



ANALYSIS

Livestock depredation by wolves and the ranching economy in the Northwestern U.S.

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ABSTRACT

Due primarily to wolf predation on livestock (depredation), some groups oppose wolf (*Canis lupus*) conservation in the Northwestern U.S., which is an objective for large sectors of the public. Livestock depredation by wolves is a cost of wolf conservation borne by livestock producers, which creates conflict between producers, wolves and organizations involved in wolf conservation and management. Compensation is the main tool used to mitigate the costs of depredation, but this tool may be limited at improving tolerance for wolves. Furthermore, livestock production may in fact provide indirectly an important benefit for wolf conservation – i.e. a positive externality, by maintaining relatively intact habitat on private lands. We analyzed some of the costs of livestock depredation by wolves to livestock producers relative to recent economic trends in the livestock production industry, specifically income generated from livestock production and trends in land and livestock value. Data were gathered from depredation investigations, from the livestock compensation program and on land and livestock price in Idaho, Montana and Wyoming, U.S.A. from 1987 to 2003 – a period during which wolves had endangered species status. We found that instigation of attacks on livestock by wolves was determined by need for food, but wolves may kill sheep in excess of food needs. Excessive killing of livestock may contribute significantly to intolerance for wolves. Livestock killed by wolves cost producers approximately \$11,076.49 per year between 1987 and 2003, although costs were increasing linearly ($R^2 = 0.789$, $P < 0.001$). Each year such costs accounted for $< 0.01\%$ of the annual gross income from livestock operations in the region. Thus, wolf depredation is a small economic cost to the industry, although it may be a significant cost to affected producers as these costs are not equitably distributed across the industry. Compensation for depredation was efficient when compared to other regions. Land prices increased steadily throughout the study period ($R^2 = 0.966$, $P < 0.001$), while the price of cattle decreased ($R^2 = 0.749$, $P < 0.001$). We maintain that conservation groups should consider the potential consequences of all of these economic trends. Specifically, declining cattle price and the steady increase in land price might induce conversion of agricultural land to rural-residential developments, which could negatively impact wolf conservation via large scale habitat change and increased human presence.

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1. Introduction

Livestock production is an important economic activity in the Northwestern U.S. (Bedunah and Willard, 1987; Sarchet, 2005) yet the livestock industry is facing challenges in maintaining its economic viability (Wuerthner, 1994; Hanson et al., 2008). One particular challenge is dealing with the costs of wolf predation on livestock (i.e., depredation). Since 1987, Canadian wolves (*Canis lupus*) have recolonized regions of Northwestern Montana. In 1995, wolves were reintroduced in Yellowstone National Park and central Idaho, and since then have expanded their range into contiguous areas (Fig. 1). Many parts of the Northwestern U.S. now frequented by wolves overlap livestock production areas and consequently wolves have killed livestock. Livestock depredation by wolves is therefore a financial cost of wolf reintroduction borne by livestock producers,

which creates conflict between producers, wolves and organizations involved in conservation and management that can undermine wolf conservation (Niemeyer et al., 1994; Naughton-Treves et al., 2003). Ironically, contiguous, relatively undeveloped private rangelands can provide habitat for wildlife outside of public land (Hobbs et al., 2008). Such landscapes are often necessary for conservation of wide-ranging wildlife species, particularly for large carnivores such as wolves (Woodroffe and Ginsberg, 1998; Carroll et al., 2003). In actuality, livestock production may provide indirectly an important benefit for wolf conservation – i.e. a positive externality. Externalities (see Pigou, 1932; Baumol, 1972), are the positive outcomes (benefits) or negative outcomes (costs) of an economic activity (in this particular case, livestock production) that are not reflected in the market price of the commodity (e.g., livestock). Typically, externalities influence individuals and groups that are not engaged in the economic activity. In our case, livestock production may provide a benefit to wolf conservationists, which are a large portion of the public (Kellert et al., 1996) and come from different social contexts than those engaged in

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Fig. 1. Map of the study area in the northwestern U.S. Light gray areas within Idaho, Montana and Wyoming indicate the range of wolf populations in those states and thus the area within which livestock depredation can occur and where depredation data was collected. National parks are indicated as dark grey.

livestock production. In practice, livestock producers maintain landscapes that are important to wolves and wolves are important to other groups. In accordance with externality theory, these benefits are not reflected in the market price of livestock.

The purpose of this paper is to assess some of the economic costs of livestock depredation by wolves to livestock producers relative to recent economic trends in the livestock production industry, specifically income generated from livestock production and trends in land and livestock value. Our approach illustrates why livestock depredation by wolves is an important concern to livestock producers and how trends in various assets of livestock production, of which livestock and land value may be of paramount importance, may ultimately affect wolf conservation in agricultural areas in the Northwestern U.S.

Depredation can have significant monetary costs and cause emotional stress for individual livestock producers (Bangs et al., 1998; Bangs and Shivik, 2001; Naughton-Treves et al., 2003). Several aspects of wolf depredation damage may contribute significantly to the perception of the problem by the affected producers. For example, one perception held by livestock producers that likely contributes to conflict with wolves is that wolves kill livestock at a rate beyond that necessary to supply their immediate needs for food (i.e., “surplus killing”; Gipson et al., 1998). Surplus killing is characterized by an absence of (Kruuk, 1972), or a low level of (Short et al., 2002) utilization of the prey carcasses by the predator. If wolves engage in surplus killing of livestock they could kill a number of individuals over a short period of time, potentially contributing to increased financial costs to producers. In addition, surplus killing by wolves may significantly influence opinions of livestock producers, as well as their perception of the costs of depredation.

Surplus killing by wolves has been documented on wild prey (DelGiudice, 1998), although it is not considered common. However, surplus killing of livestock may be relatively more frequent because of poor anti-predator behaviour in domestic animals. Artificial selection has produced populations of domestic animals with reduced potential for survival in nature (Foley et al., 1971; Eibl-Eibesfeld, 1975; Wood-Gush and Duncan, 1976; Price, 1984; Mignon-Grasteau et al., 2005). In domestic livestock production, traits with economic value (e.g., faster weight gain, more wool) are favored, which diverts resources from other traits (Mignon-Grasteau et al., 2005). As a result, domestic animals typically have smaller brains and less acute sense organs than do their wild ancestors (Diamond, 2002). Furthermore, animals that are less fearful of humans are preferred, and therefore domestic animals tend to

be much tamer than wild animals (Lankin, 1997; Gross, 1998). Domestic animals may therefore express a lower incidence of behaviours and morphological traits that deter predators (Johnsson et al., 2001; Mignon-Grasteau et al., 2005). We identified whether surplus killing is in fact occurring on livestock in the Northwestern U.S. to evaluate whether it should be considered when evaluating the monetary and non-monetary costs of livestock depredation by wolves.

While depredation by wolves is an important concern of livestock producers, this concern occurs within the larger economic argument: that is, livestock producers who lose livestock to wolves pay a cost (i.e., what could be viewed as a negative externality) for conserving rangelands that are critical for wolf persistence. One means to mitigate this cost is through compensation for livestock depredation. Compensation programs are designed with the objective to help producers financially and to reduce or eliminate animosity towards wolves by reimbursing livestock producers for the monetary value of livestock killed by wolves (Wagner et al., 1997; Naughton-Treves et al., 2003; Bangs et al., 2004).

Compensation has been in place in the Northwestern U.S. for the last 20 years. However, compensation programs can be controversial as they do not necessarily improve attitudes of livestock producers towards wolves (Naughton-Treves et al., 2003). In fact, in some cases compensation programs may have the opposite effect by increasing the conflict between producers and agencies. For instance programs that take a long time to reimburse producers create the impression that the agencies providing compensation do not take the problem seriously (Fourli, 1999; Montag, 2003). Nevertheless, halting compensation is not advisable due to potential backlash (Naughton-Treves et al., 2003) and compensation is proposed to continue in the Northwestern U.S. in the near future (USFWS, 2008). Therefore, the compensation program in the Northwestern U.S. should be assessed to ensure producers are promptly reimbursed.

Wildlife conservation programs that employ economic tools such as compensation must understand the economic context within which the compensated individuals' industry operates, as economic factors important to that industry may ultimately influence the success of such programs. A good example of this comes from the U.S. management of livestock depredation by coyotes (*Canis latrans*). For 80 years the U.S. government promoted and funded lethal control of coyotes as a means to improve sheep production by preventing coyote depredation of sheep (Berger, 2006). Perception was that coyote depredation was driving the decline in the sheep industry. However,

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