Paying for the Presence of Predators: An Evolving Approach to Compensating Ranchers

By Dan Macon

On the Ground

- Conversion of rangeland habitats in North America (to more intensive agriculture or to urban/exurban uses) concentrates livestock and predators on a shrinking landscape, making conflict inevitable.
- Rural communities often feel disenfranchised by efforts to protect or restore native predators.
- Ranching businesses typically bear the direct costs (from livestock depredation) and indirect impacts associated with coexisting with predators.
- Many researchers indicate that direct compensation for depredation of livestock does not increase tolerance for predators within ranching communities.
- The emerging use of "payments for ecosystem services" (or PES) programs offers an alternative to direct depredation compensation programs.
- With the recent re-establishment of gray wolves (*Canis lupus*) in California, a Pay for Presence program for conserving large carnivores offers an alternative for supporting habitat conservation while acknowledging (and at least partially compensating) the direct and indirect costs to ranchers.

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Introduction

Many apex predators, including gray wolves (*Canis lupus*), mountain lions (*Puma concolor*) and bears (*Ursus arctos* and *Ursus americanus*), as well as meso-predators like coyotes (*Canis latrans*), foxes (*Vulpes* spp. and *Urocyon cinereoargenteus*), and bobcats (*Lynx rufus*), exist within (and largely rely upon) rangeland habitats throughout North America. Similarly, many cattle and domestic sheep operations rely on these same habitats for agricultural production (Fig. 1).[1] Conversion of these rangelands to more intensive agriculture and (increasingly) to urban and exurban development, concentrates both predators and livestock on the habitat – making conflict inevitable.[1]

These conflicts are often intensified by public policy. State and federal wildlife management agencies have reintroduced and protected carnivore species through the Endangered Species Act (ESA) and other laws.[2] California has taken these efforts even further through ballot initiatives, providing state protection to mountain lions despite strong evidence that these animals are not threatened with extinction (Fig. 2).[3] Furthermore, gray wolves, which are protected under both the state and federal endangered species acts, have recently returned to California[4] and have been implicated in cattle depredation in several northern counties (Fig. 3).[5] The California Department of Fish and Wildlife (CDFW) predicts that gray wolves will eventually become re-established at least as far south as Interstate 80 in the Sierra Nevada and Mendocino County in the Coast Range.[4] As the population levels and geographic ranges of these protected predators increase, human-wildlife conflict will only increase.

Because of these shared landscapes, tension between ranching communities and predator advocates frequently occurs. Range overlap between carnivores and livestock, and the dietary preferences of some large carnivores, make these conflicts inevitable.[6] Coexistence, or at least conflict avoidance, requires mutual adaptations by large carnivores and humans – and large habitat requirements (for predators as well as for rangeland livestock) means coexistence is essential.[7]

Rural communities in North America – especially those that depend on ranching as a key economic and land use activity – are often opposed to the reintroduction and protection of predator species.[8] While this opposition has practical aspects (that is, concern regarding predation and its associated direct and indirect economic impacts), reintroduction and protection of predators also symbolize a profound divide between urban and rural attitudes regarding natural

Figure 1. Rangeland livestock operations and large carnivores increasingly share the same landscapes in California and throughout the West, making conflict inevitable. (Photo: D. Macon)

resource use and management. Reintroduction of predators is often viewed as an urban attempt to change rural areas and land uses.[8] Conflicts over predators may be the visible aspect of a more complex struggle between urban and rural attitudes and perspectives.[2]

The Legacy of Lethal Control

Since 1914, the federal government has worked with ranchers to lethally control predators on private and public land – to the point of exterminating some predators from portions of their historic ranges (notably, gray wolves and grizzly bears).[9] Local, state and federal agencies have assisted with these control measures; the predecessor of the U.S. Department of Agriculture's Wildlife Services agency was established in 1885 within the Animal and Plant Health Inspection Service. While the agency initially focused on collecting data regarding "various birds and mammals of economic interest", it began controlling predators in 1914, when Congress first appropriated funds for this purpose.[10,11] In fiscal year 2013, USDA's Wildlife Services agency spent more than $43 million to protect agricultural resources nationwide.[12] While much of the agency's current funding

Figure 2. Mountain lions are a specially protected species in California – lethal control is only allowed with a depredation permit issued by the California Department of Fish and Wildlife. (Photo: J. Dellinger)

Figure 3. While cattle are often less susceptible to predation, localized impacts in the Sierra foothills can be significant. (Photo: D. Macon)

Table 1. Number of predators lethally controlled by the USDA Wildlife Services during 2012–2014.[12]

Predator	2012	2013	2014
Coyotes	76,120	75,326	61,702
Feral dogs	488	305	271
Mountain Lions	396	345	305
Black Bears	567	419	580
Grizzly Bears	2	0	0
Bobcats	1062	866	796
Gray Wolves	503	320	322

supports nonlethal control activities, Wildlife Services continues to utilize lethal control techniques to protect livestock (Table 1).

Since the late 20th century, these lethal control measures have become increasingly unpopular – especially with urban residents.[13,14] Recent court cases have reflected changing societal perspectives on this issue as well. In 2015, the 9th Circuit Court of Appeals ruled that federally funded predator control activities were subject to review under the National Environmental Policy Act (NEPA).[13] Subsequently, a number of California counties have put cooperative agreements with Wildlife Services on hold as the NEPA review is completed.[14]

While targeted lethal control (in which a predator known to be responsible for a specific predation event is killed) can sometimes reduce losses for a specific ranching operation, non-targeted lethal control may be largely an expedient approach with minor short-term benefits.[15] Research regarding lethal control of coyotes demonstrates mixed results. Indiscriminate lethal control of coyotes coincided with increased sheep depredation at the University of California Hopland Research and Extension Center (Fig. 4).[16] Conversely, an analysis of aerial coyote hunting in Utah suggests that it reduced losses to sheep operations in some cases.[17]

Importantly, a tradition of lethal predator control, combined with other internal and external economic forces, have significantly changed livestock husbandry practices in North America and in other parts of the developed world. This has intensified livestock-carnivore conflict, especially in areas where carnivores have been reintroduced and control options are limited (Fig. 5).[18] Since gray wolves were wiped out in

Figure. 4. In California, as in other western states, lethal control of coyotes is permitted without a hunting license or bag limit. Some evidence suggests, however, that indiscriminate lethal control of coyotes may not reduce depredation. (Photo credit: D. Macon)

Figure 5. Gray wolves are listed under both the federal and California endangered species acts. No lethal control – even of wolves known to be killing livestock – is permitted in California. (Photo: J. Dellinger)

California and elsewhere in the West in the early 20th Century, many modern ranchers have never dealt with these predators.[18] In addition, many traditional non-lethal tools, like livestock guardian dogs, are no longer used in some areas.[18]

Rediscovering Nonlethal Livestock Protection Tools

As lethal control options have become more limited, rangeland livestock producers are rediscovering – and in some cases, developing – nonlethal protection tools.[19] Because small ruminants are typically more vulnerable to predators, sheep and goat producers make more extensive use of nonlethal tools than cattle producers.[20] Overall, 58.0% of sheep operations and 93.0% of goat producers used one or more nonlethal tools in 2014, compared to just 12.4% of beef cattle producers. Low adoption rates among cattle producers may suggest that future use of nonlethal tools may be limited by producer attitudes and knowledge (Table 2).[20]

Direct Compensation – Mixed Results

Obviously, the killing of livestock by predators represents a direct economic loss to ranchers. These direct losses are relatively easy to quantify – a dead animal can be valued based on current market prices. However, indirect losses (such as reduced weight gain, reduced reproductive success and additional labor) may be costlier than direct predator losses.[21] The loss of an individual animal also represents the loss of that animal's future genetic potential in a particular herd or flock, as well as the loss of years of investment and emotional attachment for the rancher.[22]

To address the disconnect between a positive perception of the value of predators at a global (or urban) scale with the negative value perceived at a local (or rural) scale, non-governmental organizations (NGOs) and governments have developed a variety of compensation and indemnity programs.[23] The purpose of these programs is to provide some reimbursement of the direct economic loss associated with the killing of livestock and to acknowledge that compensation represents a societal cost imposed on individual livestock producers when it protects or restores carnivore populations.[23]

These direct compensation programs have mixed success with respect to increasing rancher acceptance of predator restoration and protection. A survey focusing on public and producer attitudes in the northern Rockies found that compensation programs may represent a tangible indication that society acknowledges the costs of predator reintroduction.[23] On the other hand, a study of a direct compensation program in Wisconsin (for wolf depredation) indicates that ranchers who were compensated for losses were no more tolerant of wolves than those who were not compensated.[24] Other researchers have reported that compensation payments do not improve individual tolerance of wolves or public acceptance of lethal control.[22]

Beyond rancher and public perception, compensation programs present several on-the-ground problems. Insufficient compensation can result in resistance to carnivore recovery programs.[25] Most programs require official determination of the cause of death in suspected predation cases, which can be difficult to obtain in a timely manner.[26] For example, CDFW officials, who work at some distance from where wolf depredations typically occur, must verify depredation by gray wolves in California. These officials often find it difficult to make a definite determination once scavengers have begun to feed on livestock carcasses.[4] Direct compensation programs that do not require ranchers to undertake

Table 2. Percentage of cattle, sheep, and goat producers who used nonlethal protection tools.[20]

Nonlethal Method[1]	Beef Cattle Producers (2010)	Sheep Producers (2014)	Goat Producers (2014)
Livestock guardian dogs	4.7%	23.5%	33.0%
Llamas	(data not reported)	5.4%	4.2%
Donkeys	(data not reported)	8.2%	9.6%
Predator exclusion fencing	3.8%	31.8%	44.5%
Shed lambing/kidding	(data not reported)	20.0%	18.3%
Herding	0.7%	6.4%	5.5%
Night penning	0.7%	19.5%	23.8%
Fright tactics/devices	0.3%	1.8%	2.1%
Carcass removal	2.9%	6.6%	5.0%
Culling older females	3.6%	9.6%	7.0%
Changing bedding grounds	(data not reported)	6.3%	6.3%
More frequent checks in high predation areas/seasons	4.1%	9.5%	10.3%
Altered breeding season	(data not reported)	2.9%	2.3%
Other nonlethal methods	0.8%	3.9%	57.8%
Any nonlethal method	12.4%	58.0%	93.0%

[1]Many producers use more than one nonlethal protection tool, therefore totals across columns may sum >100%.

protective action (in the form of nonlethal protection activities) may create a "moral hazard" by creating a disincentive for protecting livestock. Old or infirm animals may be allowed to be killed to obtain reimbursement.[27]

Figure 6. Livestock protection tools, like livestock guardian dogs, can help ranchers coexist with predators. But like any tools, these methods come with a cost. (Photo credit: D. Macon)

Such problems may exist even when compensation is tied to proactive measures. Marin County (California) terminated its contract for lethal predator control with USDA Wildlife Services in 2000. Instead, the county has provided cost-share funds for ranchers to implement a variety of nonlethal predator protection tools, including fencing and livestock guardian dogs (Fig. 6).[28] Despite this incentive, many local producers remain convinced that lethal control is the most effective predator protection tool and continue to practice lethal control at their own expense. Indeed, most sheep producers surveyed in Marin County are unhappy about the county's Livestock Protection Program.[29]

Perhaps most importantly, most of the compensation and cost-share programs presently utilized in the U.S. focus entirely on direct losses, despite clear evidence that indirect losses (e.g., weight loss or reproductive failure) may cause greater economic impact than direct depredation losses, especially with respect to wolves. These indirect losses are not compensated.[9,21,30,31]

Paying for Presence: An Evolving Approach

Considering the challenges highlighted above, a different approach to providing incentives for livestock producers and rural communities to coexist with large carnivores may be more effective than direct compensation.[32] Performance-based arrangements, where payments are based on specific

conservation outcomes, are one such approach. Under this scenario, there is no need for producers to find killed livestock, or for experts to verify kills.[32] Evidence suggests that these types of conservation payments can provide incentives for individual landowners and important sources of revenue for rural communities.[24] Rather than compensating rural landowners and land managers for wildlife damage, these payments are based on wildlife abundance.[27] Accordingly, payments for ecosystem services (e.g., the provision of wildlife habitat) offer a framework for developing additional incentive-based approaches to conserving large predators.[33]

These types of programs also acknowledge the importance of indirect losses. For example, the Mexican Wolf/Livestock Coexistence Council has developed a "Payments for Wolf Presence" program.[34] In addition to known wolf kills, this program recognizes that undetected depredations – and changes in livestock behavior that result in reduced reproduction and growth, impacts to meat quality and added labor and management costs – can directly impact ranch-level economic viability.[34]

Regional or community-based approaches that are led by stakeholders (rather than producer-by-producer programs led by outside NGOs or government agencies) appear to be most effective.[35] Researchers in Europe found that wolves may switch from protected to unprotected herds, highlighting the need for a community-based (rather than individual producer) approach.[35] Furthermore, working across land ownerships and jurisdictional boundaries is critical to conserving wildlife.[36]

These programs are "voluntary, conditional agreement[s] between at least one 'seller' and one 'buyer' over a well-defined environmental service – or a land use presumed to produce that service".[37] Pagiola and Platais[38] advocate a payment system that provides continuous, open-ended payments that are targeted to specific outcomes and that avoid providing perverse incentives (for example, if a reforestation incentive payment actually encourages landowners to cut down standing trees to qualify for the payment, it would provide a perverse incentive).[38] These programs also require secure sources of financing, which in turn requires identifying the beneficiaries of specific ecosystem services.[38]

But will ranchers participate? California ranchers, faced with significant pressure to convert rangelands to other land uses (including suburban development and intensified agricultural production), are interested in programs that compensate them for services that are typically not reflected in land prices or livestock market prices.[39] With appropriate flexibility and adequate compensation, many California ranchers express strong interest in wildlife-focused payment for ecosystem services programs.[39]

A New Opportunity in California

As gray wolves become re-established in northern California, and as rangeland conversion constricts both rangeland livestock production and wildlife (especially carnivore) habitat, coexistence between livestock and large predators will become increasingly critical. Since 7.24 million ha (17.9 million acres) of California rangelands are privately owned,[40] wildlife conservation will succeed only if private landowners have positive incentives to provide habitat. Public objection to and legal restriction of lethal predator management tools in California make incentive-based approaches to coexistence even more important.

From a practical standpoint, such coexistence will require ranchers to adopt a suite of nonlethal predator protection tools (e.g., turbo fladry, livestock guardian dogs, or alarm devices); equally as important, coexistence will require society at large to support the private landowners and rangeland livestock producers who provide habitat (i.e. ecosystem services) for these wildlife species (Fig. 7). A Pay for Presence program for large carnivores is perhaps the best option for supporting private and public land habitat conservation while acknowledging the direct and indirect costs to ranchers (Fig. 8).

The creation of a Pay for Presence program must draw on the experiences of successful payment for ecosystem services programs elsewhere in the world. As we have seen, these programs have several common elements, including:[37]

- Community engagement and leadership
- Proactive actions required by payment recipients
- Adequate funding
- Shared governance
- Continued research

Any community-based approach must build trust between ranchers, wildlife and conservation advocates, and wildlife management agencies. A community-based approach can also alleviate the potential for one producer's nonlethal techniques pushing predators to a neighboring property. Landowners will need assurances that their conservation activities will not create unintended restrictions on management decisions. Program governance must include ranchers, wildlife advocates, local governments, tribal governments (where applicable) and state/federal wildlife management and agriculture agencies. Examples of successful partnerships include the Malpai Borderlands Group in southeastern Arizona and southwestern New Mexico,[41] as well as the Blackfoot Challenge in western Montana.[42] Each of these partnerships are distinctive in that they include ranchers, public agencies, and conservation organizations – and each is committed to collaborative problem solving. Furthermore, each organization has enjoyed long term collaborative leadership from local landowners and agency managers.[41,42]

Funding support should come from a robust public-private partnership. All sources of funding should have a seat at the table in developing and administering a Pay for Presence program. On the public side of the revenue stream, agencies with direct responsibility for wildlife conservation and management should contribute funding to such an effort. Funding from nonprofit organizations and foundations will also be an important component of the financial package for this effort. Crowd-source and corporate funding opportunities may

Figure 7. Incentives for using tools, like turbo fladry (electric fence with flagging that creates a visual and psychological barrier for wolves), can encourage adoption by ranchers. (Photo: D. Macon)

provide a mechanism for broad public support as well. Finally, these funding streams must be long-term because ranchers may be reluctant to participate in short-term programs.

Finally, any such effort should support a robust research program. Since this is a relatively new approach to encouraging coexistence, new questions regarding wildlife management, nonlethal protection tools, resource economics, and public policy will inevitably arise. The relationships and trust that a partnership approach develops will also help support multi-disciplinary approaches to wildlife research. Such a program will not only help identify critical research needs, it will help focus funding and other resources on these questions.

Currently, several research priorities deserve attention. First, additional research is needed to quantify the indirect costs of coexisting with predators. UC Davis and UC Cooperative Extension are currently developing a long-term producer survey that will analyze many of these impacts in California. Second, research should focus on whether the use of nonlethal tools disrupts predator behaviors or simply moves problem predators to neighboring regions. Third, community-based, multi-stakeholder, long-term collaboration is often difficult to achieve successfully. Building trust around issues of wildlife management and predator protection requires long-term investment in trust building and community capacity. Characteristics of successful collaborative resource management efforts (like the Malpai Borderlands Group or the Blackfoot Challenge) should be evaluated, as well as those of less-than-successful efforts. Fourth, a significant amount of research has looked at a variety of nonlethal tools in isolation. In practice, producers use many of these tools in combination. Future research should evaluate the interactions between these tools and their effects on issues like predator habituation. Finally, the decision to use (or not to use) nonlethal tools is complicated. Not only is the success of these tools very site-specific (in other words, a rancher needs to use a tool that fits his or her terrain, type of livestock, type of predator, etc.); success depends largely on whether an individual producer believes in the tool.

Conclusion

In his book *Monster of God* (2003), David Quammen writes, "[t]hey [alpha predators] will not survive into the distant future unless they are allowed to survive amid, not just apart from, areas of landscape that are occupied and exploited

Figure 8. Some tools, like electro-net fencing, add labor costs to livestock operations. A pay-for-presence program acknowledges the benefits of these added production costs to the long-term conservation of large carnivores. (Photo: E. Macon)

by humans".[43] Conflict between predators and livestock are, perhaps, especially unavoidable. Predator habitat spans both public and private land in the U.S., and domesticated grazing animals and large predators often share the same rangeland landscapes – landscapes that are increasingly constricted by fragmentation and conversion to other uses. Ranchers in the U.S. have practiced lethal control of predators for generations (often with the direct and implicit support of federal, state, and local governments) and targeted lethal control may reduce predation at the ranch or watershed scale, or for relatively short time periods.[17,44] However, some evidence suggests that indiscriminate lethal control may not reduce the long-term direct and indirect losses associated with these predators.[16]

At the individual producer level, decisions about predator control or prevention activities are made in the context of complex management decisions regarding class and species of livestock, production and marketing systems, local and regional land use policies, and global economic factors.[9] In much of the western U.S., development places increasing pressure on land historically used by both livestock and wildlife. Profitable ranching may be the best option for keeping critical ecosystems from being permanently fragmented or altered by development.[9]

Government agencies and nonprofit organizations have developed compensation programs designed to offset the direct cost of predation. Evidence suggests, however, that indirect costs (from reductions in livestock performance and increased labor costs – as well as the costs of nonlethal tools) have a greater economic impact on ranching operations.[21] Performance payments (based on conservation outcomes) may help encourage coexistence and provide revenue to the rural communities most impacted by predator reintroduction and management activities. The emerging use of payments for ecosystem services provides additional support for these types of programs.

California offers a unique opportunity to implement a new program to pay rangeland livestock producers for the presence of predators on their ranching operations. Legal restrictions on and public objections to lethal predator management tools make incentive-based approaches to coexistence even more critical. A community-based approach that acknowledges the value of proactive actions on the part of ranchers offers the greatest opportunity for balancing the needs of predators, rangeland livestock operations, and rural communities.

Declaration of competing interest

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