

MAINTAINING LONG-TERM SUSTAINABILITY OF THE NATURAL WORLD:
REINTRODUCTION OF GRAY WOLVES (*Canis lupus*) TO
OLYMPIC NATIONAL PARK

by

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ABSTRACT

MAINTAINING LONG-TERM SUSTAINABILITY OF THE NATURAL WORLD: REINTRODUCTION OF GRAY WOLVES (*Canis lupus*) TO OLYMPIC NATIONAL PARK AS A CASE STUDY

James Blacklaw

The Olympic Mountains in northwestern Washington State are home to a unique mixture of plants and animals, some of whom are endemic and/or listed as threatened or endangered under the Endangered Species Act (ESA). Of the 15 threatened or endangered species currently listed for the Olympic Mountains, only the gray wolf (*Canis lupus*) was deliberately eradicated by early European settlers to the region. The loss of this apex-predator was an unmitigated disaster for this rare ecosystem. It is important to reestablish gray wolves in Olympic National Park (Olympic NP) to: A) recover lost ecosystem services, B) maintain prey and mesocarnivore populations at sustainable levels within the park and adjacent lands, and C) provide federally protected habitat for wolf population recovery objectives of Washington State. However, wolf reintroductions are controversial and thus require an examination into possible common ground solutions. Using Human Dimensions theory as a practical framework, this thesis investigated wolf and human coexistence in the United States. Additionally, this thesis examined ecological, social, and political influences on land management decisions made by agencies such as the National Park Service. Using an internet-based snowball survey, this research focused on people in the agricultural sector that resided in the Olympic Peninsula Region, near projected wolf recovery zones to: A) assess their natural resource conservation social norms and values, B) ascertain demographically which subgroups support/do not support reintroductions and why, and C) determine if common ground solutions are possible. Findings from the survey indicate that among this target audience, there is more support than opposition to wolf reintroductions at Olympic NP and highlighted areas of consensus among stakeholders. This thesis recommends that a randomized survey of the Olympic Peninsula be conducted to verify the findings of this pilot study, that Olympic NP immediately begin a wolf reintroduction social marketing campaign aimed at improving the attitudes that stakeholders have towards wolves, and to not reintroduce gray wolves at Olympic NP until at least the first two recommendations have been addressed. If biologists refuse to learn from mistakes made at Yellowstone National Park after reintroductions in 1995, gray wolves at Olympic NP likely will be the ones to suffer from history repeating itself.

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CHAPTER 1: Introduction

“The real wealth of the Nation lies in the resources of the earth—soil, water, forests, minerals, and wildlife. To utilize them for present needs while ensuring their preservation for future generations requires a delicately balanced and continuing program, based on the most extensive research. Their administration is not properly, and cannot be, a matter of politics.”

-Rachel Carson

In European folklore and mythology, wolves symbolize “... our fears and our idealizations of wilderness ...” (Jones, 2011, p. 201). These symbolic constructs along with religious beliefs, capitalism, and manifest destiny would form the European ideology that would eventually justify the eradication of gray wolves (*Canis lupus*) who thrived in North America well before white settlers began to colonize the continent. Regardless of their biological importance to the ecosystems they inhabit, by the 1930s, wolves were purged from most of their native range in the continental United States (Babcock, 2013).

As white settlers trudged west during their conquest of native lands, they relentlessly hunted wolves out of fear and because humans and wolves compete for the same resources—food and territory (Babcock, 2013). Eventually, killing wolves became a social norm that reinforced the values held by the settlers: “... extirpating predators and resisting federal mandates ...” (Babcock, 2013, p. 56). Having little chance to protect themselves from humans, wolves faced the real possibility of extinction within the United States (U.S.). Carrol et al. in 2006 noted that by the 1950’s, wolf populations in the U.S. were critically low, occupying approximately 1% of their native range with less than 1000 individuals.

With the rapid disappearance of gray wolves and loss of their habitat in mind, recovery plans were set into motion with the enactment of the Endangered Species Act of 1973 (Babcock, 2013; Carrol et al., 2006). After reintroductions at Yellowstone National Park (Yellowstone NP) in 1995, negative attitudes from the general public towards wolves eventually began to improve to a more favorable outlook. However, rural residents such as farmers, and ranchers with firsthand experience were more likely to continue with their negative viewpoints regardless of the biological benefits that reintroductions bring (Williams et al., 2002).

Wolves were reintroduced in 1995 at Yellowstone NP to reverse damage to the park's ecosystem caused by an overabundance of elk (Carroll et al., 2006; Stewart et al., 2009). These wolves successfully reclaimed their place within the Greater Yellowstone Ecosystem as the region's dominant apex predator. Quicker than expected, wolves began regulating overabundant elk populations, thus beginning the gradual process of repairing an ecosystem in the midst of a trophic cascade. Yellowstone's trophic cascades can be thought of as the domino effect on ecosystems associated with the loss of a keystone species (Smith et al., 2003). Regardless of how quickly the environment welcomed back its apex predator, to some researchers, the arrival of reintroduced wolves from a social acceptance standpoint, was an unmitigated failure with long lasting negative impacts for both reintroduced and naturally recolonizing wolves (Babcock, 2013). Before reintroductions began, wolves were listed as an endangered species across the United States under the Endangered Species Act (ESA) of 1973, which protected them from hunting and harassment (Bangs et al., 1996). With these protections in place, wolves began slowly recolonizing northern portions of their lost habitats in the United States

from Canada. Allowing wolves to reestablish themselves more gradually allowed humans who live on the frontline time to become used to them (Babcock, 2013). After wolf reintroductions at Yellowstone NP went ahead without utilizing input from local stakeholders in the final wolf restoration plan, reintroductions became the controversial political issue that it still is today. Government agents underestimated the animosity held by local residences towards wolves, who disliked the perceived risks that predators impose on economic interests (i.e., livestock and farming) outside the protected park boundaries but within wolf recovery zones (Pooley et al., 2016; Williams et al., 2002). Unsurprisingly, many people who are directly affected by government mandates such as the ESA find it hard to support environmental and economic reforms that they themselves had little input in creating or implementing (Hanson, 1995).

This thesis' primary objective was to answer the question: Is it time to reintroduce gray wolves to Olympic National Park? From a biological point of view, a majority of the literature on this topic would support reintroductions at Olympic National Park. From a social acceptance point of view from people in the agricultural sector, current attitudes about wolf reintroductions on the Olympic Peninsula are unclear. There are many similarities between Yellowstone NP and Olympic NP, however, there are important differences that could allow for a socially acceptable wolf reintroduction where resource managers fell short at Yellowstone NP. For example, at Yellowstone NP, the major resource extraction activities near the park are primarily ranching and farming whereas at Olympic NP, the closest major activity is timber harvesting. According to Smith et al. in 2003, wolf winter range at Yellowstone NP is 65% within the park and 35% on public and private lands. In comparison, it has been estimated that the suitable habitat for gray

wolves in Olympic NP is located 98% inside the park and U.S. Forest Service wilderness area, with just 2% on tribal and private lands (Ratti et al., 1999). Economically for the Olympic Peninsula, there are no projected impacts for timber industry on public or private lands (Wiles et al, 2011), insignificant impacts projected to livestock production, and modest impacts projected to ungulate populations (Ratti et al., 1999). However, the current attitudes of the people in the agricultural sector that will be directly affected by wolf reintroductions on the Olympic Peninsula are unknown.

I used the principles of human dimensions theory to create an internet-based snowball survey aimed at finding out what historically opposed locals' attitudes and values are in regard to wolf conservation and reintroductions. Research has shown that conflicts between stakeholders associated with species conservation are more likely social conflicts that are deeper than the perceived threats imposed by that species (Lute et al., 2017). Human conflicts about natural resource conservation and restoration are more likely in response to perceived differences between stakeholders' attitudes and values (Redpath et al., 2013; Lute et al., 2017). Understanding the attitudes and values of people in the wolf recovery zones and incorporating their perspectives prior to wolf reintroductions is key to creating a successful management plan (Babcock, 2013)

CHAPTER 2: LITERATURE REVIEW

2.1 - Introduction

“Here is your country. Cherish these natural wonders, cherish the natural resources, cherish the history and romance as a sacred heritage, for your children and your children's children. Do not let selfish men or greedy interests skin your country of its beauty, its riches or its romance.”

-Theodore Roosevelt

Should gray wolves (*Canis lupis*) be reintroduced to Olympic National Park (Olympic NP)? In one form or another, people have been suggesting some sort of reintroduction to Olympic NP since 1935 (Ratti et al., 1999). Almost a century after wolf populations were extirpated from the Olympic Mountains, biologists at Olympic NP are struggling to manage unstable elk populations that have wreaked havoc on riparian plant communities and the stream and riverbanks that the elk need to survive (Carroll, 2006; Beschta et al., 2008). During the 20th century, conservation efforts were based on anecdotes and myths rather than a systematic review of the evidence, which strained an already delicate relationship between people in wolf recovery zones and conservation biologists (Sutherland et al., 2004).

After the passing of the Endangered Species Act in 1973, which listed the gray wolf as endangered, plans to bring wolves back into core habitat areas began to be made. Environmentalists and anti-wolf groups have historically disagreed over wolf management policies that impact public lands. However, in 1991 a group of stakeholders made up of federal and state agencies, conservationists, and hunting and ranching groups called the Wolf Management Committee came together to create a wolf reintroduction and management plan for the Greater Yellowstone Ecosystem. Through negotiations and compromises, they recommended 1) that wolves that preyed on livestock, working

animals, or pets needed to be controlled, 2) returning control to the states as early as possible, and 3) allowing sport hunting after wolf populations have recovered. However, their recommendations to Congress were ultimately rejected (Babcock, 2013). That rejection created opponents who, in 1994, tried to stop biologists from reintroducing wolves by citing hardships for agricultural interests and disruptions to local lifestyles (Bangs et al., 1996). Still, without incorporating the committees' recommendations and in spite of the opposition's concerns, reintroductions of 31 gray wolves from Canada began in 1995, creating significant resentment from people in the Greater Yellowstone Ecosystem who felt betrayed by the government (Smith et al., 2003). So, in 2012 when wolves were delisted from the Northern Rocky Mountains and the Great Lakes by the U.S. Fish and Wildlife Service (FWS), long held negative attitudes towards wolves and mistrust of the government culminated in an unjust slaughter of wolves that were venturing outside park boundaries trying to fulfill their biological need to expand (Babcock, 2013).

This literature review examines public reactions to gray wolf reintroductions at Yellowstone National Park (Yellowstone NP). In the first section of this literature review, I introduce you to gray wolves in the United States to: A) illustrate their ecological importance; B) explain how western expansion and government sponsored predator-culling programs lead to a nearly complete removal of wolves in the continental United States; C) clarify the differences between a species naturally recolonizing an area vs planned reintroductions to see how each management method influence public attitudes. In the second section, I introduce the National Park Service to; A) explain how its Congressional mandates effect management of park resources; B) show the evolution of

carnivore management at Yellowstone NP; C) clarify what trophic cascades do to an ecosystem; and D) consider whether gray wolf reintroductions at Yellowstone NP were biologically and/or socially successful. In the third section, I introduce the Olympic Peninsula to: A) explain the process and reasons for colonization by white settlers to the region, B) answer how the extirpation of wolves caused the resulting trophic cascade, and C) establish Olympic National Park and give reasons to reintroduce. Finally, the fourth and final section concludes the literature review and explains why there is a need for further research.

2.2 - Gray Wolves in the United States

“Almost dead yesterday, maybe dead tomorrow, but alive, gloriously alive, today.”

- Robert Jordan

In North America prior to European contact, gray wolves flourished from the Atlantic Ocean in the east to the Pacific Ocean in the west, from Mexico in the south and to Northern Canada and Alaska (Figure 1). Being a generalist species that can adapt to many different environments and prey species, wolves require a large area to sustain their populations (Carroll et al., 2006). As the apex predator in the ecosystems they inhabit, their importance cannot be understated (Carroll et al., 2006). Being the top predator in the food chain, wolves put direct population-limiting pressure on large herbaceous ungulates such as deer, elk, bison, and moose. This top-down pressure changes the prey's behavior, which indirectly benefits the plant communities that these ungulates depend on (Fortin et al., 2005).



Historical and current range of gray wolves.

NPS

Figure 1: Map of the historic range of gray wolf vs. current range (after reintroductions at Yellowstone National Park) in North America (National Park Service, 2022).

Wolves often outcompete smaller mesopredators such as coyotes and foxes for resources and territory, which has the benefit of decreasing their populations while allowing smaller prey species populations to increase. For example, at Yellowstone NP after wolves were reintroduced, pronghorn sheep populations increased fourfold with the decline of coyotes (Ritchie et al., 2009). Without apex predators to perform their ecologically vital functions, prey populations are able to exponentially increase beyond

the carrying capacity that their ecosystem can support, ultimately damaging riparian plant communities and degrading ecosystem services that humans rely on (Beschta et al., 2017).

By the late 1940s, wolves began to naturally recolonize Isle Royale National Park (Isle Royale NP) from Canada. They did this without the aid of humans by crossing Lake Superior while it was frozen (Smith et al., 2003). Smith et al. (2003) noted that there were some public concerns about the effects of wolves on overabundant moose populations. However, public concerns faded when wolves effectively capped the moose population density on the island, and completely removed coyotes, alleviating their concerns as people became accustomed to coexisting with wolves and saw that they restored a much-needed balance within Isle Royale's ecosystem (Figure 2). Regardless of the apparent biological gains, however, some people continued to irrationally fear wolves. One concerned citizen even stated that they worried that after the wolves finished eating all the moose, they would switch to the next best thing, humans (Smith et al., 2003). Unfortunately, the controversy that surrounds wolf conservation is disproportionate to the actual harm that wolves have exacted on humans (Bangs et al., 1996), especially considering that no serious gray wolf related injuries or deaths have been reported since 1890 (Ratti et al., 1999).

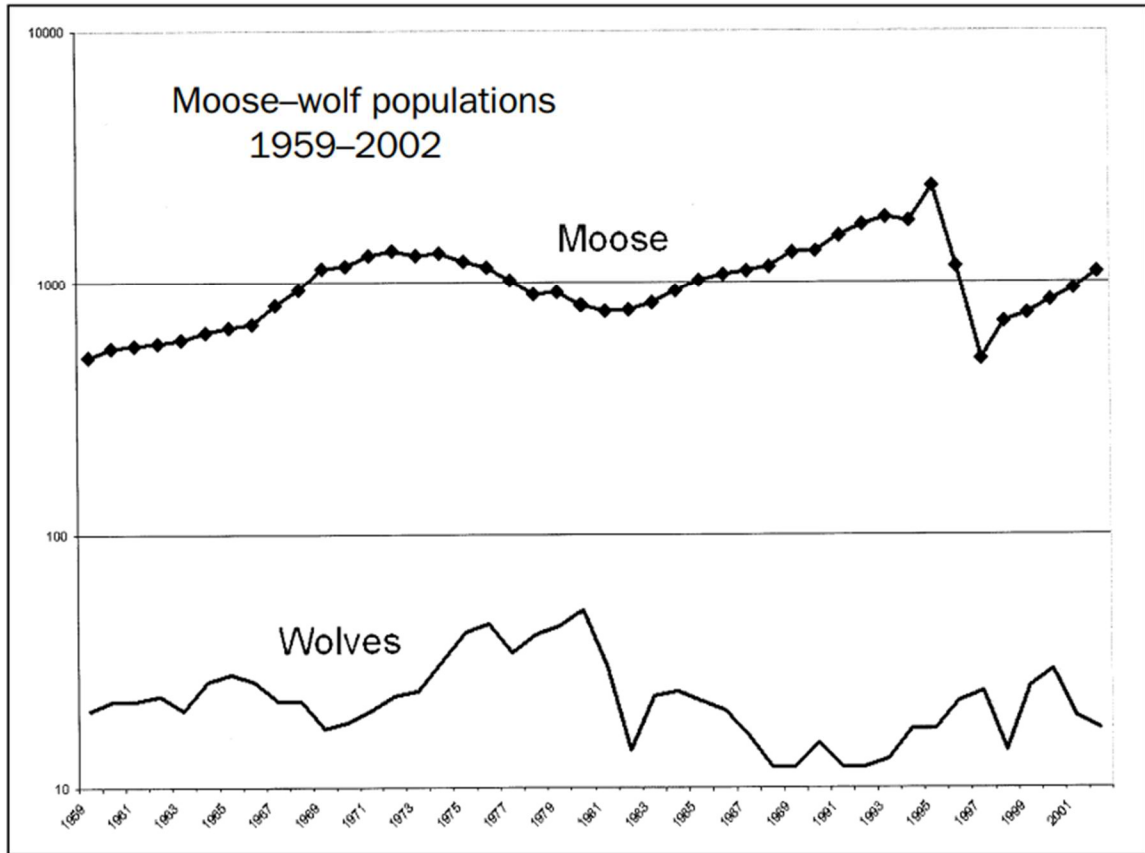


Figure 2: Moose-wolf population fluctuations at Isle Royal National Park, 1959-2002 (Smith et al., 2003).

2.3 - National Park Service: Legacy of Predator-culling Programs

“It will be critical for the NPS to incorporate new findings into planning and adaptation efforts, anticipating that new evidence, new feedback loops, and new consequences may challenge commonly accepted resource management practices or decisions.”

-NPS Climate Change Action Plan (2012-2014)

Yellowstone was our nation’s first National Park (Yellowstone NP). It was established in 1872 and was considered at the time by many to be a wise decision, made just in time before settlers began claiming land in the area (Jackson, 1942; Dilsaver et al., 2005). When settlers did begin to colonize the region, Jackson (1942) pointed out that they did so to capitalize on the abundant natural resources for hunting, ranching, and

mining and also to promote ecotourism in the form of hot springs. In all, to protect what we know as Yellowstone NP today, Congress set aside an unprecedented 3,472 square miles of pristine wilderness that today borders Wyoming, Montana, and Idaho. With such a large area to protect from vandals and poaching, the U.S. Calvary was used for 30 years to preserve park resources until 1916 when the National Park Service (NPS) was established (Dilsaver et al., 2005).

The NPS was established with strong bipartisan support by the U.S. Congress when it enacted the National Park Service Organic Act of 1916. That act not only established the NPS, but it also established the services "... dual objectives of protecting wild-life and retaining the support of the public ..." (Wright, 1998, p. 475).

Unfortunately, retaining public support became the NPS's primary objective once they began to pander to public influence. Providing consistent wildlife for visitors to view began a long and controversial history when it comes to carnivore and ungulate management. Park managers observed that when people visit national parks, they want to experience seeing animals in the wild but don't want to feel they are in any danger. So, park personnel at Yellowstone began a predator culling program and implemented a policy that kept unsustainably large elk populations fed over the harsh Yellowstone winter, eventually eradicating wolves, and artificially increasing prey species populations (i.e., elk, bison, deer, etc.). Through these programs, the NPS unknowingly began a trophic cascade that was in direct conflict with the Congress's mandate to protect wildlife (Figure 3). Unfortunately for wolves, elk, and riparian plant communities across the National Park System, providing public enjoyment became the NPS's primary objective in the early 20th century (Wright, 1998).

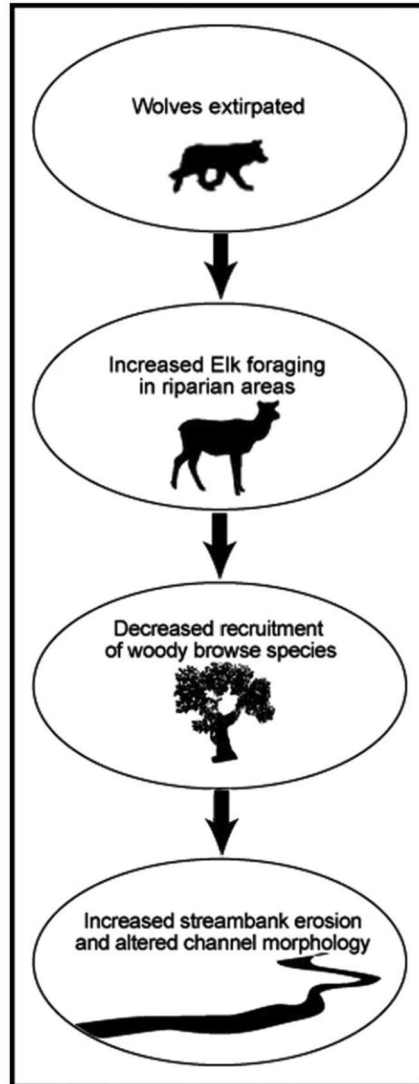


Figure 3: Diagram of trophic cascade at Olympic National Park after wolf extirpation (Beschta et al., 2008).

The NPS implemented their predator-culling program in a bid to gain political and economic support from the public by enhancing their visitors' enjoyment. The extremely efficient culling of wolves at Yellowstone NP allowed ungulates such as elk and bison to unsustainably expand their populations in hopes that tourists would be able to view an abundance of these animals while they explored the parks (Wright, 1998). This mistaken policy allowed park visitors to believe that the massive quantities of ungulates were natural and perpetuated the misconception that wolves were not. While these

questionable management decisions did gain the park service considerable support, the biological cost to the park's ecosystems have manifested in catastrophic trophic cascades (Wright, 1998).

At Yellowstone NP, trophic cascades began to develop with the loss of wolves in the early 1920's (Peterson et al., 2014). It wasn't too long before park managers began to worry about the excessive habitat degradation happening to riparian plant communities along stream and riverbanks due to the overabundance of ungulates (Wright, 1998). In the 1930s, elk took advantage of the absence of their primary predator and rapidly increased beyond the ecosystem's ability to sustain them. Normally, predators maintain prey species at carrying capacity, the number of animals that an ecosystem's food chain can support, by imposing top-down pressure on their prey, forcing them to weigh the risks of predation vs. personal security when they forage for resources (Stewart et al., 2009). When there are no predators to influence elk behaviors, elk tend to stay longer in a single location, congregate in larger groups, and show more displays of conspectus behavior (Creel et al., 2005), ultimately exacerbating the degradation of critical riparian plant communities that are needed to stabilize stream and riverbanks (Beschta et al., 2017). As elk populations increase beyond carrying capacity and the abundance of available food resources diminish, their physical condition and pregnancy rates decline (Stewart et al., 2009). The resulting trophic cascade would be allowed to continue until park employees in the 1940s began to cull elk herds to protect the environment (Wright, 1998).

By the 1960's, in a vain attempt to keep elk at a sustainable level and prevent habitat degradation, Yellowstone personnel were having to cull elk populations by 20-

30% annually (Peterson et al., 2014). Beschta et al (2017) noted that at one point the elk culling was up to 50% of the population at Yellowstone. The mass slaughter of elk became an unfortunate but necessary evil to provide visitors to Yellowstone with an “illusion of a primitive state” while minimizing habitat degradation (Wright, 1998). The culling wouldn’t come to an end until the plight of the elk was brought to the public’s attention with national news coverage and publications in popular magazines. It took public outcry and political pressure that threatened to cut the NPS’ budget to end the controversial culling programs. The elk were saved but now NPS resource managers felt that they were unable to use their best judgment when managing over abundant elk populations due to external pressures imposed by visitors who were ignorant of park problems (Wright, 1998). The need for a solution to the elk overpopulation issue would eventually lead to wolf reintroductions at Yellowstone NP in 1995.

Once reintroduced, wolves began to reestablish themselves as the dominant predator and within a few short years willow, aspen, and other woody plants began to benefit from lower levels of herbivory from ungulates (Smith et al., 2003). Fortin et al., (2005) found that excessive elk herbivory in Yellowstone NP during the wolf-free times, 1927 to 1995, prevented virtually all recruitment of Aspen trees within the park boundaries. Today, the restoration of wolves at Yellowstone NP has been viewed as a biological success by scientists, effectively ending an era of unjust predator culling programs and beginning the process of reversing elk-induced trophic cascades within the park (Smith et al., 2003). However, biologists failed to recognize the animosity they would create when they reintroduced wolves without including all the stakeholders’ points of view in the decision making (Babcock, 2013). To some people in wolf recovery

zones outside the national park boundaries, wolf reintroductions are a "... symbol of urban dominance ...” (Williams et al., 2002, p. 582).

2.4 - Reintroduction vs. Recolonization

“Hunger drives the wolf out of the wood”

- German Proverb

There are many reasons that people decide to reintroduce rather than let natural recolonization processes return a species. For example, habitat fragmentation due to land use changes can prevent or significantly slow a species from moving across the landscape (Carroll et al., 2006). Allowing a species to recolonize lost territory is the preferred method when it’s a feasible option, however, for a pair of breeding gray wolves who actively avoid humans and their development, to recolonize the Olympic Peninsula will be a challenge (Rio-Maior et al., 2019). The first documented breeding pack of gray wolves to make it to northeastern Washington was in 2008. Since then, the Washington Department of Fish and Wildlife (WDFW) estimate that wolf populations have grown to 178 individuals within Washington State (WDFW, 2021).

It is highly unlikely for wolves to naturally recolonize the Olympic Peninsula in a reasonable time frame due to a few major reasons. First, wolves would have to establish themselves south of Interstate 90 (I-90) in the central Cascade Mountains. Unfortunately, thus far no breeding pairs of wolves have been recorded south of I-90 (Figure 4), although it might soon be possible with the newly opened wildlife crossing structures installed by Washington State’s Department of Transportation near Snoqualmie pass. Second, wolves would have to navigate across the fragmented habitat of the Puget lowlands, an area that has had rapid land use changes due to agriculture development,

urbanization, road and infrastructure construction, and an influx of people moving to the region. Third, maybe the biggest obstacle for wolves to migrate to the Olympic Peninsula would be their need to cross Interstate 5 (I-5) which bisects the Puget lowlands and currently has no wildlife crossing structures. Wiles et al. (2011) identified the southern Cascades Mountains and Olympic Peninsula as areas where recolonization would be slow or difficult. If wolves are ever successful in crossing I-5, it would only be a matter of time before they would make their way north into the peninsula, so long as their progress isn't impeded by local residents.

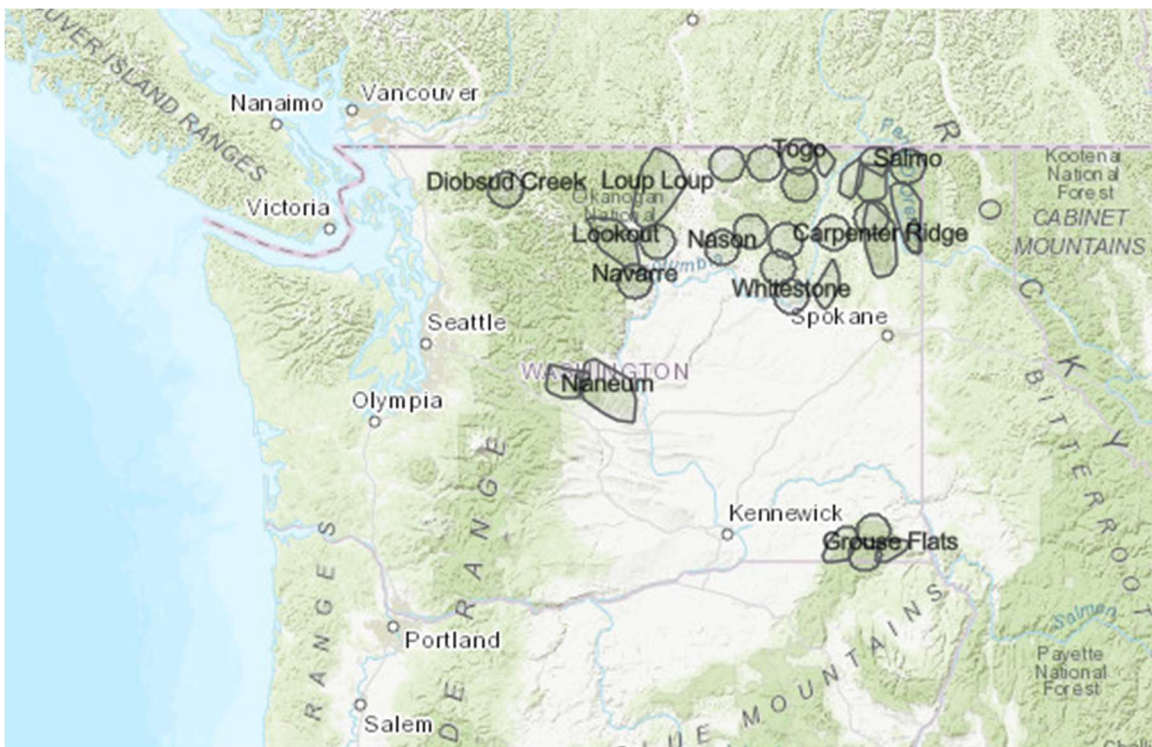


Figure 4: Map of gray wolf packs in Washington State (WDFW, 2021).

Since wolf recolonization without human aid isn't likely in the near future for the Olympic NP, resource managers should consider beginning the process of human-aided reintroductions. Either way, for wolves to successfully reclaim their lost habitat on the

Olympic Peninsula, biologists need to understand the human dimensions that shape the beliefs and attitudes of the people in the projected wolf recovery zones well beforehand. Understanding their beliefs and attitudes is important in order to reduce conflicts, improve relationships between stakeholders, and increase tolerance towards predators (Lute et al., 2017; Pooley et al., 2016).

2.5 - Olympic Peninsula

“This clash of destiny and fierce reality is the story of the Olympic Peninsula. It sounds a lot like America’s story. The story of a culture haunted by its own destiny. The story of a culture forced to reckon with its own mistakes. And yet, it is also the story of a culture that still manages to hope—some might argue to the point of delusion, though I’m not one of them. You’ll find the root of my optimism growing somewhere on the banks of a nameless creek near the heart of the peninsula. As long as that exists, I have reason to hope.”

-Jonathan Evison

Olympic NP located in the mountains and along the northwest coast of the Olympic Peninsula is home to many endemic plants and animals and is considered a stronghold of native Roosevelt Elk due to its geographic isolation (Jenkins et al., 2021). Glaciers and their runoff during the last ice age created a biogeographical island effect for the Olympic Peninsula, effectively placing a filter on the habitat connectivity corridors in the Puget lowlands from the nearby Cascade Mountain Range (Anunsen, 1993). While some species can be found in both mountain ranges (i.e., elk, deer, red alder, cedar, etc.), other species can only be found in the Olympics (i.e., Olympic marmot, short-tailed weasel, Olympic Mountain milkvetch, etc.) Ratti et al., (1999) estimates that the available habitat and available prey within Olympic NP would support 56 wolves with 6 to 7 breeding pairs.

In 2021, the National Park Service published a report that estimated the current mean population of Roosevelt Elk within Olympic NP. Unfortunately, the report didn't explicitly state the park's estimate for the total population within Olympic NP. The report did, however, supply their mean population abundance estimates for 5 subpopulations of elk within Olympic NP/projected wolf recovery habitat using survey data that was collected between 2008 and 2015 (Table 1). Park resource managers estimate elk populations to be: 1) 236 elk within the park core areas as of 2015, 2) 81 elk within the Elwha area as of 2014, 3) 15 elk within the Northwest area in 2011, 4) 213 elk within the Quinault area in 2014, and 5) 100 elk within the Southeast area in 2013 (Jenkins et al., 2021). Their statistical analysis showed that elk abundance has declined by an average of 16% annually within the park over each of the last 8 years, however, they say that this finding was of low confidence due to variations with the data set and overall small sample sizes (Jenkins et al., 2021).

TCA	Year	Replicate	Raw count	$\hat{N}_{a,t}$	SE	CV	Percent Seen
Core	2008	1	285	297	18.9	0.06	95.9%
Core	2011	1	237	250	20.5	0.08	94.9%
Core	2012	1	351	378	21.0	0.06	92.8%
Core	2013	1	241	280	21.7	0.08	86.0%
Core	2014	1	116	132	13.8	0.10	88.1%
Core	2015	1	72	80	11.0	0.14	89.7%
Means	–	–	217	236	17.8	0.09	91.2%
Elwha	2012	1	76	94	21.1	0.22	81.0%
Elwha	2014	1	43	68	22.5	0.33	63.4%
Means	–	–	60	81	21.8	0.28	72.2%
Northwest	2011	1	13	15	4.1	0.27	85.7%
Quinault	2014	1	207	213	19.7	0.09	97.2%
Southeast	2013	1	90	100	13.4	0.13	90.3%

Table 1: Estimated abundance of elk Olympic National Park using survey data collected between 2008-2015 (Jenkins et al., 2021).

Gray wolves were once native to the Olympics where they were considered a keystone species due to how much influence they have over the other species they interact with. However, early settlers to the peninsula in the 1890s began competing with wolves for resources and territory by harvesting lumber, raising livestock, planting crops, and hunting predators and ungulates. Eventually, Roosevelt Elk populations began to dwindle due to over-hunting by settlers. In an effort to conserve elk before they disappeared, a Peninsula wide moratorium on hunting elk was imposed in 1905. To then protect elk populations further from hunting and their habitat from resource extraction, Congress created Mt. Olympus National Monument in 1909. Without understanding the trophic cascades that would follow, the competition between wolves and settlers for the Peninsula ended predictably with the settlers and the federal government launching an extremely effective eradication campaign against wolves, completely removing these beneficial carnivores from the peninsula in the 1920s (Scheffer, 1993; Beschta et al., 2008). By the time that Olympic National Park was created in 1937 to add permanent protections for elk and their habitat, wolves had already been exterminated and native elk populations were allowed to exponentially expand, causing significant long-term consequences to riparian plant communities and considerable damage to stream and river systems (Beschta et al., 2008) (Figure 5). Along with elk population issues, non-native coyotes began to colonize the peninsula, which has been associated with the decline of the endemic Olympic Marmot populations to the point that they are categorized as a candidate for Washington States' Endangered, Threatened, or Sensitive Species List (Witczuk et al., 2013; Griffin et al., 2007; WDFW, 2021). Witczuk et al. (2013) noted that controlling coyote populations will be the only way to conserve the endemic

Olympic Marmot and that wolves could help resource managers by limiting new coyotes from migrating into Olympic NP.

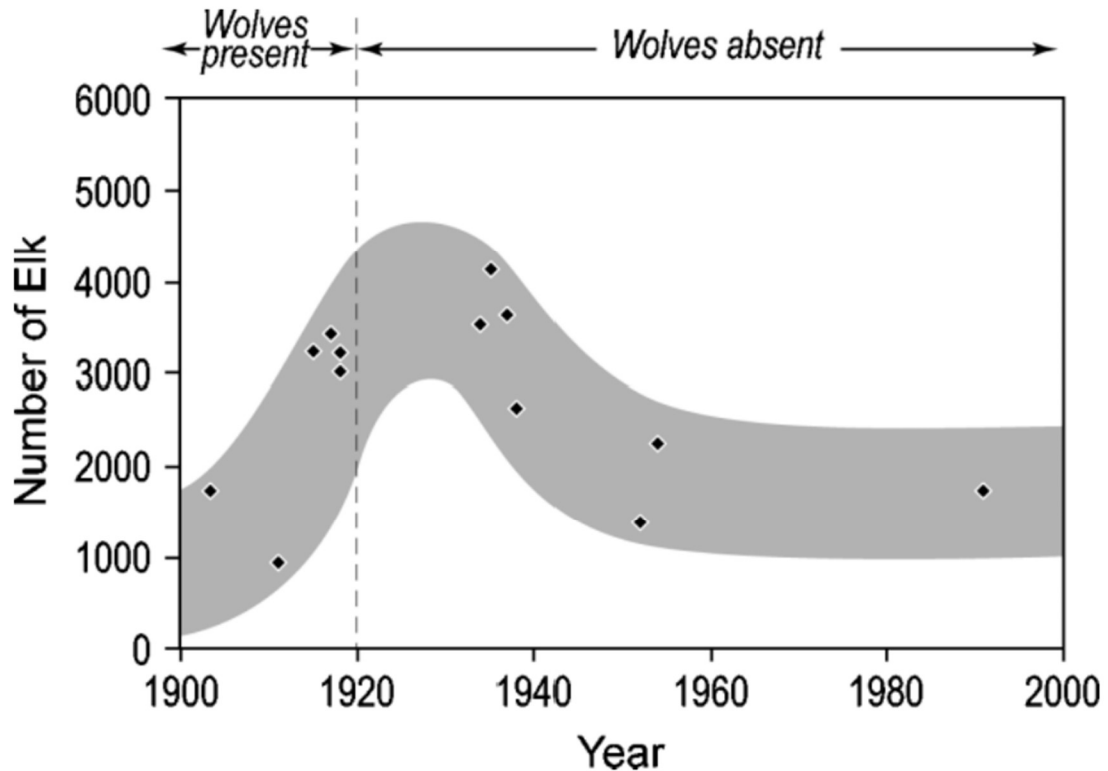


Figure 5: Estimated abundance of Roosevelt elk on the Olympic Peninsula with and without gray wolves in the Hoh, Queets, and Quinalt River catchments from 1900 to 2000 (Beschta et al., 2008).

Today, besides native Cougar, Roosevelt elk on the Olympic Peninsula no longer have an effective apex predator, such as the gray wolf, to help maintain them at an appropriate carrying capacity with the available food supply (Scheffer, 1993; Stewart et al., 2009). Without the risk of wolf-predation, elk on the Olympic Peninsula have been allowed to apply high levels of herbivory on native palatable plants (Stewart et al., 2009; Jenkins et al., 2021). When an ecosystem is in equilibrium, low levels of herbivory by elk can be beneficial to native plant species diversity (Stewart et al., 2009). Carnivores such as wolves indirectly influence plant communities by putting biological limits on ungulate populations (Fortin et al., 2005), and changing their behavior (Creel et al., 2005). When

wolves were removed from the Olympic ecosystem, it triggered the beginning of a catastrophic trophic cascade for the peninsula (Beschta et al., 2017).

Researchers examining trophic cascades in Olympic NP determined that elk were causing significant long-term damage to park wetlands, forests, and rivers (Beschta et al., 2008). Due to heavy browsing of palatable trees and shrubs (i.e., Black Cottonwood, Bigleaf Maples, Vine Maples, Ferns, etc.) in riparian habitats along streams and riverbanks, elk dramatically changed the composition and diversity of riparian plant communities, thus giving unpalatable species (Sitka Spruce, and Red Alder) a competitive advantage to dominate riparian ecosystems they were once only a minor component (Stewart et al., 2009; Beschta et al., 2017) (Figure 6). Besides the direct effects on the riparian plant communities, indirect effects of heavy grazing along riverbanks in Olympic NP led to rivers shifting from single, tight channels to braided channels, allowing river widths to increase, a decrease of large woody debris in the river system, and a reduction of biodiversity (Beschta et al., 2008). This heavy browsing also significantly degrades the ecosystem services that an intact riparian ecosystem provides (i.e., erosion control, shade during the summer for climate mediation, flood resistance, etc.) (Beschta et al., 2017). Wolves reduce elk abundance in riparian areas due to their tendency to use riparian corridors to travel and to hunt for ungulates (Fortin et al., 2005). Low levels of herbivory by ungulates are an important process in riparian ecosystems because it prevents one species from dominating the plant community and it allows more species to coexist, thus increasing the biodiversity in that system (Stewart et al., 2009). Unfortunately, with the absence of an effective apex predator over the last century, elk have caused long-term degradation to ecosystems of Olympic NP.

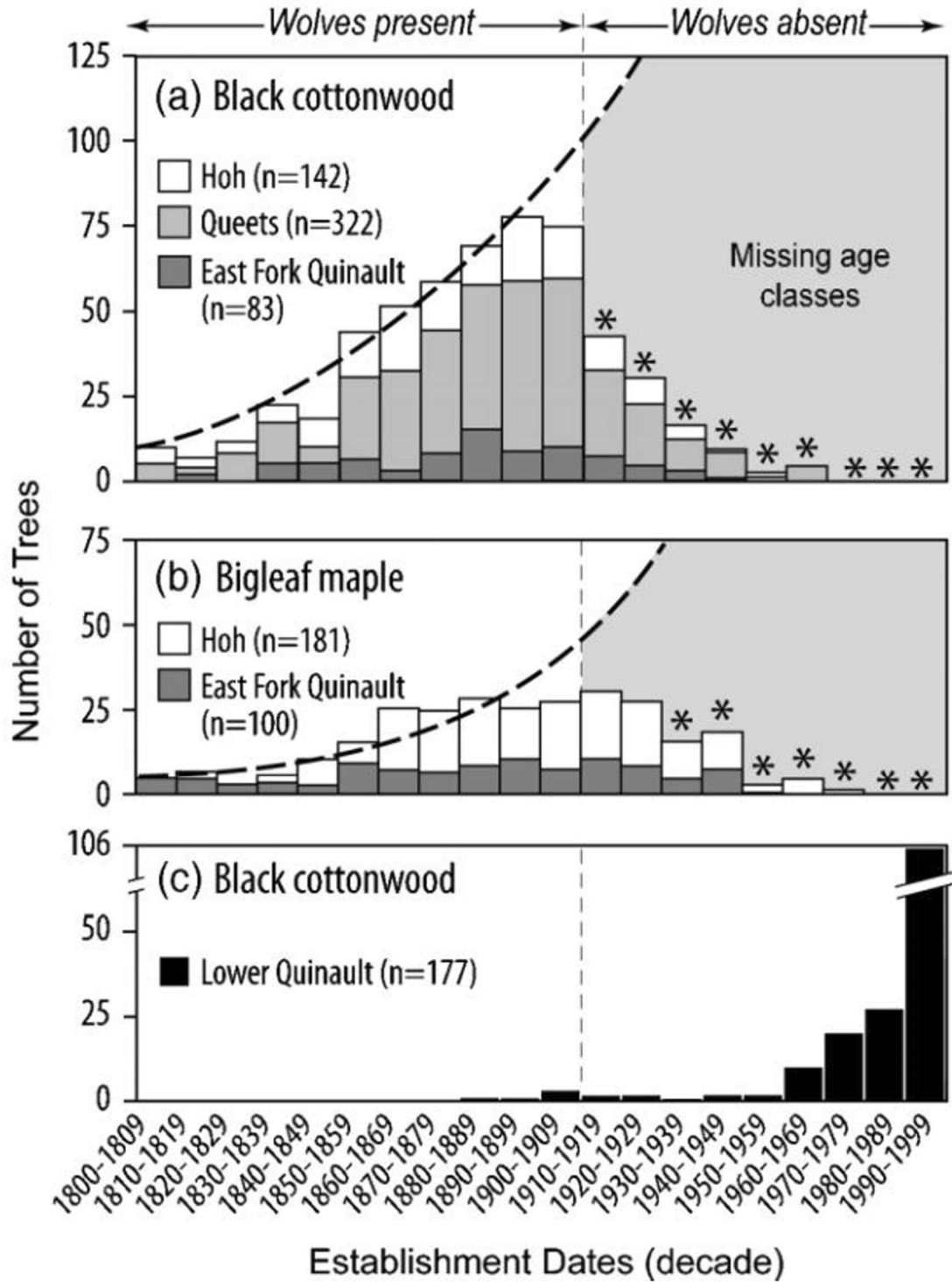


Figure 6: Number of trees in stands of black cottonwood (a), and bigleaf maple (b) within Olympic National Park and black cottonwood (c) outside the park in Quinault Indian Nation lands by decade. Age classes marked with * are below 95% confidence limit (Beschta et al., 2008).

Humans are a poor substitute for wolves when it comes to managing ungulate populations. For example, at Yellowstone after reintroductions, studies showed that wolves help keep elk population more fit by killing very old (approximately 14 years old) females. In contrast, humans outside Yellowstone killed young females (approximately 6 years old) in the prime of their reproductive life. Bull elk (approximately 5 years old) were killed by both humans and wolves (Smith et al., 2003). Studies have shown that wolves prefer to prey on animals that have little reproductive value, such as the old and sick (Peterson et al., 2014).

Ecosystems that have a complete food chain with its appropriate apex predators have shown to support more diverse plant and animal species, are more productive, and provide enhanced ecosystem services (Larson et al., 2007). When ecosystems have more diversity of species, it is more likely to contain “disturbance-resistance species,” which will make it more resistant to anthropogenic changes (i.e., climate change, habitat fragmentation, etc.) and herbivory by large ungulates (Stewart et al., 2009). To see if restoration actions would help restore native plant communities in degraded areas, researchers-built enclosures that excluded elk from elk-preferred grazing areas in the Olympic rainforest (Figure 7). Quickly woody shrubs and saplings of Western Hemlock began to vigorously recolonize the non-native grassy areas created by elk (Larson et al., 2007). These findings were a good sign for resource managers at Olympic NP and are in line with what researchers found at Yellowstone after wolves were reintroduced.



Figure 7: Native plants aggressively recolonize disturbed habitat in response to elk exclusionary fencing at Olympic National Park after 26 years (Larson et al., 2007).

At Olympic NP, elk dominate due to NPS policies that protect them from being hunted and the legacy of predator culling programs (Beschta et al., 2008). These policies have resulted in trophic cascades that have caused long-term degradation to park riparian plant communities and rivers. Olympic NP faces damaged ecosystems, snowpack in decline since the 1970's (Jenkins et al., 2012), and unprecedented climate change models that project shorter, wetter winters and longer, warmer summers for the Olympic Peninsula (Nadkarni et al., 2019). Park managers should be looking for any way to make Olympic NP more resilient. Reintroducing wolves at Yellowstone demonstrated that trophic cascades can be reversed (Smith et al., 2003). However, they also demonstrated

that reintroducing wolves without gaining the support from communities in recovery areas was a failure from a social acceptance point of view (Babcock, 2013).

One of the main requests that the Wolf Management Committee at Yellowstone recommended to Congress in 1991 was to return the management of wolves to the states as soon as possible (Babcock, 2013). Unfortunately, this request was rejected by Congress due to the ESA's requirement that an endangered species must be restored to a "... significant portion of its range ... (i.e., significant portions) of suitable habitat within historic ranges ..." before delisting was possible (Carroll et al., 2006, p. 25). From a scientific standpoint, this provision was a win for environmentalists though the elation from winning was short lived. Wolves that venture out of their protected core recovery areas to recolonize suitable habitats face significant dangers associated with habitat fragmentation and hostility from anti-wolf opponents (Carroll et al., 2006). Regrettably, animosity grew among opponents, culminating in the mass slaughter of wolves in 2007 when wolves were briefly delisted in the outside Yellowstone NP (Babcock, 2013). The final decision in 2011 to officially delist wolves in the greater Yellowstone area was based on political ideology rather than science or law (Babcock, 2013).

While wolves were delisted from the ESA in 2011 from the eastern side of Washington State, wolves remained federally protected in western Washington until January 2021 when gray wolves were officially delisted from the continental United States, relinquishing the rights to reintroduce wolves to the state and/or to tribal agencies, although this decision has been contested (Fish and Wildlife Service, 2021). Returning control to the State of Washington, where wolves are still classified as endangered under state law, might make it easier for the state to accomplish the goals of its Wolf

Conservation and Management Plan, established in 2011. Washington State’s ultimate wolf recovery intention is to reestablish 4 breeding pairs for 3 consecutive years within each of their recovery regions (Eastern, North Cascades, and the Southern Cascades & Northwest Coast regions) (Figure 8) with an additional 3 breeding pairs anywhere else within the state (Wiles et al., 2011). Of the three regions, only the Eastern region has met the delisting requirement to date. As of 2020, the North Cascades region has documented their first year with 4 successful breeding pairs. However, no breeding pairs of wolves have yet to be documented in the Southern Cascades & Northwest Coast region, the region that Olympic NP resides within (Bassing, 2021).

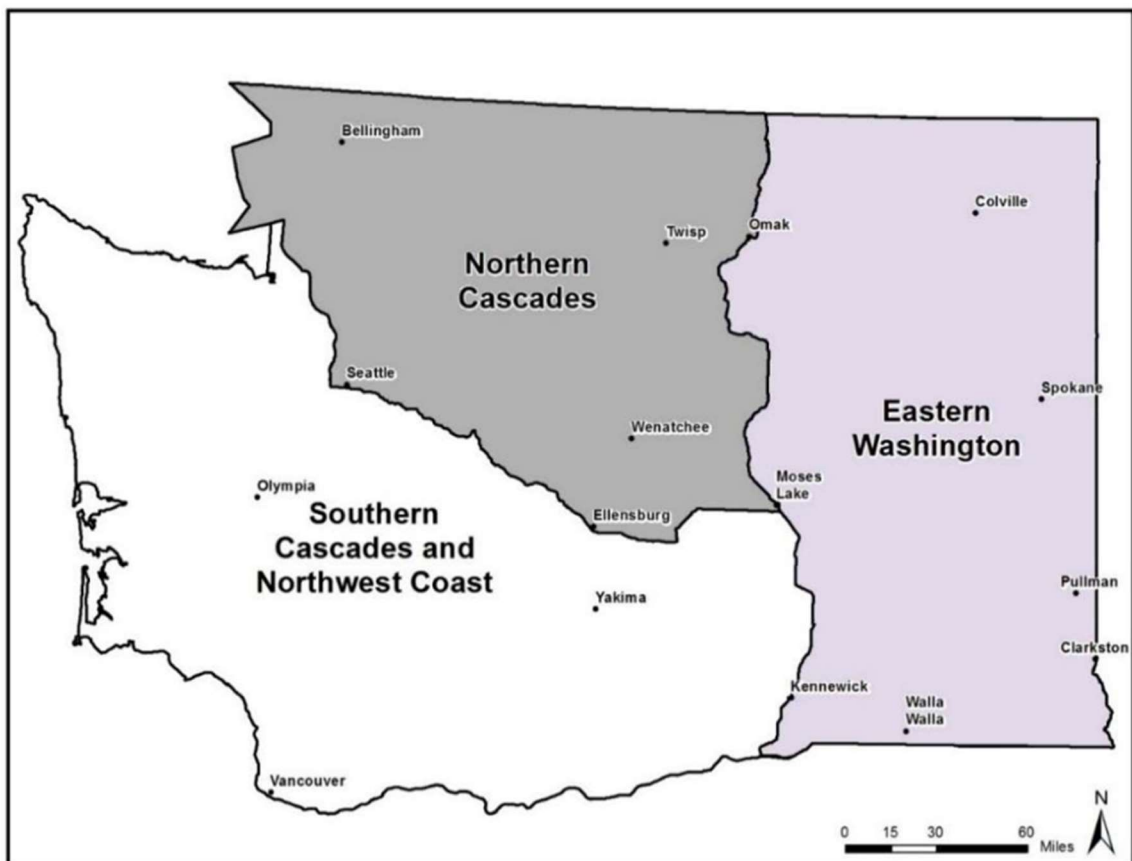


Figure 8: Recovery regions within Washington State for the gray wolf (Bassing, 2021)

Reintroducing wolves to Olympic NP would simultaneously begin the process of healing the parks degraded riparian ecosystems from an elk induced trophic cascade, and provide a federally protected population of wolves to fulfil the states requirements for delisting gray wolves under the state's Wolf Conservation and Management Plan (Bassing, 2021; Carrol et al., 2006). Resource managers need to examine the attitudes of all the applicable stakeholders prior to any reintroduction attempt to mitigate for the backlash that wolves faced after the Yellowstone reintroductions in 1995 (Babcock, 2013). Understanding these attitudes is critical for long term sustainable conservation efforts (Hernandez et al., 2017).

CHAPTER 3: METHODS

3.1 - Research Objectives

To answer my thesis question, *is it time to reintroduce gray wolves to Olympic National Park*, I conducted an in-depth literature review of the best available sources (i.e., peer reviewed journals, books, and government documents) on gray wolf reintroductions and human dimensions theory. This literature review found that a majority of researchers would support the idea of gray wolves returning to Olympic NP from a biological feasibility standpoint (i.e., adequate habitat and prey base available) (Ratti et al., 1999; Beschta et al., 2017; Wiles et al., 2011). However, from a human dimensions standpoint (i.e., factors that influence public attitudes) it remained unclear if people in the agricultural sector adjacent to Olympic NP would support it. Since Wiles et al., (2011) revealed that approximately 75% of the overall general public in Washington State supports wolf restoration efforts, I wanted to find out what local people in the agricultural sector on the Olympic Peninsula specifically would think about it due to the tendency of this population to oppose wolf reintroductions in other regions of the country (Babcock, 2013).

3.2 - Acquiring Data on Human Subjects

It took many steps to obtain the approvals needed to acquire data on human subjects for this thesis. The first step was to create a survey instrument (questionnaire) specifically crafted to assess the level of social acceptance that people who work in the agricultural sector on the Olympic Peninsula feel towards wolf conservation and reintroductions (Appendix D). Second, after a lengthy review process, Evergreen's Institutional Review Board approved my application to conduct research that included

working with human subjects (Appendix A). On February 24th, 2021, this pilot study received final approval to begin collecting data on human subjects (Appendix C). To reach the study's target audience, it was necessary to craft an internet-based snowball survey that I would administer remotely using ArcGIS's Survey 123. This survey method was chosen because it allows the survey instrument to be customized for the intended target audience and would allow respondents to refer other potential respondents to take the survey who wouldn't have otherwise been able to be reached. The reason this target audience was chosen was because an individual's occupation is a strong indicator of their attitudes towards wolves (Liordos et al., 2016), and because a majority of people within the agricultural sector, primarily ranchers and farmers, in wolf recovery zones around Yellowstone NP oppose wolf reintroductions (Bangs et al., 1996).

While this target audience was initially difficult to connect with, 117 potential survey candidates contact information (i.e., name, email address) were eventually identified by methodically searching the internet for agricultural organizations (i.e., farm bureaus, cattlemen's associations, natural resource workers, farmers markets, etc.) located on the Olympic Peninsula to contact. After identifying these potential respondents, each was sent an individualized introduction email that explained who I was and asked them if they would like to participate in this confidential snowball survey (Appendix B). Referrals from respondents generated an additional 10 potential respondents, bringing the total number of people contacted for this pilot study to 127. In all, 20 people responded out of 127 sent survey invitations.

3.3 - Survey Instrument

Alongside the findings in chapter 4 from the data that was collected, the survey instrument itself is an important contribution of this research project (Appendix D). The survey was custom tailored to the target audience to learn the level of social acceptance that local people in the agricultural sector have towards wolves on the Olympic Peninsula. To accomplish this, the survey was strategically designed to be as easy as possible for potential respondents by customizing the questioner's content, formatting, organizational elements, and by streamlining the way they access the questionnaire. For example, when designing the questionnaire controversial demographic questions (i.e., respondents geographic coordinates, political affiliation, religious beliefs, annual income, etc.) were out. I used font to size 14 on the questionnaire instead of the smaller size 12 font, to make it easier for people to read, thus making the survey easier in hopes of increasing the response rate. The questions and answers were presented in a standardized way on the questionnaire, thus making questions less complicated and easier to answer.

The questionnaire (Appendix D) itself contained 19 questions. Each question fit into at least one of 5 subcategories: 1) target audience verification, (Questions 1, 2, and 12), 2) personal beliefs and values in regard to wolf reintroductions (Questions 3, 5, 10, 11, and 19), 3) opinions on factors that make an acceptable wolf management plan, (Questions 4, 6, 7, 8, and 9), 4) demographics (Questions 13, 14, 15, 16, and 17), 5) snowball referrals (Question 18). These subcategories were developed to help determine what respondents found important about wolf reintroductions.

3.4 - Analysis

The survey data that was collected on Survey 123 was analyzed using Microsoft Excel. To transfer the data from Survey 123, the responses were downloaded as an .xlsx file and uploaded to Excel. Once in Excel the data was cleaned and organized into pivot tables, which enabled cross analysis of multiple variables to tease out details that were important to the thesis findings and discussion sections. Next, bar and pie charts were created to aid in identifying themes for analysis and to visually display these findings.

The method this thesis utilized was designed to determine the thoughts and attitudes of the targeted respondents. Identifying themes that motivated respondents helped in the development of recommendations based off their input for future research and ways to improve social acceptance of wolves on the Olympic Peninsula prior to any future reintroduction efforts.

CHAPTER 4: RESULTS

4.1 - Summary

Of the 127 survey invitations sent to potential respondents, 20 responded. While the sample size for this survey was too small to be a representative sample that can be generalized to the broader population. The information that was gathered was interesting and helped to better understand the attitudes and values that motivate the respondents in regard to wolf reintroductions at Olympic NP. These findings indicate that from a socially acceptable standpoint, gray wolf reintroductions might have more support than opposition on the Olympic Peninsula among people in the agricultural sector (Figure 33), a subgroup of the population that have historically opposed reintroductions in other regions of the United States (Babcock, 2013).

4.2 – Background Demographics

Of the 20 respondents, 95% said they currently live, work, or own land on the Olympic Peninsula (Figure 9). When asked if respondents worked in agriculture (Figure 10), 69% of respondents said they do, however, of the 31% who responded that they did not, all but one respondent said they were either a hunter, farmer, forester, or rancher (Figure 11). When respondents were asked to best describe themselves, 10% of respondents said they were Native American or Alaskan Native, with another 70% saying they were White or Caucasian, and 20% selecting prefer not to say (Figure 12). As for their gender, they identified themselves as 30% male, 55% female, with 15% selected prefer not to say (Figure 13). All of the respondents were college educated, with 70% possessing a bachelor's degree, 15% possessing a master's degree and 15% having

achieved a Ph. D. (Figure 14). The age range for the respondents at the time of the survey were between 31 and 79 years of age (Figure 15).

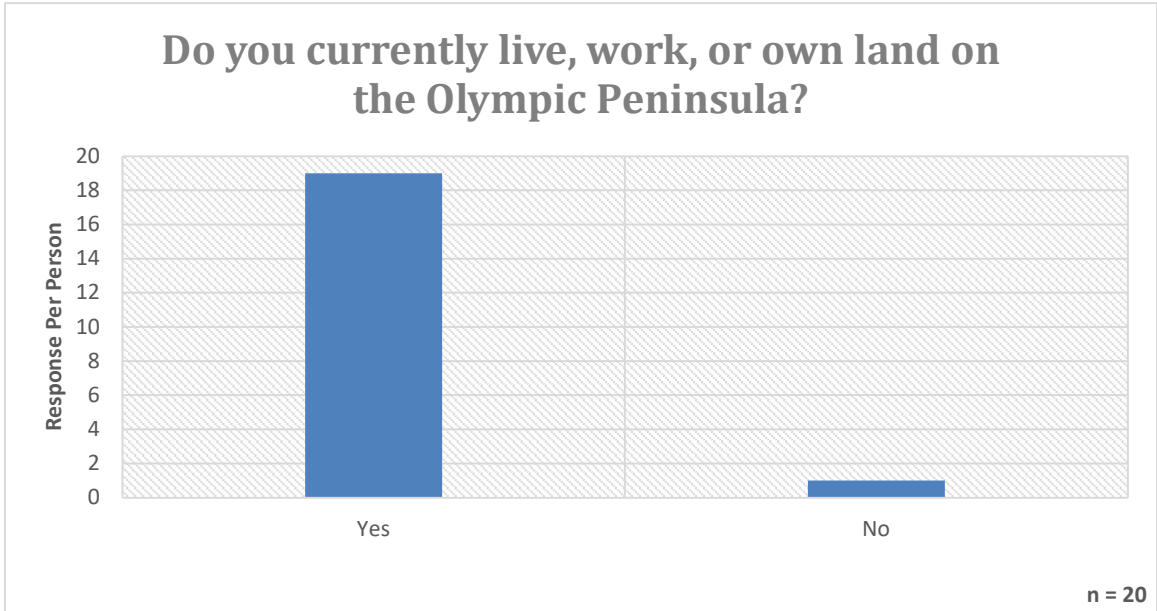


Figure 9: When asked if respondents currently live, work, or own land on the Olympic Peninsula, 95% of respondents claimed to either live, work, or own land on the Olympic Peninsula at the time of the survey. This indicates that the majority of respondents are from the target geographic area (n = 20).

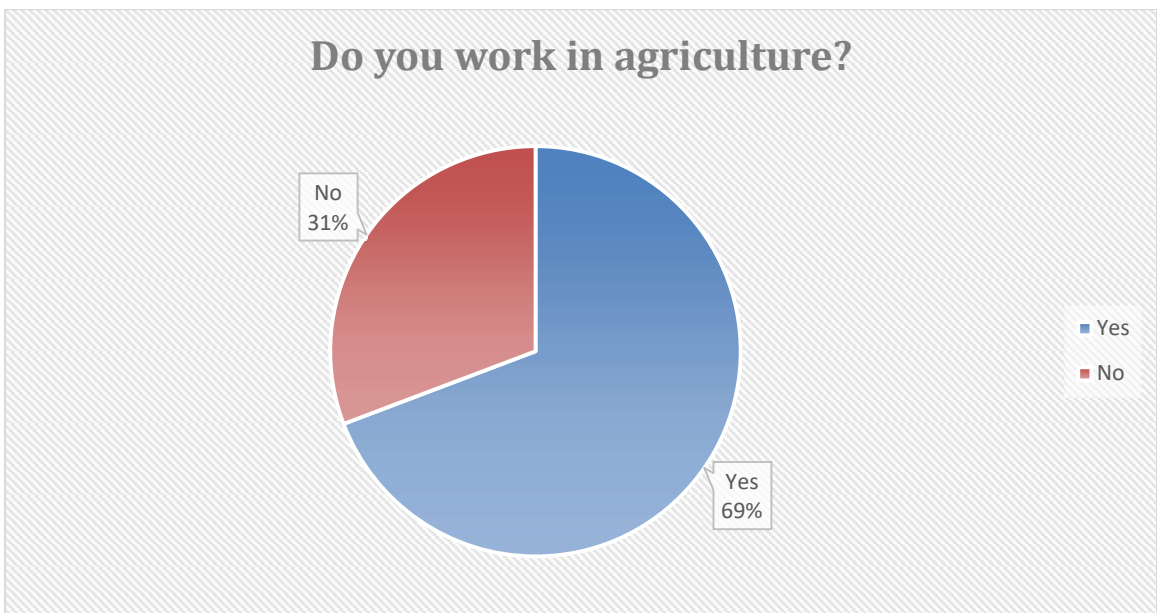


Figure 10: I asked respondents if they work in agriculture to determine if I reached my target audience; 69% of respondents said they worked in agriculture, and 31% said they did not. One respondent did not answer this question. One respondent did not answer this question (n = 19).

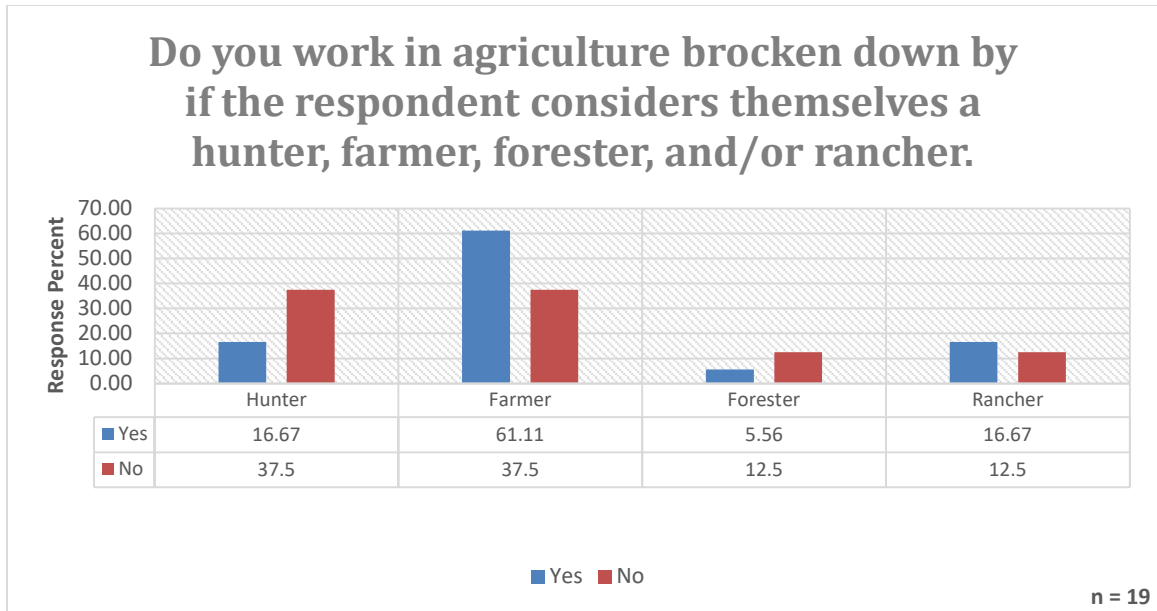


Figure 11: This figure cross tabulated respondents' answers to: *do you work in agriculture?* and their affiliation as a *hunter, farmer, forester, or rancher* to clarify if respondents were part of the agricultural sector as a whole. Of the respondents who answered *yes* to working in agriculture (69% of the total respondents), 16.67% said they were a *hunter*, 61.11% said they were a *farmer*, 5.56 said they were a *forester*, and 16.67% said they were a *rancher*. Of the respondents who answered *no* to working in agriculture (31% of the total respondents), 37.5% said they were a *hunter*, 37.5% said they were a *farmer*, 12.5% said they were a *forester*, and/or 12.5% said they were a *rancher*. Only one respondent (11% of the respondents who answered *no* to working in agriculture) said they did not work in agriculture and were not a *hunter, farmer, forester, or rancher*. One respondent did not answer either question (n = 19).

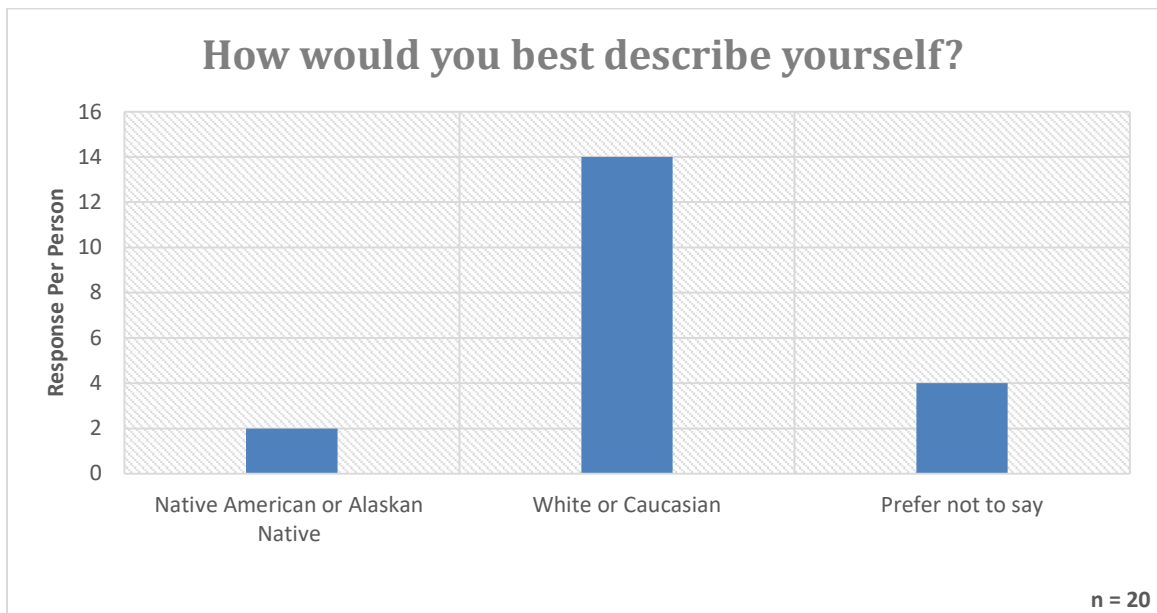


Figure 12: Respondents described themselves as: 10% *Native American or Alaskan Native*, 70% *White or Caucasian*, with 20% selecting that they *preferred not to say* (n = 20).

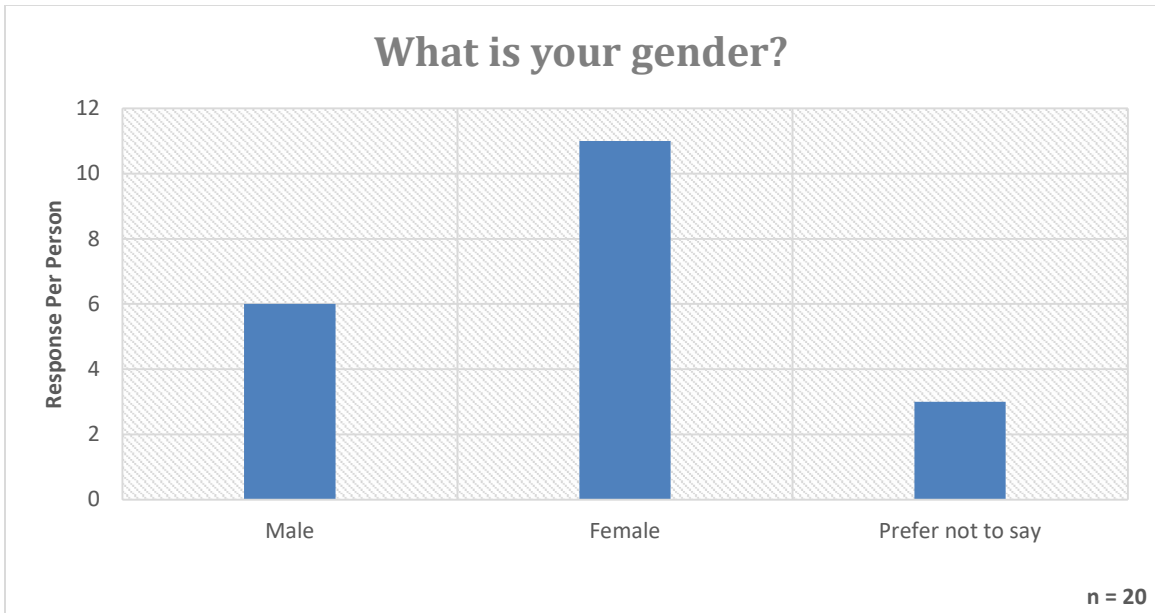


Figure 13: The respondents indicated they were: 30% *male*, 55% *female*, with 15% selecting they *preferred not to say* (n = 20).

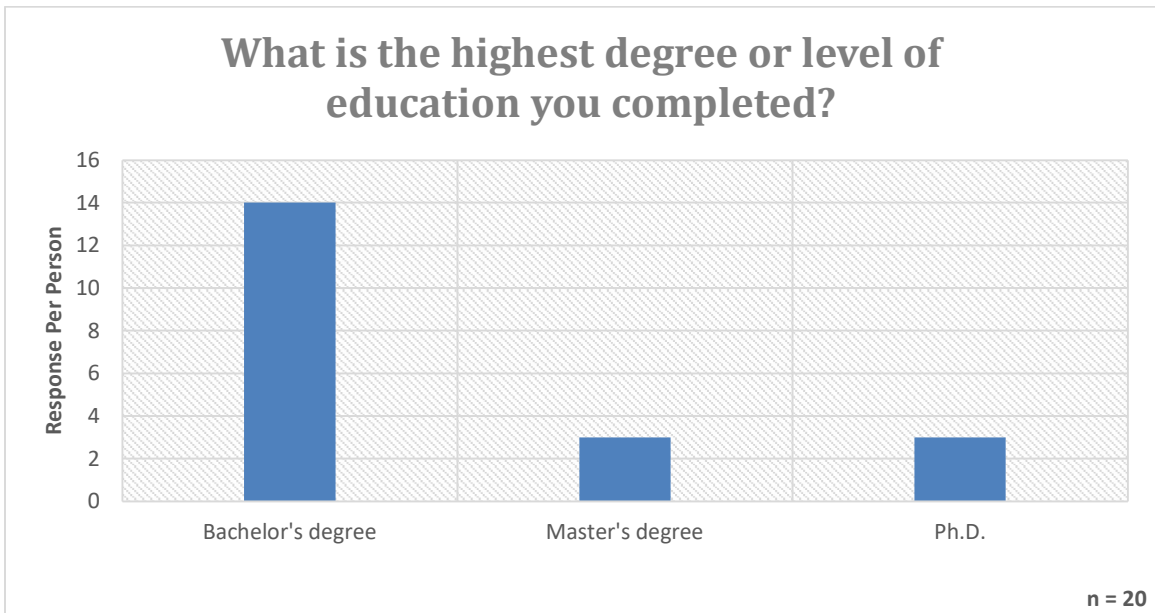


Figure 14: Respondents indicated their level of education were: 70% with a *bachelor's degree*, 15% with a *master's degree*, and an additional 15% with a *Ph.D.* (n = 20).

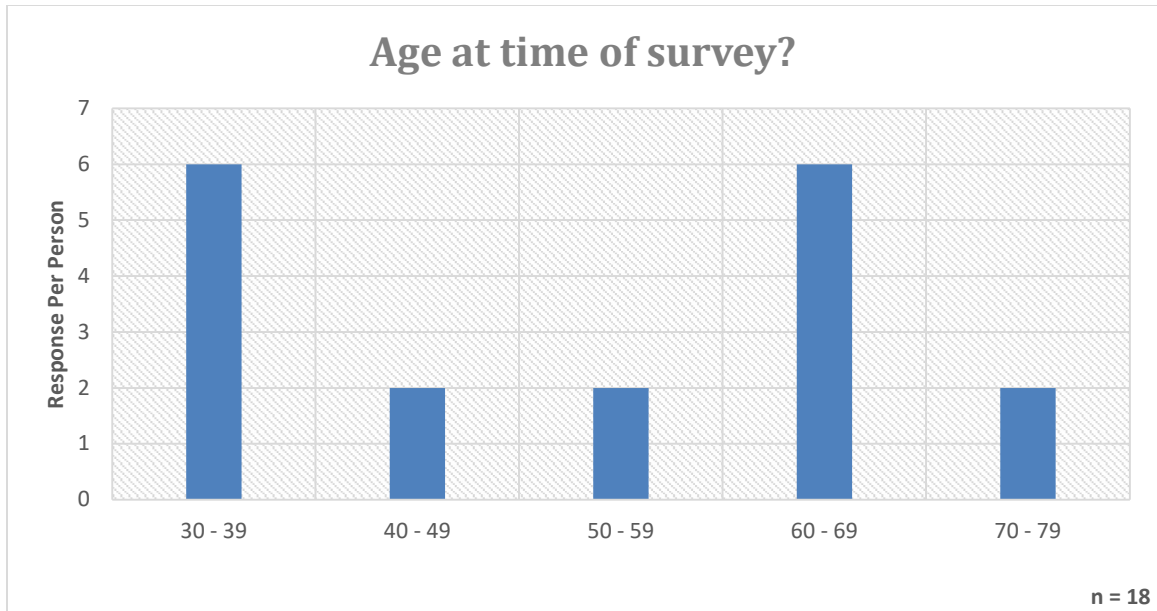


Figure 15: Respondents who answered this question indicated that their ages at the time of survey to be: 33% between 30 and 39, 11% between 40 and 49, 11% between 50 and 59, 33% between 60 and 69, and 11% between 70 and 79 years old. Two respondents did not answer this question (n = 18).

4.3 - Age and Gender: Indicators of Support for Reintroduction

When I cross tabulated the respondents' ages and their support for wolf reintroductions at Olympic NP, the findings showed that age was a strong determining factor when it came to their support or opposition to wolf reintroductions at Olympic NP (Figure 16). For example, the younger a respondent was, the more likely they were to support reintroductions. Comparatively, gender was not as much of a determining factor although the results did show that males were more likely than females to strongly support reintroductions (Figure 17). However, for both age and gender, when respondents did not provide their age (left blank) or if they preferred not to say their level of support for reintroductions, they were more likely to oppose reintroductions (Figures 16, and 17 respectively). These findings suggest younger people who work in the agricultural sector on the Olympic Peninsula will more likely support reintroductions, thus could be potential allies for wolf restoration efforts. The average age of respondents who oppose

reintroductions at Olympic NP is 59.1 years old while the average age of respondents who support reintroductions at Olympic NP is 43.7.

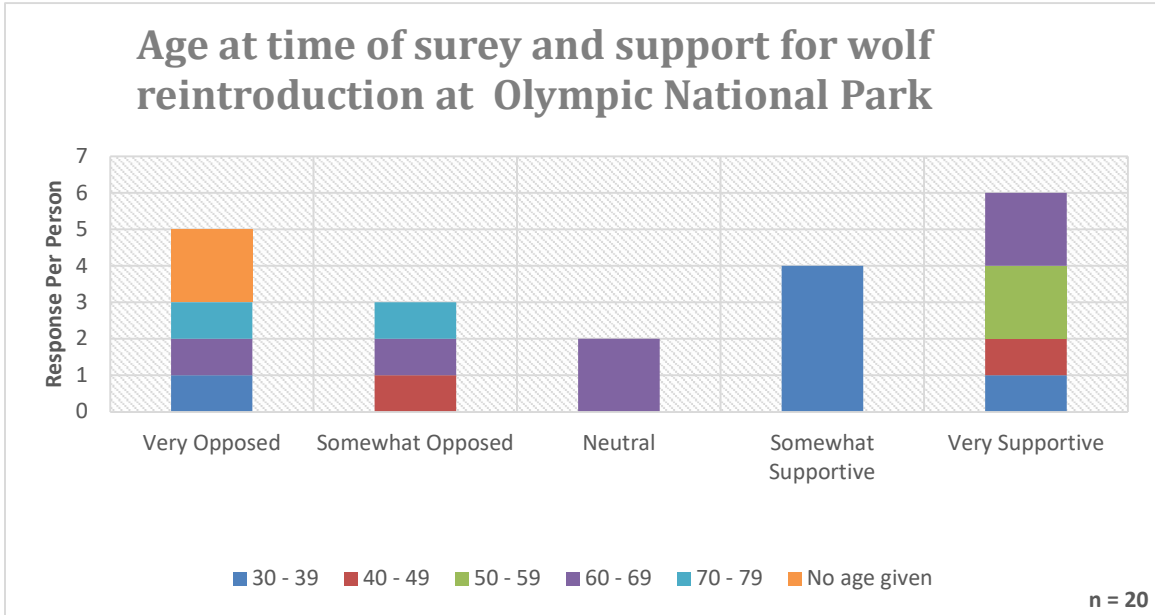


Figure 16: This figure cross tabulated the respondents’ answers to: *How would you feel about the prospect of wolves being reintroduced at Olympic National Park?* and their *age at time of survey*. The result indicated that there is more support for reintroductions among the younger respondents than among the older ones (n = 20).

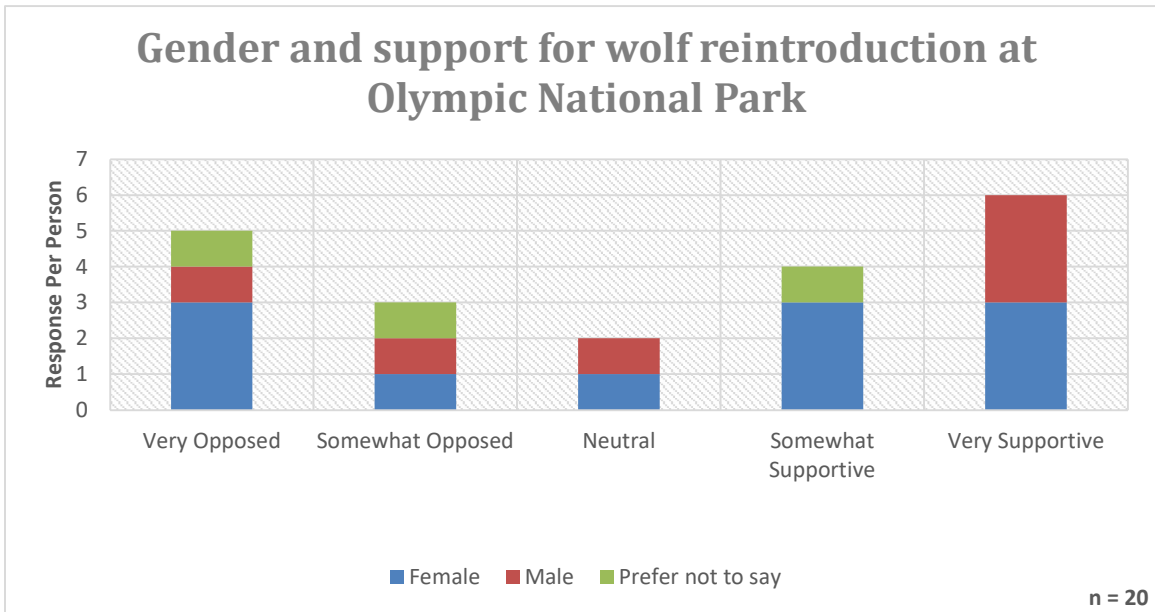


Figure 17: This figure cross tabulated the respondents’ answers to: *How would you feel about the prospect of wolves being reintroduced at Olympic National Park?* and their *gender*. The result indicates that both

female and male respondents were equally likely to support reintroductions. However, males were *very supportive* of reintroductions while females who opposed reintroductions were more likely to be *very opposed* than *somewhat opposed* (n = 20).

4.4 - Factors for an Acceptable Wolf Management Plan

When asked about how important each of the following factors are when making an acceptable wolf management plan, three factors were clearly favored by respondents who participated in this survey. 95% of respondents indicated that incorporating input from all stakeholders, using evidence-based conservation practices, and educating people about wolves were very important with only 5% of respondents saying they were unsure (Figures 18, 19, and 20 respectively). When asked about adequately compensating ranchers and farmers for wolf-killed livestock, only 65% of respondents thought it was very important factor (Figure 21). With even less importance to the respondents, keeping wolf populations at agreed upon levels were only very important to 50% of respondents (Figure 22). Respondents indicated that allowing for sport hunting after wolf population recovered was only very important to 55% (Figure 23). Returning control to states was the factors that respondents were the most conflicted about when determining what factors were important when making an acceptable wolf management plan with only 6% saying it was very important, 50% saying they were neutral, 22% saying it was not at all important and 22% saying they were unsure about it (Figure 24).

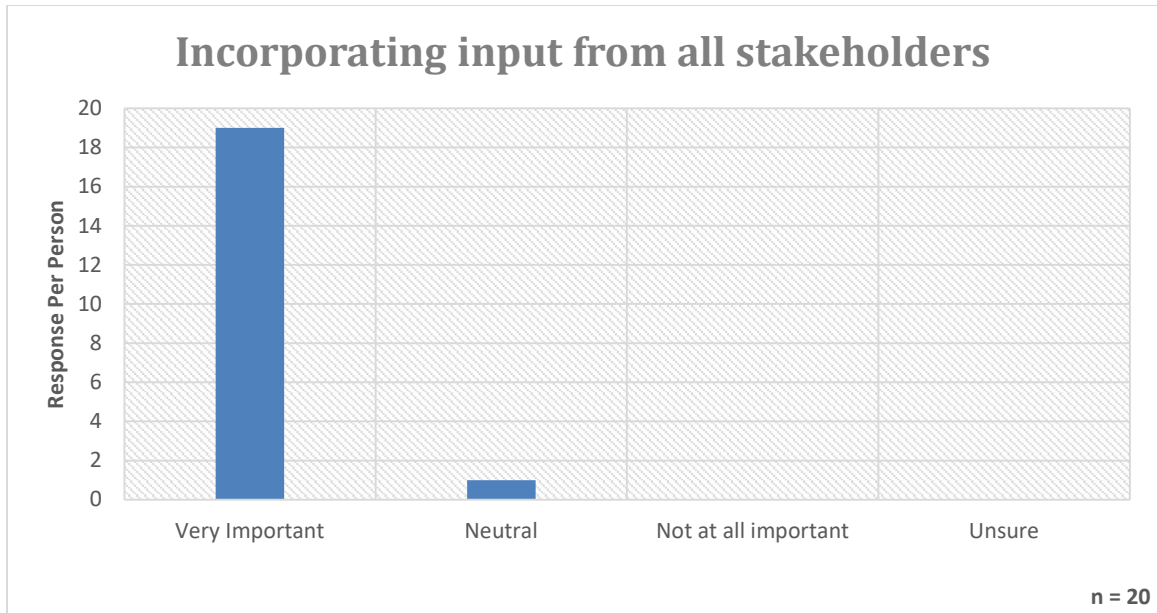


Figure 18: Respondents were asked *how important of a factor is incorporating input from all stakeholders when making an acceptable wolf management plan?* and 95% of respondents said it is *very important*, with 5% remained *neutral*. No respondents said it was *not at all important* or were *unsure* (n = 20).

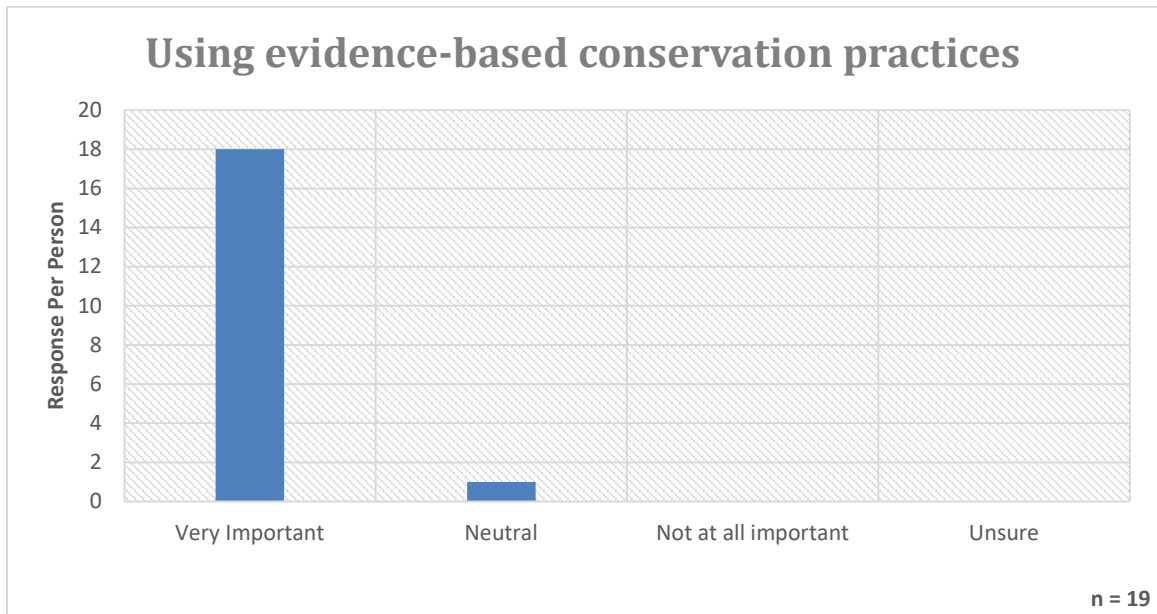


Figure 19: Respondents were asked *how important of a factor is using evidence-based conservation practices when making an acceptable wolf management plan?* and of the respondents who answered this question 95% of respondents said it is *very important*, with 5% remained *neutral*. No respondents said it was *not at all important* or were *unsure*. One respondent did not answer this question (n = 19).

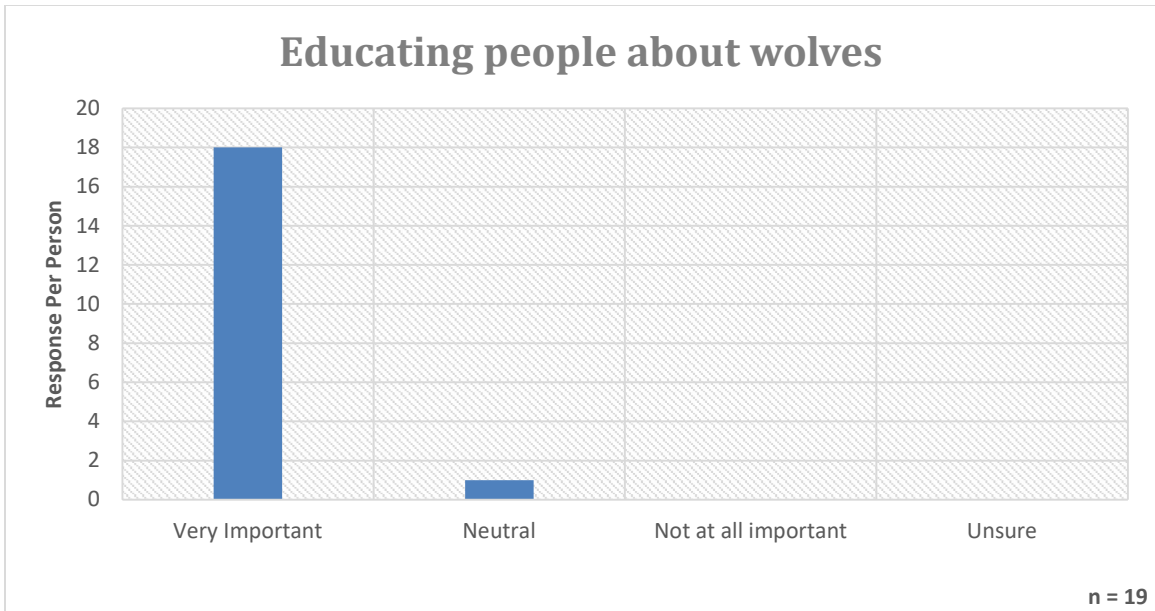


Figure 20: Respondents were asked *how important of a factor is educating people about wolves when making an acceptable wolf management plan?* and of the respondents who answered this question 95% of respondents said it is *very important*, with 5% remained *neutral*. No respondents said it was *not at all important* or were *unsure*. One respondent did not answer this question (n = 19).

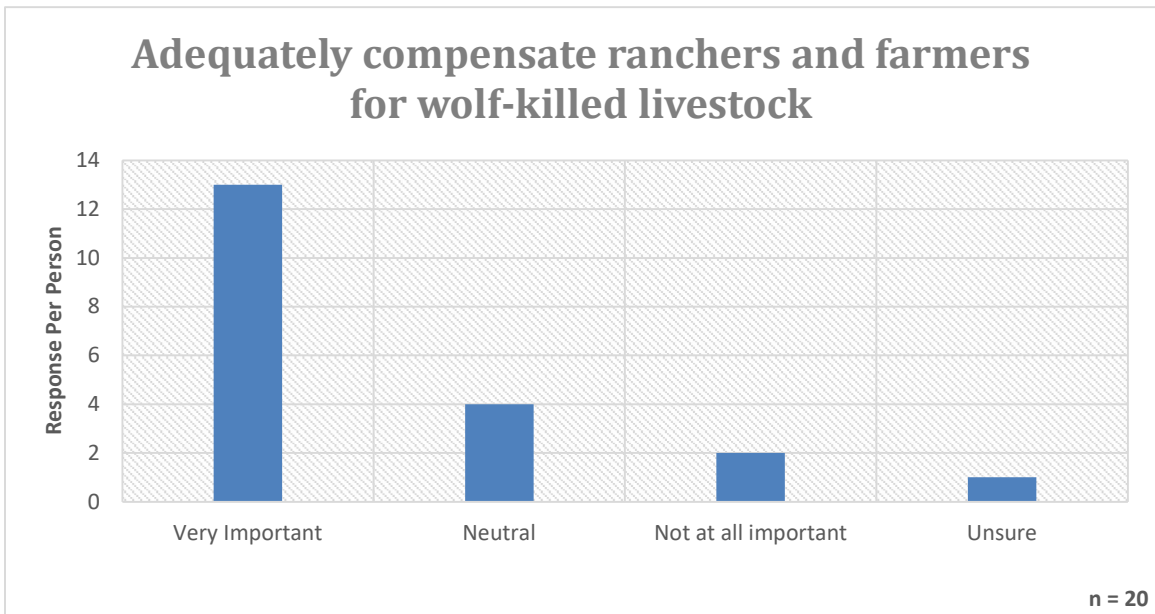


Figure 21: Respondents were asked *how important of a factor is adequately compensating ranchers and farmers for wolf-killed livestock when making an acceptable wolf management plan?* and 65% of respondents said it is *very important*, 20% remained *neutral*, 10% said it was *not at all important*, and 5% said they were *unsure* (n = 20).

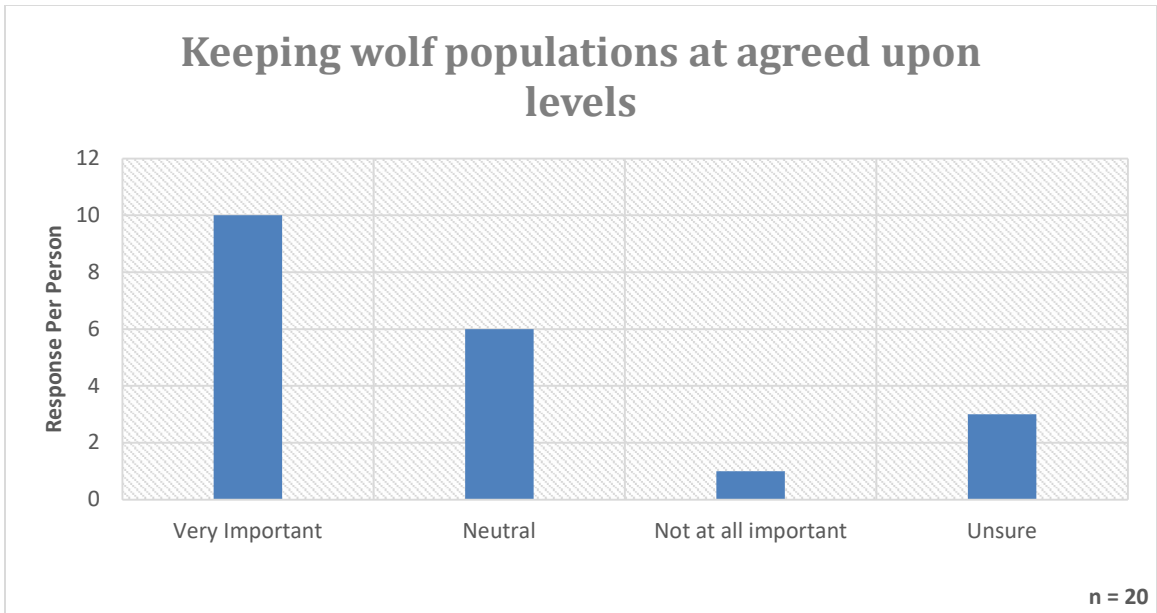


Figure 22: Respondents were asked *how important of a factor is keeping wolf populations at agreed upon levels when making an acceptable wolf management plan?* and 50% of respondents said it is *very important*, 30% remained *neutral*, 5% said it was *not at all important*, and 15% said they were *unsure* (n = 20).

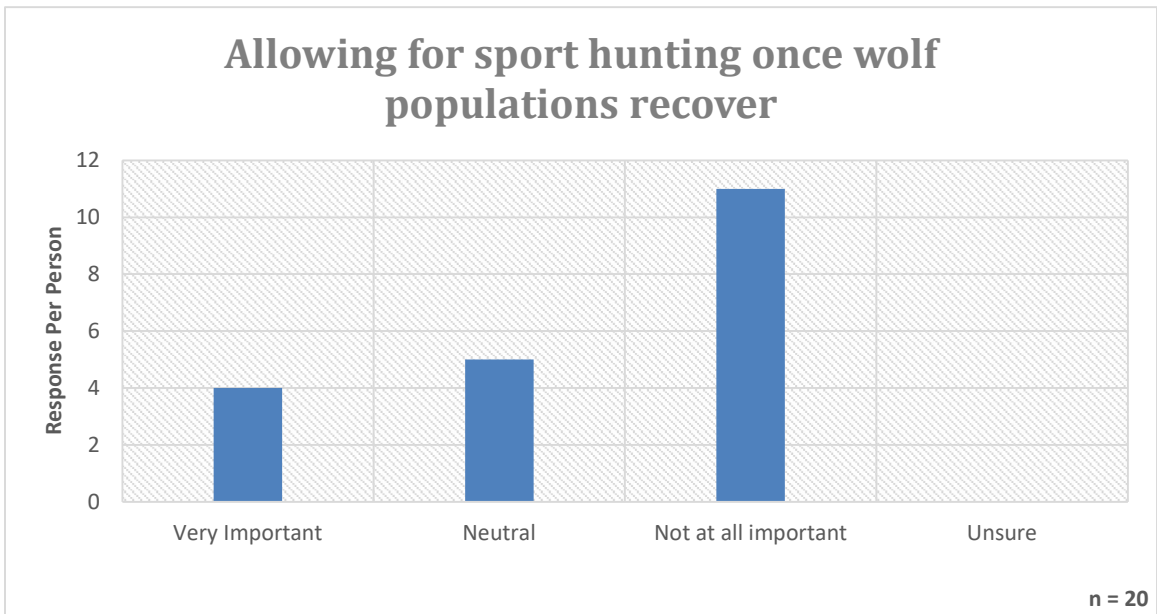


Figure 23: Respondents were asked *how important of a factor is allowing for sport hunting once wolf populations recover when making an acceptable wolf management plan?* and 20% of respondents said it is *very important*, 25% remained *neutral*, and 55% said it was *not at all important*. No respondents said they were *unsure* (n = 20).

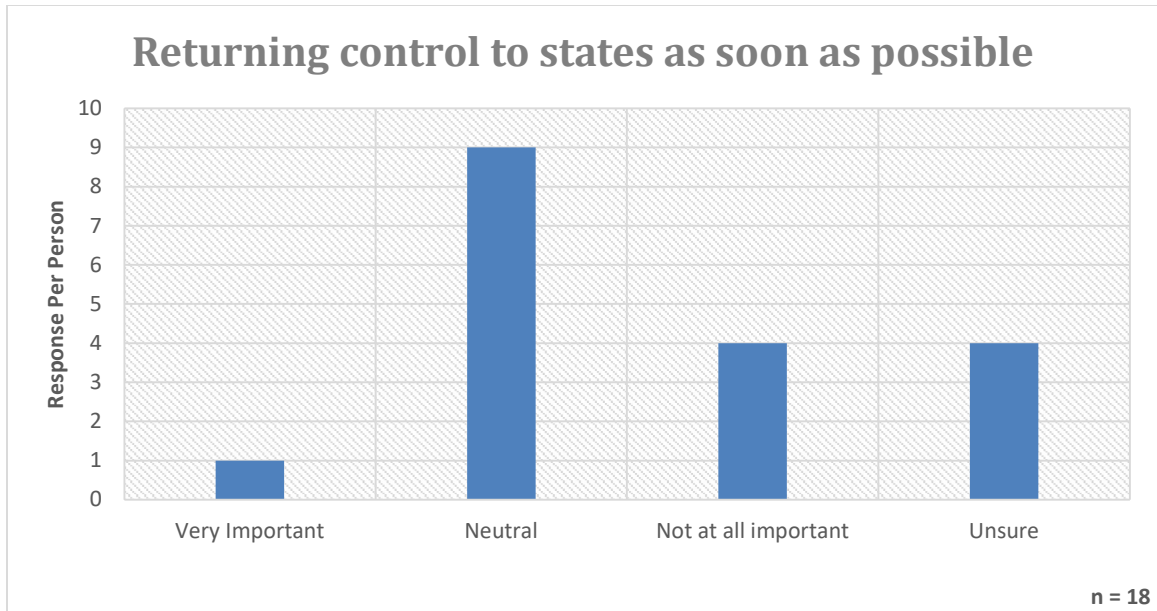


Figure 24: Respondents were asked *how important of a factor is returning control to states as soon as possible when making an acceptable wolf management plan?* and of the respondents who answered this question 6% of respondents said it is *very important*, 50% remained *neutral*, 22% said it was *not at all important*, and 22% said they were *unsure*. Two respondents did not answer this question (n = 18).

4.5 - Would Reintroductions be an Advantage or Disadvantage

When respondents were asked if it would be an advantage or disadvantage to them personally if wolves were reintroduced at Olympic NP, their responses were almost equally distributed between huge disadvantage, and huge advantage (Figure 25). The neutral option was by far the most selected response at (45%). When considering responses to two other questions, respondents indicated that educating people about wolves is very important to them (see Figures 20, and 29), so perhaps with a little knowledge about the benefits of having an intact ecosystem with its apex predator, the respondents wouldn't have been so neutral with their answers for this question.

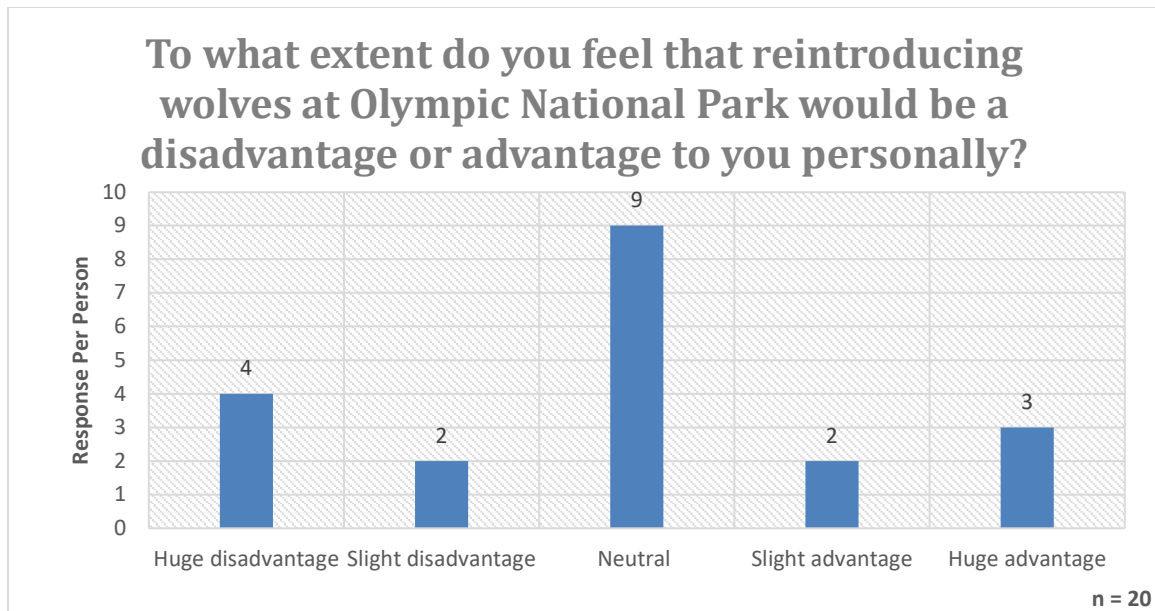


Figure 25: Respondents were asked *to what extent do you feel that reintroducing wolves at Olympic National Park would be a disadvantage or advantage to you personally?* and 20% of respondents said reintroductions would be a *huge disadvantage*, 10% said it would be a *slight disadvantage*, 45% were *neutral*, 10% said they it would be a *slight advantage*, and 15% said it would be a *huge advantage* (n = 20).

4.6 - Coexisting with Wolves

Respondents were asked *where should humans and wolves coexist?* (Figure 26), and *where do you believe wolves should be allowed to live?* (Figure 27). Each question shared five identical possible answers (*historic habitats, secluded wilderness, national parks, public lands, and private lands*). These questions and answers were almost identical to each other, but were designed to assess the respondent's tolerance for wolves on different land types when compared to each other. The comparative analysis found that respondents agreed that *secluded wilderness* and *private lands* were equally acceptable place for wolves to live and for humans and wolves to coexist. Interestingly, there appears to be marginally higher levels of tolerance for wolves to live in *historic habitats, national parks, and public lands* if coexistence with humans is left out (11%, 4%, and 4% respectively).

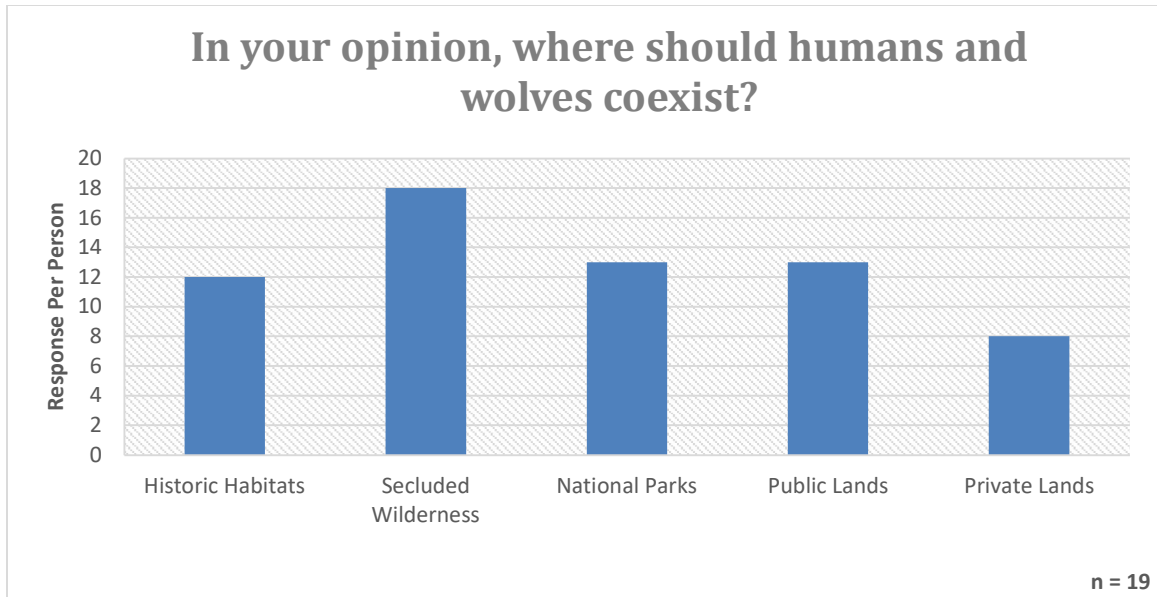


Figure 26: Respondents were asked *in your opinion, where should humans and wolves coexist?* and of the respondents who answered this question 63% of respondents said *historic habitats*, 95% said *secluded wilderness*, 68% said *national parks*, 68% said *public lands*, and 42% said *private lands*. One respondent did not answer this question (n = 19).

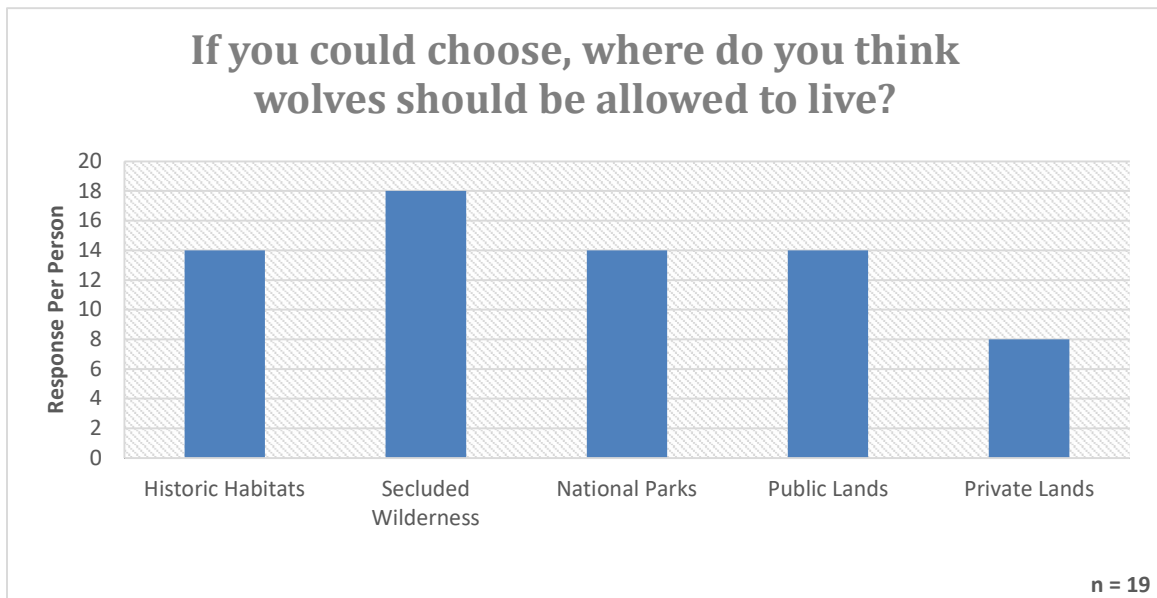


Figure 27: Respondents were asked *if you could choose, where do you think wolves should be allowed to live?* and of the respondents who answered this question 74% of respondents said *historic habitats*, 95% said *secluded wilderness*, 74% said *national parks*, 74% said *public lands*, and 42% said *private lands*. One respondent did not answer this question (n = 19).

4.7 - Lethal Removal

When asking respondents to indicate when a wolf should be lethally removed, only twelve of the twenty people surveyed answered at least one of the three possible options. Of the respondents who answered this question, 100% said it would be acceptable to lethally remove a wolf if *it kills a pet or livestock*, 58% said it would be acceptable if *it threatens a pet or livestock*, and 33% said it would be acceptable if *it is on public land* (Figure 28). While I did not offer a *wolves should not be lethally removed* option, it's possible that at least some of the eight respondents who left their answers blank for this question would have chosen that option because when these same respondents were asked *how effective is lethal removal of wolves at reducing human-wolf conflicts?* (Figure 29), two respondents said that lethal removal is *not at all effective*, two others said they were *neutral*, and one said they were *unsure*.

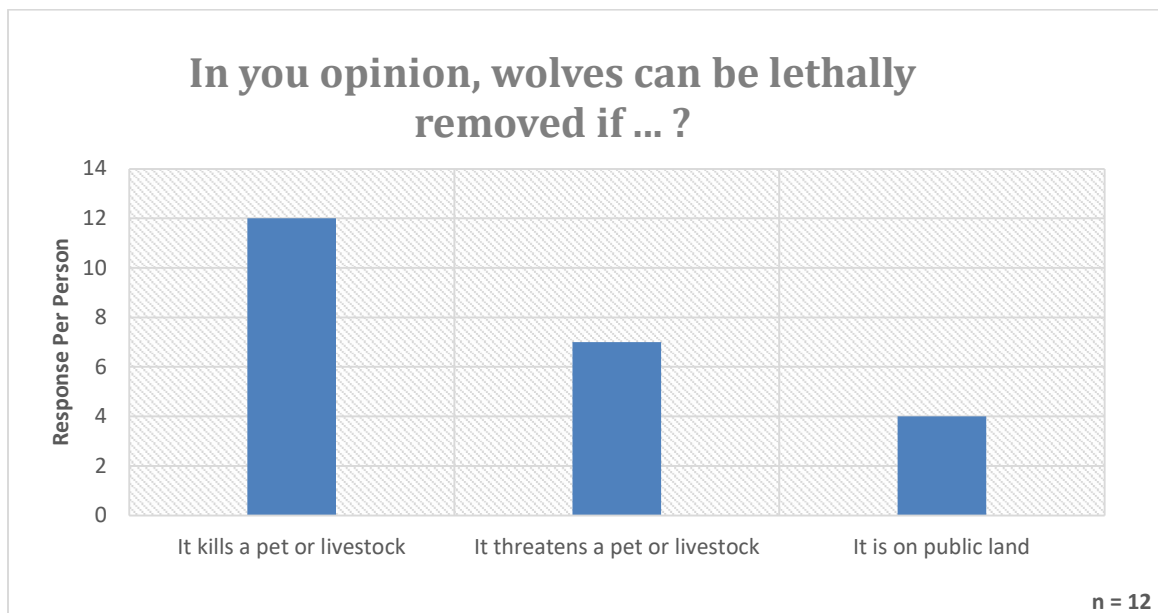


Figure 28: Respondents were asked *in your opinion, wolves can be lethally removed if ...?* and of the respondents who answered this question 100% of respondents said if it kills a pet or livestock, 58% said if *it threatens a pet or livestock*, and 33% said if *it is on public land*. 8 respondents did not answer this question (n = 12).

4.8 - Reducing Human-Wolf Conflict

I asked respondents to rate six different factors that influence human-wolf conflicts. The respondents indicated that *educating people about wolves* was the most important factor followed in descending order by *avoiding high risk areas*, *management plans*, *lethal removal*, *non-lethal hazing*, and finally the least effective factor *fencing* (Figures 29). These findings are important in determining possible areas where biologists can focus their efforts when trying to reduce human-wolf conflicts.

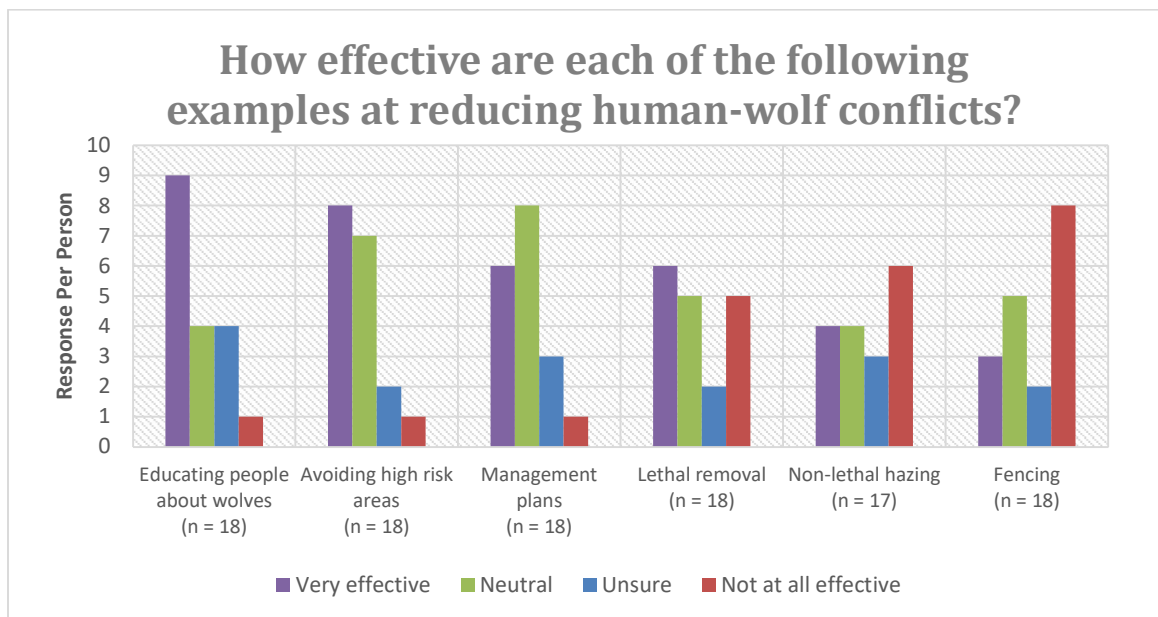


Figure 29: Respondents were asked *how effective are each of the following at reducing human-wolf conflicts?* The data reflects the most effective factor, *educating people about wolves* (50%), on the left to the least effective factor, *fencing* (44%), on the right. Three respondents did not fully answer this question (n = 17/18).

4.9 - Level of Concern

To gauge the level of concern that my respondents associated with possible reintroductions of wolves at Olympic NP, I asked them what their level of concern was for the following examples: *increased danger to humans*, *declines in elk and deer populations*, and *increased danger to livestock* (Figure 30). Findings indicated that

respondents were most concerned with *increased danger to livestock* followed by *declines in elk and deer populations*, with the lowest level of concern to *increased danger to humans*. Respondents indicated that they were most concerned about livestock depredation, followed by declines in elk and deer populations, and were least concerned about humans being in danger. Biologists should be mindful of these concerns because researchers project that the danger to livestock would be insignificant (Ratti et al., 1999).

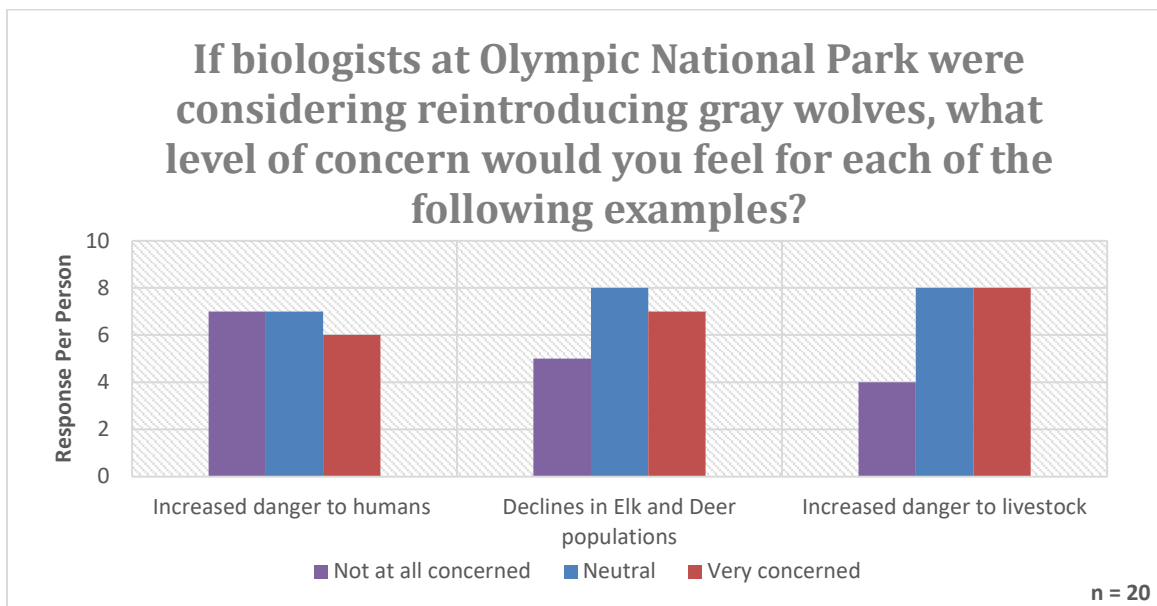


Figure 30: Respondents were asked *if biologists at Olympic National Park were considering reintroducing gray wolves, what level of concerned would you feel for each of the following examples?* The data reflects the least concerning example, *increased danger to humans* (30%), followed by *declines in Elk and Deer populations* (35%), and *increased danger to livestock* (40%) (n = 20).

4.10 - Support for Reintroductions

To assess how respondents felt about wolf conservation efforts, I asked them two similar questions about reintroductions: 1) how they felt in general about humans reintroducing wolves to historic wolf habitats (Figure 31), and 2) how they felt about possible reintroductions to Olympic NP (Figure 32). Interestingly, when comparing answers to both questions, I found that 30% of respondents were *very supportive/strongly*

agree with reintroductions in general and at Olympic NP, and a further 20% of respondents being *somewhat supportive/somewhat agree* to the same. Similarly, respondents were equally *somewhat opposed/somewhat disagree* (15% respectively) to the reintroduction of wolves at both historic habitats and at Olympic NP. The real difference between the two sets of answers came from one respondent who was *neutral* about wolf reintroductions in general switching to *very opposed* to reintroductions at Olympic NP. Overall, there seems to be a decent amount of support from these respondents.

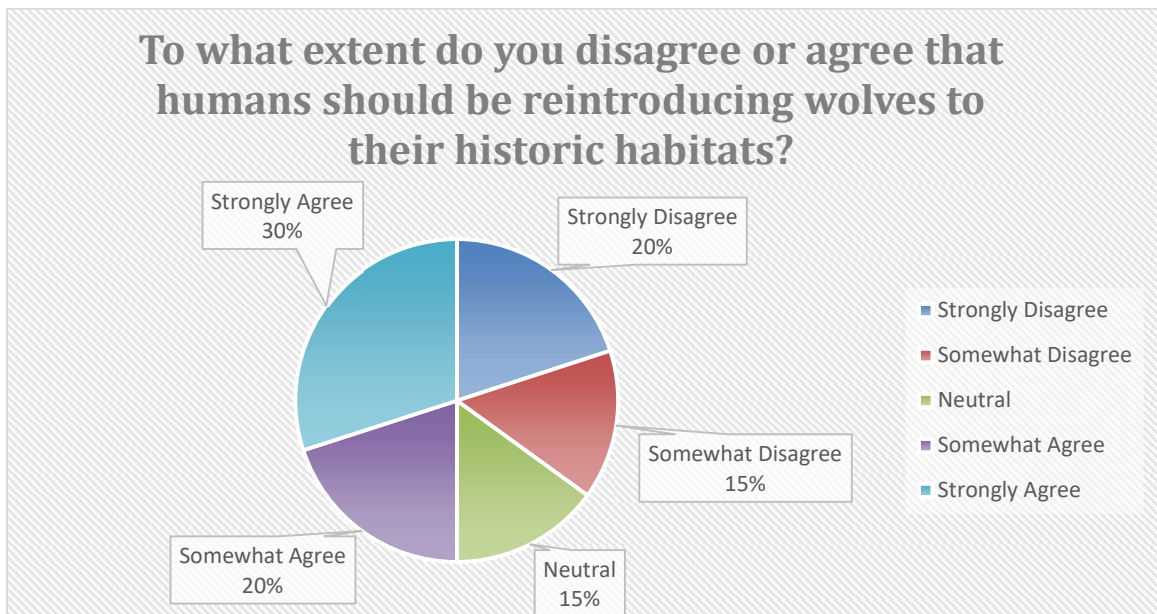


Figure 31: Respondents were asked *to what extent to you disagree or agree that humans should be reintroducing wolves to their historic habitats?* and 30% of respondents *strongly agree* that humans should be reintroducing wolves to their historic habitats, 20% *somewhat agree*, 35% *disagree*, and 15% are *neutral* (n = 20).

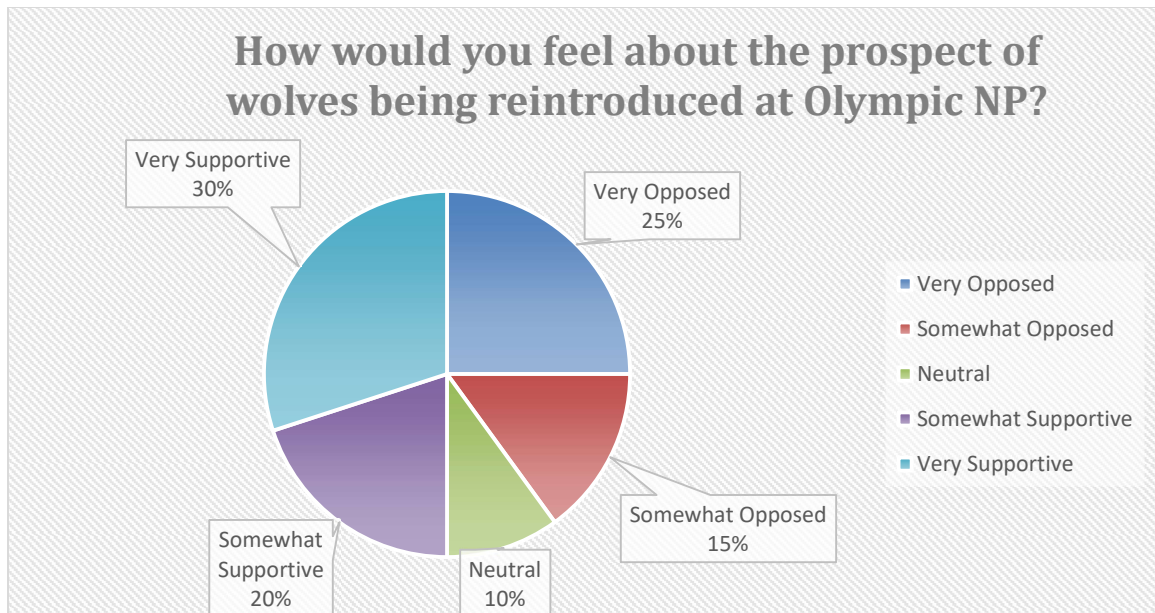


Figure 32: Respondents were asked *how would you feel about the prospect of wolves being reintroduced at Olympic NP?* and 30% of respondents are *very supportive* about the prospect of reintroductions of wolves to Olympic NP, 20% *somewhat supportive*, 25% are *very opposed*, 15% are *somewhat opposed*, and 10% are *neutral* (n = 20).

4.11 - Comments

For the last question of the survey, I used an open-ended style question to ask respondents if they had any comments about wolf reintroductions at Olympic NP to 1) to give respondents an opportunity to write me a confidential message that could help me understand possible motivations behind answers they gave; and 2) gain insights that will help me improve the survey instrument itself. Nine respondents decided to submit a comment with their survey responses, five in opposition, and four in support of gray wolf reintroductions at Olympic NP. The *Don't ask, just do it comment* submitted by a *Very Supportive Respondent* I found to be interesting because attitudes like that are counterproductive and are exactly why there is so much opposition to wolf reintroductions. Here are all the comments I received, organized by their level of support or opposition to wolf reintroductions at Olympic NP.

“I[sic] KNOW RACHERS[sic] IN EASTERN WASHINGTON WHO CANNOT LET THEIR[sic] CHILDREN OUTSIDE[sic] TO PLAY”

- Very Opposed Respondent

“I think this would be a real hazard to hikers and campers. It is too populated, except high in the mountains, and as much as proponents would wish it, wolves do not respect human's idea of borders or barriers.”

- Very Opposed Respondent

“Good luck! ;)”

- Somewhat Opposed Respondent

“I do not support reintroduction, they will get here on their own. Some Peninsula residents believe they have seen wolves in the Clearwater area.”

- Somewhat Opposed Respondent

“Not sure about the idea of re-introducing wolves into the ONP. I do not know enough about wolves to be able to comment very objectively. Prey such as elk do not remain in high country and range close to humans. The proximity to large populations of humans could create problems. Wolves are territorial and this could create dangers to people. Not as concerned about elk, deer or livestock as I am about the wolves and people conflict. Do NOT support sport hunting.”

- Somewhat Opposed Respondent

“Leadership at Olympic National Park makes decisions based on politics, not what is best for local stakeholders. They don't care what locals want or need. They cater to a national audience of out-of-town national park tourists.”

- Somewhat Supportive
Respondent

“One of the biggest issues in my mind is if/how to ensure WDFW would adjust hunting pressure in response to potential deer/elk declines on the OP following wolf reintroduction. Also, would wolves have any impact on the spread of TAHD? The concerns about reducing deer and elk

populations could be partially mitigated if there was proof that wolves would reduce TAHD prevalence. As of now no such proof is possible in the near future, and reintroducing wolves to find out is too large a gamble.”

- Somewhat Supportive Respondent

“2 comments. After visiting Yellowstone subsequent to wolf[sic] reintroduction, I got a good sense of how important it is to restore balance to the wilderness. There have been so many positive changes to the greater Yellowstone ecosystem after the reintroduction of wolves. I think that serves as a good template for what to do in other regions where wolves were extirpated. If also have a bun guesthouse I believe it would be a boon to the tourism of the area to have wolves back”

- Very Supportive Respondent

“Don't ask, just do it!”

- Very Supportive Respondent

CHAPTER 5: DISCUSSION

5.1 - Introduction

Olympic National Park (Olympic NP) was established in 1937 to conserve the last stronghold of Roosevelt Elk and the primeval forests that sustain them. Unfortunately, prior to the park's establishment, gray wolves had already been extirpated from the Olympic Peninsula, well before biologist realized how vitally important apex predators are at preventing trophic cascades. Rather than being apprehensive to reintroducing gray wolves to Olympic NP, resource managers can instead choose to learn from the mistakes made at Yellowstone NP. This literature review and pilot study demonstrate that there is a great need to launch a social information/education marketing campaign aimed at educating people in potential wolf recovery zones on the Olympic Peninsula prior to reintroduction attempts. Educational topics should utilize evidence-based conservation practices and be accessible to all potential stakeholders.

5.2 - Human Dimensions and Findings

To improve human-wildlife conflict mitigation efforts, researchers need to assess the human dimensions (i.e., values and attitudes) associated with carnivore management (Liordos et al., 2016). Conflicts between stakeholders can occur when people disagree about the methods utilized when managing species (Liordos et al., 2016). One way to find out what values and opinions shape a person's attitude toward wildlife conservation is to conduct a survey. Williams et al. (2002) analyzed 28 years' worth of survey data associated with wolf conservation and discovered that there are key demographic factors (age, gender, education level, hunting membership, etc.) that can indicate what someone's attitude might be toward wolf conservation. They found that the general

public overall had positive attitudes toward wolves with the most support coming from urban residents, females, people in environmental groups, people with higher education levels, and hunters. The more negative indicator factors were older people, males, people with more experience with wolves, farmers, and ranchers. Resource managers can use this kind of information to find allies or to appeal to stakeholders who might oppose their management strategies.

To find out what how the general public felt about wolf conservation when creating the Washington State's Wolf Conservation and Management Plan in 2011, researchers found two independent surveys from 2008 and 2009 that found that approximately 75% of the general public supports wolf recovery efforts (Wiles et al., 2011). In comparison, my survey, which focused directly on people in projected wolf recovery zones outside Olympic NP found that 50% of respondents would support reintroductions (Figure 32). Williams et al. (2002) stated that the best strategy to finding allies for a wolf management plan is to appeal to the general public, females, those with higher education and/or higher income, and hunters/trappers.

I think that the most compelling data that I collected with this survey was the survey responses about creating an acceptable wolf management plan. Most of my findings show that there are a lot of differing opinions concerning other aspects of wolf reintroductions; however, I was able to determine there were three areas where a strong consensus of respondents (95%) that agreed that including input from all stakeholders, using evidence-based conservation practices, and educating people about wolves were very important factors when creating a wolf management plan (see figures 10,11, and 12). While 65% agreed that adequately compensating rangers and farmers for wolf-killed

livestock, and 50% agreed that keeping wolves at agreed upon levels was very important (see figures 13, and 14).

5.3 - Conclusion

Biologists need to do a better job at understanding the human dimensions involved in resource management. Utilizing all stakeholder input, not just biologists' and politicians', increases the likelihood that a management plan will be socially acceptable to everyone involved, thus improving the possibility of a successful restoration project. Conflict managing strategies need to be a major component of any managing plan, especially any highly controversial government-sponsored wolf conservation plan.

Advocates and opponents to wolf reintroductions can learn a lot from each other. I believe that on the Olympic Peninsula there is more support for reintroductions than opposition, however, opponents should not be excluded from any future Olympic Wolf Management Plans because if biologists refuse to learn from mistakes made at Yellowstone NP, wolves at Olympic NP will be the ones to suffer.

5.4 - Future Research

Future research on gray wolf reintroductions at Olympic NP should investigate potential impacts on Treponeme-associated hoof disease (TAHD) in the Roosevelt elk population on the Olympic Peninsula if wolves were reintroduced. Another area of research that should be investigated is whether Olympic NP should consider reintroducing wolves to combat climate change under current National Park Services climate change policies.

5.5 - Recommendations

I have three recommendations based on this literature review and the findings from this pilot study. Recommendation: 1) Although this survey had a small sample size, its findings indicate that there could be some support for reintroductions at Olympic NP from people in the agricultural sector (see figure 24). It will be important to verify these findings by conducting a random sample of the population of the Olympic Peninsula are impacted by a potential wolf reintroduction to gain a more complete understanding of public opinion. Recommendation 2) Olympic NP resource managers will need to assemble a coalition of pro-wolf reintroduction stakeholders prior to actually reintroducing wolves. Thus, my second recommendation is that Olympic NP immediately begin a wolf reintroduction social information and education marketing campaign aimed at improving the level of tolerance that stakeholders have towards wolves. To accomplish this goal, Olympic NP personal should utilize evidence-based conservation practices, examples learned from Yellowstone NP's experiences with wolf reintroductions, and an open-minded approach to finding common ground. Recommendation 3). While I personally would support reintroductions from a biological standpoint, from a social acceptance standpoint, it would be premature to recommend that anyone reintroduce gray wolves to Olympic National Park until the first two recommendations have been addressed.

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APPENDICIES

Appendix A: Institutional Review Board Application

1) Project Abstract (500 words)

The Olympic Mountains in northwestern Washington State are home to a unique mixture of plants and animals, some of whom are endemic and/or listed as threatened or endangered under the Endangered Species Act (ESA). Of the 15 threatened or endangered species currently listed for the Olympic Mountains, only the gray wolf (*Canis lupis*) was deliberately eradicated by early white settlers to the region. The loss of this apex-predator was an unmitigated disaster for this rare ecosystem. It is important to reestablish gray wolves in Olympic National Park to: A) recover lost ecosystem services, B) maintain prey and mesocarnivore populations at sustainable levels within the park and adjacent lands, and C) provide federally protected habitat for wolf population recovery objectives of Washington State. However, wolf reintroductions are controversial and thus require an examination into possible common ground solutions. Using Human Dimensions theory as a practical framework, this thesis investigated wolf and human coexistence in North American from western expansion in the 19th and 20th centuries to present. Additionally, this thesis examined ecological, social, and political influences on land management decisions made by agencies such as the National Park Service and Washington State Department of Fish and Wildlife. Using an internet-based snowball survey, this research focused on stakeholders that resided in the Olympic Peninsula Region, where wolves are not present, and other regions of Washington State where wolves are actively recolonizing to: A) assess if natural resource conservation social norms and values differed between these groups, B) ascertain demographically which subgroups support/do not support reintroductions and why, and C) determine if common ground solutions are possible.

Recommendations: may include suggestions for educational programs, policy changes or legislative actions.

2) Bibliography

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- Smith, Douglas W., Rolf O. Peterson, and Douglas B. Houston. (2003). “Yellowstone after Wolves.” *BioScience* 53 (4): 330.
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3) Risks and Benefits

Please describe the possible risks to human subjects. Specify possible kinds and degrees of risks, e.g., minimal, emotional risk in the form of distress or embarrassment. Outline the precautions that will be taken to minimize these risks, and how the benefits outweigh the risks.

a) Specific level of risk to subjects

To estimate the risk level that my study might impose on its subjects, I estimated the probability of the survey causing harm and weighed the

magnitude of that harm to my subjects if it occurred. I concluded that the probability and magnitude of harms were of minimal risk to potential subjects. Thus, I believe that keeping my respondent's responses confidential will be sufficient to protect my subjects.

These are the steps I will take to assure the probability and magnitude of harms are of minimal risk to my subjects:

- Make it very clear that this is survey is for research purposes only and that no one, to my knowledge, is actively trying to reintroduce wolves at ONP.
- Ensure that the subjects are at least 18 years old.
- Design the survey to be confidential.
- Allow people to quit at any time.
- Explain that their participation is voluntary.
- Not ask for or keep any personally identifiable information.
- Generalize the survey questions to minimize the probability of causing emotional distress.
- Restrict access to the data to people who need to see it to help me with my thesis.
- Keep my data on a password protected computer.
- Delete the data once my thesis has been completed.

b) Benefits of the research

It has been over 100 years since wolves were removed from the Olympic Peninsula. The main benefit of this research will be that state and federal agencies could use it to justify a more thorough survey of the Olympic Peninsula Region. Ultimately, my goal with this research is to make recommendations for educational programs, policy changes, or legislative actions that will be socially acceptable to people that work in agriculture on the Olympic Peninsula.

4) Purpose and Research Design

My thesis will attempt to answer the question: Is it time to reintroduce gray wolves to Olympic National Park (ONP)? My literature review on the subject found that reintroductions are supported at ONP from a biological feasible standpoint. However, the literature is unclear if wolf reintroduction would be socially acceptable to residents who live in the Olympic Peninsula. Thus, I decided to create an internet-based snowball survey to reach agricultural workers from the Olympic Peninsula. I will utilize Survey 123 by ESRI to design, implement, collect data, and for basic analysis of my survey. The survey will be

administered 100% remotely and will be conducted in accordance with Washington state and The Evergreen State College Covid-19 procedures.

To analyze my data, I will use Excel and Survey 123 for cross tabulations, and simple statistics. I will not be collecting any locational data other than verifying that the person must live, work, or own land on the Olympic Peninsula due to the sensitivity of my research topic. I believe my survey findings will help me gauge the level of support or opposition from local farmers to the idea of reintroducing wolves at Olympic National Park. I think that the findings will also help me understand what factors might change their minds on the topic.

5) Problem Statement (300 words) *Provide the HSR a clear description of what the research aims to examine)*

In the 18th and 19th centuries, European settlers colonized the Pacific Northwest and purposefully hunted gray wolves (*Canis lupus*) to the brink of extinction. Settlers removed the wolves out of fear, without considering their ecological importance as a keystone species. In the Olympic Mountains, the last recorded gray wolf was killed in the 1920's. The lack of a primary predator on the Peninsula profoundly changed predator/prey dynamics. Ungulates such as elk and deer have had free range to degrade critical ecosystems by over-grazing and causing erosion (Carroll et al., 2006). Coyotes (*Canis latrans*) filled the ecological niche that the wolves once occupied; unfortunately, coyotes prefer smaller game, so the endemic Olympic Marmot populations have suffered.

Researchers and environmentalists in the second half of the 20th century began to recognize the vital role that gray wolves provided to the landscape. After the U.S. Fish and Wildlife Service reintroduced them to Yellowstone in 1995, wolves began to heavily influence interspecific competition within forest and riparian ecosystems in ways that significantly affected forest growth and composition (Carroll et al., 2006). However, recolonization of the Olympic Mountains is extremely unlikely without human assistance. Without wolves, natural ecological functions within the park will continue to deteriorate this unique ecosystem (Douglas, 2003).

Public opinion of gray wolves has changed over the past few decades, particularly since wolf reintroductions were biologically successful in Yellowstone National Park. Williams et al. (2002) told us that people's attitudes towards wolves and their reintroduction change overtime due to many factors. My survey will help me gauge the level of support or opposition from local agriculture workers and hopefully shed light on possible common ground solutions.

6) Research Question

Is it time to reintroduce gray wolves to Olympic National Park?

7) Selection and recruitment of participant

How will the recruitment of human subjects for your proposed project be carried out? Include your recruitment criteria and procedures. Attach copies of any advertisements, flyers, announcements, or messages you will use to recruit participants.

My target audience will be agricultural workers who live on the Olympic Peninsula. Here is my list of recruitment criteria.

- Prospective subject criteria:
 - Subject must live, work, or own land on the Olympic Peninsula
 - They must work in agriculture
 - They have access to the internet for contact and survey purposes
 - They are legally able to give informed consent
 - They must be at least 18 years of age

I will recruit prospective subjects by initially contacting agricultural workers using internet searches and/or recommendations via the snowball method. Below is an example message I will send to a prospective subject.

Example Introductory Email

Dear Agricultural Worker,

I am a U.S. Coast Guard veteran currently enrolled in graduate school and I am working on a research project involving agriculture in the Olympic Peninsula. The reason I am contacting you is because I am conducting a survey to find out what those in the agricultural field working in the Olympic Peninsula would think about gray wolf reintroductions at Olympic National Park (ONP). I am not a pro-wolf reintroduction advocate or activist; this survey serves no purpose outside of my project and is not sponsored by any person or agency. To the best of my knowledge, no organization is actively working on reintroducing gray wolves to ONP.

That being said, I believe that a controversial topic like the one I am working on needs to have input from all points of view, especially from people who are

directly affected by policy decisions. If you decide to participate in the survey, your responses will remain confidential. I will not ask you any personally identifiable questions and you are free to quit the survey at any time. I estimate that it should take approximately 10 to 15 minutes to complete.

To ensure confidentiality, the data you provide will be stored on a password protected computer and will only be shared with faculty members on a need-to-know basis. My findings will be made publicly available once I complete my thesis. If you are interested in finding out more about my research project, you can request a copy of my final report by emailing me directly at blajam03@evergreen.edu.

If you have any question about this survey, I would be happy to answer them as best as I can. If you know of any other agricultural workers located on the Olympic Peninsula that you think would be interested in taking this survey, please consider helping me contact them.

I appreciate your time.

Respectfully,
James Blacklaw

8) Data collection process and protocol

Include the procedures and protocols to which humans will be subjected, (i.e., questionnaires, interviews, audio, or video recording). Provide detailed description of when, where, and how data will be collected, and the procedures and protocols used. Please attach a copy of all the questions you will be asking.

I will be collecting my data using an internet-based snowball survey method. After this application is approved by the IRB, I will begin emailing and calling agriculture organizations to recruit subjects to take this survey. The survey will be conducted remotely using Survey 123 by ESRI. When a subject completes the survey, the data will be collected automatically and be protected by password on Survey 123. Once I feel that I have enough respondents, I will begin cleaning the data and prepare to move into my analysis phase.

I have attached a copy of my survey questions with this application.

9) Debriefing Procedures *(For studies that use deception or pose more than minimal risk)*

N/A

10) Confidentiality and Anonymity

Explain whether the participants will be protected through confidentiality or anonymity and how this protection is appropriate for the level of risk and how this protection will be managed. Include how information from this study will be distributed, and how will the promise of confidentiality be kept or carried out in the final product.

This survey is estimated to be of minimal risk to my subjects. Due to the controversial nature of my topic, I have designed the survey to be confidential. Here are the ways I will ensure confidentiality.

- I will not ask for any personally identifiable information.
- Data will be stored on a password protected computer.
- Raw data will be deleted after my thesis is completed.
- The only people who will have access to the raw and cleaned data will be myself and Evergreen faculty members on a need-to-know basis.
- I will not be collecting locational data from my subjects. However, if any location data is accidentally collected, I will delete it during the data cleaning process.
- My findings will be reported in aggregate to further ensure that individual respondents will not be easily identifiable.

11) Data Management and Storage

Explain how the data will be managed (transferred, used, shared) and stored once it is collected. Include how long the data will be kept, and why that amount of time is necessary.

The data for this research project will be collected using my Evergreen provided Survey 123 account. I plan on downloading the raw data from Survey 123 into an Excel file. I will be analyzing the data in Excel on my password protected personal computer. To ensure I do not prematurely erase needed data, I plan to keep the data on my computer until I complete my thesis. Once my thesis is completed, I will delete the data from my personal computer and from Survey 123.

I will not share the data with anyone other than Evergreen faculty on a need-to-know basis to maintain confidentiality and anonymity.

12) Informed Consent Process and Form

Explain how informed consent will be obtained and attach the specific informed consent form for this study. (See sample sections for informed consent)

I have attached an example consent form that I plan to attach to the beginning of my survey. I will ensure that my subjects have given their informed consent by having them read the consent form and agree to it before they can take the survey.

You are being invited to participate in a research study titled: Maintaining Long-term Sustainability of the Natural World: Reintroduction of Gray Wolves (*Canis lupus*) to Olympic National Park. This study is being done by James Blacklaw from The Evergreen State College.

This is only a student research project. To the best of my knowledge, no organization is actively trying to reintroduce wolves to Olympic National Park. The purpose of this research study is to help me gauge the level of support or opposition from agricultural workers on the Olympic Peninsula. If you agree to participate, you will be asked to complete a confidential online survey. This survey will take approximately 10 to 15 minutes to complete and will ask you for your opinions on natural resource management and gray wolf reintroductions.

You may not directly benefit from this research. However, your participation in the study may help me make recommendations for educational programs, policy changes, or legislative actions that reflect your opinions.

Risks to you are minimal and are likely to be no more than mild discomfort with sharing your opinion. The survey will not collect information that could be linked to you personally. To the best of my ability your responses will remain confidential. With any online related activity, however, the risk of a breach of confidentiality is always possible. I will minimize any risks by; 1) not ask for any personally identifiable information during the survey, 2) deleting any personally identifiable information if accidentally given, 3) protecting your survey responses on a password protected computer, and 4) erasing the data after my thesis is complete.

Your participation in this study is completely voluntary and you can withdraw at any time. You are free to skip any questions that you choose.

If you have questions about this project or if you have a research-related problem, you may contact the researcher, James Blacklaw at blajam03@evergreen.edu. If you have any questions concerning your rights as a research subject, or you experience problems because of your participation in this research project, you may contact Rhonda Woods, IRB Staff at The Evergreen State College at irb@evergreen.edu.

Once you complete the survey and see what kind of questions I am asking, feel free to recommend others that you think would help me with this project by also taking the survey. I would greatly appreciate it.

By clicking "I agree" below you are indicating that you are at least 18 years old, have read and understood this consent form and agree to participate in this research study. Please print a copy of this page for your records.

I Agree

I Do Not Agree

Appendix B: General Email Introduction

Participant,

My name is James, and I am currently enrolled in graduate school in Olympia working toward a Master of Environmental Studies degree. I hope you don't mind my contacting you directly, I found your contact info on a list of agricultural businesses in the Olympic Peninsula. I am writing my thesis on the social acceptability of gray wolf reintroductions to Olympic National Park (ONP), and I am conducting a survey to learn the opinions of those in the agricultural field working in the Olympic Peninsula. I am not a pro-wolf reintroduction advocate or activist; this survey serves no purpose outside of my project and is not sponsored by any person or agency. To the best of my knowledge, no organization is actively working on reintroducing gray wolves to ONP.

That being said, I believe that a controversial topic like this one needs to have input from as many viewpoints as possible, especially from those who are directly affected by policy decisions. If you decide to participate in the survey, your responses will remain confidential, and you are free to quit the survey at any time if you so wish. I estimate that it should take approximately 10-15 minutes to complete.

My findings will be made publicly available once I complete my thesis. If you are interested in finding out more about my project, you can request a copy of my final report by emailing me directly at: blajam03@evergreen.edu.

If you have any question about this survey, I would be happy to answer them as best as I can. If you know of any other agricultural workers located on the Olympic Peninsula that you think would be interested in taking this survey, please consider helping me contact them.

To access the survey, click on this link: <https://arcg.is/O0qyv>.

I appreciate your time.

Respectfully,
James Blacklaw

Appendix C: Institutional Review Board Approval Letter



To: James Blacklaw, MES Program
CC: Ralph Murphy, MES Program
From: Mike Crow, IRB Chair
Date: February 24, 2021
RE: IRB Request for Review Protocol
IRB Protocol #: 21-005-R1
Protocol Title: "Maintaining Long-Term Sustainability of the Natural World: Reintroduction of Gray Wolves (*Canis Lupus*) to Olympic National Park"

Thank you for your recent Institutional Review Board Request for Review of Protocol #21-005-R1 entitled, "Maintaining Long-Term Sustainability of the Natural World: Reintroduction of Gray Wolves (*Canis Lupus*) to Olympic National Park Your protocol has been approved as Human Subjects Research. We have reviewed this request and find that it meets the IRB's criteria for protection of human participants in accordance to the federal regulations 45 CFR 46. Your IRB approval end date is **February 24, 2022** and you are free to begin your research.

If this study continues unchanged past the IRB approval end date, you will need to submit a Request for Continuing Review. If there are changes to the research design or data that is collected, you will need to submit a Request for Review of Modification or Amendment to Approved Research form.

Best of luck with your study.

Institutional Review Board

The Evergreen State College | 2700 Evergreen Parkway NW | Olympia, Washington 98505 | evergreen.edu/irbhomepage

Appendix D: Survey Instrument

You are being invited to participate in a thesis research study titled: Maintaining Long-term Sustainability of the Natural World: Reintroduction of Gray Wolves (*Canis lupus*) to Olympic National Park. This study is being done by James Blacklaw, a Master of Environmental Studies student from The Evergreen State College.

This is only a student research project. To the best of my knowledge, no organization is actively trying to reintroduce wolves to Olympic National Park. The purpose of this research study is to help me gauge the level of support or opposition from agricultural workers on the Olympic Peninsula. If you agree to participate, you will be asked to complete a confidential online survey. This survey will take approximately 10 to 15 minutes to complete and will ask you for your opinions on natural resource management and gray wolf reintroductions.

You may not directly benefit from this research. However, your participation in the study may help me make recommendations for educational programs, policy changes, or legislative actions that reflect your opinions.

Risks to you are minimal and are likely to be no more than mild discomfort with sharing your opinion. The survey will not collect information that could be linked to you personally. To the best of my ability your responses will remain confidential. With any online related activity, however, the risk of a breach of confidentiality is always possible. I will minimize any risks by; 1) not ask for any personally identifiable information during the survey, 2) deleting any personally identifiable information if accidentally given, 3) protecting your survey responses on a password protected computer, and 4) erasing the data after my thesis is complete.

Your participation in this study is completely voluntary and you can withdraw at any time. You are free to skip any questions that you choose.

If you have questions about this project or if you have a research-related problem, you may contact the researcher, James Blacklaw at blajam03@evergreen.edu. If you have any questions concerning your rights as a research subject, or you experience problems because of your participation in this research project, you may contact Rhonda Woods, IRB Staff at The Evergreen State College at irb@evergreen.edu.

By clicking "I agree" below you are indicating that you are at least 18 years old, have read and understood this consent form and agree to participate in this research study. However, by selecting "I Do Not Agree" below you are indicating that you are not at least 18 and/or do not want to participate in this research study. Either way I appreciate your time. Please print a copy of this page for your records.

Informed Consent *Select one*

a) I Agree

b) I Do Not Agree

Thank you for your participation in this survey. Below are 19 questions that will help me understand what your opinions are about wolf reintroductions at Olympic National Park.

1) Do you consider yourself a ...? *Select all that apply*

a) Hunter

b) Farmer

c) Forester

d) Rancher

2) Do you work in agriculture? *Select yes or no (this question uses skip-logic)*

a) Yes – go to 2.5

b) No – go to 3

2.5) If yes, what is your primary focus in agricultural? *Select one*

a) Dairy Farming

b) Flowers

c) Forestry

d) Fruit

e) Livestock/Ranching

f) Produce

g) Other (please specify)

3) To what extent do you disagree or agree that humans should be reintroducing wolves to their historic habitats? *Select one*

a) Strongly Disagree

b) Somewhat Disagree

- c) Neutral
 - d) Somewhat Agree
 - e) Strongly Agree
- 4) In your opinion, how important are each of the following factors when creating an acceptable wolf management plan? *Select level of importance for each factor*
- a) Not at all important
 - b) Neutral
 - c) Very important
 - d) Unsure
- a) Incorporating input from all stakeholders
 - b) Keeping wolf populations at agreed upon levels
 - c) Returning control to states as soon as possible
 - d) Allowing for sport hunting once wolves recover
 - e) Using evidence-based conservation practice
 - f) Educating people about wolves
 - g) Adequately compensate ranchers and farmers for wolf-killed livestock
- 5) To what extent do you feel that reintroducing wolves at Olympic National Park would be a disadvantage or advantage to you personally? *Select one*
- a) Huge Disadvantage
 - b) Slight Disadvantage
 - c) Neutral
 - d) Slight Advantage
 - e) Huge Advantage
- 6) In your opinion, where should humans and wolves coexist? *Select all that apply*
- a) Historic habitats
 - b) Secluded wilderness
 - c) National Parks

- d) Public lands
 - e) Private lands
- 7) In your opinion, wolves can be lethally removed if... *Select all that apply*
- a) it kills a pet or livestock
 - b) it threatens pet or livestock
 - c) it is on private land
 - d) it is on public land
- 8) How effective are each of the following examples at reduce human-wolf conflicts? *Select level of effectiveness for each of the examples*
- a) Not at all effective
 - b) Neutral
 - c) Very effective
 - d) Unsure
- a) Educating people about wolves
 - b) Avoiding high risk areas
 - c) Fencing
 - d) Non-lethal hazing (i.e., loud noises, paintball guns, etc.)
 - e) Management plans
 - f) Lethal removal
- 9) If you could choose, where do you think wolves should be allowed to live? *Select all that apply*
- a) Historic habitats
 - b) Secluded wilderness
 - c) National Parks
 - d) Public lands
 - e) Private lands
- 10) If biologists at Olympic National Park were considering reintroducing gray wolves, what level of concerned would you feel for each of the following examples? *Select level of concern for each example*

- a) Not at all concerned
 - b) Neutral
 - c) Very concerned
 - d) Unsure
-
- a) Declines in Elk and Deer populations
 - b) Increased danger to humans
 - c) Increased danger to livestock
- 11) How would you feel about the prospect of wolves being reintroduced at Olympic National Park? *Select level of opposition or support*
- a) Very Oppose
 - b) Somewhat Oppose
 - c) Neutral
 - d) Somewhat Support
 - e) Very Supportive
- 12) Do you currently live, work, or own land on the Olympic Peninsula? *Select one*
- a) Yes
 - b) No
- 13) How would you best describe yourself? *Select all that apply*
- a) Asian or Pacific Islander
 - b) Black or African American
 - c) Hispanic or Latino
 - d) Native American or Alaskan Native
 - e) White or Caucasian
 - f) Prefer not to say
 - g) Other (please specify)
- 14) What is your gender? *Select one*

- a) Male
 - b) Female
 - c) Prefer not to say
 - d) Other (please specify)
- 15) What is the highest degree or level of education you completed? *Select one*
- a) No diploma
 - b) High school diploma / G.E.D.
 - c) Some college, but no degree
 - d) Technical / Associate / Junior college
 - e) Bachelor's degree
 - f) Master's degree
 - g) Ph.D. or higher
- 16) What occupation are you currently employed in? *Write your occupation in box*
- 17) What year were you born? *Click on calendar icon inside the box to select your birth year*
- a) yyyy
- 18) Will you help me contact other agricultural workers who work, live, or own land on the Olympic Peninsula that might be interested in taking this survey? *Select one*
- a) Yes
 - b) No
- 19) If you have any comments that you would like to add regarding wolf reintroductions at Olympic National Park, please enter them below. *Write comment in box*