Management of Predators: A need for changes in policies

By George Wuerthner (gwuerthner@gmail.com), May 2011
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ABSTRACT: Management of predators has historically been based on extirpation and/or a grudging tolerance of low populations. While extirpation of predators is no longer the goal of wildlife agencies, current state wildlife policies often maintain populations above extinction levels, but well below maximum biological carrying capacity. Predator policy typically ignores the ecological influence of predators in terms of their important influence upon ecosystem organization. Furthermore, management for populations without considering the social organization of top predators can lead to greater conflicts with humans, particularly livestock owners and hunters, the two groups who are often hostile to predators.

Introduction

Predators have always been a controversial subject in wildlife management. Traditionally predators were viewed as competitors to hunters and a threat to the livelihood of livestock owners. Informally, the motto "the only good predator's a dead predator" historically represented the prevailing attitude of most European Americans. Changing cultural values now give greater consideration to the ecological value of wolves (Canis lupus) and have resulted in changes in public policies best represented by the attempt to recover wolves within their historic range in the United States. Yet, negative attitudes towards predators from hunters and ranchers still influence management policies of state wildlife agencies. Unfortunately, current predator management policies of many state agencies tend to reinforce negative attitudes and hostility to predators, both in how agencies frame the issue of predators, as well as by advocating indiscriminate control that ignores predator ecology and disrupts social organization.

Historical Background

European settlers in North America brought negative attitudes towards predators with them when they colonized the continent. Predator extirpation was one of the early activities of many colonial, territorial and state governments. For instance, in 1630, just ten years after the Mayflower landed, the Massachusetts Bay colonists enacted a bounty on wolves.[1] One of the first political actions of settlers in Oregon Territory were so-called "wolf meetings." The first such meeting, held in 1843, levied a $5 assessment on each settler to pay for bounties on predators.[2] Similarly, some 80,730 wolves were killed for bounty in Montana and $342,764 in bounties was paid between 1883 and 1918.[3]

In Montana, during the years 1902 to 1930, bounties on wolves and cougars were significantly reduced as predators were extirpated. Bounty payments declined from 4,116 in 1903 to zero by 1928.[4]

Eventually the burden of paying for predator bounties was transferred to the federal government. In 1907, in exchange for paying fees to graze their livestock on federal lands, the US Forest Service entered into agreements with ranchers to control wolves on national forests. Authority for predator control was later transferred to the

Bureau of Biological Survey in 1914.[5] Professional hunters were hired by the Bureau to track down and kill predators with as many as 200 men in the employ of the government at the height of predator extermination efforts. As a consequence of government extirpation efforts – combined with on-going unceasing slaughter by hunters, ranchers and settlers – both grizzly (Ursus arctos horribilis) and wolves were nearly extirpated from the West by the 1940s.[6] Other species like mountain lion (Puma concolor) fared slightly better, in part, because they were less vulnerable to poisoning efforts. Nevertheless, even mountain lions were reduced to half of their natural geographic range as a result of persecution.[7]

Changes in attitudes towards predators came slowly. One of the first organizations to question the pervasive notion "the only good predator is a dead one" was the American Society of Mammalogists who issued a report in 1928 asserting that predators had scientific, economic and educational value. The mammalogists called for protection of predators in national parks and other public lands.[8]

By the 1930s visionary biologists like George Wright and Adolph Murie were calling for an end to predator control in the national parks.[9] And ecologist Aldo Leopold, who wrote the first textbook on game management, eventually came to see predators as an intrinsic part of nature. In 1949 he published his book *A Sand County Almanac* which included his powerful essay "Thinking like a Mountain" where he describes the changes in his ideas about the role of predators in nature.

In response to changing public attitudes towards predators, most states have given "game" animal status to larger predators. For instance, mountain lions were nearly extirpated from Oregon by the 1960s. In 1967 Oregon listed mountain lions as "game animals," enacting hunting seasons and attempting to maintain viable populations of the animal. As a consequence, mountain lion populations rose from 214 in 1961 to 3,114 by 1994.[10] Similar changes in the status of most predators, with the exception of coyotes (Canis latrans), from "vermin" to "game," occurred in other states throughout the West.

The ecological and philosophical value of predators was given greater legal status and protection when Congress enacted the Endangered Species Act (ESA) in 1973. The Act provided protection to species that were considered endangered or threatened and provided a mechanism for protection of habitat. Of the species given early protection under the ESA, both the grizzly bear and the gray wolf were listed as endangered in the lower 48 states, along with the Florida panther (mountain lion).

A transformation in public attitudes from utilitarian to more non-utilitarian values of wildlife has led to some changes in how state and federal agencies manage wildlife with greater emphasis on restoring intact ecosystems and slightly less importance on sustainable yield of trophies and/or meat.[11] Yet hostile attitudes towards predators among many hunters, outfitters and ranchers remain. For instance, Lynn Madsen, owner of Yellowstone Outfitters in Wyoming was quoted at an anti-wolf rally in Jackson Hole, Wyoming as saying: "They (wolves) have put people, literally, out of business," he said. "The only thing that keeps Wyoming in the running is the (elk) feedgrounds."[12] Similarly, Ron Gillette, an Idaho outfitter, was quoted in a *High Country News* article suggesting wolves "are the most cruel, vicious animal in North America...the only predator that eats its prey alive because they like the taste of warm blood!" Gillette went on to say "Enviros – the 'wolf-thug terrorist groups'– are full of crap and baloney when they claim wolves have little impact. When they turned wolves loose, they were having toasts that hunting in Idaho would soon be over!"[13]

State Control of Wildlife Management

Despite legal and philosophical changes, predators are still treated differently from other wildlife species by state wildlife agencies. Unless a species is listed under the ESA, management of wildlife is under the jurisdiction of state wildlife agencies. Most state agencies are required to manage for viable populations

of all wildlife species; however, there is no requirement to manage for ecological health and/or social stability.

Since predators can limit populations of large ungulates, state agencies generally tend to manage predators far below their biological carrying capacity. Photo: George Wuerthner.

Many pro-hunting organizations, though more moderate in their rhetoric than some of the outfitters quoted above, demand that agencies manage predators the same as any other wildlife. For instance, M. David Allen, President of the Rocky Mountain Elk Foundation, wrote in their publication, *Bugle Magazine*, that "we should be actively managing them (wolves) through regulated hunting and other prescribed methods."[14] In other newspaper editorials, Allan has stated that "Every wildlife conservation agency, both state and federal, working at ground zero of wolf restoration – Idaho, Montana and Wyoming – has abundant data to demonstrate how undermanaged wolf populations can compromise local elk herds and local livestock production. There's just no dispute, and emotion-over-science is not the way to professionally manage wildlife."[15] The implied message is that a decline in elk (Cervus elaphus) herds – or any other game species sought by hunters – as a result of predation is undesirable and unacceptable to hunters. The more moderate pro-hunting organizations typically hold the stance that wolves are OK so long it doesn't affect hunting success; however, maintaining wolf populations at this level may reduce the ecological influence on prey or ecosystems.

This strong pressure to reduce predation effects upon favored game species has a significant influence on state wildlife agencies. Wildlife agencies have a direct conflict of interest when it comes to managing predators since all state wildlife agencies depend on hunting license fees to fund their programs. Thus, whether stated implicitly or not, the main goal of most wildlife management is to maximize species considered desirable to hunters, like elk and deer, and often at the expense of other species, including predators.

Since predators can limit populations of large ungulates, state agencies generally tend to manage predators, particularly large predators like mountain lion (cougars), wolves and bears far below their biological carrying capacity. As a result, their ecological influence upon ecosystems is limited. The union of hunters with stockmen and state wildlife agencies – as well as other government agencies like Wildlife Services, which kills predators – formed what one author termed a "diamond triangle" that dominates and exercises disproportionate control over predator management policies.[16]

For instance, coyotes are treated as vermin by all wildlife agencies, with no closed season or limits on the kill. Other predators like mountain lion, wolves and grizzlies are often managed to maintain populations well below biological carrying capacity based upon perceptions of public acceptance, particularly among hunters and livestock owners.

In response to the perception that wildlife agencies were overly biased against predators, citizens in some states have taken management of some predators away from wildlife agencies. For instance, in 1990 California voters supported an initiative that banned sport hunting of mountain lion (cougar). Similar

legislation that sought to ban the use of hounds to hunt the animals so as to reduce the kill of mountain lions was passed in both Oregon and Washington as well.

In 1994 three bills designed to reverse the ban on mountain lion hunting were introduced in the California legislature, but defeated. In 1996 another referendum introduced by the legislature to rescind the ban on mountain lion hunting was defeated by California voters. A similar attempt to reverse a voter-approved referendum ban on mountain lion hunting by dogs was also placed before Oregon voters by hunters and livestock owners. But Oregon citizens voted to maintain the ban. The Oregon Dept. of Fish and Wildlife (ODFW) responded to this citizen ban on hound hunting of mountain lions by significantly reducing the cost of mountain lion licenses and lengthening the hunting season in an effort to maximize the kill on mountain lions by hunters. For instance in 2009, 42,000 mountain lion licenses were sold in Oregon.

In 2006 the Oregon Fish and Game Commission voted to allow federal agents to use dogs to track mountain lions. The Commission also voted to permit private hound hunters to be appointed by the state to "assist" federal agents in the tracking and killing of mountain lions.[17]

Not only animals that may have attacked livestock, but any animal deemed "potentially" a stock-killer can be killed. As a consequence, the number of mountain lions killed in Oregon has actually increased since the ban on hound hunting of mountain lion was implemented.

A similar citizen ban on use of dogs in mountain lion hunting passed in Washington in 1996. Just as in Oregon, the Washington Fish and Game agency responded by increasing the length of the mountain lion hunting season, bag limits and combined the mountain lion license with a general license to hunt elk and deer, increasing greatly the potential legal number of mountain lion hunters. These changes led to increased mortality for mountain lions, thereby nullifying the ban's original purposes.

State agencies say they are responding to concerns about public safety, arguing that large predator populations are a threat to humans. Agencies claim they are receiving more complaints from the public about conflicts between mountain lion and the public and are merely responding to public safety concerns.[18] Agencies respond to hunters dismay over declines in huntable animals like elk, but frequently fail to counter negative viewpoints by noting the positive ecological effects resulting from predation on ungulates.[19]

Critics of state wildlife agency predator management claim that fish and wildlife departments often feed public fears about predators through indirect and subtle propaganda campaigns that exaggerate the threat of predator attacks. They suggest agencies may be contributing to the rise in complaints by increasing outreach and making a greater efforts to seek and track complaints. In addition, critics argue that agencies sometimes attribute any decline of huntable species like elk or deer to predators, without a corresponding attempt to place such declines in historic perspective (often prey numbers are historic highs and may decline somewhat, but well within the normal carrying capacity for a region).[20] Agencies, critics suggest, also do little to place a decline in ungulate numbers within an ecological perspective (i.e. enumerating the ecological and ecosystem services that predators provide).[21]

Wolf (Canis lupus). Photo: George Wuerthner.

Proponents of predator control suggest that without hunting, predators become habituated to humans, and thus pose a greater safety threat to humans. However, a study of mountain lion attacks on humans finds no compelling evidence that hunting and population control reduces attacks on humans. Beiers notes that mountain lion are heavily hunted and controlled on Vancouver Island, BC. In a paper on the topic, he says "Compared to other North American cougar population, Vancouver's cougar population may be the least habituated to humans and the most subject to aversive conditioning. Nonetheless Vancouver Island has by far the highest concentration of cougar attacks on humans. This fact seems difficult to reconcile with the habituation hypothesis." [22]

A review by Tavaas, which looked at how effective hunting was in reducing human conflicts and complaints of black bear, found that hunting had little overall effect on conflicts. In fact, states with increases in hunting had increases in complaints and conflicts. By contrast, non-lethal measures such as bear-proofing garbage cans and reducing access to human foods resulted in far greater reductions in human/predator conflicts.[23]

Another study of black bear in Wisconsin found similar outcomes. Although hunters removed 356 bears implicated in nuisance complaints, they took these bears in proportion to their availability. The authors concluded that the Wisconsin bear hunting season did not show clear evidence of reducing nuisance complaints during 1995–2004, probably because hunting was not effectively designed for that goal.[24]

Ecological Role of Predators

Many state wildlife agencies, because of their desire to maximize populations of ungulates such as elk, moose, caribou and deer for hunters, do not emphasize the ecological benefits of predators in shaping ecosystems. Predators are maintained at population levels so their ecological role as top down predators and influence in trophic cascades (when predators suppress the abundance of their prey) are muted, and/or non-existent.

Recent research on the ecological role of predators in exerting top-down influences upon prey populations with long-term consequences for vegetative communities demonstrates that predator influence has significant ecological consequences for ecosystem health. Trophic cascades, where "top down" controls on herbivores by predators prevent overexploitation of vegetation, has been postulated and confirmed in various places.

Wolves in Yellowstone's Hayden Valley feed on a young elk while ravens wait their turn. Photo by Phil Knight.

Terborgh et al. describe the ecological consequences of loss of predators in forest fragments created by hydroelectric development in Venezuela. There, predators of vertebrates are absent and densities of rodents, howler monkeys, iguanas and leaf-cutter ants are 10 to 100 times

greater than on the nearby mainland, suggesting that predators normally limit their populations. The densities of seedlings and saplings of canopy trees were severely reduced on herbivore-affected islands, providing evidence of a trophic cascade unleashed in the absence of top-down regulation.[25]

The presence of predators creates what some biologists are calling "ecology of fear" in prey species like elk. Animals have the ability to learn and can respond to differing levels of predation risk and will respond to fear of predation with measurable responses including changes in densities, vigilance observations and foraging effects on plants.[26]

Robert L. Beschta and William J. Ripple describe how the absence of wolves in Olympic National Park permitted elk browsing to influence plant communities. In Olympic National Park, where wolves were extirpated in the early 1900s, Beschta and Ripple found significantly decreased recruitment of bigleaf maple and cottonwood along riparian areas, which they attribute to heavy elk browsing in the absence of wolves. [27]

A study of the influence of wolves upon elk by Hebblewhite and colleagues in Banff National Park found that the absence of wolves in one part of the Bow River Valley permitted elk numbers to increase an order of magnitude. Annual survival of adult female elk was 62% in the high-wolf area vs. 89% in the low-wolf area. Annual recruitment of calves was 15% in the high-wolf area vs. 27% without wolves. Wolf exclusion decreased aspen recruitment, willow production, and increased willow and aspen browsing intensity. Herbivory by elk negatively affected beaver lodge density.

Loss of beaver had several negative effects. Beaver dams help control flooding and provide water storage that helps to maintain stream flow in late summer, benefiting fish and other aquatic life. Plus beaver and their dams create wet meadows, which are utilized by many wildlife species. For instance, Hebblewhite and colleagues found that elk herbivory had an indirect negative effect on riparian songbird diversity and abundance.[28]

Ripple and Beschta found an increase in cottonwood recruitment in Yellowstone National Park after restoration of wolves.[29] And Ripple and Larson reported that aspen regeneration in Yellowstone National Park essentially stopped by the 1920s once elk populations expanded with protection afforded by the park and the concurrent extirpation of wolves from the park.[30]

Ripple and Beschta compiled information from five parks – Yellowstone, Olympic, Yosemite, Wind Cave and Zion – and concluded the absence of large predators allowed herbivores to alter plant community structure.[31]

Another study just outside of Yellowstone in the Gallatin Range found similar results. In the absence of large predators, elk herbivory significantly reduced aspen recruitment.[32]

Beschta and Ripple also found that riparian vegetation and hydrological function was influenced by the elk browsing which they hypothesize is a consequence of wolf extirpation. In a study of the Gallatin River northwest of Yellowstone National Park they compared channel cross-sections on three reaches of the upper Gallatin River. Willow cover on floodplains averaged 85% on the transect that was outside of the wintering range of elk, but only 26% and 5% for reaches dominated by wintering elk.[33]

Beyer and colleagues studying willow in Yellowstone National Park found a two-fold growth in the plants after reintroduction of wolves that could not be explained by climate and/or other factors. The researchers

believe that wolf presence changed habitat use by elk.[34]

Another consequence of the loss of apex or top predators is meso predator release where the loss of a top predator allows smaller predators to increase in numbers and distribution. Meso predator release was coined by Michael Soule in a paper published in 1988.[35]

This phenomena has been observed at numerous levels.[36] Meso predator release, for instance, is blamed for increased predation on ground nesting birds in the eastern U.S. In this case, it is the control and reduction in coyotes which normally keep in check other predators like raccoons (Procyon lotor) and skunks (Mephitis sp.).[37]

The Druid wolf pack in Yellowstone National Park makes it way across the valley. Research shows that wolves have had a positive impact on both riparian vegetation and hydrological function in Yellowstone. Photo by Phil Knight.

The presence of wolves was found to limit and redistribute coyotes. Coyote densities declined by 33% in Grand Teton National Park and 39% in Yellowstone National Park in wolf abundant sites after wolf restoration.[38]

The changes in coyote population and distribution had indirect and direct effects. For instance, Kim Berger and colleagues found four times higher pronghorn (Antilocapra Americana) fawn survival in areas dominated by wolves because wolf presence led to a reduction in coyote predation on pronghorn fawns.[39]

The presence of wolves may even affect rodent populations. Miller and colleagues, studying vole (Microtus sp.) populations near wolf dens and away from wolf dens, found greater numbers of voles near dens. They were able to document that coyotes, a major predator on voles, avoided wolf activity centers like wolf dens, hence this led to a reduction in predation on voles by coyotes. They were unable to document, but speculated that more abundant vole populations near wolf dens may lead to greater utilization by other vole predators from weasels to hawks.[40]

Top predators such as wolves also create carrion that is utilized by scavengers, including bears, ravens (Corvus corax), magpies (Pica pica), wolverine (Gulo gulo) and coyotes, among others. Wilmers and colleagues studying carrion use by scavengers found that wolves increased the time period over which carrion is available.[41] For example, grizzly bear coming out of hibernation have little vegetative food to eat. Finding wolf-killed carrion can help bears through the late winter and early spring season of food scarcity and may be important for bear survival.[42]

One study even suggests that top predators and their creation of carrion may ameliorate the effects of climate change. Wilmers and Getz looked at the long-term climate data for Yellowstone National Park and found that winters are warmer and shorter. As a consequence, they hypothesize this would result in less winter-kill and thus carrion. However, the recent restoration of wolves to the park, which create carrion, may provide scavengers with an on-going source of late winter food.[43]

Another study on the interaction between climate and predators by Hebblewhite in Banff National Park in Alberta found that the North Pacific Oscillation (NPO) influenced winter elk survival, with harsher winter weather strongly reducing elk numbers. However, in areas where wolves were present, elk were even more vulnerable and had greater population declines. Hebblewhite concluded that the effects of NPO were weaker in the absence of wolf predation.[44] This "predator effect" might serve to more quickly balance herbivore numbers to the available forage base and may be important to plant communities by providing vegetation with respite from heavy herbivory pressure.

Predator Influences on Prey Behavior

Many state wildlife agencies suggest that hunting can mimic the role of top predators. Recent research demonstrates that predators have different influences on prey species than hunters.

Hunters tend to select different age and sex animals from predators. In a study comparing elk killed by hunters with elk taken by predators, researchers found that hunters selected a large proportion of female elk with the greatest reproductive values, whereas wolves killed a large proportion of elk calves and older females with low reproductive values. The mean age of adult females killed by hunters throughout the study period was 6.5 years, whereas the mean age of adult females killed by wolves was 13.9 years. They concluded that hunting exerted a greater total reproductive impact on the elk herd than wolf predation.[45]

Another study of winter wolf predation on elk in Yellowstone by Smith et al. found that 43% of the elk killed were calves, 28% were adult females (cows), 21% were adult males (bulls) and 9% were of unknown age/sex. Comparing prey selection to prey availability, wolf packs residing on the northern range (NR) of the Greater Yellowstone Ecosystem selected for elk calves, and against cows, but selected bulls approximately proportional to availability.[46] The selection for calves by wolves, in particular, is considerably different from the typical selection made by human hunters.

There is also evidence to suggest that human hunters are causing rapid evolutionary changes in wildlife species different from the influence exerted by native predators. A review of human-caused changes in hunted species found average declines of almost 20% in size-related traits and shifts in life history traits of nearly 25%.[47]

Another difference between human hunters and native predators is the seasonality of influence. While it's well documented that elk will seek out safety refugia like private ranches to avoid hunters during the hunting season, such shifts in habitat are short-lived. By contrast, native predators like wolves can influence elk and other prey behavior and habitat selection throughout the year.

And unlike human hunters, which may provide a seasonal input of carrion resulting from gut piles left by hunters and/or the subsequent death of wounded animals, predation by large predators like wolves has a different spatial and temporal influence on carrion abundance and thus availability to scavengers.[48]

A study in Yellowstone National Park comparing habitat use by elk before and after wolf restoration demonstrated that in summer elk avoided wolves when wolf activity was centered around dens and rendezvous sites by selecting higher elevations, less open habitat, more burned forest and, in areas of high wolf density, steeper slopes than they had before wolf reintroduction.[49]

A study of wolf and cougar predation influence and effects on elk in the Madison Range of Montana found that wolves preyed primarily on male elk in poor condition, the exact opposite of human hunters who tend to kill mature bulls in prime condition.[50]

And the year-round presence of large predators, even in the absence of direct predation, may even influence reproductive fitness, leading to reductions in prey populations.[51]

Hunting of ungulates, the prime prey of top predators, may actually lead to greater conflicts with livestock productions. In some areas fish and wildlife agencies maintain ungulates like elk at their "political" rather than biological carrying capacity – in other words the perceived tolerance of large landowners, typically ranchers. According to research on wolves in Europe, this may actually increase predation by wolves on livestock.[52]

In North America, the rural agricultural areas where wolves occur are often frequented by wild and domestic ungulates, both of which the wolves prey upon. Managing for high densities of wild ungulates could result in decreased livestock depredation by wolves.[53]

In addition, human hunting pressure can force elk to seek refuge on private ranchlands that may be inaccessible and/or closed to public hunting.[54] While human hunters may not be able to follow the elk on to these ranchlands, wolves can and do, thus setting up a situation where predators may kill livestock.

Predator Social Interactions Ignored by State Agencies

Most of what we know about predators is by studying animal groups under duress. Nearly all predators are trapped and hunted, thus much of what we assume about their behavior may be skewed or misinterpreted.

Kathleen Green contends that social behavior needs to be incorporated into management of social species. She argues that social predators have a greater risk of extinction due to "inverse density dependence" and reproductive suppression.[55] Yet these social aspects of predators are seldom considered by management agencies.

In a study of Washington mountain lions (cougars), Hilary Cooley found that cougars responded to hunting pressure through emigration and immigration and that traditional survival/fecundity harvest models did not accurately predict populations.[56] The increased immigration and recruitment of younger animals from adjacent areas resulted in no reduction in local cougar densities, however, there was a shift in population structure toward younger animals. Thus cougar hunting may lead to misinterpretation of population trends, since immigration may mask population declines in the sink and surrounding source areas.[57]

Robert Crabtree, studying coyotes in Yellowstone National Park, found that unexploited coyotes behaved much more like wolves, with a dominant pair doing the breeding, while sub-dominant adults helped with raising pups. Territories were held for long periods of time, often decades. But these behavioral traits are seldom seen in exploited coyote populations.[58]

New research is finding that hunting of mountain lions (cougars) may not actually control population levels as much as it shifts population structure towards younger animals. Photo by George Wuerthner.

Wolf biologist Gordon Haber, who studied wolves in Denali National Park for 40 years until his untimely death in an airplane crash, argues that social behavior and social organization that emphasizes group hunting and cooperate breeding requires a different response in management. According to Haber, family groups are the preeminent functional units, not meta populations, and it is this behavior that predominates and most defines wolves as a species. Haber claims at least one family lineage in Denali National Park may have occupied the Toklat River drainage continuously since they were studied by Adolph Murie in the 1930s. As a consequence, there is multi-generational learned behavior and "cultural" knowledge transmitted from wolf to wolf about prey location, hunting opportunities and other information important for survival.[59]

Writing in *Conservation Biology*, Haber argues the widespread assertion that wolves can maintain 25 to 50% mortality without biological consequences ignores the damage done to social interactions and long-term degradation of predator social cohesion. Haber suggests that "true sustained-yield management requires more emphasis on qualitative biological features to determine the extent to which wolves and other species with evolutionary histories as predators, rather than as prey, should be harvested." [60]

There are studies of other animals that demonstrate that stable social structure contributes to long-term viability and productivity of social members. Female elephants (Loxodonta africana), for instance, in well established family groups have lower levels of stress hormones and higher reproductive output than those in groups that have been socially disrupted by poaching.[61]

A study comparing a heavily hunted mountain lion population and a lightly hunted one in Washington demonstrated that hunting did disrupt social relationships and demographics. Researchers found that heavy harvest resulted in higher immigration, reduced kitten survival, reduced female population growth and a younger overall age structure. Light harvest corresponded with increased emigration, higher kitten survival, increased female population growth and an older overall age structure.[62] The researchers concluded that "contrary to accepted belief, our findings suggest that cougars in the Pacific Northwest are currently declining."

Lambert and colleagues hypothesized that among other factors, "increased conflicts between cougars and humans in this area could be the result of the very young age structure of the population caused by heavy hunting." [63]

A study of wolves near Algonquin Park in Ontario demonstrated clearly the negative impacts of hunting on wolf social structure. Linda Rutledge and colleagues found that after a hunting ban outside the park was instituted, human-caused mortality decreased, but was largely offset by natural mortality, such that wolf density has remained relatively constant at approximately three wolves/100 km2. However, the number of wolf packs with unrelated adopted animals decreased from 80% to 6%, indicating a much more stable social organization.[64]

Disruption of social organization has important consequences for wolf management. A number of studies have documented that increased prey demands are associated with the birth and growth of pups. If the "cultural knowledge" of where to hunt and/or ability of a pack to effectively hunt is destroyed by loss of key pack members, creating more unstable social systems, the remaining pack member may be more prone to attack livestock and/or wander into new territories. Such social interactions are totally ignored by "population" oriented wildlife management, which merely attempts to maintain population numbers rather than social cohesiveness.

Plus indiscriminate hunting (i.e. the opportunistic killing of predators by hunters) can disrupt social cohesion in predators, reduce the ability of an animal and/or pack to hold a territory, reduce its effectiveness in hunting (thereby making it more likely to attack livestock) and can also skew overall population towards a younger age cohort.

If livestock is available to wolves during this critical period, the likelihood of predator losses is significantly increased. Thus the seasonality of grazing determined predator opportunity and conflicts with livestock producers.[65]

A review by Karlsson and Johansson of predation on livestock in Europe demonstrated that once a farm or ranch suffers a predation event, it is much more likely to experience additional predator losses. In their study, depredated farms were approximately at 55 times higher risk for a repeat predation event within 12 months compared to other farms in the same area.[66] The researchers believe predators, attracted by carrion, are more likely to attack additional livestock, making clear that rapid removal of dead animals may be a potential way to reduce predator opportunity.

However, the mere presence of livestock within wolf territory does not automatically result in predation. Chavez and Gese, in a study of wolves in agricultural areas of Minnesota, found that radio-collared wolves passed directly through a pasture containing cattle on 28% of the nights of tracking, and that 58% and 95% of the wolf locations were within 1 km and 5 km from a pasture, respectively. Space use of wolves in this study demonstrated that wolves visited livestock pastures during the 24-hour tracking sessions; they apparently were passing through these pastures with cattle and not preying on livestock.[67]

Animal Husbandry Influences on Predation Losses

Not all wolves are inclined to kill livestock. Animal husbandry practices (such as lambing and calving sheds, herders, guard dogs, night time corralling and barn use, as well as other methods) are effective at discouraging predator opportunity.

One study in Africa found much lower predation losses for cattle that were corralled at night compared to herds without night-time corralling.[68] Research by Mordecail Ogada and colleagues in Africa found that cattle, sheep, and goats experienced the lowest predation rates when attentively herded by day and enclosed in traditional corrals (bomas) by night.[69]

One study of wolf predation on domestic sheep in the French Alps found that confining or simply gathering sheep at night in the presence of five livestock-guarding dogs was predicted to prevent most kills (94% and 79%, respectively) that would have occurred in similar conditions but with free-ranging sheep.[70]

Another study in Poland also concluded that poor husbandry practices contributed to higher livestock losses.[71]

In an experiment in Montana, researchers put road-killed deer inside fenced enclosures amid active wolf territories and used electric fladry to discourage wolves. They found electric fladry was 2 to 10 times more effective than fladry at protecting food in captivity and that hunger increased the likelihood of wolves testing fladry barriers, suggesting that electrified fladry could be one effective means of discouraging predators.[72]

A Minnesota study found that trapping of depredating animals like wolves did not appear to reduce future predation, though it may sometimes affect predation in certain situations. However, the authors speculate that just the additional presence of people may contribute to fewer depredations.[73]

The presence of domestic livestock can contribute to conflicts between predators and ranchers. Domestic livestock diets overlap with native species like elk and deer and is well documented, especially on poor condition rangelands. Thus forage consumption by domestic animals can reduce the biological carrying capacity of the land for native prey species.

In addition, social displacement of key prey species by livestock can also influence predation rates. Many wildlife species, including elk and deer, are known to abandon pastures where livestock are present. Thus if wolves den in an area in the spring where natural prey like elk are abundant, only to have the elk abandon the area once livestock are moved on to a grazing allotment (as occurs on many public lands in the West), it may leave predators, especially those with dependent young, little choice but to prey upon domestic livestock.[74]

In effect, livestock producers over much of the West have been successful in externalizing one of their operational costs – predator losses – by extirpation and/or reduction in predators. Opportunities to reduce predator losses by changing grazing practices are not likely to be implemented as long as the public continues to subsidize livestock operations with predator control.

Hayes and Harestad found evidence that compared to unexploited populations, packs experiencing control and/or hunting had higher mortality rates as a direct consequence of reductions – pack sizes are smaller, home ranges were less stable and occupied at variable times and more young are produced in the population.[75]

Younger animals may breed earlier, and in exploited populations produce more young. Young growing pups consume more biomass (meat) than adults, creating a greater need to obtain food. Typically in exploited populations, pack size is smaller, with only the breeding adults to raise pups, putting greater pressure on adults to obtain easily available meat. Plus young pups reduce the mobility of the pack, limiting the area where adults can seek prey. Thus indiscriminate hunting puts increased pressure on the few adults to obtain meat, and they often satisfy this need by attacking livestock.

The effects of lethal control and/or hunting on pack stability can lead to social disruptions and loss of territory. A study, which pooled data on 148 breeding wolf packs, showed that the loss of adult breeders (from any causes, including natural mortality) often leads to the dissolution of the pack and loss of pack territory and/or limited breeding in the following season. For instance, in 47 of 123 cases (38.2%), groups dissolved and abandoned their territories after breeder loss. Of dissolved groups, territorial wolves became reestablished in 25 cases (53.2%), and in an additional 10 cases (21.3%) neighboring wolves usurped vacant territories.[76] Thus any increases in mortality caused by human hunting and/or lethal control may disrupt social interactions between packs and lead to the loss of social/cultural knowledge that long time residency by family lineages may provide.

Simple animal husbandry techniques have been shown to greatly reduce livestock losses from predators; unfortunately, many ranchers don't use them. Photo by George Wuerthner.

An on-going study in Washington confirms this trend. According to Dr. Robert Wielgus, killing large numbers of mountain lion (cougars) creates social chaos. Ironically, as cougar population declined due to increased mortality from hunting, complaints about exploding cougar populations and human conflicts increased. The incidence of cougar complaints, which averaged about 250 a year before Washington increased cougar hunting effort, more than doubled the following year before peaking at 936 in 2000, all the while cougar populations were declining as a consequence of hunter-caused mortality.[77]

Researchers attribute this increase in human conflicts to the social disruption created by hunting. According to Wielgus, trophy hunters often target adult males, which act as a stabilizing force in cougar populations. Loss of mature male cougars as a consequence of hunting permits young males to occupy territory. “The adults police large territories and kill or drive out young males. With the grown-ups gone, the ‘young hooligans’ run wild,” Wielgus says.

Evidence suggests cougars under two years of age, just learning to live on their own, account for the majority of run-ins with people and domestic animals. “You don’t get to be an old cougar by doing stupid stuff like hanging out in backyards and eating cats,” Wielgus says.[78]

Carroll et al. warn that social carnivores such as the wolf, which often require larger territories than solitary species of similar size, may be more vulnerable to environmental stochasticity and landscape fragmentation than their vagility and fecundity would suggest.[79]

Predator control by management agencies creates a vicious circle of self-fulfilling feedback mechanisms, whereby livestock owners demand greater predator control, which state wildlife agencies provide willingly since, in general, they want fewer predators preying on game animals, which hunters want to shoot. Hunters are encouraged to kill more predators, disrupting social organization and skewing the population to younger animals, which in turn are more likely to kill livestock, leading to ever more demands for more “predator control.”

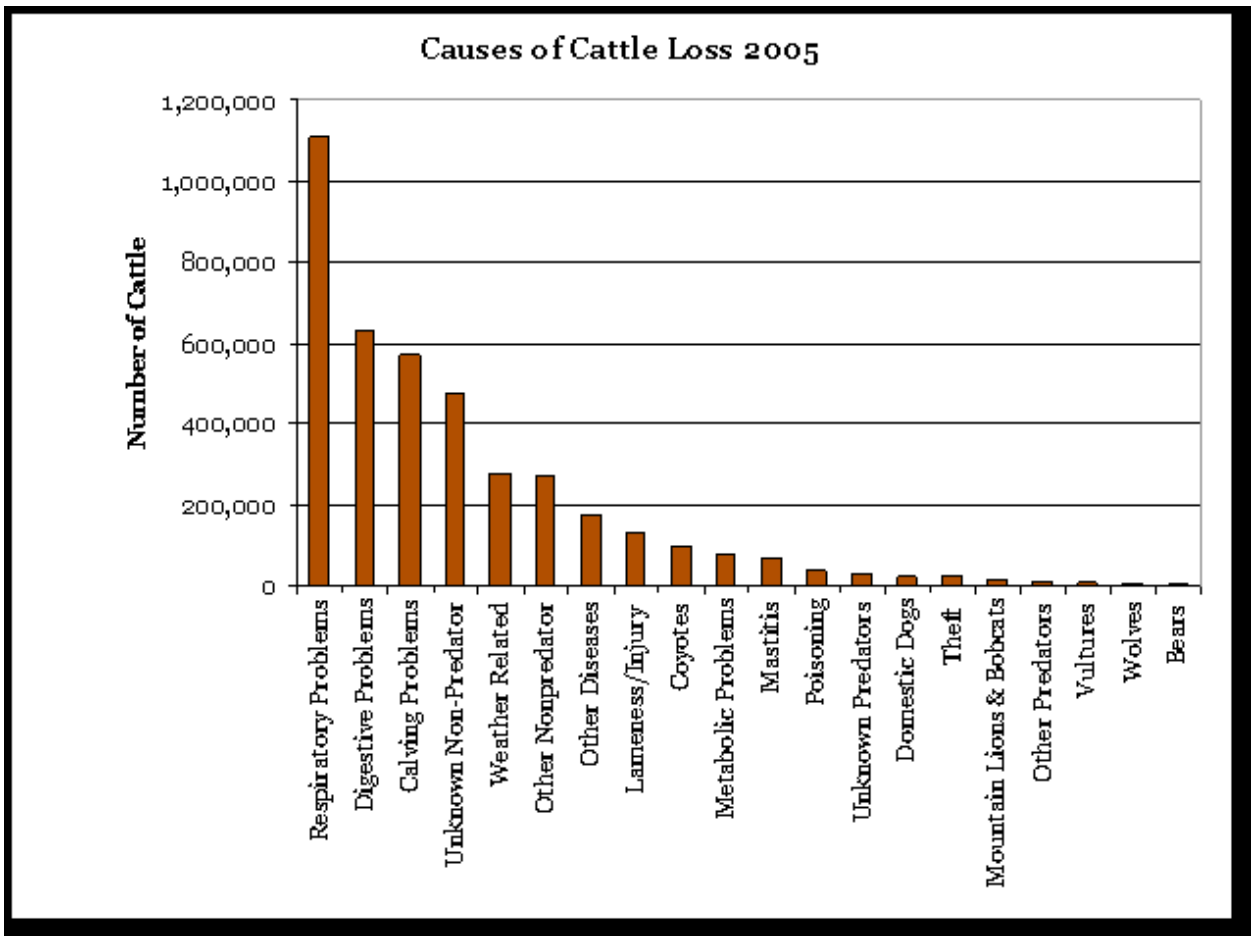
Predator control may be creating other conflicts with livestock producers as well. Artificial feeding of elk that leads to winter congregations has been documented to increase the occurrence of brucellosis infection in wildlife.[80]

There is evidence that wolf predation (as well as other predators) can reduce disease occurrence and thus transmission from wildlife to livestock. For instance, researchers in the Greater Yellowstone Ecosystem found that wolves helped to disperse elk and apparently kept brucellosis infection low under natural conditions. Under more crowded conditions in feedlots, brucellosis infection rates are much higher.[81] Brucellosis is a major concern to ranchers since it can cause abortion of fetuses in livestock and bison that wander out of Yellowstone National Park are routinely killed by the Montana Department of Livestock to prevent brucellosis transmission from bison to cattle. Recent occurrence of brucellosis in cattle due to elk transmission is fueling fears that ranchers may soon demand elk control as well.

Livestock Losses to Predators Exaggerated

Perhaps one of the most perplexing aspects about predator management is the unrealistic and exaggerated importance of livestock losses attributed to predators. Notwithstanding the fact that any loss to predators can be significant to individual livestock producers, overall predators are not a threat to the livestock industry as a whole.

For instance, in 2005 only 5% of all cattle losses in the continental U.S. were attributable to predators. In addition, only 0.11% of all cattle losses in 2005 were due to predation by wolves. (However, it's important to note that wolf distribution is more limited than other predators like coyotes). Coyotes killed more than 22 times more cattle, domestic dogs killed almost five times as many cattle and vultures killed almost twice as many cattle as wolves did in 2005. Interestingly, theft was responsible for almost five times as many cattle losses as were lost by wolf predation.[82]



Source: NASS

In 2009 wolves were responsible for 192 confirmed cattle losses in the northern Rockies. This was lower than in 2008 when 214 were killed. However, confirmed sheep losses were 721, almost double the 355 reported in 2008, primarily due to the loss of more than a hundred sheep in one predation event.

A total of 478 wolves were killed by either hunters or agency personnel in 2009. Montana removed 145 wolves by agency control and 72 by hunting. Idaho removed 93 by agency control and 134 by hunting. In Wyoming, 32 wolves were removed by agency control. In Oregon two wolves were removed by agency control.[83]

These numbers could be expected to change as wolf numbers increase, but there are reasons to believe the presence of wolves may actually reduce livestock losses. Since it is well documented that the presence of wolves reduces the number of coyotes, and since coyotes are among the major predators on livestock (particularly sheep), some have argued that restoration of wolves throughout the West would lead to a reduction in predator losses.

A Case Study: Management of Wolves

The management of gray wolves in the northern Rockies provides a case study in the problems associated with current management paradigms with regards to top predators. While there are differences in the behavior, prey selection and resource allocations between top predators, most share some common attributes with regards to how state agencies manage them, or perhaps mismanage them. The current debate over wolf management demonstrates the conflicts that dominate wildlife agency policies.

The gray wolf was listed under the Endangered Species Act in 1978. Natural recolonization of the northern Rockies near Glacier National Park began in the 1980s. In order to speed recovery efforts, the US Fish and Wildlife Service reintroduced wolves into two other recovery zones – Central Idaho and the Greater Yellowstone Ecosystem. Wolves were trapped in Canada and released in these zones in 1995 and again in 1996. Wolves in these two areas were considered "experimental and non-essential" populations and thus had reduced protections under the ESA. This permitted the US Fish and Wildlife Service to kill any wolves that were deemed harmful to the long-term prospects of species recovery. Typically wolves were killed after depredation on livestock. In reality, wolves both in the Glacier Park recovery area, as well as other recovery zones, were treated essentially the same and were regularly killed by the US Fish and Wildlife Service in response to documented predation upon livestock and/or pets.

From that start, the population has grown to more than 1,600 wolves in the three state area, so that by 2009 the government proposed delisting of wolves in Montana and Idaho and handing management over to state wildlife agencies. The FWS retained management control over wolves in Wyoming because of conflicts over management policies with that state, which proposed making wolves "predators" over most of the state with year-round open season and no limits on hunting.[84] Meanwhile environmental organizations sued to reverse delisting based on several fine points of the law, including the requirement by the Gray Wolf Recovery Plan that genetic exchange between all three recovery zones had to be documented before delisting could occur and that under delisting rules, wolf populations could dip as low as 300 animals.[85] Despite significant long distance dispersal of wolves into adjacent states, as of 2010, no genetic exchange has been documented between wolves in the Greater Yellowstone Ecosystem and other recovery zones.

Meanwhile, in response to delisting by the federal government, both Idaho and Montana, in an attempt to control wolves, instituted hunting seasons. By March of 2010 hunters had killed 159 wolves in Idaho and 72 in Montana. Additional wolves were also killed by Wildlife Services in response to livestock depredation. At the end of 2009 the northern Rockies gray wolf population was estimated to include 525 wolves in Montana, 320 wolves in Wyoming and at least 843 wolves in Idaho. Three packs are now verified in Oregon and Washington.[86]

State wildlife agencies and the US Fish and Wildlife Service argue that hunting does not endanger wolf recovery. In a narrow sense they are correct. It is unlikely that hunting, alone, would reduce wolf populations to critical levels. However, indiscriminate hunting, along with livestock depredation control deaths and disease, might jeopardize at least local populations. Most wildlife agencies maintain the position that regional numbers, or meta populations, are the only valid consideration in evaluating

hunting, trapping and control programs on wolves. Such concerns are the crudest measure one can employ in wildlife management and ignores much of the latest research on evolutionary behavior and the ecological importance of predators in structuring ecosystem function.

More importantly, state agency management goals to maintain predators at populations lower than biological carrying capacity does have other consequences. It is increasingly obvious that top predators play an important role in ecosystem regulation. Plus indiscriminate hunting and killing of predators can actually increase conflicts with humans – the opposite of what wildlife agencies profess is their goal.

Greater attention to the social interactions of predators, as well as appreciation of the ecological influence of top predators, should lead to more enlightened management of predators that recognizes them as an important ecological process that has significant evolutionary influence upon ecosystems.

In April 2011 a rider was attached to a federal budget bill at the behest of Congressman Mike Simpson of Idaho and Senator Jon Tester of Montana, which legislatively returned management of wolves to state control in Montana and Idaho, while maintaining federal protection for wolves in Wyoming. Wolf hunts are also being planned for the 2011 fall general hunting season in both Montana and Idaho. On May 12, Montana Fish Wildlife and Parks set the fall 2011 wolf hunt quota at 220, a quota number that Idaho is also considering.

George Wuerthner (gwuerthner@gmail.com) is the Ecological Projects Director for the Foundation for Deep Ecology. He is a former Montana hunting guide, and previously worked as a biologist and botanist for several federal agencies. He is also the author of 35 books dealing with natural history, conservation and environmental issues. This report was commissioned by Big Wildlife (www.bigwildlife.org), a non-profit conservation group working to ensure the longterm viability of top carnivore wildlife throughout the west.

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