

# **US Gray Wolf Conservation Investigation: Conservation Effort vs. State Reliance on Ranching**

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## **Abstract**

The wolf population of North America was eradicated in the 1920s due to government management plans. Wolves were reintroduced in the mid-1990s and have returned to a habitat range that occupies about one fifth of their historic range. This population has been maintained with the help of national and state protection. The only problem is when ranchers retaliate to the threat that wolves pose on their livelihoods.

States with wolves have their livestock at risk, threatening a percentage of a state's GDP. This reliance on livestock can be compared to a state's effort to protect its wolf population in order to determine a correlation between these two factors nationwide. The role of National Parks should also be taken into account when looking at its influence on a state's protection status.

The solution to the problem of killing on both sides is coexistence in the form of protective legislation, non-lethal management, and education of the public. States with high reliance on livestock and wolves unprotected must learn to coexist in order to prevent economic and environmental loss. This study focuses conservation efforts to states where it most pertinent and gives a much needed solution to the conservation predicament.

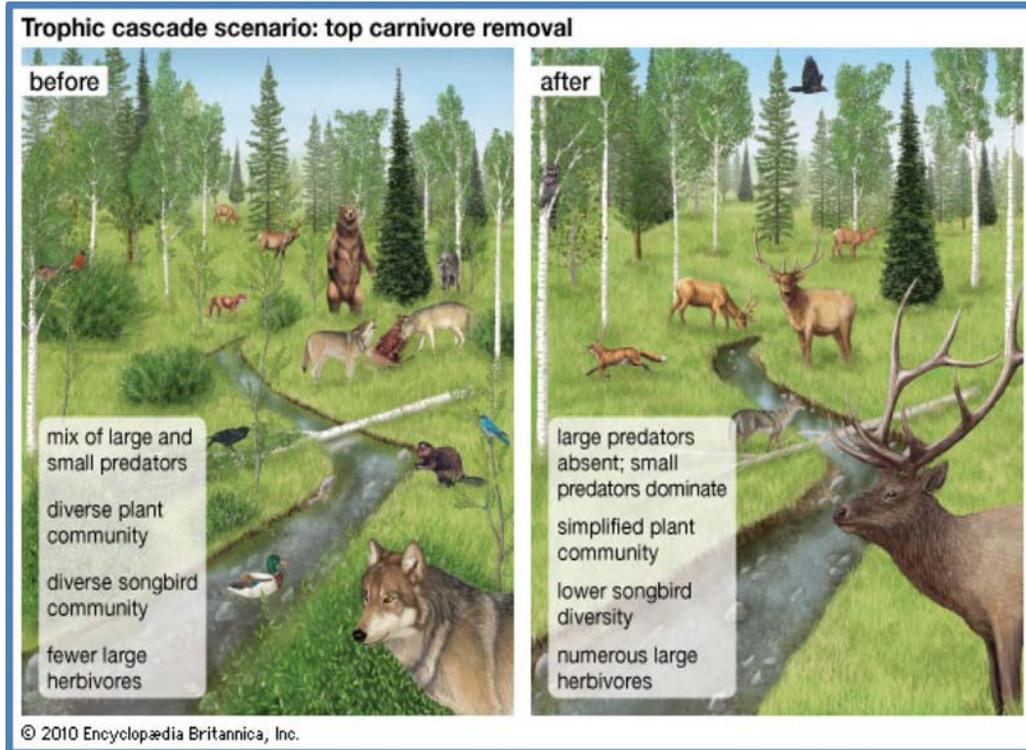
## **Introduction**

Earth is feeling the effects of a serious disease. Humans have been interfering with every ecosystem and are endangering this planet's health. Global warming has become a major downturn for Earth, however, the removal of apex predators "may be humankind's most pervasive influence on nature (Estes et al., 2011)." Globally, there has been a significant downturn for numerous apex predators. The apex predator of any ecosystem plays the largest role in maintaining balance across its food chain and its field of influence. Humans have begun to remove these keystone species to the point of catastrophe such that ecosystems worldwide are being stifled.

There are many examples showing how the loss of tertiary consumers leads to the destruction of ecosystems. Such examples include the loss of big cats in African savannas, the removal of otters in Amchitka Island, and over whaling across global deep sea ecosystems. The human caused decline in population of lions led to a surplus of baboons (Sinclair et al., 2003). This alteration then led to increased transmission of simian diseases to humans. Human removal of sea otters caused the rise in population of sea urchins: species herbivorous to the island's kelp populations (Estes et al., 1995). The anthropogenic removal of great whales caused a massive boom in plankton (Duggins et al., 1989). These plankton release carbon into the environment through feces. The populations of plankton released over a hundred million tons of carbon into the biosphere that should have been consumed by the whales. These are just a few of the examples of how human detriment to secondary consumer populations has caused serious consequences affecting both humans and the environment.

A process for the protection of ecosystems needs to be in place to maintain the planet's health. The reintroduction of apex predators into a natural habitat may be the key to restoring the targeted ecosystem as it begins to fail. Protection of natural predators will, in turn, protect the

fragile biological structure. Wolves have proven these methods valid.



Wolves are one of the clearest examples of this environmental breakdown because of their eradication and the suffocating effect of their disappearance. Numerous studies have been conducted about the increase of plant population after the reintroduction of wolves. Multiple studies in the declines of aspen, balsam fir, cottonwood, willow, berry producing shrubs, black oak, and alder had been taking place along the banks of rivers in declining ecosystems such as Yellowstone (Ripple et al., 2003, 2004, 2008, 2015)(Nelson et al., 2011)(Beschta et al., 2010, 2012). Ungulates and herbivores, specifically elk, bison, moose, beaver, and mule deer, were causing excessive herbivory in the various plant species (Ripple 2003, 2004, 2006, 2008)(Nelson et al., 2011). Elk had been suppressing aspen, alder, willow, and berry shrubs (Beschta 2010, 2012)(Larsen et al., 2003)(Ripple et al., 2004, 2012). Bison created an excessive herbivory of cottonwood (Ripple et al., 2003). Moose suffocated balsam fir populations (Nelson et al., 2011). Beaver lowered willow populations (Ripple et al., 2006). And finally, mule deer had stifled black

oak (Ripple et al., 2008). The suppressed plants all play major roles in their ecosystem such as changing climates, preventing erosion, and providing food and shelter for animals other than the large herbivores (Ripple et al., 2015). These studies took place in Oregon, Wyoming, Michigan, and Montana in various national parks that contained a declining population of apex predators. These plants and ecosystems all became suppressed after the removal of wolves or large cats. However, they all began to revive after the reintroduction of the predators.

The removal of wolves in Yellowstone because of a series of management plans in the 1920s caused wolves to become totally eradicated in the wild. The lack of wolves led to an overpopulation of herbivores, which required more plants for food. Nationwide predator management occurred with other predators such as the cougar or the mountain lion, which led to further rise in ungulate population. There was a severe drop in plant populations when wolves and other predators were gone after the 1920s. The plant herbivory was out of control, and therefore, the ecosystems were in an unhealthy state. In cases such as alder in northern Yellowstone, plant species population went extinct (Ripple et al., 2015). Areas as large as Yellowstone can create massive climate changes throughout a vast region. Not only was the national park affected by the collapse of the ecosystem, but the entire northwestern region was devastated from the effects caused by removal of plant species.

Reintroduction of wolves in the 1990s reduced the ungulate population, causing a revival of balance in the targeted ecosystems. The Alder species made a comeback within the year of wolf reintroduction (Ripple et al., 2015). The grey wolf, as well as other apex, keystone species, have the greatest effect on their ecosystem in comparison to the other members in the same biological community. With this, repopulation of herbivores began to end and the ecosystems began to return to balance. After the 1990s, there was a one hundred percent rise in plant and

predator populations and up to a thirty six percent drop in ungulate populations (Ripple et al., 2015). The revival of plant species had turned the ecological decline around and the plants returned to their jobs performing as the foundation of the ecosystem (Ripple et al., 2015).

Reintroduction of wolves to their natural habitat has reversed the effects of a mass ecological destruction that took its course over several decades. Ripple's 2015 study of wolves shows how other ecosystems with a lack of keystone species can ecologically restore the region's biological structure. Protection in this case was necessary, but since there were no wolves left, there was need for a more dramatic solution involving a complete re-establishment.

The return of the wolf to North America has benefitted many in numerous ways, however, there are some that are opposed to what is clearly a beneficial outcome. Farmers and ranchers are acting out towards the reintroduction of wolves since it poses a threat to the commerce that they use to support themselves. This issue is an understandable concern however it is a highly misinformed situation. The mortality rate caused by wolves on livestock is less than three percent (Dorrance et al., 1980). Wolves pose one of the smallest threats to livestock and still their presence is seen as the greatest threat by many ranchers. Farmers see wolves killing their livestock and turn to lethal management to remove the problem. It would seem that killing the wolves would remove the problem; however, killing only results in more livestock deaths the following year (Wiegus et al., 2014). Wolf removal not only is a detriment to the ecosystem but leads to negative consequences for the rancher.

## **Study Areas**

The goal of this research is to determine why wolf protection status changes and how to allow for coexistence between ranchers and wolves. With this goal in mind several research questions will be focused on in order to keep the general goal in mind. Such questions are:

- **Q:1** To what extent does the reliance on livestock ranching effect grey wolf conservation in the United States?
- **Q:2** Do National Parks play an effective role in US wolf conservation?
- **Q:3** What methods will be effective in allowing for the coexistence of wolves and ranchers?

The results of each question should be definitively supported by one of the two corresponding hypotheses. Each hypothesis is a brief answer to its corresponding question. A hypothesis will support each answer, but will most likely be more complex than the simple two solution scenario. The explanation behind which hypothesis supports the problem will be given with deeper insight as to why it fits in the conclusion.

- **H:1:1** The reliance on livestock ranching will greatly affect each state's effort to conserve.
- **H:1:0** The reliance on livestock will not affect state's efforts to conserve.
- **H:2:1** National parks will play an effective role in protecting wolf populations.
- **H:2:0** National parks will not play a role in protecting wolf populations.
- **H:3:1** The national protection of wolves as an endangered species, the education of ranchers in methods pertaining to non-lethal wolf management, and the compensation for livestock losses will be effective in allowing for the coexistence of wolves and ranchers.
- **H:3:0** No methods will be effective in the coexistence between wolves and ranchers.

The questions and possible solutions will lead to conclusions that could allow for coexistence between wolves and ranchers.

## **Procedures**

In terms of answering question 1, a two sample T-test will be performed using the protection status of the wolves and the percent found by taking livestock earnings and dividing it by its state's GDP. States without protection will be assigned a 1 while states with protection are assigned a 0. Alaska will be left out of the test since it is determined that livestock reliance is not a factor in the protection status of Alaska's wolves. This T-test will then give the statistical significance of the correlation between reliance and protection status. Results giving a value in the outermost .05 on a scale from 1-0 will be statistically significant while anything else will not be significant. Significance means that there is a definite correlation but insignificant will either be determined as suggestive or unsuggestive relative to the distance from significance. Suggestive results could be argued for a correlation but not one that is definite. Conclusions will be based on significance as its primary factor.

Data will be collected using public databases; most being state and federal agencies. Any other data is received from organizations' finding on topics such as population, poaching rates, coexistence methodology, etc. Several sectors of research are conducted on the variables that will influence a correlation between wolf correlation and reliance on livestock. These sectors are specifically looked at to take into account all possible scenarios where wolf protection may be influenced. Such sectors include:

Wolf population/population trends: Populations can help to show the quantity of wolves in a state and give insight into their prevalence in the state ecosystems and interaction with humans. An extremely high or extremely low population could explain protection status without

the need to regard a state's reliance on livestock. States with high populations should have so many wolves that they are beyond the point of endangered and have a population surplus that should be detrimental to a state's ecosystem. A state with a very small population will be in dire need of the wolf population and will protect it until the population becomes stable.

Protection status (federal & state): Federal protection of wolves will bar the killing of all wolves to a certain extent. This might have some exceptions such as a wolf posing a threat to the life of humans or pets. However, a treatment similar to those of the American Bald Eagle would prevent the killing of wolves across the country. Without federal protection, wolf protection is up to state governments. State governments will decide the legislation based on several factors but will ultimately decide weighing in economic need versus environmental need. State governments will provide the same level of protection as federal, however, will only protect wolves in the given state.

Management: States that don't protect wolves may have plans to lower the population. Any form of management plan could be caused by a population that is considered too high or to remove wolves that have been killing livestock. States that protect wolves may also be managing their populations with non-lethal forms of deterrence. States could also implement methods to compensate for wolf caused livestock losses.

Livestock reliance per state: Livestock reliance should be the underlying factor of whether or not a state focuses on protecting its wolves or livestock. Looking at the amount of money a state earns from livestock sales as a portion of the state GDP, a state's reliance on livestock can be determined. A high reliance should result in the management or delisted protection status of wolves. A low reliance should mean that a state will focus on environmental conservation and will be less focused on its livestock sales.

Role of National Parks: States with national parks will protect wolves within the parks.

The parks may influence the protection status of the state where it is located.

Likely solutions: The states with or without protection status need to be persuaded away from killing wolves today or in the future. A solution that will benefit both the ranchers and wolves must be found or else both will be getting in each other's way. Wolves must become less of a threat to livestock and ranchers can not continue killing keystone species.

## Results

State	Population (past)	Population (present)	Protection Status	Reliance on Livestock	Poached	Harvested
Michigan	20 (1992)	639 (2015)	protected	0.80%	0	0
Minnesota	~1,150 (1970s)	2,221 (2015)	protected	2.50%	0	0
Wisconsin	25 (1979)	746 (2015)	protected	2.60%	0	0
Idaho	15 (1994)	770 (2014)	unprotected	7.30%	0	4
Montana	~55 (1994)	554 (2014)	unprotected	4.70%	0	12
Oregon	~30 (1997)	77 (2014)	unprotected	0.80%	2	0
Washington	~20 (2000)	68 (2014)	protected	0.70%	0	11
Wyoming	66 (1996)	333 (2015)	protected	3.10%	0	0
Arizona		44 (2015)	protected	0.60%	0	
New Mexico		43 (2015)	protected	2.10%	0	
Alaska	300 (1996)	11,200 (2015)	unprotected	0%	0	1,200

The two variable T-test resulted in a P value of .158. This P value is not statistically significant, meaning that there is no proof of causation between a state's reliance on livestock and its wolf protection status.

The population past population values were taken from the earliest account of reintroduction into the state. This reintroduction was of course prior to the ~70 year removal from North America. Different states had wolves reintroduced at different times. The final population values were recorded between the years of 2014 and 2015, with the state's protection

status corresponding to the same year. Arizona and New Mexico had been reintroduced a few years prior to the other state's final population values, therefore there is no past population value.

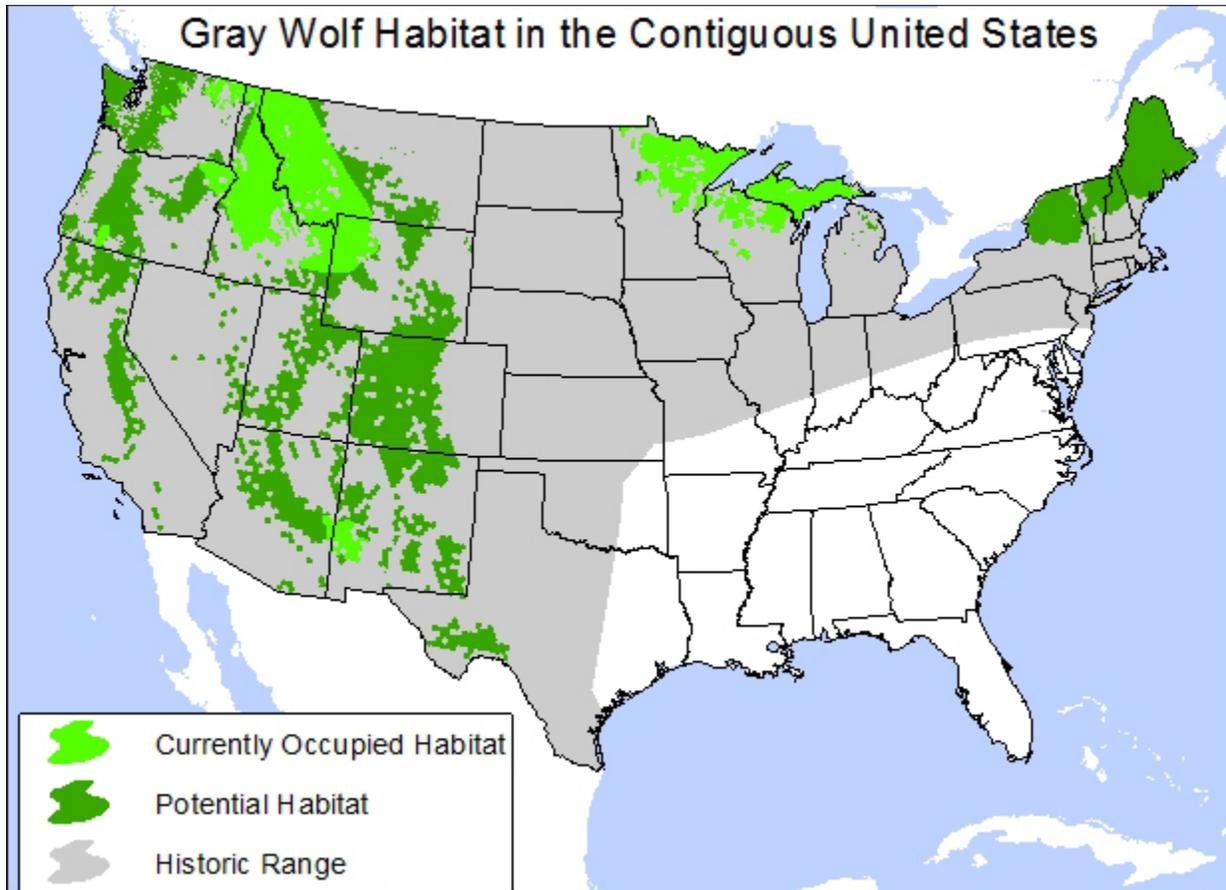
Harvested wolves are wolves that are killed for a bounty with the state's permission. The 11 wolves in Washington that were harvested were bounties designated to certain research facilities. This incident was not considered as interference with the wolf's protection status in the state despite the legal killing of wolves. The state of Alaska did not give out hunting permits statewide and would not know a precise number of harvested animals. For more rural areas, an estimate based on market values and exportation of wolf products produced the estimate for the total number of harvested wolves in the state.

Oregon was the only state with recorded poachings within the given time frame. While the state did not protect its wolves using an endangered species list, Oregon still used a permit system to allow for the killing of wolves. The wolves are still unprotected despite a need for permits to kill.

## **Discussion**

The results of the two variable t-test were not significant, but were statistically suggestive. Statistically suggestive results can help to show correlation without causation. There is a clear difference when comparing the data, however there are data points that prevent significance. Oregon brings the unprotected average down where Wyoming brings the protected average closer to the protected average. Outliers of both statuses created statistically suggestive data. This could have been fixed were there more data points, but there are only ten states with gray wolves. With this result, it can be concluded that there is a correlation between a state's protection status and its GDP reliance on livestock. The results support the hypothesis H:1:1,

with some hesitation since causation cannot be proved. Despite this fact, the P value is very much in favor of showing that the reliance on livestock ranching greatly affects each state's effort to conserve. Using these results, economic predictions can foresee a wolf's danger of interfering with livestock as a state's GDP reliance increases. Action can be taken to promote coexistence before damage is done to both sides.



National Parks were found to play a smaller role in the protection of wolves than anticipated. What was found supports H:2:1 where national parks will played an effective role in protecting wolf populations to a lesser extent. While national parks don't allow for the killing of wolves on federal land, the parks don't influence state protection statuses or any effort to conserve outside the park. The federal component could be playing a much larger role in influencing state legislation. The two national parks containing gray wolves in the continental

US are Yellowstone and Isle Royale. Isle Royale is an island isolated from humans in the middle of Lake Superior. The park isn't expected to influence state protection status since its isolation protects wolves without much effort from national agencies. Yellowstone on the other hand encompasses land in three states: Idaho, Wyoming, and Montana. Two of these states have wolves listed as unprotected whereas a large portion of their land has been designated to defending wolf populations. While there is little to no influence in this aspect, national parks do still protect wolves effectively within their borders.

What was found pertaining to coexistence greatly supports H:3:1. According to Parr and Wolf Awareness Inc., there is an easy solution to the lack of coexistence : non-lethal wolf management. A way to deter the wolves without killing them will protect the wolves, the livestock, and the wellbeing of the ranching community. Some obvious and effective methods of non-lethal protection include guard animals, surveillance, and electric fences. These methods are cheap and save money in comparison to what would be lost due to the loss of livestock. Methods such as wire fencing or even fladry are extremely cheap and highly effective with little need for maintenance. These methods are often effective for an extended duration of time, but can become arbitrary if wolves figure out their way in regardless. This downside is often inevitable, however can be withheld for up to five years before wolves learn their way through. Coexistence gets more expensive with range riders, sometimes armed with incapacitating ammo, who act as guards and generally scare wolves off without ever interfering. Ranchers often times already have employees acting as the defense of their livestock but could take better advantage of the use of horse riding surveillance to ensure safety. Guard animals are less expensive, but can be just as effective as range riders. Animals including dogs, horses, donkeys, and llamas will all deter wolves from hunting the easy prey that farm animals present.

States protecting wolves on their endangered species list compensate for the livestock lost due to wolf predation. This is a great solution and discourages a desire to shoot wolves for any losses. Everything would seemingly work out except for the fact that livestock lose weight as juveniles due to the “landscape of fear” caused by the presence of wolves. This in turn means that wolves stress mother cows and cause inefficient foraging behavior leading to less food for calves. The calves of 18 Montana ranches were on average 22 pounds less. This translated to a loss of \$6,679 for an average ranch per year. This loss is not seen by state governments as a compensable issue.

The only hindrance standing in the way of coexistence is the lack of knowledge that ranchers have in methods allowing for coexistence. Ranchers that have been given the green light to kill wolves by state legislation haven't been exposed to the previously mentioned methods. Being educated in the dangers killing wolves, both for the environment and livestock, would help promote a necessity for coexistence. The data showing correlation between state protection status and its reliance on livestock can now help to focus the education process to states that don't protect wolves. With the insight into the problem, effort of prevention can be taken with much greater accuracy and intention of producing a better outcome. This supports the hypothesis that protection of wolves as an endangered species, the education of ranchers in methods pertaining to non-lethal wolf management, and the compensation for livestock losses is effective in allowing for the coexistence of wolves and ranchers.

The changes suggested towards California's Department of Fish and Wildlife “Draft Wolf Plan,” by The Center for Biological Diversity, gives methods of gray wolf protection. The plan gives a recommended set of guidelines for the legislation to follow the reintroduction of wolves to California. The following points have been adapted from the list of guidelines and very

much can apply to the mentality that all states with wolves should have in promoting coexistence.

- Prohibit the killing of wolves for depredations on public lands and require use of nonlethal measures before resorting to any lethal control of wolves.
- Thresholds for population numbers must be raised.
- Prioritize recovery, conservation, and the securing of funds from state/federal sources.
- Wolves, coyotes and bears should not be killed to conserve wild ungulate populations.
- Change laws regarding punishment of illegally killing wolves due that have been mistaken identification as coyotes.
- Show potential economic benefit to local and regional economies from reestablishment of wolves.
- Protect, restore, and enhance wolf habitats as part of the State Wildlife Action Plan.
- Improve human social tolerance for wolves and show how attacks by carnivores are due to misconduct by humans.

There are several glaring problems with this study. First is how the politics of wolf conservation are always changing. Conservation status can change between protected and unprotected within a matter of months. In addition, not every poaching or wolf harvested can be recorded. The data presented is recorded data that does not include estimates of the true number of wolves poached or harvested. Wolves in Arizona and New Mexico have not been around long enough to alter any policies based on population size. This fact could change as soon as populations reach higher numbers. The state GDP and reliance on livestock were also taken during the year of 2012 when census number had recorded specifics about state economies. This data in turn is being used to analyse population and protection status of 2015. Since there are no

other points of reference that contained the necessary economic data, the results are as close as they can be to accurate.

Future research could look at the reintroduction of wolves into California. As populations rise and change within several years of reintroduction, it will be interesting to see how it influences protection policy as more wolves interact with humans. The same can be said for Arizona and New Mexico as their populations rise. There is still much progress to be made in pioneering the way in which ranchers and wolves can coexist. Ingenuity and education can make the problems greatly affecting the environment and the ranching community an obsolete part of the past.

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