationship between a linear combination of the variables (education, self-initiated education, and compensation) and tolerance for grizzly bears.

Alternative and Null Hypotheses

The three research hypotheses were tested using simple regression. The reason for using simple regression was to determine if each research hypothesis would be rejected, or not rejected, independent of any consideration of the other two hypotheses. Each hypothesis separately describes the relationship between each independent variable and the dependent variable. The following three statements specifically delineate the research hypotheses (alternate hypotheses).

First Alternate Hypothesis—Formal Education. The tolerance level of the population who possess high formal education levels will be significantly different from the tolerance level of the population who do not possess high formal education levels.

Second Alternate Hypothesis—Self-Initiated Education. The tolerance level of the population who possess high self-initiated education levels about grizzly bears will be significantly different from the tolerance level of the population who do not possess high self-initiated education levels about grizzly bears.

Third Alternate Hypothesis—Financial Compensation. The tolerance level of the population who favor high financial compensation levels for grizzly bear damage will be significantly different from the tolerance level of the population who do not favor high financial compensation levels for grizzly bear damage.

Combined Null Hypothesis. The final analysis examined the combined effects of the three independent variables after controlling for several important extraneous variables. The final null hypothesis for this study is: there is no relationship between a linear combination of the independent variables (education, self-initiated education, and compensation) and tolerance for grizzly bears after controlling for the effects of region and losses. The null hypothesis was tested using multiple regression.

Alpha Applied to the Study

An alpha of 0.05 was selected for the study based on Gliner and Morgan (2000, p. 174) and Gay and Airasian (2000, p. 476); and their intimation that 0.05 is the usual alpha level. Field (2000) suggests that 0.05 is adequate when he states: “Usually, social

scientists accept any probability value below 0.05 as being statistically meaningful and so any probability value below 0.05 is regarded as indicative of genuine effect . . .” (Field, 2000, p. 88). Based on the above assertion, the alpha level in the current study will be 0.05.

Pilot Study

I conducted a pilot study in the fall of 2001 as part of my coursework in quantitative research. The pilot study was an experience-based effort at analyzing some of the major components of a quantitative research design. The pilot survey, in part, was an attempt to mimic an expanded research design as described in the current study. The 2001 research area was an area north of Yellowstone National Park in Park County, Montana. The same three independent variables (formal education, self-initiated education, and financial compensation) were used as well as the same dependent variable (tolerance).

The results of the pilot study offered many insights as to how to conduct quantitative research. The pilot study also helped me realize that many adjustments would be necessary if an expanded study were to be successful. Essentially, the pilot study became the driving force behind the current study. The pilot study offered ample evidences that the current research would be successful when examining associations between variables. The pilot study also suggested opportunities for using inferential statistics to generalize results from a sample to a population.

Chapter Summary

Chapter three describes the methodology used to infer statistical relationships between the population and a sample from the population. The chapter describes the principle quantitative statistics to be used in the study: simple regression and multiple regression. The chapter further describes how data collected facilitates the use of other statistics such as t-tests and chi-square. All variables (formal education, self-initiated education, financial compensation, and control variables) will be associated with the single dependent variable (tolerance) using simple regression, multiple regression, t-tests, and chi-square.

Arguments, primarily derived from Gay and Airasian (2000) and Gliner and Morgan (2000), contribute to determining the validity and reliability of the data collection instrument (questionnaire). In this regard, discussion in this chapter was directed specifically at how the data collection instrument solves the questions surrounding validity and reliability.

RESULTS

Introduction

The problem investigated in this study was to determine if tolerance for grizzly bears can be predicted based upon education levels of, and attitudes about financial compensation of, livestock producers living in or near the NCDE.

The first research hypothesis tested the association between years of formal education and livestock producer tolerance for grizzly bears. The second hypothesis tested the association between hours of self-initiated education and tolerance for grizzly bears. The third hypothesis tested the association between levels of financial compensation and tolerance for grizzly bears. The fourth hypothesis tested the combined effect of formal education, self-initiated education and financial compensation on tolerance. A fifth component of the analysis includes a number of variables that are best used as descriptive statistics. These data are nominal and ordinal and are used to provide summaries about the sample.

During the analysis of data phase, a fifth component was developed to perform additional analysis using other statistical tests such as t-tests and chi-square. The use of these tests deepened the understanding of interrelationships among independent variables and control variables.

An important notation throughout this chapter is the reference to two different regions: region zero and region one (Table 4). Region zero is geographically defined as

the three major counties on the west side of the Continental Divide: Flathead County, Lake County, and Lincoln County. Region one is geographically defined as the six remaining counties principally on the east side of the Continental Divide. The reason for having two regions is to describe and compare data from livestock producers from region zero (N = 179), which is composed of numerous small-acreage ranches with data from livestock producers in region one (N = 207), which is composed of more scattered large-acreage ranches. Table 4, below, delineates respondent frequencies between counties and regions.

Table 4. County/Region Respondent Frequencies

County/Region		Frequency/Percent	
County	Region	Frequency	Percent
Flathead	0	38	9.8
Glacier	1	30	7.7
Lake	0	122	31.4
Lewis & Clark	1	28	7.2
Lincoln	0	14	3.6
Missoula	1	3	.8
Pondera	1	43	11.1
Powell	1	25	6.4
Teton	1	55	14.2
Flathead/Lake	0	3	.8
Glacier/Pondera	1	9	2.3
Glac/Pond/Tet	1	1	.3
Lake/Missoula	0	2	.5
L & C/Powell	1	1	.3
L & C/Teton	1	5	1.3
Pondera/Teton	1	7	1.8
Total		386	99.5
Missing System		2	.5
TOTAL		388	100.0

Questionnaire Response

From the list, and based upon the location of cities and towns, I determined there were 1065 livestock producers in or near the Northern Continental Divide Ecosystem, constituting the research population. In December, 2004 I mailed questionnaires to livestock producers (N = 700) randomly selected from the population. Livestock producers returned 416 questionnaires. There were several returned questionnaires that I determined ineligible because of age limitation (under age 18), or respondents marked the first question as not being a livestock producer, or respondents returned the questionnaire too late for calculation. The number of ineligible questionnaires (N = 28) resulted in an adjustment to 388 eligible questionnaires. Therefore, after adjustment for ineligible questionnaires, the adjusted response rate (total returned questionnaires minus ineligible questionnaires / total questionnaires mailed) was 55.4%.

Results of Data Analysis

Descriptive Statistics

Descriptive statistics were used to make simple comparisons of data, and will be addressed in this section in the same order as they appear on the questionnaire, and include: primary source of income, type of livestock produced, county or counties in which the livestock producer operates, type of business (individual, corporate, etc.), gender, ethnicity, age, highest level of education attained, college degree received, knowledge self-rating, how knowledge is acquired, hours devoted to acquiring

knowledge about grizzly bears, financial compensation received, compensation requested, and producer's designation of fair compensation.

Sixty-one percent of livestock producers (N = 236) in the entire NCDE indicated livestock production as their primary source of income, while 39% (N = 151) indicated livestock production was not their primary source of income. On a regional basis, 50% (N = 89) of the respondents in region zero (west side) said livestock production was their primary source of income, however, 70.5% (N = 146) of the respondents in region one (east side) said livestock production was their primary source of income.

Eighty-eight percent (N = 341) of the respondents said they raised cattle, while 5% (N = 18) raised sheep. An additional 5% (N = 19) indicated they raised both cattle and sheep. Additionally, approximately 2% (N = 8) were honey producers.

Table 4 (above) delineates the number of respondents per county and region. Note that some livestock producers (N = 28) operate in two or three different counties. Also two respondents returned questionnaires but did not mark in which county they operated. Three hundred eighty-seven respondents reported being a livestock producer in their principle county for an average of 29.5 years with a range from 1 to 73 years.

The questionnaire requested livestock producers to indicate the type of business they operated. Table 5, below, reflects the respondents' selection. Note that in the "Other" category the most frequent response was "Family," which totaled eight. Six respondents did not indicate a business type, and are indicated as "Missing System."

Table 5. Business Type

Business Type	Frequency	Percent
Individual	286	73.7
Partnership	36	9.3
Corporation	52	13.4
Other-Family	8	2.1
Total	382	98.5
Missing System	6	1.5
TOTAL	388	100.0

The question about gender revealed that 16% of the respondents were female (N = 62) and 83% were male (N = 321). The ethnicity question revealed two livestock producers reporting themselves as African American and Hispanic (one each). American Indian livestock producers accounted for 8.8% (N = 34). An additional 1% (N = 4) reported themselves as American Indian/Caucasian. Caucasian was the largest ethnic group (83%) with 322 livestock producers. The age of livestock producers (N = 380) ranged from 19 to 93 with a mean age of 55.6 years.

Three hundred eighty-four livestock producers reported some level of highest education attained. Highest grade attained ranged from 7 to 24 years with 14 years being the average. Table 6, below, is a comparison of the highest grade attained, frequency, and percent.

Table 6. Highest Grade Attained

Highest Grade	Frequency	Percent
7	1	.3
8	5	1.3
9	3	.8
10	4	1.0
11	3	.8
12	126	32.5
13	46	11.9
14	51	13.1
15	26	6.7
16	74	19.1
17	19	4.9
18	18	4.6
19	3	.8
20	2	.5
22	1	.3
23	1	.3
24	1	.3
Total	384	99.0
Missing System	4	1.0
TOTAL	388	100.0

Livestock producers (N = 148) responded to having either a 2-year associate, bachelor's, master's, or doctoral degree. Frequencies and percents are reported for each degree in Table 7, below. The term "Missing System" in the table indicates that 240 of 388 respondents did not report having received a degree.

Table 7. Degree Received

Degree Received	Frequency	Percent	Valid Percent
2-year Associate	33	8.5	22.3
Bachelor's	92	23.7	62.2
Master's	22	5.7	14.9
Doctorate	1	.3	.7
Total	148	38.1	100.0
Missing System	240	61.9	
TOTAL	388	100.0	

In part II, question 12, of the questionnaire, I asked livestock producers to rate their knowledge about grizzly bears in seven categories: habitat, feeding habits, travel patterns, management, economic impact, public issues, and public policy. In each category, respondents were asked to rate themselves using the knowledge scale from 1 (no knowledge) to 5 (expert) (Table 8). Because the results are lengthy, tables for each category are contained in Appendix J.

Table 8. Statistics from Questionnaire, Part II, Question 12

	Self-Rated Knowledge Areas						
	Habitat	Feeding Patterns	Travel Patterns	Manage-ment	Economic Impact	Public Issues	Public Policy
Valid	379	383	381	379	381	380	378
Missing	9	5	7	9	7	8	10
Mean	3.30	3.24	2.99	2.87	3.07	3.14	3.05
Median	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Mode	3	3	3	3	3	3	3

Part II of the questionnaire also asked livestock producers to disclose the resources they used to acquire knowledge about grizzly bears. A respondent could mark as many resources as they desired. The most frequent resources selected were personal observation (N = 277), Newspaper (N = 232), and visiting with ranchers (N = 236). Government officials accounted for selections in the following categories: county government official (N = 72), state government official (N = 141), and federal government official (N = 135). In the category of "Other," tribal government officials accounted for the least number of selections (N = 9) of all government officials. Complete tallies of all resources are listed in Appendix K.

Research Questions

Below is a restatement of the research questions from chapter three. Two of the three research questions were determined statistically significant following analyses of data from returned questionnaires.

First Alternate Hypothesis—Formal Education. The first alternate hypothesis states: The tolerance level of the population who possess high formal education levels will be significantly different from the tolerance level of the population who do not possess high formal education levels.

Two variables, tolerance (dependent variable) and years of formal education (independent variable) were correlated. Simple regression produced statistical significance (p-value = .001, r = .172), indicating that as education levels increased, tolerance also increased.

Second Alternate Hypothesis—Self-Initiated Education. The second alternate hypothesis states: The tolerance level of the population who possess high self-initiated education levels about grizzly bears will be significantly different from the tolerance level of the population who do not possess high self-initiated education levels about grizzly bears.

Two variables, tolerance (dependent variable) and hours of self-initiated education (independent variable) were correlated. Simple regression did not produce statistical significance (p-value = .996, r = .001), indicating that hours of self-initiated education did not influence tolerance.

Third Alternate Hypothesis—Financial Compensation. The third alternate hypothesis states: The tolerance level of the population who favor high financial compensation levels for grizzly bear damage will be significantly different from the tolerance level of the population who do not favor high financial compensation levels for grizzly bear damage. This hypothesis had two parts. First, was the association between financial compensation for livestock losses only and the second part was for livestock losses plus other associated costs. In the first part, two variables, tolerance (dependent variable) and compensation levels for losses of livestock only (independent variable) were correlated. Simple regression produced statistical significance (p-value = .000, r = .371), indicating that as compensation levels increase there is a corresponding increase in tolerance. In the second part, two variables, tolerance (dependent variable) and compensation levels for losses of livestock plus other associated costs (independent variable) were correlated. Simple regression produced statistical significance (p-value =

.000, r = .336), indicating that as compensation levels increase there is a corresponding increase in tolerance.

Final Hypothesis—Combined Effect of Independent Variables on Tolerance

I tested the bivariate relationship of formal education to tolerance controlling for several important categorized variables. Numerous bivariate comparisons were analyzed without particularly noteworthy results. Others that are noteworthy are mention in this section. The procedure for examining data is to systematically calculate variables in each category (individual questions) in the same order as questions appear on the questionnaire (Appendix E). Then, under each category I made the bivariate correlations in terms of tolerance (dependent variable) and education level (independent variable).

Primary Income. When examining only those who responded to the question as to livestock production being their primary source of income, there was no statistical significance when correlating the variables for those respondents that answered "yes" to livestock production being their primary source of income; however, of those that answered "no" (N = 150), there was statistical significance (p-value = .002, r = .256). Data indicate that for those that do not list livestock production as their primary source of income, tolerance for grizzly bears increases as education levels increase.

However, when analyzing data on a regional basis, the outcome is different. Only those respondents in region zero that answered "no" to livestock production as being their primary source of income did the correlation between tolerance and education produce statistically significant results (p-value = .003, r = .310). Those that responded "yes" were close, but not statistically significant (p-value = .06, r = .203). Among producers in

region one, there was no statistical significance between the variables regardless of whether responses were “yes” or “no” to the question of livestock production being their primary source of income.

Type of Livestock. Correlations were calculated based upon the types of livestock raised. Cattle producers (N = 335) demonstrated a strong correlation (p-value = .022, r = .125) between tolerance and education levels, as did beekeepers (N = 7, p-value = .025, r = .817). Sheep producers (N = 18) and operators of both sheep and cattle (N = 19) did not correlate to any level of statistical significance.

Gender. When correlating tolerance and education, female respondents (N=61) differed from male respondents (N=316) indicating there is statistical significance (p-value = .004, r = .160) in the male population; furthermore, indicating that among males, as education levels increase there is a corresponding increase in tolerance levels for grizzly bears. Among female respondents (N = 61), the bivariate test did not yield statistical significance (p-value = .128, r = .197).

Ethnicity. For the category of ethnicity, the sample was divided into two sub-samples. Caucasian comprised the first sub-sample (N=318). The second sub-sample combined the categories of American Indian and American Indian/Caucasian (N=38). Caucasian respondents produced statistical significance (p-value = .001, r = .190) indicating tolerance among Caucasian respondents. The bivariate analysis for the American Indian sub-sample indicates no statistical significance (p-value = .980, r = -.004). However, since the American Indian sub-sample constitutes only 10% of the total

sample, the non-significant results may be at least partially attributable to the small sample size.

Compensation Received. Question 15 of the questionnaire asked livestock producers to indicate whether they received compensation for livestock losses in the past five years. When making the bivariate correlation between the variables tolerance and education, there was no statistical significance among those that answered "yes" (N = 43). Conversely, there was statistical significance among those that answered "no" (N = 337, p-value = .003, r = .159). When correlating the variables based upon regions, those respondents in region zero (west side) demonstrated there was statistical significance for both those that answered "yes" (N = 6, p-value = .001, r = .969) and those that answered "no" (N = 169, p-value = .003, r = .231). In region one (east side) there was no statistical significance regardless of whether the answer was "yes" (N = 37) or "no" (N = 166).

No Request for Compensation. There were those livestock producers that indicated they received livestock losses due to grizzly depredation, but did not request compensation. I made the same bivariate comparison of variables (tolerance and education) for those in the entire NCDE that responded "yes" (N = 94) to having livestock losses and there was no statistical significance. However, there was statistical significance among livestock producers in region zero (west side) regardless of whether they answered "yes" (N = 17, p-value = .021, r = .555) or "no" (N = 146, p-value = .003, r = .246). In region one (east side), there was no statistical significance among those that answered "yes" (N = 77) or "no" (N = 112).

Between Group Comparisons

Independent samples t-tests were administered to analyze comparisons between certain groups for the dependent variable, tolerance. Categories (independent variables) for group analysis were: gender (female and male), ethnicity (American Indian and Caucasian), region (east side and west side), livestock as a primary source of income (yes and no), and livestock losses (yes and no). The dependent variable for each group comparison was tolerance. In all circumstances there was no statistical significance between groups.

Interrelationship of Control Variables

Chi-square was used to compare two non-parametric variables: gender and livestock as a primary source of income. No statistical significance was revealed in this comparison.

However, there was statistical significance (chi-square = 47.822) when comparing region with losses. By using the chi-square test, the results strengthened the notion that losses and region are two variables that should be included in multiple regression analysis.

Multiple Regression Models

The dependent variable (tolerance level) was correlated with the four research hypotheses variables and four control variables. The hypotheses variables are: a) years of formal education, b) hours of self-initiated education in the past five years, b) compensation for livestock losses only—measured in multiples of fall market value, and, d) compensation for livestock losses and other associated costs—measured in multiples

of fall market value. The four control variables are: a) gender—male/female, b) ethnicity—American Indian or Caucasian, c) losses—yes/no, and, d) region—east side or west side.

It is important for the reader to be aware that, during the data analysis process, two additional control variables emerged: losses and region. The variable "losses" became important when it appeared from the statistical tests that livestock producers that had livestock losses due to grizzly bear depredation may have a particular intolerance for grizzly bears regardless of all other variables; thus, losses could not be ignored as an important independent control variable for multiple regression analysis.

The variable, "region" also became important in a similar fashion. When comparing responses from livestock producers from the west side of the NCDE with responses from livestock producers on the east side of the NCDE, the dissimilarities simply could not be left ignored; thus, region is an important independent control variable for multiple regression analysis.

As has been previously noted, all variables were analyzed and compared using several statistical tests. Some variables seemed indicative of notation while others did not. Age, for instance was regarded as a primary control variable in the literature survey; however, age did not produce any notable results and was therefore not included in multiple regression analysis.

There are three principle models that emerged from multiple regression analysis that are worth noting. The first multiple regression model correlates the four independent variables used in the research hypotheses. The second multiple regression model

correlates four independent variables as well as four control variables (losses, region, gender, and ethnicity). The third multiple regression model correlates the four independent variables as well as the two strongest control variables: losses and region.

First Multiple Regression Model. This model correlates the four independent variables used in the research hypotheses. Table 9 contains coefficients for the first regression model.

Table 9. Coefficients for the First Multiple Regression Model

	Unstandardized Coefficients				
Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.614	.270		9.700	.000
Highest Grade	.048	.018	.166	2.697	.008
Hours – past 5 yrs.	8.586E-05	.000	.021	.335	.738
Fair Comp – Lvst Only	-.191	.078	-.207	-2.467	.014
Fair Comp – Lvst + Other	-.105	.060	-.145	-1.735	.084

The SPSS model summary for the above correlations contains the following information: R = .367, R Square = .135, and Adjusted R Square = .120. Two of the four independent variables are statistically significant: highest level of formal education (p-value = .008) and fair compensation for livestock losses only (p-value = .014). When evaluating the standardized beta values or "size of influence" (Vogt, 1993, p. 20), the greatest influence upon the dependent variable is fair compensation for livestock only (beta = -.207) followed by highest level of formal education (beta = .166).

Second Multiple Regression Model. This model correlates the four independent variables as well as four control variables (losses, region, gender, and ethnicity). Table 10 contains coefficients for the second regression model.

Table 10. Coefficients for the Second Multiple Regression Model

	Unstandardized Coefficients				
Variable	B	Std. Error	Beta	t	Sig.
(Constant)	3.055	.395		7.744	.000
Highest Grade	.034	.018	.116	1.910	.057
Hours – past 5 yrs.	.000	.000	.073	1.216	.225
Fair Comp – Lvst Only	-.219	.075	-.228	-2.919	.004
Fair Comp – Lvst + Other	-.047	.058	-.064	-.810	.419
Losses	-.362	.100	-.233	-3.610	.000
Region	-.329	.092	-.235	-3.601	.000
Gender	.075	.115	.039	.649	.517
Ethnicity	-.011	.112	-.006	-.101	.920

The SPSS model summary for the above correlations contains the following information: R = .524, R Square = .274, and Adjusted R Square = .247. Three of the eight independent variables are statistically significant: fair compensation for livestock losses only (p-value = .004), losses (p-value = .000), and region (p-value = .000). In the above correlation, formal education is close but not statistically significant (p-value = .057). When evaluating the standardized beta values, the greatest influences upon the dependent variable are in the following order: region (beta = -.235), losses (beta = -.233), and fair compensation for livestock only (beta = -.228).

Third Multiple Regression Model. This model correlates the four independent variables as well as the two strongest control variables: losses and region. Table 11 contains coefficients for the third regression model.

Table 11. Coefficients for the Third Multiple Regression Model

	Unstandardized Coefficients				
Variable	B	Std. Error	Beta	t	Sig.
(Constant)	2.980	.260		11.466	.000
Highest Grade	.037	.017	.129	2.239	.026
Hours – past 5 yrs.	.000	.000	.075	1.301	.195
Fair Comp – Lvst Only	-.222	.072	-.240	-3.085	.002
Fair Comp – Lvst + Other	-.056	.057	-.078	-.991	.323
Losses	-.347	.097	-.222	-3.584	.000
Region	-.318	.087	-.229	-3.660	.000

The SPSS model summary for the above correlations contains the following information: R = .516, R Square = .266, and Adjusted R Square = .247. Four of the six independent variables are statistically significant: formal education (p-value = .026), compensation for livestock losses only (p-value = .002), losses (p-value = .000), and region (p-value = .000). When evaluating the standardized beta values, the greatest influences upon the dependent variable are in the following order: fair compensation for livestock losses only (beta = -.240), region (beta = -.229), losses (beta = -.222), and highest level of formal education (beta = .129).

Chapter Summary

The quantitative research design investigated several possible statistical comparisons to determine which calculations would produce the most significant results. A portion of the research and data analysis simply described the sample (N = 388). These descriptive statistics give the consumer of the research an idea of the number of respondents in terms of: livestock being their primary source of income, the type of livestock raised, in which county they operate, type of business, gender, ethnicity, age years of formal education, and type of college degree received. Further investigation gives the consumer an idea of how respondents rate themselves in their knowledge about grizzly bears and which resources they use to acquire knowledge about grizzly bears.

The next approach to describing the sample was to use more advanced statistical tests (bivariate correlation, t-test, chi-square, and multiple regression) to determine if and how variables connected themselves to provide meaningful insight. The best insights came from bivariate analyses that indicate statistically significant correlations between years of formal education and tolerance levels. For the entire NCDE it is sufficiently clear that tolerance for grizzly bears increases as formal education levels increase. However, when the same bivariate correlation is examined on the basis of two regions of the NCDE, region zero (west side) differs significantly from region one (east side). The west side sample demonstrates a statistically significant correlation between tolerance and formal education, whereas the east side does not.

Another bivariate computation that demonstrated statistical significances was the correlation between tolerance and compensation. On the basis of the entire NCDE, the

bivariate analysis indicated statistical significance when correlating the dependent variable (tolerance) with compensation levels for livestock losses only (independent variable) and compensation for livestock losses plus other costs (independent variable). Both bivariate correlations produced the same statistical significance (p-value = .000), with compensation for livestock losses only producing an R correlation coefficient of .371 and livestock losses plus other costs producing an R correlation coefficient of .336. The results of correlating tolerance with compensation substantiate that financial compensation is a strong predictor of tolerance; thereby concluding that tolerance levels increase as compensation levels increase.

The multivariate correlations produced three multiple regression models worthy of reporting. Each model produced new information as variables were added or removed. Three variables remained as consistent predictors of tolerance. They are: compensation for livestock losses only, losses, and region. Formal education was also a strong predictor of tolerance in the first and third models.

The data for the research questions were analyzed. The first and third hypotheses (formal education and compensation) were found to be statistically significant. The second research question (self-initiated education) was found to not be statistically significant.

CONCLUSIONS

Introduction

Since the advent of the Endangered Species Act, the role of education has become increasingly more significant for effective grizzly bear management. More and more government documents dedicated to strategies for recovering grizzly bear are stressing the essential component, education.

Furthermore, as state and federal agencies observe private entities, such as the Defenders of Wildlife, compensate livestock producers for losses to grizzly bear depredation, they, too, are considering such compensation programs as part of a strategy for creating tolerance for grizzly bears. Specifically, these agencies are considering compensation programs as a viable component to overall grizzly bear management.

This investigative study simply brings to the discussion table the kind of data that may assist grizzly bear managers with their decision-making processes. A persistent question that wildlife managers' debate is: does education and financial compensation make a real difference in tolerance for grizzly bears? In the area of education, the literature review substantiates that there is not much, if any, research that deals with education directed at livestock producers. Furthermore, to date, it is probably safe to say that short of the pioneering study by Montag and Patterson (2001) and Montag, Patterson, and Sutton (2003), not much beyond anecdotal evidence or professional opinion has served as the basis for incorporating—or even considering—financial compensation into grizzly bear management programs.

Within the prevue of this study, I have provided a definition for tolerance that directly applies to that relationship between livestock producers and grizzly bears. This is a good starting point for professional discussion, because my experience has led me to believe that wildlife managers want to achieve something like increased tolerance, and yet do not have a grasp of what the concept means. Admittedly, defining tolerance can be a challenge. However, this study—as bold as it may be regarded—provides a working definition for tolerance, as well as a research design that correlates tolerance with multiple variables including education levels and compensation levels. As researchers and wildlife managers critique the data I've provided in this study, it may well be a first step in comparing anecdotal statements and opinions to data grounded in systematic investigation.

This chapter discusses some of the broader implications of the research, as well as summarizes the results of the research hypotheses. Good research would not be complete without some regard for problems or inconsistencies that arose in the research process or from the data collection instrument. Some of these areas are also highlighted in this chapter. The descriptive statistics were also useful to help describe for the consumer of this study a snapshot of what the sample looked like.

Discussion of Broader Implications

The results of the study, outlined in chapter four, give specific details of how descriptive statistics provided insights to control variables such as types of businesses, gender, ethnicity, and age. Then I applied more advance statistical tests to the data and put to use some of the parametric data for inferential tests. This later approach gave the

investigation some broader implications with regard to predictability of the data and generalizability from the sample to the population. Below are brief descriptions of some of the more important implications of the data in terms of descriptive statistics and inferential statistics.

Descriptive Statistics

Not surprisingly, most businesses were individually owned as opposed to smaller numbers of corporations and partnerships.

Female respondents, as expected, comprised a much smaller percentage (16%) of the number of returned questionnaires. What was worth noting is that female respondents—when comparing their education levels with tolerance—demonstrated no correlation between the two variables. However, when comparing male respondents with education levels and tolerance, there is a statistically significant linear relationship between the variables. In the male category, as education increased, so did their tolerance for grizzly bears. In the female category the lack of statistical significance may simply imply that the number of respondents was too small, and certainly does not imply tolerance one way or the other.

Ethnicity, as one could expect demonstrated small numbers of American Indian livestock producers at approximately 9%. Again, when comparing education levels with tolerance, there is no indication that American Indians are more or less tolerant of grizzly bears than their Caucasian counterparts; there simply is no statistically significant correlation. Caucasian livestock producers had a much larger number of respondents and

statistical significance, indicating that as education levels increased, tolerance for grizzly bears increased as well.

Sampling and Inferential Statistics

A major sampling factor came into account that was not anticipated at the outset of the research. After consultation with my graduate committee, and under the direction of my committee chairperson, I segregated the sample into to regions: west side and east side (Table 4). The benefit resulted in some eye-opening comparisons that should help future researchers and decision-makers: the primary consumers of this study. This adjustment in the research methodology improved the effectiveness of the data analysis to make it more applicable to local use. For instance, based upon a sizeable response rate, 55.4%, the computation clearly indicated that tolerance increased as education levels. However, when looking at livestock producers on the west side as compared to the east side, the result was much different. West side respondents were statistically significant whereas east side respondents were not. What this means in a practical sense would depend upon how consumers of the information would want to interpret the result. Certainly, these considerations might come into play when developing educational programs, information and outreach efforts, or training agency personnel that will be working with livestock producers.

The dividing of the sample into two regions had another benefit. By using t-tests, I was able to determine that differences existed between groups. I analyzed the data based upon two groups of individuals: those that had losses of livestock in the past five years and those that did not. When considering the dependent variable (tolerance), I

discovered that there was a significant difference between the “yes” respondents and the “no” respondents. The same t-test analysis was again applied to the same groups, but on a regional basis. Again, the difference between regional groups were statistically significant. The mean tolerance scores were significantly lower among the “yes” respondents, suggesting there may be some indication of less tolerance for grizzly bears from those individuals that experienced losses to grizzly bears. Again, the data seems to support what most ranchers and wildlife managers could tell you anyway. But now there is data that may support such conclusions. The t-test results seemed so compelling that I carried the data analysis another step forward. I entered livestock losses (yes/no) as an independent variable into the multiple regression analysis. The analysis was an attempt to determine if livestock losses were a predictor of tolerance. Based on the outcome of the computation, livestock losses could be regarded as a statistically significant predictor of tolerance.

Research Questions

Three research questions (hypotheses) were investigated. The data collection analysis rendered sufficient information to formulate conclusions about the research questions. Below is a restatement of each research question from chapter one, along with appropriate conclusions. Each statement is based on the research questions articulated in chapter one.

First Alternate Hypothesis—Formal Education

Simple regression analysis concludes that the null hypothesis is rejected. There is a linear relationship between the independent variable and the dependent variable. As education levels increase, tolerance levels also increase.

Second Alternate Hypothesis—Self-Initiated Education

No linear relationship exists between the independent variable and the dependent variable. Self-initiated education levels do not correlate, indicating that hours of self-initiated education did not influence tolerance.

Third Alternate Hypothesis—Financial Compensation

This hypothesis has two parts. First, the association between financial compensation for livestock losses only and the second part for livestock losses plus other associated costs. In the first part, two variables—compensation level for losses of livestock only (independent variable) and tolerance (dependent variable)—were correlated. There is a linear relationship between the independent variable and the dependent variable. As financial compensation levels for livestock losses increase, tolerance levels also increase. In the second part, two variables—compensation levels for losses of livestock plus other associated costs (independent variable) and tolerance (dependent variable)—were correlated. There is a linear relationship between the independent variable and the dependent variable. As financial compensation levels for livestock losses and other associated costs increase, tolerance levels also increase.

Multiple Regression Conclusion

Multiple regression was calculated using three independent variables (formal education, self-initiated education, and financial compensation) and the dependent variable (tolerance). The null hypothesis from chapter three states: There is no relationship between a linear combination of the variables (education, self-initiated education, and compensation) and tolerance for grizzly bears. The multiple regression outcome indicates statistical significance exists between formal education, financial compensation (for livestock only), and tolerance; thus, supporting the assertion that these two independent variables are the best predictors of tolerance. Self-initiated education was not statistically significant; therefore, supporting the assertion that it is not a predictor of tolerance. Additionally, financial compensation (for livestock and other associated costs) was found to be close to statistical significance, but not to the extent that it could be regarded as a predictor of tolerance when built into multiple independent variables.

Summary

Descriptive statistics and inferential statistics provided significant credibility to the role that education and financial compensation play in predicting livestock producers' tolerance for grizzly bears. Descriptive statistics gave a picture of the sample in terms of age, gender, ethnicity, years in business, type of business, and whether livestock production was their primary source of income.

Inferential statistics produced multiple benefits to the data analysis effort. As the data were viewed and reviewed, other significant—and previously overlooked—

components emerged as strong predictors of tolerance. Those two components were regional locale and livestock producer losses to grizzly bear predation. Additionally, inferential statistics helped conclude that three of the four research questions could be regarded as statistically significant predictors of tolerance.

Formal education was probably the most significant predictor of tolerance on the basis of the entire NCDE. However, on a regional basis, formal education was found not to be a predictor of tolerance on the east side of the NCDE. This analysis is probably the result of there being more livestock losses on the east side than the west side (Appendix C). Financial compensation, for both livestock losses and losses plus other associated costs, held strong statistical significance when viewed from bivariate and multivariate analyses.

Considerable effort was put into the literature survey to determine how, and from what resources, livestock producers learned about grizzly bears. This exercise was meritorious in effort but frustrating in results. As much as society credits ranchers for being motivated entrepreneurs and self-motivated learners, the numbers from data analysis did not support the hypothesis that self-initiated education about grizzly bears influenced tolerance in a positive way. Perhaps part of the reason for this result is in the nature of the questionnaire itself, in that, hours of self-initiated education is based on judgment whereas years of formal education is a pre-defined number. However, because there was a large response to the questionnaire survey, there emerged useful descriptive statistics to give sufficient information as to what learning resources were most often used.

Recommendations

Further Research

To the good fortune of the research effort, there were large numbers of returned questionnaires. Large numbers enhance opportunity for more accurate sample description, group comparisons, and prediction analysis. A certain amount of success is certainly suggestive of topics for further research. But prudent research should also suggest room for improvement. There are several suggestions that researchers may find valuable when looking at procedure, replication or new research questions to ponder. Below is a breakdown of each area for consideration.

Procedural Adjustments. Whereas, the population and sample investigated were strictly confined to livestock producers, there is room for comparison by integrating other populations, such as recreationists, general public, or hunting and fishing outfitters. Another adjustment may be to integrate more qualitative investigative (interviews) into the research. Montag and Patterson (2001) included the general public and interview procedures into their three-state study for livestock compensation. Since self-initiated education was a variable that did not correlate with anything, it seems feasible to look at other ways of measuring self-initiated education, or defining self-initiated education in another way.

Replication. Because of the response rate (55.4%) from livestock producers, this study would be a good candidate for replication. It would be a substantial contribution to the literature to compare research results with another sampling from the same

population. The livestock industry is not as demographically dynamic as other businesses; concluding, that the population should be rather stable and available for years to come. Even on a piecemeal basis, the study provides a systematic procedure for gathering simple descriptive data. Researchers could replicate the study for a more focused search effort at gathering inferential data that specifically targets formal education. Formal education is such a strong predictor of tolerance that it should undergo additional critique from multiple perspectives.

New Questions. A number of options could be put into some very innovative research designs. Some suggestions would include the following.

1. How do livestock producer education levels influence decision-makers as they consider the development of educational programs for grizzly bear management?

2. Are livestock losses a significant predictor of tolerance, as this study suggests? How can that determination be made?

3. Self-initiated education seems to fit ranching livelihoods very well. But hours of self-initiated education did not correlate with any other variable. Why not? Is it an absurdity to think that ranchers spend time learning about grizzly bears? Was the question in the questionnaire too unpractical to understand? Were responses more geared toward whether ranchers liked or disliked grizzly bears? Would a focus group or interview procedure be more appropriate as a prelude to trying to quantify self-initiated education?

Chapter Summary

As grizzly/rancher conflicts arise, there is an increased demand for conflict resolution. The whole realm of resolution strategies range from education and outreach to garbage removal and hunter education. The focus of this chapter—and the entire study—has been on the livestock producer. The challenge of the study has been to correlate tools (variables) that might move that livestock producer—a huge contributor to grizzly bear habitat—to becoming a more tolerant person. Since the literature suggests that tolerance is a difficult term to define, it is further compounded by being a moving target. Depending on conflicts that have directly or indirectly affected a particular livestock producer, one could expect a shift in tolerance.

It is the practice of research to try and isolate and test a variable (as best as possible) that is not influenced by other variables. In the ideal world—let's say, in a laboratory setting—that may be possible using an experimental group and a control group. In the social science field, such settings are rare and could be argued as creating an artificial environment. It was the intent of this study to try to measure variables in terms of correlating trends. Regression analysis will not tell you if one livestock producer is more tolerant than another, but regression analysis will give you a statistical indication as to whether trends, for instance, toward increasing formal education levels of the sample, results in increasing tolerance levels of the sample. Of course the opposite may occur or there may be no correlation at all, as was the case with the self-initiated education variable.

To the researcher, the beneficial use of regression statistics means that what occurs in the sample can be generalized to the larger population. For instance, the research suggests that if education correlates with tolerance in a sample of 388 livestock producers, then the same correlation should apply to the larger population of 1,065 livestock producers in or near the NCDE. Statistical procedures do not imply reality for all consumers of the research. Statistics do not imply exactness or total truth, but rather statistics tell you the probability of being wrong.

Conclusion

The research question asked whether a relationship existed between education levels and financial compensation to livestock producers living in or near the NCDE and tolerance for grizzly bears. Analysis revealed there was a positive linear relationship between years of formal education and tolerance. However, analysis also revealed there was no relationship between hours of self-initiated education and tolerance. The analysis of financial compensation, as related to tolerance, produced positive results. Both financial compensation for losses of livestock only and losses of livestock plus associated costs indicated a positive linear relationship to tolerance.

Additionally, when examining livestock losses sustained by producers on the west side of the NCDE separately from losses by producers on the east side of the NCDE, there remained a positive relationship to tolerance with west side producers and no relationship between losses and tolerance by producers on the east side. It appears that

because there are more losses of livestock on the east side, there is less tolerance for grizzly bears.

For consumers of the study, the research results appear to be useful for those who manage grizzly bears and provide education and outreach to livestock producers in grizzly bear habitat. Additionally, the research appears to be useful in curriculum development and to those practitioners involved in information, education, and outreach to livestock producers as well as the recreating public.

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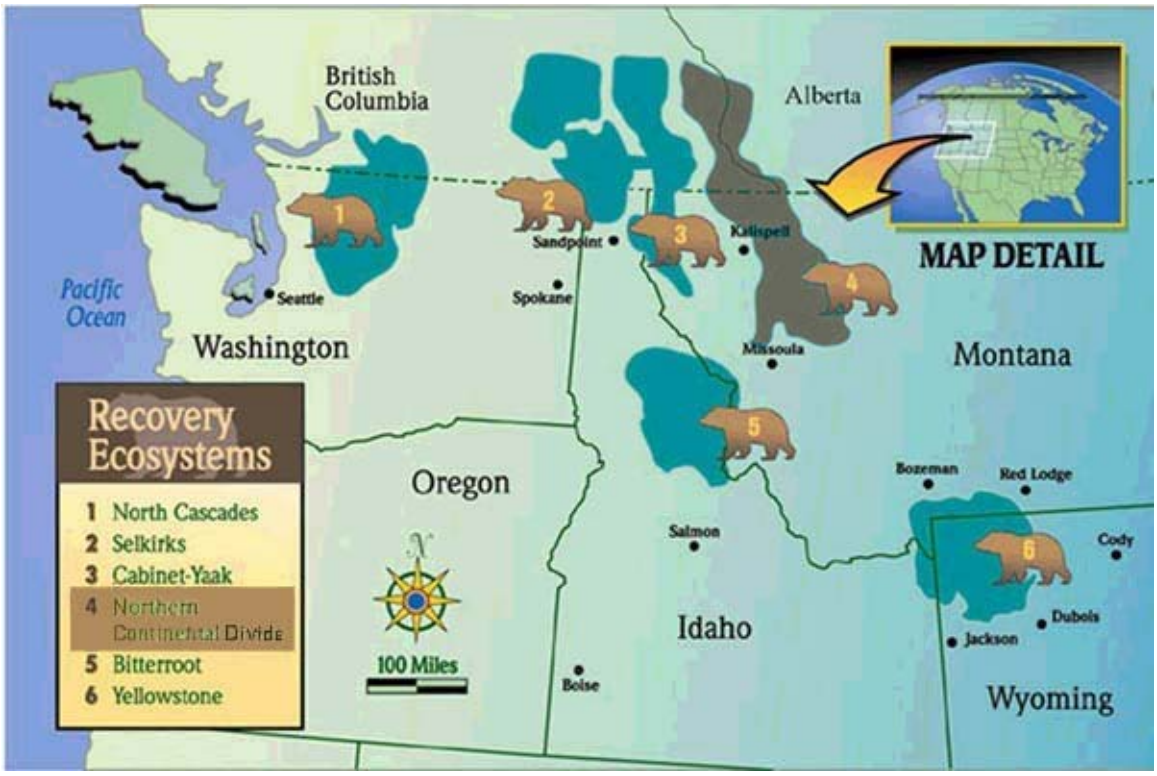
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APPENDICES

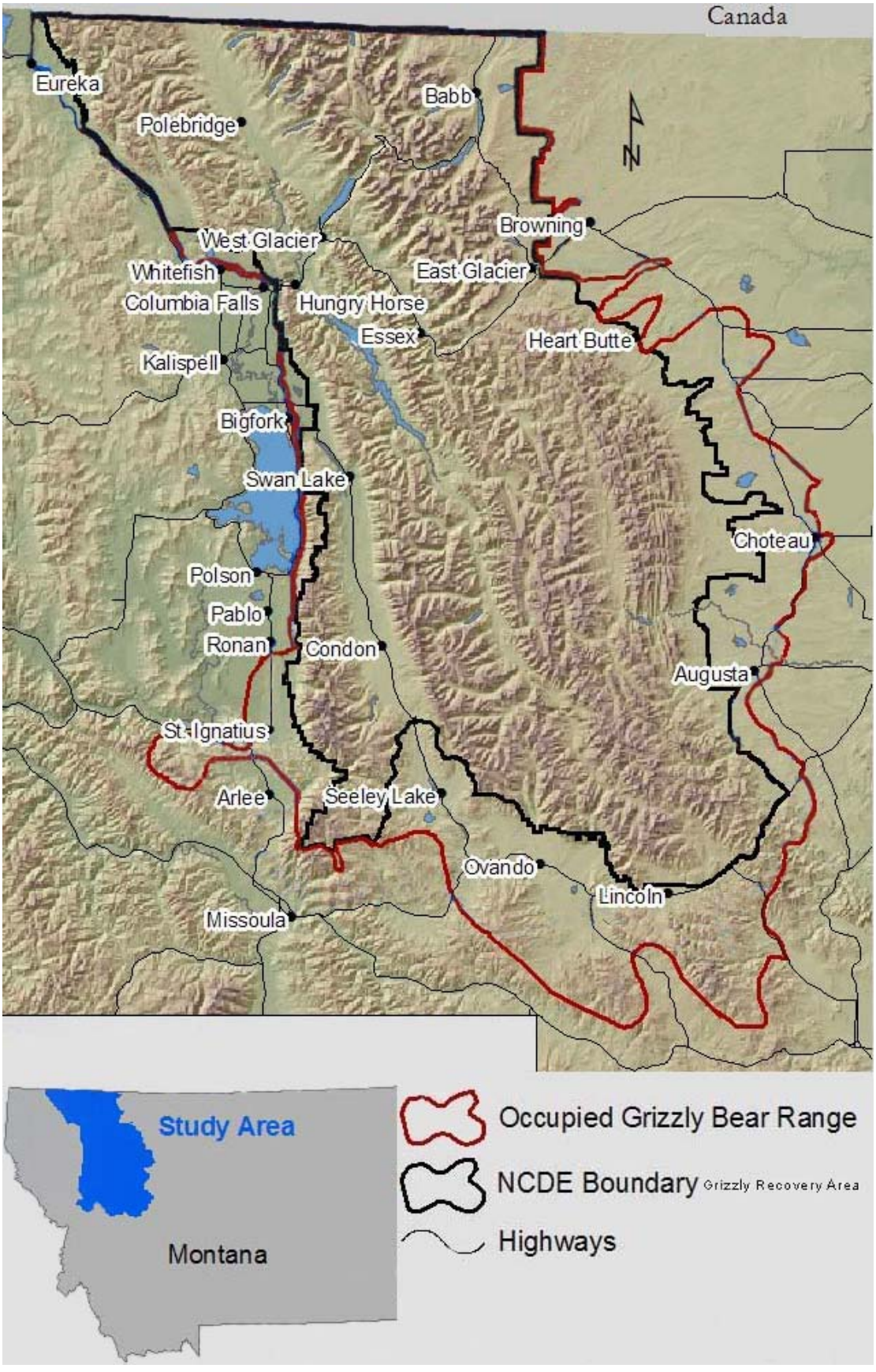
APPENDIX A

RECOVERY ECOSYSTEMS


British Columbia
Alberta
MAP DETAIL
Pacific Ocean
Seattle
Washington
Sandpoint
Spokane
Kalispell
Missoula
Montana
Recovery Ecosystems
1 North Cascades
2 Selkirks
3 Cabinet-Yaak
4 Northern Continental Divide
5 Bitterroot
6 Yellowstone
Oregon
100 Miles
Salmon
Boise
Idaho
Bozeman
Red Lodge
Cody
Dubois
Jackson
Wyoming

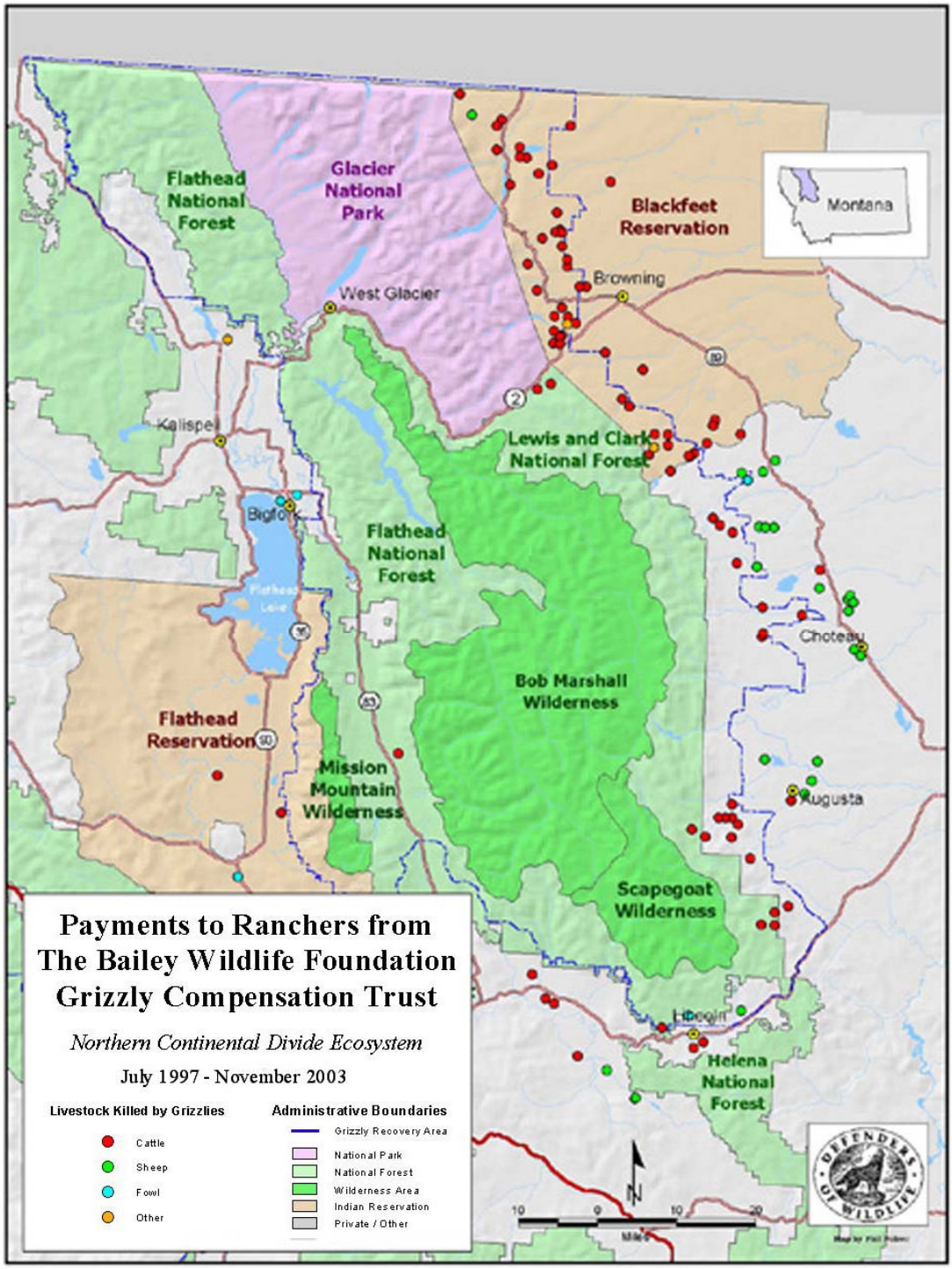
APPENDIX B

MAP DELINEATING THE NCDE GRIZZLY BEAR RECOVERY AREA


Canada
Eureka
Polebridge
Babb
West Glacier
Whitefish
Columbia Falls
Hungry Horse
Essex
Kalispell
Bigfork
Swan Lake
Polson
Pablo
Ronan
Condon
St. Ignatius
Arlee
Seeley Lake
Missoula
Ovando
Lincoln
Browning
East Glacier
Heart Butte
Choteau
Augusta
Study Area
Montana
Occupied Grizzly Bear Range
NCDE Boundary
Grizzly Recovery Area
Highways

APPENDIX C

PAYMENTS TO RANCHERS FROM THE BAILEY WILDLIFE FOUNDATION


Flathead National Forest
Glacier National Park
Blackfeet Reservation
Montana
West Glacier
Browning
Kalispell
Lewis and Clark National Forest
Bigfork
Flathead National Forest
Flathead Lake
Choteau
Bob Marshall Wilderness
Flathead Reservation
Mission Mountain Wilderness
Augusta
Scapegoat Wilderness
Helena National Forest
Payments to Ranchers from The Bailey Wildlife Foundation Grizzly Compensation Trust
Northern Continental Divide Ecosystem
July 1997 - November 2003
Livestock Killed by Grizzlies
Cattle
Sheep
Fowl
Other
Administrative Boundaries
Grizzly Recovery Area
National Park
National Forest
Wilderness Area
Indian Reservation
Private / Other
N
Miles

APPENDIX D

WESTERN MONTANA COUNTIES


WESTERN MONTANA COUNTIES
LINCOLN
FLATHEAD
GLACIER
TOOLE
LIBERTY
HILL
PONDERA
SANDERS
LAKE
TETON
CHOUTEAU
LEWIS
AND
CLARK
CASCADE
MINERAL
MISSOULA
POWELL
JUDITH
BASIN
MEAGHER
GRANITE
BROAD-
WATER
RAVALLI
DEER
LODGE
JEFFERSON
SILVER
BOW
GALLATIN
BEAVERHEAD
MADISON
PARK
Northern Continental Divide Ecosystem
Occupied Grizzly Bear Range

APPENDIX E

FINAL QUESTIONNAIRE

LIVESTOCK PRODUCER QUESTIONNAIRE

Do not write in this area ------>	Date recd:	Sequential #

PART I - RESPONDENT INFORMATION

For the purpose of this questionnaire, a <u>livestock producer is defined</u> as: A person (individual, partnership, corporation) that has sales – or expects this year to have sales – of livestock (cattle, sheep) and/or honey in the amount of $1000 or more per year.

1. Are you a livestock producer according to the above definition? (circle) a. Yes b. No
   (Note: Even if your response is "no" please complete those questions that pertain to you in Part I, and all questions in Parts II, III, and IV; and return the questionnaire)

2. Is livestock production your primary source of income? (circle) a. Yes b. No

3. What type of livestock production are you primarily engaged? (circle)
   a. Cattle b. Sheep c. Beekeeping

4. In which county or counties are you a livestock producer? _____

5. How many years have you been a livestock producer in your principle county? Years _____

6. Your business is (circle):
   a. individually owned b. partnership c. corporation d. other (describe) _____

7. Gender of person to whom this questionnaire was mailed (circle): a. Male b. Female

8. Your ethnicity (circle): a. African-American b. American Indian c. Asian d. Caucasian
   e. Hispanic f. Other_____

9. Your age _____

10. Highest grade attained (circle one)

1 2 3 4 5 6 7 8 9 10 11 12	13 14 15 16	17 18 19 20 21 22 23 24
(elementary / high school)	(college)	(graduate school)

11. Degree(s) received (circle all that apply):
    2-yr associate bachelor's master's doctorate Other (specify)_____

(Continued on back side)

Part II

12. Rate your knowledge about grizzly bears. (Circle a number for each item below)

	None	Low	Moderate	High	Expert
a. Habitat	1	2	3	4	5
b. Feeding habits	1	2	3	4	5
c. Travel patterns	1	2	3	4	5
d. Management	1	2	3	4	5
e. Economic impact	1	2	3	4	5
f. Public issues	1	2	3	4	5
g. Public policy	1	2	3	4	5

13. How did you acquire your knowledge about grizzly bears? (Check (√) all the resources that apply)

- □ a. School: K – 12
- □ b. School: College
- □ c. Newspaper
- □ d. TV news
- □ e. Radio news
- □ f. Educational TV
- □ g. County government official(s)
- □ h. State government official(s)
- □ i. Federal government official(s)
- □ j. Personal observation
- □ k. Fiction books (novels, etc)
- □ l. Scientific book (textbook, etc.)
- □ m. Public meetings
- □ n. Professional meetings
- □ o. Private organization that generally favors grizzlies
- □ p. Private organization that generally does not favor grizzlies
- □ q. Professional magazine
- □ r. Popular magazine
- □ s. Internet
- □ t. Visiting with ranchers
- □ u. Museum
- □ v. Zoo
- □ w. Other (specify) _____

14. With the above resources in mind, how much time in the PAST 5 YEARS have you spent educating yourself about grizzlies?

Total number of hours _____

15a. In the past 5 years have you received compensation for livestock losses due to grizzly bear predation? (circle). a. Yes b. No

15b. If you answered "yes" to the previous question, please indicate losses for the past 5 years for which compensation was received:

	# Cows		# Calves		# Sheep
a		b		c	

16a. In the past 5 years have you sustained livestock losses due to grizzly bear predation but did NOT apply for compensation? (circle) a. Yes b. No

16b. If you answered "yes" to the previous question, please indicate losses for the past 5 years for which compensation was NOT requested:

	# Cows		# Calves		# Sheep
a		b		c	

Part III

17. Regardless of any property damage you may or may not have received because of grizzly activity, what do you feel is FAIR financial compensation for LIVESTOCK (only) destroyed by grizzlies? (check (√) one):

- □ a. ½ of Fall market value of the livestock destroyed
- □ b. Fall market value of the livestock destroyed
- □ c. 1 ½ times the Fall market value of the livestock destroyed
- □ d. 2 times the Fall market value of the livestock destroyed
- □ e. 2 ½ times the Fall market value of the livestock destroyed
- □ f. 3 times the Fall market value of the livestock destroyed
- □ g. 3 ½ times the Fall market value of the livestock destroyed
- □ h. 4 times the Fall market value of the livestock destroyed
- □ i. Other amount (specify) _____

18. What do you feel is FAIR financial compensation for LIVESTOCK DESTROYED and OTHER associated costs when livestock are destroyed by grizzlies (check (√) one):

- □ a. ½ of Fall market value of the livestock destroyed
- □ b. Fall market value for the livestock destroyed
- □ c. 1 ½ times the Fall market value of the livestock destroyed
- □ d. 2 times the Fall market value of the livestock destroyed
- □ e. 2 ½ times the Fall market value of the livestock destroyed
- □ f. 3 times the Fall market value of the livestock destroyed
- □ g. 3 ½ times the Fall market value of the livestock destroyed
- □ h. 4 times the Fall market value of the livestock destroyed
- □ i. Other amount (specify) _____

(Continued on back side)

Part IV

Please place an "x" in the appropriate box below:
(**SD**=Strongly Disagree, **D**=Disagree, **N**=Neutral, **A**=Agree, **SA**=Strongly Agree)

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	1 **SD**	2 **D**	3 **N**	4 **A**	5 **SA**
19. In order to prevent grizzly/livestock conflicts, I suggest that grizzly bears that are near livestock be relocated.					
20. In order to prevent grizzly/livestock conflicts, I suggest that grizzly bears near livestock be killed.					
21. I feel that all natural resources should be developed even if it results in a much smaller grizzly bear population.					
22. I maintain that using grass land for livestock production should be done in ways that mutually benefit livestock and grizzly bears.					
23. I agree that grizzly bears should be eliminated from private property in all circumstances.					
24. Regardless of whether livestock producers are compensated, I don't think livestock should be raised to feed bears.					
25. Illegal killing of grizzly bears should result in stiff fines and, if done repeatedly, I would recommend that prison sentences be imposed.					
26. It is my opinion that the government (state and federal) should spend very little time and money trying to educate the public about grizzly bear issues and problems.					
27. As long as the public doesn't criticize the way I make a living, I can tolerate grizzly bears.					
28. When livestock producers use preventative measures (electric fencing, herding, attractant removal, etc.) and a grizzly still depredates, I would insist that the bear be killed immediately.					
29. I can tolerate grizzly bears as long as they do not pose an economic threat to my livelihood.					
30. I would be willing to not graze livestock in certain areas when grizzlies are using those areas at certain times of the year.					
31. Do not write in this space ----------→					

THANK YOU! Please use the self-addressed stamped envelope and return to:
John Vollertsen, P.O. Box 5194, Bozeman, MT 59717

APPENDIX F

SELF-INITIATED EDUCATION RESOURCES

Author(s) / Date	**Resource from Literature**	**Adaptation to Questionnaire**
(Anderson et al., 2003; Brody et al., 2002; Crane, 1994; Dierking et al., 2003; Eveland et al., 1998; Gibbons & Phillips, 1982)	Formal education	School: K—12
		School: College
(Crane, 1994; Dierking et al., 2003; Miller, 2001)	Newspapers	Newspaper
(Crane, 1994; Dierking et al., 2003; Miller, 2001)	Radio	Radio news
(Chen, 1994; Dhingra, 2003; Dierking et al., 2003; Eveland et al., 1998; Falk & Adelman, 2003; Rennie et al., 2003; West & Pines, 1985)	Television	TV news
		Educational TV
(Crane, 1994; Dhingra, 2003; Eveland et al., 1998; Miller, 2001)	Magazines	Professional magazine
		Popular magazine
(Dierking et al., 2003; Falk & Adelman, 2003; Pautler et al., 2001;	Internet	Internet
(Anderson et al., 2003; Gibbons & Norman et al., 1980)	Officials, Professionals	County government official(s)
		State government official(s)
		Federal government official(s)
(Anderson et al., 2003; Gibbons & Bailey et al., 1980; Gibbons & Norman et al., 1980; Knowles, 1975)	Discussions with others, Interactions	Visiting with ranchers
(West & Pines, 1985; Gibbons & Bailey et al., 1980; Gibbons & Norman et al., 1980; West & Pines, 1985)	Observing	Personal observation

(Continued on Next Page)

Author(s) / Date	**Resource from Literature**	**Adaptation to Questionnaire**
(Crane, 1994; Dierking et al., 2003; Gibbons & Norman et al., 1980; Rennie et al., 2003)	Books	Fiction books (novels, etc)
		Scientific book (textbook, etc.)
(Crane, 1994; Dierking et al., 2003; Falk & Adelman, 2003; Rennie et al., 2003)	Community-based education	Public meetings
		Professional meetings
(Crane, 1994; Dierking et al., 2003; Falk & Adelman, 2003; Gibbons & Norman et al., 1980; Rennie et al., 2003)	Organizations, Community-based organizations	Private organization that generally favors grizzlies
		Private organization that generally does NOT favor grizzlies
(Anderson et al., 2003; Brody et al., 2002; Crane, 1994; Dierking et al., 2003; Eveland et al., 1998; Miller, 2001; Rennie et al., 2003;	Museums	Museum
(Anderson et al., 2003; Brody et al., 2002; Crane, 1994; Rennie et al., 2003)	Zoos	Zoo

APPENDIX G

PILOT QUESTIONNAIRE

GRIZZLY SURVEY Park County

Do not write in this area ------>	I.D.:	Date recd:

RESPONDENT INFORMATION

Gender of person to whom this questionnaire was mailed (circle): Male Female
Ethnicity (circle): African-American American Indian Asian Caucasian Hispanic Other_____
Age (circle one): (13-19) (20-30) (31-40) (41-50) (51-60) (61-70) (71-80) (81+)
Are you a livestock producer? Yes No
Is livestock production your primary source of income? Yes No
How many years as a livestock producer in this county? Years _____

FORMAL EDUCATION

Highest grade attained (circle one) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
(elementary / high school) (college) (graduate school)

Degree(s) received (circle all that apply) 2-yr associate bachelor's master's
doctorate Other (specify)_____

SELF-EDUCATION

In the PAST 1 YEAR, I have educated myself about grizzlies to the following extent (circle one):

(less than 1 hour) (1-5 hrs) (5-10 hrs) (10-15 hrs) (15-20 hrs) (20-25 hrs) (25-30 hrs)

(30-35hrs) (35-40 hrs) (40-45 hrs) (45-50 hrs) (50-75 hrs) (75-100 hrs) (over 100 hrs)

In the PAST 6 YEARS, I have educated myself about grizzlies to the following extent (circle one):

(less than 1 hour) (1-5 hrs) (5-10 hrs) (10-15 hrs) (15-20 hrs) (20-25 hrs) (25-30 hrs)

(30-35hrs) (35-40 hrs) (40-45 hrs) (45-50 hrs) (50-75 hrs) (75-100 hrs) (over 100 hrs)

(Continued on back side)

Rate your knowledge level about grizzlies. (Circle a number for each item below)

	None	Low	Moderate	High	Expert
Habitat	1	2	3	4	5
Feeding habits	1	2	3	4	5
Travel patterns	1	2	3	4	5
Management of grizzlies	1	2	3	4	5
Economic impact	1	2	3	4	5
Public issues	1	2	3	4	5
Public policy	1	2	3	4	5

How did you acquire your knowledge about grizzlies? (Check (√) all that apply)

☐ School: K – 12
☐ School: College
☐ Newspaper
☐ TV news
☐ Radio news
☐ Educational TV
☐ County government official(s)
☐ State government official(s)
☐ Federal government official(s)
☐ Personal observation
☐ Fiction books (novels, etc)
☐ Scientific book (textbook, etc.)
☐ Public meetings
☐ Professional meetings
☐ Private organization that generally favors grizzlies
☐ Private organization that generally DOES NOT favor grizzlies
☐ Professional magazine
☐ Popular magazine
☐ Internet
☐ Visiting with ranchers
☐ Other (specify) _____

COMPENSATION

Regardless of any property damage you may or may not have received because of grizzly activity, what do you feel is FAIR monetary compensation for LIVESTOCK (ONLY) destroyed? (check (√) one):

- ☐ ½ of full market value of the livestock destroyed
- ☐ full market value of the livestock destroyed
- ☐ 1 ½ times the full market value of the livestock destroyed
- ☐ 2 times the full market value of the livestock destroyed
- ☐ 2 ½ times the full market value of the livestock destroyed
- ☐ 3 times the full market value of the livestock destroyed
- ☐ 3 ½ times the full market value of the livestock destroyed
- ☐ 4 times the full market value of the livestock destroyed
- ☐ Other amount (specify) _____

Regardless of any property damage you may or may not have received because of grizzly activity, what do you feel is FAIR monetary compensation for LIVESTOCK DESTROYED and OTHER associated costs when livestock are destroyed? (check (√) one):

- ☐ ½ of full market value of the livestock destroyed
- ☐ full market value for the livestock destroyed
- ☐ 1 ½ times the full market value of the livestock destroyed
- ☐ 2 times the full market value of the livestock destroyed
- ☐ 2 ½ times the full market value of the livestock destroyed
- ☐ 3 times the full market value of the livestock destroyed
- ☐ 3 ½ times the full market value of the livestock destroyed
- ☐ 4 times the full market value of the livestock destroyed
- ☐ Other amount (specify) _____

(Continued on back side)

TOLERANCE

Please place an "x" in the appropriate box below:
(**SD**=Strongly Disagree, **D**=Disagree, **N**=Neutral, **A**=Agree, **SA**=Strongly Agree)

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	SD	D	N	A	SA
Generally, livestock producers with more formal education are more tolerant of grizzlies.					
I feel my formal education level has a lot to do with my TOLERANCE of grizzlies.					
I feel my formal education level has a lot to do with my INTOLERANCE of grizzlies.					
(Do not write in the boxes to the right in this row) ---------->					
Generally, livestock producers with more self-education are more tolerant of grizzlies.					
I feel my self-education has a lot to do with my TOLERANCE of grizzlies.					
I feel my self-education has a lot to do with my INTOLERANCE of grizzlies.					
(Do not write in the boxes to the right in this row) ---------->					
I feel that livestock producers that have livestock destroyed because of grizzly activity should be LESS tolerant of grizzlies.					
I feel that livestock producers that have livestock destroyed because of grizzly activity, AND are compensated fairly for livestock ONLY, should be MORE tolerant of grizzlies.					
I feel that livestock producers that have livestock destroyed because of grizzly activity, AND are compensated fairly for ALL livestock AND associated costs when livestock are destroyed, should be MORE tolerant of grizzlies.					
(Do not write in the boxes to the right in this row) ---------->					

WITHIN 2 DAYS after receiving, please return this survey to:

John Vollertsen, P.O. Box 5194, Bozeman, MT 59717 (Please use self-addressed stamped envelope)

Thank you !!

APPENDIX H

COUNTIES AND CITIES IN OR NEAR NCDE

COUNTIES AND CITIES IN OR NEAR NCDE

FLATHEAD	Bigfork Columbia Falls Kalispell Lakeside Whitefish
GLACIER	Babb Browning East Glacier Heart Butte
LAKE	Arlee Charlo Pablo Polson Ravalli Ronan Saint Ignatius
LEWIS & CLARK	Augusta Helena Lincoln Wolf Creek
LINCOLN	Eureka Fortine Rexford Trego
MISSOULA	Arlee*
PONDERA	Dupuyer Heart Butte Valier
POWELL	Avon Helmville Ovando
TETON	Bynum Choteau Fairfield** Great Falls*** Pendroy
*Addresses at Arlee (Lake Co.), operate in Missoula Co. **One Fairfield address ***Address at Great Falls (Cascade Co.), operates in Teton Co.	

APPENDIX I

QUESTIONS FOR EXPERT VALIDITY

Questions for Livestock Producers

Are the questions understandable?

Are there any questions you think livestock producers would be uncomfortable answering?

Other Comments?

Questions for Tribal Officials

Do you think the data from the questionnaire are usable to decision-makers involved in grizzly bear management?

Do you think the data from the questionnaire are usable for educational purposes?

Does the questionnaire provide questions that delineate (quantitatively) differences of tolerance between Native American and non Native American people when considering their regard for grizzly bears?

Are there any parts of the questionnaire that may not be culturally sensitive?

Other comments?

Questions for Government Officials

Do you think the data from the questionnaire are usable to decision-makers involved in grizzly bear management?

Do you think the data from the questionnaire are usable for educational purposes?

Do you think the questions are written clearly?

Other comments?

APPENDIX J

KNOWLEDGE RATING

Questionnaire, part II, question 12, Self-rated knowledge about grizzly bears. Below are tables with data analysis. Ratings: 1 (no knowledge) through 5 (expert).

Key to terminology used in tables:

Frequency = Number of respondents with that rating
Mean = Average rating
Median = Middle rating
Missing or Missing System = Respondents did not rate for that category
Mode = Most common rating
Percent = Percent of the total
Valid Percent = Percent of those that reported

Statistics

	Habitat	Feeding Patterns	Travel Patterns	Manage -ment	Economic Impact	Public Issues	Public Policy
Valid	379	383	381	379	381	380	378
Missing	9	5	7	9	7	8	10
Mean	3.30	3.24	2.99	2.87	3.07	3.14	3.05
Median	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Mode	3	3	3	3	3	3	3

Rate Habitat

Rating		Frequency	Percent	Valid Percent
	1	6	1.5	1.6
	2	30	7.7	7.9
	3	196	50.5	51.7
	4	137	35.3	36.1
	5	10	2.6	2.6
	Total	379	97.7	100.0
	Missing System	9	2.3	
Total		388	100.0	

Rate Feeding Patterns

Rating		Frequency	Percent	Valid Percent
	1	6	1.5	1.6
	2	42	10.8	11.0
	3	199	51.3	52.0
	4	126	32.5	32.9
	5	10	2.6	2.6
	Total	383	98.7	100.0
	Missing System	5	1.3	
Total		388	100.0	

Rate Travel Patterns

Rating		Frequency	Percent	Valid Percent
	1	12	3.1	3.1
	2	89	22.9	23.4
	3	182	46.9	47.8
	4	88	22.7	23.1
	5	10	2.6	2.6
	Total	381	98.2	100.0
	Missing System	7	1.8	
Total		388	100.0	

Rate Management

Rating		Frequency	Percent	Valid Percent
	1	25	6.4	6.6
	2	88	22.7	23.2
	3	185	47.7	48.8
	4	72	18.6	19.0
	5	9	2.3	2.4
	Total	379	97.7	100.0
	Missing System	9	2.3	
Total		388	100.0	

Rate Economic Impact

Rating		Frequency	Percent	Valid Percent
	1	13	3.4	3.4
	2	87	22.4	22.8
	3	161	41.5	42.3
	4	101	26.0	26.5
	5	19	4.9	5.0
	Total	381	98.2	100.0
	Missing System	7	1.8	
Total		388	100.0	

Rate Public Issues

Rating		Frequency	Percent	Valid Percent
	1	13	3.4	3.4
	2	62	16.0	16.3
	3	178	45.9	46.8
	4	111	28.6	29.2
	5	16	4.1	4.2
	Total	380	97.9	100.0
	Missing System	8	2.1	
Total		388	100.0	

Rate Public Policy

Rating		Frequency	Percent	Valid Percent
	1	16	4.1	4.2
	2	74	19.1	19.6
	3	173	44.6	45.8
	4	106	27.3	28.0
	5	9	2.3	2.4
	Total	378	97.4	100.0
	Missing System	10	2.6	
Total		388	100.0	

APPENDIX K

RESOURCES FOR ACQUIRING KNOWLEDGE

Questionnaire, Part II, Question 13, Resources for Acquiring Knowledge about Grizzly Bears

Resources for Knowledge	**Number Selected**
School: K-12	93
School: College	53
Newspaper	232
TV news	189
Radio news	154
Educational TV	116
County government official	72
State Gov Official	141
Federal government official	135
Personal observation	277
Fiction books	14
Scientific books	75
Public meetings	116
Professional meetings	64
Private Org that favors grizzlies	65
Private Organization that not favors grizzlies	75
Professional magazine	49
Popular magazine	44
Internet	16
Visiting with ranchers	236
Museum	25
Zoo	15
Other - Tribal government official	9