The Return of Gray Wolves to Yellowstone National Park: A Bioethics Case Study

Michael Schwartz

Excelsior College Department of Biology & Natural Sciences

Abstract

For many conservation biologists, ecologists, environmentalists, and wildlife lovers, the reintroduction of the gray wolf (*Canis lupus*) to Yellowstone National Park in 1995 and 1996 was heralded as a win for the reestablishment of biodiversity, the return to a more ecologically functioning national park, and an overall rewilding success story in a world that is otherwise on the brink of losing a number of species in what is colloquially known as the Sixth mass extinction. There are, however, some bioethical considerations to be made regarding the decision to reintroduce gray wolves to Yellowstone National Park, particularly concerning human-wildlife conflict and its impact on the ranching communities of Idaho, Montana, and Wyoming. The following paper describes this bioethical dilemma, identifies relevant stakeholders and how their positions relate to wildlife conservation decision-making within the context of preserving a sustainable population of gray wolves in Yellowstone National Park, gives a brief overview of how data is used by stakeholders, and provides additional recommendations for how this bioethical dilemma might be resolved for the benefit of people and wildlife.

Female wolf (*Canis lupus*) in Yellowstone National Park. Photo courtesy of Wikimedia Commons.

Introduction

While wolf attacks on humans are historically low (McNay, 2002), gray wolves (*Canis lupus*) still pose a threat to human livelihoods, particularly as their population grows (Bangs & Fritts, 1996) near the livestock industry in the western United States.

For many farmers and ranchers living near Yellowstone National Park, the loss of livestock can unleash a heavy financial burden on their way of life, not to mention the concomitant price increase for consumers who purchase beef throughout the United States; prices would likely increase due to the need for farmers to make up for their fiscal losses.

There is a growing concern among the ranching community living within the vicinity of Yellowstone that an increasing population of wolves will result in more livestock depredation and a subsequent loss of income. Likewise, conservationists from a variety of scientific backgrounds worry that livestock owners might take punitive action against any wolves located in the vicinity of a livestock attack, offending wolf or not. What makes this an especially important dilemma to resolve is that the concern by ranchers is quantitatively validated.

The year 2016 in Wyoming saw the deaths of livestock by wolves reaching an alarmingly high 243 individuals, which included 154 cattle, 88 sheep, and a single horse, exceeding the 2009 record of 222 (U.S. Fish and Wildlife Service, 2016).

The successful reintroduction of *C. lupus* to Yellowstone National Park in 1995 and 1996 (Carroll et al., 1997) is largely seen as a victory by stakeholders consisting of conservation biologists, wolf enthusiasts, environmentalists, the tourism industry, state and federal government and other related administrative agencies, and the Native American community. Yet it is imperative to understand the concerns of the stakeholders comprised of ranchers, farmers, and additional livestock owners living under threat of human-wildlife conflict in order to come up with resolutions that will not only protect highly-valued livestock, but also ensure that any lethal retaliation taken against offending individual wolves or entire packs does not reduce their population to unsustainable levels.

Overview of Stakeholders

Stakeholders involved in gray wolf reintroduction come from a variety of backgrounds. But before delving into the role these stakeholders have or should play in this particular process, it is necessary to briefly outline their importance based on the different biodiversity values held (Soulé, 1985; The Environmental Literacy Council, n.d.) by those stakeholders who either believe in the importance of wolves as residents of Yellowstone, or who are opposed or at least skeptical of an expanding wolf population.

For many environmentalist stakeholders, gray wolves hold an intrinsic, ethical, and aesthetic value (Soulé, 1985). These are considered non-use values under the greater auspices of the utilitarian values of biodiversity (Soulé, 1985; The Environmental Literacy Council, n.d.). In essence, simply knowing that gray wolves exist is a value in and of itself.

The same might also be said regarding what is known as a bequest value (The Environmental Literacy Council, n.d.), otherwise known as the value that comes from the knowledge that an intrinsic natural resource such as gray wolves will be there for future generations.

Federal and state agencies along with associated conservationists (ecologists, wolf biologists, etc.) and the tourism industry, meanwhile, would likely have a more pragmatic value system of biodiversity. While degrees of intrinsic value might be held, varying from individual to individual or institution to institution, these stakeholders see gray wolves through the lens of direct use (goods) and indirect use (services) values (The Environmental Literacy Council, n.d.). For example, ecologists and wildlife biologists would likely view wolves as an indirect value, providing not only an ecologically functional role within an ecosystem as a trophic cascade species, but also giving researchers a chance to study them for the purposes of advancing science and education.

The tourism industry also shares an indirect value that gray wolves provide by bringing in revenue from people who journey to Yellowstone to see them. This, too, is similarly echoed in state and federal agencies, who strategically rely on taxpayer dollars to support biodiverse nature parks like Yellowstone, made all the more important with the addition of a keystone and intrinsically valued species.

Finally, the Native American communities see wolves as both culturally and spiritually significant, which is as much an indirect value as it is an aesthetic (non-use) one. In this context, wolves are regarded highly through stories, myths and legends, songs, ceremonies, dances, and even the application of human names (Fogg et al., 2015), giving added weight to Native Americans not only as stakeholders, but as indigenous peoples who are descendents of those who lived alongside wolves long before the coming of Europe. The following is an excerpt taken from Horace Axtell, a Nez Perce Tribal Elder who took part in the 1995 gray wolf reintroduction:

> I sang one of our religious songs to welcome them back. Then I looked into the cage and spoke to one of the wolves in Nez Perce; he kind of tilted his head, like he was listening. That felt so good. It was like meeting an old friend (Littell, 2006; Wright, 2014).

In summary, those in favor of wolves living in Yellowstone include the United States Fish and Wildlife Service, who are responsible for enacting wildlife management policies that support wildlife conservation, environmentalist citizens who, for one reason or another, believe it is morally right to have wolves in Yellowstone, and the tourism industry operating in and around Yellowstone National Park in Idaho, Montana, and Wyoming that rely on a healthy, robust wolf population to bring in revenue from tourists hoping to see wolves in their natural habitat, not to

mention state and county governments who also benefit from tourism. Native Americans, meanwhile, have cultural, historical, and spiritual reasons for supporting wolves in the park.

By contrast, ranchers, farmers, and others connected to these two industries concerned about the threat of human-wolf conflict may hold more of a direct use value system when it comes to the land itself, but not necessarily share a value system for *C. lupus*. For these stakeholders, land holds value for the goods it provides them (grazing for livestock), in addition to the indirect use value of services that it provides their respective businesses through different farming and cattle ranching enterprises.

Bioethical Principles and Theory Considerations

Considering that a hypothetical end goal would be to protect both ranching investments (livestock) and gray wolves, it might seem likely that a utilitarian approach should be adhered to, beginning by stakeholders in favor of wolves remaining an integral part of Yellowstone designing frameworks and implementing strategies that take the needs of those concerned about the effects of livestock depredation into serious account.

Though Callahan (2012) clearly states that utilitarian perspectives can vary within different stakeholder groups, which would then negatively impact wolf conservation and wolf conservation efforts, she appears to make the case for a utilitarian approach spearheaded by conservation biologists and wolf management experts specifically after analyzing the results of a study that assessed attitudes and tolerance of wolves in Washington State.

Utilizing qualitative surveys mailed to a sample population of 1,500 Washington State residents, Callahan (2012) was surprised to discover that 48.3% of her respondents approved of wolves, while 18.1% disapproved. Moreover, 57.2% indicated that a potential danger from wolves wasn't an adequate reason to disapprove, and that disapproval of wolves by suburban residents was surprisingly greater than by people living in rural areas (Callahan, 2012).

Based on the results, Callahan stresses the need for wildlife management officials to avoid any, predetermined stereotypes of stakeholders, working instead to unite them in an effort to minimize human-wildlife conflict. The latter, Callahan argues, would be best accomplished if wildlife managers intentionally bridged divides between those stakeholders, "believed to hold irreconcilable differences," including the conservation biologists responsible for wolf reintroduction and those who hold wolves in high aesthetic regard (Callahan, 2012).

To reiterate, the bioethical theory of utilitarianism, only when specifically utilized by wildlife management experts, could be applied across stakeholder groups that hold to different utilitarian value systems, including - but not limited to - a utilitarian view of nature (environmentalist

stakeholders), a utilitarian view of lifestyle protection (ranchers), and a utilitarian view of those who hold wildlife in a spiritual regard (Native Americans). This is particularly relevant in that it would unify stakeholders under one hypothetical cohesive theme - the pursuit of satisfaction for all stakeholders. For wildlife managers specifically, that theme would be maximizing satisfaction to each group for the purposes of ensuring a sustainable gray wolf population and protecting livestock.

Callahan (2012) specifically hypothesized that wildlife managers should avoid unnecessary conflicts with stakeholders by building community support, writing that, "through an understanding of wolf ethics, policymakers can formulate and modify policy decisions to benefit both humans and wolves in a shared environment."

In short, and in addition to utilitarianism, Callahan appears to be underscoring the principle of beneficence, where bringing about the most favorable results would be particularly paramount. This is certainly an essential component, but again, it would likely depend on who is defining the favorable result. In other words, beneficence is in the eye of the beholder; the most favorable results for one group of stakeholders might not necessarily line up with the most favorable results for another group, which could pose as problematic within this particular context.

Finally, Callahan writes that, "a worthwhile goal is to minimize wolf-human interactions and to respond effectively and efficiently to the conflicts that arise." When applied to the theories and principles of bioethics, this could be interpreted in one of two different ways.

First, the theory of care ethics might be applied when dealing with communities that fear wolf attacks on livestock. This would especially be true in cases of dependence and interdependence, both from those relying on wildlife management experts to intervene in any human-wolf conflicts, and wildlife management experts who must rely on communities such as ranchers and farmers for transparency, accountability, and honesty (e.g. wolf sightings, punitive action taken, livestock movements) in order to determine best methods for safeguarding livestock, thus promoting the interest of the stakeholder.

Second, non-maleficence could certainly be applied, as wolf management experts would seek to incorporate methods of mitigating conflict that would result in a sustainable wolf population. This would certainly stress the need to do as minimal damage as possible, particularly in instances where any re-offending wolf might need lethally dealt with.

Decision-Making Framework

Given each of these value systems and bioethical descriptions as it pertains to each stakeholder group, it becomes more clear that each group has a vital role to play in decision-making over the

future of *C. lupus* in the region, though ultimate decision making should likely fall into more of a tiered system of importance based on a stakeholder group's objectivity rather than having every group on equal footing.

Recall the hypothesis that wildlife managers should avoid unnecessary conflicts with stakeholders by building community support (Callahan, 2012). Looking at it from a utilitarian point of view, it would then make more sense to have a slightly neutral stakeholder party as the arbiter between the two primary camps of stakeholders - one group of different stakeholders being decidedly more pro gray wolf, the other being skeptical, fearful, or decidedly against wolf recovery efforts. In this case, primary decisions should likely fall to the U.S. Fish and Wildlife Service.

Some may argue that this stakeholder group might be compromised given that part of it is composed of scientists from varying backgrounds that are likely more prone to advocate for gray wolf protections. But it should be noted that those working in wildlife management do not exclusively align themselves with absolute wildlife protection efforts. For example, wildlife technicians are often called upon to neutralize a problem animal deemed a threat to humans, livestock, or both. Additionally, recent efforts are underway by the U.S. Fish and Wildlife Service to delist gray wolves from the endangered species list (Bles, 2019).

Whether one agrees with this view by the U.S. Department of the Interior and the U.S. Fish and Wildlife Service's (which would open the door to wolf hunting), the case can be made that the institution is more of neutral body regarding decisions that would take into account the differing perspectives of stakeholder groups.

Considering the historical relationship that Native Americans have with wolves, it would also be beneficial to place them toward the top of the stakeholder tier in terms of priority and decision-making. This is not necessarily meant to downplay or ignore concerns coming from the ranching industry, but it would be foolhardy to ignore a group that has already suffered greatly from historical oppression and modern day marginalization.

This leaves the remaining groups - environmentalists, the tourism industry, and the ranching industry - at the bottom level of the tier concerning decision making. Again, this does not nullify or in any way downplay their respective concerns. But it should be the job of a more neutral entity to consider every opinion, find ways of unifying the stakeholders (Callahan, 2012), and apply adaptive management strategies that will ensure a utilitarian approach in the overall goal of satisfying every stakeholder involved, which will be touched on later.

Data Use by Stakeholders

Concerning the use of data as it relates to human-wolf conflict in Yellowstone National Park, it is a safe bet that stakeholders such as conservation biologists, ecologists, and other scientific institutions and individuals do their utmost to utilize findings to reach objective conclusions, to underscore fairly unbiased positions, and to make fairly sound recommendations. (The word fairly is used here due to the fact that bias - implicit or explicit - is almost always unavoidable to one degree or another.)

For example, Licht et al. (2010) observed that certain population segments of gray wolves (*Canis lupus*) were removed from the endangered and threatened species list, largely due to what was deemed as wolf successful recovery strategies. With the understanding that wolf conservation is still paramount for regulating ungulate populations and restoring biodiversity, they proposed a different wolf conservation paradigm, emphasizing the recovery of the ecosystem in lieu of single species management (Licht et al., 2010). In essence, they argued for a more heavily managed, smaller population of wolves to be reintroduced in addition to existing free-ranging wolves, largely for the purposes of gaining benefits that are educational, scientific, ecological, recreational, and economically beneficial in nature (Licht et al., 2010).

Where evidence came into play was providing a comprehensive layout of the ecological and economic benefits that wolf reintroduction has already brought to Yellowstone National Park, complete with proposed benefits that a small, managed population would also usher in. These ecosystem and other human services were adequately mapped out in their study, *Using small populations of wolves for ecosystem restoration and stewardship*. Moreover, they even made a case for barriers in certain sections of Yellowstone to help mitigate human-wolf conflict, showcasing their use to help conserve predators in other parts of the world, including livestock protection fences in Australia for dingos (*Canis lupus dingo*), park fences in South Africa to protect livestock and people from lions (*Panthera leo*), while underscoring the fact that visitors from around the world report positive experiences seeing wildlife (Licht et al., 2010).

As is clearly demonstrated, such a proposal comes with scientifically-backed evidence that showcases successful predator conservation strategies carried out elsewhere around the globe. By contrast, biologist Mike Phillips, who was an integral member of the 1995 gray wolf reintroduction to Yellowstone, had a tough time convincing Colorado ranchers to follow suit with proposed wolf reintroductions to the Centennial State (Condon, 2018).

After a 60-minute, fact-driven presentation to stakeholders, including concerned ranchers and hunters, Phillips was essentially called a liar by J. Paul Brown, a former Colorado state House representative (Condon, 2018). The following is a brief illustration of the differences between facts and hyperbole:

> J. Paul Brown, a former Republican state House representative from southwest Colorado, said ranchers own the majority of private lands in western Colorado. “They don’t want wolves in Colorado,” he said. Brown introduced a bill while in the state House to nullify a 1992 vote by residents of Colorado to overturn restrictions on when black bear could be hunted. He dismissed Phillips’ data-driven study by noting that figures lie and liars figure. Phillips, who serves as a state senator in Montana, retorted, “It’s all good to stand up and say something, but talk is cheap. Give me some numbers.” That was a challenge to Brown to show data that contradict the numbers Phillips was using (Condon, 2018).

Note how Brown deemed himself the spokesperson for the ranching industry, including those at the forum and those absent. Note also his dismissal of hard data, which is a common occurrence among many stakeholders opposed to predator reintroductions when manufacturing political ploys. Clearly this is not scientific analysis, nor is it based on scientific data.

It would not be fair, however, to cast the cattle ranching industry (or representative of the cattle ranching industry) in a completely negative light. As an example of the use of good science, Oregon State University, the University of Idaho, and the USDA Agricultural Research Service, with the support and cooperation of members of the cattle ranching industry as stakeholders, spearheaded a study called the Cattle-Wolf Interactions Research Project. This was done to best evaluate possible effects from the presence of gray wolves on cattle rangeland areas (Williams et al., 2017) Here is a small portion of the methodology used to determine such effects:

> The research was conducted in three study areas of high wolf presence in west-central Idaho and three study areas of low wolf presence in northeastern Oregon. Mature beef cows (*Bos taurus*) were tracked with custom-made GPS collars (Figures 1, 2, and 3) to record individual cow position at 5-minute intervals throughout the grazing season. A minimum of 10 cows on each of the 6 study areas carried GPS collars each year (Williams et al., 2017).

Ultimately, the study found several high-risk areas where livestock were at considerable risk from wolf depredation (Williams et al., 2017).

The primary goal of such as study was to make recommendations for improved livestock husbandry practices, including avoiding high-risk areas (as identified and determined by the study), adjusting the distribution of cattle and rotation schedules of pasture in order to avoid unnecessary encounters with wolves, and utilizing risk maps to determine if and when predation occurred, take additional precautionary measures, and even locate missing cattle (Williams et al., 2017). This increased understanding of the spatiotemporal wolf-cattle interface will thus empower ranchers with ways of protecting their livestock, which in turn protects existing wolf populations.

It is here that the cattle ranching industry relied on science to support their concerns, which were accurately portrayed, and ultimately worked in their favor, not to mention the gray wolves who inhabit these critically important habitats.

Adaptive Management Recommendations

Adaptive management - also known as adaptive resource management or adaptive environmental assessment and management - is a highly structured and iterative (computational) method of decision-making when confronted with uncertainty (Holling & Sundstrom, 2015). Moreover, and according to Holling (1978), it is a tool that can and should be utilized not just to change a system, but to learn more about that system. In other words, improvement exists not as a final goal or ultimate destination to be reached, but as a continual refining process, largely based on an objective, measurable, and constant assessment of successful (and unsuccessful) strategies.

Nowhere is this assessment and management system, which includes continued monitoring and adaptation after implementation (Susskind, Camacho, & Schenk, 2011), more important than in its relationship with natural resource and other environmental challenges. But how does this factor in to implementing solutions that carry not just an associated environmental challenge, but a bioethical dilemma to boot?

Looking once again at the dilemma of human-wolf conflict with ranchers and their livestock after the successful 1995/96 reintroduction of gray wolves (Canis lupus) to Yellowstone National Park (Carroll et al., 1997), Fox and Bekoff (2011) specifically point to a failure of integrating bioethical principles by governing stakeholders who exhibit greater degrees of autonomy over how and to what extent natural resources are to be managed, protected, and otherwise maintained.

Fox and Bekoff (2011) allude to adaptive management by writing in support of strategies that would support coexistence, while urging wildlife agencies to consider all stakeholders and invest the right type of resources that would best inform people on ways of mitigating conflict between domestic animals, their human owners, and predators. Additionally, they argue that ethics and values must be integrated into management and wildlife policy, which means asking the hard ethical questions and learning from past errors (Fox & Bekoff, 2011).

More specifically, they challenge the status quo of state and federal wildlife authorities, arguing for the increased allowance of participation by the public within a decision-making context (Fox & Bekoff, 2011), with a focus on adaptive management based on a perceived failure of incorporating utilitarianism as it relates to addressing stakeholder concerns.

Given that Fox and Bekoff are staunch wolf advocates, it comes as no surprise that their recommendations are holistic and interdisciplinary in nature, including listening to concerns expressed by the community, investing in resources that educate for the purposes of sensitizing and increasing the tolerance levels of certain stakeholders toward gray wolves, and engaging groups of stakeholders that would not otherwise communicate with one another, due primarily to ideological, pragmatic, or valuation differences (Fox & Bekoff, 2011).

Moreover, they describe wolves as, "a prototypical example of an animal whose reputation precedes them. They bring out extremes in human emotions from almost romanticized idolatry and reverence to blatant contempt and hate," thus complicating what might otherwise be a more unified accord from diverse groups stakeholders concerning gray wolf protection. (There are arguably very few, if any, stakeholder groups that would call for the total eradication of white-tailed deer. Gray wolves, however, are not so fortunate.)

Lastly, Fox and Bekoff (2011) write that while many would agree that ethics should play a centralized role in projects involving animal use, it is interesting to observe that in a number of books written about the interactions between humans and animals, including the conservation of carnivores, there is often a large gap when it comes to ethics. This, according to Fox and Bekoff, must change. They add that wildlife management experts and researchers are under a growing level of scrutiny by an increasingly educated and concerned public who question their perceived lack of morality and compassion and the degree of authority wielded. This is especially true of problem wolves that are often killed unnecessarily by lethal means, often by hunters that do not abide by sustainable standards. Once more, such observations not only underscore a more utilitarian and holistic approach by administrators, but also one in which adaptive management strategies should be planned, implemented, monitored, and altered if and when necessary.

With all of this in mind, how would it be possible for an administrative institution like the United States Fish and Wildlife Service to ethically solve such a dilemma? The short answer would be to outline an adaptive management strategy, a framework based largely on round-tables with different stakeholder groups, quantitative studies, qualitative surveys, interviews, and public meetings to encourage debate, civil discourse, recommendations, and even an incorporation of citizen science projects that could help promote dialogue between groups that are, in many ways, diametrically opposed (e.g. a citizen environmentalist group and ranchers living near Yellowstone).

The following is a rough framework of a hypothetical plan of action:

1) Hold a one-week series of introductory round-table discussions, spearheaded by elected stakeholder leaders.

2) At the same time, researchers will come up with a comprehensive qualitative/quantitative assessment that will be handed out to members of each stakeholder group (e.g. Native Americans, citizen environmentalists, ranchers, farmers, hunters, etc.)
3) Conduct door-to-door interviews, especially with stakeholders that are reticent of wolf conservation, and write down list of concerns.
4) Hold a public meeting where all concerned stakeholders can have an opportunity to voice opinions, ask questions, and debate. The meeting would be chaired by a panel of experts from each stakeholder group.
5) Finally, hold a one to two-week round-table to write an adaptive management strategy, one that will attempt to meet all stakeholder concerns.

It must be reiterated that adaptive management strategies are subject to continued monitoring and evaluation, and would evolve in response to any and all successes and failures upon its implementation.

Final Suggestions

Those opposed to continued gray wolf conservation strategies will arguably be those who stand to lose the most from their presence, namely farmers and ranchers who depend on livestock in order to make a living. While learning to live with wildlife is paramount in a time when charismatic creatures like wolves are fast disappearing, ranchers certainly have a right to voice their concerns about the dangers that a growing wolf population can pose. This means helping people in order to save wildlife, which is ultimately how this dilemma can be resolved.

Similar to conservation biologists working with pastoral communities to solve human-wildlife conflict in sub-Saharan Africa, it becomes more clear that this dilemma is vitally important to continue researching in order to see how American conservationists involved in wildlife management might be able to mitigate the threat that humans and wolves pose to one another. Wildlife cannot be better protected unless people are taken care of. In other words, people may not necessarily care about the fate of wildlife unless their voices are heard and action is taken to better secure their livelihoods.

Conclusion

Gray wolves belong in Yellowstone National Park, both from a moral perspective as well as an ecological, cultural, and economic one. Moreover, conservationists are duty-bound to protect people and their assets from wildlife, not only to save wildlife, but to show those living with the threat of predator species like wolves that they care just as much about them as they care about the fauna with which they share the lands.

Acknowledgements

I would like to thank my wonderful wife, Rachael, for her love and support as I navigate the challenging and rewarding road of biology in the hopes of earning a career in wildlife biology. I would also like to thank my professor of evolutionary biology, Linda Armstrong, who encouraged my interest in phylogeny, speciation, and introgressive hybridization - particularly in North American gray wolf (*C. lupus*) and coyote (*Canis latrans*) populations. Last but certainly not least, my sincerest thanks goes out to bioethics professor, Aaron Adams, for his positive feedback, constructive criticism, and willingness to answer any question I had during my time as his student. Professor Adams has been a joy to learn from, someone I highly recommend to any student looking to gain a deeper knowledge and understanding of bioethics as it relates to biology and decision-making.

References

Bangs E., Fritts S. (1996). *Reintroduction of the gray wolf to central Idaho and Yellowstone National Park*. Wildl Soc Bull 24:402–413

Bles, L. (2019, March 13). U.S. Fish and Wildlife Service announces gray wolf recovery. Retrieved from https://wildlife.org/u-s-fish-and-wildlife-service-announces-gray-wolf-recovery/

Callahan, J. (2012). *Ethics and wolf management: Attitudes toward and tolerance of wolves in Washington State*. (Master's Thesis). San Jose State University. San Jose, USA.

Carroll, N., Dunning, J. B., Freeman, A. J., Halberg, C. A., & Morgan, J. (1997). *Reintroduction of the gray wolf to Yellowstone National Park: A case study.* Retrieved from http://ethics.iit.edu/eelibrary/biblio/reintroduction-gray-wolf-yellowstone-national-park-case-study/

Condon, S. (2018, February 7). Gray wolf reintroduction talk has ranchers seeing red. Retrieved from https://www.aspentimes.com/trending/gray-wolf-reintroduction-talk-has-ranchers-seeing-red/

Fogg, B. R., Howe, N., & Pierotti, R. (2015). Relationships between indigenous American peoples and wolves 1: Wolves as teachers and guides. *Journal of Ethnobiology*, 35(2), 262-285. doi:10.2993/etbi-35-02-262-285.1

Fox, C. H., & Bekoff, M. (2011). Integrating values and ethics into wildlife policy and management—Lessons from North America. *Animals*, 1(1), 126-143. doi:10.3390/ani1010126

Holling, C. S. (1978). *Adaptive environmental assessment and management.* Hoboken, NJ: John Wiley & Sons.

Holling, C. S., & Sundstrom, S. M. (2015). Adaptive management, a personal history. *Adaptive Management of Social-Ecological Systems*, 11-25. doi:10.1007/978-94-017-9682-8_2

Licht, D. S., Millspaugh, J. J., Kunkel, K. E., Kochanny, C. O., & Peterson, R. O. (2010). Using small populations of wolves for ecosystem restoration and stewardship. *BioScience*, 60(2), 147-153. doi:10.1525/bio.2010.60.2.9

Littell, R. (2006). *Our Brother's Keeper*. In National Museum of the American Indian. Pp. 22-27, Vol. Spring. Washington D.C.: Smithsonian Institution.

McNay, M. E., & Alaska. Division of Wildlife Conservation. (2002). *A case history of wolf-human encounters in Alaska and Canada*. Juneau, AK.

Soulé, M. (1985). What is conservation biology? *BioScience*, 35(11), 727-734. doi:10.2307/1310054

Susskind, L., Camacho, A. E., & Schenk, T. (2011). A critical assessment of collaborative adaptive management in practice. *Journal of Applied Ecology*, 49(1), 47-51. doi:10.1111/j.1365-2664.2011.02070.x

The Environmental Literacy Council. (n.d.). Biodiversity. Retrieved from https://enviroliteracy.org/environment-society/environmental-resource-economics/biodiversity-2/

Williams, J., Johnson, D., Clark, P., Larson, L., & Roland, T. (2017). Wolves—A primer for ranchers. *OSU Extension Catalog*. Retrieved from https://idrange.org/wp-content/uploads/2018/02/em9142.pdf

Wright, J. L. (2014). *Lessons from wolves: stakeholder perspectives and experiences with northern rocky wolf reintroduction (master's thesis)*. Retrieved from https://cedar.wwu.edu/cgi/viewcontent.cgi?article=1336&context=wwuet

U.S. Fish and Wildlife Service. (2016). Wyoming wolf recovery 2016 annual report. Retrieved from https://www.fws.gov/mountain-prairie/es/wolf-2016.php

Return of Gray Wolves to Yellowstone