# ARE LARGE PREDATORS VITAL TO OUR ECOSPHERE?: INSTITUTIONAL ANTI-PREDATOR POLICY BIAS IN ELEVEN WESTERN STATES AND RECOMMENDATIONS FOR IMPLEMENTING ETHICAL CHANGES IN LARGE MAMMAL PREDATOR MANAGEMENT POLICIES IN A CHANGING LANDSCAPE

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By

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ABSTRACT

This thesis examines the predator management policies of eleven Western States as they compare to the management policies of non-predatory game mammals. I measured for bias by determining the minimum number of discrete actions required for the legal take of each mammal under study. The results yielded qualitative numeric values indicating consistent bias against predatory mammals.

I included discussions of trophic influences imparted by large mammalian predators on ecosystems, prehistorical (i.e., Clovis-era 13,000 years ago) and historical origins of anti-predator bias, historical and present-day state predator management policies, emerging multi-disciplinary policies, and suggestions for future policies based on environmental and animal rights concerns from an ethical perspective.

My findings indicate both ethical and unethical biases within existing state wildlife management policies. I offer suggestions for creating predator management policies that are both ethical and take into account the necessary public safety issues that are increasingly more relevant due to an ever-expanding urban-wild interface.

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At the outset, I would like to extend my sincerest appreciation to Bob Voeks for serving as my Thesis Committee Advisor. My original advisor, Al Flores, took ill and was unable to continue, and Bob was willing to step into Al's shoes—without reservation. My greatest hopes are with Al and his family for a full recovery. When I last saw him, he had the heart of a tiger, and that warmed my Spirit. I also want to offer my appreciation to Mike Horn and Steven James for serving on my Thesis Committee. I feel fortunate to have become acquainted with all of these men.

I also want to tell my wife, Glynis, how much I appreciate both her technical support—I am a computer dinosaur—especially when it came to formatting this thesis and her emotional support. I want to thank my daughter, Alexis, for putting up with "daddy" being absent for some of the weekend trips to the park and for my occasional "gruff" demeanor. I am not sure the latter will change, but the former will. The embryonic origins for my final thesis originated prior to her birth almost three years ago, but my efforts have been invigorated by her presence—I wanted, and still intend, to fight for the just treatment of our Ecosphere even though the results may not be seen by my eyes. She will act as my future eyes: I can live with that.

My mom has always supported higher education, and she has been keeping vigilance over my progress. I thank her for contributing a new laptop computer to simplify my work. My mom doesn't always share my enthusiasm for large, mammalian predator interactions, but that has never prevented her enthusiastic involvement in my work.

My Uncle Mort was very interested in reading my finished thesis. I am disappointed that he will never have the opportunity: He passed away peacefully in the spring of 2006. I think he would have enjoyed arguing about it with me: We have the kind of family that debates everything, which I believe is quite healthy. I will continue to incorporate this philosophy into the remainder of my life—both professionally and within our family. My Uncle Shirl has always been willing to read my work and be very honest in his feedback to me. He offered feedback and advice that was invaluable during the early writing of this thesis.

Last, I would like to thank all of the state wildlife management policy officials who were willing to help me when I needed clarification of particular statutes or procedures. Lloyd Dorsey of the Greater Yellowstone Coalition was very helpful in his recommendations of Wyoming state wildlife management officials to consult. I have identified all contributors within the body of the thesis, so I will not list them here.

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# CHAPTER 1

# INTRODUCTION

## Purpose

Encompassing the long history of *Homo sapiens sapiens* is the interaction between humans and the non-human animals that share their respective ecosystems. At times these interactions provided benefits to the major stakeholders in that humans fulfilled their *needs*, while non-human animals incurred sustainable losses that were, at worst, benign or perhaps, at best, were contributory to their viability as a species. At other times, due to a variety of reasons, human impacts decreased species viability and, ultimately, required humans to resort to different strategies to maintain their *needs* and, later, their *wants*.

In the title of this thesis, I ask if large (coyote-sized and larger) predators provide benefits to their respective ecosystems and, in the larger context, to the Ecosphere. The implied question is also important: if animals that occupy higher trophic levels are beneficial, then are not the other animate and the inanimate portions benefited as well? I believe that large predators interact with the ecosystem so as to benefit a wide variety of floral and faunal life as well as

the inanimate components of some ecosystems, and much of the literature I have reviewed consistently provides evidence to support this assertion. In spite of this, there are multiple existing factors that, if left unchecked, may lead to diminished numbers of these valuable members of our trophic web. Landscape-scale changes (e.g., habitat fragmentation, degradation, and loss) are most often cited as the proximal cause of the decline of large mammalian predators and their loss of viability; this is explained by the fact that large predators require larger home ranges than their smaller counterparts. The temporal scope I utilize to discuss these changes is broad: I address these changes from the pre-Clovis and Clovis-era to present day including discussions of the European colonization of North America, nineteenth century livestock issues, and twentieth century predator eradication programs and urbanization. Pre-Clovis peoples could include many cultures including the Nenana, which utilized a biface and blade industry out of Broken Mammoth site in Alaska. The case for the utilization of watercraft by Clovis-era cultures—as opposed to cultures utilizing Clovis-points—is probably best documented by human remains at the Arlington Spring site on Santa Rosa Island, California. The human remains on Santa Rosa Island were coeval with Clovis peoples; however, no artifacts were found at this site (Waters and Stafford 2007). There may have been a multi-cultural contingent inhabiting North America during the very Late Pleistocene and Holocene.

One cause I focus on in this thesis is the investigation of institutional anti-predator biases within state wildlife management policies. One purpose of this thesis is to demonstrate that, if anti-predator bias exists, it has existed for much longer than the anti-predator campaigns of the nineteenth and twentieth centuries. Pre-Clovis and Clovis hunters may have had significant interactions with predators that ultimately, over a significant time period, influenced present-day human attitudes toward predators and modern predator-management policies. The most likely transmission of these attitudes was through learned behaviors; it is also possible that a cultural and genetic component may have influenced these behaviors if this vertical and horizontal transmission of information did indeed transcend the ten millennia that separated early Native Americans and historic Anglo-Europeans. This argument is not without its share of conjecture, and I want to emphasize that I am presenting this argument because it makes intuitive sense to me. This portion of my discussion will not be without detractors as this topic is far from resolved. It is certainly reasonable to state that Anglo-Europeans brought their own set of behaviors that contributed to present day attitudes toward predatory mammals.

Ever since modern humans and their evolutionary antecedents have occupied landscapes with large predators, humans have rightly had an aversion to being eaten alive. Whether this aversion originates in our DNA, as from our *Homo sapiens* antecedents (i.e., *Homo erectus*)—although this "gene of fear" has not

been demonstrated to exist—or from culturally inherited behaviors such as from pre-Clovis and Clovis-hunters, the results tend to be similar. It is even possible that pre-Clovis and Clovis-hunters brought such a narrow genetic complement that their traits were directly inherited in the recent term (i.e., the last 13,000 years). These changes are not to be confused with the evolutionary "hard-wiring" that would likely have originated several hundreds of thousands to a million years ago or longer—if it did, indeed, occur at all.

*Homo sapiens* have good reasons to fear predators. I, for one, would not enjoy a face-to-face with a 550-pound Siberian tiger. At face value, this seems like common sense, does it not? I will argue that, while at certain times during *Homo sapiens* long history, this was a valuable survival instinct: present day human-predator interactions may not necessarily fall into the same category.

While pre-Clovis and Clovis-hunters were moving across the Bering Land Bridge—and, perhaps, utilizing ocean watercraft—and south into North, and later, South America, this attitude was not only reasonable, but necessary. But, what about the more recent immigration of Europeans into North America over the last five centuries? The Anglo-Europeans that immigrated into North America were exposed to a different kind of predator fear. European myths and the religious idea of Dominion entrenched in the Anglo-European people moving from east to west in North America seems to have a different basis in predator fear. As I will discuss, the earliest European settlers were motivated by the idea

of converting the "evil" of wilderness to the "good" of Lockian land conversion to pastoralism and agriculture. The fear of wilderness was initially manifest in the wars against Native Americans and then, eventually, to the next enemy of this "progress"—large, mammalian predators that affected the domestication of the landscape—especially the domestic animals that this pastoral-agricultural ideal enlisted—that is, domestic livestock.

I believe the coalescence of these additive fears of evolutionary, genetic, and cultural and behavioral origins created an anti-predator bias that is present in many of our institutional predator management policies to present day. The goal of this thesis is to investigate the idea that present day policies may not properly reflect the importance that top-chain predators exert upon our ecosystems. If this is indeed the case, the next logical step is to determine appropriate policies that consider all aspects of human-predator fears in juxtaposition with the benefits that predators impart upon our Ecosphere.

These benefits ought to be a factor when we formulate policies that address human-predator interactions. Of course, in the changing landscape inspired by human progress we must also consider the human components of these predator interactions—public safety, protection of property and livestock and the overall well-being of humans. Policies that attempt to address all of these components will be an important part of the conclusory discussions of this thesis.

However, before I embark on the body of the thesis, there are a few discussions the reader will encounter later that I will expand upon now to avoid confusion by elucidating their relevance before the fact.

Introductory comments regarding what constitutes a carnivore and a large predatory mammal must address the differences between taxonomic and trophic classifications. All of the animals I discuss in this thesis that display predatory behavior, except javelinas and feral pigs, are members of the order Carnivora: this is a taxonomic definition that groups all of the predators under discussion as carnivores. The trophic classification of these same animals often differs considerably from the taxonomic definition. While cougars (*Puma concolor*), bobcats (*Lynx rufus*), and lynx (*Lynx canadensis*) are obligate carnivores, grizzly bears (*Ursus arctos*), black bears (*Ursus americanus*), javelinas (*Pecari tajacu*), and coyotes (*Canis latrans*) are best classified as omnivores. Black bears are probably the most omnivorous of these species, and grizzly and black bears may practice strict herbivory during certain periods of their seasonal feeding cycles. Coyotes are highly opportunistic omnivores and will feed on disparate fare varying from berries to young deer and lambs. As coyotes enter into human-dominated landscapes, they will often feed on backyard fruits and human garbage. Javelinas and feral pigs (*Sus scrofa*) are very omnivorous and often may engage in more "carnivorous" trophic habits than some of the other species discussed above.

The distinction between small and large carnivores is nebulous as well. For the purposes of this thesis, I am considering a large carnivore as any mammal in the order Carnivora that is coyote-sized or larger. Many would consider coyotes medium-sized carnivores; however, when they are considered in the context of urban ecology (i.e., where they prey upon mesopredators like skunks, raccoons, opossums, and domestic or feral cats), they could be considered large carnivores in the trophic and regional sense. In some states this is a practical distinction, and in other states it may not appear to be a reasonable distinction. In California this distinction seems sensible since there are currently a relatively small selection of carnivores including cougars, bobcats, coyotes, and black bears. In Montana, Idaho, and Wyoming, however, coyotes could be considered small carnivores because of the extensive number of larger carnivores: grizzly and black bears, wolves, cougars, and bobcats. One might not consider bobcats or coyotes large carnivores in Montana, Idaho, or Wyoming; but, I am utilizing a uniform classification for all eleven Western States in spite of the arguments that can be made to the contrary. The purpose of this introductory distinction is for the reader to be mindful of the differences between taxonomic and trophic classification and the liberties I am exercising in making these classifications.

Another contentious discussion is Elin Whitney-Smith's Second-Order Predation (2OP) Hypothesis (2001, 2003b). I hope these introductory explanations will serve to elucidate the relevance of certain topics where

relevance may appear tangential. 2OP is a hypothesis that offers differing ideas regarding the Late Pleistocene Megamammal extinctions than the ones put forth by Paul Martin's overkill hypothesis (1984) and Donald Grayson's climate change hypothesis (2001), which are currently the most widely accepted, and disparate, theories in the literature. My reasons for discussing the Late Pleistocene extinctions is two-fold: (1) to introduce the 2OP hypothesis, which I believe presents a reasonable argument that large mammalian predators *may* have contributed significantly to the changing landscape of the Late Pleistocene; and, (2) to address the possibility that pre-Clovis, Clovis-era and Clovis-hunters may have been a genetic base for a significant contingent of progeny that inhabited the Western New World.

In addition, I believe it is important to distinguish between three possible sources of the human fear of large predators: (1) cultural/behavioral transmission—that is, vertical or intergenerational and horizontal or intragenerational transfer of information within tribes; (2) evolutionary (i.e., over hundreds of thousands or a million or more years); and, (3) genetic (i.e., the passage of genetic material already present in the original populating source). Currently, there is no proof of (2) or (3), and, therefore, these are completely speculative. In this thesis, the reader will encounter historical and prehistorical background information. I have already discussed some examples of this. The more current discussions of Anglo-European and American history serve two

functions: (1) they help to explain the view of "wilderness" that the Europeans brought to the New World; and, (2) they allow the reader to appreciate the landscape changes brought about by humans that have created many of the problems this thesis deals with. When I discuss Cooper and Parkman, I am hoping the reader can infer that these writers were primary observers of the changing Frontier landscape that affected the Native Americans and the ramifications that had on large mammalian predators. I will specifically discuss the effects these landscape-scale changes had on predators. Certain artists such as Thomas Moran, Albert Bierstadt, and others—who often traveled with explorers to document these changes—also offer some insight into these significant landscape changes.

The discussion of animal rights and environmental ethics advocates provides a basis for supporting ecosystems in as "natural state" as possible. From Thoreau to Muir to Leopold to Commoner to Rolston, it is apparent that the maintenance of ecosystem functions in their "natural state" takes center stage. This is important because large mammalian predators require large intact ecosystems in order to maintain viable population numbers and avoid extirpation or extinction. Given the trophic impact of large predators on the proper functioning of many ecosystems these discussions become relevant.

Past, present and future wildlife management policy rests on the foundation of the discussions that precede the wildlife management policy discussion in this

thesis. It is important to note that when I discuss cougars, I am discussing cougars as a proxy for all other large mammalian predators, many of which, in spite of some of their trophic differences, require similar landscape elements—namely, large swaths of *connected* land. One exception to this is the coyote, which has demonstrated the ability to exist in a wide variety of habitats.

So, to condense the previous discussion into a few key points, I want the reader to be attentive to the following: (1) is bias present in state management policies?; (2) the importance of predators in the trophic web; (3) the explanatory history of why humans behave the way they do towards predators; (4) the importance of animal rights and environmental ethics as a bridge between practice and policy; and, (5) the necessity of changes in predator management policies at the state level. With that introduction, I will proceed with the discussion.

While many scholars of North American anthropogenic environmental impacts refer to the European settlements in North America and their subsequent impacts as the beginning of irreversible environmental changes, the last several decades have produced scholars who are studying anthropogenic environmental impacts originating many millennia prior to the aforementioned settlements (i.e., approximately 13,000 years before present [BP]). The importance of these more recent investigations is two-fold: (1) human impacts on the environment have been in place far longer than previously considered; and, (2) humans have been

shaped by their interactions with other animals—for the purposes of this thesis, dangerous and competitive mammalian carnivores—for a sufficient time to allow present-day humans to perpetuate behaviors that their distant ancestors required for survival but that modern humans perpetuate under less dire circumstances (Anderson 2005; Barton, Schmick, and James 2004; Frison 1998; Gruhn and Bryan 1984; Haynes 2002; Kirch 2004; Martin 1984; Martin and Steadman 1999; Martin and Szuter 2004; Merchant 2002; Owen-Smith 1989; Redman 2004 and 1999; Whitney-Smith 2001, 2003a, and 2003b).

What has all of this to do with twenty-first Century mammalian carnivore management? In view of the fact that these behaviors may be the equivalent of the human appendix of human-mammalian carnivore interactions—maybe everything: Present day wildlife management policies may be anathema to maintaining the dynamic equilibrium paramount to the long-term survival of humans, non-human life, and their relationships to the animate and inanimate world.

I will begin with an evaluation of contemporary carnivore management policies as written for the eleven Western States (i.e., Arizona (AZ), California (CA), Colorado (CO), Idaho (ID), Montana (MT), Nevada (NV), New Mexico (NM), Oregon (OR), Utah (UT), Washington (WA), and Wyoming (WY)) by comparing policies governing large, mammalian game and non-game carnivores with those governing non-carnivorous game mammals. The purpose of this evaluation is to

determine whether bias exists within state wildlife management policies. I will also evaluate the manner by which game mammals are managed, tangentially considering the economic benefits that result from hunting licenses and game and fur-bearing tags and how they differ from the management of non-game mammals (i.e., animals that do not *directly* contribute monetarily to state conservation funds). I will attempt to compare qualitatively both intra- and interstate wildlife management policies.

As an example, the management of mountain lions in California presents a unique situation in that *P. concolor* is designated as a "specially-protected mammal" and, therefore, does not fall under the auspice of a game mammal. The conundrum of this designation is that *P. concolor* is protected from hunting via game tags but not from depredation permits, and this status does not provide funding for its conservation. If *P. concolor* was considered a game animal in California, it would generate income for its own conservation programs. As the policy now stands, *P. concolor* is "protected" but under funded. So, the question is whether being a "specially protected mammal" offers the protections intended by California's Proposition 197 considering that there are no state-funded contributions for its protection. Proposition 197 was passed in 1990 and provided California with Fish and Game Code (FGC) 4800-4809. Would allowing limited hunting of mountain lions actually allow greater protection than the current arrangement? And, if this is the case, can we justify the managed killing

of individuals of a protected species under the auspice of better possibilities for future conservation of the species as a whole resulting from the funds generated by controlled hunting?

This is a complicated ethical and public awareness issue: does the individual animal or the species per se deserve greater ethical consideration? I will refer to Holmes Rolston III and others to help debate this question (Kaufman 2003; Rolston 1985; Regan 1985; Singer 1990). When we factor in threatened and endangered species under the Endangered Species Act (ESA), which are under federal protection, the issue becomes even more convoluted. The California mountain lion is only one of the examples I will discuss in this thesis.

The discussion begins with a the history of human-wildlife interactions in North America including landscape-scale changes that resulted, and continue to result, from both human and climatologic impacts over many millennia—from the initial migration of modern humans into N. America approximately 13,000 years ago, or earlier, to present day. These landscape-scale changes often impart their most deleterious effects on animals with large home ranges including many large carnivores. Included in this historical treatment will be a brief discussion of environmental ethics and animal rights as presented by significant historical contributors.

A qualitative analysis of the wildlife management policies of eleven Western States is presented. Discussion of the results will include policy

recommendations integrated with references to ethical and animal rights considerations as an aid in determining whether our current policies are adequate to provide for the survival of all species including humans over the long-term—from centuries to millennia.

I will complete my discussion by introducing general contemporary policy recommendations followed by specific recommendations pertaining to the findings of my qualitative analysis. These final discussions will evaluate current decision-making policies and offer suggestions concerning the manner by which we may initiate and improve multi-stakeholder policy-making processes. This discussion will be supported by evaluating the writings of prominent conservation policy arbiters, including Tim Clark from Yale University (Clark 2002); additionally, I will include a review of *Cougar Management Guidelines* (CMGWG 2005) because I believe this to be a seminal collaboration regarding cougar conservation principles. In light of the fact that many policy issues have become increasingly polarized and, by definition, political, and have become mired in our court systems, I offer suggestions that, in theory, are more expedient, and will lead to more acceptable compromises on these time-sensitive issues. Our current system may necessitate spending decades fighting environmental battles in the courtroom while our ecosystems continue to decline in quality.

One goal of this thesis is to suggest ways to overcome litigatory grid-lock and expedite environmental policy decisions for the benefit of humans, non-human

animals, our ecosystems and, ultimately, our Ecosphere. Large predatory mammals, which are many times keystone, and sometimes umbrella, species, are the medium I have chosen to address these policies.

## Definitions

Are the management policies regulating large mammalian predators consistent with those regulating non-predatory game animals in the western United States? In order to answer this question, this thesis will be driven mainly by evaluation research for it "considers the implementation and effects of social policies and programs" (Schutt 2004, 11). This study attempts to identify cause (i.e., the number of layers of protection [LOP]) and effect (i.e., ease of issuance of a depredation permit as a surrogate for bias), and, if bias is present, I will discuss whether this bias creates unethical policies: this latter element will utilize explanatory research to relate bias and ethics regarding state wildlife management policies and to, ultimately, formulate policies that preserve large mammalian predators. This, in turn, will provide the best opportunity to preserve all species.

I compare the management policies of predator and non-predatory game animals within and between the eleven Western States by evaluating existing state wildlife management policies. This evaluation yields the number of "layers of protection (LOP)"—defined below—for each species of study in each state: this parameter is the dependent variable. Most parsimoniously, the ease of

issuance of a depredation permit will represent the independent variable; however, in a broader sense, this is a measure of bias for or against one species relative to another. The assumption is that policies affording increased LOP for one species over another are biased in favor of the survival of those species protected by greater numbers of layers. Attempting to determine whether a biased policy is ethical or unethical will necessitate the use of explanatory research to investigate possible causes of bias (e.g., public safety, threat of litigation, revenue generation, public perception, and wildlife management goals) and then relate those to a given ethical standard—one which will derive from a range of environmental and animal rights ethicists.

The number of LOP serves as the dependent variable, and is defined as the number of discrete actions that the permit applicant is required to complete prior to issuance of a depredation permit for a problem animal. A problem animal is one that is causing damage to property, pets, or livestock; I will not consider depredation permits for public safety situations unless public safety and property damage are treated equally under a given statute. This single indicator variable will utilize ratio level measurement (Schutt 2004): Species afforded no protection (e.g., species designated as "vermin" or "pests") will be assigned a value of zero, and each additional discrete layer of protection will be assigned the next appropriate integer (i.e., 0, 1, 2, 3…). Discrete LOP will be assigned equal numerical status regardless of their perceived relative importance.

Intrastate, interspecific policy comparisons ought to be reasonably straightforward; interstate comparisons will likely require some operational adjustments. For instance, one state may list as a single action that which is listed as two or more separate actions in a different state. In this study, discrete actions are assigned separate values even if they are grouped as one action in other states provided one or more states lists them separately. My criterion is that I must make the case that they are, indeed, discrete actions. The "ease of issuance" of a depredation permit is inversely related to the number of LOP: this variable is relevant for intrastate, interspecific comparisons and interstate, intraspecific *and* interspecific comparisons. The independent variable will also be a single indicator, ratio level measurement; however, when comparing values between three or more states, averaged values will not be limited to integers. Due to the small sample size and the other potential problems that may arise as a result, the values obtained in this study will be, by necessity, qualitative in nature; however, differences in these values between species and states ought to provide face validity if bias does indeed exist within the policies studied. If bias is demonstrated to exist, I will attempt to determine whether the existing bias is ethical (i.e., appropriate) or unethical (i.e., inappropriate) utilizing explanatory research.

This thesis will utilize evaluation research to study existing state wildlife management policies. Data will be obtained by studying wildlife management

policies from eleven Western States either by obtaining internet access from the appropriate state agencies or by contacting the agencies directly and obtaining hard copies or speaking with wildlife management professionals. Temporally, this study will be cross-sectional in that policies in place at the time of evaluation will be compared to one another. A longitudinal element of time will likely be present because policies from different states, and even different policies within the same state, have been adopted at different times. In this study, I do not attempt to evaluate the longitudinal element of these policies; however, in my discussion, I address the issue of public attitudes regarding predators and other animals from a contemporary and historical perspective. There are other methods of investigating bias within and between state management institutions. Looking at management actions is another appropriate way to evaluate bias. The problem with this method of evaluation is that there are too many variables to confuse validity—namely, the potential disconnect between policy and practice (i.e., inappropriate individual bias not consistent with existing policy). Therefore, evaluating existing policies as written is the most appropriate manner in which to evaluate policy bias. Perhaps agency action would be an appropriate topic of study once the policy of that agency is appropriately evaluated.

In this study, sample size is determined by an existing regional grouping of states, and this thesis will look at the wildlife management policies of these states. These Western States are grouped together because they share similar

historical "frontier" attitudes and similar contemporary and historical land uses. After some deliberation I have included the three western states that encompass the Greater Yellowstone Ecosystem (GYE)—ID, MT, and WY—in spite of the current dynamic involving the GYE and the current attempts to de-list the grizzly bear and gray wolf from the ESA. I will address the unique manner by which the species under the federal guidelines of the Endangered Species Act (ESA) as is appropriate. I refer the reader to Appendix 1 for detailed explanations of these species. The sample size of this thesis could be narrowed or broadened by refining or expanding evaluation criteria. For example, certain regions that currently do not have significant levels of certain alpha-predators (e.g., North Carolina does not have wolves or panthers, and Florida only has 80 to 100 panthers) may have higher levels in the future; so, over time, other regions may be appropriate for inclusion in this study. It may be interesting to compare the Pacific States (WA, OR, and CA) with traditional Western States (e.g., CO, UT, AZ, etc.), and I evaluate these kinds of comparisons in this thesis when feasible or applicable.

The sampling technique for this thesis is best described as nonprobability, "purposive sampling" because it evaluates the policies of particular, pre-selected organizations—in this case, state wildlife management agencies—selected by non-random sampling. The significance of studying predator policies of the Western States is that there are large areas of open space under government

control (i.e., Bureau of Land Management (BLM) and other federal land agencies) coupled with significant human development encroaching on previously unpopulated or sparsely populated "wilderness." This necessarily creates an increase in the number of human-predator interactions thereby bringing these states' policies under greater scrutiny over time. Within the U.S. there is likely no better region in which to study this issue.

## Problems

Because most LOP are listed separately and the current study set is constant, this study ought to offer a high level of reliability. The one area where this study could lose reliability is where two or more discrete protective layers are combined into a more general layer of protection. I believe this issue is adequately addressed by documenting each or any time I separate "combined" layers of protection into "discrete" layers of protection. This will allow for repeatability and, therefore, high reliability. In this study, validity may not be quite as straightforward. The underlying assumption when addressing the question of validity is whether the number of LOP is a proper measure of bias. I am confident that this aspect of the study is face valid.

I am less confident that this study is content valid because there are other aspects of wildlife management policies that may indicate bias (e.g., hunting license cost, bounty value, amount of money budgeted per species for conservation or management, and umbrella of protection (i.e., mandated

protection under the federal (ESA) nexus). However, because these issues will not be addressed quantitatively—they will be addressed qualitatively in the discussion, when appropriate—I believe that this study will underestimate the presence or magnitude of bias: the lack of measured bias will not confirm the absence of bias, but the presence of measured bias will confirm the presence of bias. I believe the greatest difficulty in this study will be determining whether a biased policy—if one exists—is ethical or unethical. I may argue that a particular policy is biased but that bias is necessary for public safety. Alternatively, I may demonstrate that a policy is biased because of a false perception of public safety issues. For example, most people believe that mountain lions are more dangerous to humans than are deer; however, in the U.S., deer are directly, or indirectly, responsible for more human deaths in one year—mainly due to automobile collisions—than are mountain lions in 100 years (Torres 1996; URMNH 2006). In my opinion, the former situation where bias exists for valid public safety reasons would be an example of ethical bias while the latter situation of mountain lions vs. deer would be an example of unethical bias. The reliability and validity of this study could be tested against existing or future "in-kind" studies and by peer-review.

# CHAPTER 2

# THE PREHISTORY AND HISTORY OF HUMAN-MAMMALIAN PREDATOR INTERACTIONS

Grey Wolf
We are sending you
to that Great God.
Tell Him
that we, who invented forgiveness
do not forgive,
that we, who speak of trust
can not trust,
that we, who invoke faith would not believe

I write as though you could read
But I know you understand.
When you have left the forests and tundras
and no longer leave your sinewy trails within the snows,
tell Him that
you were made on a different day

Your howls of bewilderment will echo with the mountain winds.
And your songs will join those of the whales
Tell Him for me,
"Forgive them Father for they know not what they do."

Donaldson

## Introduction

Humans and carnivores have occupied the same landscapes for many millennia. During this long coexistence, it seems likely that humans developed a

natural fear—that is, a fear of being eaten alive. I have long felt that this type of fear has been encoded in our DNA; however, no genetic basis has yet been determined to exist. Therefore, we must conclude that predator fear is passed on by intra- and inter-generational learning. Regardless of the origin of this fear, humans often behave towards predators in ways that defy logic (i.e., irrationally). In this thesis I will present examples of, what I believe to be, misplaced priorities concerning our interactions with predators. But, first, I will discuss what I believe to be possible origins of this behavior.

## Prehistory

### First Contact (FC)

There is a general consensus in the literature that around 13,000 years before present (B.P.), the Late Pleistocene, North America lost 34 genera (~73 percent) of terrestrial mammals weighing over 44 kg (i.e., megafauna). The two main *opposing* hypotheses as to the origin of this catastrophic extinction event, Paleoindian hunting and climate change, and most of their various combinations, consider a "bottom-up" trophic collapse to explain the loss of large, mammalian carnivores (i.e., the loss of prey, primarily mammoths and mastodonts, due to climatic habitat loss or competition from Paleoindian hunters). In this chapter I present the possibility of a "top-down" trophic cascade caused by Paleoindian predation on large, mammalian carnivores (i.e., second order predation), as first postulated by Elin Whitney-Smith (2001) and expounded upon in her Pleistocene

Extinction Model (2003b). I will summarize the Pleistocene Extinction Model (PEM), which will function to explain some trophic inconsistencies found in other theories. This "keystone-predator" scenario has significant implications for our extant top-chain predators as their habitats, and available home ranges, disappear under the influence of continued human progress (i.e., habitat degradation and reduced home range size) and predator management policies that are, at times, biased against mammalian predators.

Background

While it may seem antithetical to discuss present day predator management policies in relation to Late Pleistocene extinctions, I believe the relevance will reveal itself as we progress through current, historic, and prehistoric human-related activities. Chapter 3 of this thesis deals with present day mammalian predator management policies in the eleven Western States. My position is that current wildlife management policies of the Western States, and, perhaps, other states, are biased against large, mammalian predators (i.e., coyote-sized and larger members of the order Carnivora). The ramifications of this statement become more significant if we believe that some large, mammalian predators may act as "keystone" and "umbrella" species and, therefore, exert top-down trophic control. If our beliefs tend toward a "bottom-up" trophic system, then we may not consider that mammalian predators exert significant ecological influence. In all likelihood, both of these trophic processes are significant

depending upon which particular scenarios or ecosystems we are dealing with. For example, the reintroduction of gray wolves (*Canis lupus*) into the Yellowstone-Grand Teton Ecosystem has demonstrated that the gray wolf is a "keystone predator" (Berger et al. 2001; Ripple and Beschta 2003; Smith, Peterson, and Houston 2003; Wilmers et al. 2003) while, in some areas of California, the population level of mule deer (*Odocoileus hemionus*) appears to be the controlling factor for determining the number of mountain lions (*Puma concolor*) in a given region (Doug Updike, pers. comm. 2003); however, the latter situation is currently being debated (Anonymous pers. comm. 2003) and, it is probable that it is an ecosystem dependent relationship as well. It is a well-known axiom that cougars are often more abundant in regions where their prey, mule deer, are abundant. Mule deer are more abundant where the habitat suits their trophic needs; therefore, if a region is poor in the nutrients that mule deer feed upon, that region will not support either significant populations of mule deer or cougars. Proper floral requirements, therefore, are a prerequisite for the presence of viable cougar populations. In this way, the vegetative and landscape components of a region will be the primary limiting factors determining cougar populations. This is a form of bottom-up trophic control; however, without cougars preying upon mule deer, the vegetative components of some regions will eventually be over-browsed more quickly, and the deer will seek different regions in which to forage. If more suitable habitats are not

accessible, then the deer populations will decline. In these situations there is a combination of bottom-up control (i.e., the presence or absence of suitable vegetation) and top-down control (i.e., the control of deer populations by adequate numbers of cougars). Without the top-down control of cougars or other deer-predators, deer will eventually follow a boom-bust cycle. In some cases, this may lead to a tropic collapse.

Historically, the U.S. maintained a policy of "predator management" that was better described as "predator eradication." Aldo Leopold was the first wildlife ecologist to recognize the value of wolves as *part of* the ecological balance in spite of the fact that he was a long-time predator management biologist for the U. S. Forest Service (USFS). In *A Sand County Almanac*, Leopold (1949) describes, among many other important ecological issues, the evolution of his belief system from one of predator eradication to one of predator management: Leopold later established the Department of Wildlife Ecology at the University of Wisconsin. By the mid-twentieth century, most large predators had, at minimum, been extirpated from many regions of the U.S.; and, significantly, there remained anti-predator biases well into the late 1960s. Although I believe state wildlife management policies still harbor significant anti-predator biases, the general population harbors more ambivalent views. These views range from those of general public acceptance of predators (Manfredo et al. 1998) to those that are more divided among regions (Holsman and Peyton 2003) to those that

question whether public attitudes are truly becoming more accepting of human-wildlife interactions (Butler, Shanahan, and Decker 2003).

ANTH 504T (Human Impact in Past Environments, Dept. of Anthropology, CSUF taught by Dr. James in Fall 2005) encouraged me to add additional information into this chapter of my thesis. This chapter will consider the origins of anti-predator bias by investigating the Late Pleistocene mammalian extinctions. As I read through the literature, I was surprised by the lack of attention given to the trophic influence of large, predatory mammals. This is especially relevant because of the impressive breadth of the Late Pleistocene guild of large, mammalian predators in juxtaposition with the fact that most of the theories involved the megaherbivores (i.e., mammoths and mastodonts). I have hypothesized that if the demise of large, mammalian predators played a significant role in one of prehistory's most recognized large extinction events, and that demise came at the hands of prehistoric humans, perhaps more present day people would pay attention to large, mammalian carnivore preservation. This is a motivating factor in presenting this scenario as one possibility.

In the following section, I will present discussions of the ongoing debate regarding the prehistory of human-carnivore interactions. This debate remains highly contentious, and I acknowledge that much of what I write in the following section is theoretical and not well-supported in the literature; however, it is a

theory that makes intuitive sense to me and one that I believe ought to be given more serious consideration than is afforded by the current literature.

Introduction to the Late Pleistocene Mammalian Guild

A preponderance of the literature concerning Late Pleistocene mammalian extinctions has been limited to in-depth discussions of large, mammalian herbivores (i.e., mammoths [*Mammuthus columbi*] and mastodonts [*Mammut americanum*]) with little attention given to non-human predators, especially large, mammalian predators. The mammalian predator guild was quite diverse toward the end of the Pleistocene: dire wolf (*Canis dirus*), short-faced bear (*Arctodus simus*), American lion (*Panthera leo atrox*), saber-toothed cat (*Smilodon fatalis*) and another, rare, Machairodont cat (*Homotherium serum*), cougar (*Puma concolor*), coyote (*Canis latrans*), jaguar (*Panthera onca*), gray wolf (*Canis lupus*), and spectacled bear (*Tremarctos sp.*). There is general agreement that mammoths and mastodonts were extinct by 11,000 years B.P. Within a short time before or after the aforementioned extinctions, the dire wolf, short-faced bear, American lion, saber-toothed cat, and *H. serum* became extinct while the spectacled bear became extirpated in North America; however, the limited resolution of radiocarbon dating techniques or the lack of temporally resolute data may prevent determination of the exact extinction order.

Why is the question of extinction order worthy of concern? My review of the literature has revealed a general consensus that whatever caused the

megafaunal extinction event of the Late Pleistocene—climate, human-induced, or variable combinations of the two—the role of large, mammalian predators in this process is rarely addressed in any detail. Most often they are considered to be part of a "bottom-up" trophic collapse due to the human-induced loss of "keystone herbivores" (i.e., mammoths and mastodonts) and the habitat transformations that followed (Alroy 2001; Haynes 2002; Martin 1984; Martin and Steadman 1999; Owen-Smith 1989 and 1987), or they are considered to have been out-competed by Paleoindian hunters during a time of diminishing and spatially isolated resources (Barton et al. 2004; Redman 1999; Van Valkenburgh and Hertel 1993). In some instances the "bottom-up" trophic collapse hypothesis is entirely attributed to climate change (Grayson 2001; Grayson and Meltzer 2003). This same dismissal of predator influence on ecosystems is currently present in many state wildlife management policies.

What is yet to be determined is whether, and to what extent, prehistoric humans killed large, mammalian predators be it for food, protection, fur, or removal of competition. Did Paleoindian hunters specifically target mammalian predators as do modern day humans? Whitney-Smith (2001) has been one of the few to address second order predation (2OP) occurring in the New World of the Late Pleistocene. If 2OP did occur, could some of the extinct mammalian predators have been adversely affected by these activities to such an extent that, in the absence of such pressure, they would have otherwise survived? If

this proves to be the case, can we infer any prehistoric precedent for the manner in which we currently deal with mammalian predators?

Late Pleistocene Extinctions in North America

There is general agreement in the literature that almost three-quarters of megafaunal genera succumbed to extinction around 11,000 years B.P (Grayson 2001; Grayson and Meltzer 2003; Haynes 2002; Martin and Steadman 1999; Martin and Szuter 2004); where agreement diverges, however, is exactly what caused this catastrophic extinction event. The most ardent supporter of a climate-induced Late Pleistocene extinction scenario is Donald Grayson (2001, 35) whose antipathy toward Paul Martin's "overkill hypothesis" is clear when he writes:

> [t]his is an argument that has been accepted by superb ecologists whose research focuses on contemporary organisms. . . . It is also an argument that most scientists fully versed in the relevant archaeology and paleontology firmly reject.

Grayson's and Meltzer's (2003) arguments against the "overkill hypothesis" are founded on the following contentious points: (1) the extrapolation of island extinctions to continental ecosystems; (2) ignoring or questioning the accuracy of the early dates of the Monte Verde, Chile, a pre-Clovis site; and, (3) the lack of the resolute dating of individual species extinction episodes (i.e., arguing that extinctions could have occurred over a longer period than Martin hypothesizes). Recent radiocarbon dating by Waters and Stafford (2007) support some of

Grayson's and Meltzer's arguments—primarily (2) and (3) above. However, while Waters and Stafford argue against Clovis hunters as the earliest humans in North America, they also discuss that there were likely multiple coeval tribes or cultures during the Late Pleistocene. Perhaps they all hunted with similarly effective technologies. While this would place some holes in Martin's hypothesis that Clovis-hunters were solely responsible for megamammal overkill, Whitney-Smith's hypotheses discuss Paleoindian hunters, which could include Clovis and non-Clovis hunters. Both sets of hypotheses could be challenged based upon the changes in timing that Waters and Stafford put forth: I am certain we have not heard the last of this debate.

The most published supporter of the "overkill hypothesis," that is, the Late Pleistocene megamammal extinction as being caused by Paleoindian over-hunting, is Paul Martin; his theory, or some variation of it, has widespread support in the literature. Haynes (2002), Martin and Steadman (1999), and Martin and Szuter (2004) all support the "overkill hypothesis" without significant consideration of climatic influence while Barton et al. (2004), Frison (1998), Redman (1999) and others consider prehistoric human impacts to be a significant contributor to megafaunal extinction with climate change and, perhaps, other factors being contributory. The "overkill hypothesis" is based upon the idea that a relatively small number of efficient Clovis-era Paleoindian hunter groups could have significantly and directly reduced the number of large,

mammalian herbivores (i.e., mammoths and mastodonts) over a relatively short period of time.

According to "overkill" supporters, the temporal sequence of Paleoindian entry into North America, the relative timing of the extinction of megaherbivores, and a non-random faunal response to climate change would all support a rapid extinction hypothesis. If mammoths and mastodonts were indeed "keystone herbivore" species as put forth by Haynes (2002), then a bottom-up trophic collapse would have followed the loss of these species. Haynes argues that a Clovis-era drought may have forced these genera into "refugia" where they would have positively influenced local biodiversity by expanding ponded water sources, exposing mineral licks, and keeping trails open by browsing; additionally, their dung would have supported large numbers of insects and would have transported numerous seeds. This, and their wider landscape effects on fire regimes and the benefit their carcasses would have provided for predators and scavengers, would have qualified them as "keystone" species. These same "refugia" would have made them easier to hunt even as their population levels became dangerously low especially if as Barton et al. (2004, 140) suggest, "As high-ranking resources become more difficult to procure, foragers would simply move to another locality rather than change their diet."

Late Pleistocene Predator Interactions: Paleoindians and Mammalian Carnivores

Non-human mammalian predators would likely have had little difficulty finding these "refugia" as well. With the diversity of large, sometimes quite large, mammalian carnivores co-existing with Paleoindian hunters in the Late Pleistocene, it is quite likely that their paths would have crossed, at least on occasion. Most theories in the literature depict large, mammalian carnivores being out-competed by Paleoindian hunters or simply dying out because of a bottom-up trophic collapse. However, I would like to discuss the possibility that Paleoindian hunters directly hunted various large, mammalian predators for one or more of the following reasons: (1) competition, (2) protection, (3) fur, (4) sustenance. I believe the first three reasons are the most plausible, while the fourth is less likely or, at least, less common. And, in relation to protection ([2] above), Quammen (2003, 3) writes, "Great and terrible flesh-eating beasts have always shared landscape with humans. They were part of the ecological matrix within which *Homo sapiens* evolved." Along the same line of thought, Redman (1999, 53) writes:

> Carnivores have rarely been a substantial source of food for humans, perhaps due to their dispersed range or to some more basic avoidance of this type of food source. After all, we were among their prey at one time, and they remain a threat to us in some circumstances.

The relevance here is significant: *Homo sapiens* has developed cognitive pathways, learned from generational passage and individual experience, that may initiate a response to kill that which poses, or once posed, a deadly threat or competition (i.e., large mammalian carnivores). 2OP is likely a manifestation of these learned behaviors. Just a note on generational learning in *Homo sapiens*: few would argue that modern humans have cognitive abilities that are unique, or at least very rare, among our Ecosphere's faunal contingent. While it may be optimistic to believe that humans have the potential to overcome that which resides in well-developed cognitive pathways, I believe that our abilities to evaluate the past and present and to reconcile these events into a cogent plan for future action may allow us to override that which would otherwise be ingrained in us as a foregone conclusion. The very basis of human ethical conduct is that we often *do not act* on our first impulses. While exceptions exist to a greater degree than most humans would prefer, I believe that most humans behave in a reasonably ethical manner. Inherent in this idea is the hope that *Homo sapiens* is capable of cognitively overriding our learned urges.

The competition between large, mammalian carnivores and Paleoindian hunters would have taken two forms: direct and indirect. Direct competition would have entailed direct contact between the two at hunting sites which involved both the potential loss of prey and the potential for personal injury. Being at risk, Paleoindian hunters would likely have, on occasion, killed large

carnivores to protect their prey and themselves. If their hunting expedition was fruitful (i.e., killing a mammoth or mastodont), the carcass of the carnivore may have been left for scavengers—*sans* hide and other ornaments such as teeth—leaving no paleontological record.

A 2OP hypothesis put forth by Whitney-Smith (2001) postulates that Paleoindian hunters may have deliberately hunted mammalian carnivores to reduce competition. Because of the greater requirement for caloric intake of mammalian carnivores versus Paleoindian hunters (approximately two times the per-pound caloric need), the number of megaherbivores would have increased, due to release by predators, leading to a trophic cascade and the creation of a boom-bust cycle. The bust cycle would have been enhanced by the Paleoindian hunting within "refugia," which may have led to megamammal extinction. For the purposes of this discussion, indirect competition encompasses that which is neither direct competition, as described above, nor 2OP.

Some authors believe that Paleoindian over-hunting would have created sufficient competition to out-compete large, mammalian carnivores resulting in their extinction. If this was, indeed, the case, one would expect some signs of nutritional stress within the Late Pleistocene mammalian carnivore population. In attempting to assess the level of health of Late Pleistocene mammals, Duckler and Van Valkenburgh (1998, 180) studied Harris lines which are "osteological markers of recovery from an episode of growth arrest that have been utilized

primarily to track fluctuations in the health of prehistoric human communities." Their findings indicated that *C. dirus*, *C. latrans*, and *S. fatalis*, among others, possessed long-bone Harris lines in the same range as healthy modern populations but lower than a population of presumably stressed endangered Florida panthers (*P. concolor coryii*). These findings seem to support the idea that Late Pleistocene mammalian carnivores were not nutritionally stressed and may support the 2OP hypothesis. Van Valkenburgh and Hertel (1993) documented excessive tooth breakage among carnivores of the Rancho La Brea tar seeps indicating a utilization of a disparate size-range of prey and, therefore, indirect competition. It is possible that the Paleoindian hunters recognized this competition and engaged in 2OP, eliminating competing predators before physiologic stress manifested itself. Barton et al. (2004, 159) state that "[c]omputer modeling of human-carnivore competition by Whitney-Smith . . . has produced results analogous to those suggested by us for the late Pleistocene Americas . . . ." The difference, though, is that Barton et al. suggest a mechanism that is more indirect than 2OP. Another argument against the direct hunting of mammalian carnivores by Paleoindians is the lack of carnivore remains in most archaeological sites. James (2004, 39), in reference to *C. lupus*, asserts that "this large carnivore was not killed very often by prehistoric hunters in the Southwest, as indicated by the lack of wolf remains in most archaeological sites." But, again, I wonder if durable remains would have been brought back to a

home site if the animal was killed by Paleoindians due to competition in the field; or, perhaps, they utilized the bones and hide to such an extent that they were unrecoverable. Perhaps the absence of evidence is not evidence of absence.

In an idea antithetical to 2OP, Martin and Steadman (1999, 27) [citing Janzen (1983)] proposed that *C. dirus* "interacted with human hunters at FC . . . to create a predator pit that may have vastly amplified human predation pressure, engulfing the large herbivores." This would have created an additive effect and would have accelerated the extinction of all involved species. Haynes (2002, 409) suggested "After megamammal extinction, these species [including *C. dirus*] and others began dying out due to a severe reduction in food supply" [emphasis added].

The large Machairodont cat *H. serum* may be the rarest of the North American Late Pleistocene mammalian carnivores, generally leaving only isolated bones and teeth in the fossil record; however, findings at Friesenhahn Cave in Texas prompted Marean and Ehrhardt (1995) to discuss the likelihood that *H. serum* disarticulated high-yield body parts and transported them back to their cave leaving a moderate amount of the carcass left for scavenging, perhaps by non-primate animals and early hominids—a positive ecological interaction. These behaviors may indicate the presence of a social structure among *H. serum* previously thought to be lacking; in fact, *H. serum* may have specialized on young mammoths. But, as Clovis-era Paleoindian hunters, possessing far more

efficient hunting abilities than earlier hominids, migrated south of the ice sheets, they may have been reluctant to share prey in this manner, thereby creating more direct competition and 2OP. Barton et al. (2004, 159) suggest that "humans and their dogs . . . would have been in direct competition with other large American carnivores." It is possible that the disappearance of large, mammalian carnivores in the Late Pleistocene may have been due to both direct and indirect competition and 2OP from Paleoindians.

Direct evidence of Paleoindian predation on Late Pleistocene mammalian carnivores in the New World may remain elusive because of the relative rarity of large, mammalian carnivores and the past disinclination of Paleoindian hunters to consume predator meat in the presence of preferable quarry; however, Soffer (1985) documented human predation on large, mammalian predators, including wolf, bear, and wolverine, for fur in the Old World (i.e., Siberia) of the Upper Paleolithic. To this point, we have ample evidence of current and historic human hunting of large, mammalian predators coupled with isolated, scant, evidence of Old World prehistoric hunting of mammalian predators for fur. What we do not have is evidence for human hunting of large, mammalian carnivores in the New World of the Late Pleistocene, although Anderson (1984) has noted markings on the bones of *S. fatalis* and *A. simus* that could be consistent with human procurement; however, the important distinction between hunting and scavenging has yet to be resolved. The following discussion of Whitney-Smith's

Pleistocene Extinction Model (PEM) will present some alternative hypotheses for this missing evidence.

Second Order Predation (2OP) and the Late Pleistocene Extinction Model (PEM)

2OP is the killing of large, mammalian predators by humans without regard for reason (e.g., competition, protection, fur, and food). Whitney-Smith (2001, 2003a, and 2003b) critiques both the "overkill" and climate change hypotheses as providing incomplete explanations. She believes the "overkill" hypothesis to be flawed for three main reasons: (1) predators, in this case humans, cannot eradicate their prey and still maintain appropriate population levels; (2) certain animals not hunted by humans (i.e., ground sloths [*Paramylodon harlani* and *Northrotheriops shastensis*] and horses [*Equus occidentalis*]) also became extinct; and, (3) this model does not consider the effects of the influence of carnivores or changes in vegetation occurring during this period. In relation to (2) above, there is significant evidence in the literature to suggest that early and more modern human beings did hunt and ingest horses and some ground sloth species in S. America. The 1976 excavation at Taima-taima—located in northern Venezuela—revealed the presence of two horses (genus *Equus* and *Hippidion*) and a ground sloth (*Glyptodon*) in the absence of mastodonts in an area referred to as the Unit I/II disconformity (Gruhn and Bryan 1984). There is also evidence of horse ingestion by Neanderthal humans during the Paleolithic at the Maurillac Cave site north of Bordeaux, France (Hamilton 1991). Although there is not an

abundance of evidence of Clovis-era horse and ground sloth hunting in North America during the Late Pleistocene, it seems reasonable to assume that they may have done so based on the above findings.

Whitney-Smith believes the climate change models to be equally flawed for many reasons, including: (1) mammoths, mastodonts, sloths, and other fauna had previously survived similarly rigorous warming trends—that is, the movement from an ice age into an interglacial period; (2) New World horses, which succumbed during the Late Pleistocene, are thriving in a similar climate today (i.e., a warming climate); and, (3) while extinction rates and climate change seem to have a correlation in the New World, climate change does not seem to correlate with extinction rates in the Old World. Taking the 2OP idea to a more complicated level, Whitney-Smith (2003) modeled overkill, 2OP, and environmental degradation and obtained interestingly counterintuitive results encompassed in a revised PEM. The original PEM included 2OP modeled against overkill; the more recent modeling includes combining extreme climate change with overkill and comparing those results with extreme climate change and 2OP.

Whitney-Smith (2003) found that, counterintuitively, overkill and climate change had moderating effects upon one another, and the results of climate change were greater—on extinction rates—than overkill and climate change combined. In the revised model, environmental effects were modeled by separating browsers, grazers, and mixed feeders. The underlying idea is that in

a drastically changing landscape, generalists will initially be outcompeted by specialists because they are more efficient. In following this to its logical conclusion, ruminant grazers out-competed non-ruminant grazers because they were digestively more efficient. The model that most closely approximated the paleontological record was the combination of 2OP and extreme climate change. In cursory terms, climate change decreased plant stocks directly while the overhunting of herbivores increased plant stocks slightly: these effects moderated one another. 2OP and climate change had an additive effect on one another with both causing diminished plant stocks. Whitney-Smith's PEM helps to explain certain inconsistencies in previously offered theories concerning Late Pleistocene megamammal extinctions. First, it explains why some animals disappeared even though they may not have been significantly hunted by humans (e.g., ground sloths [*P. harlani* and *N. shastensis*] and the horse [*E. occidentalis*]). Second, it helps to explain why the species that survived, or emerged from, the Late Pleistocene were smaller in size: the ecosystem changes that created "refugia" of vegetation would no longer support animals of "megamammal" stature. Third, the PEM presents the counterintuitive idea that "overkill" and climate change were not additive: the PEM predicts that these two effects moderated one another. It would have required a far more severe climate change than is reflected in the archaeological record to have caused the Late Pleistocene megamammal extinctions.

There are, however, a couple of potential problems with the Pleistocene extinction model (PEM). First, there is no undisputed *direct* evidence of the human hunting of large, mammalian carnivores in the New World of the Late Pleistocene. Second, the PEM presumes a period of diminished primary productivity as the interglacial period approached; it assumes a significant period of time before appropriate successional changes would have occurred. At present, it is unknown whether Waters and Stafford (2007) data will refute or confirm the time element; their data drastically shortens the time frame during which Clovis hunters were influential but allows for the fact that there may have been multiple tribes or cultures that were active before, during, and after Clovis hunter groups.

The Fate of the Late Pleistocene Mammalian Predator Guild

We know that the dire wolf, short-faced bear, American lion, all Machairodonts (i.e., saber-toothed cats), and the cheetah-like *Miracinonyx* all failed to survive into the Holocene. We also know that the gray wolf, mountain lion, jaguar, brown bear, black bear, and coyote have all managed to survive to present day. The spectacled bear, although extirpated from North America in the Late Pleistocene, survives today in Asia. What factors decided which species survived into the Holocene of North America? In Whitney-Smith's PEM, we saw that herbivore survival may have been contingent upon being a specialist, at

least for a period of time. But, with large, mammalian carnivores, it appears as though being a generalist may have been more adaptive. It also appears, as in the case of herbivores, size was an issue. The larger carnivores did not tend to survive as readily as the smaller carnivores due to their need for larger home ranges and the fact that the benefit of increased body size diminishes with increasing temperatures.

Being omnivorous (i.e., a generalist diet) appears to have been of some advantage. Coyotes, wolves, and brown and black bears forage from a wide variety of foods, including plant *and* animal forage. Additionally, these species tended to be the smaller of the Late Pleistocene mammalian predator guild. Therefore, the persistence of these species makes ecological sense. One bothersome question for me is why didn't the dire wolf survive? It was not much larger than the gray wolf; however, we still do not know enough about its social structure or foraging habitats to draw any conclusions. What about the mountain lion (i.e., puma or cougar) and jaguar? These were the smallest of the above mentioned cats, but there is one more factor: they are both ambush predators and are quite secretive. They also have the ability to adjust their diets within a relatively large range of animal species. This may have protected them from 2OP, and their smaller size would have kept them from hunting the same prey as the Clovis-era Paleoindian hunters and, therefore, from direct and indirect competition. The cheetah-like *Miracinonyx* was much larger than today's

Old World cheetah and would have required the kind of prey that may have coincided with Paleoindian hunters after the disappearance of mammoths and mastodonts. The timing of these extinctions is still not resolute enough to determine exact orders; so, this is conjecture. In simple terms, with some exceptions, it was advantageous for Late Pleistocene carnivores to be smaller and to be generalists; and, it was advantageous for herbivores to be smaller and to be specialists (i.e., efficient primary consumers). When compared to mixed-feeders, obligate- grazing ruminants would be considered specialists.

The saber-toothed cat (*Smilodon fatalis*) is one of the more famous predators of the Rancho La Brea tar-seep mammalian predator guild. There was an earlier Pleistocene saber-toothed cat that was much larger (*Smilodon populatus*) that did not survive into the Late Pleistocene: size may have been an issue. But *S. fatalis* was small enough to have made a run into the Holocene; however, it is likely that its mode of killing and its long canines (i.e., saber-teeth) may have rendered it too specialized to avoid extinction. The method of killing used by *S. fatalis* was to asphyxiate its prey by clamping down on its trachea. Because of the size of its occluding bite (i.e., the distance from its canines to its premolars), *S. fatalis* may have been limited to a very narrow prey size: attempting to kill prey outside of these parameters may have resulted in excessive tooth breakage as demonstrated by Van Valkenburgh and Hertel (1993).

Another Machairodont cat (*Homotherium serum*) failed to emerge from the Late Pleistocene. Marean and Ehrhardt (1995) derived their hypotheses concerning the hunting and food-collecting behavior of *Homotherium serum* from Friesenhahn Cave in Texas. There, as discussed below (Turner 1997), a wide variety of age classes of *H. serum* were discovered along with the fossils of young mammoths (approximately 2 years old). The theory presented is that *H. serum* may have been quite adept at disarticulating high-ranking body parts (i.e., legs), which would have allowed them to protect the greater portion of their kills from scavengers, including early Hominids. This behavior would have nonetheless left a portion of the mammoth carcass available for scavenging. In agreement with Marean and Ehrhardt (1995), Turner (1997) concludes that *H. serum* specialized on young mammoths and transported them back to their caves. Therefore, in the case of *Homotherium*, possessing a large body size and specialized foraging needs may have been sufficient to prevent their survival into the Holocene.

In addition, while early hominids in the Old World may have welcomed this symbiosis (i.e., abandoned, partially eaten carcasses), modern *H. sapiens* (i.e., Paleoindian Clovis-era hunters) may have considered *H. serum* as a direct competitor. This may relate to Whitney-Smith's 2OP Hypothesis: why allow *H. serum* to usurp usable prey when the technology and skill exist to prevent it? Marean and Ehrhardt also discuss the rarity of carnivore remains in the

paleontological record as an expected result of their normally low population numbers, which implies that direct proof of second-order predation would also be rare.

Conclusions and Implications

If second order predation (2OP) is a viable hypothesis, then maintaining our current large, mammalian "keystone predators" has some basis in prehistory. While only a small number of the carnivores in this study are truly "keystone" species, the loss of any of these species is significant. Additionally, I do not believe that the lack of "keystone" status diminishes the importance of preserving those species that do not fit into that category. Because we do not always know the consequences of the loss of coyotes, black bears, or bobcats, I believe the Precautionary Principle is one that we ought to strictly adhere. In essence, this prehistoric scenario could serve as a precautionary tale of predator fragility. However, there is still a long way to go before this theory is accepted. Most important, *direct* evidence of the human hunting of large, mammalian predators in the New World of the Late Pleistocene must be found. And, as mentioned previously, the Late Pleistocene glacial landscape transition must be demonstrated to have resulted in diminished primary productivity for a significant period of time.

It is intuitively coherent to accept the idea of 2OP in the Late Pleistocene given that 2OP was shown to occur in the Old World at approximately the same

time (Soffer 1985) and that 2OP is a known entity during historic and current periods in the New World. But, intuition alone will not solve this mystery: we need the simultaneous, cooperative efforts of many disciplines to solve these complicated issues. Archaeologists, anthropologists, paleontologists, conservation biologists, wildlife ecologists, palynologists, paleoecologists, plant ecologists, and system dynamicists (e.g., Elin Whitney-Smith) must all work toward one end: finding the truth with regard to Late Pleistocene extinctions.

Here is one modern truth: the general public is generally quite willing to co-exist with mammalian predators except in the rare cases of attacks on human beings (Manfredo et al. 1998; Naughton-Treves et al. 2003) or in cases of farmers or ranchers who live near wolf reintroduction areas or who have lost, or perceive that they have lost, livestock due to predation by large, mammalian predators (Naughton-Treves et al. 2003). Although many studies of these types (i.e., public attitude surveys) reveal that a majority (i.e., ~75 percent) of the population support ecologically sound predator management, ranchers who have been financially compensated for livestock losses often prefer lethal solutions for predator management problems. This may relate to the inherent bias I discussed earlier: maybe some humans possess a deeply seeded fear of large, mammalian predators to the extent that, in their opinion, there is no feasible solution short of lethal control. If we believe *Homo sapiens* does possess unique

cognitive characteristics, perhaps one of those qualities is the ability to overcome certain learned, ingrained fears when we perceive a benefit is to be had.

I believe the truth is generally elucidated by a combination of the efforts and results of multiple disciplines. In this case, I believe that prehistoric humans did hunt large, mammalian carnivores for a variety of reasons already discussed. I believe that we ought to work diligently to provide enough space for present day "top-down" and "bottom-up" trophic processes and to proceed in a manner that requires minimal management by humans. This is certainly an issue that interested William Cronon (1995, 81-82, The trouble with wilderness) when he asked, "Is managed wilderness actually wilderness?"

Current literature strongly illustrates what happens when we institute multi-tiered, hierarchical management policies concerning the quality of our environment: There is often a disassociative relationship between the upper and lower tiers of the hierarchy with the former often unaware of the needs of the latter. Redman (1999) addresses these issues quite nicely in Chapters 5, *Impact of Agrarian Systems,* and 7, *Forces That Grew with Society* of his volume. The general idea is that as a greater number of hierarchical levels develop, there is a greater likelihood of information gaps between the higher and lower levels. Current state predator management policies appear to be emblematic of this type of relationship. It is important that the inter- and cross-disciplinary cooperation discussed previously be instituted post-haste. Regardless of

whether we have "top-down," "bottom-up," or combination trophic controls, we must pay close attention to both the intuitive and counterintuitive relationships that occur within and among our ecosystems—specifically, Ecosystem Earth. After all, it is not the Earth that we must save: It is ourselves.

## History

### The European Colonization of North America

In the previous section, I discussed the possible dynamics of human-mammalian predator interactions from FC, which is, in practical terms, prehistory. In this section, I discuss human-predator interactions in a historical context (i.e., a period documented by multiple written accounts).

#### Introduction

Prior to European colonization, Native Americans (i.e., Indians) populated much of North America. Their subsistence niches varied widely and included hunting, gathering, and fishing in the Mississippi Valley and eastern woodlands in conjunction with technologically advanced horticulture in the Southwest (Merchant 2002; Anderson 2005). Anderson advances the idea further when discussing the active approach that Native Americans employed when manipulating (i.e., weeding, cultivating, clearing, etc.) native plant stocks. The Southwest that the Spaniards first considered "pristine," had been sustainably manipulated by Native Americans for centuries. European settlements precipitated major changes in Native American land use and culture over vast

regions and niches: (1) horticulture in the Southwest; (2) hunting cultures of the Northeast; and, (3) buffalo cultures of the Great Plains. That is not to say that Native Americans did not have some adverse effects on the land; there are many cases where certain land uses did, over time, create deleterious effects such as salinization [due to water saturation] even with the most advanced irrigation systems of the Southwest (e.g., the prehistoric Hohokam), and faunal overutilization (James 2004). However, when one considers the length of time the Hohokam (and the Anasazi [=Ancestral Pueblos]) was able to practice sustainable agriculture in the arid Southwest, or the Sioux tribes were able to sustainably hunt bison, the environmental damage that resulted was relatively minor compared to the rapid environmental changes that European colonization thrust upon the continent. While it is known that the prehistorical agricultural societies (i.e., Hohokam, Anasazi, and Mogollon) had a substantial impact on the land (e.g., some prehistoric sites today 600-300 years after abandonment still support little plant growth) (James 2007, pers. comm.), a strong European influence drastically altered landscapes that adversely affected large carnivores simply by creating fragmentation and diminishing their necessarily large home ranges. Additionally, when bison were replaced by domestic cattle, carnivore-human interactions greatly intensified because carnivores were forced to prey upon domestic cattle in place of diminishing natural prey.

Many volumes have discussed these issues in great detail, but it is important to note that the manner by which the Native Americans were dealt with by the European settlers parallels the manner by which the land and its flora and fauna were treated by these same settlers. The treatment of Native Americans in the history of North America is beyond the scope of this thesis; however, Ernesto "Che" Guevara de la Serna noted a similar relationship during his visit to Chile's Chuquicamata (a U. S. owned copper mine) ca. 1951 (Anderson 1997):

> The hills show their gray backs prematurely aged in the struggle against the elements, with elderly wrinkles that don't correspond to their geological age. How many of these escorts of their famous brother [Chuquicamata] enclose in their heavy wombs similar riches to his, as they await the arid arms of the mechanical shovels that devour their entrails, with their obligatory condiment of human lives?

In the context of this thesis, I am fond of interpreting this period of Guevara's life by noting that the proletariat is the people *and the place* including the animate and inanimate components of that place: Those who exploit people have no moral issue with exploiting the place, and vice-versa. With these thoughts at the fore, the following discussion will document the significant faunal changes that resulted from the east to west movements of humans in North America from the seventeenth century to present time.

A Beginning

To John Locke in the late 1600s, the New World represented the chance for a new beginning in what was thought to be the last pristine opportunity for such an incarnation. This ought to be taken in the context of both the Old World landscape (i.e., pastoral or Eden-like) and literal interpretations of the Bible, which often depict good (i.e., a Garden of Eden) versus evil (i.e., wilderness). Our European descendents, namely the Puritans and Quakers, viewed wilderness as an entity to be overcome and, therefore, converted into a utilitarian landscape. This landscape was to be free of the dark, foreboding forest including European myths such as the Beowolf—a precursor of many fables that made their way into children's stories such as the Big Bad Wolf and Little Red Riding Hood. While, at first contact, Native Americans cleared much of the eastern seaboard of timber by clearing and burning, the regions to the west were still a "dark, foreboding forest" which Euro-Americans were impelled to convert to an agrarian landscape: the resultant landscape transformation would provide safety (i.e., the absence of dangerous wildlife including large carnivores) and utility (i.e., crops).

In *Wilderness & the American Mind*, Nash (2001, 8) discusses the idea that the Judeo-Christian tradition was embodied by "wilderness as fact and symbol" leading to the first immigrants of North America having preconceived ideas regarding wilderness. He goes on to postulate that "[t]his intellectual legacy of

the Old World to the New not only helped determine initial responses but left a lasting imprint on American thought." In viewing the luxurious garden (i.e., Eden) as paradise where all was harmonious, Nash continues, "[i]f paradise was early man's greatest good, wilderness, as its antipode, was his greatest evil" (9). In *Monster of God*, Quammen (2003, 13) refers to Leviathan from Job 41 as a feared beast with the role of keeping people humble; however, Quammen's words best describe that relationship between humans and predatory animals:

> Meanwhile, real animals with big teeth and long claws were accomplishing the same thing. For as long as *Homo sapiens* has been sapient—for much longer if you count the evolutionary wisdom stored in our genes—alpha predators have kept us acutely aware of our membership within the natural world. They've done it by reminding us that to them we're just another flavor of meat.

As I have discussed previously, first contact—in this case Clovis-era hunter-gatherers— humans may have passed on the learned behavior of predator fear; the above authors suggest that later settlers may have brought that fear with them as well. Fear, however, is only one factor that drove the human-predator or human-wilderness dynamic in the settlement of the New World and, particularly the western U.S. Another idea—the Biblical idea of Dominion—was, and still continues to be a significant driving force in resource exploitation. Dominion, in its most anthropocentric interpretation, created an equally insidious justification for the transformation of the New World: the sense of human

entitlement or, more precisely, the sense of Anglo-Christian human entitlement. These are the ingrained principles that pervade many of our conservation policies to this day.

East of the Mississippi

Seventeenth century life in Anglo New England was quite challenging to all involved parties, namely the New England Puritans and the Native Americans of the region. The King Philip's War of 1675-76 pitted the New England Puritans against the Metacomets (Wampanoags), which was, in relative terms, the most destructive war in American history (Leach 1958). However, this was only one of many Anglo-Indian wars that spanned more than five centuries and fed a large portion of the history of the settlement of the frontier west.

In *The ADVENTURES of Col. Daniel Boon; containing a Narrative of the Wars of Kentucke* [*sic*], John Filson (1747-1788) created the first nationally viable statement of the "Myth of the Frontier" (The Free Library 2006). His work, which appeared initially in the form of an appendix to *Discovery, Settlement, and Present State of Kentucke* (1784)—a state travel companion book—gave birth to the first American hero of "common" origin: Daniel Boone. Although it had been purported that this work was written by Boone, most academics agree that Filson was the author, thereby contributing to the idea of the myth. There is a general consensus that James Fennimore Cooper's protagonist in *The Leatherstocking Tales* was based on the frontier experiences of Boone. The five works

comprising *The Leatherstocking Tales—The Pioneers* (1823), *The Last of the Mohicans* (1826), *The Prairie* (1827), *The Pathfinder* (1840), and *The Deerslayer* (1841)—documented the life of Nathaniel (Natty) Bumppo as a commentary for the "taming of the frontier." As with a number of nineteenth century writers, Cooper saw the disappearance of the "wilderness" as an inevitable, yet troubling, by-product of progress; and, these works represented this process in a fiction-nonfiction hybrid of the life of Daniel Boone.

West of the Mississippi

In 1849 Francis Parkman, Jr. wrote *The Oregon Trail*, which documented his travels within the frontier during his early twenties. In spite of poor health (i.e., malaria), he was determined to see the iconic aspects of the frontier—Indian battles, emigrating wagon trains, and the buffalo of the Great Plains—before they were consigned only to literature. There is no doubt that Parkman (1982, 252) knew that frontier life and, therefore the life of the Indian, was coming to an end when he wrote:

> The Indians will soon be corrupted by the example of the whites, abased by whisky and overawed by military posts; so that within a few years the traveler may pass in tolerable security through their country. Its danger and its charm will have disappeared together.

As with many of his contemporaries, it is obvious that Parkman understood the dependency of the Indians upon buffalo herds when he wrote, "[w]ith the

stream of emigration to Oregon and California, the buffalo will dwindle away, and the large wandering communities [Indians] who depend on them for support must be broken and scattered" (252). Keep this important fact in mind: with the disappearance of bison came the introduction of domestic livestock and the concomitant effects they had on predatory mammals.

Even as late as 1874, with bison numbers significantly diminished, Secretary of the Interior Columbus Delano snubbed a Congressional law prohibiting the killing of any female bison by any non-Indian by advocating their continued extermination. Delano had previously written, "I would not seriously regret the total disappearance of the buffalo from our western prairies, in its effect upon the Indians" (Robinson 2005, 25). President Ulysses S. Grant pocket-vetoed the legislation and the slaughter of bison continued. By the mid-1870s Colorado and Kansas were devoid of bison; thus was their fate in Texas by 1878 and Montana by 1883. Other ungulates—pronghorn antelope, bighorn sheep, elk—were also targeted with similar ferocity (Robinson 2005). With the newfound paucity of native ungulates, the frontier prairies of the 1880s found themselves inhabited by another species of ungulate: domestic cattle. Although the process of institutionalized lethal predator eradication policies began five decades earlier, the introduction of domestic cattle began the largest scale mammalian predator extermination program which, to some extent, continues to present day.

## Institutionalized Predator [Eradication] Control

### The Early Campaign

Commercial strychnine production began in the U.S. in 1834 courtesy of a private company based in Pennsylvania. Although strychnine had been used occasionally to poison wolves in colonial America, its use for this purpose escalated exponentially beginning in the 1840s (Robinson 2005). The earliest large scale poisoning of wolves was, in all likelihood, driven by economics: trappers would kill a bison and then bait it with strychnine. By the next morning the trappers would have been presented with dozens of wolf pelts unmarred by the passage of a bullet. The paucity of the over-trapped beaver, which had been the preferred pelt for export to Europe, made wolf pelts more valuable during this period when bison numbers were just beginning to decline.

One important aspect of strychnine is that it is not species specific. Baited carrion had lethal effects on multiple species including raccoons, skunks, weasels, black-footed ferrets, badgers, bears, coyotes, foxes, crows, ravens, magpies, and eagles: It would seem that the sequele to this kind of generalized killing would have been obvious to anyone with even the most basic understanding of ecology. However, there were so few contributors to conservation-minded literature, and even fewer readers, that it is unlikely that those engaging in the practice would have had any misgivings as to the ramifications of their deeds. And, as Robinson (2005, 19) points out, "For all the

growing profit, economic incentives for killing wolves, beaver, and bison do not explain the magnitude of slaughter on the Great Plains." So, what does? This question returns us to the main factors contributing to the human-predator [human-wilderness] dynamic: Fear and Dominion.

The Great Plains appeared to many settlers as an infinite, wild landscape so vast as to swallow an individual whole. There may have been a feeling of insignificance and, perhaps, loneliness that fed the fear of becoming a middle member of the trophic web—a process without a conscience. There may have been the idea that transformation of the wild landscape into "civilization" would have allayed these fears. Additionally, especially concerning wolves, mythology may have displaced reality so as to create an irrational fear of *Canis lupus*. The fact that there have been few, if any, documented [unprovoked] wolf-human attack in North America bears out the irrationality of the human fear of wolves in the realm of individual and general public safety. That is not to say that wolves never attacked humans: There are documented cases of rapid wolves, wolves attacking a person's horse, or wolves trapped in snares, steel-jawed traps, or wounded by firearms attacking human beings (Robinson 2005); but, these are far from unprovoked attacks, and I will not waste further ink on them.

The Influence of Cattle Ranching on Mammalian Predators

In certain regions of North America, clashes with Native Americans retaliating for the slaughter of bison made cattle ranching a very difficult prospect. In 1856

cattle numbers remained relatively low; however, the 1859 gold rush in the Pike's Peak region of Colorado was followed by a significant increase in emigration to the region from Indian Territory in Oklahoma. By 1860 two major cattle movements into the plains of what is now Colorado were notable: Colonial Alexander Majors wintered 5,000 head in the eastern portion of the region, and John W. Prowers drove a herd of significant numbers from Missouri (Robinson 2005). During the same year, cattle carcasses—dead from disease—were not an uncommon sight in the northern Colorado plains: wolves required little coaxing to substitute cattle for bison as a food source. Predators, disease, and weather took a significant toll on the newly thriving cattle business; but, the former would become the center of attention as the latter two were, at the time, beyond human control. Today humans have greater control over animal diseases, but the end result often remains the same.

The Civil War slowed the progress of the westward frontier movement; but, in 1866 cattle production began to grow exponentially. Open range (free range) ranching operations were utilized as both domestic and international commodities. By 1866 beef was transported to the eastern states and, by 1868, to England: by 1875 overseas interests owned 500,000 head of cattle in Colorado alone. The international aspect of the cattle industry is important: western ecosystems could have, at least for a significant time, sustainably handled domestic livestock production (Robinson 2005). Taking this logic

further, bison could have likely been harvested on the Great Plains for domestic consumption without significant impacts to the ecosystem. There are two significant reasons that this may have been possible: (1) bison are migratory, which would allow for sustainable forage re-growth, and constant movement diminishes the risk of parasite infection and other diseases; (2) bison are far more able to protect themselves against predators than domestic cattle both individually [due to size and aggressiveness] and as a herd (i.e., both by circling to protect the young *and* by stampeding).

While poisoning, mainly with strychnine, was utilized by *individual* cattlemen until the late 1860s, wolves managed to remain outside rifle shot range—a skill that bison never practiced. In 1867 the Colorado Stockgrowers Association formed as a coalition of local Chapters with the following goals: (1) to deter the rustling of open range cattle by recording livestock brands, creating stricter range law enforcement, and funding bounties to encourage the capture of cattle rustlers; and, (2) funding bounties on, what they considered, another type of rustler—wolves. Colorado's Bent-Prowers County Cattle and Horse Growers Association, one example among many, allocated a portion of its constituents' funds toward purchasing wolf poisons and funding a $4.50 bounty on wolf scalps (Robinson 2005). In 1869 the bounty system was incorporated into the legislative process when Colorado's territorial legislature enacted a fifty-cent wolf bounty in addition to the existing private bounties. The western states followed

suit on predator bounties: (1) the Territory of Montana in 1883; (2) Wyoming in 1893; and, (3) Arizona-New Mexico in 1893, which included grizzlies, cougars, bobcats, and coyotes in addition to wolves (Robinson 2005).

Ironically, 1893 brought the publication of Frederick Jackson Turner's *The Significance of the Frontier in American History*—a thesis declaring that the Frontier West was closed. Although this thesis eventually proved to have more holes than a Great Plains' bison pelt, one prominent turn-of-the-century personality—Theodore Roosevelt—took it very seriously. Turner's premature closure of The Frontier West contributed to Roosevelt's propensity for trophy hunting as one method of counteracting "the feminization of America" (Morris 2002). One must wonder if this attitude permeated the psyche of the West as it only took another half-century for wolves to be exterminated from all but the most remote regions of the conterminous U.S. But, it would take more than bounties. What is known is that, by 1914, annual government bounties paid to the western states amounted to more than one million dollars: this did not include private bounties. But, unlike other successful monetary compensation programs (e.g., bison), wolves and coyotes were able to rebound because their pursuers were not aware of what is common ecological knowledge today: reduced predator numbers allows for increased prey, which, in turn, allows wolves and coyotes to produce larger litters. The extermination of wolves required more than a system of bounties: It required a unified, government

effort and an ethically questionable relationship between public agencies and private interests. The U.S. Forest Service (USFS) would become the first federal agency to organize a wolf extermination program, but it would not be the last.

The USFS was formed to stem the tide of unchecked deforestation. This was an unpopular agenda in the west, and, in fact, to many westerners, the idea of federal control of forests was less appealing than the presence of wolves. Therefore, to gain support for its forest conservation policies, the USFS initiated a wolf extermination program. At this time, the USFS was an autonomous agency within the federal government; however, in 1904, Theodore Roosevelt approved a newly created "Forest Service" within the U.S. Department of Agriculture (USDA) with Gifford Pinchot as its director. Almost immediately, Pinchot instituted a grazing fee on federal forest service land and met with significant resistance from the usual sources. As a way to mitigate and justify the grazing fee, 1905 brought two changes that would forever effect the trophic landscape: (1) the purchase of leghold traps for the killing of wolves on forest reserves; and, (2) an association with another agency within the USDA—the Bureau of Biological Survey—to aid in locating these wolves.

In March 1906 Vernon Bailey, an assistant to C. Hart Merriam in the bureau, was temporarily transferred to the USFS to, in Pinchot's words, "undertake a study to determine methods for the extermination of wild animals which prey upon live stock in the forest reserves" (Robinson 2005, 62). One of Bailey's

contributions was to inform every hunter, trapper, forest ranger, and ranchman the most efficient methods for trapping, poisoning, and hunting wolves and locating their dens. Initially, the poisoning campaign was successful; however, it did not take long before wolves became wary of baited carcasses. So, in the few years prior to 1920, the methods of distributing strychnine were altered. Strychnine was now being manufactured into a pill that would be easily hidden in one-inch cubes of meat or fat. Often, a tainted carcass was surrounded by these cubes with the idea that wolves wary of an entire carcass might readily consume small bits of fat and meat in proximity to the carcass. When the wolves' grew savvy to these methods, the bureau employed new techniques: (1) the initial cubes did not contain poison, and, once the wolves trusted the untainted bait, the cubes were again filled with strychnine; (2) trails along which wolves traveled to their feeding areas or dens were baited with poison. Many of these innovations may be credited to a man named Stanley P. Young, who became assistant predatory animal inspector for the bureau's Colorado district in early 1921.

Young began with the bureau as a periodic trapper (i.e., killer) of problem predators. By mid-1922 there were only small pockets of a few wolves remaining in the West; and, not surprisingly, coyotes were becoming the new focus of anti-predator campaigns. While Young always made certain to receive and document congratulatory letters from interested parties (e.g., stockmen and

live stock associations or state game wardens) when he completed a particular job, in the bureau's 1923 annual report the chief of the bureau wrote:

> With the practical elimination of the gray or timber wolf over much of the range country of the Western States, cattlemen have discovered that heavy losses of calves heretofore attributed to wolves have evidently been due to coyotes. (Robinson, 2005 169)

In essence, our government's preoccupation with killing wolves created a new "problem": a healthy wolf population keeps the coyote population in check, and a non-existent wolf population allows coyotes to greatly expand their niche.

With coyotes elevated to the top-tier of the anti-predator list, poison baits were being distributed in massive numbers. By 1924, the survey distributed 3,567,000 baits over an area of 284,400 square miles. Because poison baits were not very effective for killing mountain lions, and several mountain lion hunters lost their dogs due to these poisons, there emerged the idea that coyote poisoning in mountain lion infested regions would prevent the capture and killing of mountain lions; so, many areas instituted new funding for mountain lion bounties. Another problem emerged: magpies were found to be removing poisoned baits before the coyotes could ingest them. As a result, in 1926, Young declared, "Heretofore . . . in many localities of the San Luis Valley it has been necessary to eradicate magpies first before any effective work with coyote poisoning could be done" (Robinson 2005, 171). And, surprising as it may seem,

an additional sequele to wolf killing manifested itself in the population explosion of rodents: in prompt, orderly fashion, the bureau began a poisoning campaign on prairie dogs, ground squirrels, gophers, hares, porcupines, and anything else they decided they needed to "control." I will discuss unintended consequences when I discuss the Kaibab Plateau and the Greater Yellowstone Ecosystem (GYE) later in this thesis.

By the late 1930s, with many of their preferred prey extirpated or eradicated, coyotes turned their attention to sheep and other vulnerable domestic baits. Strychnine, while an effective killing agent, had two major drawbacks: (1) it had a bitter taste; and, (2) it was fast acting, which meant that the poison victims died near enough to the baited carcass to create wariness among potential victims. Thallium sulphate avoided these drawbacks by being tasteless, odorless, and taking days to weeks to kill the victims. Then, in 1944, along came sodium fluoroacetate—also known as Compound 1080, named because it was the 1080th experimental attempt that succeeded. Like thallium sulphate, Compound 1080 was odorless and tasteless, but death occurred in approximately thirty minutes. Even though thallium sulphate caused coyotes to lose their foot pads, hair, and blindness over days to weeks, Compound 1080 was considered a more painful death due to violent convulsions lasting up to several hours. Just in case these techniques were insufficient—which, in the larger picture, they were—the U.S. Fish and Wildlife Service [formed in 1939] created the "humane coyote

getter." This was a vertical pistol-like device partially buried into the ground that exploded a lethal dose of cyanide into the mouth of the victim. Its "humaneness" must have referred to the quickness of the victim's demise—just a few minutes. If the above narrative highlights aspects of our government that give the reader pause, then you are in excellent company: a number of prominent scientists, naturalists, and nature lovers (i.e., budding environmentalists) began to speak and write against these practices beginning in the early nineteenth century.

## A Brief History of Environmental Ethics and Animal Rights

### Early Environmental Activism

In his discussion of the *American* wilderness, Nash (2001, 67) addresses the fact that, in an attempt to defend the New World (i.e., America) as a worthy entity when compared to the Old World (i.e., Europe) from which they emigrated, there was one significant aspect that Americans felt their country was different: its unrivaled wilderness. Nash begins by quoting the notable Hudson River School artist Thomas Cole:

> Though American scenery is destitute of many of those circumstances that give value to the Europeans, still it has features, and glorious ones, unknown to Europe . . . the most distinctive, and perhaps the most impressive, characteristic of American scenery it its wildness.

James Fennimore Cooper's Leatherstocking Tales and the novels of Robert Montgomery Byrd, Timothy Flint, and William Gilmore Simms were, in essence, American fiction because they emphasized the uniqueness of the American environment. Other notable Hudson River School artists—Albert Bierstadt and Thomas Moran—and pioneer landscape photographer William H. Jackson initiated an artistic medium "that soon became a force in directing American attention to wilderness as a source of nationalism" (Nash 2001, 83).

In 1851 Henry David Thoreau addressed the Concord Lyceum:

> . . . to speak a word for Nature, for absolute freedom and wildness . . . . Let me live where I will . . . on this side is the city, on that side is the wilderness, and ever I am leaving the city more and more, and withdrawing into the wilderness . . . in the Wildness is the preservation of the World" (Nash 2001, 84).

These thoughts emanated from an idea that incorporated the spiritual with the material—the concept of Transcendentalism. Thoreau lived a life on the border between civilization and wilderness: the rural was the compromise, and refinement and wildness were not polar opposites but ideas to be coalesced into an American ideal. These ideas "led the intellectual revolution that was beginning to invest wilderness with attractive rather than repulsive qualities" (Nash 2001, 95).

Many proponents of wilderness preservation were the eastern literary and social elite of which John James Audobon was a prominent contributor. His *Birds*

*of America (1827-1838)* was a prominent work that called significant attention to America's natural beauty (Nash 2001). William Cullen Bryant and essayist Charles Lanman also brought national attention to the minority, but strongly opined, idea that wilderness was being destroyed at a rate that could, if unchecked, be irreversible. In 1851, after visiting Europe, Horace Greeley wrote, "Friends at home! I charge you to spare, preserve and cherish some portion of your primitive forests; for when they are cut away I apprehend they will not easily be replaced" (Nash 2001, 96). And, although the setting aside of two million acres of northwestern Wyoming as Yellowstone National Park by President Ulysses S. Grant in 1872 was less for its aesthetics than its utilitarian potentialities, these early preservationists provided arguments that led to its implementation.

In the early twentieth century, a prominent female ornithologist, Florence Merriam Bailey, sister of C. Hart Merriam and wife of Vernon Bailey (of the Bureau), likely played a significant role in bringing to light the predator eradication program of the Bureau to Eleanor Roosevelt in an anonymous communication: by this time (the late 1930s), Vernon Bailey no longer advocated the methods entrenched in the bureau regarding predator eradication (Robinson 2005).

In the period between Grant's creation of Yellowstone National Park in 1872 and the Dust Bowl of the 1930s, John Muir was probably the most notable "voice

yelling from the wilderness." Muir was a well-known preservationist with many political connections; unfortunately, Muir's most well-known battle—to prevent the damming of the Hetch-Hetchy Valley [adjacent, and connected, to Yosemite Valley]—was lost in spite of these connections. Consider the ramifications of the decision to dam the Hetch-Hetchy Valley: Yosemite Valley would have been twice the size it is today. Animals with large home ranges (e.g., large carnivores) suffer to a greater extent than smaller animals when landscapes are fragmented; when an area is split in half, the effective home range is quartered due to edge effects and physical barriers. In spite of this prominent defeat, Muir's contributions, although they were not so different from Thoreau's, were more effective probably due to the timing of his writings and the changes that took place at the turn of the twentieth century.

Aldo Leopold is best known for *A Sand County Almanac* (1949) and, more specifically, the conclusory discussion entitled "The Land Ethic." What is often forgotten is that Leopold began his career in 1909 as a manager of national forests in Arizona and New Mexico in the highly utilitarian U. S. Forest Service (USFS) headed by Gifford Pinchot. Among his first projects "was a campaign for the complete extermination of "bad" predators (chiefly wolves and mountain lions) in the interest, he then believed, of helping the "good" animals (cattle and deer)" (Nash 1989, 64).

However, by 1933, as a professor of wildlife management at the University of Wisconsin, Leopold held a very different view regarding predator management. He proffered that the good-bad dichotomy did not have a place in natural systems; he advised those who would modify natural systems to apply the precautionary principle and that "to keep every cog and wheel [in its proper place] is the first precaution of intelligent tinkering" [emphasis added] (Nash 1989, 64). Leopold would claim that the turning point in his thinking was when he had occasion to "watch a fierce green fire dying in her [a wolf's] eyes" after he had shot a wolf and watched her die [emphasis added] (Leopold 1949, 130). The fact that twenty-four years had elapsed between that incident and Leopold's precautionary words to his students at the University of Wisconsin points to the fact that it is never too late to change one's perspective. The fact that Leopold was able to change his ecological philosophy so radically and that he is best remembered for his Land Ethic and not for his years as a predator "removal" manager offers hope for the future of predator management in specific and environmental ethics in general.

Leopold's "Land Ethic" is a broad, well-articulated discussion of the human-ecology dichotomy: the discussion includes soil ecology, agriculture, public and private land use and the ethic necessary for balanced coexistence, energy flow (the energy pyramid), and the need to balance ecological science with economic necessity. The discussion is so detailed that I will not reproduce it here. I hope

the reader will excuse the brevity with which I attempt to convey Leopold's intent; however, I feel the following quote exemplifies the essence of this intent (Leopold 1949, 224-225):

> The 'key-log' which must be moved to release the evolutionary process for an ethic is simply this: quit thinking about decent land-use as solely an economic problem. Examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.

For me, The "Land Ethic" represents the process and culmination of Leopold's personal evolution of a belief system from a man who, at one point in his professional life, killed predators to a man who, in the end, who believed that there was a better manner in which to interact within our Ecosphere. And, perhaps most important, this evolution of ecological thought found its way into the psyche of generations of environmental ethicists through the pen of a man who was uniquely capable of articulating these thoughts in a passionate manner.

Contemporary Environmental Activism

Rachel Carson may be the most iconic person never to have lived to see the modern environmental movement; however, *Silent Spring* (1962) is a book that many believe was the gateway to that very movement and was published just thirteen years after *A Sand County Almanac*. In *Silent Spring* Rachel Carson, a former U.S. Fish and Wildlife marine biologist, effectively expanded on Leopold's

work by documenting the effects of DDT on the ecosystem as a whole. Carson's impassioned discussion of the effects of organophosphate insecticides on the trophic web brought the science of environmental toxicology into the discussion of the balance of nature. Where Leopold utilized ethical arguments and ecological theory to argue in favor of a precautionary approach to human-ecological interactions, Carson documented an actual case study of human technology creating unintended consequences. In this way these two scientists inadvertently created the momentum for significant environmental policy changes.

At the time of its publication, *Silent Spring* was greeted with tremendous animosity from the industries that it targeted (i.e., the chemical and agricultural industries) as was Carson. Even today, there are still vocal opponents to the validity of Carson's conclusions. In spite of this, it is likely no coincidence that a prodigious number of environmentally astute legislations and organizations followed within a decade: (1) the National Environmental Policy Act (NEPA) (1969); (2) the Environmental Protection Agency (EPA) (1970); (3) the Federal Water Pollution Control Act (FWPCA) (1972) which was amended to the Clean Water Act (CWA) (1977); (4) the Federal Insecticides, Fungicides, and Rodenticides Act (FIFRA) (1972) which amended the FIFRA of 1947; (5) the Clean Air Act (CAA) (1970); and, (6) the Endangered Species Act (ESA) (1973). All of these legislative acts have since evolved as more information has become

available. For this reason and the fact that numerous vocal environmental advocates became active after the publication of *Silent Spring*, this book must be considered one of the most influential books ushering in the modern environmental movement.

A contemporary of Carson, Murray Bookchin, was quite interested in the social aspects of environmental degradation as perpetrated by humans. Bookchin published *Our Synthetic Environment* (1963) just a year after Carson's *Silent Spring* and found his work somewhat obscured by the furor created by Carson's work. But Nash (1989 164) is adamant that Bookchin most effectively put forth the thesis that "the domination of nature by man stems from the very real domination of human by human."

In *Nature and Madness* (1982), Paul Shepard focuses on the historical and psychological aspects of human nature in relation to their environment. He makes comparisons between humans reared in the hunter-gatherer societies (i.e., communities where humans from infant to adult are reared in close proximity to pre-agricultural nature) to those raised in more human-dominated environments (i.e., agricultural communities). Shepard contends that "relict tribal peoples" seem to live in greater peace in their world seeing themselves as guests rather than masters of their environment. The *ontogeny* (development) of the children of these societies fosters "a calendar of mental growth, cooperation, leadership, and the study of a mysterious and beautiful world where

the clues to the meaning of life were embodied in natural things . . . ” He contrasts this way of life with Western civilized cultures that “have largely abandoned the ceremonies of adolescent initiation that affirm the metaphoric, mysterious, and poetic quality of nature, reducing them to esthetics and amenities” (Shepard 1982, 6-7). Shepard writes that the ontogeny of the former “is more normal than ours . . . and that it may be considered to be a standard from which we have deviated” (Shepard 1982, 6).

Shepard further states that “. . . . In the ideology of farming, wild things are enemies of the tame; the wild Other is not the context but the opponent of “my” domain. Impulses, fears, and dreams—the realm of the unconscious—no longer are represented by the community of wild things with which I can work out a meaningful relationship” (Shepard 1982, 35). Much of this is in concert with what I have written previously regarding hierarchical societies; but, Shepard’s work goes well beyond this more simplistic argument by discussing a “psychological evolution”—my terminology—that is quite esoteric in content. His work is an excellent read, and I will leave those interested in this depth of explanation to refer to this publication.

In *Nature’s Economy: A History of Ecological Ideas, 2nd Edition,* Donald Worster (1994) presents the history of ecology from many points of view. Worster’s description of the Kaibab Plateau in the 1920s is what I will focus on

here; by no means is this meant to represent the entire thesis of his book, but this aspect is relevant to my discussion.

On the northern Arizona plateau in the Kaibab Forest area designated as the Grand Canyon National Game Preserve, deer numbers were estimated at approximately 4,000 in 1906. By 1924 the deer population in that region was over 100,000. If you recall the discussion of the predator eradication policies of the intervening years discussed previously, one may assume—at the very least—causation; there may have been other secondary contributing factors. According to Worster (1994, 270), this game management endeavor "became the *cause cele bre* of game management in America." Of the 100,000 deer present in 1924, by 1939 only 10,000 remained due to malnutrition and starvation. Worster refers to Irvin Rasmussen who estimated, at that time, "the range had been so severely damaged that 20,000 was an excessive population" (Worster 1994, 270). Of those 100,000 deer, thousands had died from malnutrition because the unchecked population was overgrazing, overbrowsing, and highlining of trees—that is, eating leaves and branches as high as the deer could reach. This was the direct result of a poorly conceived predator eradication program and a poor conception of ecology and the trophic web. Unfortunately, this cannot be written off as a lack of knowledge as there were several official game management personnel, as well as NGOs, whose warnings went unheeded. This was a clear case of bias against large mammalian predators for

the reasons previously discussed. This situation stands in superb contrast to the GYE wolf reintroduction program discussion later in this thesis. The Kaibab Plateau of the 1920s is an excellent example of top-down trophic influence—and a trophic cascade.

A recent study in *Biological Conservation* (Ripple and Beschta 2006) presents compelling evidence of the impacts of cougars on two analogous ecosystems in Zion National Park [~15 km apart]: The system where cougar numbers have been significantly diminished by the large number of tourists (> 3.5 million per year) is compared to an ecosystem where cougars are far more prevalent due to the lack of human influence. The system with an adequate number of cougars present to control deer populations has a significantly higher level of floral and faunal biodiversity. This is as close as one can get to a double-blind study in nature and suggests the importance cougars impart to ecosystems—that is, it suggests cougars are capable of creating beneficial ecosystem impacts through top-down control.

There are other instances where bottom-up tropic controls are more influential. Côte (2005) discusses Anticosti Island, which is a large island about 35 km south of the north shore of the Gulf of St. Lawrence in Quebec that was once the native habitat of only two mammals that fed on vegetation: black bear and deer mice (*Peromyscus maniculatus*). In 1896 about 220 white-tailed deer were introduced to Anticosti Island; prior to this, there were narrative accounts

of a plentiful number of black bears. Unsustainable hunting of the black bear prior to this introduction allowed the unchecked deer population to multiply to numbers in excess of 50,000 individuals by 1934.

Black bears were dependent upon the berries and wild fruits—currants and gooseberries—which they utilized in massive numbers during the summer and autumn mast. The overpopulation of deer resulted in excessive browsing affecting a major change in the vegetative content of the island: eventually, the island was nearly devoid of all deciduous shrubs—vegetation that the black bear required for survival. Alternative explanations for the extirpation of black bears on Anticosti Island are certainly plausible (e.g., overhunting); however, this study did not reveal any other single, plausible explanation for this extirpation. As in many instances, multiple ecological variables may have contributed to the extirpation; but, it appears that the significant decline of necessary vegetation was the most significant contributor. The significance of this case study is that this is one case where the introduction of a prey species was a significant contributor to the extirpation of a large carnivore; in this instance, the mechanism of extirpation is best described as bottom-up trophic collapse.

In *The Diversity of Life* (1992, 347), Edward O. Wilson asks the loaded question, "What difference does it make if some species are extinguished, if even half of all the species on earth disappear?" The short answer is the fact that the science of ecology has matured to the degree that we understand the great

benefit, and concept, of ecosystem services—that is, the processes of a properly functioning Ecosphere that contribute to cleaner air and water, carbon sequestration, buffers against storm damage, healthy soils and substrates, healthy food sources, medicinal benefits, and numerous other benefits. These ecosystem services all benefit humans; therefore, one could argue that Wilson's argument is anthropocentric in origin. But, this argument is only the tip of Wilson's iceberg.

Wilson has always argued from a very Darwinian point of view. A book he co-authored with Robert MacArthur, *The Theory of Island Biogeography* (MacArthur and Wilson 1967), is a testament to his devotion to Darwin's work. This particular work is devoted to the idea of speciation in relation to islands—in particular their size and distance from the mainland. This follows closely with what both Charles Darwin and Alfred Russell Wallace learned about speciation on islands a century earlier; however, Macarthur and Wilson utilized Macarthur's mathematical ingenuity to advance and quantify the theory. In *The Diversity of Life,* Wilson injects the Darwinian ideal into his discussion when he writes:

> . . . . We did not arrive on this planet as aliens. Humanity is part of nature, a species that evolved among other species. The more closely we identify ourselves with the rest of life, the more quickly we will be able to discover the sources of human sensibility and acquire the knowledge on which an enduring ethic, a sense of preferred direction, can be built. (Wilson 1992, 348)

Wilson puts forth a strong argument for the preservation of biodiversity: He makes the point that we have not even identified a small fraction of the species on Earth and, therefore, we ought to be very careful to preserve all forms of life. Although Wilson has always held an affinity for insect biodiversity, he is an advocate for all species. I have already shown examples of what can happen when we exterminate top-chain predators (Kaibab Plateau) and when we reintroduce them (GYE wolf reintroduction): these examples, and Wilson's ethic, greatly illuminate the need to practice the Precautionary Principle when dealing with the many unknown aspects of Earth's ecological interactions.

In *The Closing Circle* (1971), Barry Commoner emphasizes this point when he writes:

> Any living thing that hopes to live on the earth must fit into the ecosphere or perish. The environmental crisis is a sign that the finely sculptured fit between life and its surroundings has begun to corrode. As the links between one living thing and another, and between all of them and their surroundings, begin to break down, the dynamic interactions that sustain the whole have begun to falter and, in some places, stop. (Commoner 1971, 8)

Commoner emphasizes nutrient movement through the ecosphere—beginning in the soil, continuing through the food chain, moving through the atmosphere, and, ultimately, re-entering the cycle via the saprophytes that break down waste products into their component parts—as a naturally occurring, unbroken cycle. Much of this book is devoted to those anthropogenic processes and by-products

that break this cycle. By working to reduce and eliminate unnatural and harmful products and processes that interfere with this cycle, Commoner presents the theoretical manner in which we can close the circle. He is emphatic that the closing of this circle is an essential element for the preservation of healthy ecosystems, a healthy ecosphere, and all forms of life on Earth. Commoner acknowledges that there is much about ecology and our ecosphere that we do not understand: The same is true today.

If we do not know the outcome of a particular environmental policy, we must proceed with extreme caution; if we *know* that a particular policy, process, or product is detrimental to our Ecosphere—especially when less harmful alternatives exist—then it is a crime against nature to proceed. Some would call this left-wing environmentalist hyperbole: I consider it to be Gospel.

## Animal Rights

### Introduction

As citizens of the United States of America, arguably the most successful democracy in human history and currently the most powerful nation on Earth, we may have the temerity to believe that we are the center of the ethical universe; but, a study of the historical origins of environmental ethics and animal rights demonstrates that we have merely added to a foundation that had its beginnings in ancient times. The ancient Greeks and Romans began these very foundations that have since been built upon by a strong European influence. British

philosophers such as John Locke, and his antecedents, proffered ethical principles that we, as Americans, have attempted to extend into the realm of the environment.

The worldwide movement of animal rights had its origins in England in the eighteenth century; additionally, Arne Naess, a Norwegian, and others greatly extended the circle of environmental ethics in the form of deep ecology.

But, although America did not produce the foundation principles of environmental ethics and animal rights, we have greatly expanded those principles over the last three centuries. When I speak of America, I am not simply referring to our government but to the American people. In fact, it has always been individuals with strongly held principles that have contributed the principle of ethical extension to the rights of oppressed people, animals and nature. The fact that England abolished the practice of human enslavement a century prior to America demonstrates that these processes (i.e., the freeing of oppressed entities) have been slow, ugly, and violent and are still very fluid. During some periods we seem to be moving in an undesirable direction; but, that is the way the process seems to "progress." We cannot study the history of ethics in a confined box of time: what seems like a regression is often only a period of learning—that is, of learning what *not* to do. This is not a new phenomenon.

We must sustain the optimistic view that we will progress in the moral sense as human beings in order to achieve the radical changes in humanity that may lie ahead of us. Without that optimism, there would be no more reason to write, act, and fight for the principles that must continue to evolve in order for society—our Ecosphere—to progress in a manner that will make life meaningful. I believe that until all elements of our Ecosphere are treated respectfully, our Universe will not provide a suitable feeling of belonging [to the Earth]: and I firmly believe that most people, in some way, know this to be the truth. In the remainder of this chapter, I will discuss some prominent contributors to the idea of widening our ethical circle—to borrow a concept from Barry Commoner—which will greatly contribute to the progression towards a better life for the animate and inanimate—that is, for all of us that inhabit this great Ecosphere.

Early Contributors to Ethics

In Runnymede, England, almost eight centuries ago, a group of 25 barons forced King John of England to sign the *Magna Carta*—which prohibited imprisonment or banishment by autocratic decree and transferred the power of judgment to one's peers and transferred the power of taxation and confiscation of land to the Great Council—was the first written document that set the precedent of ethical expansion. While this was not the purpose envisioned by English nobility of the time, this "Great Charter" laid the foundation for the creation of the American Constitution by introducing natural rights (Nash, 1989).

Greek and Roman Philosophy

Nash wrote of the idea that Greek and Roman philosophers distinguished between natural and man-made law. They understood that humans had not been alone at the dawn of history: animals, lower life forms, and the inanimate components of the environment were present as well. While the Latin principles of raw nature, called *jus naturae,* and the ideas of justice created by humans, *jus commune*, were understood to be distinct, the question of where non-human animals fit into this thinking concerned philosophers of the day. They put forth the idea that animals possessed inherent or natural rights, which they termed *jus animalium*. The third-century Roman jurist Ulpian argued that *jus animalium* was part of *jus naturae* because nature included a component that was not confined to humans—that is, animals. Although Ulpian "included only animals in his concept of justice, [that concept was] derived from the idea that nature as a whole constituted an order that humankind should respect" (Nash 1989, 17). After the decline of Greece and Rome, the advent of Christianity did not hold nature to the same standard as did the Greek and Roman philosophers. The early Christian philosophers Hugo Grotius (1583-1645) and Samuel Pufendorf (1632-1694) did not consider the human relationship to the environment worthy of ethical concern. Pufendorf's conclusion that " there is no common rights/law between man and brutes'" prompted John Rodman to identify "this Seventeenth-

Century rejection of animal rights as a turning point in the history of thought'" (Nash 1989, 17).

This time period was also the center of debate over the practice of vivisection. Early physicians and physiologists relied upon vivisection to study the inner workings of the body; however, this practice was strongly denounced by early humanitarians. Vivisectionists turned to Rene Descartes (1596-1650) to champion their research methods. Descartes was an accomplished mathematician, physiologist, and psychologist: these qualifications enabled him to provide a general philosophy of the irrelevance of ethics to the human-nature relationship. Descartes' philosophical argument was that "animals were insensible and irrational machines. They moved, like clocks, but could not feel pain. Lacking minds, animals could not be harmed. They did not suffer" (Nash 1989, 18). While there was an extremely minor contingent that challenged anthropocentrism during this period, Christianity weakened the ideas of an extended natural community. However, there is some evidence that, on rare occasions, Middle Age courts actually placed animals that killed people on trial; while, at first glance, this may have seemed to be consistent with Christian thought regarding human-nature interactions, it actually makes the argument that animals possessed rights. How else could one justify placing an animal on trial save for the fact that the animal had sufficient rights to possess standing

before the law? Future animal rights philosophers, such as Tom Regan and Peter Singer, would make such arguments more than three centuries later.

The late seventeenth century brought with it a challenge to anthropocentric thought manifested as a Renaissance period of widening scientific horizons during which humans, with the aid of telescopes, were beginning to understand that Earth was not the center of the universe. Some humans were beginning to understand that humanity did not seem to be the master of nature but, simply, a member of the natural community. Nash (1989, 22) posits that "Charles Darwin . . . would put the capstone on this line of reasoning in 1859." I will devote a short discussion to evolution below.

Jeremy Bentham was a strong late eighteenth century voice in opposition to animal cruelty upon which modern American animal rights philosophers based later arguments. Bentham was quite poignant in his 1789 writing:

> The day may come when the rest of the animal creation may acquire those rights which never could have been withholden from them but by the hand of tyranny . . . . [T]he blackness of the skin is no reason why a human being should be abandoned without redress to the caprice of a tormentor. It may come one day to be recognized, that the number of the legs, the villosity of the skin, or the termination of the *os sacrum* [i.e., spinal base], are reasons equally insufficient for abandoning a sensitive being to the same fate . . . . The question is not, Can they *reason*? nor Can they *talk? ,* but Can they *suffer?"*

In *Animal Liberation,* Peter Singer (1990), discussed below, utilized these very arguments over two centuries later to make his argument against "speceisism" and that all animals are equal.

Charles Darwin and his supporters brought forth the concept of the unity and continuity of life. Evolution's primary unit—the species—may have been continuously changing; but, inherent in the process was the idea of an unbroken connection to the first life forms. Because Darwinism built upon a centuries-old philosophy of organicist and animist philosophy, the concept spread rapidly and exerted a significant impact on Western ethics. In 1867, John Muir [as written by Nash] (1989, 42-43) noted:

> This star, our own good earth, made many a successful journey around the heavens ere man was made, and whole kingdoms of creatures enjoyed existence and returned to dust ere man appeared to claim them . . . . After human beings have also played their part in Creation's plan, they too may disappear without any . . . extra ordinary commotion whatever.

Darwin's beliefs described fierce competition, but that competition possessed a commonality among *all* competitors. The idea of all beings living and dying together over the eons put forth the idea that everything alive was part of a universal kinship: it was not a great leap from there to the idea of respect for humans' fellow creatures. According to Nash, Darwin believed that human respect for these creatures defined a civilized people (Nash 1989). In *The Descent of Man*, Darwin wrote, "'As soon as [a] virtue is honoured and practiced

by some few men . . . it spreads through instruction and example to the young, and eventually becomes incorporated in public opinion'" (Nash 1989, 44). Through time, by ethical extension, humans expanded their ethical circle "'to the imbecile, maimed, and other useless members of society [and might eventually extend to] "disinterested love for all living creatures'" [emphasis added] (Nash 1989, 44). These ideas present a foundation—even an inspiration—for the idea that current policies can be changed given enough time.

Contemporary Animal Rights Philosophy

In his 2nd edition of *Animal Liberation* (1990), Peter Singer introduces the concept of "speceisism"—a prejudice or attitude of bias in favor of the interests of members of one's own species and against those of members of other species—which rests on the idea that it is analogous to racism and sexism. I would extend this definition of "speceisism" to include the bias of one species over another even when neither species is one's own. This modification of the definition obviously will augment my thesis argument; however, I feel that it is a reasonable extension that will stand scrutiny. For instance, how different is the argument [in Singer's view] that humans deserve special consideration over deer than the view that argues special consideration of bighorn sheep over cougars? Singer argues that the basic element of "speceisism" is:

> . . . the taking into account of the interests of the being, whatever those interests may be—must, according to the principle of equality, be extended to

> all beings, black or white, masculine or feminine, human or nonhuman . . . (Singer (1990) as cited by Kaufman 2003b, 151)

Singer utilizes arguments posed by Jeremy Bentham in 1789 when he also writes, "The question is not, Can they *reason?* nor Can they *talk?* But, can they *suffer?*" (Kaufman 2003b, 151).

Singer's arguments emanate from the context of animal experimentation for medical research but can be extended to include bias against species for other reasons (e.g., game management).

Singer is somewhat vague on the idea that there may be certain instances when animal experimentation may benefit the greater good by refusing to enter into the controversy that some opponents of animal experimentation have denied that any animal experiments have been essential in making significant discoveries. He also acknowledges that positive contributions made through animal experimentation are difficult to estimate. These statements make it difficult for me to determine Singer's stance on certain management decisions between two or more nonhuman animals (e.g., strategic killing of California mountain lions in order to protect the more endangered Peninsular bighorn sheep distinct population segment [DPS]). Tom Regan is less ambiguous on these issues.

Tom Regan's *In Defense of Animals* (1985), specifically the section "The Case for Animal Rights" represents a more absolute position against the use of

nonhuman animals for the benefit of humans—especially when nonhuman animal suffering is involved. Regan outlines three important criteria that define his advocacy of animal rights: (1) the total abolition of the use of animals in science; (2) the total dissolution of commercial agriculture; and, (3) the total elimination of sport hunting and trapping. As an example of ethical relativism, Regan writes:

> The clubbing of baby seals is abhorrent; but not the harvesting of adult seals. I used to think I understood the reasoning. Not any more. You don't change unjust institutions by tidying them up (Regan (1985) as cited by Kaufman). (2003a, 157)

In answer to the question of how we address this issue, Singer writes, "People must change their beliefs before they change their habits" (Kaufman 2003, 157). Singer bases his arguments on "indirect duty views." This argument is based on the idea that the harm to a nonhuman animal only infringes on the rights of the "owner" of the animal harmed—not to the rights of the animal itself. This leads Singer to argue for the *equal* inherent value and rights of the individual animal itself whether or not the animal in question is human. Singer adamantly believes that the human rights and animal rights movements are closely tied to one another—not antagonistic; and, in the case of utilizing animals in science, he believes that the rights view is "categorically abolitionist" (Kaufman 2003, 163).

In *Duties to Endangered Species* (1985), Holmes Rolston III begins his discussion by confronting the anthropocentric argument of preserving species: the argument that while we have duties to protect species, those duties do not reflect duties to the species themselves, but duties to future human beings. In response to this human-centered thinking, Rolston writes, "To value all other species only for human interest is like a nation's arguing all its foreign policy in terms of national interest. Neither seems fully moral" (Rolston (1985) as cited by Kaufman 2003, 69). Twenty years after he wrote these words it is no wonder that environmental protections have been eroding rapidly in the early twenty-first Century. Nevertheless, simply because our country or, more accurately, our current government behaves in a less than ethical manner, that behavior ought not to be considered the proper manner in which to conduct ourselves as individuals.

Historically, at least at the time of Rolston's writing, taxonomists were often divided into lumpers and splitters. Present day taxonomists have the advantage or encumbrance of DNA testing to determine how to classify organisms. Even with this new technology, the question of "what is a species?" will always present challenges. When we are deciding what duties or rights are due particular organisms, it is important to understand that there is not always a consensus on what constitutes a species. Rolston asks, "Is there enough factual reality in species to base duty there?" He later defines "[a] species [as] a coherent,

ongoing form of life expressed in organisms, encoded in gene flow, and shaped by the environment" (Rolston (1985) as cited by Kaufman 2003, 69). He argues that it is not form (i.e., the species) as mere physical structure, but the formative (i.e., speciation) process that humans ought to preserve: of course, the process cannot be preserved without its products. Rolston articulates this by writing, "The individual represents (re-presents) a species in each new generation. It is a token of a type, and type is more important than the token" (Kaufman 2003, 70).

As counterpoints, Rolston quotes Feinberg, Singer, and Regan. Feinberg, as quoted by Rolston, writes, " ' A whole collection, as such, cannot have beliefs, expectations, wants, or desires . . .'" Singer, as quoted by Rolston, writes, "'Species as such are not conscious entities and so do not have interests above and beyond the interests of the individual animals that are members of the species.'" Regan, as quoted by Rolston, writes, " The rights view is a view about the moral rights of individuals. Species are not individuals, and the rights view does not recognize the moral rights of species to anything, including survival'" (Kaufman 2003, 71). To these points Rolston argues that species are the sum of and reducible to the benefit of the individuals of that species. Rolston writes that "duties to a species are not duties to a class or category, not to an aggregation of sentient interests but to a lifeline . . . . No individual crosses the extinction threshold; the species does" (Kaufman 2003, 71-72). An

appropriate conclusory statement encompasses Rolston's entire argument: ". . . the appropriate survival unit [the species] is the appropriate level of moral concern" (Kaufman 2003, 67). In the realm of ecological science, Rolston seems to have a more appropriate grasp of the long-term survival of species than other animal rights philosophers by placing the emphasis on the species unit over the individual.

In terms of landscape-scale ecology and wildlife management, Rolston's species-oriented approach appears to be the most reasonable in terms of preserving biodiversity and naturally functioning ecosystems in relation to modern conservation management policies. These ideas will, no doubt, run counter to many animal rights advocates who hold the welfare of the *individual* in the highest esteem. In naturally occurring systems, it is commonplace for the young, old, weak, and infirm organisms to be "sacrificed" for the good of the species or herd. An example I observed in Yellowstone National Park (YNP) or the GYE illustrates this point. In the Lamar Valley of northeastern YNP, I observed three wolves from the Druid Pack attempting to isolate a wounded bison calf—the calf had an obvious right foreleg lameness; the pack was unsuccessful in their attempt because the calf made it back to the larger herd. However, it is likely that this calf's days were numbered: darkness prevented us from viewing the outcome of this encounter. These observations took place 12

September 2006 in the company of my wife, daughter, and another family with whom we were traveling.

A wounded animal that requires additional energy to be expended by the herd is a liability to the survival of the herd. The loss of this animal, and others like it, inevitably strengthens herd health and strengthens the viability of the species and improves its chances of survival. When we speak of approximating natural systems, this example serves as a template of what appears to be appropriate twenty-first century wildlife management. Since the re-introduction of wolves into the Greater Yellowstone Ecosystem (GYE), the ecosystem as a whole, and the general health of elk, bison, and moose herds have improved, and deer herd health is equivocal. Wilmers and Getz (2005) report on these beneficial ecological effects in *Wolves Buffer Scavengers against Climate Change*. In the absence of wolves, warmer winters result in fewer elk (*Cervus elaphus*) carcasses, which may have deleterious effects on scavengers such as bald eagles (*Haliaeetus leucocephalus*), grizzly bears (*Ursus arctos*), ravens (*Corvus corax*), and black bears (*Ursus americanus*). Wilmers and Getz (2005) found that March elk deaths declined 27 percent before wolf reintroduction and only 4 percent with wolves present; April elk deaths declined 66 percent and 11 percent, respectively. This work makes an excellent argument that human hunting is a poor substitute for the ecological dynamics of intact ecosystems.

While the GYE wolf reintroduction is only in its infancy, and we do not know exactly what will transpire next, it seems logical that healthy species will contribute to improved ecological quality and herd viability to a far greater extent than healthy *individuals* alone. Survival of the fittest is not pretty to watch—we were not looking forward to seeing a bison calf killed by wolves—but it is the primary manner by which species retain their viability and vigor.

## Nature's Dark Side

Human interaction with the beauty and grandeur of wilderness, nature, or the great outdoors—whatever adjective one uses to describe what is not civilization—can be the most sublime experience of one's life. It can also be the most deceptively dangerous experience a human will ever face—even without factoring in the chance encounter one may have with a fierce mammalian predator. But, like it or not, the two go hand in hand.

Observing an animal being eaten alive is not a pretty sight: I have witnessed such an occurrence. During my sophomore year of veterinary school, my most loyal study companion—a lap cat named Mr. Bill—was dismembered by a pack of feral dogs. I arrived just in time to fight off the dogs and place Mr. Bill's remains into a black plastic bag. I lost three other cats to coyotes while I was away at school. My initial primal thought was to do likewise to the perpetrators; but, then, my humanity took over, and I accepted the horror and sadness that followed. These "perpetrators" were simply doing what animals do. What I can

say with complete honesty is that observing and experiencing these incidents is easier for me to accept than the painful process of institutionalized predator management.

Our scientific knowledge has grown exponentially and there are greater numbers of predator advocates than ever before; however, our government institutions continue committing the same ecological errors based on information available only to their closed community. The fact that institutionally-backed, ecologically unsound predator management practices have gone on relatively unchecked for a century is a sign that we need policy changes. Chapter 3 presents a qualitative evaluation of state wildlife management policies, and chapter 4 is an attempt to promote changes commensurate with the findings in chapter 3.

# CHAPTER 3

# STATE WILDLIFE MANAGEMENT POLICY: QUALITATIVE DATA ANALYSIS

> In any organization there will always be
> one person who knows what is going on.
> This person must be fired.
>
> —Conway's Law

## Introduction

The data I present in this chapter are the result of the detailed study of the wildlife management policies and statutes of the eleven Western states (Arizona (AZ), California (CA), Colorado (CO), Idaho (ID), Montana (MT), Nevada (NV), New Mexico (NM), Oregon (OR), Utah (UT), Washington (WA), and Wyoming (WY)). In the first section I will discuss the layers of protection (LOP) for two or four different comparisons: (1) *all* predators (AP)—coyote and larger—compared with non-predatory *game* animals (NPG); (2) *predatory* game (PG) animals compared with non-predatory game animals (NPG); (3) same as (1) except I will include javelinas and wild pigs as *predators* (All predators including pigs (APP)); and, (4) same as (2) except predatory game will include pigs (PGP). For (3) and (4) above, I will concurrently remove pigs from the big-game cohort. The rationale explaining (3) and (4) is that OR considers wild pigs as *predatory* game

mammals and that, often, wild pigs can be more carnivorous than black bears: I have included black bears as *predatory* mammals in all of the above states. For clarification, I note that black bears are legally categorized as big or trophy game in these same states and that the trophic classification of predatory and the legal classification of big or trophy game are not mutually exclusive; cougars often carry the same big or trophy game designation. Because CO, ID, MT,NV, UT, WA, and WY either do not have wild pigs or do not consider pigs as game animals—in fact, in CO, NV, UT, and WA they are considered illegal, exotic, invasive species—these states will only have the first two comparisons. AZ, CA, NM, and OR will include all four comparisons since javelinas and wild pigs are considered game mammals.

Appendix 1 lists the eleven states, the species of interest in each state, the layers of protection (LOP) of each animal listed with explanations, and the nominal or numeric state statutes—or federal legislation, when applicable—that provide the legal basis for these protections. The "Sources Consulted" section will provide website or personal communication references for each statute.

Each state will have a corresponding bar graph (figure) listing the species present in that state that fall under the above criteria. The species present may vary by state (e.g., some states do not have javelinas or white-tailed deer), but the general concept of predatory mammals and non-predatory game mammals will remain intact. Additionally, in most of the states under study, bobcats are

considered furbearers; AZ is the one state that considers bobcats both a predator *and* a furbearer. California is the only state that considers bobcats non-game animals. In this thesis, I am classifying bobcats as predatory game animals as this makes sense ecologically and because that is the consensus among ten of the eleven states: although furbearers are not necessarily considered game, they are hunted and trapped and a license is required to do so. The difference is not, in my opinion, significant enough to exclude them as game animals.

I present numeric layers of protection (LOP) representing the above comparisons; these may or may not be integers as they will be averages of the LOP (ALOP) for all animals in that cohort; all numbers will be rounded to the nearest tenth. I will present the average LOP of all species (AS) studied in each state as the conglomerate ALOP (ALOP-AS). I will also present the average disparity between predatory and non-predatory mammals (ALOPD): this is defined as the average LOP of AP, PG, and PGP subtracted from NPG. Additionally, I will utilize a formula that will allow me to compare relative biases between states by utilizing a combination of formulae. The first is the ALOP–AS multiplied by the average layers of protection of all predators (AP) divided by the ALOP of non-predatory game mammals (AP/NPG). This ratio will allow me to determine the relationship between non-predatory mammal protection and the total protections allotted to all mammals. By dividing this number by the ALOPD, I will effectively be comparing the way non-predatory game is differentiated from

predatory-mammals. A low number would suggest an increased bias against predatory-mammals. This [(ALOP-AS) • (AP/NPG)]/ALOPD relationship will be represented as the NPG-AP disparity (NPG-AP-D). The previous calculations are defined below:

$$\frac{(\text{ALOP-AS}) \bullet (\text{AP/NPG})}{\text{ALOPD}} =$$

$$\frac{(\text{Average Layers of Protection of All Species}) \bullet (\text{ALOP for All Predators/ALOP Non-Predatory Game})}{\text{The Average LOP Disparity Between Predatory and Non-Predatory Mammals}}$$

Table 3.1 includes all of the above data and calculations for all eleven states. Figures 3.1 through 3.11 represent the LOP from each state individually.

In the second section of this chapter, I present numeric regional comparisons when they are of explanatory value and will note when they are inconsequential. Additionally, I present other *interstate* comparisons along with a narrative explanation relevant to those comparisons. Last, I will present state and regional appropriate practical recommendations for minimizing livestock and pet depredations as represented by peer-reviewed studies.

## State Results

### Arizona

The data points (LOP) I obtained (AZGF 2006) are presented graphically in Figure 3.1: predatory mammals are presented as dark columns, and the non-predatory mammals are presented as light gray columns. Most calculations

derived from these LOP are presented in Table 3.1; when I present calculations not represented in Table 3.1, I will explain them in the text. This applies to all eleven states.

There are obvious differences in the LOP afforded non-predatory game mammals compared to predatory mammals in AZ: these differences are noted as a ratio parenthetically represented in numerical form in Table 3.1. This value is the average of all of the calculated ratios (either two or four). A ratio of 1.0 would indicate equal protection of predators and non-predators; the average ratio of predatory mammals to non-predatory game mammals (PM: NPG) for AZ is 0.4, which implies that non-predatory game mammals are given 2.5 times greater protection than predatory mammals.

At this point it is important to discuss a few points. While the differences between predator and non-predatory game mammals suggest bias, it is important to note that a large disparity in LOP can result from a large number of protections of non-predatory game mammals. Therefore, it would not be correct to conclude that AZ does not value many of its mammals. Also, a state may have a low disparity between LOP because they either highly value all species or because they devalue all species. In either situation, bias between specific classifications of mammals does not exist; however, the latter situation may indicate an overall bias against large mammals. Based on the NPG-PA-D numeric, all eleven states will be ranked from lowest (i.e., 1) indicating the least

bias against predatory mammals to highest (i.e., 11) indicating the greatest bias against predatory mammals. In the case of AZ, the data indicate a face valid bias against predatory mammals: with an NPG-PA-D value of 0.2, AZ ranks 7th with CA and CO.

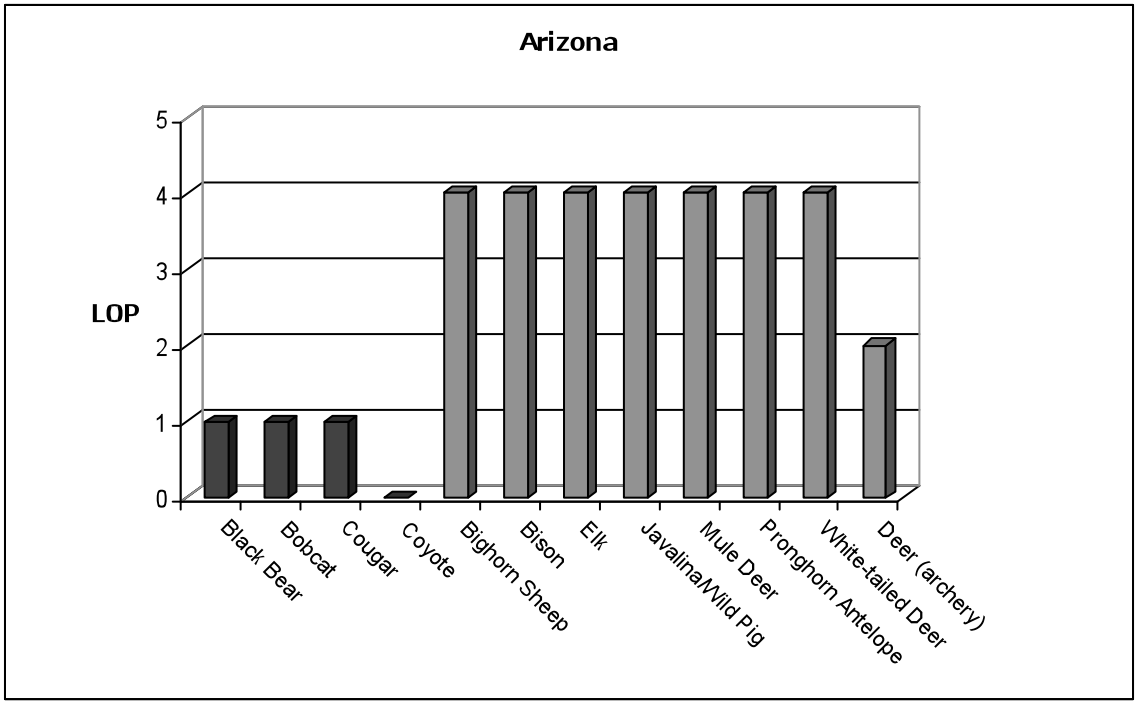


FIGURE 3.1. ARIZONA LAYERS OF PROTECTION (LOP). All species are classified as big game (BG) except coyotes and bobcats, which are classified as predatory mammals (PM). Bobcats are also classified as furbearers (FB).

TABLE 3.1. DATA AND CALCULATIONS FOR ELEVEN WESTERN STATES

Average layers of protection (ALOP) are represented for all predators (AP), predatory game (PG), non -predatory game (NPG), all predators including wild pigs [or javelinas] (APP), and predatory game including pigs (PGP). NPG* indicates NPG excluding wild pigs LOP from the calculation. The remainder of the ratios and calculation are explained in the body of the text.

| | AZ | CA | CO | ID | MT | NV | NM | OR | UT | WA | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | 0.8 | 0.5 | 0.5 | 1.8 | 0.9 | 1.2 | 1.4 | 1.0 | 0.5 | 0.8 | 1.2 |
| PG | 1.0 | 0.5 | 0.7 | 2.0 | 0.5 | 1.7 | 2.0 | 1.2 | 1.0 | 1.0 | 1.7 |
| NPG | 3.7 | 2.6 | 3.0 | 3.0 | 5.0 | 2.6 | 3.0 | 2.0 | 2.0 | 2.0 | 3.1 |
| APP | 1.4 | 0.6 | N/A | N/A | N/A | N/A | 1.7 | 0.8 | N/A | N/A | N/A |

TABLE 3.1 Continued

| | AZ | CA | CO | ID | MT | NV | NM | OR | UT | WA | WY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PGP | 1.8 | 0.8 | N/A | N/A | N/A | N/A | 0.8 | 1.0 | N/A | N/A | N/A |
| AP/NPG | 0.8/3.7 | 0.5/2.6 | 0.5/3.0 | 1.8/3.0 | 0.9/5.0 | 1.2/2.6 | 1.4/3.0 | 1.0/2.0 | 0.5/2.0 | 0.8/2.0 | 1.2/3.1 |
| | (0.2) | (0.2) | (0.2) | (0.6) | (0.2) | (0.5) | (0.5) | (0.5) | (0.2) | (0.4) | (0.4) |
| PG/NPG | 1.0/3.7 | 0.5/2.6 | 0.7/3.0 | 2.0/3.0 | 0.5/5.0 | 1.7/2.6 | 2.0/3.0 | 1.2/2.0 | 1.0/2.0 | 1.0/2.0 | 1.7/3.1 |
| | (0.3) | (0.2) | (0.2) | (0.7) | (0.1) | (0.6) | (0.7) | (0.6) | (0.5) | (0.5) | (0.6) |
| APP/NPG* | 1.4/3.7 | 0.6/2.6 | N/A | N/A | N/A | N/A | 1.7/3.0 | 0.8/2.0 | N/A | N/A | N/A |
| | (0.4) | (0.2) | | | | | (0.6) | (0.4) | | | |
| PGP/NPG* | 1.8/3.7 | 0.8/2.6 | N/A | N/A | N/A | N/A | 0.8/3.0 | 1.0/2.0 | N/A | N/A | N/A |
| | (0.5) | (0.3) | | | | | (0.3) | (0.5) | | | |
| ALOP-AS | 2.8 | 1.7 | 2.0 | 2.5 | 3.1 | 1.9 | 2.3 | 1.5 | 1.4 | 1.5 | 2.5 |
| ALOPD | 2.4 | 2.1 | 2.4 | 1.1 | 4.3 | 1.2 | 1.5 | 1.0 | 1.2 | 1.1 | 1.6 |
| NPG-PA-D | 0.2 | 0.2 | 0.2 | 1.4 | 0.1 | 0.8 | 0.8 | 0.8 | 0.2 | 0.5 | 0.6 |

California

These LOP (CDFG 2006) are represented graphically in Figure 3.2. While all but one of the eleven states assign coyotes an LOP of 0, CA is unique in that cougars are designated as a "specially protected mammal." This explains why the AP and PG LOP are identical. The average PM: NPG ratio for CA is 0.2. The NPG-PA-D for CA is 0.2, which ranks 7th with AZ and CO.

Colorado

These LOP (CDOW 2006) are represented graphically in Figure 3.3. The average PM: NPG ratio for CO is 0.2 which is equivalent to CA. The NPG-PA-D value of 0.2 ranks 7th with AZ and CA.

Idaho

These LOP (IFG 2006) are represented graphically in Figure 3.4. The average PM: NPG ratio for ID is 0.6. ID ranks 1st with an NPG-PA-D value of 1.7: this high value is a result of the relatively high values assigned to PA. Clearly, these values are high because of the presence of grizzly bears and wolves (ESA protected) and the fact that all predators are trophy game (TG), BG, or FB, which generate income for the state. If ESA protections are relaxed, it would be prudent to re-evaluate these values.

Montana

These LOP (MWFP 2006) are represented graphically in Figure 3.5. The average PM: NPG ratio for MT is 0.2. With an NPG-PA-D value of 0.1, MT ranks

11th. This low value is explained by a relatively low value assigned to PA, and the fact that gray wolves and grizzly bears can be taken under special circumstances; in addition, MT has relatively high LOP (i.e., 5) for NPG.

Nevada

These LOP (NDOW 2006) are represented graphically in Figure 3.6. The average PM: NPG ratio for NV is 0.5. The NPG-AP-D value for NV is 0.8, which ranks 2nd with OR and NM. NV's high ranking is due to a cessation of black bear hunting, and the fact that coyotes are given a LOP value of 1 for fur procurement for profit, which is unique among the eleven states.

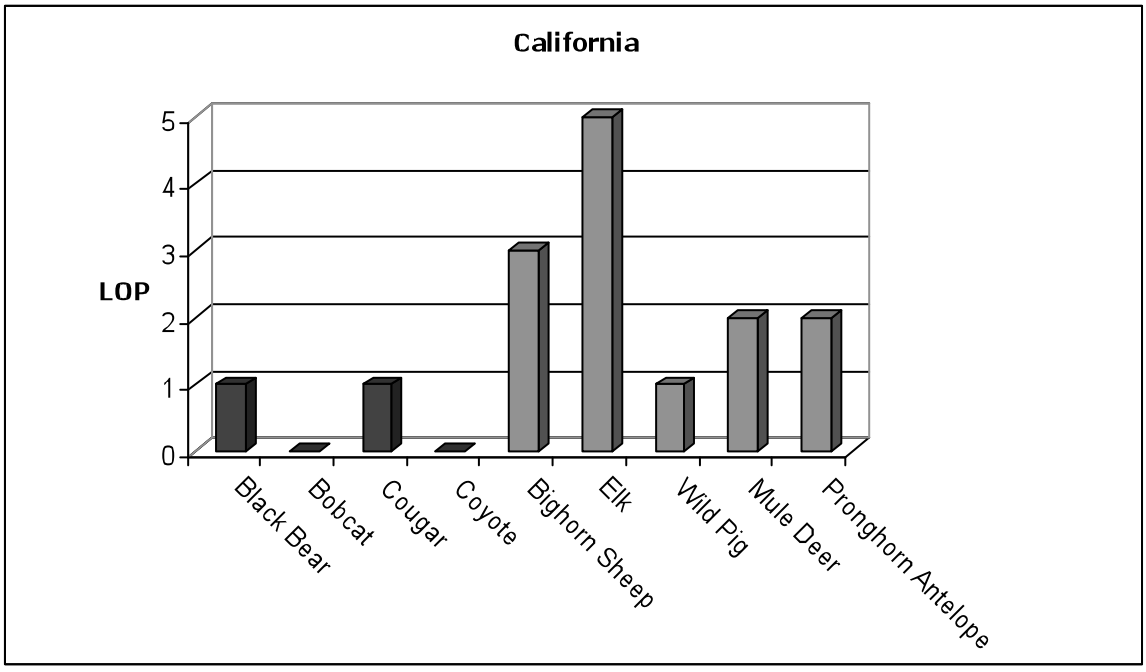


FIGURE 3.2: CALIFORNIA LOP. All species are classified as game animals (G) except bobcats (FB) and coyotes, which are classified as non-game (NG).

New Mexico

These LOP (NMDFG 2006) are represented graphically in Figure 3.7. The average PM: NPG ratio is 0.5. The NPG-AP-D value of 0.8 is ranked 2nd with OR and NV. This relatively high value is due to the relative high LOP values given to black bears and cougars (i.e., 3) and the fact that non-residents hunting coyotes are required to hold a hunting license (HL). NM holds a high NPG-AP-D value due to its relatively high LOP for AP.

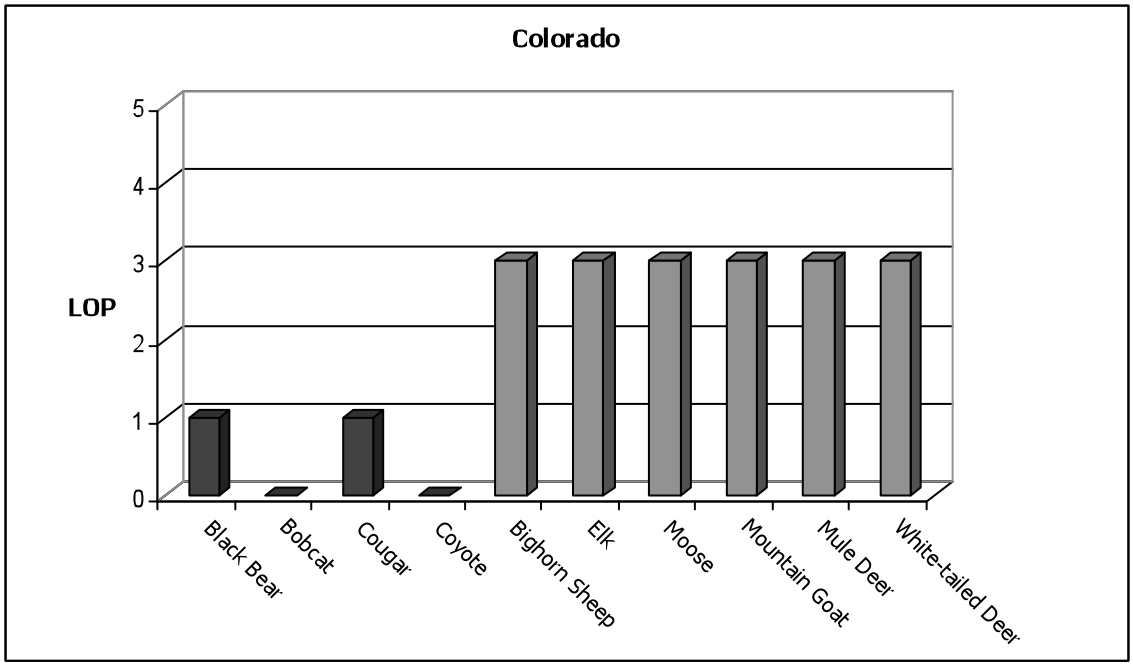


FIGURE 3.3: COLORADO LOP. All species are classified as BG except bobcats (FB), cougars (PM) and coyotes (PM). Coyotes are also classified as an unprotected species, and black bears are also classified as (PM). Bobcats are also classified as small game (SG). (FB), cougars (PM) and coyotes (PM). Coyotes are also classified as an unprotected species, and black bears are also classified as (PM). Bobcats are also classified as small game (SG).

Oregon

These LOP (ODFW 2006) are represented graphically in Figure 3.8. The PM: NPG ratio is 0.5. The NPG-PA-D for OR is ranked 2nd at 0.8, which is equivalent to NV and NM; however, OR's ranking appears to be due to low LOP for *all* species, and this appears to contribute to their higher ranking for low anti-predator bias: relative to other states OR is biased against all species equally. It authorities are notified within a specific time period.

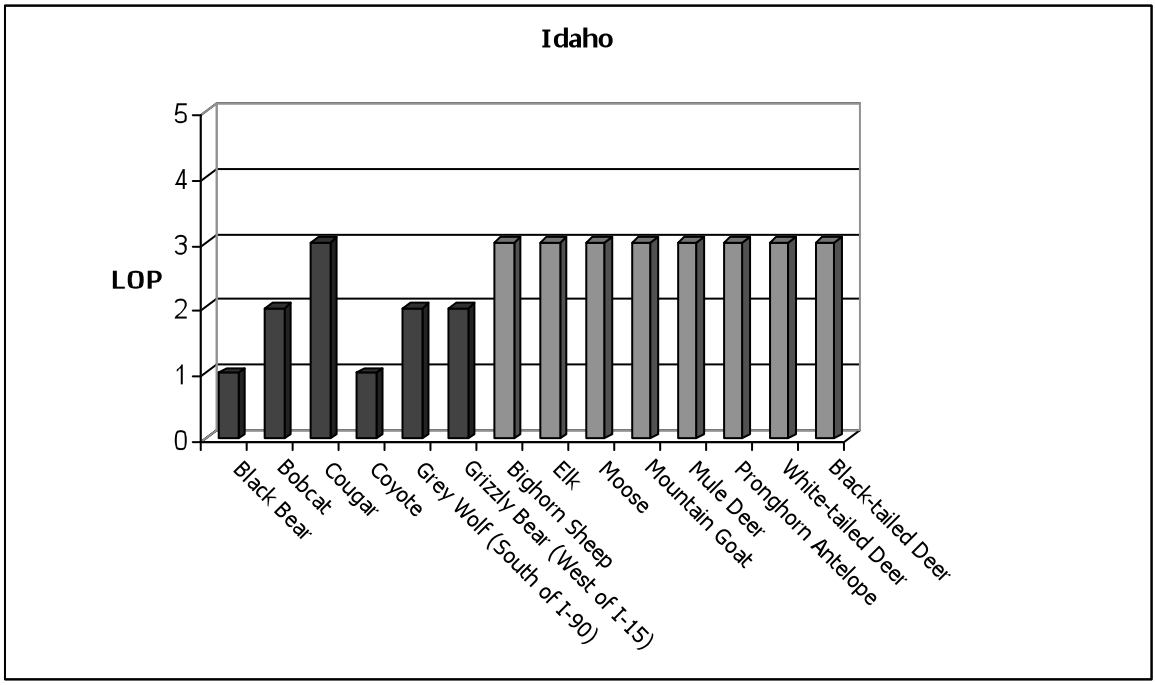


FIGURE 3.4. IDAHO LOP. Bighorn sheep, moose, and mountain goats are all classified as TG. Grizzly bears are classified as TG west of Interstate 15 [and endangered east of I-15]. Elk, pronghorn, all species of deer, black bear and cougar are classified as BG. Bobcats are classified as FB and coyotes are classified as PM. Gray wolves are classified as non-essential, experimental south of I-90 and are endangered N. of I-90.

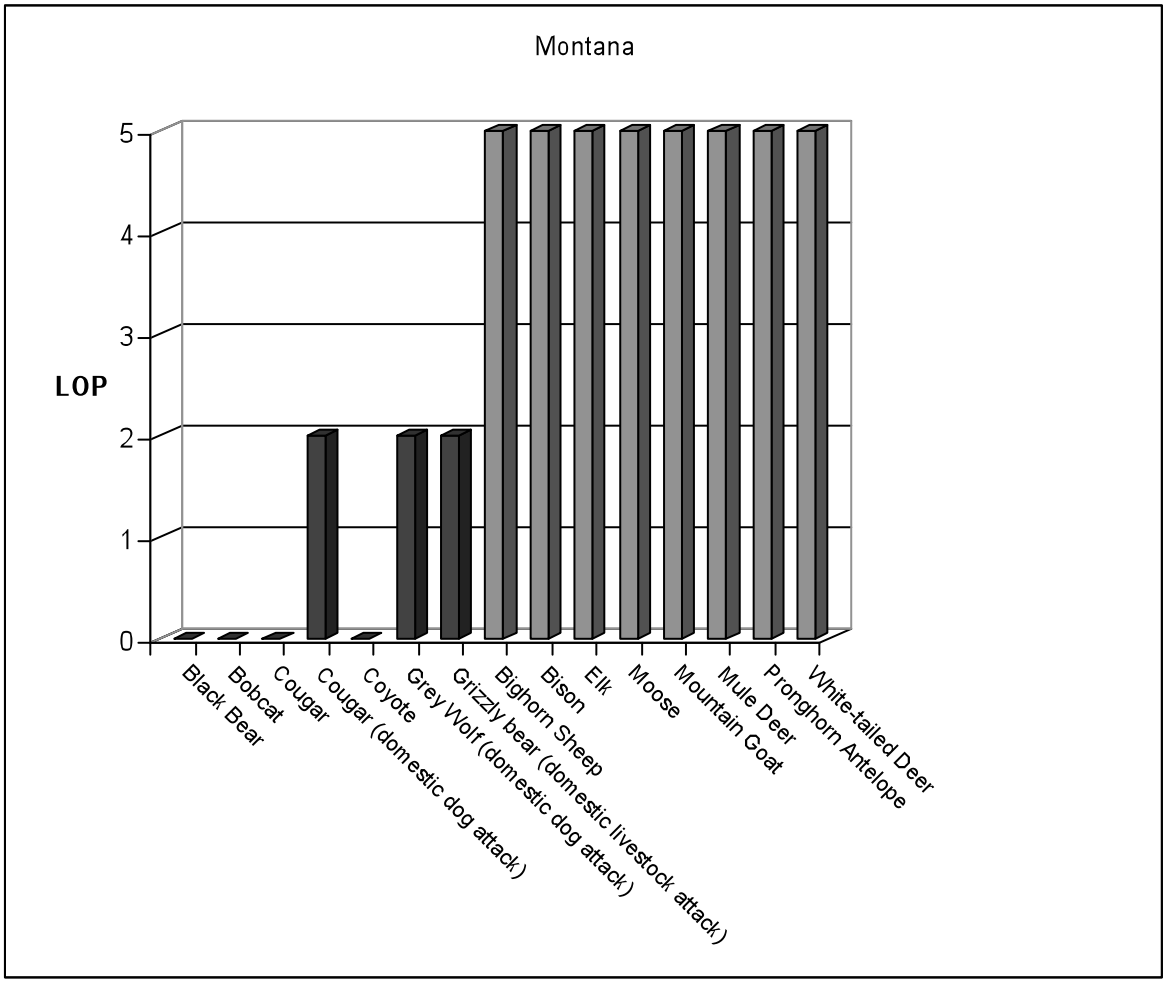


FIGURE 3.7. MONTANA LOP. All species are classified as BG except bobcats (FB), and coyotes (non-game predator). Gray wolves and grizzly bears are classified as threatened but may be taken in the act of attacking a domestic dog or domestic livestock, respectively. Cougars are also classified differently when caught in the act of attacking a domestic dog.

Utah

These LOP (UDOWR 2006) are represented graphically in Figure 3.9. The average PM: NPG ratio is 0.4. UT's NPG-AP-D of 0.2 ranks 7th with AZ, CA, and CO. UT's relatively low ranking can be explained by its AP LOP ranging from 0 to

1. Although UT's NPG are only given LOP of 2, the comparison with the low AP rankings explain its relatively low ranking among the states.

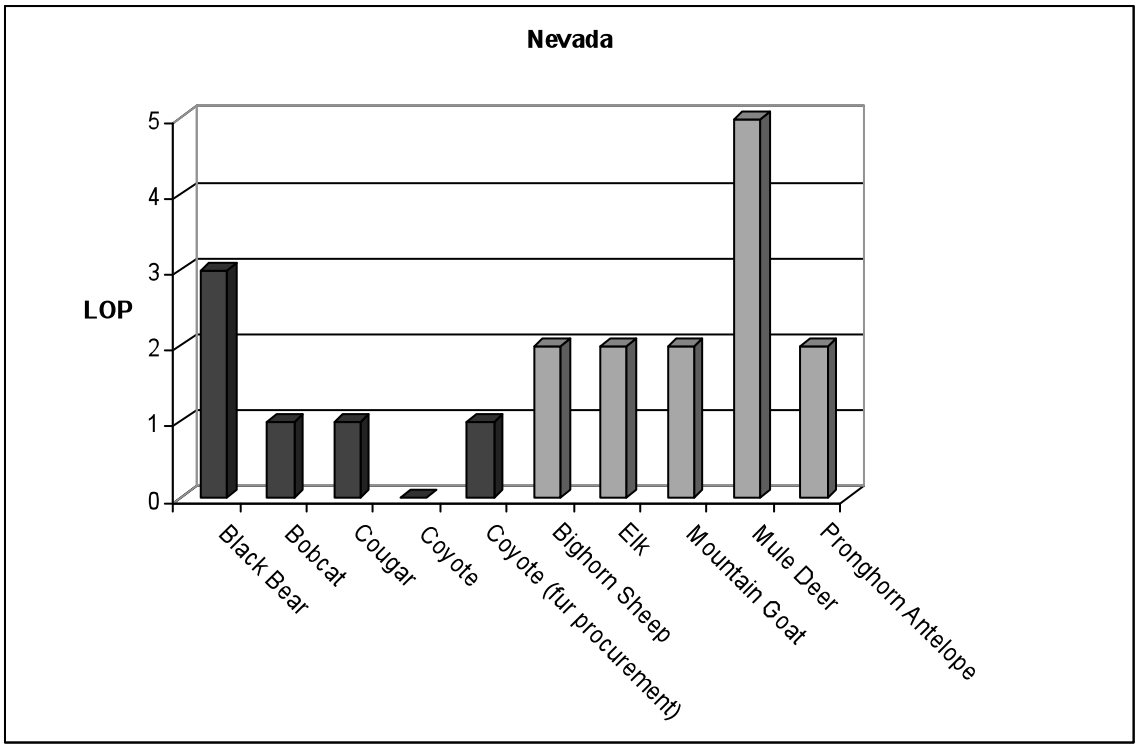


FIGURE 3.5. NEVADA LOP. All species are classified as BG except bobcats (FB) and coyotes (unprotected mammal). Coyotes are afforded greater protection when utilized for fur procurement, and black bears, while classified as BG, currently do not have an open hunting season.

Washington

These LOP (WDFW 2006) are represented graphically in Figure 3.10. The average PM: NPG ratio is 0.5. WA ranks 6th with an NGP-AP-D value of 0.5. There are generally low LOP values for all species, and lynx—a threatened species—can be taken on a depredation permit. These generally low values for

all species explain WA's relatively moderate ranking and relatively low interspecific bias.

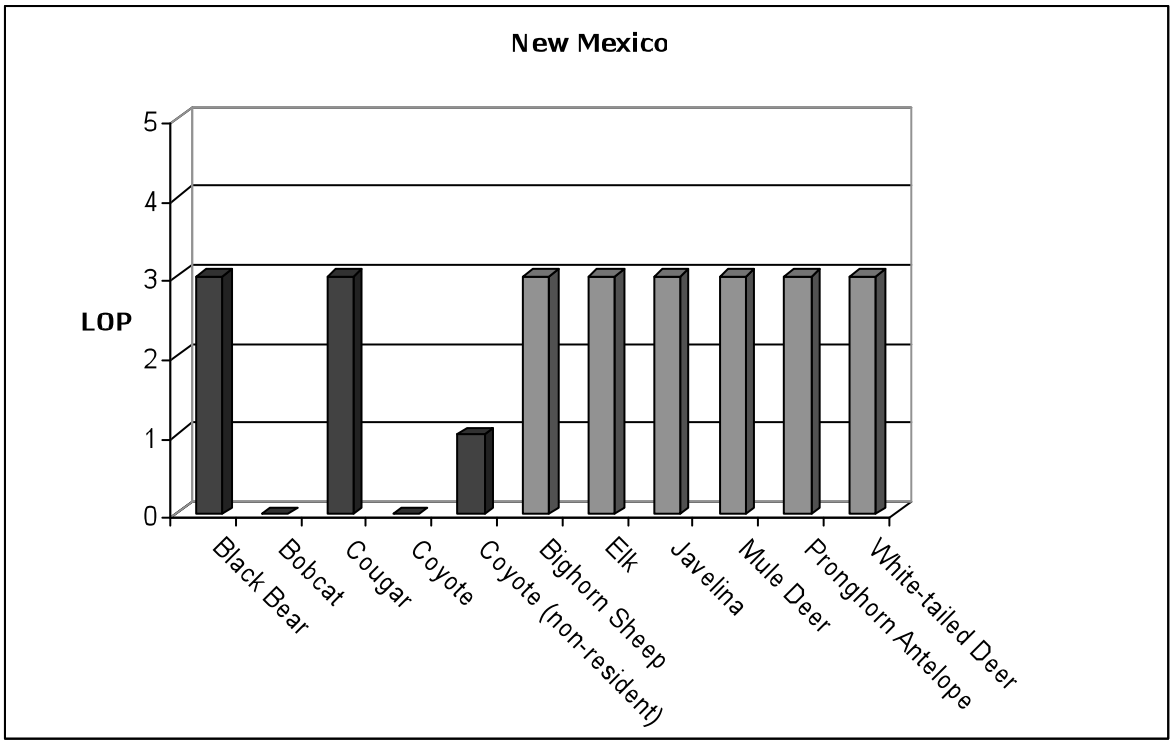


FIGURE 3.6. NEW MEXICO LOP. All species are classified as BG except bobcats (FB) and coyotes (NG). Coyotes are given one LOP when taken by a non-resident.

Wyoming

These LOP (WGFD 2006) are represented graphically in Figure 3.11. The average PM: NPG ratio is 0.4. WY has an NGP-AP-D value of 0.6, which ranks 5th. WY's relatively high ranking is due to a reasonably high ranking for all NPG species and for bobcats (i.e., LOP 3): black bears, cougars, and coyotes all rank relatively low.

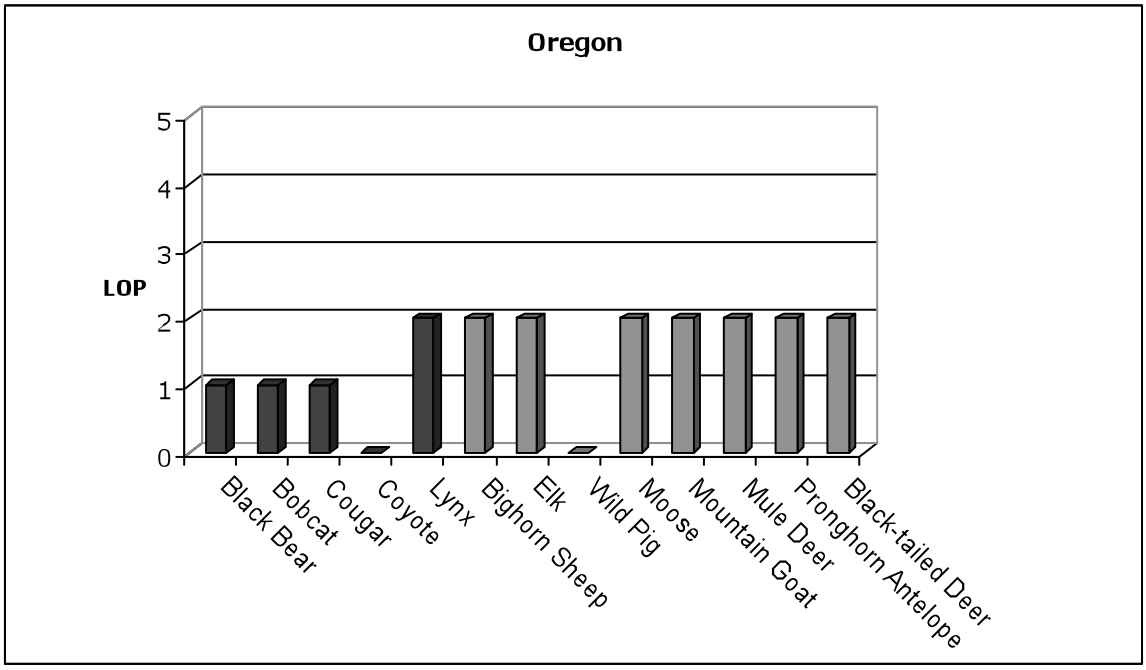


FIGURE 3.8. OREGON LOP. All animals are classified as BG except bobcats (FB), coyotes (PM), and wild pigs (PM). Lynx are classified as threatened, but are assigned two LOP for incidental take. White-tailed deer cannot be hunted in western OR.

## Interstate Policy Comparisons

All eleven Western States except ID share one common indicator: their AP-NPG-D values are all <1.0. Regardless of their ALOPD values, all but one of the states in this study revealed an anti-predator bias: AP-NPG-D values ranged from 0.1 to 1.7; however, all states possessed AP/NPG ratios of 0.6 or less. Figures 3.1 through 3.11 are generally face valid in this respect; NV and NM are two exceptions in that the LOP for bear (NV) and bear and cougar (NM) equal or exceed some NPG mammals, and ID has a relatively high AP-NPG-D value which appears to indicate a relatively equal treatment of both AP and NPG cohorts.

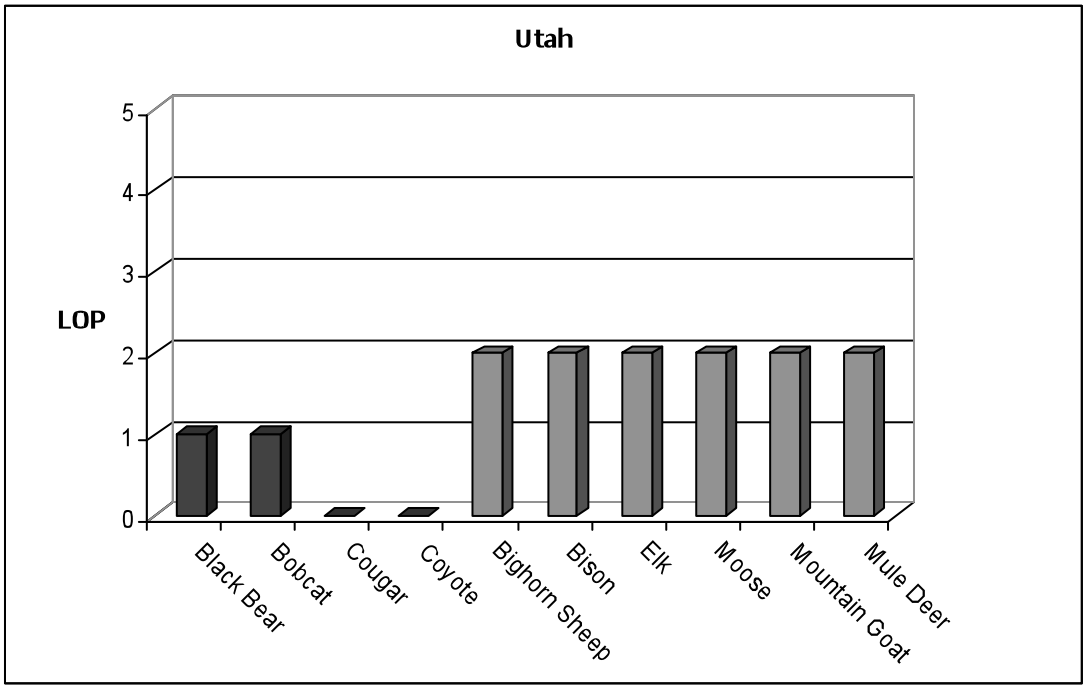


FIGURE 3.9. UTAH LOP. All species are classified as BG except black bears (G), cougars (G), bobcats (FB), and coyotes (unprotected wildlife).

In OR, the LOP for lynx equal the LOP for NPG; however, in this case, it is essential to note that lynx are protected under the ESA, and the lynx LOP encompasses incidental take—there are provisions for incidental (i.e., accidental) lynx take because they are sometimes mistaken for bobcats. While this may seem to be a case of increased predator protection, I argue that this is actually a situation of an unethical reduction of lynx protection: Oregon has a statutory loophole that allows an ESA protected species to be taken with impunity. When compared to other states where lynx reside, OR actually offers less protection. I will discuss this in more detail in chapter 4.

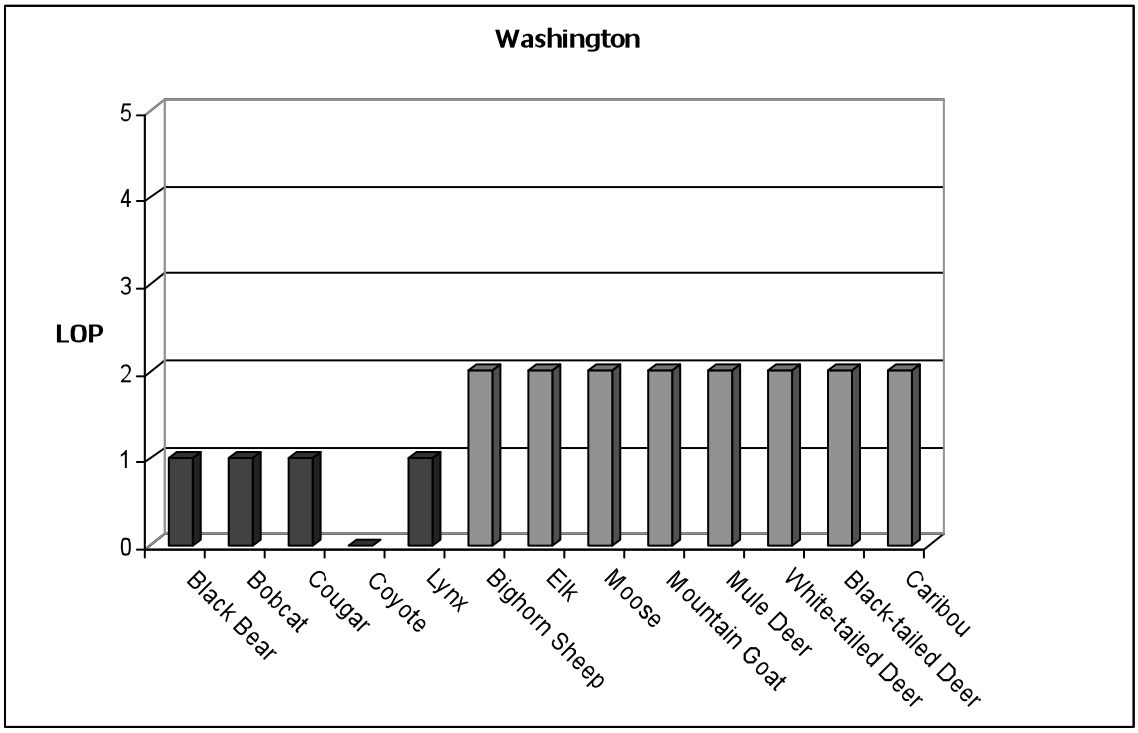


FIGURE 3.10. WASHINGTON LOP. All species classified as BG except bobcats (FB and small game), coyote (unprotected wildlife), and lynx (threatened). Lynx can be taken on a depredation permit. Elk depredation criteria differ from other BG (Appendix 1).

In NV, because bear population numbers have declined, NDOW banned bear hunting until the viability of their population improves: this is an excellent example of adaptive management. In NM the protections to bears and cougars are afforded because of their game status (i.e., these species generate the very financial needs required for their conservation while appeasing hunters). One may argue that NM's policies regarding these two species have an ethical basis. I am not sure the same can be said regarding Oregon's lynx policy.

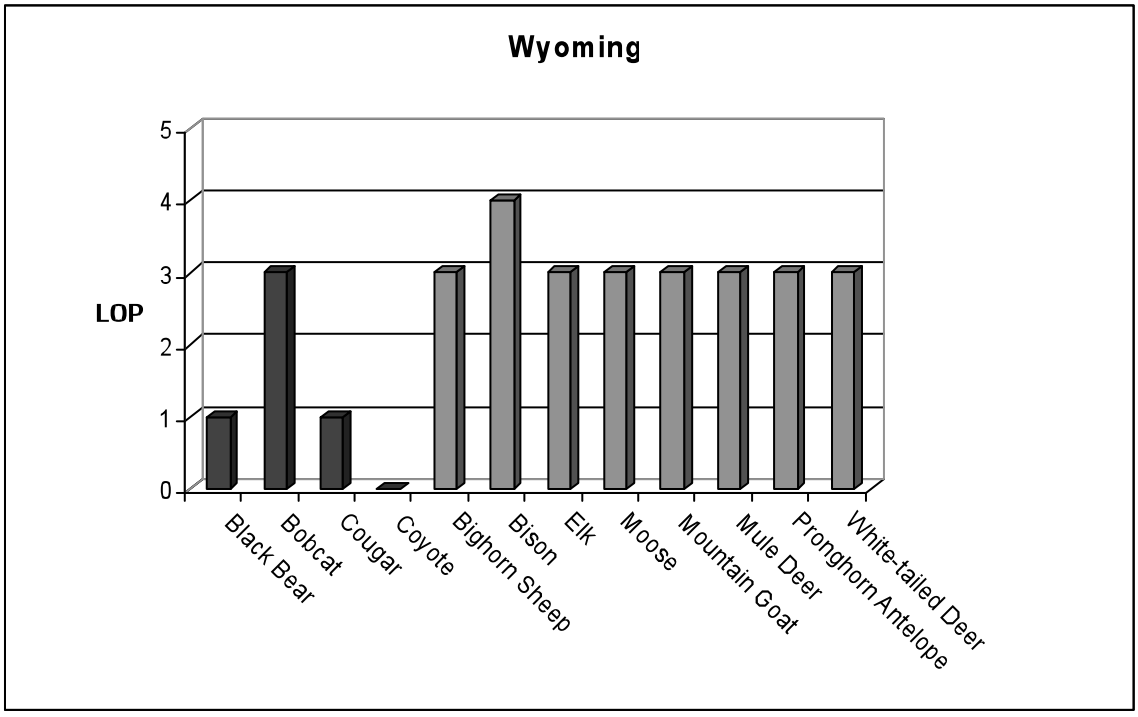


FIGURE 3.11: WYOMING LOP. All species are classified as BG except black bear and cougar, which are classified as trophy game (TG), coyotes (PM), and bobcats (FB treated as BG). Bison are technically classified as "wildlife" but are treated equally with BG (refer to Appendix 1 for explanation). Although gray wolves are endangered and cannot be taken, they are state classified as PM in half of WY and TG in the other half. The TG designation occurs in national parks and, as yet, undefined adjacent areas.

When studying Figures 3.1 through 3.11, there is one species of predator that is consistently unprotected: The coyote. With the exception of NM, which requires non-resident hunters to possess a hunting license (HL) to hunt them, and ID, which requires a HL to take a coyote, coyotes are afforded no protections—that is, they have an LOP of 0. As was apparent in chapter 2, the vilification of coyotes is not a new phenomenon. Historically, coyotes have been

the target of the most organized predator eradication efforts with the exception of the wolf. It do not believe it to be an overstatement to say that this anti-coyote bias has simply become institutionalized within state wildlife management policies as well as the focus of Wildlife Services (WS)—a Division of the U.S. Dept. of Agriculture (USDA): several states actually defer their "problem" coyotes to WS (see Appendix 1). As I will discuss in chapter 4, many studies have demonstrated the benefits coyotes confer upon certain ecosystems by their predation upon mesopredators (e.g., skunks, raccoons, domestic and feral cats); most often, these studies are dismissed by state wildlife management agencies, and coyotes are generally considered "vermin" or "pests."

In spite of generally being considered furbearers, bobcats do not fare much better than coyotes. Clearly, bobcats are not nearly as vilified as coyotes; this is partly due to their relatively secretive nature and rarity compared to coyotes. However, bobcats only achieved more than one LOP in MT (2) and WY (3); and, in nearly half the states, they had 0 LOP.

Cougars, which have been receiving much media attention lately due to their incursions across the wild-urban interface and their occasional encounters with humans, fare only slightly better than bobcats. The fact that they are a highly coveted trophy predator, especially among hound hunters, has allowed them to be afforded some protections. In NM, cougars are afforded three LOP, which is

equivalent to their non-predator game counterparts. Generally, though, cougars are protected by one or 0 (MT and NM) LOP.

In the eleven Western States, the average LOP for predatory mammals is 0.9, and the average LOP for non-predatory game is 2.9—a ratio of 3.2: 1.0.

## Results and Discussion

When I began my research for this thesis, I had some preconceived notions about regional anti-predator biases because the traditional Western States are often stereotyped as regions where there are greater livestock and sport-hunting interests. In addition, I hypothesized that the Pacific States (Washington, Oregon, and California) would have significantly less anti-predator bias than the other states I studied because of their purported tendencies towards liberal thought and action. That did not turn out to be the case; numerically, there did not appear to be any significant difference between those two cohorts. In fact, after reading the different state management plans for predatory mammals and NPG mammals, I came across some instances that were counter to my hypothesis. Oregon's 2006 Final Cougar Management Plan was a case in point. It struck me as interesting that this plan mentioned big game ungulates to a far greater extent than it mentioned cougars. Oregon's stated concern was focused more on how cougars would affect big-game hunting than on cougar population viability. There were discussions regarding cougar hunts in certain Game

Management Units (GMUs) where they felt that ungulate populations were declining.

I will discuss the problem with this non-targeted (i.e., random) approach later in this thesis; but, suffice it to say that there are many reasons native ungulate populations decline (e.g., climate, disease, availability of forage, natural disasters, domestic livestock (i.e., overgrazing and, occasionally, predation). Similarly, and without exception, the non-predatory big game management plans afford a large proportion of their discussion to predator management. This is, again, based on the dubious conclusion that naturally occurring predators are competing with human big game hunters. Most of these plans also address methods to prevent crop and property damage caused by big game ungulates. Chapters 3 and 4 address these issues as they apply to cougars; and, in chapter 4, I discuss the science related to these issues and offer policy suggestions to help add clarity—that is, I will attempt to coalesce science and policy to create transparent game management policies so that there will be a greater understanding of what are sometimes unpopular policy decisions and agency actions.

To their credit, all eleven states' websites addressed methods to prevent encounters with predatory mammals, which included humans, pets, and livestock encounters: I will discuss many of these specific methods later in the thesis.

Idaho, Nevada, New Mexico, and Wyoming assigned relatively greater protections to certain mammalian predators. Idaho assigned bobcats and mountain lions 2 LOP. Nevada has banned bear hunting until the viability of the bear population improves: this ban is still in place as of the writing of this thesis. This is an excellent example of the manner by which adaptive management ought to work. New Mexico appears to value bears and cougars as predatory game mammals as evidenced by their relatively high LOP (3) for those species. I did not expect NM to "set the curve" for any predatory mammals because the average NM livestock/landowner has the purported reputation of shooting most "wildcats" on sight. This lesson I take from this is to examine my own biases regarding "expected" regional differences in state wildlife management policies. Wyoming assigned bobcats 3 LOP.

Of the states I studied, Washington has the most forgiving relocation option for bears and cougars: WDFW agents have the option, at their discretion, of relocating these animals *one time* before they are euthanized. The reason I assigned WA bears and cougars only one LOP is because private landowners are able to take these animals if they are causing damage to livestock: I feel there is an ethical issue when property is treated in an equal manner to public safety. In this situation, if "problem" bears and cougars are dealt with by WDFW officials, they may fare better than if they are dealt with by private landowners. I will discuss this policy conundrum in chapter 4.

When I began this thesis, I was ambivalent about including ID, MT, and WY despite the fact that it would have increased my sample size to include all eleven Western States. My ambivalence was fueled by the tenuous ESA status of gray wolves and grizzly bears; however, I decided to include ID, MT, and WY because of a change in congress and at the behest of one of my advisors who correctly suggested increasing my sample size. Shortly thereafter, the USFWS announced its plan to de-list the Northern Rocky Mountain DPS of the gray wolf. As of the writing of this thesis, gray wolves are still afforded full ESA protections; however, ID, MT, WY, and any state where gray wolves are expected to immigrate all have state management policies in place that would allow gray wolves to be taken. At the present time, the ESA protections supercede the state management policies; but, again, this situation may change in the near term. According to recent reports, there may be some changes within the next year.

In *Restoring the Gray Wolf to the Southern Rocky Mountains: Anatomy of a Campaign to Resolve a Conservation Issue*, Phillips et al. (2004) discuss the paucity of information concerning the initiation of large carnivore conservation considerations in such a way that they include relevant legal and scientific standards and are supported by a consensus of stakeholders. By the late 1950s, gray wolves in the conterminous U.S. numbered less than 1,000 individuals and occupied less than 1 percent of their historic range; by March 2003 those parameters improved to 3,500 individuals and just fewer than 5 percent of their

historic range. In April 2003 the USFWS determined that this level of improvement warranted a reclassification of gray wolves into three distinct population segments (DPSs): (1) western; (2) eastern; and (3) southwestern (including Mexico).

Where this reclassification became significant was that it was the first step by which the USFWS determined that gray wolf recovery had been completed; and, because these DPSs are not contiguous, delisting of any of these segments could be a significant impediment to long-term gray wolf recovery. This impediment exists because:

> It is unlikely that state legislators, state game commissions, and corresponding state game agencies would initiate actions for recovering wolves once the species has been removed from the federal list of threatened and endangered species. (Phillips et al. 2004, 241)

This threat to wolf conservation has led to concerted efforts by conservation NGOs to focus on the southern Rocky Mountain region (SRM) of the southwestern gray wolf DPS.

The SRM includes vast expanses of unroaded public land and expanding populations of wild ungulates. This region extends from south-central Wyoming through western Colorado and into north-central New Mexico. This 39,000 square mile area of public land supports prey sufficient to support a viable population of wolves and represents a significant gap in the range of the species.

The SRM contains (1) one and a half times more public land than is available to wolves in the GYE; (2) nearly twice as much as is available in central Idaho; and, (3) six times the public land available to Mexican wolves in the Blue Range Wolf Recovery Area (BRWRA). Government agencies and private land owners currently manage sufficient tracts of land—approximately 70% of wilderness available in the Yellowstone area—to facilitate wolf recovery. Phillips et al. (2004) cite Bennett (2004) in writing that the Colorado portion of the SRM could support over 1,000 wolves, and a 1994 public opinion survey noted that 71 percent of registered voters in Colorado would support gray wolf restoration in the state (Pate et al. 1996; Manfredo et al. 1994). To place this in a landscape-scale perspective, Phillips et al. (2004, 244) write:

> Because the ecoregion is nearly equidistant from the northern Rocky Mountains and the BRWRA, it is possible that a SRM population would contribute significantly to the establishment and maintenance of a spatially segregated population of wolves that extended from the Arctic to Mexico.

Due to strong public support for wolf restoration in the SRM coupled with the successful reintroduction projects that are ongoing, a group of experts met in Vermejo Park Ranch in 1997 to consider the issue of SRM wolf restoration. Their preliminary conclusions recognized three requisite steps to resolving the issue: (1) developing coalitions with a focus on advocacy, education, and research; (2) development and dissemination of the best available science (BAS) on the issue;

and, (3) developing an outreach program to involve appropriate stakeholders in comprehensive discussions regarding SRM wolf restoration. Although the USFWS has not fully recognized this proposal, in 2003 they did reclassify the southern two-thirds of the SRM into the southwestern gray wolf DPS: this reclassification maintained the endangered classification for much of the region. This process is not yet resolved in the political advocacy arena and therefore will require ongoing efforts concerning constituent education, public debate and continued biological research and monitoring.

In this study, I developed a metric—the non-predatory game predatory animal disparity (NPG-PA-D)—that I felt would best correlate the relationship between the protections afforded all large mammals, non-predatory game mammals, and predatory mammals. Utilizing this metric, there does appear to be three distinct groupings among the eight states: (1) AZ, CA, CO, MT, and UT all have values ranging from 0.1 to 0.2; (2) NV, NM, OR, WA, and WY have values of 0.8, 0.8, 0.8, 0.5 and 0.6, respectively; and, (3) ID has a value of 1.7. As I wrote in Chapter I, the sample sizes are too small to arrive at any quantifiable differences between these states; however, in the qualitative sense, this metric does seem to divide these states into three groups. ID's value of 1.7 appears to be an outlier. Again, it is notable that all values except ID's are below 1.0, which indicates a general anti-predator bias from the perspective of face validity. I am not sure I can make any sweeping conclusions about the first

two groups except to conclude that they all exhibit anti-predator biases and they differ only in the extent of their bias. However, ID has the most face-valid appearance of equal and fair treatment of all species. As is the case in MT and WY, ID has multiple ESA protected species. In the event that ESA protections are relaxed on wolves and grizzly bears, it will be of interest to re-evaluate these states at that time. I can comment that of the three states in the GYE, ID seems to offer the greatest overall protections against animals that are involved in depredation incidents. I am hopeful that the preceding historical discussion and the subsequent policy discussions will enable me to explain the origins of these state management policies and to offer recommendations that will create policies applied fairly and ethically to all species for the benefit of the entire Ecosphere.

Specific Policy Recommendations: Reducing Human-Carnivore Conflicts

There is no shortage of literature offering potential solutions for resolving human-carnivore conflicts both in the U.S. and internationally. This section is devoted to practical recommendations and considerations in order to develop human-wildlife policy principles that can be incorporated into state wildlife management policies.

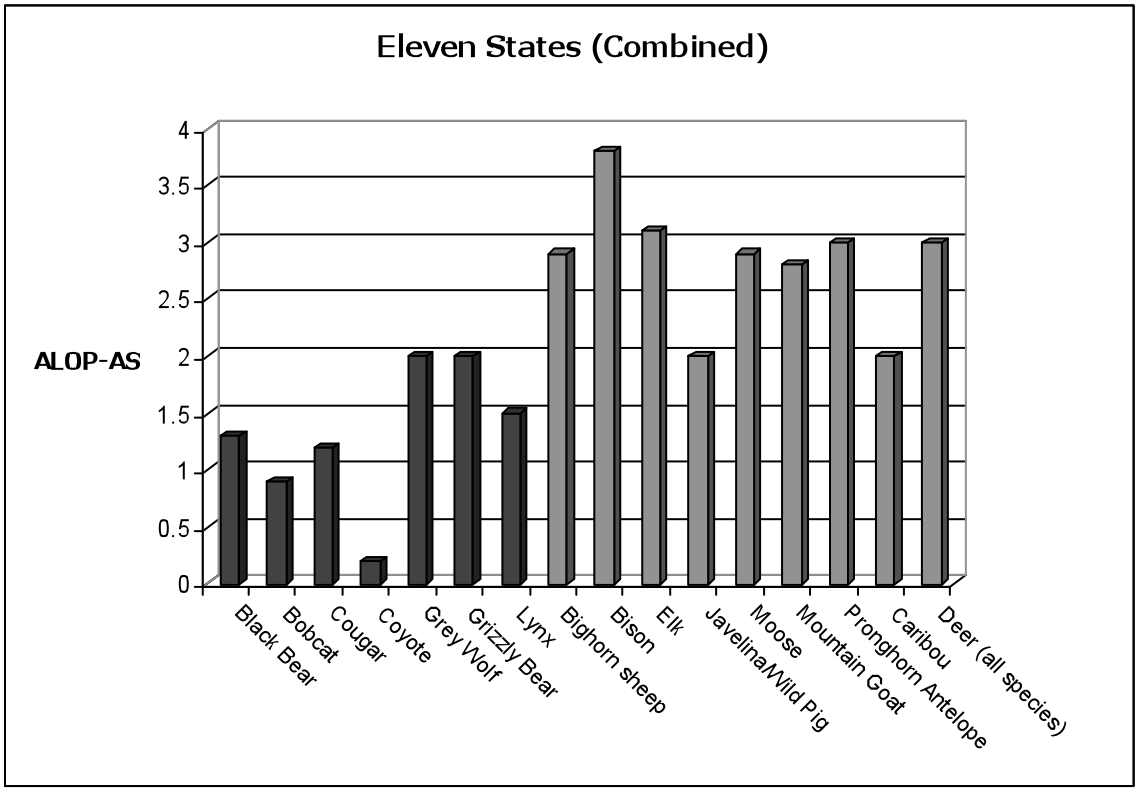


FIGURE 3.12. AVERAGE LOP FOR ALL SPECIES (ELEVEN STATES COMBINED). The ALOP for non-predatory game mammals (NPG) is 3.2 times that of the ALOP for all predatory mammals (AP). The gray wolf, grizzly bear, and [Canada] lynx are all ESA protected species: the LOP for these species are based upon more specialized circumstances than for the other species (see Appendix 1).

Breck (2004) addresses the importance of properly designed studies in generating the information needed to minimize carnivore-livestock conflicts. He points out that well-designed experiments in this area of study are difficult to execute due to the inherent problems of manipulating ecosystems, finding adequate controls in problem regions, and achieving replication—especially between different regions and species. Breck suggests the development of an

international oversight committee with three goals: (1) implementation of strategies to prioritize research questions; (2) improving communication between scientists and managers; and, (3) encouraging collaboration among participants (i.e., stakeholders). (Breck 2004, 25) summarizes his discussion by writing:

> Carnivores of all sizes are built to kill and eat other animals, and livestock are built to be eaten, having lost most of their antipredator instincts. It is intractable and untenable to imagine solving this problem so that carnivores do not kill livestock; however, it is reasonable to believe that we can optimize the interaction so that a minimum number of livestock are lost to predators and a minimum number of carnivores are lethally removed. Finding solutions will require well-planned and well-executed research to generate reliable knowledge regarding management solutions.

Field Research: Policy Recommendations

Chhatre and Saberwal (2005), writing in reference to the Great Himalayan National Park (GHNP), propose that we be more cognizant of the intricacies of local dynamics. Too often, they state, there is a poor appreciation of the politics of conservation and development in two particular areas: "electoral politics that keep a postcolonial government in power and development politics that today keep the state financially solvent (311)."

Domestic Studies

In *Conserving Mountain Lions in a Changing Landscape*, Papouchis (2004) writes of the vital role top carnivores play in maintaining the integrity and stability of ecosystems. In spite of this fact, he emphasizes that contemporary

mountain lion management continues to be driven by a traditional utilitarian philosophy. He points out that mountain lions have inhabited the Western Hemisphere for at least 100,000 years over the largest distribution of any other terrestrial mammal in the Americas—from the Yukon to the southern tip of Chile. However, as I discussed in chapter 1, they were eradicated in the same manner that gray wolves, grizzly bears, and coyotes were in the post-European colonization period until and including very recent times—on occasion, even present day. Today, mountain lions occupy only 33% of their historic range in the U.S. In chapter 4, I engage a detailed discussion of mountain lion policy especially in reference to the most current collaborative compilation of mountain lion management principles: *Cougar Management Guidelines* authored by the Cougar Management Guidelines Working Group (2005). However, I will present a few more salient policy points advocated by Papouchis (2004).

The current state management of mountain lions primarily involves mortality regulation—that is, controlling the primary reasons mountain lions are killed: (1) trophy hunting; (2) domestic animal depredation; (3) competing with hunters for game; (4) research; and, (5) public safety. In 2002, at least 3,500 mountain lions were killed by humans in the western U.S.; and, this estimate is likely to be low as these are only the reported killings. Since 1970, that number is at least 53,000: most of these killings have been for sport hunting, often with the management ideal of maintaining "adequate" numbers of ungulate game

species. There is a paucity of evidence that controlling mountain lion populations via depredation (i.e., killing) has any positive effect on wild ungulate populations; and, often, random killing of mountain lions may actually hinder public safety objectives. Papouchis (2006, 5) writes, "Nine states and one Canadian Province [British Columbia], which have sport hunting of mountain lions, had a higher per capita rate of attacks on humans than did California." Logan and Sweanor (2001) [as cited by Papouchis (2004, 227)] write that "[mountain lion] hunting management in most western states is a far cry from science."

Due to the fact that mountain lion populations often function beyond the state boundaries that regulate them, landscape-level conservation is very important for their long-term survival. In spite of this necessity, Papouchis writes that ingrained philosophies and entrenched funding sources have created a serious impediment to the movement from a single-species, utilitarian approach to an ecosystem or landscape level approach.

Habitat fragmentation is the primary cause of diminished mountain lion population viability and, particularly in the case of the Florida panther, it is likely the greatest threat to extinction of the species. The necessity of creating and maintaining habitat connectivity in southern California is well documented by the South Coast Wildlands Project (2001), and I will review this critical and intricate work below. Developing collaborative networks (i.e., involving multiple

stakeholders), encouraging nonlethal resolution of mountain lion-human conflicts, and improving our conservation-related research—especially those that address research gaps in mountain lion behavior and the effectiveness of wildlife corridors—will all be necessary elements if mountain lions are going to persist in a robust manner over a significant period of time.

Ernest et al. (2002) demonstrated that cougar depredations on Peninsular bighorn sheep—a DPS under ESA protection—were often confined to a very small number of cougars. By utilizing mitochondrial DNA (mDNA), it was possible to be very specific in which animals were lethally removed. In the past, and in many regions today, entire Wildlife Management Units (WMUs) have been targeted for cougar removal in spite of the fact that many non-depredating cougars have been killed as the result of such broad management actions. This may actually select for the survival of the very cougars responsible for depredations. Contemporary management actions ought to be more precise as advocated by Ernest et al. (2002).

Musiani et al. (2004) studied gray wolf depredation patterns in the western states of Idaho, Montana, and Wyoming, and the Canadian province of Alberta. The most significant difference between these study areas is the fact that gray wolves are not a protected species in Alberta, or anywhere in Canada, due to their abundance relative to the U. S. where gray wolves are protected as Endangered under the ESA. Two significant aspects of gray wolf depredation

patterns studied were (1) the effect of increased gray wolf populations on the number of domestic animals killed by wolves; and, (2) seasonal variations in wolf depredation on domestic animals. This study showed no increase in the number of domestic animals killed by wolves during the period of 1987-1994 in northwestern Montana when wolf numbers were slowly increasing. Nor was there any correlation between wolf population size and domestic animal depredation. However, there was a strong relationship between the numbers of domestic animals killed and injured by wolves and the number of wolf depredations by humans. Additionally, in the period 1995-2002—when wolves were reestablished in Idaho, Montana, and Wyoming—wolf numbers increased without a concomitant increase in depredations of or injuries to domestic animals by wolves. Musiani et al. did find a seasonal pattern to wolf depredation on livestock in Idaho, Montana, and Wyoming during the period 1987-2002 with depredation events varying significantly by month: February and March showed significantly increased depredation events while October and November showed significantly decreased depredation events. In Alberta, seasonal variation in depredation incidents were also noted, but these were divided into three depredation seasons: (1) a medium depredation season from October to January; (2) a low depredation season from February to April; and, (3) a high depredation season from May to September. In spite of these seasonal variations, the fact that there was no significant relationship between wolf

numbers and numbers of domestic animal depredations is not easily explainable. Musiani et al. (2004) offered that, perhaps, lethal elimination of problem wolves by the Dept. of Natural Resources (DNR) or other agencies removed packs or individuals that had learned to take livestock. This implies that wolves have the ability to teach their offspring to kill livestock; and, by eliminating the learned wolves, the cycle of learning is broken. Musiani et al. reported that Linnell et al. (1999) have argued against the idea of problem individuals within predator populations. So, the issue of whether there is generational learning among wolves may only be decided with the aid of further research.

In the U.S. region of this study, improving collaboration between government, NGOs, and ranchers may be improving animal husbandry practices such that domestic animal depredations have been mitigated to some degree. Musiani et al. (2004, 64) have posited:

> Some ranchers are actively participating in wolf depredation management by monitoring wolf movements close to farms and relocating livestock herds when wolves are present. (Defenders of Wildlife (DOW) 2003)

These types of collaborations are precisely the social processes that Clark and many others are advocating for the resolution of these previously intractable problems.

This study summarizes some effective measures that will work toward improving good will between ranchers, scientists, NGOs, and government agencies: these measures are presented in Table 3.2.

TABLE 3.2: MEASURES FOR IMPROVING STAKEHOLDER RELATIONSHIPS

| | Recommendations for Improved Stakeholder Relationships |
|---|---|
| 1 | Financial compensation [especially by NGOs] to ranchers for livestock depredations with the caveat that ranchers are actively involved in management actions that reduce depredation risks. |
| 2 | Increased surveillance of livestock herds. |
| 3 | The use of guardian dogs, especially for the protection of sheep. |
| 4 | Techniques (e.g., electric fencing, fladry [flag-like] barriers, portable and permanent night pens). |
| 5 | Appropriate fencing. |
| 6 | Capturing and translocating individual wolves involved in depredations can be a viable option; however, the process is costly and may result in unintended wolf mortality due to dominance fights as is seen with other predators such as cougars, grizzly bears, and coyotes. |
| 7 | Aversive conditioning (e.g., shock collars, livestock carcasses laced with non-lethal, but aversive, chemicals). |
| 8 | Lethal removal of wolves or wolf packs where other techniques have not been effective. |

Obviously, recommendation (8), with its inherent emotional and politically-charged opposition, ought to be utilized judiciously and as a last resort. Musiani et al. (2004, 70) conclude by writing, "Conservationists are challenged to work with ranchers and others experiencing depredation to improve methods for mitigating impacts and increasing tolerance of wolves."

In *Living with Fierce Creatures? An Overview and Models of Mammalian Carnivore Conservation*, Mattson (2004) is in agreement with many conservation biologists when he implicates humans as the cause of the majority of carnivore losses. Table 3.3 lists the direct (proximal) and indirect (distal) anthropogenic factors that contribute to carnivore losses.

TABLE 3.3: DIRECT AND INDIRECT HUMAN IMPACTS ON CARNIVORES

| | Direct Impacts | Indirect Impacts |
|---|---|---|
| 1 | Harvest of body parts. | Road densities. |
| 2 | Retaliation for depredation of livestock or hounds. | Human densities. |
| 3 | Vehicular mortality. | Wealth (where poor people live near carnivores, the incentives are greater to kill carnivores for profit or for livestock depredation retaliation). |
| 4 | Loss of naturally occurring prey. | Joint concentrations (i.e., where human and carnivores coexist in close proximity). |
| 5 | Loss of habitat conducive to hunting. | Values and perspectives of the humans living near carnivores (more residents of interior regions express negative attitudes toward carnivores than do coastal residents where carnivores are either extirpated or in extremely low densities). |
| 6 | Disease (often introduced by exotic species). | N/A. |

Mattson concludes by addressing a number of mitigatory measures that can improve human-carnivore interaction incidence and outcomes: these are represented in Table 3.4.

TABLE 3.4: RECOMMENDED MITIGATIONS TO IMPROVE HUMAN-CARNIVORE INTERACTIONS

| | Recommended Mitigations |
|---|---|
| 1 | Compensation to stockmen for livestock depredations. |
| 2 | Curbing the harvest of prey (i.e., ungulate game animals) to diminish the likelihood of livestock depredations. |
| 3 | Reducing livestock numbers. |
| 4 | Conversion of existing livestock to larger-bodied or more mobile animals with some predator defense or evasion mechanisms. |
| 5 | Improving husbandry practices better able to protect small-bodied livestock. |
| 6 | Institute programs that diminish the elimination [killing] of depredating herbivores which will increase the prey populations essential to carnivores. |
| 7 | Imposing sanctions on the illegal trade of animal body parts on the national and international level. |
| 8 | Allocating greater resources for the direct protection of carnivores. |
| 9 | Habitat restoration including watershed restoration and management. |
| 10 | Proper road fencing and speed limit enforcement. |
| 11 | The disarming of humans in sensitive habitats. |

The essence of the multiple stakeholder era of conservation policy is best described by Mattson (2004, 173-174) when he writes:

> Whatever the human and biological factors, the identification of threats and the articulation of potentially efficacious tactics and strategies is but one step in carnivore conservation. The promotion, adoption, implementation, and appraisal of governing policies necessarily follow (Clark, 2002). Crafting an effective conservation policy process requires not only knowledge about humans and human social systems but also considerable skill in operating in policy arenas. Without such skill and without such knowledge, no amount of concern or knowledge about the carnivores themselves will be sufficient to save them.

Shivik et al. (2003) discuss the use of primary and secondary repellents as nonlethal means of managing domestic animal depredations by carnivores. Primary repellents present immediate disruptive stimuli (e.g., chemical, visual, auditory) that alter the normal progression of predatory behavior (i.e., stalking or attacking); however, because they rely on novelty, they are often ineffective due to learning ability. Examples of primary repellents include fladry (a linear flag-like barrier), movement activated guard devices (MAG), or noxious odors. Secondary repellents are those that rely on animal learning to be effective—that is, they rely on aversive conditioning. Examples of secondary repellents include shock collars or wires, rubber bullets, and noxious taste.

Shivik et al. (2003) found MAG technology to be most widely beneficial in that it repelled all vertebrate consumers until the end of the study. Fladry has shown some limited effectiveness against wolf depredation but does not appear to be effective against other species. This study did not evaluate the duration of effectiveness (i.e., post-study) of the MAG device, so more research is required. It is likely that this device will be more effective against canid predators, which are inherently wary, than ursid predators which habituate more quickly. Shock collars on wolves had extremely variable effectiveness with some wolves significantly affected and others barely bothered. I have seen this in veterinary practice with shock collars on domestic dogs. This study concluded that primary repellents are more likely to be effective due to their ease of use and cost

effectiveness. Problematically, repellents are region and species specific and may not be well accepted by range managers who can solve the problem with "a single bullet from a high-powered rifle."

Common acceptance among managers will require further research resulting in the development of repellent techniques that are uncomplicated, effective, and more clearly defined as to which species, and in which specific instances, they will be useful. Additional research ought to address the differentiation between repellents that are effective against predatory and consumptive behaviors.

Musiani et al. (2003) studied the effectiveness of fladry barriers in preventing wolf depredation. Initial studies in Alberta, Canada demonstrated that wild wolves could be deterred from baited sites and cattle pastures for at least 60 days in areas of 25 hectares or less; however, the researchers could not rule out the alternative hypothesis that the fear of a novel repellent along with researcher presence contributed to this effectiveness. More research is needed to determine if fladry barriers are effective in larger areas. Musiani et al. (2003) did find that fladry barriers in larger areas were more effective when there was available prey outside the fladry boundary.

It is likely that fladry has some limited effectiveness over a short time period; however, at some point, the wolves become habituated enough to cross the fladry barrier. The effectiveness of the repellents discussed above would likely

be enhanced by utilizing multiple types of repellents over variable time periods—possibly during the most vulnerable periods such as calving or lambing.

Wydeven et al. (2004) set out to identify traits influencing livestock and dog depredation by Wisconsin wolf packs. Their findings were interesting in that while nearly 80 percent of wolf packs occupied areas that allowed bear hunting with hounds and 100 percent of wolf packs occupied areas that allowed coyote hunting with hounds, only 4-10 percent of the wolf packs were implicated in dog depredation. "Larger packs, with more pups, were more likely to attack dogs, while smaller packs with smaller home ranges were more often implicated in livestock depredation" (43). It appeared that the attacks on dogs were related to territorial disputes as the dogs were killed but not consumed by wolves. Other variables (e.g., landscape and vegetation type, and pack demographics) showed promise in predicting which wolf packs and locations were likely hot spots. This type of information is valuable because unpredictability increases the perception of threats; therefore, any increase in predictive ability ought to increase the likelihood of tractability. Studies like these enable the Wisconsin Department of Natural Resources (DNR) to provide hound hunters with general maps and depredation histories on wolf packs. In this way, hunters utilizing hounds can choose to avoid areas with wolf packs most likely to attack their dogs.

Livestock managers could choose to keep smaller, more manageable and easily guarded herds in areas where livestock depredations are problematic. These information sets could be valuable in allowing managers to designate zones in which different management techniques might be effective. Minimalist wolf harvests through adaptive management protocols could be aimed at protecting source packs and discriminating against sink packs. Under current management conditions in Wisconsin, trapping is expected to affect less than 7 percent of wolf packs only after greater than one DNR confirmed depredation: these numbers are far less than the 28-30 percent sustainable harvests that have been deemed reasonable for wolf populations. Regardless of one's ethical stance on "sustainable harvests" (i.e., kills), this four-fold margin of killing ought to provide some solace to those interested in protecting the species [*C. lupus*] as a whole but who are also concerned about individual animal losses.

In *Ecology and Management of Striped Skunks, Raccoons, and Coyotes in Urban Landscapes*, Gehrt (2004) focuses on the similarities and differences between these different species in their manner of interactions within the urban landscape. Although this thesis will not directly address skunks, raccoons, and other small carnivores [or mesopredators], Gehrt addresses an important concept: we ought not to fall into the fallacy that all carnivores act and react in the same manner. Additionally, we ought to consider that the same species may not behave similarly from one study region to the next (i.e., we must be careful

not to make broad generalizations based on single study areas). He points out that skunks and raccoons behave very differently within the urban landscape: skunks tend to be less visible and less pervasive in urban landscapes than are raccoons.

The one way in which these species' behaviors are relevant to this thesis is that their behaviors in the urban landscape may influence the number, and kind, of other species that occupy the same landscape. Gehrt's study area encompassed an outlying region northwest of Chicago—the Ned Brown Forest Preserve 30 km from Chicago proper. Gehrt found that coyote densities—although they varied widely—were highest within the urban forest preserve and lower in more developed areas. Other researchers have found similar distribution patterns in other regions (Riley et al. 2003; Crooks 2002; Romsos 1998). In Gehrt's study, skunks and raccoons rarely left the preserve and were reluctant to cross prominent highways; coyotes, although they did not often leave the preserve, were not inhibited from doing so by highways or development.

One important characteristic of species that are successful urban dwellers is behavioral plasticity: coyotes [and raccoons] seem to adapt more readily to urban environments due to generational learning. Because coyotes display significant familial relationships beyond weaning, parental teaching may play a significant role in their ability to prosper in urban landscapes: coyotes adapt

rapidly, not because they "evolve" more rapidly, but because they are able to alter their behaviors generationally—that is, they display behavioral plasticity.

Although coyotes may not require anthropogenic food sources to survive, they will utilize allochthonous sources when available. Therefore, coyote adaptability is enhanced by their ability to benefit from these sources including domestic/feral cats, raccoons, skunks, opossums and the anthropogenic resources that attract these mesopredators. To this end, Gehrt (2004, 99) writes:

> Removing access to refuse may not result in the same response in skunk and coyote populations, although removing trash and discouraging wildlife feeding by residents may affect the behavior of certain individual animals, thereby reducing human-wildlife conflicts . . . . Nevertheless, discouraging feeding by residents may help reduce habituation by some individual coyotes at the local level.

In conclusion, Gehrt notes that increasing our knowledge regarding different species in different locales may enhance our ability to minimize negative human-wildlife incidents and, therefore, diminish negative human attitudes toward these animals.

International Studies

Treves and Karanth (2003) address *worldwide* human-carnivore conflicts by reviewing past approaches and offering future directions that researchers and other stakeholders must follow to allow for the concomitant human tolerance of,

and the successful conservation of, carnivores across the spatial and temporal landscape.

Human-carnivore conflicts most often arise due to the fact that their protein-rich diets and large home ranges result in recurrent competition with humans in overlapping environments. Because many large carnivores favor ungulate prey, some individuals inevitably kill domestic livestock when the opportunity presents itself. This is a worldwide issue, and specific examples include (1) wolves and bears killing sheep in North America and Europe; (2) pumas and jaguars (*Panthera onca*) taking cattle in South America; (3) multiple carnivorous species depredating cattle and goats in Africa; (4) and tigers (*Panthera tigris*) and leopards (*P. pardus*) taking livestock in Asia. And, of course, in some instances individual carnivores attack and kill humans (Patterson 2004; Baron 2004; Quammen 2003; Torres 1996).

Past approaches to these conflicts have taken three forms: (1) eradication through bounties, private and government hunters; (2) regulated harvest of carnivores to keep populations at "manageable" levels; and, (3) preservation of declining carnivore populations as manifested by complete protection of endangered carnivores regardless of their actions (e.g., India protects large felids with a "no-kill" policy instead utilizing translocation or sequestration). Treves and Karanth (2003) suggest new tactics for mitigating human-carnivore conflicts ought to be classified as those that modify human, livestock, or

carnivore behavior and those that limit the intersection of humans and carnivores at the spatial level. Behavior modification may take its most drastic form by killing offending carnivores, sterilization, or translocation. Most studies have demonstrated that lethal control ought to be performed in a selective manner to ensure that only the offending carnivores are killed. Improper translocations may also result in the eventual death of the animal due to intraspecific competition or recurrence of offending behavior in another locale; therefore, translocation ought to be based on sound science and performed in areas amenable to such tactics.

Nonlethal deterrence such as aversive stimuli (e.g., chemical deterrence, sound and light stimuli, or electrical or mechanical aversive stimuli) may be successful in some instances. Modification of human or livestock behavior including alternative husbandry and guarding practices may be effective in some cases. And, when carnivores threaten humans directly, education campaigns may be beneficial in reducing risks. Barriers such as fences, trenches, and walls have the benefit—when constructed of local materials using traditional technologies—of being inexpensive to construct and maintain thereby meeting the constraints of lower socioeconomic conditions. Specialized zoning regions that restrict certain human activities within protected areas where human habitations are encroaching within the last remaining habitat of endangered

carnivores may also be effective in some situations. None of these solutions are applicable to all circumstances and local criteria must be considered.

In conclusion, Treves and Karanth (2003, 1496) write:

> Carnivore management is as much a political challenge as a scientific one . . . . Successful conservation of carnivores depends on tolerant sociopolitical landscapes and favorable ecological conditions because humans have caused most of the carnivore mortality worldwide and most of the recent extirpations of carnivore populations. The human dimensions of carnivore conservation can trap carnivore managers between powerful interest groups and inflexible legislation. As a result, carnivore managers must now invest in intense and prolonged public outreach and engage social scientists to study public approval for management tactics.

They point, further, to the fact that "solutions must be situation-specific and driven by scientific data (both biological and social), not by fears and prejudices against carnivores."

Woodroffe and Frank (2005) conducted research indicating that relatively few African lions (*Panthera leo*) are involved in livestock depredations on African ranches. In a study area that included more than 100 lions and a predominance of domestic livestock (i.e., cattle, sheep, and goats), the researchers found that almost half of the 14 radio-collared lions shot during the four year study included those originally captured at livestock kills while only 13 percent were captured in other locations. In the study area, thorn-bush bomas are traditionally utilized as livestock enclosures with excellent success. The one ranch with an abnormally high kill rate of lions by humans (40 percent at this ranch compared to 13

percent elsewhere) were utilizing wire mesh enclosures: in the two years after adopting the traditional thorn-bush boma fencing, there were no lions shot on this particular ranch. This research demonstrates that sometimes the solutions to these problems are relatively simple, and, that by working with concerned parties and demonstrating the effectiveness of these solutions, stakeholders are willing to adopt win-win strategies.

Mishra et al. (2003) explore the use of incentive programs in the conservation of snow leopards (*Uncia uncia*). In south and central Asia, snow leopards and other carnivores are responsible for a significant number of livestock depredations which, in turn, places them at risk for retaliatory killing by herders. This region is heavily grazed by domestic livestock, and these grazing practices create significant forage competition with wild ungulates. This competition, along with poaching of wild prey by humans, results in diminished numbers of wild ungulates—the natural prey of snow leopards—and creates the necessity for snow leopards to prey on domestic livestock. Because the average livestock herd is quite small and even small losses pose a major economic hardship, incentive or compensation programs may often be the only viable and accepted options for preserving endangered carnivores. In this region, traditional livestock production systems are widespread and significantly overlap the range of many large carnivores including the snow leopard, wolf (*Canis lupus*), dhole (*Cuon alpinus*), and lynx (*Lynx lynx*). Mishra et al. (2003, 1514) write that "curtailing

retaliatory killing and restoring wild prey populations are perhaps the most important conservation needs of these carnivores today."

The Spiti Valley in the western Trans-Himalaya in the Indian state of Himachal Pradesh was the site of one such incentive program. One of the largest villages in Spiti Valley—Kibber—was the study area; the researchers determined that the recovery of prey populations hinged upon reducing stocking densities with or without creating grazing-free areas. The village was represented by a committee of 10 villagers entrusted to negotiate and implement the program in conjunction with the Nature Conservation Foundation.

The rangeland set-aside was to be utilized strategically to maximize the population viability of the bharal (a wild ungulate and natural prey species). Participant observation and semi-structured interviews on local herding practices revealed that a reduction in stocking densities was not immediately feasible because the tribal people were economically dependent upon many goods (milk, meat, wool, and manure) and services (draft power, religious ceremonies) for which there were no suitable substitutes; however, there was a readiness on the part of the villagers to abide by certain practices—village ownership of and contributions of premiums for their livestock—if a communal insurance fund were set up to counter the costs of livestock depredations.

The village committee agreed to a 6 percent set-aside of livestock-free grazing for 5 years commensurate with a yearly payment of 450 USD met by a

grant from the Van Tienhoven Foundation in the Netherlands. The set-aside was used to graze livestock during summer and autumn. After 4 years of protection, the researchers noted a threefold increase in use by bharal: these result indicated that the objective of increasing wild ungulate prey was achieved through strategic grazing practices.

The International Snow Leopard Trust contributed to this cooperative fund (on a temporary basis of 2-3 years) until it became self-sustaining. This was achieved, in part, by providing incentives for better antipredator herding and included biannual monetary rewards for safe herding which was paid to successful herders from the insurance fund. This fund was partially funded by the villagers themselves by paying monthly premiums toward insuring yaks, horses, cattle, cattle-yak hybrids, and donkeys. The requirements of this agreement include clauses—agreed to by all stakeholders in writing—that safeguard wildlife and large carnivores from persecution and prohibit the removal of carcasses of depredated livestock. The program offered realistic rates of compensation (up to 100 percent) compared to the 3 percent previously offered by government agencies. Additionally, the villagers were encouraged to develop programs to achieve sustainability through, among other things, the marketing of handicrafts which would be purchased at market price. This compensation program has resulted in no large carnivore losses in this village over a 4-year period including two incidents where the villagers turned away army personnel

intending to poach bharal and ibex (*Capra ibex*) with the warning that poaching of protected wildlife would not be tolerated in Kibber.

An additional incentive program was set up in Mongolia where levels of retaliatory killing of snow leopards was high—14 percent of 116 herders interviewed had hunted snow leopards as a result of livestock depredations. The snow leopard incentive program in Mongolia was spearheaded by Snow Leopard Enterprises—initiated in 1998—in response to an expressed need on the part of the herders for improved access to markets in exchange for a conservation commitment from these important stakeholders. In this instance, the incentive program centered on value addition to wool (i.e., the handcrafted products that the herders were encouraged to produce result in a 15-20 times more valuable product than the raw wool they usually sell). Through site specific contracts with varying clauses depending upon the conservation needs at each specific snow leopard site, the herders agreed to a complete ban on poaching of snow leopards and their prey. If by end of the contract period, all herders have adhered to the contractual conservation commitments, producers will receive an additional 20 percent bonus. If, however, there is a breach of contract within the community—either by villagers or those outside the community—the bonus is forfeited by all participants. If the person involved is a member of the conservation program, the family loses its membership. This membership is significant because the handicrafts produced from the small portion of the raw

wool they produce allow families to increase their per capita income by 50 USD in a country where government workers earn approximately 35 USD per month. Those communities that are compliant over a 5-year period can expect their household income to increase by 150 USD per annum. Again, as with the Spiti Valley incentive program, this incentive program encourages improved vigilance both within and outside the community (i.e., peer pressure against poaching seems to be an effective measure at self-regulation).

Although preservationist programs have their place in conservation of endangered species and ecosystems, the sustainable-use approach engenders a greater appreciation of the value of natural resources and an understanding that degradation of these resources will have direct economic effects on those who depend upon them. To this end, Mishra et al. (2003, 1517) write that these stakeholders

> can therefore be motivated to conserve them, provided the authority to regulate resource use is devolved to them. By supporting extractive human use of natural resources, the sustainable-use approach has succeeded in mobilizing greater local participation and support for conservation.

They do point out, though, that particularly vulnerable species and ecosystems may be sensitive to this kind of extractive pressures. This reemphasizes a theme common throughout this thesis: different species, ecosystems, and situations require situation-specific solutions. One size does not fit all.

Ogada et al. (2003) examined the role of livestock husbandry in limiting livestock depredations by African carnivores. They monitored livestock depredation rates by lions, leopards, cheetahs (*Actonomyx jubatus*), and spotted hyenas (*Crocuta crocuta*) and retributive killings of these carnivores by farmers in the livestock-producing regions of the Laikipia District of Kenya. As expected, farmers killed more predators where these predators killed more livestock; and, also as expected, livestock husbandry had a clear effect on the rates of depredation.

Ogada et al. (2003) concluded that livestock depredation is preventable—to some extent—depending upon the husbandry practices of the farmers. Livestock kept closely herded by day and kept in traditional bomas at night were less likely to be killed by wild predators. Increased livestock vigilance may have two significant positive effects on predator conservation: (1) reduction of livestock losses in the short-term; and, (2) prevention of predators from developing a taste for killing in the long-term. Armed, human vigilance appeared to have the strongest effect in deterring lion depredation on livestock. Some results were equivocal or, even, counterintuitive (e.g., hyena depredation and distance to cover was relatively weak, and leopard depredation revealed an inverse correlation with boma height). The authors acknowledged that the latter relationship may have been due to a lack of control elements related to boma construction and warrants further study.

There were significant differences between East African rangeland management and those employed in southern Africa. In southern Africa large carnivores have, for the most part, been eliminated from the majority of livestock areas where grazing cattle are often unaccompanied by herders. This lack of human vigilance often leads to a greater number of human-carnivore conflicts especially where rangelands border protected areas where predator numbers are increasing after a period of local extirpations.

East African rangelands—such as Laikipia—still retain traditional husbandry largely because of the possibility of cattle rustling. In these regions there is a relatively large pool of herders willing to work as cheap labor. Interestingly, these commercial ranches are able to employ a high level of human presence and more traditional acacia bomas—due to access to heavy machinery to move trees with greater ease—that most closely resemble the Maasai and Samburu pastoralists which may be effective in minimizing some livestock depredations. The authors, again, point out that more research quantifying the nature of the traditional bomas will be necessary to determine what criteria contribute to an "effective" boma enclosure.

Ogada et al. (2003, 1529) conclude:

> that depredation by large African carnivores can be mitigated through livestock husbandry. This has demonstrable conservation benefits in that fewer predators were killed where predators killed fewer livestock . . . . decisions concerning approaches to livestock husbandry are largely economic

> . . . [and that] simple, effective, low-technology solutions can make substantial contributions to the resolution of conflicts between people and predators . . . . Such measures could be implemented . . . around borders of reserves. Where necessary, subsidy of such practices might provide a cost-effective means of increasing the capacity of reserves to protect wide-ranging carnivores [emphasis added].

Public Attitude Assessment

Naughton-Treves et al. (2003) introduce the topic of differential risk and benefit in relation to wolf management in Wisconsin. They acknowledge that "most U.S. citizens support carnivore conservation, and many enjoy . . . benefits of restoring wolves, grizzly bears . . . and mountain lions," while correctly pointing out that "the direct costs of conserving these animals fall on a minority of individuals . . . who lose livestock or pets to carnivores" (2003, 1501). This study explored whether specific experiences with, and compensation for damage by, carnivores affected individual tolerance of these animals. A mail-back questionnaire with two non-respondent mail follow-ups was sent out over a six-week period in fall 2001. A follow-up phone survey was attempted for those non-respondents who had filed complaints against wolves because this group had the potential to have a small sample size without additional follow-up. Questionnaires were sent to individuals belonging to four groups: (1) landowner complainants (those who experienced wolf depredation on livestock, commercial game, or both pets and livestock); (2) randomly sampled landowners in the same counties as group (1); (3) bear hunter complainants; and, (4) randomly

sampled members of the Wisconsin Bear Hunters' Association. After data tabulation, respondents were reclassified into four cohorts: (1) livestock producers; (2) bear hunters; (3) both bear hunters and livestock complainants; and, (4) general residents (i.e., neither bear hunters nor livestock producers). Information requested from respondents included sex, age, years of formal education, income, landholding size, number of livestock, and descriptions of their encounters with wolves and other wild predators, including depredation events and compensatory payments for loss. Questions asked of respondents included five human-wolf interaction scenarios and four responses to those scenarios. Lethal control proved more popular among respondents in this study than in other surveys: this was especially the case when there was depredation on livestock and family pets. The authors note that a recent study on bears and coyotes demonstrated that 11-71 percent of carnivores killed by wildlife-control agents showed no evidence of having been involved in depredations (i.e., depredation techniques may not be selective). Additionally, compensation payments do not appear to improve individual tolerance toward wolves or human approval of lethal control. In spite of all these findings, 73 percent of Wisconsin residents support maintaining or increasing wolf numbers. The authors conclude that maintenance of wolves at an "acceptable" level in Wisconsin will engender public support for wolf conservation. They also suggest that, in spite of the lack of apparent benefit of compensation payments, continued compensation

programs are vital for public support for wolf conservation for two primary reasons: (1) other research suggests that ceasing compensation payments causes retaliation and increased hostility; and, (2) some experts believe that compensation programs may earn support from state-level political representatives thereby appeasing broader constituencies.

One broad implication to glean from this study is that policy decisions regarding wild life management ought to consider regional public attitudes at two different scales: differences *between* different [Western] states, and differences *within* a given state. The epoch of "one size fits all" policies is likely well behind us.

Butler, Shanahan, and Decker (2003) studied public attitudes toward wildlife in New York from 1984-1996. The research was initiated because the authors believed that commonly held beliefs about public attitudes toward wildlife—that is, that the public was becoming more protectionist and less utilitarian—were not accurate. The authors felt that wildlife managers were developing perceptions of public attitudes from unsystematic processes such as selective media exposure and unsolicited input from the public; this risk, they felt, could result in wildlife managers operating from inaccurate assumptions. The first important finding of this study was that problem tolerance declined for all residents living in both rural and non-rural residents between 1984 and 1996. The most significant finding of the study was that while men appeared to be in greater agreement

with traditional conservation practices over time, women were not showing any change in this respect. Communication regarding wildlife, however, was rated relatively high among women but declined with increasing age regardless of sex. It is important to note that this study ended before the results of the Greater Yellowstone Ecosystem (GYE) wolf re-introduction were known; judging from studies that looked at more recent survey data, it is possible that this study may have elucidated a period when human attitudes toward wildlife began to change away from a utilitarian ideal.

Manfredo et al. (1998) studied public acceptance of mountain lion management in the Denver, Colorado region. They found that there was significant public acceptance of depredation of mountain lions in instances where humans were attacked either fatally or non-fatally. Single attacks on domestic animals or the mere presence of mountain lions in urban-wild areas did not garner public acceptance for depredation. There was, however, a stronger correlation in the foothills region than in the city of Denver: city dwellers were less tolerant of mountain lion presence than those who resided on the outskirts of the city. This study presented specific human-wildlife encounter situations and questioned specific public cohorts as to whether they approved of the outcomes of these situations. They found near universal approval for tranquilization and relocation and near universal disapproval for hazing; however, further public education as to the specific science-based reasons for

these actions may allow for more informed public responses. As I have discussed above, hazing may be more beneficial to the viability of mountain lion populations than trapping and relocating. Most of the data collected for this study was obtained during spring 1995. This comes at the tail-end of the study that looked at public attitudes between 1984 and 1996. Manfredo et al. (1998) may represent a period of change in human attitudes regarding wildlife in spite of the fact that Butler, Shanahan, and Decker (2003) was published five years later. With the 1995 GYE wolf re-introduction, the Manfredo et al. (1998) study may have served as a bridge between old and new trends of public wildlife acceptance.

Holsman and Peyton (2003) researched stakeholder attitudes toward ecosystem management in southern Michigan. They concluded that although ecosystem management as a tool in wildlife management was well accepted in principal, there were still many stakeholders that were undecided regarding specific management principles depending on the orientation of the stakeholders. Their study place a great emphasis on including all stakeholders and providing them with the appropriate transparency to allow appropriate decisions to be made. Holsman and Peyton acknowledged the expected difficulties when multiple stakeholders with countervailing interests are involved in the process; however, they still believed this to be the most effective manner to reach consensus.

Although there has been much literature regarding human-wildlife interactions since this study was conducted, some stakeholders are still unconvinced concerning many issues including the effects of large carnivores on wild ungulate prey (i.e., game) and large carnivore-domestic livestock interactions. While general public acceptance of large carnivore conservation may be more accepted than in the past, some stakeholders are still unconvinced. Based on existing public attitude surveys, there is still a long way to go until general consensus is reached between all major stakeholders; it is certainly possible this disconnect will remain making consensus building difficult.

# CHAPTER 4

# CONSERVATION AND POLICY: A CONTEMPORARY APPROACH

## Sound Ideas and Collective Misunderstanding: Is Science Being Heard?

Throughout history there have always been forward thinking individuals charged with presenting ideas not universally accepted: Saint Francis of Assisi, Aristotle, Copernicus, Thoreau, Muir, Carson, Commoner, Abbey—the list is long. In the forward to *People and predators: From conflict to coexistence*, Estes (2004, xiii), from the U.S. Geological Survey (USGS) and Defenders of Wildlife (DOW), presents relevant points of consideration:

> We stand at a point in time when wild things and wild places are disappearing rapidly. Large carnivores are perhaps the most poignant symbol of these losses. But that emotional rendering has not been sufficient to redirect policy, nor does it capture the enormity of all that we are losing. Our perception of the loss of species is reasonably accurate, while our understanding of the associated loss of species interactions—the the complex effects of wolves on terrestrial ecosystems or sea otters on kelp forests—is miniscule almost beyond imagination. The challenge is to open our minds, to learn about these interactions, and to imagine what might be. With that knowledge lies hope and opportunity: a reason not to lock up our carnivores in a park somewhere and pray that some minimal-istic vision of a viable population will suffice in preserving them for future generations; a pathway by which we might indeed effect a transition from conflict to conservation between people and predators.

This grouping of words conveys much more than is immediately apparent. First, the number of people that have even heard of, much less read this book, would be depressingly low to those of us concerned with the issue of carnivore management. Second, the fact that "emotional rendering" has not affected policy changes speaks to the lack of translational scientists who can explain these issues to a wide audience (i.e., legislators, business owners, private citizens, and other stakeholders) (Brosnan and Groom 2006) and that science, while only part of the process, is the initiating influence behind policy. Third, the fact that ethically-practiced science requires the disclosure of uncertainties is often exploited by certain stakeholders as a weakness in the argument. Properly trained translational scientists ought to be adept at informing laypeople that science generates, by definition, uncertainty: any "science" that professes absolute certainty is not following proper scientific methods and, therefore, is not science: It is dogma. As scientists we ought to be able to present an uncertainty of 1% or 5% as a confidence level of 99% or 95%, respectively. If scientists are not permitted to be advocates of their life's work—as long as objectivity is maximized and bias is minimized—then the non-scientific community will continue writing or re-writing science-based policies, and the outcomes will continue to be poor.

Throughout history and prehistory, and until present day, the more complex a society becomes (i.e., the greater the number of levels within the

social or administrative hierarchy) the greater the disparity of understanding between the decision-makers and the producers (Kirch 2004; Redman 2004; Redman 1999; and Redman et al. 2004). This kind of hierarchical structure is often described as maladaptive and, often, precedes societal collapse: This does not bode well for contemporary societal agencies that rely upon these hierarchies—such as some state and other government wildlife management agencies—or the proper creation and implementation of their policies. A tangential concern is well articulated by Redman (2004, 158-159) when he writes:

> As successful agrarian societies began to develop managerial and hierarchical social systems they set in motion forces that reshaped the decision-making process guiding human interactions with the environment. That is to say, as societies grew more complex, key decisions often rested not with the primary producers, but with individuals and groups facing different constraints and thus having a different view of risks and rewards. Furthermore, people higher up in the social hierarchy may not have had immediate access to information on the productive situation or a solid understanding of the actual alternatives. Anthropologist Roy Rappaport (1978) considered this type of inefficiency in the flow of information a "maladaptation" that exists in many complex societies and often undermines their continued survival.

I would not consider it a stretch to extend these concerns to the carnivore management policy hierarchies that exist today at all governmental levels especially given the current relationships between lobbyists, legislators, and scientists. Numerous examples of this disjunction are evident within the

California Department of Fish and Game's (CDFG) mountain lion management policies and their actual practice in the field (*Los Angeles Times* 2003; *L.A. Times* 2006; MLF 2006): The period between 2003 and 2006 has brought incidents of an inhumane killing—depredation—of a mountain lion in San Juan Capistrano, a questionable and unpunished civilian related shooting—and wounding—of a mountain lion in Rancho Santa Margarita (Orange County, CA) without the appropriate depredation permit, and the tranquilization and relocation of a mountain lion, which is against CDFG policy guidelines. While I may agree with the latter action in the ethical sense, this action was, indeed, against California state mountain lion management policy as written and, therefore, counter to California state wildlife predator management policies.

Brosnan and Groom (2006) discuss the idea that when conservation biology was in its infancy, the challenge was to convince scientists and those funding scientific efforts that conserving biodiversity was a necessary priority on all levels—including, and, perhaps, especially, on the global level. Not only was it incumbent upon us to determine that there was a threat to biodiversity but that preserving biodiversity, per se, was essential to the proper ecological functioning of our Ecosystem. They correctly reason:

> This is no longer the case. Our challenge today is not about convincing our colleagues that there is a biodiversity crisis; rather it is about making

> science an integral part of how we solve that crisis at local, state, federal, and international levels. (Brosnan and Groom 2006, 625)

## Conservation and Policy: Effectiveness Through Inclusiveness

### Shouting From the Wilderness: A Solution?

Where is the voice crying [shouting] in the wilderness? There are far more voices shouting today than in recent U.S. history; so, why does it seem as though environmental issues have no charismatic voice—that is, no leader? Perhaps there are so many shouting voices that this unknown charismatic leader is being obscured by unprecedented levels of white noise. Al Gore made a valiant attempt as Vice President under Clinton but faded miserably when he entered the spotlight alone. He is currently re-entering the environmental arena and is making an impact; I hope the momentum of his documentary continues. Robert F. Kennedy, Jr.—an environmental attorney—presents well articulated arguments that most of his detractors cannot successfully rebut; but, I cannot hear him, can you? That is not to say that Mr. Kennedy is not making excellent contributions to the environmental cause as the founding member of the Riverkeepers Alliance; however, his cause is not well-represented in the mainstream media. My favorite author, or, more accurately, the author of my favorite book (*Desert Solitaire: A Season in the Wilderness*)—Edward Abbey—was one such shouting voice: a voice shouting *from* the wilderness. Abbey's most popular

book—*The Monkey Wrench Gang* (1973)—was the source for the term "monkeywrenching," which was adopted in terminology and practice by an environmental advocacy group known as Earthfirst! However, because of Abbey's acerbic style and unplanned—but not unappreciated—association with radical environmental groups, both he and his work never emerged above cult status. Abbey died in 1989, but if there was one person I could bring back from the dead to be an environmental advocacy icon, it would be Edward Abbey: Unfortunately, he would impolitely decline.

That is not to say that Abbey, even as early as the 1960s, did not understand the hierarchical disparity discussed above. The following excerpt from *Desert Solitaire* (Abbey 1968, 46) demonstrates that understanding along with his ability to predict future trends:

> The Park Service, established by Congress in 1916, was directed not only to administer the parks but also to 'provide for the enjoyment of same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.' This appropriately ambiguous language, employed long before the onslaught of the automobile, has been understood in various and often opposing ways ever since. The Park Service, like any other big organization, includes factions and factions. The Developers, the dominant faction place their emphasis on the words '*provide for the enjoyment.*' The Preservers, a minority but also strong, emphasize the words '*leave them unimpaired.*' It is apparent, then, that we cannot decide the question of development versus preservation by a simple referral to holy writ or an attempt to guess the intention of the founding fathers; we must make up our own minds and decide for ourselves what the national parks should be and what purpose they should serve.

Abbey captured the essence of the problems we face today when we enter the realm of conservation and policy; and, although he follows with cogent arguments for preservation, he understood all to well that the "Developers" had cogent arguments of their own. He understood the intractability of these arguments as well as the fact that the influences of monetary capital often prevailed.

Abbey wrote the above words more than four decades ago, and it has taken our collective society nearly that long to realize that a different approach to the conservation policy process may be the only solution for the resolution of seemingly intractable issues. As much as I respect Abbey's legacy, I believe he would not have been party to such pandering; however, today's world requires a different kind of thinking—one of cooperation, inclusion, mitigation, compromise, and discussions with lower decibel levels and diminished rhetoric. Solutions and inclusiveness *must* replace shouting and divisiveness: a pow wow, but how?

Conservation and Policy: A Contemporary Approach

I am hopeful that the preceding discussion has made it apparent that in order to resolve many of our contemporary conservation policy issues, radical changes must be implemented if there is any hope of rectifying many of these previously "intractable" challenges. I am pleased to note that the current literature (i.e., literature over the last 7-10 years) contains a plethora

of discussions that propose some very well thought out solutions to the current conservation policy conflicts. This section will serve to review the current literature in this realm, and I will attempt to coalesce these policy arbitration techniques for the purpose of addressing human-predator management policy formation and implementation.

In *The Policy Process: A Practical Guide for Natural Resource Professionals*, Clark (2002) describes the conservation policy process as requiring solutions that include the policy sciences: an issue may be intractable when utilizing conventional scientific approaches alone but may become more tractable when also utilizing the policy sciences. He writes:

> The very term *policy sciences* emphasizes the need to join our biggest and most important decisions—policy—to systematic, empirical inquiry—science, in the broadest sense—thus producing insight and improved judgment both for human freedom and for the sustainability of the natural environment. (Clark 2002, 15)

Clark's work in this book is quite hierarchical in nature and can be difficult to assimilate unless one understands that this hierarchical organization is an excellent *guideline* for multi-stakeholder policy discussions. In the appendix of *The Policy Process*, Table 1 contains what Clark refers to as the "Maximization Postulate." This postulate states that "all living forms tend to complete acts in ways that are perceived to leave them better off than if they had completed them differently" (2002, 179). It ought not to surprise

anyone that we—*Homo sapiens*—act in ways that create the best possible outcomes for ourselves; and, it is with this difficult task in mind—to please all stakeholders, at least to some extent—that Clark puts forth these conservation-policy negotiating tools. We must keep in mind that these are only tools, and Clark very forcefully advocates that these tools can only be perfected by practice both in preparation for and in actual negotiations. Table 4.1 is taken verbatim from Clark (2002, Appendix Table 1, 179).

Table 4.1. Principal Conceptual Tools in the Interdisciplinary Problem-Solving Method of the Policy Sciences

| Social Process | Components |
|---|---|
| Participants | Individuals, groups, value shapers (official, nonofficial), value sharers (official, nonofficial) |
| Perspectives | Identities, myths (doctrine, formulas, mirandas), expectations, demands, value demands |
| Situations | Unorganized (territorial, pluralistic), organized (territorial, pluralistic), value inclusive or exclusive, crisis or intercrisis, in terms of space, time |
| Base Values | Positive assets (perspective, capabilities), negative assets (perspectives, capabilities) by the eight value categories (see below) |
| Strategies | Coercive, persuasive, communicative (diplomacy, propaganda), collaborative (military, economic) |
| Outcomes | Value indulgences, deprivations, decisions, choices (by phases of decision process) |
| Effects | Value (accumulation, enjoyment, distribution), institutions (structures, function, innovation, diffusion, restriction) |

Table 4.1 continued

| Values | Outcomes and Institutions |
|---|---|
| Power | Victory or defeat in fights or elections (government, law, political parties) |
| Enlightenment | Scientific discovery, news (languages, mass media, scientific establishments) |
| Wealth | Income, ownership transfer (farms, factories, banks) |
| Well-being | Medical care, protection (hospitals, recreational facilities) |
| Skill | Instruction, demonstration of proficiency (vocational, professional, art schools) |
| Affection | Expression of intimacy, friendship, loyalty (families, friendship circles) |
| Respect | Honor, deference (social classes and castes) |
| Rectitude | Acceptance in religious or ethical associations |
| Decision Process | Outcomes |
| Intelligence | Gathering, processing, and disseminating information relevant to decision making |
| Promotion | Active advocacy of policy alternatives |
| Prescription | Setting community policy that is both authoritative and controlling |
| Invocation | Provisional characterization of events in terms of a prescription |
| Application | Resolution of disputes with regard to a prescription, including sanctions for noncompliance |
| Appraisal | Evaluation of past decision process, including assigning responsibility |
| Termination | Ending prescription and arrangements made in accordance with the prescription |

Table 4.1 continued

| Problem Orientation | Questions and Tasks |
|---|---|
| Goals | What future states are sought in social process? (goal clarification) |
| Trends | To what extent have past events approximated the preferred goals? (trend, history description) |
| Conditions | What conditions have influenced the direction and magnitude of the trends described? (analysis of conditions) |
| Projection | If current policies are continued, what is the probable future of realizing the goals, or what discrepancies exist? (projection of future developments) |
| Alternatives | What intermediate objectives and strategies will best realize the preferred goals? (invention, evaluation, and selection of alternatives) |

*Source:* Adapted from Lasswell 1971a; Brunner 1995a. (from Clark 2002)

Campbell (2005), in *Overcoming Obstacles to Interdisciplinary Research*, strongly advocates the necessity for interdisciplinary approaches in relation to conservation research and submission of scientific papers; and, while she acknowledges from first-hand experience the difficulties facing those attempting to publish their findings in discipline-based journals, she offers some suggestions for overcoming these difficulties. Often, interdisciplinary papers are reviewed primarily by biologists familiar with the natural science aspects of a particular subject but are not familiar with the social science aspects of the theories or methods upon which the results are based. She

suggests that interdisciplinary journals should expand their editorial boards to include more social scientists familiar with these methods. In addition, the group of scientists authoring these papers for publication ought to involve social scientists at the beginning of the process instead of adding them after the fact (e.g., to fulfill a funding requirement): this would be more true to the interdisciplinary aspect of the paper and would bring greater depth to the end product. Along these same lines, the ideological differences between natural and social scientists ought to be addressed at the outset of the writing process; Campbell believes this will not only prevent problems at later stages of the publication process, but that it will also benefit the overall quality of the science. Last, the hierarchy of credit ought to be determined at the beginning of the process as to mitigate "power relations" (2005, 576)—that is, in what way ought to credit be distributed when two different branches of science are involved? Her strong beliefs in working toward interdisciplinary collaboration are revealed when she writes, "We have not turned to interdisciplinary research on a whim, but rather because there are compelling arguments in its favor" (Campbell 2005, 577).

I introduced the concept of the translational scientist early in this discussion. Brosnan and Groom (2006) point out that the coordination of conservation science and environmental policy is impossible when only the scientists understand the science. They are unequivocal when they identify

"one of the greatest needs in conservation practice is a cadre of "translational scientists" to aid in conservation policy . . ." (2006, 626). They define a translational scientist as "a conservation scientist (from either a natural or social science background) who can translate scientific language into a policy framework so that decision-makers can use the science appropriately" (2006, 626). They go on to write that environmental policy decisions will necessarily entail political, social, and economic compromises: conservation science may be a necessary starting point, but science alone will not solve environmental policy issues. I refer the reader back to Table 4.1 as a reminder of the intricate nature of these compromises.

In a comment piece addressing concerns about "Conservation and the Myth of Consensus" (Petersen et al. 2005), Leach (2006) advocates the consensus approach and downplays the out-of-hand dismissal of consensus approaches advocated by Petersen et al. Leach points out:

> Joint fact-finding involves stakeholders with differing interpretations of the scientific evidence working together to develop common assumptions, commission new studies or analysis, and define remaining areas of disagreement or uncertainty. (2006 573)

Leach applauds the fact that universities are creating degrees in collaborative environmental management which allow for further understanding of the actual consensus process. Leach's implied, but salient, point is that, in the

contemporary era of conservation policy, excluding stakeholders would only further stagnate the policy process.

In the introduction to *People and Predators: From Conflict to Coexistence*, Fascione et al. (2004, 1) posit the central question of human-carnivore policy, "How do we manage the world's carnivore populations to conserve this important natural resource while mitigating any harmful impacts?" There will be those who say that we cannot, and I cannot completely disagree. To the family that loses someone to a predator attack, any attempts at mitigation may be perceived as inadequate. As discussed earlier, there are always going to be risks when we allow predators and people to coexist in any environment—whether in the "wilderness," the wild-urban interface, a zoo, a cable television program, or a Las Vegas show.

Acceptance of human-predator coexistence can only occur when humans accept the risks, however small, associated with this coexistence. At least in the U. S., humans accept far greater risks without a second thought: one example is simply driving an automobile. Automobile accidents account for far more deaths (>40,000 deaths per year in the U.S., Bureau of Transportation Statistics 2006) than predator attacks on humans. Unfortunately, this argument brings us full circle to an argument I discussed previously: not only would most people, if they had to make a choice, choose to die behind the wheel rather than to be eaten alive, but the entrenched fear

of being predated upon has a far longer history. So, how do we address these perceived disparities?

In *The Look of Success*, Robbins (2005, 28) discusses wolf reintroduction in the West and asks: "Are we ready for modern predator management?" He focuses on the work done by Ed Bangs—head of the USFWS's Endangered Species Office—who was intimately associated with establishing the first wolf pack in the Northern Rockies since their extirpation in the 1940s. Now Bangs is in the unenviable position of having to utilize lethal control on the species he worked so hard to reintroduce. The reason for this ironic twist is that the wolf reintroduction was incredibly and rapidly successful. Although Bang's job duties still entail protecting wolves, many of his recent duties have centered on killing wolves that kill livestock. Bangs summarizes the problem succinctly when he says:

> The key to keeping the wolf around is human tolerance . . . . [t]he only reason wolves disappeared is because we killed them all. How do you kill the minimum you need to maintain human tolerance so we don't kill them all again? You kill problem wolves. (Robbins 2005, 30)

The USFWS requires at least one member of every pack be fitted with a radio collar; and, according to the USFWS, wolves in Yellowstone National Park are required to wear two to four times that number. However, an anonymous game warden in Wyoming's Lamar Valley reported that the actual

number is significantly lower. Some, like William Cronon, might argue that this kind of intensive, high-technology management renders the West's wildlife less than "wild." When asked if hyper-management of wolves was worth it, Bangs did not mince words:

> I think it's kind of ridiculous, myself . . . . We don't do it with any other animal in North America. There's a lot to be said for ignorance and mystery. The essence of wilderness and the wild is its unpredictability. (Robbins 2005, 34)

A high-profile example of why this "hyper-management" is necessary comes from actress Andie McDowell who lived north of Yellowstone during the wolf reintroduction. Initially, she was an outspoken, adamant supporter of wolf reintroduction. After her two Great Pyrenees guard dogs were killed by wolves, her enthusiasm waned: although she still supported wolves, she no longer spoke out in favor of them. Although the number of wolves that kill domestic animals (i.e., livestock and pets) is relatively low, negative personal experiences may reduce public support for such reintroductions. As stated earlier, urbanites tend to favor carnivore conservation more than humans who live in rural communities—that is, areas where human-wildlife conflicts are more likely to occur.

Robbins also discusses non-lethal wolf control (e.g., fladry, radio-activated guard (RAG) collars similar to movement activated guard (MAG) collars, and

the DOW's Wolf Guardian Project). Fladry are strategically placed flags that may help deter the entry of certain carnivores into enclosures. The Wolf Guardian Project centers on the idea discussed previously that human presence may be one of the best deterrents to wolves that prey on livestock. This group of volunteers place themselves in strategic areas at strategic times (e.g., remote pastures during lambing season) and utilize primary repellent techniques [mostly auditory] to repel potential problem-wolves. Unfortunately, the number of volunteers is insufficient to replace the primary method of controlling problem wolves: lethal control. Wildlife Services (WS)—a division of the Department of Agriculture—are charged with the duty of killing problem wolves; but, this service is done out of the public eye. While the press can ride with Marines in Iraq, "no one gets to see what Wildlife Services is doing to wolves with taxpayer dollars . . . . The business of killing wolves is better done out of view of the public" (Robbins 2005, 34).

This kind of secretive killing of wolves would likely be less necessary if the initial process of reintroduction involved multiple-stakeholder policy talks—including, and maybe especially, the public. Clark (2002) addresses this issue when he discusses the social outcomes process and when he discusses problem orientation in terms of projection [of possible problems]. We must be better at discussing as many possible outcomes and contingencies at the outset in order to avoid the need to hide management practices: When we

operate covertly, we leave the impression that we are engaging in an unethical action. We ought to make every attempt to avoid such impressions; and, of course, we ought to avoid the need to engage in unethical actions. The irony is that the same action—in this instance, killing wolves—might well be more accepted by the public if the possibility was disclosed in the early stages of policy planning. That would serve to make an unethical practice, in essence, ethical. Is this moral relativism? I do not believe so; but, this belief is contingent upon the necessity of transparency during all stages of the policy process.

The topic of conservation education is aggressively pursued by Trombulak et al. (2004) through a comprehensive outline of "recommended guidelines for conservation literacy [from the Education Committee of the Society of Conservation Biology]." A complete review of this article is beyond the scope of this thesis; however, they conclude:

> Our belief is that if citizens, decision makers involved in conservation, and conservation practitioners become fully conservation literate, then our collective societies will be able to live more harmoniously with nature. (Trombulak et al. 2004, 1189)

Some of the criteria for literacy include the understanding of instrumental values, psychological values, understanding and participating in the policy-

making process, and educating others concerning the importance of conservation (i.e., a multi-disciplinary process).

In a comment piece in *Conservation in Practice*, Charles Alexander [a former editor of TIME magazine] concludes, quite succinctly, when addressing the most international issue on the world agenda—global climate change—that "with so much at stake, environmentalists will have to join forces with far-sighted business, labor, religious, and political leaders of all stripes. Future generations are counting on it" (Alexander 2005, 19).

Solutions to our Ecosphere's environmental problems—from those discussed in this thesis to all others—will only materialize when we apply multi-disciplinary approaches equally across a bargaining table that includes all interested stakeholders: This idea is already becoming pervasive in the scientific literature and merits and in-depth look into the future of the conservation-policy conundrum. The future is now.

## Cougar Management Guidelines

### Introduction

I believe *Cougar Management Guidelines* (CMGWG 2005) is worthy of being considered a seminal work in the arena of institutional large mammal predator management. I realize the term "seminal work" is often reserved for older, well-established works that have proven their academic worth over time through intensive peer-review and the benefit of historical perspective.

However, some works are so novel and prescient in their content that they have the potential to be seminal works in that context. I believe this to be one of those works; therefore, I am treating this publication as such.

Recommended Basic Principles

There is a singular, pervasive understanding that encompasses all state and provincial cougar management research and policy principles influencing human-cougar interactions—that is, uncertainty. Uncertainties about demographic parameters, management prescriptions and hunter selectivity in the temporal and spatial sense, predictive models of present and future cougar viability, and the ever-evolving science of conservation biology, all contribute to the difficulties encountered in the management of cougars (Cougar Management Guidelines Working Group (CMGWG) 2005). The Cougar Management Guidelines Working Group (CMGWG) has suggested that cougar management ought to be structured upon four basic principles. This section serves as a review and summary of the 2005 *Cougar Management Guidelines*.

First, a large landscape-scale approach (i.e., thousands of $km^2$ of well-connected habitat with healthy natural prey populations) is necessary for self-sustaining cougar populations. This is based upon research that acknowledges that cougars are large, obligate carnivores that exist at low population densities—as do most top-chain predators—and possess relatively

large home ranges. While female cougar home ranges may overlap, male home ranges do not. Therefore, almost all young male cougars disperse between 18 months and three years of age due to the necessity of avoiding confrontations, which are often fatal, with older, dominant toms. A small proportion of female offspring remain, although a larger percentage of females remain than do males, and immigration of male and female cougars is necessary to preserve cougar populations and sustained, viable, genetic influx.

Second, cougar management ought to encompass the full spectrum of human values and adequate input from all stakeholders.

Third, because of the variety of human values and diversity of stakeholders, funding for cougar research, management, and conservation ought to be derived from sources additive to hunting-related programs.

Fourth, because of the previously mentioned demographic parameter uncertainties, the varied responses of different populations to management prescriptions or hunter selectivity, temporal and spatial variation between populations or metapopulations, and the understanding that the nature of cougar habitat is dynamic, cougar management ought to adopt an adaptive management process.

By definition, adaptive management is a dynamic process that is effective in continuously re-evaluating systems that are, by nature, non-constant. The

spirit of adaptive management is that management policies evolve over time as do the processes and organisms that they oversee. The adaptive management process includes (adapted from (CMGWG 2005, 10) (1) clearly stated and justified cougar management goals and objectives; (2) management actions designed as scientific experiments that allow evaluation of management prescriptions in attaining management goals and objectives. Specifically: (a) design objectives as questions to be answered or as hypotheses to be tested, along with attendant predictions through experimentation; (b) monitor effects of management prescriptions in time frames appropriate to the objectives. (3) assess public stakeholder interests in cougar management; (4) modification of cougar management based on information gained from management experiments, monitoring, other research, and public stakeholder interests.

Cougar-Prey Relationships

I will present cougar-prey interactions in a tabular (Tables 4.2 and 4.3) format derived from the text of the CMGWG (2005): I will divide this section into seven major principles of predator-prey ecological interactions and four main recommendations for managing these ecological interactions.

TABLE 4.2. COUGAR PREDATOR-PREY INTERACTIONS: SEVEN MAJOR PRINCIPLES

| | MAJOR PRINCIPLES |
|---|---|
| 1 | Cougar predation likely has little effect on ungulate numbers when the ungulate population is in poor physical condition; the corollary is likely also true. |
| 2 | It is likely that cougar predation can create a predator pit (i.e., a prey population at an abnormally low density). |
| 3 | The following four factors suggest the presence of a predator pit: (a) alternate prey; (b) excellent prey condition and reproduction; (c) high mortality due to predation; and, (d) historic evidence of a significantly larger prey population. |
| 4 | Some small, isolated bighorn populations may be limited by cougar predation. |
| 5 | Cougars are adaptive, opportunistic predators that select vulnerable prey. |
| 6 | Cougars affect, and are affected by, other carnivores in their ecological systems. |
| 7 | The structure and density of ecological communities are affected by cougars. |

TABLE 4.3. RECOMMENDATIONS FOR MANAGING COUGAR PREDATOR-PREY INTERACTIONS

| | RECOMMENDATIONS |
|---|---|
| 1 | Following a sudden decline in prey carrying capacity, an increased cougar harvest may help avoid problems caused by a time lag in the response of cougars to changes in prey. |
| 1a | Many studies have demonstrated that public safety is not affected by indiscriminate cougar harvests unless the harvests exceed 50 percent of the total cougar population. |
| 2 | An adaptive management approach ought to be utilized by managers to design meaningful case studies of potential predator pits involving cougars. |
| 3 | Small bighorn sheep populations could benefit from targeted removal of cougars that are predation specialists [on bighorn]. |
| 4 | The determination of prey selection requires a comparison of diet with the availability of prey. |

## Cougar Habitat

Cougars are the most widely distributed of all non-human terrestrial mammals in the western hemisphere encompassing multiple habitats ranging from sea level to 4,500 m. There are known reproducing populations of cougars in a variety of habitats including coniferous and deciduous forests, woodlands, mangroves, savannahs, chaparral, contiguous riparian forests, desert canyons and mountains, and semi-arid shrub lands. And, although cougars are able to persist in most habitats that offer appropriate prey and cover, human land use significantly affects their ability to sustain viable populations. The by-products of anthropogenic influences on cougar habitat—high human densities, extensive habitat fragmentation due to roads and other encumbrances, agricultural and urban land use—result in cougar losses due to vehicular road kill, intraspecific cougar interactions, depredation incidents involving livestock, pets, and cougar removal under the auspice of public safety (i.e., potential attacks on humans). Because cougars exist in low densities and require extensive home ranges, habitat fragmentation is probably the greatest impediment to the development and maintenance of viable cougar populations.

The Cougar Management Guidelines Working Group "assert that habitat conservation is an essential component of cougar management, and should involve efforts to identify, map and protect cougar habitat and the landscape

linkages that join them" (CMGWG 2005, 26). They suggest that wildlife managers ought to have 3 objectives in identifying and managing habitat for cougars: (1) identifying habitat is the best starting point for defining populations; (2) conserving cougar habitat to increase population resiliency; and, (3) conserving cougar habitat because it has an umbrella effect for biological diversity.

Because most habitat management has been focused on ungulates and game birds rather than carnivores, cougar habitat has often been insufficiently evaluated. Proper cougar habitat evaluation ought to involve a simplified approach based on large-scale assessments of presence-absence, habitat quality assessments based on the specific requirements of cougars including prey distribution, and a landscape-scale approach designed to integrate smaller units into a larger scale evaluation. The CMGWG has put forth nine guidelines to contribute to the proper identification of appropriate cougar habitat (Table 4.4). In relation to conserving and restoring linkages (Table 4.4, recommendation 7), the South Coast Missing Linkages Project in southern California is probably the most comprehensive effort in this regard. I encourage anybody interested in this subject to read the entire proposal as it attempts to solve habitat connectivity issues in one of the most fragmented

TABLE 4.4. COUGAR HABITAT: PROPER IDENTIFICATION OF COUGAR HABITATS

| | RECOMMENDATIONS FOR PROPER COUGAR HABITAT IDENTIFICATION |
|---|---|
| 1 | Map cougar habitat in an accessible, modifiable format. |
| 2 | Identify and map subpopulations as a network of sources and sinks. |
| 3 | Manage areas designated as sources for low mortality and human conflict. |
| 4 | Assess and map the status of, and threats to, each subpopulation. |
| 5 | Identify linkages using GPS collars, surveys for sign, or GIS analysis. |
| 6 | Assess the quality of each linkage. |
| 7 | Conserve and restore linkages*. See text (page 180). |
| 8 | Provide incentives to landowners to protect habitat. |
| 9 | Consider augmentation as a last-resort alternative to natural connectivity. |

habitats in the U.S. (i.e., southern California) (South Coast Wildlands Project 2003). Simberloff (1987) has been the most outspoken critic of wildlife corridors because of their cost and the potential for disease transmission; however, the scientific consensus is that corridors—when properly researched and constructed—have the potential to mitigate some of the negative effects of habitat fragmentation. However, it would be fallacious to consider linkages as a panacea for large predator conservation: wildlife corridors are a last resort of habitat enhancement in a world of increasingly receding "large predator-appropriate" habitat. In a perfect world, the goal is the preservation of large, contiguous habitats with built-in connectivity.

## Assessing Cougar Populations

In all species, population growth is determined by births, deaths, immigration, and emigration; however, cougar populations, specifically,

depend upon immigration for nearly all breeding males and approximately one-third of breeding females. Immigration recruits tend to provide far more recruits than local progeny; and, therefore, interpopulation dispersal is essential for proper cougar population viability. The unique nature of cougar population dynamics has resulted in twenty-three recommendations (principles) by the Cougar Management Guidelines Working Group for [cougar] wildlife managers. I refer the interested reader to the original publication for the full complement of the twenty-three recommendations put forth by the CMGWG. I will discuss the recommendations I feel are most pertinent to the topic at hand.

Of significance is that "cougar sightings, depredation events, and harvest levels are not reliable ways to index cougar populations" (CMGWG 2005, 49). Cougar sightings are the least reliable method for indexing N or evaluating population trends because of the inadequacy of eyewitnesses to differentiate domestic felines, coyotes, and bobcats from cougars on a consistent basis. Media reporting of cougar sightings and other cougar related incidents also influence the frequency of reporting of such sightings. However, clusters of cougar "sightings" may be a useful indicator of where managers ought to evaluate the potential for cougar-human encounters.

Depredation events are affected by multiple variables including changes in wild prey populations, density of hobby ranching, changes in the numbers

and species of pets and livestock, the number of landowners, and trends in recreational use of land. Again, these indicators, while not accurate indicators of cougar populations, may be useful in identifying the potential for cougar-human conflicts in a given area. Cougar harvest levels can reflect hunter effort or cougar vulnerability but are not accurate reflections of cougar numbers because they are open to diametrically opposed conclusions. One may argue that increased harvest levels are indicative of over-exploitation or an increase in cougar population levels depending upon the nature of one's advocacy (i.e., anti-hunting vs. predator control advocates).

## Depredations

The last of the California state cougar bounties were eliminated in 1972. In the stead, state wildlife management agencies established policies to allow cougar removal (killing) associated with cougar-related property damage or threats to public safety: this type of removal is termed "depredation." These depredation policies vary between states but ought to have five similar aspects: (1) verification that the damage or killing of livestock can be attributed to a cougar; (2) supplying property owners with information to prevent future damage to livestock and pets and cougar depredations; (3) the issuance of cougar kill permits (i.e., depredation permits) that fall under certain regional and temporal constraints; (4) providing appropriate government agents (usually from USDA Wildlife Services (WS)) to perform

cougar depredations; (5) requiring the property owner to report back to the managing agency as to the disposition of the cougar (i.e., trapped, killed, escaped). In my research, I found that, although some states required all of the above criteria, most only required one or more criteria.

In the western U.S., the last 30 years has brought an increase in cougar depredation incidents likely due to declining deer numbers, elimination of bounties, increasing cougar numbers, and changes in land use. Notice that increasing cougar numbers and changes in land use are two very interactive variables: it is possible that a modest increase in cougar numbers can have a large impact when land use expands into habitats previously unoccupied or under-occupied by humans.

There are two trends regarding depredation permits worth noting. First, "most depredation permits are issued in response to cougars killing domestic sheep" (CMGWG 2005, 64). Cougar depredation permit data reveal that cougars kill a variety of domestic animals including sheep, goats, cattle, horses (immature), llamas, alpacas, pigs, dogs, cats, geese, chickens, and emus. These incidents are most common where livestock range adjacent to, or within, cougar habitat; and, with increasing human development in cougar habitats, cougar depredations are becoming more commonly associated with attacks on pets and hobby animals. Of these, cougars kill sheep most commonly and often kill disproportionately to need (i.e., uneaten sheep will

be left behind). Cougars will kill cattle depending upon the type of cattle management present and the presence of alternative prey species: Cougars tend to kill their natural prey (i.e., mule deer) when they are available, but they will turn to other prey when mule deer abundance is diminished. When cougars do kill cattle they rarely kill cattle over 300 pounds and mainly choose calves and yearlings.

Second, "cougar depredation on pets is becoming more common" (CMGWG 2005, 65). Pet depredations occur where numbers of new housing starts are relatively high: pets tend to be kept closer to human residences, and these types of depredations are coincident with areas where cougar habitat is being lost. In these cases, education on protecting pets and livestock ought to be a primary focus. Not surprisingly, these areas also tend to have a higher incidence of cougar vehicular mortality and a higher number of depredation permits issued: These areas may represent cougar population sinks; and, therefore, depredation permits issued in these regions ought to be strongly tied to human education and the modification of human practices to prevent future incidents of like kind.

The Cougar Management Guidelines Working Group offers six principles and guidelines to help managers evaluate and manage the risk of cougar attacks on pets and livestock (Table 4.5). It is vitally important that all of the above data and conclusions be made available to entire regions and different

state wildlife management agencies so that they may be applied appropriately over large regions that have previously not communicated well with one another.

## Sport Hunting

State agencies tend to emphasize [cougar] hunting's utility as a tool to benefit other species as a justification for sport hunting (e.g., The 2006 Oregon Draft Cougar Management Plan); the resultant sequele is decreasing public support for the idea that sport hunting for recreation is a legitimate use

TABLE 4.5. GUIDELINES TO EVALUATE AND MANAGE THE RISK OF COUGAR ATTACKS ON PETS AND LIVESTOCK

| GUIDELINES | |
|---|---|
| 1 | Guidelines for handling depredations ought to include 6 elements |
| 1a | Provide a clear description of the property involved in a damage complaint. |
| 1b | Inspect attack sites to verify that the damage or loss of livestock can be attributed to a cougar. |
| 1c | Provide the property owner with information to help protect livestock from future incidents. |
| 1d | Issue a permit to the property owner to kill one or more cougars within a specific area and time period. |
| 1e | Allow an agent (typically USDA WS) to help the property owner remove the cougar(s). |

TABLE 4.5 Continued

| | GUIDELINES |
|---|---|
| 1f | Require the property owner to report on cougars removed under the permit. |
| 2 | Kills ought to be inspected within 48 hours to determine if a cougar was responsible. |
| 3 | Short-term, non-selective cougar population reduction has not been demonstrated to reduce depredation. |
| 4 | Depredation response ought to include education efforts to prevent or reduce future losses. |
| 5 | Agencies ought to maintain a database relating depredation events to husbandry practices. |
| 6 | Research is needed to determine the effectiveness of husbandry in reducing depredation. |

of this resource. As more challenges to sport hunting programs are put forth, it is becoming more apparent that many agencies lack data and analyses to design or defend these hunting programs. Although sport hunting is often touted as a tool to reduce cougar populations, only one study (Anderson, 2003 as cited by CMGWG 2005) demonstrated that sport hunting reduced a cougar population; however, it is unlikely that hunting mortality is compensated for by relaxation of other forms of mortality.

There are 3 main harvest strategies for sport hunting: (1) general season; (2) limited entry; and, (3) quota systems. A general or "open

hunting" season allows an unlimited number of cougars of either sex to be killed from a specific population during the hunting season. The only control over harvest is length and time of season. Because of variability in weather conditions, general season harvests are often spread unevenly over the hunt area. Limited entry programs limit the number of hunters by limiting the number of licenses sold. One benefit of limited entry programs is that the number and distribution of hunters can be controlled, which can decrease the pressure on at risk cougar populations, and can create lower hunter densities where these same areas are utilized heavily by the public for other activities. Again, variability in weather conditions, methods of hunter take, and hunter effectiveness will produce seasonal differences in take. The cost of license sales to the agency will increase if drawings are required to allocate a limited number of licenses.

Steve Torres (pers. comm. 2005) was able to fund an entire season of desert bighorn sheep research from the proceeds of just one bighorn sheep hunting permit. These limited availability hunting tags are called fundraising tags and also apply to elk, deer, and pronghorn. This exemplifies that a financial benefit for conservation efforts can be extracted via sport [or trophy] hunting. In light of the fact that there is a lack of conservation funds available for cougar conservation in California due to their "specially protected mammal" status [and lack of sport hunting], there may be similar

opportunities available for offering limited sport hunting opportunities for cougars in California. I discussed the arguments for and against the ethics of this type of policy in chapter 2.

Quota systems set a legal limit on the number of cougars that may be harvested in a season or a particular region. The limit may be set on the total number of cougars, the total number of females, or the total number of males. In this system, hunting ends when a specified number of cougars are killed—period. Problems may occur when the quota is exceeded either due to hunting during the grace period or by hunters becoming less selective of age and sex of cougars as the quota limit is approached. It is well-known that even experienced hunters may have difficulty determining the gender of younger cougars or whether females are rearing cubs.

Limited entry or quota systems are generally in place to protect adult females which generally reduces the impact of harvest on the long-term productivity of cougar populations. The Cougar Management Guideline Working Group present twelve recommendations to improve and maintain sound research as it relates to cougar management (Table 4.6).

## Strategies to Manage Cougar-Human Conflicts

It is a given that maintaining sustainable cougar populations will result in human-cougar encounters—however rare. An important starting point in minimizing human-cougar encounters is proper interpretation of cougar behavior. As is the underlying theme in this chapter and thesis, these interpretations ought to be modified as new information becomes available. Cougar behavior ought to be considered over a continuum from *natural* to *habituated* to *overly familiar* to *nuisance* to *dangerous*: these behaviors are listed in increasingly undesirable behavior from an anthrocentric perspective. Natural behavior is defined as cougar behavior in the absence of humans. Habituated refers to frequent use of developed areas (i.e., campgrounds, trails, roadsides) by a cougar. Habituated cougars appear to be comfortable in the presence of humans. Overly familiar behavior is when a cougar purposefully approaches a human or allows a human to approach it after the cougar has seen the human. A nuisance cougar exhibits overly familiar behaviors more than once. Dangerous behavior is displayed, non-defensive, behavior towards humans including postures, vocalizations, and actions communicating an intention to harm the individual [human]. Aggressive behaviors may also be defensive in nature if elicited by a perceived threat to itself, its young, a food source, or when a cougar is surprised or harassed. It

TABLE 4.6. RECOMMENDATIONS TO IMPROVE AND MAINTAIN SOUND RESEARCH AS IT RELATES TO COUGAR MANAGEMENT

| | RECOMMENDATIONS |
|---|---|
| 1 | Incorporate landscape thinking into cougar harvest strategies. |
| 2 | Implement Zone Management or a related harvest strategy at the state level. |
| 3 | Transition from general seasons toward limited entry or quota systems to achieve adaptive management objectives. |
| 4 | Monitor for harvest objectives and hunter acceptance. |
| 5 | Monitor for achievement of population objectives. |
| 6 | Seasons should be timed primarily to protect females and young, and secondarily to meet hunter preferences. |
| 7 | Hound hunters can be more selective in harvesting cougars. |
| 8 | Sport hunting to benefit wild ungulate populations is not supported by the scientific literature. |
| 9 | Sport hunting has not been shown to reduce risk of attack on humans. |
| 10 | Human attitudes must be considered in sport hunting programs. |
| 11 | Develop cougar harvest strategies in a framework of adaptive management. |
| 12 | Pursuit seasons should be given cautious consideration. |

may be worthwhile to include a category of curious, which would split the behavior continuum between *natural* and *habituated*. The reason is simple: a cougar may be in a human environment for the first time, which would not qualify it as "habituated."

The age of cougars at dispersal is generally between 18-30 months, and this behavior may increase their probability of encounters with humans and human developments. Their inexperience and unfamiliarity with their environment may cause them difficulty in capturing wild prey: this combination of inexperience, unfamiliarity, and hunger may cause young cougars to have a higher likelihood of negative encounters with humans. These factors—when combined with close proximity to human habitations—may increase habituation; however, there is no scientific evidence that habituation increases the risk of attack.

The CMGWG writes that "both innate and learned behaviors help cougars identify and attack prey, and respond to non-prey animals" (2005, 86). The CMGWG offer eleven principles and guidelines to aid managers in evaluating and managing the risk of cougar attacks on humans. For attack scenarios, lead agencies should designate an information officer to coordinate media contacts. This information officer should be at the command post and easily accessible to media. The CMGWG recommends "treating the carcass in a respectful manner, which may not be consistent with allowing it to be photographed" (2005, 108). I am not sure that photographing the dead cougar is disrespectful; in fact, I feel that the reasoning behind this recommendation is to prevent public outcry. I believe that a transparent investigation that has been adequately communicated to the public ought to

be sufficient to prevent public outcry. If anything, seeing the dead animal may be informative to the public that we are not simply dealing with some

TABLE 4.7. GUIDELINES TO AID MANAGERS IN EVALUATING AND MANAGING THE RISK OF COUGAR ATTACKS ON HUMANS

| | GUIDELINES AND PRINCIPLES |
|---|---|
| 1 | Behaviors may be interpreted as indicators of the risk of a predatory attack. |
| 2 | Management should be directed at avoiding encounters and reducing chances of attack. |
| 3 | Land management agencies should promote public education and outreach. |
| 4 | Managers should be proactive rather than reactive. |
| 5 | Development that increases human-cougar encounters should be discouraged. |
| 6 | Develop protocols to document and investigate reports of overly familiar, nuisance, or aggressive behavior by cougars. |
| 7 | Level of response should be determined in advance. |
| 8 | We recommend that agencies determine the feasibility of, and their tolerance for, area closures and cougar removal before proposing them to resolve a specific situation. |
| 9 | Public agencies should establish their level of tolerance for various cougar behavior in developed and remote areas. |
| 10 | Agencies should determine, and formalize, their response to a cougar attack on a human. |
| 11 | Agencies should identify a single point of contact for media following human attacks. |

nebulous threat, but, in fact, we are dealing with a valuable animal life that was taken as a last resort.

I also recommend that, when possible, in these sensitive situations, translational scientists [as discussed previously and in Brosnan and Groom (2006)] are the best qualified personnel to address the media. So often, in the recent political arena, the information officer, or "communications specialist," is usually working from a narrow list of releasable information: many people regard this as a way to hide information rather than as a way to adequately explain the circumstances surrounding the event. This may create the impression of opacity rather than the transparency that we are attempting to achieve. A translational scientist will be able to explain, in lay-person terms, the biology and legality that created the need to kill the offending cougar or other wild, "tamed," or domesticated animal. I believe that the only way to achieve public acceptance to these unavoidable events is transparency. While Wildlife Services, or other involved agencies, may prefer to work under the cloak of secrecy, transparency will engender better relations between the agencies and the public that pays their salaries.

Cougar Research and Management Information

To promote sound research, the CMGWG recommends the following: (1) prioritizing cougar research needs; (2) structuring research according to the scientific method; (3) validation and justification of population models; (4)

being realistic and collaborating in cougar research; (5) standardizing reporting methods; and, (6) following safe capture, handling, and euthanasia protocols when researching and managing cougars.

It is also vitally important that, when euthanasia of an offending animal must be performed, the euthanasia must be performed in a humane manner. Although this is generally written into management policies, there are occasions when the person euthanizing the animal is not qualified to do so. The protocols outlined by the CMGWG ought to translate into always having appropriate, qualified personnel to perform this task. There is no greater way to create public resentment toward an agency than an inhumane kill; and, unfortunately, this occurs too often. When it does, it is an unacceptable end to an animal life that was doing no more than "being a wild animal" responding to human-induced factors beyond its control. If we must kill, let us do it properly and humanely.

In this chapter I have reviewed some excellent examples of what I believe are appropriate, humane, and ethical methods to manage the human-predator conflicts that I have discussed throughout this thesis. While many of these recommendations have not yet been incorporated into state wildlife management policies, I believe that they can be with some thoughtful approaches towards policy implementation. The final section of this chapter

offers some novel ways in which the policy implementation process can allow these recommendations to become policy realities.

## Fatal Outcomes and Public Acceptance

The last section of this chapter discusses two tragic—that is, fatal—outcomes of human-cougar encounters that resulted in surprising public responses. The first took place on January 8, 2004, in the Whiting Ranch wilderness area in Orange Co., CA (nbcsandiego.com 2004). An experienced adult male mountain biker was attacked and killed by a cougar as he was repairing his bike: the victim was in a crouching position, which may have created the appearance of a prey template to the cougar. A short time following the attack, a woman mountain biker happened upon the scene and was attacked by the same cougar; she was ultimately saved by two other cyclists who fought off the cougar. The woman suffered severe wounds but survived the attack. The cougar most likely attacked the man in a case of mistaken prey identity; the woman was most likely attacked because the cougar was protecting its kill. When the family—who lived in the Midwest—of the male cyclist first learned of the attack, they were prepared to initiate legal action against the county. The friends of the male cyclist informed the family that he routinely rode in Whiting Ranch and was acutely aware of the risks of a cougar attack [however rare]: the male victim's friends made it known that

the victim would not have wanted a lawsuit filed on his behalf. The family of the victim dropped the lawsuit.

The second incident occurred in the late 1990s and involved an eighteen-year-old high school cross-country runner in Boulder, CO. This young man was also an avid outdoorsman who was acutely aware of the risks involved in running in cougar country. This story is told nicely by David Baron in *The Beast in the Garden* (2004). The interested residents of Boulder participated in a town hall discussion that addressed whether the city ought to become more aggressive in their predator control actions. They made it known that they lived in this region of the country for its beauty and wildness, and they voted to accept the remote risks of cougar attacks as a trade-off for their ability to live in their chosen city—just as it was.

I tell these two stories because they are, indeed, tales of the acceptance of the wild that necessarily accompanies living in close proximity to wilderness. These are rare public reactions that depict, what I believe to be, an informed, ethical decision to accept that nature and wilderness are not always kind. They understood that nature is neutral: it offers both beauty and danger without malice. It operates without a conscience, but it is not sociopathic—it is simply neutral: it merely exists without guile as long as the public is educated concerning the risks that accompany the beauty and grandeur of "wild" nature. Those people who cannot accept the risks of living

in one of the most picturesque regions of the world may consider relocating to "safer" environs—for instance, New York City. However, when living in any big city, one must evaluate how they define safety. I believe I have covered those relative risks *ad nauseum*, so I will not discuss them further here.

## Summary and Conclusions

### A New Beginning?

> One can either curse the darkness
> or light a candle to find the way
> out.—Adlai Stevenson
>
> Wilkinson

### Where Are We?

I have written of events that occurred at the end of the last Ice Age, of what the future of policy might look like, and of many events that occurred in between. For me, as for the reader, it has been a long journey; in this final discussion, I will coalesce the information gleaned from studying state wildlife management policies, the prehistory and history of the relationships between humans and large carnivores, the history of predator management policies and the manner by which these policies were created, the ecological interactions of predators and their ecosystems, and the efforts of groups and individuals to create ethical and humane policies in novel ways.

Throughout this thesis, I have offered suggestions when I thought policy principles were lacking in some manner. As I mentioned previously, policy-

making has begun to evolve into multiple stakeholder discussions, which was a missing—but essential—component of past policy-making decisions. In this section, I will utilize the suggestions of Clark (2002), the CMGWG (2005), and all worthy (i.e., informed stakeholders willing to compromise) contributors to the policy discussion and offer a combination of policy-making parameters that I believe will engender greater public acceptance by being more transparent. Regarding policy, we know where we have been, and I will write about where I believe we ought to be. So, where are we now? We are in a place where we ought not to stay for too long. We are in a place that puts all of us—our Ecosphere—at odds with long-term humane survival. We are in a place I believe it would be best from which to move.

Anti-predator bias

I began this thesis with the hypothesis that state wildlife management agency actions are dictated by policies that are biased against large, mammalian predators. When I would engage in casual conversations on this subject, most people I spoke with agreed that an anti-predator bias existed, not only in state management policies, but also in our collective human psyche. However, my goal was to investigate this hypothesis and assign some form of numerical qualification to these general ideas. I believe the data I presented in chapter 3 revealed this hypothesis to be face valid. I do not believe that this kind of study has been conducted previously, perhaps

because it seems so intuitively obvious. One common response was, "Of course we are biased against large predators: They are capable of devouring us." However, I purposely avoided that particular issue in this thesis: I excluded public safety guidelines—that is, I only included layers of protection (LOP) concerning livestock, crops, pets, and property. I concede the fact that it is sometimes necessary to euthanize animals that pose a direct threat to humans; and, I also acknowledge the fact that some "non-public safety" situations can escalate to habituation of wildlife, which can lead to public safety concerns.

Having conceded the above, I will point out some ironies that render certain predator "public safety" and "management" arguments fallacious. I spoke with a WS official [who preferred to remain anonymous] who was convinced that coyote attacks on humans were on the rise. I have not found any documentation to confirm that trend. There was a recent case where a coyote attempted to attack a couple, and the coyote was killed by the potential victims; however, it was later determined that the coyote was rabid—a rare occurrence, indeed. There are definitely more coyote sightings in urban areas and increased incidents of pet depredations by coyotes, but these incidents must be juxtaposed with the fact that there are approximately 4.7 million dog bites on humans per year. Of those bites, 800,000 require

medical attention, and 12 of those people die as a direct result of those bites (CDC 2006).

In the last 116 years, approximately 16 people have been killed by cougar attacks in the U.S. and Canada (Torres 1996): that averages to about one human death every 7 to 8 years. Every year in the U.S., more than 200 people are killed as a result of vehicular encounters with deer (URMNH 2004); additionally, and additively, the occasional human death is directly due to a deer attack on a human. When these numbers are compared to the number of people killed in automobile accidents—~40,000 per year in the U.S. (Bureau of Transportation Statistics 2006)—one must pose the question of why we place a disproportionate emphasis on the number of human deaths caused by predatory mammal attacks. Obviously, the numbers do not reveal the answer.

The answer may be both simple and complex. The simple answer is that certain activities and practices are so commonplace to most Americans (e.g., driving automobiles and owning pets) that the consequences are acceptable because we view these activities as essential. The idea of being attacked, and maybe eaten alive, by a wild animal is so rare and unexpected that the very idea of that kind of death is intolerable to most people. But, I believe a large part of the answer—the more complex component—is based on some of my discussions in chapter 2. I believe that as soon as humans became

bipedal and lost some of the defensive or evasive mechanisms of our primate predecessors, we became potential targets (i.e., prey) of large, predatory mammals. As these humans migrated across the Bering Land Bridge, and probably other routes as well, they likely brought with them a fear of predators. I refer the reader back to the discussion of 2OP in chapter 2. This fear and anti-predator bias is likely due to intra- and intergenerational learning. If we couple this with the European mythologies regarding "wilderness" versus "civilization," then we have a combination of disparate behavioral elements that exacerbate these fears—however factually unfounded they may be. When we add the element of competition—that is, the loss of domestic livestock to predators—these feelings become intensified. And, finally, when we factor in the ideas of Dominion and land-ownership/entitlements, we are left with an ingrained anti-predator bias that we *may* never fully overcome.

I believe that all of these factors have entrenched themselves into our state wildlife management policies. The question is how do we work within these constraints to create predator management policies that preserve our top-chain predators *and* appease the ingrained feelings humans have towards these animals?

One interesting exception to these biases is evident in the Sunderbans region of India. Within the Ranthambhore Reserve, resides a group of

indigenous people who live sustainably—as fishermen—in a region where they co-exist with tigers that regularly kill humans—approximately 16 human deaths per year—(National Geographic Channel 2004). This tribe clearly understands their situation. Without the "protected" status afforded to their territory, the tigers could be killed, and their people would be protected against the predations of tigers. However, if the "protected" status was removed, which would allow removal of the tigers, their way of life would be removed as well. The fishermen that were interviewed felt that their current way of life [including tiger predations] was more important than the human losses (i.e., they accepted the disadvantages in order to have the advantages). I often think of these people when I encounter situations in the U.S. where people move into urban-wild interfaces and complain about wildlife encounters. Perhaps these people do not see the benefit that predatory mammals afford the ecosystem.

Coyotes are probably the most commonly encountered mammalian predators in urban areas. Given the fact that coyotes are uniformly classified as unprotected mammals (i.e., pests or vermin) by the states I studied, it is not surprising that the general public views them in the same manner. However, there are several studies that demonstrate some very real benefits afforded by the presence of coyotes. Crooks and Soule (1999) and Romsos (1998) both address the concept of "mesopredator release." Mesopredator

release refers to the fact that when coyote numbers decline, the animals that they normally prey upon (mesopredators) increase in number. These mesopredators (e.g., domestic cats [including feral cats], skunks, foxes, and raccoons) are then free (released) to prey upon native wildlife, especially song birds. Coyotes do not prey on song birds; so, when coyote numbers are adequate to control mesopredators, coyotes actually have the potential to positively influence local biodiversity. In addition, by controlling mesopredator populations, coyotes decrease the chances of humans encountering certain diseases and parasites: skunks are well-known carriers of rabies and raccoons can harbor a parasite (specifically, a roundworm) that is innocuous to them but can be fatal to humans.

Of course, coyotes can carry rabies; but, predators of higher trophic levels are generally present in lower densities than lower level mesopredators. That is why skunks have a far greater incidence of rabies than coyotes. It is possible that coyotes would be better tolerated by the public if these kinds of studies were more frequently discussed by the agencies that control them: this idea harkens back to the idea of "translational scientists." Tolerance for coyotes may be influenced by the simple fact that many people enjoy songbirds; but, to be aware of the connection between coyotes and songbirds, people must be informed about the science behind the claim. However, humans also must be proactive in preventing some of the problems

caused by coyotes. Humans must be asked to participate in this endeavor by removing allochthonous food sources (i.e., they must secure food sources that attract coyotes and their prey), keeping their small pets (especially cats) indoors when coyotes are most active, and not leaving small children unattended, which ought to be a given regardless of the threat of coyotes. Essentially, we must ask humans to be a part of the solution—that is, to be a positive contributing factor instead of simply being complacent complainers.

Cougars have had a greater presence in media reports in the last 4 to 5 years due to a combination of sightings, curious behavior, livestock and pet losses, and 3 attacks on humans—one of them fatal. The extra media attention is often followed by a rise in "cougar sightings"—of which ~75% are coyotes, bobcats, or domestic cats—and both individual and agency actions. In March of 2003, a cougar presented itself at the Ortega Equestrian Center in San Juan Capistrano, CA two nights in a row. Both sightings involved a cougar displaying apparently "aggressive" behavior towards children unaccompanied by adults after dark. There will always be a question as to whether this behavior was actually of an aggressive, curious, "habituated," or "overly familiar" nature; however, a CDFG official attempted to kill the cougar on the second sighting. The cougar was wounded by a shotgun blast and wandered around in a wounded [and, potentially, more dangerous] condition for 10 days before it was found and killed (*Orange County Register* 2003).

After this incident, I wrote an essay—that went unpublished—on the ethical implications of the way the situation was handled by the CDFG. I received an E-mail response from a CDFG wildlife biologist—who shall remain anonymous—defending the action on legal grounds. California Fish and Game Codes do not allow immobilization and relocation of cougars. The idea behind this is sensible: Most cougars that are taken for either public safety reasons or for livestock/pet damage are young, male cougars dispersing from territories occupied by older toms; relocation often results in the younger cougar being killed as a result of intraspecific territorial disputes. The lack of transparency of this incident did not allow the public to assess whether the killing was actually justified based on whether the cougar was being curious, habituated, overly familiar, or aggressive. The lack of a humane kill was another point I addressed along with the ecological importance of top-chain predators. I will quote from the E-mail I received from this official: "Our actions are dictated by laws and policies. We will continue to do what the law says, should they be changed in the future . . . . Mountain lion populations are generally regulated by the deer availability in an area. As with *most* predator/prey systems, the prey dictates the predator. In turn, the prey (deer in this case) are regulated by the available forage and habitat conditions. So if lions are removed, one would expect little effect in deer number or the general habitat conditions. Deer numbers remain at high

levels (carrying capacity) with lion predation" [emphasis added] (Anonymous pers. comm. 2003). I refer the reader back to Ripple and Beschta (2006). I followed up with a National Park Service (NPS) biologist, and he concurred, with some equivocation, with the above communication. His equivocation included the idea that trophic relationships can, and sometimes do, vary within the same ecosystems and from one ecosystem to another. This is consistent with the Cougar Management Guidelines Working Group discussion above.

In all honesty, my motivation for discussing these specific communications is not completely academic. The condescending tone of the CDFG E-mail [I omitted a portion of the communication] was the impetus for my *original* thesis—the ethical nature of CDFG agency *actions* compared to agency *regulations*—which I subsequently changed for the reasons stated in chapter 1. Fast-forward a couple of years, and we find three contradictions regarding the above paragraph. First, after two cougars were killed by rodenticides, this same NPS biologist was quoted in the *Los Angeles Times* as stating that these kinds of losses of a top-chain predator can cause an elevated and unhealthy population of deer due to over browsing. This was contradictory to comments made by the same person two years earlier.

Second, on February 20, 2006, a former City of Colton, CA, police officer shot and wounded a cougar that was sitting on a common wall

between homes in Rancho Santa Margarita in Orange County, CA (Mountain Lion Foundation 2006a). The details of this incident were also written in the *L.A. Times*: the former police officer saw the cougar, took the time to go back to the trunk of his car to get his handgun, and returned to kill the cougar. His first shot missed, and his second shot wounded the cougar. Wildlife Services had to be called out to track the cougar by helicopter to a remote canyon. The animal was *then* humanely euthanized. The former officer explained that he was in personal danger, and that he was protecting the community because there was a school less than two blocks away. His explanations are dubious. Why would a person successfully vacate a position of personal danger and then place themselves in danger again? Once that person achieved a position of safety, why would he not call the appropriate wildlife authorities who are best trained to handle these situations? Why would a person discharge a firearm within the city limits, especially when there is a school within a two block radius? Bullets travel great distances, and one does not always know where they will end up. No charges were filed against this retired police officer even though he broke several laws and displayed very poor judgment. From the reports I read, the cougar may have simply been in the process of becoming habituated (i.e., some form of aversive stimuli could have been utilized to scare the cougar and, possibly, prevent habituation or familiarity).

Third, on February 27, 2006, a cougar was sighted in the urban community of Altadena, CA. The homeowner reported the sighting to animal control authorities who, in turn, contacted the CDFG. The Mountain Lion Foundation and media (CNN and others) were notified, and CDFG gave the green-light for tranquilization and relocation (MLF 2006b; *L.A. Times* 2006). Kudos to all involved parties (CDFG, CNN, MLF, and any others) for saving the life of the cougar—at least temporarily; however, unless the California Public Safety Wildlife Guidelines or the Fish and Game Code changed its statutes or policies in the interim, which they did not, this relocation was against agency policy (Public Safety Wildlife Guidelines 2072; California Fish and Game Code 4800-4809). Laws and statutes may be consistent, but agency actions and enforcement are not always consistent. My point here, I hope, is obvious. Here is a case of a CDFG agency official dismissing an informed member of the public [me] creating opacity and resentment and whose explanations placed a future agency action under a lens of hypocrisy and illegality.

The idea of top-down and bottom-up trophic controls will always be contentious; but, the claim that *most* trophic systems are bottom-up is not accurate. The Greater Yellowstone Ecosystem wolf re-introduction and the 1920s Kaibab Plateau example are two high-profile examples that contradict this official's statement (Berger et al. 2001; Ripple and Beschta 2003; Smith,

Peterson, and Houston 2003; Wilmers et al. 2003; Worster 1994). There are many others including the 2006 study mentioned above regarding Zion National Park. Mesopredator release is another top-down trophic control that is becoming more important as our wild-urban interfaces increase in number. Each trophic system must be evaluated individually and may not fit neatly into either category. For a state official—especially a biologist in a position of influence—to utilize selective science to justify the killing of top-chain predators is, in my opinion, unethical. These are the kinds of actions that are going to have to change if we are to have civil and effective policy discussions in the future. I thank the reader for allowing me to exorcise a three year old demon. I will now discuss ethical and unethical bias.

## Ethical and Unethical Bias: A Conundrum?

Whether we care to admit it, we all hold certain biases. I prefer to take the discussion further and ask myself if I am being as objective as I can be. At all times, I attempt to avoid thinking and acting in a subjective manner. I do not always succeed. Objectivity, as I understand it, allows me to examine all available data in search of the truth. Subjectivity is the process of utilizing only that information that "proves" one's own argument; arguments that oppose one's preconceived idea(s) are ignored or excluded (scientific selectivity). I believe subjective bias has a greater tendency to lead to

unethical bias; and, therefore, policies that are derived from selective science and emotionalism have a greater tendency to be unethical.

The use of the terms ethical and unethical in relation to non-human animals is clearly not an uncontested issue. Some will argue that ethical (i.e., moral) arguments are not relevant to non-humans because ethics are a human construct. My original thesis advisor, Dr. Albert Flores, felt that I ought to utilize the terms "appropriate" or "inappropriate" in place of "ethical" or "unethical" when discussing non-human animals. While I respect Dr. Flores' opinion, I feel that, because ethics are a human construct, humans ought to be able to apply these same terms to any oppressed group—including non-human animals. There was a time in our inglorious history that we considered African-Americans as three-fifths of a person; today, our society would have no qualms about calling that Constitutional law unethical. I can cite philosophers that can make excellent arguments for utilizing, or not utilizing, the term "ethics" to refer to non-human animals. I believe this to be more of a semantic argument; and, therefore, I will continue to utilize the ethical and unethical dichotomy for non-human animals. Those who object can substitute the above terms if it makes them more comfortable; however, one ought to consider the fact that since the Environmental Studies Department offers a class entitled "environmental ethics," it is not without

precedent that one might also discuss ethics in the realm of non-human animals.

Ethical Considerations of the Eleven Western States' Wildlife Management Policies

While Tom Regan and Peter Singer might consider the killing of any animal to be an unethical practice, I believe that, as a top-chain predator and as a part of the Ecosphere, humans have an ethical right to defend their right to survive. That is the main reason I excluded public safety issues from my study: I believe that humans have a right to defend themselves against any threat that places their lives in danger. That is no different than a cougar killing another cougar in defense of its territory or a grizzly bear, wolf, cougar, or coyote from defending a kill [or its territory] against another mammalian predator.

When state wildlife management policies lump public safety, livestock, domestic pets, and property under the same protective policies, I believe that this practice ought to be considered unethical. The reason is fairly straightforward: there are proven non-lethal methods to protect livestock, domestic pets, and property against wildlife depredations. Many of the studies that address these issues were addressed in this thesis. If large mammalian predators are killed in situations where appropriate precautions have not been implemented to prevent mammalian predator depredations,

then the taking of those predators is, in my opinion, unethical. Because many state wildlife management policies treat public safety issues equally with animal and property damage, many state policies ought to be considered unethical.

If appropriate precautions are taken, and mammalian predator depredations are still a problem, then *targeted* killing of the *offending* individual predators can rightly be considered ethical. The policy of allowing bears and cougars to be immobilized and relocated once in Washington—at the discretion of the agency official—ought to be considered an ethical policy even though these animals possess lower layers of protection (LOP) than the non-predatory game (NPG) cohort. As I discussed earlier, Nevada's adaptive management policy regarding bears (i.e., suspending an open bear hunting season until their population viability increases) is another example of an ethical policy. This is consistent with Rolston's belief that the appropriate level of moral concern is the species and not the individual. In human society, we practice this type of bias in our judicial system. Murderers and other criminals are routinely incarcerated or even put to death for the benefit of human society *en total*. This is not significantly different than the targeted killing of wildlife that target endangered species, livestock, or even humans as prey. However, from the studies I have referenced in this thesis, it is apparent that the incidence of these livestock specialist attacks is relatively

low just as the incidence of criminality among humans in civilized societies is relatively low.

When Ernest (2002) demonstrates that the number of individual cougars that specialize on Peninsular bighorn sheep is only a small percentage of the population as a whole, then the targeted killing of the offending cougars in an attempt to preserve the endangered Peninsular big horn sheep utilizing fecal mitochondrial DNA (mDNA) is an ethical form of bias. When state wildlife management agencies target entire Game Management Units in the form of non-selective killing of mammalian predators, that is an unethical form of anti-predator bias. The reason is simple: the latter situation ignores the best management practices available. This is consistent with the recommendations of the Cougar Management Guidelines Working Group discussed above.

When state policies do not distinguish between human, livestock, or property damage as their criteria for removal of animals, then I feel compelled to classify this as an unethical practice. The fact that this is an economic issue does not exclude it as an ethical issue: the two are not mutually exclusive. Three of the states I studied do not distinguish these three criteria: Arizona, New Mexico, and Colorado. Arizona, California, Colorado, and Montana had the lowest non-predatory game-predatory animal disparity (NPG-PA-D) values at 0.2, 0.2, 0.2, and 0.1, respectively; however,

CA has a separate Public Safety Wildlife Guidelines section separate from their Fish and Game Code and Montana deals with ESA protected species. New Mexico scored 0.8 for this parameter—one of three states to be ranked second: Oregon and Nevada were the other two.

This study is not as much about singling out individual states as it is about evaluating all eleven states as a whole; therefore, I will make a few general statements about all eleven states. The fact that all but one of the states had NPG-PA-D values below 1.0 indicates overall bias. While I attempted to highlight the state policies that were positive and ethical, all states have some form of unethical component within their state predator management policies. Whether in the form stated in the previous paragraph or in the way certain predator management policies were written (e.g., the emphasis on non-predatory game within Oregon's cougar management policy), all of the eleven states' predator management policies had some form of unethical bias (e.g., all but two states had 0 LOP for coyotes). Therefore, the remainder of this chapter will be devoted to policy suggestions that I hope will overcome this unethical bias.

## Future Predator Management Policy: The Time is Now

The general components that create the foundation for predator management policies are not so different from those needed to create other types of institutional policies; often, however, the devil is in the details.

Given that caveat, I will list the components that I believe are essential simply to start the policy-making process. The most important element is *inclusiveness*. We must attempt to have all interested and willing stakeholders at the discussion table. This group needs to include both natural and social scientists, as well as academic, government, and NGO scientists. A translational scientist from each discipline (i.e., natural and social) should be included to permeate the barrier that often exists between scientists and the larger group of stakeholders: the general public, politicians, environmental advocates including some NGOs, business owners (i.e., ranchers, farmers, developers, extractive resource industries, etc.), religious organizations, indigenous peoples, and any other interested parties.

The next element is *transparency*, which is closely related to honesty. Transparency is often a term we reserve for large institutions, which, more often than not, the general public tend to mistrust; however, in this instance, transparency refers to the expected behaviors of *all* stakeholders. Everyone involved in the discussion must be honest about what they hope to gain, what they fear losing, and why. All participants must be free to speak of their concerns without fear of repercussions, but they must do so in a polite, respectful manner. These rules of engagement must be made clear at the onset of discussions, and those who do not abide by them give up their right to participate (see policy arbiter, below).

The third element, with the exception of inclusiveness, may be the most important: *willingness to compromise.* Any time there are successful multiple stakeholder discussions, all parties must be willing to give up some portion of their "demands." The best policy arbiters say that a successful outcome results from all parties both getting *and* giving up something they want: people ought to walk away neither too happy nor too unhappy. If all stakeholders feel this way at the end of the discussion, then the discussion has been successful because it has likely been just. The third element can obviously present problems from the beginning of negotiations. There may be groups that are unwilling to give up anything. Unfortunately, these groups may find themselves excluded from the negotiations.

A fourth element is that all parties must *focus on the issue(s) at hand*. There is nothing more polarizing than the introduction of unrelated issues. These issues are often brought to the fore when a particular stakeholder has not formulated a strong argument justifying their "demand(s)." We see this commonly concerning politics and religion. Issues of a religious nature such as abortion or stem-cell research are not fair game when discussing landscape-scale conservation issues; the political issues of past politicians are not relevant to most arguments regarding the environmental policies of current politicians. The arguments must be kept in the present-tense except when referring to past studies and policy examples; and, those stakeholders

who cannot abide by those principles are going to have problems being part of these kinds of discussions. I refer the reader to Table 4.1 for an extremely detailed listing of all elements that surround the policy process that I have greatly simplified here.

Patience and open-mindedness (i.e., objectivity) ought to be pre-requisites for all stakeholders. The issues that require these kinds of multi-stakeholder discussions will probably require multiple meetings, which will include the presentation of peer-reviewed literature by translational scientists. Everybody present must understand the science behind the proposed policies. All parties must reveal their overt and covert interests—that is, whom do they speak for and who are their backers. In other words, these types of discussions require full disclosure, which brings us back to transparency.

In relation to environmental issues—especially conservation—one of the stakeholders I mentioned is often overlooked, and I believe this oversight is a significant detriment to current policy discussions—that is, religious groups. I believe too many environmental advocates automatically assume that they are in opposition to religious groups on environmental issues. While this is truly the case in some instances—certainly some situations I have encountered—it is not the rule. So, I truly believe that any and all religious groups that want to be part of these multi-stakeholder discussions, following the same rules as the other participants, ought to be openly welcomed. I am

a firm believer in finding the point at which we disagree and backing up one step to the point at which we agree. In other words, we can exclude the irrelevant issues antecedent to our positive point of departure. The increasing prevalence of graduate programs involving theology and the environment (the University of Florida, Gainesville is offering a doctoral program in this subject) ought to work towards bringing previously disparate groups into closer agreement on environmental issues.

The journal *Conservation Biology* recently devoted a significant portion of two of its volumes to religion and conservation (Cobb, Jr. 2005; Henderson 2005; Johns 2005; Orr April, 2005 and December, 2005; Van Dyke 2005). And two recent articles in the *L.A. Times* were devoted to the same issue. In the first, Patrick Goldstein (2006) wrote an article profiling a PBS documentary entitled, "Is God Green?" This was a documentary narrated by Bill Moyers that addressed the fact that there are over 30 million Evangelical Christians that are pro-conservation and pro-environment. The second, entitled, "Evangelicals Ally With Democrats on Environment" (Simon 2006), addressed the fact that the Christian Coalition and the National Association of Evangelicals are coming forward to support the efforts to combat global climate change. While they make it clear that they are not abandoning other issues associated with the religious right (i.e., pro-life, pro-traditional marriage, and pro-morality [their terminology]), they are embracing the idea

that global climate change is a real issue and that it is their duty to be proper stewards of this planet. Their belief is that stewardship, as opposed to Dominion, is God's will. I believe those who exclude religious people from the environmental debate do so at their own peril.

Goldstein's article did address a problem with which many Evangelical Conservationists are concerned: they feel that the GOP has morphed from the "Grand Old Party" to "God's Own Party." This is an issue that transcends religion; extremists of any kind are not likely to be welcome at the multi-stakeholder bargaining table regardless of whether their beliefs are of a political, environmental, religious, personal, or social leaning. People or groups with extremist beliefs are going to have a difficult time adhering to the third and fourth elements discussed above.

An obvious exclusion from the above discussion is the manner by which we chose a policy arbiter. I utilize the singular by design: there must be one person who decides which individuals or groups are going to be able and willing to participate in these policy discussions. In addition to the translational scientists that have been proposed, we are also going to require well-trained policy-discussion arbiters. A policy arbiter is analogous to a debate moderator with one significant exception: a policy arbiter must possess excellent communication skills coupled with a great breadth of knowledge concerning the environmental issue(s) at hand. In the case of

predator-management policies, this person ought to have a natural and social science background, an understanding of the appropriate and applicable legal considerations, and must be able to gain the trust of all participants—that is, this person must be as objective as possible regardless of whatever biases that person may possess. Because no single person can be an expert on all issues, this arbiter must have the power to bring in appropriate speakers to fill the information gaps that will inevitably be present.

A Case of Bias in Eleven Western States: A Hypothetical Case Study

The final section of this thesis is based upon the insight I gleaned from my research. I am appointing myself as a policy arbiter in a hypothetical multi-stakeholder policy discussion: The goal is to discuss the findings of the study and determine whether a solution—utilizing the principles discussed in this thesis—can be reached to rectify the biases I found to exist in these states. Obviously, this is no simple task as there will be a large number of stakeholders, and we will be dealing with strongly entrenched state wildlife management policies.

The first step is to determine which individuals and groups will be willing and able to participate in what promises to be a very contentious debate. If this was an actual case, I would have to exclude myself as the arbiter because I authored the thesis. But, for this hypothetical case study, we will assume I did not author the thesis.

The first group of stakeholders will include a single scientific (i.e., a biologist) representative from each of the states under study. The second group will consist of a multi-disciplinary social scientist from each state. Both of these individuals will likely be representatives of a larger group of scientists from each cohort. It will be up to each of those larger groups to coalesce their arguments such that they can be presented by one person. Of course, that representative can and ought to present multi-authored, peer-reviewed scientific studies that coalesce their claims. All recognized NGOs will be allowed the same kind of representation as will all other stakeholders: business interests (i.e., landowners, ranchers, developers, resource extraction industries, alternative energy industries, etc.), relevant politicians, the general public, religious organizations, and indigenous peoples, if applicable. Another issue that will arise is the effect of state wildlife management policies will have on neighboring states; therefore, bordering states will also be allowed an opportunity to participate. The one caveat is that all of these groups will be required to send only one representative; therefore, these groups will be subject to the same constraints as the government officials and NGOs. This will serve two purposes: (1) it will keep the number of stakeholders at a relatively manageable number; and, (2) it will require all of these groups to coalesce their arguments prior to entering into the policy discussion. One exception will be with the general public. The general public can be so

expansive that it would be reasonable to accept written comments from all interested parties in this cohort. Indigenous peoples [or tribes] often have enough organization to send one representative member for each group or tribe.

The first order of business would be to discuss the findings of the study (thesis) in terms of bias. If there is consensus that bias exists, then the next step would be to evaluate whether the bias is ethical or unethical. This would likely be the most debated portion of the study; but, once a consensus is reached on the ethical nature of the state predator management policies, the group of stakeholders will be required to offer alternatives to those policies that are unethical.

After these issues have been decided—which may take many meetings—the next step may be to adopt an adaptive monitoring program that compares agency policies with agency actions (i.e., are state predator management policies being practiced *as written*?). I realize that this hypothetical case study is very simplistic, but the idea I am attempting to put forth is to look at state predator management policies in a way that they have not been evaluated in the past. This will necessitate overcoming the ingrained ideas that have come from thousands of years of human interactions with large, mammalian predators; and, sometimes, simply getting people to look at policies from a different perspective is a good beginning for

proposing future policies that take these previously ignored issues into consideration.

Specific Issues that Ought to be Studied

Based on the data I collected from the eleven Western States under study, coyotes are the least protected of the mammalian predators. In spite of the fact that most agencies and most of the general public consider coyotes to be "pests," I believe we ought to reconsider their status. The fact that they are the most visible of the mammalian predators, especially in urban areas, engenders fear among the general public. However, as I have written previously, coyotes are a beneficial member of the trophic web. I would recommend opening a dialogue to reconsider their status as "pests." As with most of the predatory mammals under consideration, it is human actions and incursions that create most of the problems we see with coyotes. Coyotes are attracted to allochthonous food sources because those sources attract both coyotes and the animals they prey upon. Domestic cats are one of those food sources. An aggressive education program ought to be implemented that advises humans the ways to prevent attracting coyotes into urban areas. Unfortunately, the mere presence of human developments in regions that were previously coyote habitat often creates an untenable situation. State wildlife agencies or federal agencies such as WS would be invaluable in educating people regarding the benefits that coyotes impart to

the ecosystem—even the urban ecosystem. If humans would keep their small pets indoors or in protected areas and would keep their garbage and pet food secure, coyotes would be free to feed on the mesopredators discussed previously. I believe the way we currently classify and deal with coyotes is a form of unethical bias based on a long-standing and psychologically ingrained bias. Although these are difficult barriers to overcome, I believe it is worth trying to elevate the status of coyotes to some form of higher legal standing.

As for cougars, I believe the Cougar Management Guidelines Working Group makes some excellent suggestions: I have covered these in detail in this chapter. One point that I would like to reiterate is that cougars are as ecologically important as the animals they prey upon. After having read numerous big game ungulate conservation plans, it is obvious that these plans treat cougars and other mammals that prey on ungulates as an impediment rather than a benefit. This is often the result of influential hunting, livestock, and land-use lobbies. As the CMGWG consistently indicates, normal cougar predation on their natural prey is not a valid reason to reduce cougar populations. There are exceptions to this assumption. In some cases, cougar predation on endangered species is *one* significant factor impeding ungulate recovery. In these cases, targeted killing of offending cougars may be justified. Problematically, many state wildlife management

agencies justify the utilization of the non-targeted hunting of cougars as a method for preserving appropriate number of ungulates for sport hunting. As the CMGWG pointed out numerous times, there is no scientific data to back this claim. I would like to see *all* states implement the idea of ecologically sound, targeted cougar hunting only when the data supports that action. Anything less, in my opinion, represents unethical bias against cougars or other targeted carnivores.

Keep in mind, I am not advising that we abandon any public safety considerations. These are, most often, two completely different situations. As I have explained already, humans have a right to protect themselves in cases of imminent or potential harm to themselves or other humans; however, when groups such as the Mountain Lion Foundation are willing to advise ranchers and hobby farmers on the most effective means to prevent damage to their livestock or pets, there ought to be very few occasions when cougars need to be destroyed simply because they are looking for food in an ecosystem inundated by human habitations. If humans take appropriate precautions with their animals, human-cougar encounters would be significantly diminished. When a cougar kills pets, sheep, or other small livestock that are unprotected—when the owners of these animals are aware that they live in cougar habitat—the fault does not lie with the cougar. The problems we face with large, mammalian predators are, generally, human

caused problems. Unprotected animals in cougar country are no more than "bait on a hook." When humans do not take adequate precautions against cougar predations and a cougar is killed as a result of this inaction, that inaction ought to be considered an unethical practice. If humans follow appropriate guidelines, then cougars will be less attracted to a free meal; this is likely to lead to less human-cougar encounters. The result will be less dead livestock, pets, and cougars because the underlying causes for cougar habituation will be decreased.

There are always going to be exceptions. Some dispersing cougars are going to become overly familiar no matter what precautions humans take; these cougars will probably need to be euthanized. But this scenario does not have to occur nearly as often as it currently does. As humans, we must take responsibility for the fact that we cause most of the encounters that we disdain. To conclude this section regarding cougars, I have a simple recommendation: State wildlife management agencies ought to adopt the CMGWG guidelines summarized in this chapter.

Bobcats are an obligate carnivore that I have not discussed in great detail. Their situation is not much different from coyotes and cougars. However, due to their secretive nature and their relative lack of representation in the scientific literature, bobcats do not make a lot of waves. It is also likely that the value of their pelt has prevented them from becoming another "coyote."

While the value of their fur nearly led to their demise early last century, it is likely that this commodity has given them sufficient human "value" to offer them sufficient protections to keep from being considered vermin. Obviously, bobcats deserve the same status as the other animals I have discussed, and will discuss, in this chapter: They have a right to exist due to their inherent value as a member of our Ecosphere, and I did not want to exclude them from this discussion.

Along the line of thinking present in *Cougar Management Guidelines*, bears can be dealt with similarly. The difference is that bears are omnivores, and cougars are obligate carnivores. Bear control has been achieved quite nicely by removing access to "free meals." Bear-proof trash receptacles and other simple bear country guidelines have been quite successful at decreasing the number of habituated bears. The motto, "a fed bear is a dead bear" is an apt one. In eight of the eleven states under study, the only bears we are speaking of are black bears. Some states are even willing to relocate black bears if they are not repeat offenders. Black bears appear to hold a higher status of protection likely due to their omnivorous nature. Of course, grizzly bears present greater public safety concerns, but they are currently federally protected in most situations in Idaho, Montana, and Wyoming. Nevertheless, grizzly bears can be dealt with in a similar manner to cougars and other large, mammalian predators in ways that minimize the number that must be

destroyed because of human encroachment into their territories. Similarly, gray wolves are, with few exceptions (noted in Appendix 1), under USFWS jurisdiction. However, as with grizzly bears, gray wolves can be managed utilizing similar mechanisms to those recommended by the CMGWG. In spite of their current federal protections, I still found myself dealing with state wildlife management policies dealing with wolves. Many states have wolf management plans in place in preparation for two possible, and likely, eventualities: (1) their de-listing or downgrading under the ESA; and, (2) the likelihood of a growing population of wolves entering states where they were not originally re-introduced.

I will end this thesis with a short discussion of gray wolves. The re-introduction of wolves into the Greater Yellowstone Ecosystem in 1996 is probably the most successful re-introduction in history—both temporally and ecologically. Wolves are pack hunters, and different wolf packs tend to hunt either multiple types of prey or altogether different prey. Wolves tend to hunt young, injured, sickly, or older, slower prey—that is, they tend to increase the viability of the herds that they predate upon. As long as they have adequate prey to satisfy their caloric needs, they do not tend to hunt livestock. Again, there are exceptions. But, in referring back to Chapter 2, wolves are not the "beasts" that they have been portrayed as in myth. Clearly, there are instances when they have killed pets and livestock; but, as

the studies I have cited confirm, there are numerous ways in which proper husbandry techniques can mitigate these losses. The fact that the number of confirmed, unprovoked attacks by wolves on humans in North America can be counted on one hand—if, indeed, there have been any at all—speaks to the fallacy of the European myth of the Beowolf and the ecologically fallacious fables that followed.

The re-introduction of wolves into the GYE has transformed the ecosystem in such a positive manner, that the small numbers of pet and livestock losses seem insignificant except to those experiencing those losses, of course. To the reader not familiar with the extensive changes to the GYE, I would encourage them to consult any number of studies that I have previously cited.

## Conclusion

In this thesis I have demonstrated that all but one of the states under study possess state wildlife management policies that are biased against large, mammalian predators. In many cases I believe that these biases are unethical [or, in deference to Dr. Flores, unfair]. I have also pointed out instances where I believe these policies were not only ethical, but unbiased. Unfortunately, I believe the former outweighs the latter.

There is good news. Multi-disciplinary programs are becoming more common in the university setting, and I believe this will percolate into the

general public over time. In the same way that oppressed humans have gained their rights, or are in the process of doing so, I believe that large, mammalian predators will gain increased status as more people become aware of their real benefits to our Ecosphere. As this begins to happen, I believe that the ingrained biases and myths that permeate our fears of predators will begin to fade. It will take time. I may not live to see this eventuality come to fruition; perhaps, my daughter will.

The end result of this change in thinking will be beneficial to the trophic web, multiple ecosystems, our Ecosphere, and, eventually, to our own species. I have written about the prehistory and history that has led humans to make some poor ecological decisions, and I hope I have presented the kinds of policies that can allow us to make better decisions from this point onward. I remain hopeful because I consistently think about the Thoreaus, Muirs, Carsons, Commoners, Abbeys, and others who reside among us as I write these concluding words.

# APPENDIX 1

## NUMERIC LISTING OF STATE STATUTES BY STATE AND SPECIES

Numbers following species are layers of protection (LOP); they are followed by state or federal statutes with [when necessary] or without specific explanations.

List of Abbreviations:

ADMINISTRATIVE RULES OF MONTANA (ARM)
ARIZONA REGULATORY STATUTE (ARS)
BIG GAME (BG)
CODE OF FEDERAL REGULATIONS (C.F.R.)
COLORADO REVISED STATUTES (CRS)
COLORADO WILDLIFE COMMISSION (CWC)
FURBEARER (FB)
FISH AND GAME CODE (FGC)
GAME (G)
GAME TAG (GT)
HUNTING LICENSE (HL)
IDAHO CODE (IC)
LAYERS OF PROTECTION (LOP)
NON-GAME (NG)
MONTANA CODE ANNOTATED (MCA)
NEVADA ADMINISTRATIVE CODE (NAC)
NEVADA REGULATORY STATUTES (NRS)
NEW MEXICO ADMINISTRATIVE CODE (NMAC)
OREGON DEPARTMENT OF WILDLIFE SERVICES (ODWS)
OREGON REGULATORY STATUTES (ORS)
PREDATOR (P)
PREDATORY ANIMAL (PA)
PREDATORY MAMMAL (PM)
REVISED CODE OF WASHINGTON (RCW)
TROPHY GAME (TG)
U.S. DEPT. OF AGRICULTURE (USDA)

U.S. DEPT. OF THE INTERIOR (DOI)
U.S. FISH AND WILDLIFE SERVICE (USFWS)
WILDLIFE COMMISSION (WC)
WILDLIFE SERVICES (WS)

Arizona: Arizona Department of Game and Fish (AZDGF).

Black Bear (BG) (*Ursus americanus*): 1 (ARS 17-302). (The landowner must possess a hunting license (HL) *or* must turn over the carcass to AZDGF or WS within 5 days.

Cougar (BG) (*Puma concolor*): 1 (ARS 17-302). (The landowner must possess a HL *or* must turn over the carcass to AZDGF or WS within 5 days. The wording *or* versus *and* determines whether the LOP designation is 1 or 2: Obviously, the former requires only one action.

Bobcat (*Lynx rufus*): 1 (The only predator (P) considered a furbearer (FB)). (1) trapping license *or* (2) turn over pelt to AZDGF).

Coyote (*Canis latrans*): 0 (ARS 17-239 (P)).

Mule Deer (*Odocoileus hemionus*): 4 (All Big Game (BG) species: ARS 17-239*:
(1) File a written report to AZDGF; (2) Dept. assistance in anti-depredation measures including trapping, capturing, relocating; (3) The Wildlife Commission (WC) may establish a seasonal special bag limit, set reduced or waived fees; (4) turnover carcass to WC).

*applies ARS 17-239 ((1) through (4)) to species listed below.

White-tailed Deer (*Odocoileus virginianus*): 4*
Elk (*Cervus elaphus* or *C. canadensis*): 4*
Javelina (*Tayassu tajacu*): 4*
Bison (*Bos bison*): 4*
Bighorn sheep (*Ovis canadensis nelsoni*): 4*
Pronghorn antelope (*Antilocapra americana*): 4*

Deer (archery): 2 ((1) HL; (2) report to AZDGF).

Livestock depredations are treated *equally* with public safety issues; LOP defer to livestock, pets, and other property protection.

California: California Department of Fish and Game (CDFG).

Cougar: 1 (Game (G)) (see Black Bear). (CDFG FGC 4800-4809).

Black Bear: 1† (G) (take must be reported no later than next working day). (FGC 4801.1)

Bobcat: 0 (FB) (non-game (NG) animal in the same class as the coyote [FGC 4152 and 4180]).

Coyote: (NG) 0 (FGC 4152 and 4180).

Mule Deer: (G) 2† (must apply for depredation permit *prior* to take). (FGC 4801.5).

Elk: (G) 5 (FGC 4181)

Wild Pig (*Sus scrofa*): (G) 1 (FGC 4181.1 (b)).

Pronghorn Antelope: (G) 2 (FGC 331-332, (1) HL and (2) GT).

Bighorn Sheep: (G) 3 (Restricted to *Ovis canadensis nelsoni*: (1) HL (2) game tag (GT), and (3) prehunt hunter familiarization and orientation (FGC 4902)).

†The LOP differential between bear and deer is determined by the time frame and the necessity of obtaining a permit prior to the taking of the deer and not a bear.

Tom Blankenship (Senior Wildlife Biologist, CDFG). Pers. comm. ok.

Steve Torres (Wildlife Biologist, CDFG). Pers. comm. ok.

Colorado: Colorado Department of Wildlife (CDOW).

Cougar: (P) 1 (no permit required. Must report and turn over hide to CDOW within 5 days and report within 48 hrs.). CWC Chapter 17 and CRS Title 33 Article 3-106.

Black Bear: (BG/P) 1 (same as cougar).

‡Bobcat: (FB) 1 (can be taken w/out permit but only during season).

Coyote: (P) 0 (unprotected species, CO holds no liability).

Wolves (*Canis lupus*): Protected under ESA, CANNOT be taken. 50 C.F.R 17.40(n), USFWS, DOI.

*Bighorn sheep, Mountain goat (*Oreamnos americanus*), Pronghorn Antelope, Deer, Elk, and Moose: 3 ((1) kill permit; (2) private land available for hunting (Chapter 17, Article 1 ( ), #1705) for a fee no greater than $100.00 ( #1706); (3) must form a plan to mitigate further damage to growing crop, harvested crop, of fencing ( #1710)).

*Big Game
‡small game (furbearer).

Lynx (*Lynx canadensis*): Lynx CANNOT be purposely taken. Accidental take must be reported immediately to avoid federal prosecution (ESA).

Wolves: Ok to utilize Gary Skiba and Don Madsen as pers. comm.

CO: CRC 33-3-106 does not distinguish between humans and livestock with regard to injury or death.

Idaho: Idaho Fish and Game (IFG).

Black Bear: 1 (BG). (1) HL. (IC 36-1107 (b)).

Bobcat: 2 (FB). (1) HL; and, (2) Report take to IFG.

Canada Lynx: (FB). (Threatened ESA). CANNOT BE TAKEN.

Caribou: (Endangered ESA): CANNOT BE TAKEN.

Cougar: 2 (BG). (1) HL; and, (2) Report to IFG. (IC 36-1108).

Coyote: 1 (PM). (1) HL.

Gray Wolf: N. of I-90 (Endangered ESA). CANNOT BE TAKEN.
S. of I-90 (Non-essential, experimental population): LOP 2. (1) HL; and, (2) Report to IFG. WS will collar problem wolves N. of I-90; but, if they need to take a wolf, they must consult with USFWS.

Grizzly Bear: E. of I-15 (Endangered ESA). CANNOT BE TAKEN.
W. of I-15 (Trophy Game (TG)): 2. (1) HL; and, (2) Report to IFG. WS can relocate grizzly bears but must contact USFWS to take a grizzly. To date, there has been no take.

Bighorn Sheep, Moose, and Mountain Goat (TG): 3. (1) Private landowner may make a damage complaint to IFG Director or designee who must respond within 72 hrs. to investigate; (2) IFG representative will be sent to premises to control, trap, and/or (3) Remove such animals to stop damage. Removal is the last choice.*

Black-tailed Deer, Elk, Mule Deer, Pronghorn Antelope, and White-tailed Deer (BG): 3 (same as TG (above*)).

*Title 36 Chapter 11.
http://www3.state.id.us/idstat/TOC/36FTOC.html.

I spoke with Steve Nadeau (Biologist, IFG) via telephone 18 January 2007 to clarify the jurisdictional boundaries involving protected species.

I spoke with Todd Grimm (Biologist, USDA WS, ID) via telephone 18 January 2007 for further clarification of Gray Wolf, Grizzly Bear, Canada Lynx, and Caribou status. Both parties gave permission to be listed as pers. comm.

Montana: Montana Fish Wildlife and Parks (MFWP).

Black Bear: 0 (MT Code Annotated (MCA) 87-3-127 (BG*)
When in act of taking livestock.

Bobcat: 0 (MCA 87-3-127) (FB).

Canada Lynx: NO TAKE (Endangered ESA). Could not evaluate

situations of incidental take (i.e., mistaken for bobcats).

Cougar: 0* (MCA 87-3-127).
2† (MCA 87-3-130). In the act of killing a domestic dog: (1) Notification of MFWP within 72 hours; and, (2) Surrender carcass to MFWP.

Coyote: 0 (USDA WS) (Nongame predator). Private landowner can take as well. WS is authorized to utilize Livestock Protection Collars: (M-44 (Na Cyanide) or 1080).

Gray Wolf: 2 (Threatened ESA). (MCA 87-3-130). In the act of killing a domestic dog: (1) Notification of MFWP within 72 hours; and, (2) Surrender carcass to MFWP. Can also contract out to WS (MCA 80-7-1101).

Grizzly Bear: 2 (Threatened ESA). (MCA 87-3-130). In act of killing livestock.

*Bighorn sheep, Bison, Elk, Moose, Mountain Goats, Mule Deer, Pronghorn Antelope, White-tailed Deer: 5 (Administrative Rules of MT (ARM) ±12.9.802 and MCA 87-1-125). (1) Herding as a temporary measure; (2) Dispersal methods including airplanes, snowmobiles, cracker shells, and scareguns; (3) Repellents as a temporary solution; (4) Fencing options; (5) Authorization of kill permit.

±http://arm.sos.state.mt.us/12/12-851.htm.

Nevada: Nevada Department of Wildlife (NDOW).

Black Bear: 3* ((1) game mammal but no open hunting season; (2) one-time trap/relocate; (3) HL *or* turn over remains). Pers. comm. Steve Albert.

Cougar: (BG) 1 (WS presides along w/ NDOW).

Coyote: 0 (for hunting); 1 [for procuring raw furs for profit (trapping license)]. Classified as an unprotected mammal. (WS).

Mule Deer: 5 (NRS 502.145; NAC 502.4646)†.

Pronghorn Antelope: 5†

Bighorn Sheep: 2†

Mountain Goat: 2†

Elk: 2†
† BG

Bobcat: 1 (FB). (NRS 503.470).

*With the public safety exception, black bears are often tranquilized and relocated [in close proximity to capture site].

Ok to use Steve Albert as pers. comm.

New Mexico: New Mexico Department of Fish and Game (NMDFG).

Bobcat: 2 (FB): (1) trapper's license; (2) pelt tag NMAC 19.32.1.12). 0* (NMDFG can take furbearers causing property damage at their discretion NMAC 19.32.2.12). Title 19 under
Natural Resources and Wildlife Chapter 32: Trapping and Furbearers.

*LOP of 0 assigned to bobcat. LOP of 2 for private landowners.

Coyote: resident-0; non-resident-1 (non-game species): http://www.wildlife.state.nm.us/publications/documents/rib/2006/b_riblow.pdf

Cougar, Black Bear, Deer, Elk, Pronghorn, Big-horn Sheep, Javelina: 3 (BG): (1) HL, (2) Big GT, and (3) Depredation Stamp). (NMAC 17.3-13.3).

NM: NMAC (17.2-7.2) does not distinguish between human, livestock, or crop damage.

Oregon: Oregon Department of Fish and Wildlife (ODFW).

Black Bear: (BG) 1 (ORS 498.012).

Bobcat: (FB) 1 (landowners can obtain a HL or a *free* furbearer license for take). (ORS 498.012 and OR Furbearer Hunting and Trapping Regulations).

Cougar: (BG) 1 (ORS 498.012).

Coyote: (PA) 0 (ORS 610.105).

Lynx: 2 Threatened species (incidental take must be reported).

Mule Deer, Black-tailed Deer (*Odocoileus hemionus columbianus*), Mountain Goat, Elk, Pronghorn Antelope, Bighorn Sheep: (BG) 2 ((1) Emergency Hunt, requiring (1) HL and (2) GT).

White-tailed Deer: Re-introduction in progress—no hunting—in W. OR. OR Big-game hunting regulations: http://www.dfw.state.or.us/recovery/big_game/regulations/reg-book.pdf. (Emergency Hunt Regulations).

Feral Swine: (PA) 0 (ORS 610.105).

Wolf*: Protected under ESA (Endangered). Wolves CANNOT be taken.

*Although wolves are under ESA protection (Endangered), if wolves are downgraded from the ESA, they will be considered an experimental permit research population and would have an LOP of 0 (i.e., removal without any permit if causing livestock or other property damage) (amendment to ORS 498.012).

*Anonymous ODWS official.

Utah: Utah Department of Wildlife Resources (UT DOWR).

Black Bear: 1 (Game) (Administrative Rules (AR) R657-33-23); 72 hr. notification of UT DOWR.

Bobcat: 1 (depredation [by livestock owner] allowable for molesting livestock provided carcass turned over to Utah wildlife

authorities w/in 72 hrs.). ((AR) R657-11-22). (FB).

Cougar: 1 (Game) ((AR) R657-10-21); 72 hr. notification of UT DOWR.

Coyote: 0 (Unprotected wildlife) (Under USDA WS jurisdiction).

Bighorn Sheep: 2 ((1) HL; and, (2) GT)*

Mountain Goat: 2*

Moose: 2*

Mule Deer: 2*

Rocky Mountain Elk: 2*

Pronghorn: 2*

Bison: 2*

*((AR) R657-5-56: (1) HL; (2) GT). (BG).

Left message for UTWS (801) 975-3315 on 28 August 2006: not returned.

Washington: Washington Department of Fish and Wildlife (WDFW).

Black Bear: 1 (private individuals must submit carcass to WDFW); (one relocation at officer's discretion) (RCW 77.36.030*) (BG).

Bobcat: 1 (depredation permit or county, state, or federal take for protection of property)*. Bobcat considered [small] game *and* furbearer.

Cougar: 1 (private individuals must submit carcass to WDFW); 1 (one relocation at officer's discretion). (RCW 77.36.030 of the Fish and Wildlife Code*). (BG).

Coyote: 0* (unprotected wildlife).

Lynx: 1 (depredation permit or county, state, or federal take for protection of property)*.

Deer (Mule, White-tailed, and Black-tailed): 2† (private take only (1) if no response w/in 48 hours; and, (2) carcass submitted to WDFW)*. (BG).

Elk: 2± (claims for damage *only* in hunting units). (BG).
±Except in emergency situations:
(1) Department will work with landowners suffering agricultural damage to control damage non-lethally (e.g., fencing).
(2) Take permitted if no official response within 48 hours.

Big-horn sheep: 2* (BG).

Moose: 2* (BG).

Caribou (*Rangifer tarandus caribou*): 2* (BG).

Mountain Goat: 2* (BG).

Gray Wolf: Endangered (ESA) [CANNOT BE TAKEN].

Wyoming: Wyoming Game and Fish Department (WGFD).

Black Bear: 1 (Trophy Game (TG)). (Immediate notification of WGFD). Wyoming Wildlife Statute 23-3-115†

†http://legisweb.state.wy.us/statutes/compress/title23.doc

Bobcat: 3 (Furbearer (FB)). Treated as big game.

Canada Lynx: (Threatened ESA): CANNOT BE TAKEN.

Cougar: 1 (TG)†

Coyote: 0 (Predatory mammal (PM)).

Gray Wolf: (TG) (Threatened ESA). CANNOT BE TAKEN.

2¥ (PM in half of WY and TG in other half (not yet quantitatively delineated. TG designation in national parks and adjacent areas)). ¥ (State designation) If ESA down listed: (1) Take permit; and, (2) Surrender carcass to WGFD.

Grizzly Bear: (Threatened ESA). CANNOT BE TAKEN.

Bison: 4 (Designated as "wildlife" but treated as BG). Private Landowner must: (1) Notify WGFD about damage; (2) WGFD will attempt mitigation measures (i.e., fencing); (3) WGFD will attempt relocation measures (usually herding); (4) WGFD will take bison as last choice. Bison differ from other "BG" due to the risk of transmitting brucellosis to, or becoming infected from, domestic livestock; therefore, the state handles all bison damage calls with their own personnel.

Bighorn Sheep, Elk, Moose, Mountain Goat, Mule Deer, Pronghorn Antelope, White-tailed Deer: 3 (BG). (1) Notification of WGFD; (2) WGFD attempts mitigation measures—most often, fencing; (3) Kill permit issued to private landowner as last choice.

Spoke with Mark Bruscino, Dave Moody, and Gary Brown [who clarified bison depredation policies] (all are WFGD Wildlife Biologist) on 19 January 2007. All gave permission for use as pers. comm. They were both quite helpful with clarification of ambiguities I found within the WY wildlife statutes.

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