Direct, Spillover, and Intangible Benefits of Predation Management

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Introduction

Predation management is a controversial and often misunderstood reality of livestock management. Few on either side of the argument would believe that some sort of management is not necessary to limit livestock losses. Opposition to the lethal removal of predators characterizes most debates. While most of the opposition reflects a moral opinion about the manner in which people relate to the natural world, opponents of lethal control often argue that control is not economically justified.

Simple economic justification would require that benefits of predation management outweigh the costs. If the only goal of predation management were to be economically efficient, minimization of costs would be one of the primary objectives; however, current predation management philosophies focus on minimum disruption to natural processes. These include focusing lethal management of offending individuals and populations, and using methods (such as aerial hunting) that are expensive but highly selective and humane. Boardman et al. (1996) discuss that the objective of minimizing costs is the same as maximizing net benefits. The costs of management, while important, play a minor role in the selection of management strategies.

Costs of management include direct expenditures by producers for management programs, governmental expenditures for management and compensation programs, producer and governmental costs associated with preventing predation, and societal values associated with the predators removed. Costs of predation management programs are usually easier to quantify, can have significant variance and typically are concentrated to a few individuals, while the benefits are dispersed among many. For this reason, the authors intend to focus on the benefits of predation management programs.

Benefits

Consideration of the benefits of predation management should include an examination of different types of benefits that accrue as a result of a management program. Benefits can be classified as *direct* benefits, which accrue to the primary recipient of the program; *spillover* benefits, which accrue to secondary entities that were not the intended beneficiaries of the program; and *intangible* benefits that are difficult to quantify but nonetheless exist.

Direct Benefits

Direct benefits in the case of predation management typically are calculated as the number of individual animals saved from predation (Engeman et al., 2002; Engeman et al., 2003; Merrell and Shwiff, in review). Therefore, benefits represent a cost saving, in that with predation management a certain amount of losses or costs can be avoided. The dollar value of the species saved represents the direct benefit of the program, and the losses avoided by producers. Determination of monetary values for different species is not a straight-forward process (Shwiff et al., 2003). In the case of livestock, the market price is often used to determine the value of the animal. This, however, often represents a conservative estimate of the true value of the animal (see Shwiff and Merrell, this issue). For wildlife, civil values are often used to recognize the benefit they have within society. Civil values range from $10 to $50 each for upland game birds to $250 to $450 for mule deer, up to $2,000 for bighorn sheep, and $400 to $10,000 for antelope.

Reducing loss rates is the primary focus of all livestock predation management programs, and in this sense, all programs seek to prevent losses. To calculate the benefits of predation management programs, losses in the absence of management must be determined. Measuring what did not occur is obviously a difficult task and does not require special discussion. Research conducted in the 1970s attempted to detail livestock losses where no predator control was practiced. These studies focused on coyote predation on sheep following the ban on predicides and provide conservative estimates of losses in the absence of management. The authors consider these loss rates to be conservative estimates because: (1) they were designed to estimate coyote loss rates and do not generally reflect losses to bears and cougars (which can be substantial in some areas); (2) some degree of predation management occurred on or near the study sites thus potentially mitigating some of the losses; and (3) despite the best study protocol, some predation losses are never discovered or are so completely consumed to preclude determination based on forensic evidence. Table 1 summarizes these studies.

Like sheep, goats appear more vulnerable to predation and studies to determine predation rates in the absence of management have been few. In a two-year study in Texas, Guthery and Beasom (1978) reported that 49% of adult goats and 64% (range 33 to 95%) of goat kids were killed by predators. The

National Agricultural Statistical Service (NASS) reported that in 1999 calf losses averaged 3% (for those producers experiencing losses).

At some point, discussions of predation rates in the absence of management become an academic exercise. Profit margins in livestock production do not allow a 20% loss rate, and the absence of predation management would likely result in the loss of the livestock enterprise. However, the theoretical calculation of benefits would be the difference between losses in the absence of management and the losses experienced with management in place. Engeman et al. (2002) compared the benefits and costs of four different predation management programs to protect endangered sea turtles to determine which program provided the greatest benefits measured by the number of turtles saved under each program versus the others. One of the programs involved no management and represented the historical rates of predation in the absence of management.

Bodenchuk et al. (2002) reported loss rates (to all predators) where predation management was in place averaging 1.6% of adult sheep and 6% of the calculated lamb crop. Loss of goats where predation management was in place was 12%. Calf losses where predation management was in place averaged 0.8% of the calves protected. The difference, based on the number of sheep, goats and calves protected in 1999 and the 1999 market value, indicated that over $62.6 million was saved by predation management programs. The direct benefits of a predation management program are often the easiest to calculate; however, they fail to capture all of the benefits that accrue to a program.

Spillover Benefits

Spillover benefits are also referred to as secondary, indirect or incidental benefits (Boardman et al., 1996). These benefits are usually an unintentional side effect of the primary purpose of the predation management program, and in some cases are viewed as multiplier effects from primary benefits. Shwiff and Merrell (this issue) examine the spillover benefits to cattle as a result of a coyote predation management program implemented in south central Wyoming to increase antelope recruitment. Cattle producers in the area where coyotes were managed also benefited from the program even though this was not the primary intention of the program.

The value of these benefits depends on the quantity and variety of species affected by predators. In many cases, the spillover benefit of livestock protection in increased wildlife numbers (and value) may equal or exceed the direct benefit in livestock saved. Additional spillover benefits can accrue to the communities that depend on the livestock industry as a primary source of revenue. For example, Shwiff and Merrell (this issue) calculated that the spillover effects to cattle of coyote predation management for antelope ranged from approximately $75,000 to $180,000 in 2001 and $78,000 to $185,000 in 2002. This includes the possibility of additional benefits to the community as a result of agricultural dollars having a larger multiplier effect in the local community. If the livestock industry is a significant employer in the community, the spillover effects could be even greater.

Livestock protection programs often provide benefits to wildlife resources in the same geographic area. For example, Bodenchuk et al. (2002) reported case studies in Utah where mule deer populations responded following a winter die off. Deer numbers were evaluated two years following the die-off and were compared to the state-established population objective. In units where intensive control for sheep protection was provided to summer range (coinciding with the deer-fawning range), the deer numbers averaged 74.4% of the state's management objective and increased an average 6.4% over the previous year. In units where extensive sheep protection was performed on winter range (but not fawning range) the deer numbers were 50.3% of objective and increased an average of 2.3% over the previous year. On units where no predation management was applied, the deer herd averaged 39.7% of objective and decreased an average 1.1% from the previous year.

Spillover benefits can accrue where multiple resources, such as wildlife species or habitat, are in need of protection. The Utah WS predation management Environmental Assessments detail how integrated predation management for multiple resources is conducted. Once a predation program is requested, information from all affected resource managers is obtained. Control intensity, timing, area to be treated and target species are adjusted to optimize direct and spillover benefits.

Intangible Benefits

Intangible benefits from predation management programs exist, but in most cases they are impossible to quantify. Such benefits include things like increased cooperation from landowners as a result of the implementation of a predation management program. For example, while predation management may be controversial in urban areas, in many rural areas it is an accepted and expected practice, and the presence of an effective predation management program has facilitated landowner participation in other sage grouse conservation efforts in Utah (D. Mitchell, 2003; Utah Division of Wildlife Resources, Personal

Table 1. Available information concerning losses to predators in the absence of predation management.

Source	Location	Year	Sheep Lost (%)	Lambs Lost (%)
Henne (1977)	Montana	1974	7.5	29.3
Munoz (1977)	Montana	1975	8.1	24.4
McAdoo & Klebenow (1978)	California	1976	1.4	6.3
Delorenzo & Howard (1976)	New Mexico	1974	Not Reported	12.1
Delorenzo & Howard (1976)	New Mexico	1975	Not Reported	15.6
Average			**5.67**	**17.5**

Communication). Additional intangible benefits include potentially abating amateur efforts to control predators, which are not as selective or humane, or even legal. There are no studies to document the environmental damage caused by the lack of a program, but numerous law enforcement cases exist where landowners attempted control on their own with significant environmental damage as a result. The prevention of environmentally damaging programs is an undeniable benefit of an effective predation program. In many cases, decreased stress on the producer as a result of an effective predation management program provides a significant benefit that can not be calculated.

Conclusion

Predation management has been shown to have many benefits to livestock production. The primary goal of predation management is to reduce livestock losses. It is desirable but not necessary to achieve economic efficiency in predation management programs. In order to achieve efficiency the benefits of a program must exceed the costs, which requires the accurate measurement of benefits and costs. In this paper we identified, *direct*, *spillover* and *intangible* benefits in relation to the protection of livestock from predation. This will provide a template for the quantification of these benefits, which will lead to a more accurate evaluation of predation management programs. *Direct* benefits usually can be calculated, and in most benefits-cost analyses of predation management these are the only benefits that are reported. *Spillover* benefits are more difficult to quantify, however, they reflect the indirect benefits of a particular program. *Intangible* benefits are almost impossible to quantify but recognition of their importance in a predation management program is vital to provide an accurate description of the contribution of a predation management program. Unless economic assessments of livestock predation management programs include all of these benefits, programs are significantly understating the value of livestock predation management.

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