



Wildlife Management

Facilitating safe and sustainable habitat and wildlife populations in the Rockies

By Scott Wozencraft

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Key Findings

- In the Rockies, wildlife related expenditures as a percent of state GDP is 3.2 percent; the highest in the nation.
- The percent of the Rockies' population with a hunting license peaked in 1972 at 17.7 percent. In 2007 only 6.8 percent of residents held a hunting license.
- The Rockies receives 0.36 percent of its GDP from hunting revenues; the third highest in the nation.
- Montana and Wyoming earn the most per capita hunting license revenue of any state in the country. Each state earns over \$25 per resident.

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Wildlife Management in the Rockies Region

Wildlife management in the eight-state Rockies region presents unique social, economic, and ecological challenges. Aside from preserving wildlife purely for its intrinsic value and for future generations, wildlife also has significant economic value and many argue deserves preservation and consideration on those merits alone. Wildlife-related recreation accounts for 3.2 percent of the regional economy (regional GDP), the highest in the nation (See Figure 1). Only 1.8 percent of the entire U.S. economy comes from wildlife related activities; no other census region comes within a percentage point of the Rockies in terms of wildlife revenue as a percentage of state of state GDP (See Figure 2).¹ Hunting alone in 2007 brought \$166,577,530 in revenue to the Rockies region, more than to any other region in the U.S., especially considering the relatively small population of the Rockies region (See Figure 3 and Figure 4).

At the same time though, the Rockies has experienced intense human-wildlife conflicts. Historically, agriculture and energy development, major players in the region's economy, have opposed most wildlife conservation measures that may impact their industry. Agriculture in the Rockies accounts for approximately 4 percent of the region's economy and is heavily affected by the presence of certain wildlife species (See Figure 5).² According to an agricultural study of several states in the Rockies, average farms and ranches around the Rockies region spent approximately 67.8 hours and \$2,460 per year trying to mitigate or repair wildlife damage (Rockies Region is defined differently by Conover than the State of the Rockies Project, see footnote)³. The rest of the U.S. on average spent only 35.4 hours and \$627 to prevent or fix wildlife-related damages.⁴

Energy development also plays a pivotal role in the Rockies' economy and the nation's energy supply. Oil and gas extraction accounts for 2.3 percent of the regional

economy and is continuing to expand its economic presence.⁵ The Rockies region produced approximately 26 percent of the nation's natural gas in 2005⁶ and possesses large reserves in the Pinedale Anticline⁷ and Jonah natural gas fields, which are yet to be fully developed.⁸ Pressure to develop the region's energy resources has intensified, creating a spike in the number of drilling permits and further straining the relationships among oil and gas companies, conservation agencies, and the federal government.⁹ As these groups vie to have their values determine the use of the land, wildlife managers are caught in the middle, attempting to mediate conflicts, preserve wildlife, and act in the interest of the region.

Wildlife management is defined as "the act of influencing or modifying the wildlife resource to meet human needs, desires, or goals."¹⁰ In the Rockies, where those needs, desires, and goals are diverse, politicized, and polarized, wildlife agencies must balance the interests of wildlife, conservationists, and hunters against the interests of farmers and ranchers, the energy needs of the nation, and the regional population growing at four times the national average.¹¹

History: The Evolution of Management

Modern definitions of wildlife management almost always acknowledge the influence of human desires and objectives in the field. The number of stakeholders and diversity of interests in wildlife have increased through time. Subsequently, the number and variety of goals, as well as the tools employed by wildlife managers, have also evolved, from one goal, survival, and one tool, hunting, to dozens of goals with dozens of tools to achieve them.

Prehistory Management

Wildlife populations have been managed, since the beginning of ecological competition and pre-dates human presence, with predator-prey relationships, disease, and resource limitations keeping wildlife within the carrying capacity of their ecosystem. Since the advent of humans, however, people have increasingly become the principal managers of wildlife. Aside from our role as a predator species in predator-prey interactions, humans have "purposefully" been managing wildlife since Cro-Magnon man around 35,000 B.C.¹² Thinking beyond opportunistic hunting, early modern humans and Neanderthals gradually practiced selective harvests that aimed to continue and expand future yields. Some even believe that these early tribal taboos determined which tribes survived. Those with

Figure 1:
Wildlife Related Expenditures as a Percent of State GDP, by Census Division, 2006

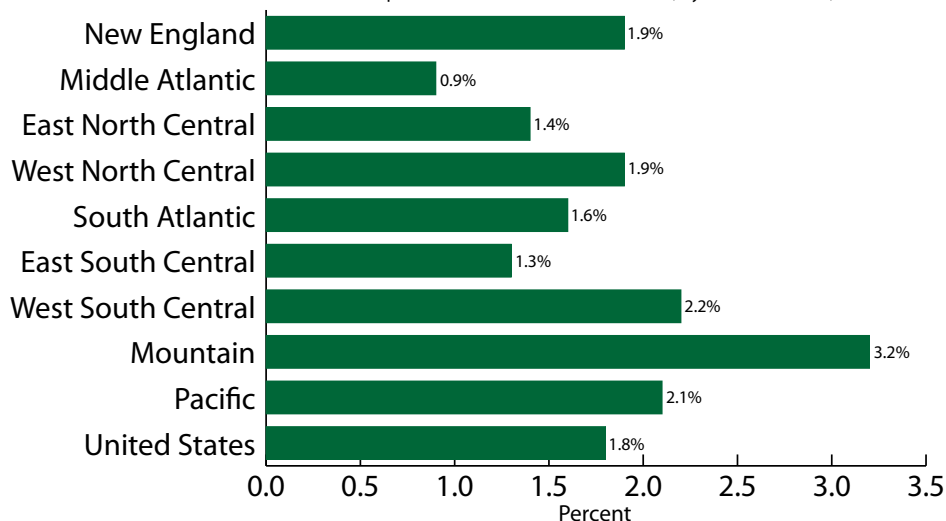
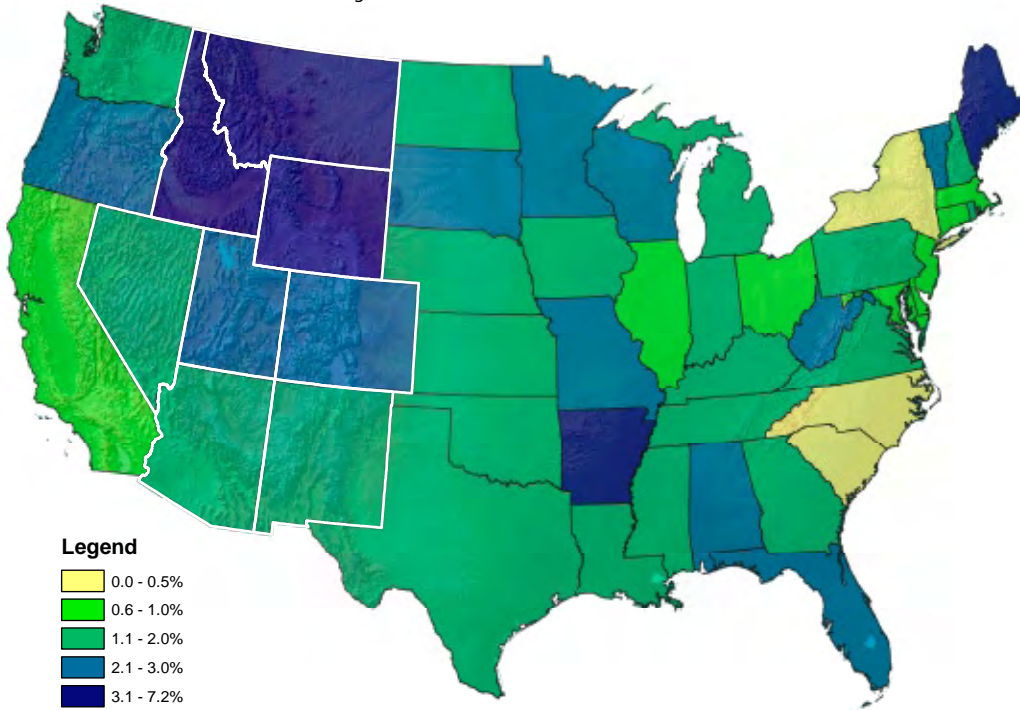


Figure 2: All Wildlife Revenue Contributions to State GDP



Source: U. S. Fish and Wildlife Service, 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 2006; U. S. Department of Commerce, Bureau of Economic Analysis, 2006

Legislature in 1779, limiting the taking of bucks, does, and fawns to between January 10 and June 10 were common in most states by the early 1800s.¹⁶ The principal difference between European and American game management arose out of the American ideology that wildlife was a publicly managed good. In Europe, wildlife was privately owned, and thus the objective was to improve hunting “for and by the private landowner.”¹⁷ Since wildlife in America was publicly owned, the objective of wildlife management was to perpetuate hunting and allow access to it. With this objective, however,

came the possibility that wildlife in the U.S. might be over-harvested and thus could not be sustained, eventually disappearing.¹⁸

The mindset of wildlife as a finite resource perpetuated regulatory management: “There was a general recognition that wildlife was a steadily dwindling resource that must be rationed. Regulations thus were designed to extend the period before the fateful day when the last deer, duck, and grouse might be shot.”¹⁹ It was not until recently that wildlife was acknowledged as a renewable resource that could be sustained indefinitely with proper management.²⁰

Thus, wildlife managers continued to enact regulations with only limited goals in mind. As Eric Bolen and William Robinson have noted, “The regulations, however, were not made with any assessment of population sizes, nor did the laws consider the reproductive potential of each species in relation to shooting pressure. Moreover, habitat was neglected by the lawmakers of the day, and no attempt was made to preserve or restore the food, cover, and water needed by the wildlife. In short, ecological knowledge and its applications did not exist in the realm of wildlife management.”²¹

Late 1800’s

Ecological principles like population monitoring and habitat preservation were not incorporated into wildlife management until the late 1800’s at the behest of Theodore Roosevelt and Gifford Pinchot. Pinchot pioneered professional forestry in the U.S., and was a close friend of Roosevelt, even convincing Roosevelt and

the taboos that were most successful at preserving wildlife may have had a better chance at survival. The first recorded wildlife management practices, arguably, come from Mosaic Law. In these, Moses asserts that those who follow the lord will not take both the hen and the eggs, but consume the eggs and leave the hen alive so that she can reproduce again. Thus, “thou mayest prolong thy days.”¹³ Although this first “purposeful” management seems very basic compared to today’s “terrarium curator” management practices, it marked the beginning of human manipulation of wildlife for our needs, wants, and desires.

Modern wildlife management before the 1800’s

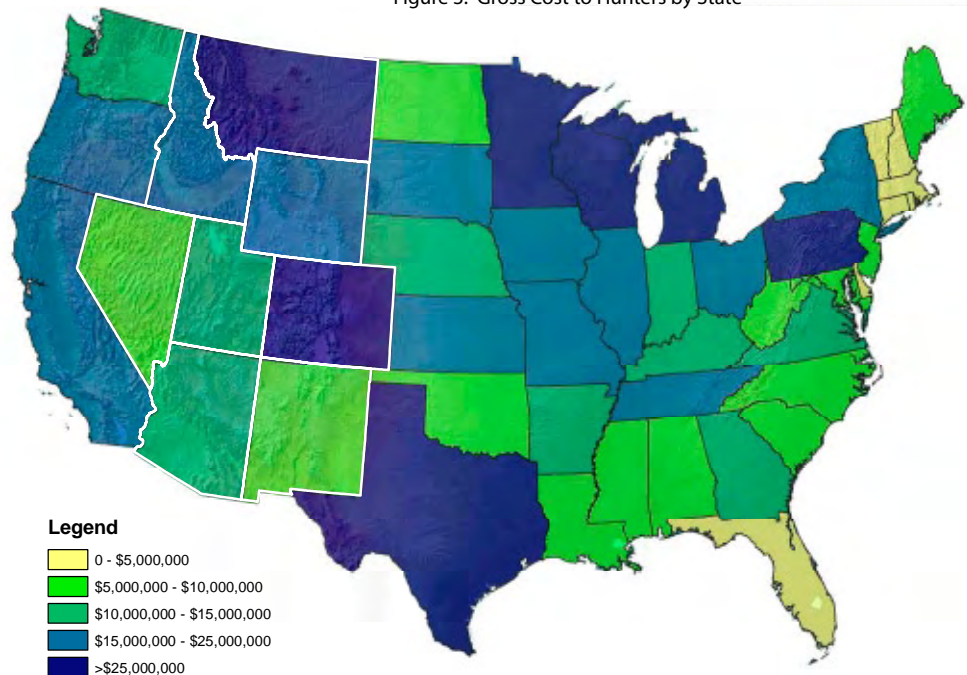
Modern wildlife management can trace its roots mostly to feudal England. One noteworthy example of modern wildlife management practices even before this however was the Mongol empire ruled over by Kublai Khan. Kublai Khan did not just regulate the season, means, and animals which could be taken, he also set-up reserves and instituted cover control aimed at increasing the supply of game species.¹⁴ Western wildlife management is largely based on the game management instituted a century later than Kublai Khan in feudal England. In feudal England Henry VIII was the first to institute written laws protecting wildlife from taking during specific seasons. Later on in the time of feudal England others in power would expand on the list of animals to be protected, the seasons in which they were to be protected, and by what methods.¹⁵

Game laws in America were heavily influenced by these earlier actions in Great Britain. Laws like The Act for the Preservation of Deer passed by the Vermont

Congress to transfer control of forest reserves to the Division of Forestry, of which he was chief.²² Roosevelt, who was heavily influenced by Pinchot and his ideas, believed that the U.S. wildlife resources “might last forever if they were harvested scientifically and not faster than they reproduced.”²³ Roosevelt also promoted conservation (a term he first applied to the preservation of natural resources and wildlife²⁴) as a social responsibility and thus bringing a whole new group of advocates to wildlife management: the American public.²⁵ With the arrival of this new stakeholder group, wildlife management legislation was pressed to answer to a more diverse and demanding constituency. No longer were the laws governing the health and taking of wildlife populations only a concern to a select few hunters, trappers, and biologists; Teddy Roosevelt reminded every American that wildlife was owned by the public and that conservation was our collective responsibility. Theodore Roosevelt’s emphasis on conservation during his presidency propelled wildlife management into a vital transitory period.

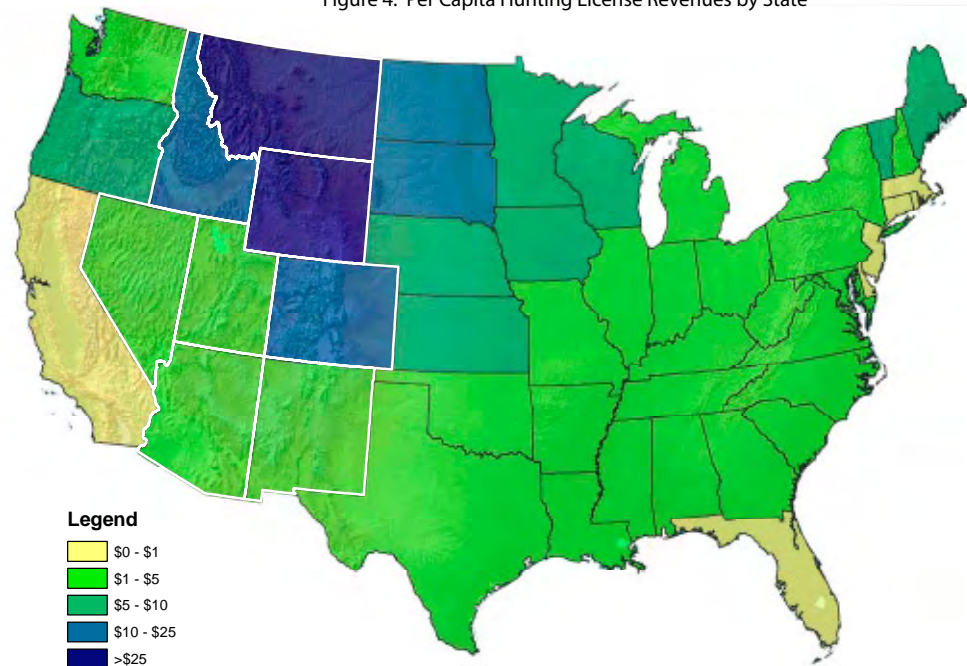
Only gradually did the U.S. public find its voice in wildlife management; Roosevelt could not instantaneously implement the organizations and infrastructure necessary for wildlife managers to become receptive to the wishes of the American public. Over the decades, however, wildlife management has begun to be more and more influenced by its ever growing and diversifying array of stakeholders. These stakeholders have begun not just to expect but demand more of a central role in wildlife management.²⁶ It is no longer just game species, or even endangered species that have a voice, the more diverse the stakeholders and the more they expect to be heard, the more diverse wildlife species being protected will become.

Figure 3: Gross Cost to Hunters by State



Source: U. S. Fish and Wildlife Service, National Hunting License Report, 2007

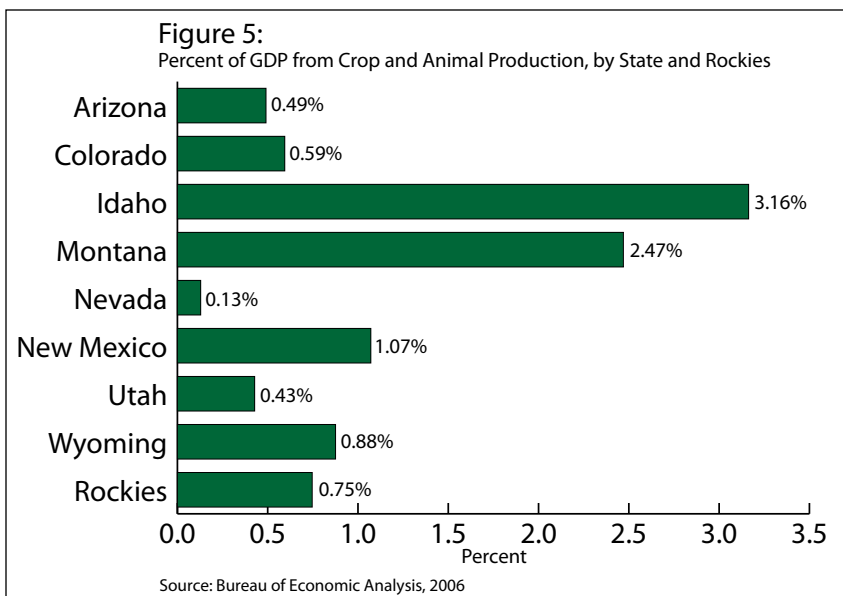
Figure 4: Per Capita Hunting License Revenues by State



Source: U. S. Fish and Wildlife Service, National Hunting License Report, 2007

Wildlife Management Tools and Techniques

This report focuses on eight common forms of wildlife management (See Table 1). Though preservation of habitat is an effective and important way to indirectly manage wildlife, it is not included in this study. The tools chosen represent a variety of the techniques that wildlife managers use on a day-to-day basis (harassment, translocation, and winter feeding), as well as the historical tools of choice (hunting and harassment), and the cutting-edge of wildlife management (predator reintroduction,



enhancement of migration corridors, contraception, and disease management).

Hunting

Hunting has been one of the primary population management tools since the first predators roamed the earth. This practice, dating back to prehistory, has only recently come under scrutiny as a wildlife management tool. Hunting, like all management tools, has positive and negative impacts, but is simply too cost-effective and too engrained in our culture to lose favor among wildlife managers at this time.

Hunting is no longer the unquestioned and sole wildlife management tool. Opposition to hunting has risen in recent decades, and the number of Americans participating in hunting has been declining since 1972 (See Figure 6). Today, many people are searching for alternative management techniques to give animals a second chance – a mentality not applicable to hunting.²⁷ Wildlife managers, while realizing the importance of hunting as a fund source, acknowledge its limitations.

Hunting generates most of state wildlife agencies' revenues. In Colorado for example, taxes on hunting equipment and license sales generate over 70 percent of the funds for the Division of Wildlife's budget. Hunting revenue allows state wildlife agencies to employ other management strategies such as contraception, predator reintroduction, and translocation that do not yield any profit. Beyond state wildlife agencies, the Rockies' economy benefits from hunting (See Figure 7).

While hunting is cost effective, it is not bullet-proof. Compensatory reproduction is the ability of a species to increase its reproduction rates in times of abundant food or times of favorable conditions. For example, some species have the ability to rapidly increase their litter size or birth rate when food is abundant. This is true in coyotes, which when hunted compensate for declines in population by taking advantage of the freed-up food resources and increasing their litter size. This behavior

makes it very difficult to control coyote populations through hunting.²⁸ Compensatory reproduction has also been observed in mountain goats in the Absaroka Mountains. The mountain goat population trends could not be explained through hunter success and size of harvest. This indicated that there was a reproductive response to hunting that negated culling impacts on the population.²⁹ Similar results have also been seen in prairie dogs³⁰ and bison.³¹ Compensatory reproduction only protects populations to a certain point following hunting. Intensive hunting (removing 30 to 40% or more of the population) will eventually decimate herds and cause populations to decline.³²

Another barrier preventing hunting from further animal population controls is its possible danger to humans. Hunting is not legal in national parks, nor is it practical or legal in urban areas. In national parks however, the National Park Service can hire sharpshooters to cull a population. Although this practice addresses population problems, it does not create funds for state wildlife agencies, eliminating one of the principal benefits of hunting. In urban areas, for both legal and practical reasons, hunting of nuisance wildlife or overabundant populations is not allowed.³³

Hunting will remain a primary tool of state wildlife agencies for its utility and revenue, but as people increasingly recreate and build houses in open space, the safety and acceptance of hunting may decline. If hunting becomes further restricted, other tools will need to be ready to contribute.



Harassment

Another technique, used for thousands of years, since the domestication of crops and livestock, is harassment. Harassment is effective as a management tool in farming and predator deterrence, but is not appropriate for handling larger wildlife management population concerns (e.g., it would be difficult to harass a population back under the carrying capacity of the land). Harassment

is effective because wildlife is naturally risk-averse.³⁴ A deer or elk looking for forage is less likely to choose a rancher's alfalfa if there is a scarecrow, a horn sounding, or a dog roaming the area.

The effectiveness of harassment varies based on the targeted animal and situation. Harassment is most commonly employed on farms and ranches to protect crops from herbivores and to deter predators from livestock. Harassment on farms and ranches includes everything from the classic scarecrow to advanced olfactory and chemical stimuli. For the most part though, the various methods share similar advantages and disadvantages. In the short term, which can vary from a few days to over a month depending on the tool, the deterrents are effective and will keep unwanted foragers away. However, animals eventually habituate to these devices and begin to engage again in the unwanted behavior.³⁵ Animals will habituate to a simple scarecrow very quickly, often just a few days. A kite that portrays the image of a large predatory bird combined with auditory stimuli may keep wildlife away for over a month. Generally, coupling fear-provoking stimulants or stimuli that are erratic, moving, or noisy on an inconsistent basis will work best. In general though, for a situation like the few days between when a crop is ripe and when it is harvested, harassment can be very effective and cost efficient.³⁶

Harassment of predators has long been used to keep down predator-livestock and predator-human conflicts. Various methods are used to keep predators away from livestock, ranging from guard dogs to electric fences to shock-collaring wild animals. Though there is some debate, most ranchers have reported that guard dogs are a cost-efficient and successful way of controlling livestock-predator conflicts.³⁷ The merits and cost effectiveness of more modern techniques, like shock collars and electric fences, are more disputed, but show promise. Although still not widely used, electric fences have proven successful at lowering predation rates of coyotes on sheep.³⁸

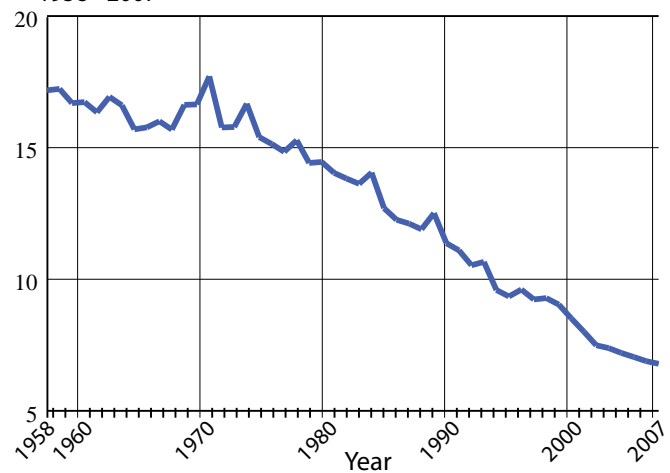
Contraception

Though it is a relatively new (the National Wildlife Research Center only began developing them in 1991), contraception has several clear advantages over hunting.³⁹ For one, contraception can be implemented in areas where hunting is prohibited such as national parks and urbanized areas. Additionally, as public favor is turning away from hunting, contraception is gaining favor.⁴⁰ Contraception also eliminates the possibility for first-generation compensatory reproduction because there is no freeing up of food resources, until the herd size shrinks for lack of replacement. Sterile animals eat, too. Even so,

previous studies have shown that it may not be effective in managing the populations of larger species who reproduce at a slower rate and have fewer offspring.⁴¹

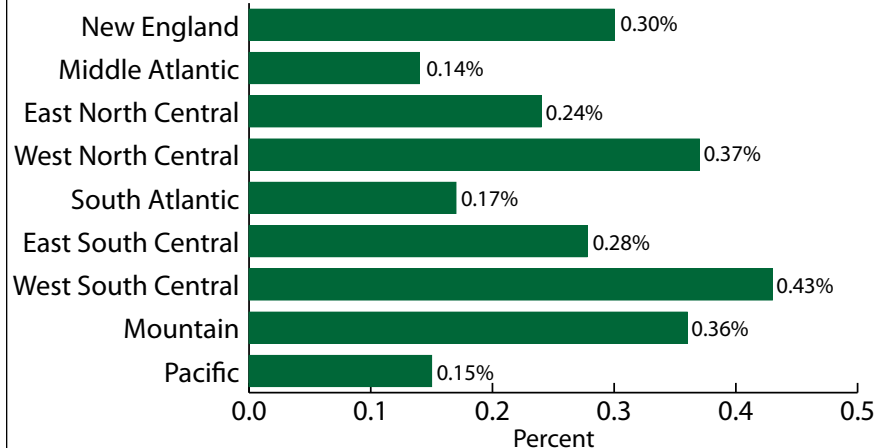
Contraception also has several weaknesses. The two largest, aside from costs, are the delivery of the fertility control and the behavioral impact of it. Currently, biobullets and treated bait are used to deliver contraceptives, though each has its drawbacks. First, biobullets are more difficult to shoot than regular bullets, which can result in labor/time intensive "hunts" which are more expensive. Treated bait presents even more problems: the bait could be poorly accepted, consumed after the breeding cycle or at the wrong time in the reproductive cycle, consumed

Figure 6:
Percent of Population with Hunting Licenses, Rockies Region, 1958 - 2007



Source: National Hunting License Report, 2007

Figure 7:
Percent of GDP from Hunting Revenue, by Census Division



Source: Survey of Hunting, Fishing, and Wildlife Recreation, 2006

in the wrong doses, and may even be consumed by the wrong species. Surgical sterilization, though generally safe, is not practicable in the wild.

In addition, contraceptives have behavioral impacts on animals. While all wildlife management efforts will impact an animal's behavior to a certain

degree, fertility controls tend to have larger impacts than many other types of methods. An animal that is shot at, trapped, or handled will likely change its behavior to avoid these situations. Those changes are desired. When fertility controls are imposed on an animal they inhibit one of the primary functions and behavioral determinants of the animal: its reproductive cycle or desire to reproduce. Impacting the cornerstone of an animal's life can have severe and often unpredictable behavioral impacts.⁴² Depending on the contraceptive agent used, there could be a prolonged but unsuccessful breeding cycle, an elimination of the breeding cycle and associated behavior, or due to a lack of estrogen, elimination of the mother-young bond (for current offspring).⁴³

At this time, contraception is likely most efficiently used in combination with hunting (or some other removal method). Contraception can help reduce the impacts of compensatory reproduction on hunting's

effectiveness. Culling a population and then using contraceptives on some of the remaining herd could be a more effective and cost-efficient way to incorporate expensive fertility controls.

Predator Reintroduction

After years of predator extermination campaigns, predator reintroduction is a strongly favored wildlife management tool among residents of the Rockies region.⁴⁴ The reintroduction of predators garners public support because it is viewed by many in the general public as reconnecting a natural ecosystem process, which has many tangential benefits. Predators do not just help control prey populations (frequently elk or mule deer); they also force these populations to redevelop instincts to avoid predation, a phenomenon known as behaviorally mediated impacts. For example, the reintroduction of wolves helps

TABLE 1: MANAGEMENT TOOLS

Tool	Brief Description	Current Status
Predator / Prey Interaction	Predator – Prey Cycle feasible in large, natural settings: controls populations of both predators and prey	Marginalized by removal of predators & human intrusions; prey populations frequently become too large for carrying capacity, disease, stress set in
Subsistence Hunting / Trapping	Hunting for basic survival purposes	Uncommon, especially in the U.S. / Rockies Region, though still isolated examples
Trophy / Recreational Hunting	Hunting for sport: trophy heads often paramount but meat maybe consumed; hunters not solely dependent upon the hunt for survival	Common, likely most widespread of all wildlife management tools. Barred from certain land-use designations, i.e. National Parks, Wilderness Areas, and urban areas
Culling (through hunting or trapping)	Hunting neither for survival nor sport, but to maintain healthy wildlife populations; often requires professional expertise	Common, used frequently in areas where trophy / recreational hunting is not allowed (National Parks, Wilderness Areas)
Harassment	Initially used to keep aggressive predators at bay; now more often used to keep wildlife off of private property	Common, used frequently by farmers attempting to protect crops and urban areas to displace overcrowding
Winter Feeding	Feed left out in harsh weather to preserve populations of affected animals	Common in certain areas, especially with large ungulates and migratory birds, losing favor due to perpetuation of non-natural conditions
Translocation	Removal and transportation of nuisance animals to new habitat	Common, especially as lethal wildlife population controls lose favor
Predator Reintroduction	Introduction of previously extirpated predator's into former habitat, used with hope that new predators will control an overly large prey population	Infrequently used, although gaining favor as support for the idea of a more "complete ecosystem" grows
Enhancement of Migration Corridors	Preservation of land vital for wildlife to move from their summer feeding grounds to winter feeding grounds	Infrequently used, although as more evidence has been presented demonstrating its importance it has begun to garner more support
Contraception	Fertility control drugs / surgeries implemented to control overgrown wildlife populations	Uncommon, expensive and impractical to implement, support is growing however as anti-lethal control sentiment rises
Disease Management	Vaccination to Control or prevent epidemics in wildlife, especially endangered or threatened wildlife	Uncommon, expensive and impractical currently, but likely to grow in importance as technology improves

Source: Developed by the State of the Rockies Project, 2008

control elk populations, but also forces the herd to remain mobile, which reduces site-intensive grazing.⁴⁵ The presence of predators also keeps elk and other mega-fauna from lingering in riparian areas where cover is dense and predators can hide in wait. This trophic cascade reduces soil erosion, preserves riparian vegetation, and improves overall stream health.⁴⁶ In addition, predators are also likely to target weakened and diseased animals, which may significantly reduce cases of chronic wasting disease in populations of elk and mule deer.⁴⁷

The benefits to predator reintroduction are numerous, but there are also potential drawbacks. For example, the release of predators can negatively impact humans around the release site. Ranchers may lose livestock, and homeowners may lose family pets, and in some cases even worry for their safety.⁴⁸ This situation has created a schism between overall public views favoring predator reintroduction and the views of those most likely to have to deal with the consequences of the reintroduction; this schism can make legislation supporting predator reintroduction difficult to pass.



Translocation

Translocation is gaining popularity as a moral alternative to lethal control for nuisance animals. People generally want to “give the animal a second chance,”⁴⁹ but translocation, despite its popularity, has several weaknesses as a wildlife management tool. There are three main problems with translocation: strong homing instincts, philopatric behavior, and a relatively high rate of mortality from handling, transporting, and the stress of living in a new ecosystem.

For species with strong homing instincts,

translocation is often wasted time and money. For example, translocating a black bear is likely to be ineffective. Nearly 50 percent of black bears translocated fewer than 120 km, and 20 percent of black bears relocated farther than 220 km, returned to their capture site.⁵⁰ Species without homing instincts, like white-tailed deer, are translocated more effectively. Studies have shown that deer often stay within 15 km of their release site.⁵¹ With such varied degrees of homing instincts among species, the usefulness of translocation is limited to wildlife populations with poor or no homing instincts.

Philopatric behavior means that if you remove a problem population from an area, it will not be quickly repopulated by other animals of the same species.⁵² Again, the money and effort expended to remove a problem animal or population is essentially wasted, unless the species exhibits philopatric behavior. It is also important that different sexes and ages of a species may exhibit varying degrees of philopatry. For example, female deer may be very philopatric, but if males are causing the problem and are much less philopatric than male deer may simply recolonize an area after other deer are removed.⁵³

In addition, there is still the high mortality rate associated with translocation. Animal mortality due to extrication and transporting ranges between zero and 30 percent depending on the species and tranquilization method used. If the mortality from stress as the animal struggles to adjust to a new ecosystem is factored in, the mortality rate can be nearly 100 percent. This is especially true of animals that are translocated from urban to rural areas. These animals have a much higher mortality rate from the rigors of the new ecosystem. For example, deer translocated from urban to rural environments show a much higher mortality rate than the native deer populations, mostly due to hunting and automobile collisions. Some species show a greater resilience to the stresses of translocation. Raccoons, grizzly bears, and wolves seem to handle translocation better than black bear or deer, for example.⁵⁴

Last, the cost of translocation compared to hunting and other tools cannot be ignored. The labor hours associated with operating a successful deer hunt (in circumstances when translocation is also an option such as urbanized areas) is 1.8 hours. Depending on the method of capture employed, simply catching a deer in the same general area requires between 3 and 8.5 hours.⁵⁵ The cost to operate a deer hunt according to another study on urban deer removal was around \$74, but to capture the deer alive, the cost would be around \$412, not including transportation costs.⁵⁶

Enhancement of Migration Corridors

Not all wildlife management tools control population numbers. Migration corridors help maintain genetic diversity and reduce the stresses of winter on animals.⁵⁷ Without migration corridors, populations

TABLE 2: MANAGEMENT SUCCESS STORIES

	MANAGEMENT IMPLEMENTED	SUCCESSFUL EXAMPLE
ARIZONA	Restoration: Working with partners to bring back wildlife and natural areas – bald eagle recovery	Portions of the State Wildlife Grants in Arizona are going towards monitoring and banding bald eagles. State agencies, local agencies, and the Southwestern Bald Eagle Management Committee are collaborating on the project. The information gained about the bald eagle population and distribution will help biologists make future management decisions regarding the bird.
COLORADO	Management: Proactive measures that benefit wildlife and people – Gunnison Sage Grouse Citizen Stewardship Program	Colorado Audubon Society and the Colorado Division of Wildlife have worked together to establish a local citizen group that will assist in the monitoring of the Gunnison sage-grouse. Due to the variety of land management groups in the Gunnison Sage-Grouse habitat, the group has also worked on reaching out to ranchers and the BLM, advocating good land stewardship and conservation.
IDAHO	Research: Gathering information to take action – pygmy rabbit population status	State Wildlife Grants in Idaho were used to gather baseline data on the pygmy rabbit population, range, and dispersal. The information gathered provided Idaho with information used to decide that pygmy rabbits did not need to be listed as an endangered species. Success stories like this are at the heart of the State Wildlife Grants goal for cost-effective management of all wildlife species.
MONTANA	Research: Gathering information to take action – finding fish in Montana’s “fishless” streams	Thousands of miles of Montana’s prairie streams had never been surveyed for fish. Now though, using State Wildlife Grants Montana has begun surveying these streams and found startling results. Streams thought to be “fishless” were found to contain 48 different species of fish (30 of them native), five different amphibian species, and 10 different reptilian species.
NEVADA	Restoration: Working to bring back wildlife and natural areas – sustaining agriculture’s benefits to the long-billed curlew	State Wildlife Grants in Nevada were used to examine the impacts of ranches on the long-billed curlew, an imperiled species. The results were surprising; ranches generally had a positive impact on populations. As a result, some state wildlife grants will go to building a landowner incentive program to ensure the continued health of the long-billed curlew.
NEW MEXICO	Research: Gathering information to take action – short grass prairie bird conservation	The Rocky Mountain Bird Observatory and New Mexico Game and Fish Department have teamed up to establish an inventory and monitoring system for grassland birds using State Wildlife Grant funds. The data collected will help in a regional monitoring effort.
UTAH	Conservation: Protecting imperiled land, water, and wildlife – implementation of sensitive species program	A portion of Utah’s State Wildlife Grant funds were used to hire five wildlife biologists to participate in a wildlife rehabilitation program. In addition to these responsibilities, these biologists are looking at wildlife diseases and their potential to affect humans.
WYOMING	Research: gathering information to take action – amphibian assessment	Insufficient information has made managing amphibians in Wyoming costly and ineffective. State Wildlife Grant funding in Wyoming has been used to compile baseline data on amphibians and with this information the state hopes to develop long-term, cost-effective management plans. The information has potentially saved Wyoming from unnecessarily listing three amphibian species as endangered.

Case Study: The Valles Caldera

The Valles Caldera National Preserve has been referred to as the Yellowstone of New Mexico because of its expansive natural beauty. The Preserve, however, could also be appropriately referred to as America's federal land management laboratory.¹ The Valles Caldera is the first federally owned land managed through a trust. According to its 2000 directive from Congress, the Valles Caldera Trust is to manage the preserve and be financially self-sustaining by 2015, although the trust may apply for extended federal funding.² To meet this goal, the Valles Caldera is allowed administrative liberties not typically permitted at other federally managed lands. Most notably, the Valles Caldera is to function as a working ranch (allow livestock grazing) where consistent with other purposes. Other revenue-generating activities include elk hunting, cattle grazing, fishing and hiking permits, wagon rides, horseback riding, van tours, and cross-country skiing.³ In addition, scientific research and educational activities make up a significant portion of public activities on the Preserve; for example, in 2008, the Preserve hosted 32 research projects totaling over \$1.6 million in outside grant funding.¹⁸

Eight years into this land management experiment, the preserve is still searching for a balance of sound environmental practices, ranching operations, and a self-sustaining budget.⁴ The Valles Caldera Trust is currently recovering about 20 percent of its operating cost through user fees. In 2008 the ranch generated \$690,000 in revenue, more than double the \$321,000 generated in 2002; however operating costs were approximately \$3.6 million for 2008.⁵ Only 21 percent of the preserve's costs are covered by preserve revenues, and yet, no concrete plan is in place to move forward and achieve financial autonomy.

The preserve's directive calls for "operation of the Preserve as a working ranch," *where consistent with* "the protection and preservation of the scientific, scenic, geologic, watershed, fish, wildlife, historic, cultural and recreational values," and "multiple use and sustained yield of renewable resources within the Preserve."⁶ This leaves ranchers, hunters and anglers, and recreationists all with legitimate but sometimes conflicting claims for access to the Preserve.

Hunters, anglers, and recreationists might point out that they are the most logical primary use for meeting revenue goals. Of the \$750,000 in revenue the preserve generated in 2007, 73 percent came from recreation programs, with elk hunts alone generating \$330,000.⁷ Grazing, on the other hand, only generated \$5,800 and is thought to be ecologically harder on the preserve than any of the other uses except the potential of future energy development.⁸ In 2008 the grazing program generated \$58,000, by quadrupling the number of steer from less than 500 to nearly 2,000. The increase in revenue came with a parallel increase in complaints and requests for refunds by recreationists whose experiences were impacted by the presence of so many livestock. Also in 2008 recreation proved king of revenue generation bringing in 91% of all revenues. However the recreation program also accounted for 22% of planned expenditures. For the preserve to meet its directive to be financially independent by 2015, it may have to rely heavily on increasing its hunting and angling revenues.

However, prior to becoming the Valles Caldera Preserve, this area was the Baca Ranch; used for grazing sheep and cattle for over a century. Cattlemen argue that the history and cultural value of the land is vested in ranching.⁹ Ranching, though, has only turned a small profit for the preserve once in the last eight years, however, placing it at odds with one of the preserve's most important directives, to be financially self-sustaining. It is noteworthy that the Trust recoups nearly \$6,000 for every elk hunted on the Preserve, and almost \$40 per day for every fisherman, while the revenue from a steer is only \$30 a year – yet livestock grazing remains the controversial focus and emphasis of the Preserve's Board of Trustees. Whether infuriating, funny, or ironic, one "unofficial" sign posted just outside the Preserve says, "Access for cows \$1.50 for six weeks; Access for people \$10 an hour." While the real entry costs are 25 cents per day per cow and \$10 per day per person, the sign clearly makes the point. Rest assured, the Valles Caldera will have plenty of input from all sides as they continue to rework their financial and operational strategies.

¹ Yablonski, Brian. "Valles Caldera National Preserve: A New Paradigm for Federal Lands?" PERC Reports: Vol. 22, no. 4 (December 2004). <http://www.perc.org/articles/article521.php?view=print>.

² Valles Caldera Trust. 2007. State of the Preserve, 2002-2007. Valles Caldera Trust, Jemez Springs, NM. 105 pp. December 2007. http://www.vallescaldera.gov/about/trust/docs/trust_SOPDecember2007ExecSum.pdf

³ Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007. <http://www.vallescaldera.gov/about/trust/docs/AnnualReportCongress2007.pdf>

⁴ Valles Caldera Trust. 2007. State of the Preserve, 2002-2007

⁵ Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007.

⁶ Valles Caldera Trust. 2007. State of the Preserve, 2002-2007.

⁷ Valles Caldera Trust. 2007. Report to Congress for Fiscal Year 2007.

⁸ Valles Caldera Trust. 2007. State of the Preserve, 2002-2007.

⁹ Valles Caldera Trust. Listening Session #5. Ghost Ranch Dining Room, March 10, 2001. Summary of Discussion Facilitator/Recorder: Lucy Moore.



Valles Caldera © Julia Head

become isolated. With no flux or interaction of animals with other populations, the genetic pool is constricted. This small gene pool slows evolution through natural selection and increases the chance for gene mutation from inbreeding.⁵⁸ Also, without migration corridors, many animals will not be able to reach their wintering grounds. Wintering at higher elevations can be stressful for animals. In addition to the scarcity of forage, animals expend more energy trudging through deep snow. This seemingly minor difference is a significant contributor to winter die-off.⁵⁹ Blocking migration corridors results in more winter die-off or necessitates more winter feeding, which comes with its own set of issues (See Case Study: National Elk Refuge, in the Wildlife: Range and Condition Section).

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Enhancing migration corridors is unlike most other wildlife management tools discussed in this paper; it requires the preservation of open space. When land is preserved as a migration corridor, many other potential uses of that land are eliminated, which often generates its own set of conflicts. When land is preserved as a migration corridor it often interferes with energy development, livestock grazing, and development. This is especially true in the Rockies region where all three of these land uses are important to the regional economy.⁶⁰

These pressures make preserving migration corridors difficult, but the wildlife do not help themselves. Mitigation tools such as highway underpasses, and overpasses are often ineffective because wildlife see them as potential risks.⁶¹ For example, “often deer and elk are reluctant to use the overpass or underpass because they want to avoid areas where they could be vulnerable to predators. Both underpasses and overpasses provide potential ambush sites for predators.”⁶²

In addition, since migratory animals can travel more than a hundred miles along these long thin corridors to their summer or wintering grounds, crossing a variety of land, owned or controlled by various people and agencies, it can be difficult to protect the entire migration route. Just one non-cooperative landowner or government agency can effectively ruin the protection of the corridor.⁶³ These

challenges make migration corridors difficult for wildlife managers to maintain.

Winter Feeding

Wide-scale winter feeding was first implemented in 1911 in Jackson Hole, Wyoming at the current site of the National Elk Refuge. Though winter feeding is still practiced, its merits are constantly debated.⁶⁴ It is heavily favored by the public but draws criticism from many wildlife managers.

Winter feeding creates economic and social benefits but rarely benefits the ecosystem. For example, a larger elk herd sustained by winter feeding can provide economic benefits by increasing gains from the hunting season and wildlife viewing. Feeding also keeps wildlife away from private lands, where it may destroy crops or gardens, and assuage public concern for the safety and health of animals.⁶⁵ In none of these instances does the wildlife itself directly benefit, but wildlife management requires balancing interests and managing wildlife for human goals and expectations. In this regard winter feeding may be successful.

Disadvantages of winter feeding are mostly shouldered by the animals being fed and the ecosystem. Without predators to regulate population, harsh winter conditions normally act as a significant limiting factor to populations. When artificial feeding removes winter die-off, the population is allowed to further expand, “thereby creating ever-increasing demands for both artificial and natural foods.”⁶⁶ Negative impacts of this are felt by both the animal and the ecosystem. Local plant communities are degraded, the spread of disease is facilitated, and the animals’ diets are harmed (animals’ digestive systems do not respond well to sudden increases in nutrient values).⁶⁷ In addition, when a species is maintained above the carrying capacity of the land, it has the potential to degrade the land beyond its regenerative capacity. This will negatively impact vegetation and any other species in the ecosystem that is dependent upon it.

On top of all this, winter feeding is expensive, which can dampen the earlier mentioned economic benefits. Depending on seasonal conditions, the cost of elk winter feeding in the mid-1990s ranged between \$35 and \$112 per elk. During this time Wyoming was feeding almost 25,000 elk; spending between \$875,000 and \$2.8 million.⁶⁸

Disease Management

Infectious disease management is a recent addition to the repertoire of wildlife managers, but its importance is already being realized. Disease has come dangerously close to wiping out some of our most endangered wildlife, such as the black-footed ferret.⁶⁹ Little research has been done on the effectiveness of current disease management techniques because it is such a new field and is often only

implemented during a crisis.

Disease management can be aimed at several targets: the infected animals, threatened animals, reservoir hosts, or the ecosystem. Disease management of the infected animal is usually impractical, and not often attempted. Managing the infected animal leaves no opportunity for blanket treatments. Treatments or vaccines are often manually administered, which is more labor and time intensive. Because treatments may have to be repeated several times to ensure complete effectiveness, it is an inefficient process, and therefore a tool used only in the most dire situations for the most important animals, such as endangered species.⁷⁰ In these instances it is often more practical to trap the few remaining animals and treat them in captivity, as was the case with the black-footed ferret.⁷¹

Vaccinating threatened hosts is more feasible, but still often used only in crisis situations when disease risk is imminent. As a result, little research can be done prior to implementation, making it difficult to evaluate how successful these programs are, since there is no benchmark, unvaccinated population for comparison. There are, however, a few documented examples where vaccinating potential hosts has had no or little impact. For example, black-footed ferrets did not produce the expected protective antibody response when given a vaccine to Canine distemper virus. As a result, the vaccination was ineffective and the black-footed ferret population continued to decline.⁷²

Treating the reservoir host is easiest and has thus far proven to be most effective. It is easier to administer vaccine to the reservoir host because in most instances it is a domesticated animal. Treatment can be as simple as mandating the vaccination of all dogs or cattle at birth. At worst it could entail forcing all the livestock and dogs in an area to get vaccinations, if the threat is immediate.⁷³ Vaccinations of reservoir populations have proven somewhat more successful than attempts to vaccinate wild populations. For example, through controlling Rinderpest in cow populations in Africa, the disease was eliminated amongst wildlife.⁷⁴

Perhaps the most effective form of disease management is to treat the ecosystem. Here, treating the ecosystem means culling or vaccinating reservoir hosts and the threatened populations. This limits the amount of contact that both would have with each other and the likelihood that the disease will spread between the two. However, this practice is sometimes socially unacceptable. Culling domestic dogs has never been attempted and likely would not be accepted.

State Wildlife Grants

(See Figure 8)

In 2000 Congress passed the Wildlife Conservation and Restoration Program and the State Wildlife and Tribal Grants, starting wildlife management in America down a

new and exciting path.⁷⁵ The passage of these two programs could facilitate “an important culture shift in many of the of the state fish and wildlife agencies.”⁷⁶ The State Wildlife and Tribal Grants “provide federal money to every state and territory for cost-effective conservation aimed at preventing all wildlife from becoming endangered.”⁷⁷ The programs aim to be proactive about wildlife conservation and to develop plans to aid non-endangered and non-game wildlife in peril. Eighty percent of wildlife does not fit into either the endangered or game designations and thus receives less attention from wildlife managers.⁷⁸ The Wildlife Conservation and Restoration Program and State Wildlife and Tribal Grants will provide support for the Endangered Species Act (ESA) by protecting species before they reach critical “endangered” status. These new programs are pre-emptive protection; a perfect complement to the ESA.

Early Legislation

Prior to these programs, an obvious gap in legislation and funding existed between protected game and endangered species and other types of unprotected wildlife. The Pittman-Robertson Act of 1937 provided game species with protection and the Endangered Species Act provided protection for species in peril. The Pittman-



Loading a bear for translocation © Deb Robinson

Robertson Act funded wildlife agencies by levying a user fee, in the form of an excise tax, on hunting equipment; the proceeds were specifically mandated to be used to conserve game species and their habitat.⁷⁹

In 1950 a similar act, the Sport Fish Restoration Act, was passed to supply similar protection to fisheries. Like the Pittman-Robertson Act it placed an excise tax on all fishing equipment and employed the revenue toward protecting game fish and fisheries.⁸⁰ The success of these laws has kept game species at the forefront of state wildlife agency agendas for the past 70 years.

Endangered species have also been a priority for the wildlife managers and the U.S. Fish and Wildlife Service. Passed in 1973, the blanket objective of the Endangered Species Act (ESA) was to conserve wildlife designated as endangered or threatened, and the habitat they depend upon. The Act prohibits the “taking, possession, sale, and

transportation” of endangered species and is perhaps the nation’s most comprehensive environmental law.⁸¹

The remaining 80 percent of species (those not classified as endangered or game species) have historically not been so generously provided for. The only legislative protection afforded for these species were the inadequate and underfunded state wildlife diversity programs and The Fish and Wildlife Conservation Act (“Nongame Act”).⁸² The state wildlife diversity programs, established in the mid-1970’s, had vague goals and at best “unpredictable and inadequate” funding.⁸³

The “Nongame Act” attempted to do for all wildlife what the Pittman-Robertson Act did for game species: find a consistent and substantial tax base. The original ideas included an excise tax on recreational equipment.⁸⁴ No funds were ever reallocated to the “Nongame Act,” and the recreational equipment tax was never implemented, rendering the program a failure.⁸⁵ In the end, these programs did little to help wildlife managers implement conservation measures for non-endangered and non-game species.

Recent Legislation

The Teaming with Wildlife Coalition was formed in the early 1990’s to find a consistent source of sizeable funding for the “Nongame Act.” Soon though, the Teaming with Wildlife Coalition refocused itself to the passage of the Conservation and Reinvestment Act (CARA), which ultimately failed in the Senate.⁸⁶ CARA called for \$3.1 billion in annual funding that “would enable communities all across the country to expand parks and recreation, preserve open space farmland, protect wildlife and endangered species, and preserve historic buildings.”⁸⁷ The wildlife funding section, Title III, of CARA had three goals: 1) to prevent species from becoming endangered, 2) to enhance the outdoor experience, and 3) to foster a responsible stewardship ethic through education efforts. CARA did not pass.⁸⁸ The bill received more than 300 votes in the House, but stalled in the Senate, possibly because Congress was reluctant to lose the offshore drilling taxes that were proposed as the source of funding for CARA.⁸⁹

State Wildlife Grants

With the defeat of CARA, Teaming with Wildlife worked to find a short-term solution to Congress’s apprehensions about CARA. The compromise was the State Wildlife and Tribal Grants Program and the Wildlife Conservation and Restoration Program. In 2000, Teaming with Wildlife successfully pushed legislation through Congress that would provide funding and direction for the protection of all wildlife.

The Wildlife Conservation and Restoration Program encompassed all of the goals put forth by Title III of CARA: prevent species from becoming endangered,

enhance the outdoor experience, and include an educational element.⁹⁰ The State Wildlife Grants were focused solely on the first goal, preventing species from becoming endangered. Funding for the Wildlife Conservation and Restoration Program was only promised for a year (despite the fact that it is a permanent program) and has not received any appropriations since 2001.⁹¹ While the Conservation and Restoration Program sits idle, the State Wildlife Grants have currently received over \$485 million.⁹²

The two main requisites for states to receive funding required the completion of a comprehensive wildlife management strategy (hereafter referred to as the state wildlife action plan) and to match at least a quarter of the federal funds received.⁹³

The state wildlife action plans required each state fish and wildlife agency to prepare a state wildlife action plan by 2005. These wildlife action plans have eight required elements. The plans require states to 1. include information on the “distribution and abundance” of wildlife and specifically identify low and declining populations; 2. provide descriptions of the locations and the relative condition of critical habitat for these species; 3. identify potential problems and threats to wildlife; 4. propose conservation action plans for species identified as having low or declining populations; 5. put monitoring plans in place for habitats, species, and the effectiveness of conservation actions; 6. review their wildlife action plans every ten years; 7. coordinate with federal, state, and local agencies in developing plans; and 8. include the public in the development and implementation of the plans.⁹⁴ Forcing each state to collect and compile all the information required by these eight requisites has the potential to improve the management of non-game and non-endangered species. Identifying at risk populations and those on the decline, combined with the requirement to identify potential threats to these populations and their habitats, is a step in the right direction. Even with no current funding, wildlife managers for the state will know where and how to direct any future funding and research.

The last two requirements allow for private and public organizations to claim a stake in the wildlife action plans. A variety of government and non-government organizations have taken an interest in and helped create the action plans. With the assistance of these groups, the Association of Fish and Wildlife Agencies, an organization that represents all of the U.S. fish and wildlife agencies and emphasizes interagency coordination, legislation, and international affairs, provided the necessary support to ensure that each state had an adequate wildlife action plan.⁹⁵ Not only did these last two requirements help the state wildlife agencies complete the other six, they also gave them the contacts that the state would need to match the funds provided by the federal government.

Some have referred to this as “facilitating buy-in”⁹⁶; the more people that buy-in and take a stake in the success of the State Wildlife Grants and non-game species,

Case Study: Diamond G Ranch

The Diamond G Ranch sits on the north end of the DuNoir valley, just outside of Dubois Wyoming. DuNoir Creek flows through the picturesque property in a valley used as an elk migration corridor between Yellowstone and the East Fork of the Wind River. Because of the wide, bare valley and surrounding, forested hills, the DuNoir valley is also among the best grizzly and wolf habitat in the state. The existence of predators makes ranching tricky, as Stephen Gordon, owner of the Diamond G Ranch, and Jon and Deb Robinett, the ranch's managers, can attest. For twenty years Gordon owned the grazing rights to the adjacent DuNoir allotment, during which time predators took between 200 and 250 calves.¹

Pressure on ranches from grizzlies and other predators is expected, and ranchers like Jon and Deb have become adept at identifying peak bear use areas and moving cattle away during certain times of the year. For the Robinetts and Gordon, grizzlies are not the problem, however. Since 1999, the ranch has lost eight percent of its cattle to predators every year, and has also seen weight loss and decreased conception rates because of predator stress on the cattle.² The increase in depredation and livestock wellness correlates directly with the resurgence of the wolf population in Wyoming.

Wolves, extirpated in the area for several decades, have experienced a healthy population increase since reintroduction measures began in Yellowstone National Park in 1995. The Diamond G Ranch is located only 20 miles southeast of the Park, and the Ranch and surrounding areas have been adopted as prime wolf habitat. The Diamond G struggled to receive compensation for wolf kills of livestock, sometimes resorting to killing (with permission and licenses issued by the Fish & Wildlife

Service) the alpha male in the pack.

In March, 2008, with the help of the National Wildlife Federation, the problematic DuNoir allotment was permanently retired from grazing. In exchange for retiring the allotment, the ranch received fair market value for the grazing rights. The National Wildlife Federation's grazing allotment buyout program has met little opposition. Since its inception in 2002, the program has spent about \$2 million on 27 grazing allotments, accounting for almost 550,000 acres.³ Rarely do these retirements generate much controversy; the National



WY game and fish inspecting a possible wolf kill © Deb Robinett

Wildlife Federation only solicits allotments that have seen constant battles between ranchers and wildlife. Often, ranchers have been quite willing to trade wolf or grizzly populated allotments for compensation to purchase grazing allotments elsewhere. Hank Fisher, coordinator for the conservation group, says he can think of only one instance where the owner of the purchased grazing allotment did not buy a less contentious right in a more favorable location.⁴ Stephen Gordon and the Diamond G Ranch, however, are not planning to purchase another allotment. Their allotment was right next to their ranch, and they do not feel that they can make the financial commitment to truck their cattle to another, non-adjacent, allotment. Even though Gordon was happy to work with the National Wildlife Federation on the DuNoir grazing allotment, he is not sure that his operation will remain solvent without it.⁵



Wolf captured at the Diamond G Ranch

¹ Tharp, Francisco. "Yellowstone Grazing Allotments." High Country News. <http://www.hcn.org/articles/17600>. March 21, 2008. Accessed 1/12/2009.

² Robinett, Jon, Presentation at Colorado College. December 1, 2008.

³ Tharp, 2008.

⁴ *Ibid.*

⁵ Gordon, Stephen. Personal Interview, July 11, 2008. Diamond G Ranch, Wyoming.

the more likely both are to succeed. In addition, the extra funding now, and especially in the future, could play a large role in the continued success of the program. These last two requirements have helped state wildlife agencies acquire necessary funds. For example, Rhode Island has only received \$3.7 million in federal funds, but state and private organizations have contributed \$6.3 million, representing close to a 200% match on federal funds.⁹⁷

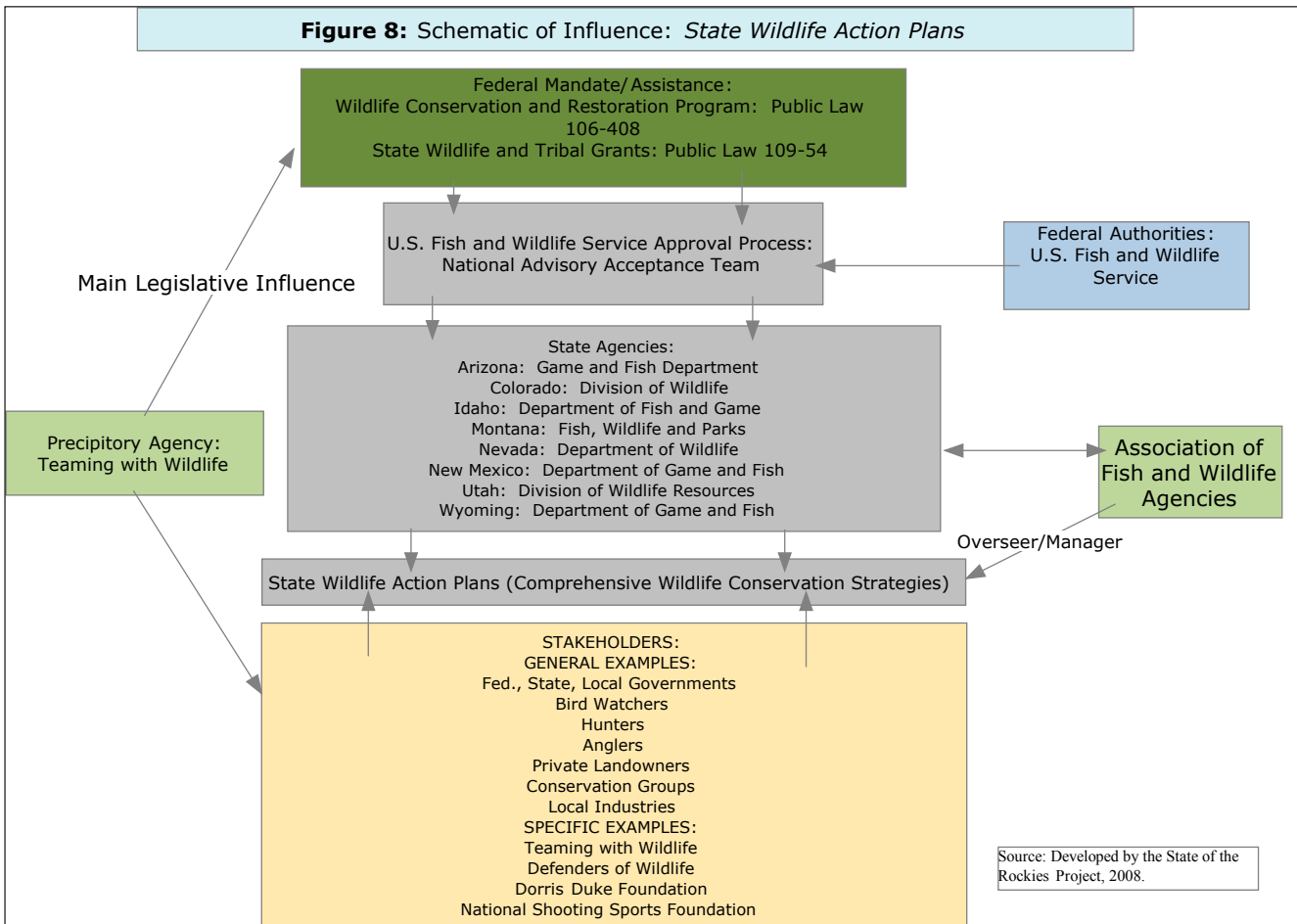
According to the National Wildlife Federation, “The best way to protect species is to protect habitat, create and implement recovery plans with broad stake holder involvement, and *provide necessary funding* (emphasis in original).”⁹⁸ The State Wildlife Grants have helped states to fulfill nearly all of these requisites. The state wildlife action plans are the most comprehensive wildlife recovery plans yet, focusing the sometimes scattered directives of state wildlife agencies. The final requisite, provide necessary funding, is logistically the most important and the weakest area of the State Wildlife Grants. Funding is consistent but inadequate; the Teaming with Wildlife Coalition anticipated three times the appropriations it initially received. The Coalition settled for less than \$100 million in each of the first nine years of funding,⁹⁹ which has been adequate to complete the research and planning associated with the state wildlife grants.¹⁰⁰ To successfully implement these strategies, however, larger appropriations will be necessary. The outside funding facilitated by the requirement for state wildlife agencies to cooperate with other areas of the government and private interests helps, but in only rare instances (like that of Rhode

Island) have outside funds been substantial enough to have a dramatic impact.¹⁰¹ “We have sowed the seeds and we have healthy seedlings. Now we need to turn them into trees with deep roots. *Money* is the water [emphasis added],”¹⁰² reasoned the Doris Duke Foundation.

For the state wildlife grants to garner more appropriations, several steps are necessary. Primarily, plans need to be implemented and successes need to be communicated. A few high-profile successes that are visible to the public would go a long way towards turning Congress’ appropriations committee towards their favor. In addition, success stories would likely convince more investors from the private sector to provide funding (See Table 2).

Conclusion

The Rockies region is home to one of America’s last great reserves of wildlife. Fortunately or unfortunately, it is also home to a variety of other resources that the country depends on, and which, at times, can negatively impact the region’s wildlife. Managing these conflicts is the job of wildlife managers. Wildlife managers employ various tools to keep these conflicts to a minimum, while still preserving the region’s wildlife resource. Tools ranging from conservation easements to hunting to winter feeding are employed to keep the demands for resources in balance with the need to preserve wildlife. The role of wildlife managers has changed dramatically from that a century ago, when wildlife was generally seen as an obstacle that somehow,



unless valued by hunters, had to be eradicated to facilitate development. The evolution of wildlife management is still not complete. In fact, many argue that its evolution is just beginning. More stakeholders are bringing more diverse interests to wildlife management. With more stakeholders and more diverse goals, the field will continually and rapidly evolve to meet the new challenges to the region and its wildlife reserves.

¹ 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. U.S. Fish and Wildlife Service. Appendix A, pg. 98. AND Bureau of Economic Analysis, U.S. Department of Commerce. <http://www.bea.gov/regional/gsp/>.

² Bureau of Economic Analysis, U.S. Department of Commerce. "Gross Domestic Product by State (millions of current dollars) Crop and animal production (Farms), 2006." <http://www.bea.gov/regional/gsp/>.

³ The Rockies region is split between two different regions in Conover's article. In his article the Great Plains region encompasses Montana, Wyoming, Colorado, and New Mexico, along with the Dakotas, Nebraska, Kansas, and Texas. The west region in Conover's article includes Idaho, Utah, Nevada, and Arizona, as well as the states directly west of them, from Alaska to California. The numbers I used for the Rockies Region are an average of the two regions statistics. Conover, Michael R. "Perceptions of American Agricultural Producers About Wildlife on Their Farms and Ranches." *Wildlife Society Bulletin* 26, no. 3 (1998).

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Case Study: Vermejo Park Ranch

The Vermejo Park Ranch, encompassing nearly 600,000 acres in northern New Mexico, is trying to turn ranch lands back to what they were before European settlement.¹ Large herds of elk, deer, and bison call the land home, black bear and mountain lions are common sights, and wolves may someday roam Ted Turner's majestic ranch.² The Turner Endangered Species Fund (TESF) plays a large role in making this lofty goal a reality. Ranch managers use money from the Turner Fund and other outside sources to reintroduce endangered and extirpated species on Turner's ranch, which is used in part as a hunting retreat, but like many of Ted Turner's ranches, as an environmental management laboratory.³

Most notably on the Vermejo Park Ranch, the Turner Endangered Species Fund is working to reintroduce the black-footed ferret,⁴ one of America's most endangered mammal that was once considered extinct.⁵ As an obligate predator, black-footed ferret populations struggled when their prey, prairie dogs, experienced their own population decline due primarily to disease and loss of habitat.⁶

The Vermejo Park Ranch has cultivated its prairie dog colonies to eventually self-support black-footed ferrets. Between 1997 and 2008, prairie dog colony acreage on the ranch grew from 500 acres to over 6,700 acres.⁷ From 2005-2007 TEF temporarily released ferrets onto select prairie dog colonies to determine if VPR was suitable as a potential ferret recovery site and to provide high quality pre-conditioned ferrets for release elsewhere. Most ferrets are pre-conditioned in large terrariums that simulate the outside world. The Vermejo Park's pre-conditioning program provides the ferrets with a more realistic training ground and also teaches biologists how to monitor ferrets in the wild. Ferrets pre-conditioned in field sites, like the one on Vermejo Park Ranch, have a higher rate of survival than ferrets raised in other types of training facilities.⁸

As the Turner Endangered Species Fund identifies,



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bringing native species back to the West is not easy: "Private stewardship of biodiversity is new, the problems are complex, and effective solutions require broad-based biological, sociopolitical, geographic, and fiscal considerations."⁹ Hopefully, by implementing broad-based, "ecosystem level" thinking, the Vermejo Park Ranch managers and the Turner Endangered Species Fund can see their reintroduction programs through to success.

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Case Study: Rocky Mountain National Park

Rocky Mountain National Park has struggled to manage elk populations for decades. The elk population is above the park's natural carrying capacity, and due to a lack of predators, the herd is less migratory and more concentrated than it would be under natural conditions. As a result, the negative impacts of the elk population are compounded; the willow and aspen communities on which the elk feed have been severely degraded. This ecosystem disruption has induced a cascade of disruption to other species and habitats throughout the park. For example, the beaver population in Moraine Park (a subsection of the Rocky Mountain National Park) has declined by 90 percent since 1940, presumably due to a lack in suitable (mature) willows for damming. Beaver, through the dams they build, are essential to maintaining surface water levels. Since 1940, when beaver populations began to decline, surface water has decreased by 70 percent in Moraine Park.¹

As a result of vegetation and species diversity loss, in 2007 the National Park Service (NPS) decided that the elk population in the park needed to be reduced to its natural levels. The Elk and Vegetation Management Final Environmental Impact Statement (FEIS) was prepared to determine which wildlife management tool or program could best accomplish this, while still accommodating the goals and directives of the park. According to the FEIS, law and the park's resource management objectives obligate it to "maintain and restore, to the extent possible, the natural conditions and processes."² The National Park Service's preferred alternative is the gradual culling of elk to the higher end of natural population variability. This alternative was selected because "it best meets the general management objectives of the National Park Service for protecting park resources and values while being consistent with the park's enabling legislation, purpose, mission, and goals."³ Additionally, according to the FEIS Record of Decision, gradual culling would be more cost effective than rapid culling and have a higher likelihood of success than the fertility control and predator reintroduction alternatives.⁴

The reintroduction of wolves to Rocky Mountain National Park was selected as the environmentally preferred option, but was not implemented because

of logistical challenges.⁵ However, the FEIS noted that the absence of a predator population is outside its normal population and behavioral ranges. Previous studies have demonstrated that using predators to manage elk not only decreases the elk population, but alter elk behavior.⁶ In the presence of wolves, elk herds are forced to be more mobile, less dense, and to linger less in riparian areas. All of these behavioral changes have positive impacts for the montane willow ecosystem.

Gradual culling and reintroduction of wolves are both feasible ways to reduce the size of the Rocky Mountain National Park elk herd. Reintroducing wolves would create the desired behavioral changes but may not be economically or socially feasible, placing it outside the parks directive. Gradual culling, on the other hand, at least in the manner outlined in the FEIS, will be economically and socially feasible, but will struggle to change the behavior of the elk. The Record of Decision is flexible, open to changes after the effectiveness of the current program is evaluated after a few years. For now, elk population in Rocky Mountain National Park remains an intriguing and multi-faceted wildlife management experiment.

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