BEFORE THE SECRETARY OF INTERIOR

PETITION TO LIST THE ALEXANDER ARCHIPELAGO WOLF (*CANIS LUPUS LIGONI*) IN SOUTHEAST ALASKA AS THREATENED OR ENDANGERED UNDER THE U.S. ENDANGERED SPECIES ACT

PETITIONERS CENTER FOR BIOLOGICAL DIVERSITY, ALASKA RAINFOREST DEFENDERS, AND DEFENDERS OF WILDLIFE

JULY 15, 2020

NOTICE OF PETITION

David Bernhardt, Secretary
U.S. Department of the Interior
1849 C Street NW
Washington, D.C. 20240
exsec@ios.doi.gov

Margaret Everson, Principal Deputy Director
U.S. Fish and Wildlife Service
1849 C Street NW
Washington, D.C. 20240
margaret_everson@fws.gov

Gary Frazer, Assistant Director for Endangered Species
U.S. Fish and Wildlife Service
1840 C Street NW
Washington, D.C. 20240
gary_frazer@fws.gov

Greg Siekaniec, Alaska Regional Director
U.S. Fish and Wildlife Service
1011 East Tudor Road
Anchorage, AK 99503
greg_siekaniec@fws.gov

PETITIONERS

Shaye Wolf, Ph.D.
Center for Biological Diversity
1212 Broadway
Oakland, California 94612
(415) 385-5746
swolf@biologicaldiversity.org

Randi Spivak
Public Lands Program Director
Center for Biological Diversity
(310) 779-4894
rspivak@biologicaldiversity.org

Larry Edwards
Alaska Rainforest Defenders
P.O. Box 6064
Sitka, Alaska 99835
(907) 772-4403
Larry@LTEdwards.com

Patrick Lavin, J.D.
Defenders of Wildlife
441 W. 5th Avenue, Suite 302
Anchorage, AK 99501
(907) 276-9410
PLavin@defenders.org

Shaye Wolf
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Date this 15 day of July 2020

Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. §1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. § 424.14(a), the Center for Biological Diversity, Alaska Rainforest Defenders, and Defenders of Wildlife petition the Secretary of the Interior, through the United States Fish and Wildlife Service ("USFWS"), to list the Alexander Archipelago wolf (*Canis lupus ligoni*) in Southeast Alaska as a threatened or endangered species. Petitioners also request that critical habitat be designated for the Alexander Archipelago wolf in Southeast Alaska concurrently with the species being listed, pursuant to 16 U.S.C. § 1533(a)(3)(A) and 50 C.F.R. § 424.12.

Petitioner Center for Biological Diversity ("Center") is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive through science, policy, law, and creative media. The Center is supported by more than 1.7 million members and online activists throughout the country. The Center works to secure a future for all species, great or small, hovering on the brink of extinction. The Center submits this petition on its own behalf and on behalf of its members and staff with a long-standing interest and involvement in protecting the Alexander Archipelago wolf and its habitat.

Petitioner Alaska Rainforest Defenders, founded in 2011, is a regional conservation non-profit corporation in Southeast Alaska. The Alaska Rainforest Defenders stand together to defend and promote the biological integrity of Southeast Alaska's terrestrial, freshwater, and marine ecosystems for the benefit of current and future generations. Alaska Rainforest Defenders seeks to foster protection of southeast Alaska's fish and wildlife and their habitat. The members of Alaska Rainforest Defenders use public lands throughout southeast Alaska for commercial and subsistence fishing and hunting, professional scientific work, and a wide range of recreational activities.

Founded in 1947, Petitioner Defenders of Wildlife is a major national conservation organization focused on wildlife and habitat conservation. It has over 1.8 million members and supporters, and is headquartered in Washington, D.C. with field offices in 12 states. Defenders is a science-based advocacy nonprofit organization committed to conserving and restoring native species and the habitat upon which they depend.

The USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on the USFWS. Specifically, the USFWS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. § 1533(b)(3)(A). The USFWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Petitioners need not demonstrate that a listing *is* warranted; rather, Petitioners must only present information demonstrating that such listing *may* be warranted. There can be no reasonable dispute that the available information indicates that listing the species as either threatened or endangered *may* be warranted. As such, the USFWS must promptly make a positive initial finding on the petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

The term “species” is defined broadly under the ESA to include “any subspecies of fish or wildlife or plants and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” 16 U.S.C. § 1532(16). A Distinct Population Segment (“DPS”) of a vertebrate species can be protected as a “species” under the ESA even though it has not formally been described as a separate “species” or “subspecies” in the scientific literature. A species may be composed of several DPSs, some or all of which warrant listing under the ESA.

The USFWS has recognized the Alexander Archipelago wolf (*Canis lupus ligoni*) as a subspecies of the gray wolf and as a listable entity. The best-available science clearly demonstrates that the Alexander Archipelago wolf is threatened or endangered throughout all or a significant portion of its range. Petitioners request that the USFWS recognize Alexander Archipelago wolves in Southeast Alaska as a Distinct Population Segment (DPS) and evaluate a Southeast Alaska DPS for listing as threatened or endangered. In the alternative, Petitioners request that the USFWS evaluate the Alexander Archipelago wolf subspecies for listing where Southeast Alaska constitutes a significant portion of the range.

Pursuant to 50 C.F.R. § 424.14(b), Petitioner Center for Biological Diversity provided notice to the Alaska Department of Fish and Game on June 12, 2020 that the Center intended to file a petition under the federal Endangered Species Act to list and designate critical habitat for the Alexander Archipelago wolf (*Canis lupus ligoni)* no sooner than 30 days from the date that notice was provided. (*see* Center for Biological Diversity 2020).

Table of Contents

Executive Summary 7

Part I. Taxonomy, Distribution, and Natural History 12

A. Taxonomy 12

B. Distribution 14

C. Habitat Use 15

1. Seasonal Habitat Selection 15

2. Habitat Use During the Breeding Season 17

D. Diet and Foraging Ecology 19

Part II. Abundance and Population Trends 20

Part III. The Alexander Archipelago Wolf As a Listable Entity Under the ESA 22

A. Listable Entities under the Endangered Species Act. 23

B. The 2016 USFWS Evaluation of Listable Alexander Archipelago Wolf Entities and the Listing Determination for Those Entities. 24

C. Alexander Archipelago Wolves in Southeast Alaska Constitute a Distinct Population Segment that Warrants Listing under the ESA. 25

1. A Southeast Alaska DPS Meets the Discreteness Criteria Based on Differences Across the International Boundary Between the U.S. and Canada. 25

2. The USFWS has Determined in Similar Cases that a DPS Meets the Discreteness Criteria Based on Differences across the International Boundary. 27

3. A Southeast Alaska DPS Meets the Significance Criteria of the DPS Policy. 30

4. A Southeast Alaska DPS Warrants Listing as Threatened or Endangered Across All or a Significant Portion of Its Range. 33

D. Alexander Archipelago Wolves in Southeast Alaska Constitute a Significant Portion of the Range of the Subspecies. 34

Part IV. Threats Analysis: The Alexander Archipelago Wolf Is Threatened or Endangered Based on the Five ESA Listing Factors 36

A. Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range: Logging and Road Development Threaten the Continued Existence of the Archipelago Wolf in Southeast Alaska. 37

1. Decades of Intensive Clear-cut Logging and Road-Building Threaten Archipelago Wolves. 38

2. Continued Intensive Clear-cut Logging and Road Development Under the 2016 Tongass Forest Plan and Associated Timber Sales Jeopardize the Archipelago Wolf. 55

3. The Forest Service's Proposed Elimination of Roadless Rule Protections on the Tongass National Forest Further Jeopardizes the Archipelago Wolf. 70

B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes: Trapping and Hunting Threaten the Archipelago Wolf 75

1. GMU 2 Wolves Are Threatened by High Levels of Legal and Illegal Trapping and Hunting. 75

2. Legal and Illegal Trapping and Hunting Threaten Archipelago Wolves Outside of GMU 2 77

C. Inadequacy of Existing Regulatory Mechanisms Threatens the Archipelago Wolf 81

1. Existing Regulatory Mechanisms Are Inadequate to Mitigate Threats From Habitat Destruction And Modification From Logging and Road Construction. 81

2. Existing Regulatory Mechanisms Are Inadequate to Mitigate Overexploitation from Trapping and Hunting. 90

3. Existing Regulatory Mechanisms are Inadequate to Mitigate the Harms of Anthropogenic Climate Change to the Archipelago Wolf. 91

4. Existing Regulatory Mechanisms are Inadequate to Protect Archipelago Wolf Populations from Inbreeding Depression. 92

D. Other Natural or Manmade Factors Threaten the Continued Existence of the Archipelago Wolf: The Climate Crisis and Inbreeding Depression. 93

1. The Climate Crisis Threatens the Archipelago Wolf. 93

2. Loss of Genetic Diversity and Inbreeding Depression Threaten the Archipelago Wolf. 99

Conclusion 102

Literature Cited 103

Executive Summary

The Alexander Archipelago wolf (*Canis lupus ligoni*) is a rare subspecies of the gray wolf that is endemic to the coastal temperate rainforests of Southeast Alaska and coastal British Columbia. In this petition, we seek protection of a "Distinct Population Segment" ("DPS") in Southeast Alaska, where the large islands of the Alexander Archipelago support the vast majority of the wolf population and wolves face multiple high-magnitude threats.

The Alexander Archipelago wolf (hereafter, Archipelago wolf) is genetically, morphologically, and ecologically distinct from interior gray wolves. It has a close association with old-growth forests, primarily using low-elevation old-growth forest habitat for denning, raising pups, hunting, movement, and other essential behaviors. Wolf habitat use is strongly associated with the availability and abundance of their primary prey, the Sitka black-tailed deer (*Odocoileus hemionous sitkensis*), which also rely on old-growth forest habitat.

Although range-wide population estimates are uncertain, the Archipelago wolf population was estimated at 908 wolves throughout Southeast Alaska in the 1990s. Prince of Wales Island ("POW") and associated islets in Game Management Unit ("GMU") 2 were estimated to support more than a third (37%) of the Southeast Alaska wolf population, with another 28% inhabiting the large islands of Kupreanof, Mitkof, Kuiu, Etolin, Wrangell, and Zarembo in GMU 3, and 20% on Revillagigedo Island and the Cleveland Peninsula in GMU 1A. The only regularly monitored Archipelago wolf population is on POW. Over the past 15 years, the POW wolf population has suffered an alarming decline of ~60% due to escalating threats from habitat destruction and mortality from trapping and hunting, raising high concern for the future of Southeast Alaska wolves.

Recognizing these threats to Archipelago wolves, in August 2011, the Center for Biological Diversity and Greenpeace submitted a petition requesting that the Archipelago wolf be listed as an endangered or threatened species under the Endangered Species Act. Petitioners also requested the U.S. Fish and Wildlife Service ("USFWS") consider POW as a significant portion of the range of the Archipelago wolf, and petitioners provided detailed evidence supporting the designation of POW and nearby islands as a Distinct Population Segment. The 2011 petition identified human-caused mortality from legal and illegal hunting and trapping as a key threat, representing the highest cause of mortality for Archipelago wolf populations in Southeast Alaska. Hunting and trapping occur at unsustainable levels on POW, with illegal killing accounting for as much as half of human-caused mortality. The 2011 petition further identified past and ongoing industrial clear-cut logging on the Tongass National Forest, as well as state and private lands, as a principal threat. Intensive clear-cut logging degrades and fragments essential wolf habitat and reduces long-term carrying capacity for deer, the wolves' primary prey, while injuring salmon runs that provide an important seasonal food source.

Logging-associated road development also increases wolf mortality by facilitating access for trappers and hunters.

In its January 2016 12-Month Finding, the USFWS determined that listing the Alexander Archipelago wolf was not warranted throughout all or a significant portion of its range. (81 Fed. Reg. 435). The Service further determined that the POW population does not meet the criteria of the DPS Policy. (*Id*.) Central to the USFWS's finding was the determination that the range of the Archipelago wolf is not confined to southeast Alaska, but rather that the wolf also occupies all of coastal British Columbia. (*Id.* at 437). The agency concluded that the population of coastal British Columbia wolves is "stable or slightly increasing." (*Id.*). In contrast to British Columbia, wolves in Southeast Alaska were found to have a more precarious conservation status. The USFWS confirmed that the wolf population on POW and associated islands is declining and facing a high level of stressors, while wolves on the large islands of GMU 3 were found to be facing intermediate levels of stressors. (USFWS SSA 2015 at Table 26). However, because of the presumed stability of wolf populations in British Columbia, the USFWS concluded that "[t]hroughout most of its range, the [Archipelago] wolf is stable or slightly increasing or is presumed to be stable based on its demonstrated high resiliency to the magnitude of stressors present" which provided the central basis for determining that the entire subspecies did not warrant listing. (81 Fed. Reg. 453).

Notably, in the 2016 Finding, the USFWS never conducted two critical listing analyses for the Archipelago wolf: (1) an evaluation of whether Archipelago wolves in Southeast Alaska constitute a DPS that warrants listing, and (2) an evaluation of whether Archipelago wolves in Southeast Alaska constitute a Significant Portion of the Range ("SPR") of the subspecies. The USFWS in the 2016 Finding also made determinations regarding the conservation status and threats to wolves in Southeast Alaska that must be re-evaluated, particularly in light of significant new information that has emerged since that finding.

This petition requests that the USFWS recognize Alexander Archipelago wolves in Southeast Alaska as a DPS and evaluate the Southeast Alaska DPS for listing as threatened or endangered. In the alternative, Petitioners request that the Service evaluate the Alexander Archipelago wolf subspecies for listing, where Southeast Alaska and coastal British Columbia constitute the range and Southeast Alaska constitutes a significant portion of that range.

Significant new information since the 2016 Finding demonstrates that Archipelago wolves in Southeast Alaska face immediate, high-magnitude threats from habitat destruction and degradation resulting from past and ongoing intensive logging and road construction, trapping and hunting mortality, the inadequacy of existing regulatory mechanisms, inbreeding depression, and anthropogenic climate change. New threats that have emerged since the 2016 Finding include the 2016 Tongass Land and Resource Management Plan ("2016 Tongass Forest Plan") which authorizes intensive ongoing old-growth and second-growth logging and road-building concentrated in essential wolf habitat, in addition to intensive clear-cut logging of wolf habitat on state and private lands; a series of massive timber sales with high levels of old-growth logging and road-building authorized under the 2016 Forest Plan concentrated in prime wolf habitat; the Forest Service's proposed elimination of Roadless Rule protections on the Tongass National Forest; unprecedented trapping mortality in the vulnerable GMU 2 wolf population during the 2019-2020 season; escalating threats from anthropogenic climate change including harms to key prey species; new genetic evidence documenting high levels of inbreeding in the GMU 2 population; and a lack of adequate regulatory mechanisms to address the primary threats to wolves. Threats are particularly severe and well-documented in GMUs 2, 3 and 1A which are estimated to support the vast majority (~85%) of the Archipelago wolf population in Southeast Alaska and which constitute a significant portion of the range of a Southeast Alaska DPS.

The 2016 Tongass Forest Plan authorizes intensive clear-cut logging of the wolf's remaining old-growth forest habitat until at least 2031, as well as intensive road-building and second-growth logging in the long-term which will permanently convert cut and fragmented forests into unsuitable habitat for deer and wolves rather than allowing these forest habitats to recover. Furthermore, ongoing logging and road-building under the 2016 Tongass Forest Plan will be concentrated in essential remaining wolf habitat on POW and other wolf islands in GMUs 2, 3, and 1A which have already suffered disproportionate losses of old-growth forests.

Adding to these harms, in October 2019 the Forest Service proposed to eliminate the protections of the 2001 Roadless Area Conservation Rule ("Roadless Rule") on all 9.2 million acres of inventoried roadless areas on the Tongass National Forest. This rollback of the Roadless Rule would open 165,000 acres of previously protected old-growth forest to logging and road-building, further jeopardizing Archipelago wolves and their prey, through massive habitat fragmentation, destruction, and disturbance.

The devastating cumulative impacts of industrial logging and road-building in Archipelago wolf habitat are illustrated in Figure 1 below. This map highlights the areas that have already been logged on the Tongass National Forest, the areas under the 2016 Tongass Forest Plan that are authorized for continued old-growth and second-growth clear-cut logging, and the previously protected roadless areas that will imminently be opened up to logging and road-building under the Forest Service's proposal to rollback the Roadless Rule.

High levels of mortality from legal and illegal trapping and hunting pose another primary threat to the Archipelago wolf. On POW, trapping and hunting is contributing to the observed large-scale population decline, and illegal unreported killing may account for as much as half of total trapping and hunting mortality. Adding to this precarious situation, during the 2019-2020 trapping season, an unprecedented number of wolves were killed on POW, totaling 165 wolves legally trapped from a population last estimated at 170 wolves in fall 2018, and not including additional wolves killed illegally. This alarming level of killing occurred after the state eliminated trapping and hunting limits and in-season mortality monitoring for this vulnerable population and failed to follow the recommendations of its own Wolf Habitat Management Program.

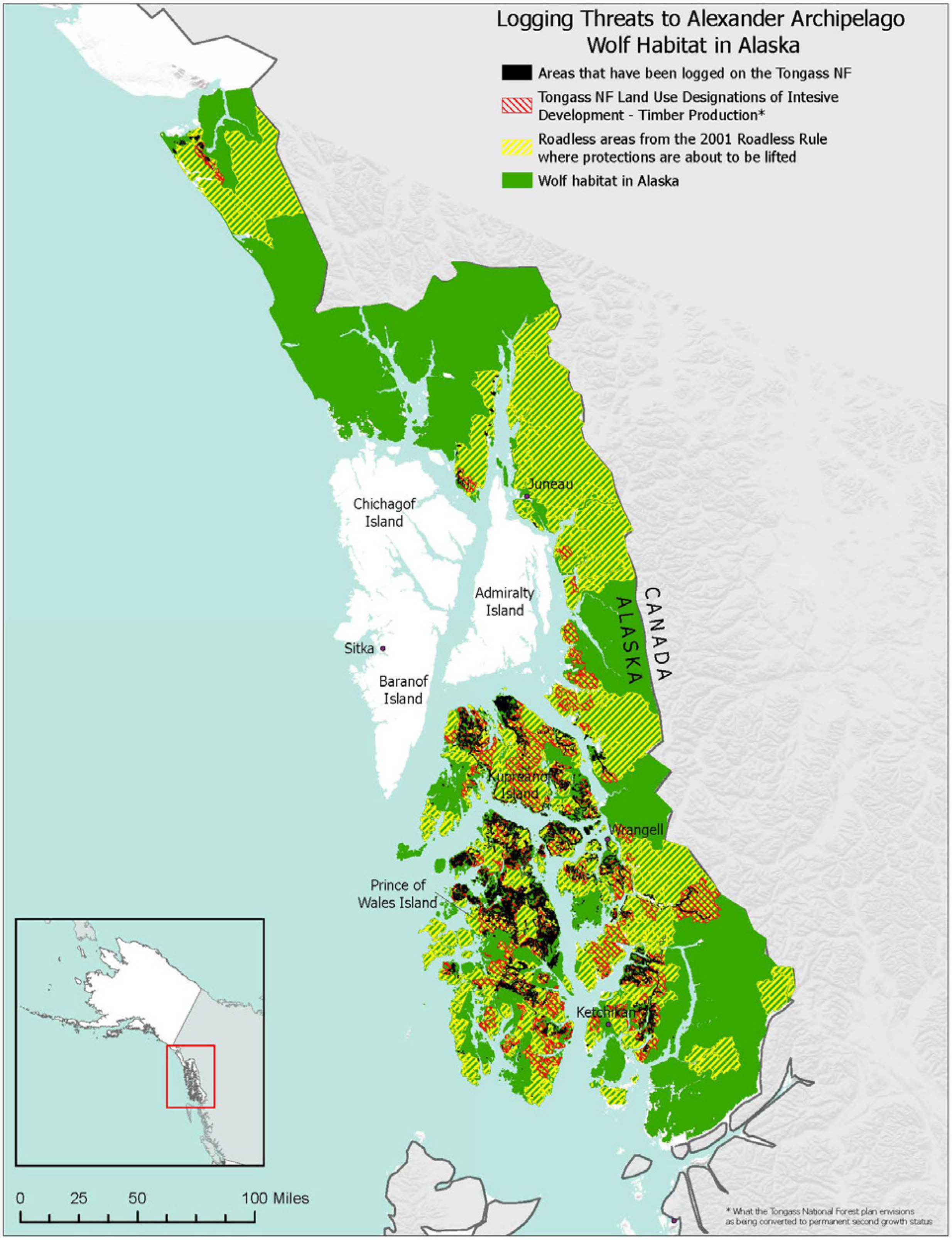
Anthropogenic climate change poses an intensifying threat to Archipelago wolves and their primary prey. Climate change may result in the increased frequency of severe winter storm events that can cause long-term harms to Sitka black-tailed deer populations. Climate change threatens salmon—an important seasonal food source for wolves—by increasing water temperatures, decreasing summer stream flows, increasing sea levels, and increasing the frequency, intensity and duration of marine heat wave events. Climate change is also leading to a significant change in forest composition and structure in Southeast Alaska due to climate-related die-offs of yellow cedar, which may have detrimental impacts on deer populations that rely on closed-canopy old-growth forests in winter.

New genetic evidence indicates that wolves on POW are already experiencing high levels of inbreeding and are at risk of inbreeding depression due to population declines caused by habitat loss and high trapping and hunting mortality, combined with the relative isolation of the POW population. Wolves on the islands of GMUs 3 and 1A also show evidence of inbreeding, making them vulnerable to loss of genetic diversity.

The Archipelago wolf in Southeast Alaska is clearly threatened by a long, ongoing history of inadequate regulatory mechanism at the federal and state levels to address and mitigate the primary threats to wolves, paired with consistent, systemic failures in enforcement of regulatory mechanisms. As a result, the threats to the Archipelago wolf identified in the 2011 listing petition have only worsened. Of added concern, Archipelago wolves in Southeast Alaska are more vulnerable to population declines, loss of genetic diversity, and population extirpations than interior gray wolves due to their small, isolated, and largely island-based population structure.

The best-available science clearly demonstrates that the Archipelago wolf in Southeast Alaska is threatened or endangered, and in immediate need of the protections of the Endangered Species Act. Petitioners Center for Biological Diversity, Alaska Rainforest Defenders, and Defenders of Wildlife request that the USFWS promptly protect the Alexander Archipelago wolf under the ESA with concurrent designation of critical habitat.

Figure 1. Cumulative impacts of industrial logging and road-building in Archipelago wolf habitat in Southeast Alaska.



Part I. Taxonomy, Distribution, and Natural History

The taxonomy, distribution, and natural history of the Alexander Archipelago wolf subspecies (*Canis lupus ligoni*) ("Archipelago wolf") was extensively described in the ESA listing petition submitted by the Center for Biological Diversity and Greenpeace to the USFWS in 2011 ("2011 Petition"). (Center for Biological Diversity and Greenpeace 2011). The 2011 Petition in its entirety is hereby incorporated and attached. The 2015 USFWS "Species Status Assessment for the Alexander Archipelago Wolf (*Canis lupus ligoni*)" ("2015 Status Assessment" or "2015 SSA") and 2016 USFWS "12-Month Finding on a Petition to the List the Alexander Archipelago Wolf as a Threatened or Endangered Species" ("2016 Finding") (81 Fed. Reg. 435) further describe the subspecies' taxonomy, distribution and natural history.

Part I of this petition focuses on describing new scientific research and information published since the 2015 Status Assessment and 2016 Finding pertaining to the taxonomy and natural history of the Archipelago wolf in Southeast Alaska. This petition requests that the USFWS evaluate a Distinct Population Segment of the Alexander Archipelago wolf in Southeast Alaska for listing, and in the alternative, to evaluate the entire subspecies for listing where Southeast Alaska represents a Significant Portion of its Range. Therefore, Part I and the remainder of the petition focus on Archipelago wolves in Southeast Alaska.

A. Taxonomy

The Alexander Archipelago wolf (*Canis lupus ligoni*) is widely recognized as a distinct subspecies of the gray wolf *Canis lupus*. As detailed in the 2011 ESA petition and 2015 USFWS Status Assessment, the Alexander Archipelago wolf is distinct from other gray wolves in morphology, ecology and genetics. Federal agencies, including the USFWS and the U.S. Forest Service ("Forest Service"), have long confirmed the subspecific status of the Alexander Archipelago wolf. In 1997 the USFWS stated that "there is persuasive support in the record for treating southeast Alaska wolves as a distinct subspecies, *Canis lupus ligoni*, and therefore… it is reasonable to review the status of wolves in southeastern Alaska as a listable entity under the Endangered Species Act." (62 Fed. Reg. 46709-46710). The Forest Service has consistently recognized *C. l. ligoni* as a distinct subspecies, including in the 2008 and 2016 Tongass Land and Resource Management Plan ("Tongass Forest Plan" or "LRMP"). (LRMP FEIS 2008 at 3-236, LRMP FEIS 2016 at 3-237).

In its 2016 Finding, the USFWS affirmed that the Alexander Archipelago wolf is a valid gray wolf subspecies. However, the USFWS for the first time considered wolves in coastal British Columbia as part of the *C. l. ligoni* subspecies: "For the purpose of this 12-month finding, we assume that the Alexander Archipelago wolf (*C. l. ligoni*) is a valid subspecies of gray wolf that occupies southeastern Alaska and coastal British Columbia and, therefore, is a listable entity under the Act." (81 Fed. Reg. 437).

Several studies since the 2016 Finding have confirmed that wolves in Southeast Alaska and coastal British Columbia are genetically and ecologically distinct from other gray wolves. Schweizer et al. (2015) quantified population structure of gray wolves as related to habitat by assessing genetic variation in 42,036 single-nucleotide polymorphisms (SNPs) in 111 North American gray wolves from across the range, including coastal British Columbia but not Southeast Alaska. The study identified six ecotypes including a British Columbia ecotype that showed a high level of genetic differentiation. The study concluded that "[w]e confirmed previous studies finding that British Columbia wolves are genetically and ecologically distinct (Muñoz-Fuentes et al. 2009)." (Schweizer et al. 2015 at 16). A companion study by Schweizer et al. (2016) concluded that "British Columbia coastal wolves have a unique suite of molecular adaptations that support arguments for adaptive distinction (Muñoz-Fuentes et al. 2009)." (Schweizer et al. 2016 at 374). In addition, a study by Hendricks et al. (2019) concluded that Alexander Archipelago wolves are genetically differentiated from interior gray wolves:

> Coastal wolves are a phenotypically distinct wolf ecotype that is found in the coastal habitats of British Columbia (BC) and the Alexander Archipelago in southeast Alaska (AK). Mitochondrial DNA sequencing, microsatellite loci, and SNP have shown that these coastal wolves are genetically differentiated from wolves interior to the Pacific coastal mountain ranges of NA (Weckworth et al. 2005; Muñoz Fuentes et al. 2009; vonHoldt et al. 2011; Stronen et al. 2014; Schweizer et al. 2016b). Despite this genetic evidence, the subspecies designation of the Alexander Archipelago wolves (*C. l. ligoni*) has been debated (Cronin et al. 2014, 2015; Weckworth et al. 2015). In 2015, the Alexander Archipelago wolves were considered for protection under the U.S. Endangered Species Act (ESA) as a result of a 60% decline in the population over one year due to human mediated habitat alteration (Jewell et al. 2015). Although ultimately not listed, this wolf population still deserves consideration for protection as a unique ecotype not found outside this area (Muñoz Fuentes et al. 2009; Schweizer et al. 2016a, b). (Hendricks et al. 2019 at 37).

Although the best-available science has established that Southeast Alaska wolves and coastal British Columbia wolves are genetically distinct from other gray wolves, the level of genetic differentiation between (and within) Southeast Alaska and coastal British Columbia populations is still being resolved. The 2015 Status Assessment pointed to Weckworth et al. (2011) as the "the most comprehensive analysis of mtDNA from wolves in southeastern Alaska (n=130) and coastal British Columbia (n=75)." (USFWS SSA 2015 at 11). This analysis found that coastal wolves in Southeast Alaska and British Columbia are divergent from continental populations, share a close evolutionary relationship, and represent a distinct portion of the genetic diversity for all wolves in North America. However, Weckworth et al. (2011) also found that within this putative phylogeographic lineage, genetic diversity differed between wolves of Southeast Alaska and coastal British Columbia. Populations of island wolves in coastal British Columbia generally possessed multiple haplotypes, whereas most island wolves in Southeast Alaska were monotypic for the common coastal haplotype, suggesting that either gene flow between mainland coastal and island wolves is higher in British Columbia than Southeast Alaska, or that island wolves in Southeast Alaska have been subjected to extreme genetic drift, perhaps due to small founding populations or subsequent bottlenecks. (Weckworth et al. 2011 at 5.) In short, haplotype differences between Southeast Alaska and British Columbia populations suggest some genetic divergence between these regions.

Genetic evidence also indicates that Archipelago wolves on Prince of Wales (POW) Island are isolated from other populations and represent a distinct genetic cluster. Based on microsatellite analysis, Weckworth et al. (2005) found that wolves on POW are genetically differentiated from nearby island populations on Kuiu, Kupreanof, and Mitkof islands, as well as mainland Southeast Alaska. Weckworth et al. (2005) suggested that the wolves on POW belong to a distinct genetic cluster due to genetic and geographic isolation. (Weckworth et al. 2005 at 917, 926). According to Weckworth (2005), the genetic distinctiveness of Prince of Wales wolves is consistent with previous studies identifying POW as a center of endemism (i.e., for flying squirrels, deer mice, ermine) because of its relative isolation from the rest of the region. (Weckworth et al. 2005 at 917, 926).

In sum, genetic, ecological, and morphological studies support the taxonomic status of coastal wolves of Southeast Alaska as a distinct subspecies, *C. l. ligoni* (i.e., Alexander Archipelago wolf), that may or may not include wolves of coastal British Columbia.

B. Distribution

As described in the 2015 Status Assessment, the Alexander Archipelago wolf occurs along the narrow mainland of Southeast Alaska west of the Coast Range and on larger islands south of Frederick Sound. (USFWS SSA 2015 at 15). Only the largest islands such as POW, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, and Dall islands likely support wolves consistently over time because of their larger prey base; for example, within Alaska Department of Fish and Game (ADFG) Game Management Unit (GMU) 2, only the three largest islands (POW, Kosciusko, and Dall) are known to have been continuously occupied by wolves for more than 20 years. (USFWS SSA 2015 at 15). On the mainland, the distribution of wolves probably is limited by icefields and high-elevation rugged terrain. (USFWS SSA 2015 at 15). Overall, the Archipelago wolf in Southeast Alaska occurs in Game Management Unit (GMU) 1, 2, 3, and 5A, but not GMU 4. (USFWS SSA 2015 at Figure 4).

C. Habitat Use

1. Seasonal Habitat Selection

New information since the 2016 USFWS Finding on Archipelago wolf habitat selection was provided by a 2018 study authored by Alaska Department of Fish and Game ("ADFG") wolf biologist Gretchen Roffler and colleagues. (Roffler et al. 2018). The study examined seasonal habitat selection of Archipelago wolves on Prince of Wales Island with respect to forest structure, succession, land cover, topography, road densities and habitat predicted to support Sitka blacked-tailed deer and salmon (*Onchorynchus* spp.), the primary and secondary prey species, based on data from 13 radio-collared wolves during 2012–2016. (Roffler et al. 2018 at 190). The researchers explained that wolves are expected to display seasonal preferences for different habitat types because of variation in behavior throughout the year.

Overall, the study concluded that wolves selected for "natural forest and land cover," including a strong preference for old-growth forest, high-quality deer habitat, and low-elevation flat terrain, and "limited use or avoidance of young-growth forests" (e.g., logged forests). (Roffler et al. 2018 at 197). The study corroborates previous research (e.g., Person and Ingle 1995, Person et al. 2001) showing that Archipelago wolves are closely associated with old-growth forest and consistently select this habitat type "significantly more than expected based on its availability." (Roffler et al. 2018 at 197). In fall and winter, wolves used young clear-cuts (less than 30 years old) but avoided older clear-cuts (greater than 30 years old), similar to habitat use by deer,[1] "indicating that young-growth forest has a limited time frame of potential use by wolves." (Roffler et al. 2018 at 197).

Importantly, the study concluded that wolves avoid seral forests greater than 30 years old, and that forestry management done ostensibly to increase habitat value in older seral forests does not appear to enhance habitat for wolves.[2] (Roffler et al. 2018 at 197). The study warned that wolves could suffer population-level consequences as an enormous amount of forest—representing over one third of the old-growth available prior to industrial logging—enters the

[1] As described in the 2011 Petition and 2015 Status Assessment, in young clear-cuts less than 25 to 30 years old, understory shrubs regenerate providing forage for deer in summer, but the lack of a forest canopy fails to intercept snow in winter, allowing burial of deer browse and increasing the energetic costs of deer movement, particularly during severe winters. In older clear-cuts more than 25 to 30 years old, dense even-aged canopies enter a "stem exclusion phase" that impedes sunlight and the growth of deer forage, creating poor-quality low-forage habitat for deer.

[2] Roffler et al. (2018) at 197 ("However, wolves avoided thinned forest during winter, and did not display patterns of selection for thinned forest stands during other seasons (Table 3) confirming previously described patterns of avoidance of second growth in the stem exclusion phase, in particular pre-commercially thinned stands (Person, 2001). Thus far, the benefits of thinning treatments on maintaining understory vegetation have proven to be short-term (5–10 years), diminishing the potential for sustaining wildlife through the long-lasting stem exclusion phase (Hanley, 2005; Farmer et al., 2006; Cole, 2010). In this study we demonstrate that thinning treatments do not thus far appear to enhance habitat for wolves.")

stem exclusion phase (i.e., clear-cuts older than 25 to 30 years) over the next two decades on POW. (Roffler et al. 2018 at 190, 197, 199). The study concluded that "the amount of habitat available to wolves could decline with an increasing proportion of the forest transitioning to the stem exclusion phase, with potential population-level consequences for wolves." (Roffler et al. 2018 at 199).

In addition to these overall patterns, the study described wolf habitat preferences across seasons which generally corroborate the findings of previous studies. During denning season, wolves showed an affinity for low-volume old growth forests (i.e., the forest class containing the lowest density of large diameter trees of all classes, but the highest forage biomass) and low elevations. (Roffler et al. 2018 at 197). Most den sites were adjacent to freshwater where wolves may be targeting alternative prey such as beaver that are more accessible. (Roffler et al. 2018 at 196). Importantly, wolves avoided areas of high road density during the denning season and late summer. (Roffler et al. 2018 at 196, 199). Overall, dens are "generally located in protected areas because of pup vulnerability" (Roffler et al. 2018 at 191) and "wolves select den sites in low elevation, flat terrain, in old-growth forests adjacent to open habitats (e.g. meadows and muskegs) and freshwater streams or lakes, and avoid high density road areas." (Roffler and Gregovich 2019 at 3).

By mid-July, wolves move to rendezvous sites when pups are more mobile. During the rendezvous period, wolves selected open vegetation habitats including muskegs and estuarine meadows, in areas of low road density. (Roffler et al. 2018 at 196, 199). In summer and fall, wolves also selected habitats with high quality deer habitat and deer carrying capacity. (Roffler et al. 2018 at 196, 197, 199). Areas close to anadromous salmon streams were also important when salmon were spawning, indicating that wolves make a dietary shift toward salmon when they are seasonally abundant as suggested by other research. (Roffler et al. 2018 at 196, 197).

During fall and winter, wolves used young clearcuts (i.e., less than 30 years old) but "more importantly, wolves avoided old clearcuts [i.e., more than 30 years old] indicating that young-growth forest has a limited time frame of potential use by wolves, similar and likely related to predictions for use by deer (≤30 years post clearcut)." (Roffler et al. 2018 at 197). Importantly, "wolves avoided thinned forest during winter, and did not display patterns of selection for thinned forest stands during other seasons confirming previously described patterns of avoidance of second growth in the stem exclusion phase, in particular pre-commercially thinned stands." (Roffler et al. 2018 at 197).

Finally, in relation to roads, the study found that wolves displayed a variable response to road density, with seasonal patterns of selection and avoidance of roads. Specifically, the study found that wolves on POW avoided areas of high road density during the denning and rendezvous periods, similar to the findings of prior research (i.e., Person and Russell 2009).

(Roffler et al. 2018 at 199). Active den sites on POW during 2012–2016 were on average 0.91 km from the nearest road, and researchers noted that wolves relocated a den site 0.36 km after experiencing nearby logging-related disturbance from low-level helicopter flights. (*Id*). During fall and winter when wolves are more nomadic, wolves were commonly documented on or near secondary roads. (*Id*).

As an important qualifier, the study found that wolves avoided areas with a combination of high road densities and high-quality deer habitat during fall. (*Id*). The researchers suggested that wolves may have been avoiding areas with higher road densities in fall to avoid being shot by deer hunters. Heavy deer hunter traffic on POW road systems peaks in October and continues through December. During the 2012–2015 deer hunting seasons, an annual average of 1,569 hunters used road vehicles, off-road vehicles, or ATVs to travel along the road system. (*Id*). Deer hunters also likely target high-quality deer habitat and may opportunistically shoot wolves while hunting deer. During the study, half of recorded wolf shootings occurred during deer hunting season. (*Id*).

Importantly, these research findings related to roads indicate that increasing road densities in Southeast Alaska not only lead to higher human-caused wolf mortality, consistent with the findings of numerous other studies, but also exclude wolves from high-quality deer habitat.

2. Habitat Use During the Breeding Season

To inform management decisions regarding buffers surrounding wolf dens, a 2019 study by Gretchen Roffler and Dave Gregovich quantified core and home range area sizes during denning season for POW wolves, based on radio-collar data from 13 wolves from seven packs from 2012 to 2016. (Roffler and Gregovich 2019). Importantly, this research found that Archipelago wolves use larger core habitat areas during the breeding season than previously assumed, meaning that current recommended den buffer distances in the 2016 Tongass Forest Plan and 2017 Wolf Habitat Management Program fall far short of protecting the core habitat used by breeding wolves and non-breeding helpers. The study concluded that "[w]olf managers should recognize the current protection buffer around dens constitutes only a portion of the core area used by breeding wolves, and habitat alterations near den sites may force breeding wolves to use sub-optimal habitat they would normally avoid." (Roffler and Gregovich 2019 at 1).

The study found that the mean minimum and maximum distance from active wolf den sites to the edge of core habitat were 734 to 2,308 meters (~2,400 to 7,600 feet) for breeding wolves, 1,638 to 10,344 meters (5,374 to 33,937 feet) for non-breeding wolves at active dens sites, and 1,186 to 6,326 meters (~3,900 to 21,000 feet) overall. (Roffler and Gregovich 2019 at 1, 5, Table 1).

Importantly, the study concluded that the current recommended den buffer distance of 366 meters (1,200 feet) for Archipelago wolves in the 2016 Tongass Forest Plan[3] and 2017 Wolf Habitat Management Program[4] does not encompass core denning use areas. Based on the study findings, this current recommended buffer distance of 366 meters is two to six times smaller than what is needed for breeding wolves, and more than four to 28 times smaller than the core habitat use areas for non-breeding wolves helping to rear pups[5]:

> Based on our results, the current recommend buffer does not encompass denning use areas. Despite breeding wolves having smaller core use areas (and corresponding den buffer widths), the mean distance of the edge of their core home range from the active den still exceeded the current recommended forest buffer distance (366 m) around the den site by nearly 2 (734 m) to more than 6 times (2308 m). When considering the non-breeding pack members associated with an active den site, the mean core home range edge further exceeded the buffer distance recommended for both ground-based disturbance (by a minimum of 1272 m) and louder noises (by a minimum of 833 m). (Roffler and Gregovich 2019 at 7,8).

The study highlighted that the protection of den sites is important for "maintaining viable wolf populations." (Roffler and Gregovich 2019 at 1). The researchers explained that "den sites have ecological importance because survival of wolf pups is most variable during early denning season through late summer, and this component of reproductive success has a large effect on the demographic trajectory of the population." (Roffler and Gregovich 2019 at 1). Limited disturbance during the denning season and access to high-quality habitat are key factors in increasing wolf reproductive success. (Roffler and Gregovich 2019 at 1).

The researchers explained that the protection of breeding wolves during the early denning season is "an essential step to ensure reproductive success and population viability." (Roffler and Gregovich 2019 at 8). However, considering the habitat requirements of non-breeding members of the wolf pack is also important because of the essential role that these wolves play in attending and feeding the pups.

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[3] As detailed in the Inadequacy of Existing Regulatory Mechanisms section of this petition, the 2016 Tongass Forest Plan standards and guidelines for Alexander Archipelago wolves recommend a 1,200-foot forested buffer around active dens, although allowing roads within 600 feet (or closer in some circumstances). (LRMP 2016 at 4-91).

[4] The 2017 Wolf Habitat Management Program developed for GMU 2 wolves recommends permitting no disturbance within 1,200 feet of active dens that could result in den relocation. (Wolf Technical Committee 2017 at 28).

[5] For non-breeding helpers, the mean distance of the edge of core home range from the active den exceeded the current recommended den buffer distance (366 m) by 4.5 times (1,638m) to 28 times (10,344 m).

Furthermore, the researchers emphasized that permanently protecting known den sites—instead of only currently active dens—is important because Archipelago wolves consistently re-use historic dens sites. The study reported that more than half of the active dens sites during the study period had been used previously during 1995–2003. (Roffler and Gregovich 2019 at 5). The study recommended that "[d]ue to demonstrated use of historic den sites with recorded denning activity up to 17 years previously, and reuse of den sites during this and earlier research (Person and Russell 2009), the Interagency Wolf Habitat Management Program recommended changes to the Forest Plan to indefinitely protect known den sites (instead of only for active dens) are supported."[6] (Roffler and Gregovich 2019 at 8).

The study also found that seasonal pack home range sizes were larger and less seasonally variable than those previously reported for POW (i.e., by Person 2001). (Roffler and Gregovich 2019 at 9). For wolves, larger home range sizes are linked to lower habitat quality, prey density, and wolf density. (*Id.*) Therefore, Roffler and Gregovich suggested that the larger home range sizes for POW wolves could be due to the decrease in wolf density on POW over the past two decades and reductions of high-quality winter deer habitat (i.e., low elevation old-growth forests) due to logging, which has reduced deer density. (*Id.*) Related to this, the study noted that clearcuts were avoided within denning season home ranges during 1995–2004 (Person and Russell 2009) and during 2012–2016 (Roffler et al. 2018), all the while becoming a more common land cover category. (Roffler and Gregovich 2019 at 8).

As discussed further in the Inadequacy of Existing Regulatory Mechanisms section, this research makes clear that recommendations related to wolf den sites in the 2016 Tongass Forest Plan and 2017 Wolf Habitat Management Program are inadequate on multiple fronts.

D. Diet and Foraging Ecology

The diet studies reviewed in the 2015 Status Assessment show that deer are by far the most important prey in the diet of Southeast Alaska wolves, with the exception of the northern mainland where both deer and wolves are scarce. (USFWS SSA 2015 at 27). Research published since 2016 by Roffler et al. (2018) on seasonal habitat selection of wolves on POW reported that wolves select areas near anadromous salmon streams only during late summer (August to mid-October), coinciding with the salmon spawning period, and consistent with prior research (i.e., Person 2001). (Roffler et al. 2018 at 196, 197). The study explained that wolves in Southeast Alaska have access to spawning salmon during late summer through early autumn, providing a predictable, seasonal prey source. The primary salmon runs on POW are pink (*O. gorbuscha*) and chum (*O. keta*), occurring in late summer, with lower abundances of sockeye (*O. nerka)* and coho (*O. kisutch*). The study concluded that "[o]ur results suggest the ability of wolves to shift

[6] As detailed in the Inadequacy of Existing Regulatory Mechanisms section of this petition, the Forest Service has not adopted these recommendations.

seasonal foraging patterns spatially, and prioritize selection of specific resources corresponding with periods of prey availability." (Roffler et al. 2018 at 197.)

Part II. Abundance and Population Trends

In the 2015 Status Assessment, the USFWS reported that there has been "only one effort to estimate the size of the wolf population as a whole in southeastern Alaska." (USFWS SSA 2015 at 19). The range-wide estimate of a mean of 908 wolves in Southeast Alaska by Person et al. (1996) was based on a model linking wolf abundance to habitat capability for deer and other prey. Person et al. (1996) estimated that wolves in GMU 2 represent about 37% of the total wolf population in Southeast Alaska, followed by GMU 3 (28%), GMU 1A (20%), GMU 1B (8%), GMU 1C/D (5%), and GMU 5A (2%). (*see* Table 1 below) (USFWS SSA 2015 at 19, Table 4). Therefore, 85% of the estimated wolf population was estimated to occur in three GMUs: GMUs 2, 3, and 1A.

Table 1. Range-wide Population Estimates for Alexander Archipelago Wolves in Southeast Alaska. Source: USFWS SSA 2016 at Table 4.

Table 4. Estimated wolf population size by Game Management Unit (GMU) and subunits (gray shaded area) derived from habitat capability models of deer, moose, and mountain goat developed in the early 1990s, southeastern Alaska (Suring et al. 1993; as presented in Person et al. 1996, p. 13); GMU-specific estimates were based on a total estimate of 908 wolves (SE=216) in southeastern Alaska (Person et al. 1996, p. 12).

GMU	Percent of southeastern Alaska wolf population	Derived population estimate	95% confidence interval	
			Lower	Upper
1 (all)	33	300	160	439
1A	20	182	97	266
1B	8	73	39	107
1C/1D	5	45	24	67
2[1]	37	336	179	493
3	28	254	136	373
5A	2	18	10	27

[1]More recent field-derived estimate available; see Table 3.

Direct estimates of population size for the Alexander Archipelago wolf are available only for GMU 2 in Southeast Alaska. In GMU 2, prior to 2013, mean population size in fall had been estimated twice: 356 wolves in fall 1994 and 326 wolves in fall 2003. (USFWS SSA 2015 at 17, 18, 114). Beginning in 2012, ADFG wolf biologist Gretchen Roffler and colleagues began estimating wolf abundance on POW using a DNA-based mark-recapture technique—noninvasive hair snaring during autumn used to identify individuals through DNA sequencing, paired with spatially explicit capture–recapture analysis. (Roffler et al. 2019). During 2012-2013, the study area covered 1,683 km^2 in the north-central portion of POW, representing ~20% of GMU 2, and was expanded to 3,281 km^2 in 2014-2015, representing ~36% of GMU 2, which increased wolf detections and the precision of the wolf density estimates. (Roffler et al. 2019 at 31, 33). The study estimated autumn wolf population densities at 24.5 wolves per 1,000 km^2 in 2013, 9.9 wolves per 1,000 km^2 in 2014, and 11.9 wolves per 1,000 km^2 in 2015. (Roffler et al. 2019 at 31, 36, Table 3). Autumn average population size for the POW management unit was estimated at 221.1 wolves in 2013, 89.1 wolves in 2014, and 107.5 wolves in 2015. (*Id.*). The researchers concluded that their method for estimating wolf abundance was "feasible and reliably applied producing a statistically robust population estimate for monitoring wolf populations in densely forested areas." (Roffler et al. 2019 at 31).

Beginning in 2016, ADFG and the Forest Service reported that an additional study area was established adjacent to the southern boundary of the ADFG study area, in collaboration with the Hydaburg Cooperative Association (HCA) and monitored by HCA staff. (ADFG 2017). The expanded study area covering approximately 80% of Prince of Wales Island and more than 60% of GMU 2's land area. (*Id.*). Hair snare mark-recapture data collected from October through December resulted in a mean GMU 2-wide population estimate of 231 wolves in fall 2016 (ADFG 2017), 225 wolves in fall 2017 (ADFG 2018), and 170 wolves in fall 2018 (ADFG 2019).

The fall 2019 population estimate for GMU 2 has not yet been released. However, as detailed in the Factor B threats analysis to follow, an unprecedented 165 wolves were legally trapped in GMU 2 during the two-month 2019-2020 trapping season, not including wolves illegally killed and not reported, raising alarm for the future of the GMU 2 population.

Similar to abundance, direct estimates of population trend for the Alexander Archipelago wolf are available only for GMU 2. The data indicate a large-scale decline in the GMU 2 population after 1994. As summarized in the 2016 USFWS Finding:

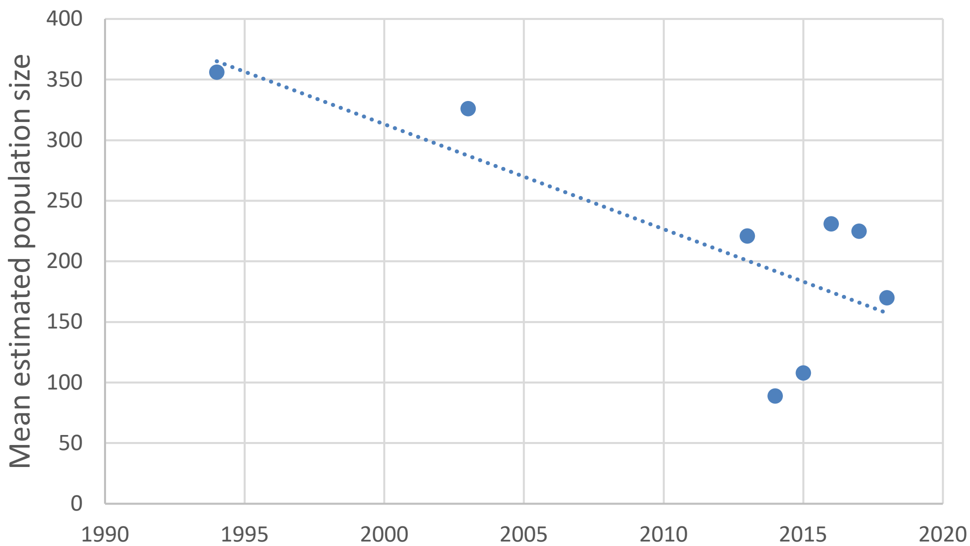
> [B]etween 1994 and 2014, the population was reduced from 356 wolves (95 percent CI = 148–564) (Person *et al.* 1996, pp. 11–12; ADFG 2014, pp. 2–4) to 89 wolves (95 percent CI = 50–159) (ADFG 2015a, pp. 1–2), equating to an apparent decline of 75 percent (standard error [SE] = 15), or 6.7 percent (SE = 2.8) annually….The most severe reduction occurred over a single year (2013–2014), when the population dropped by 60 percent and the proportion of females in the sample was reduced from 0.57 (SE = 0.13) to 0.25 (SE = 0.11) (ADFG 2015a, p. 2). (81 Fed Reg. 440).

Figure 2 shows the estimated population decline in the GMU 2 population based on available mean population estimates. The estimated decline between 1994 and 2018 is ~57%, with the population steeply declining during the 15 years since the fall 2003 estimate of 326 wolves

(USFWS SSA at 17), and the most recent estimate of only 170 wolves in fall 2018 (ADFG 2019). With the unprecedented trapping mortality that occurred during the 2019-2020 season, this decline has almost certainly grown much steeper.

As discussed in the threats analysis of this petition (Part IV), threats to wolves in other GMUs in Southeast Alaska are similar to threats in GMU 2, making it likely that population declines are happening in wolf populations outside GMU 2.

Figure 2. Estimated population decline in the GMU 2 wolf population based on available mean autumn population estimates. Population estimates from Person et al. (1996), ADFG (2017), ADFG (2018), ADFG (2019), and Roffler et al. (2019). This figure shows mean autumn population estimates and does not depict the confidence intervals for these estimates.



Part III. The Alexander Archipelago Wolf As a Listable Entity Under the ESA

In its 2016 Finding, the USFWS affirmed that the Alexander Archipelago wolf is a valid gray wolf subspecies and constitutes a listable entity under the ESA. (81 Fed. Reg. 437). However, for the first time, the USFWS included wolves in coastal British Columbia as part of the *C. l. ligoni* subspecies in addition to Southeast Alaska wolves. (81 Fed. Reg. 437). The USFWS conducted two listing analyses in the 2016 Finding: (1) evaluation of the Alexander Archipelago wolf subspecies across Southeast Alaska and British Columbia, where only GMU 2 was analyzed as potentially constituting a significant portion of the range (81 Fed. Reg. 455-456), and (2) evaluation of the GMU 2 population as a Distinct Population Segment. (81 Fed. Reg. 456).

However, the USFWS never conducted two critical listing analyses : (1) an evaluation of whether Alexander Archipelago wolves in Southeast Alaska constitute a Distinct Population Segment ("DPS"), and (2) a Significant Portion of Range ("SPR") analysis for the *C. l. ligoni* subspecies that evaluates whether wolves in Southeast Alaska—where wolf populations face higher threats— constitute a SPR. This petition requests that the USFWS conduct these two listing analyses, as detailed further below.

A. Listable Entities under the Endangered Species Act.

The ESA defines the term "species" broadly to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16). As detailed above, the Alexander Archipelago wolf is an established subspecies of the gray wolf *Canis lupus.*

A DPS is defined as a "vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species" (61 Fed. Reg. 4722). A DPS of a vertebrate species can be protected as a "species" under the ESA even though it has not formally been described as a "species" in the scientific literature. A species may be composed of several DPSs, some or all of which may warrant listing under the ESA. The definition of a DPS is set forth under the 1996 joint USFWS and National Marine Fisheries Service (NMFS) "Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act." (61 Fed. Reg. 4722). Under the Policy, three elements are considered in a decision regarding the status of a possible DPS as endangered or threatened under the Act:

(1) Discreteness of the population segment in relation to the remainder of the species to which it belongs;
(2) The significance of the population segment to the species to which it belongs;
(3) The population segment's conservation status in relation to the Act's standards for listing. (61 Fed. Reg. 4725).

For a population segment of a vertebrate species to be considered discrete, it must satisfy either one of the following conditions:

(1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.
(2) It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory

> mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act. (61 Fed. Reg. 4725).

According to the 1996 DPS policy, once a population is established as discrete, its biological and ecological significance should then be considered. This consideration may include, but is not limited to, the following:

(1) Persistence of the discrete population segment in an ecological setting unusual or unique to this taxon.
(2) Evidence that loss of the discrete population would result in a significant gap in the range of a taxon.
(3) Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range.
(4) Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. (61 Fed. Reg. 4725).

Notably, the "significance factors" are written in the disjunctive; a positive determination as to any one significance factor is sufficient to support a positive DPS finding.

B. The 2016 USFWS Evaluation of Listable Alexander Archipelago Wolf Entities and the Listing Determination for Those Entities.

The USFWS in its 2016 Finding made a series of determinations on the listable unit for the Alexander Archipelago wolf and whether that unit warranted protection under the ESA:

(1) The Alexander Archipelago wolf is a valid subspecies of gray wolf that occupies southeastern Alaska and coastal British Columbia and is a listable entity under the Act. (81 Fed. Reg. 437).
(2) Listing the Alexander Archipelago wolf is not warranted throughout all or a significant portion of its range, based on analysis of GMU 2 as a significant portion of the range. (81 Fed. Reg. 435).
(3) The Alexander Archipelago wolf population in GMU 2 does not meet the criteria of the Service's DPS policy, and, therefore, it does not constitute a listable entity under the Act. (81 Fed. Reg. 435).

As an initial matter, the best-available science at the time of the 2016 Finding, and that has emerged since the Finding, does not support the USFWS's determination that listing the Archipelago wolf is not warranted throughout all or a significant portion of its range, nor does it support the determination that the GMU 2 population does not meet the criteria of the DPS policy.

Moreover, in making these determinations, the USFWS never conducted two critical listing analyses: (1) an evaluation of whether Alexander Archipelago wolves in Southeast Alaska constitute a DPS, and (2) a SPR analysis for the *C. l. ligoni* subspecies that evaluates whether wolves in Southeast Alaska—where wolf populations face higher threats—constitute a SPR.

Petitioners request that the Service recognize Alexander Archipelago wolves in Southeast Alaska as a DPS and evaluate a Southeast Alaska DPS for listing as threatened or endangered. In the alternative, Petitioners request that the Service evaluate the Alexander Archipelago wolf subspecies for listing, where Southeast Alaska and coastal British Columbia constitute the range and Southeast Alaska constitutes a significant portion of the range.

C. Alexander Archipelago Wolves in Southeast Alaska Constitute a Distinct Population Segment that Warrants Listing under the ESA.

This petition requests that the USFWS evaluate whether Alexander Archipelago wolves in Southeast Alaska constitute a DPS that warrants listing. As detailed below, a Southeast Alaska DPS clearly meets the discreteness and significance criteria of the DPS policy. The best-available scientific information in the 2011 Petition and 2015 Status Assessment, combined with new significant information since the 2016 Finding, show that a Southeast Alaska DPS warrants listing as threatened or endangered, as detailed in the threats analysis (Part IV) to follow.

1. A Southeast Alaska DPS Meets the Discreteness Criteria Based on Differences Across the International Boundary Between the U.S. and Canada.

Alexander Archipelago wolves in Southeast Alaska meet the second discreteness prong of the DPS policy based on differences across the international boundary. There are significant differences across the international boundary between the U.S. and Canada in control of exploitation, management of habitat, conservation status, and regulatory mechanisms that are significant in light of section 4(a)(1)(D) of the Act. (61 Fed. Reg. 4725). In the 2015 Status Assessment and 2016 Finding, the USFWS repeatedly concludes there are significant differences across all the aforementioned factors between U.S. and Canadian populations that contribute to a stable or slightly increasing population in Canada with "high resilience" versus the more perilous population status in Southeast Alaska, as detailed below.

In terms of conservation status, the USFWS repeatedly concluded that wolves in coastal British Columbia have a much better conservation status than wolves in Southeast Alaska in terms of population trend, resiliency, redundancy and representation. For example, the USFWS determined that wolves in coastal British Columbia have "a stable or slightly increasing population" over the last 15 years (81 Fed. Reg. 440, 442, 444, 445, 447, 448, 450, 451, 452, 453, 454). In contrast, in Southeast Alaska, the Prince of Wales population—which until recently comprised one-third of Southeast Alaska wolves—has declined precipitously over the past 15 years. Although population trends for other GMUs are uncertain, high levels of logging, road construction, trapping and hunting, and the inadequacy of existing regulatory mechanisms indicate that wolves in other GMUs, particularly GMUs 3 and 1A, are at high risk of population declines as well.

Furthermore, the USFWS concluded that Archipelago wolves in coastal British Columbia have significantly higher resilience than Archipelago wolves in Southeast Alaska. In its overall population assessments, the USFWS determined that Archipelago wolves in all regions of British Columbia have "high" resilience, whereas in Southeast Alaska, wolves in GMU 2 have "low" resilience, wolves in GMU 3 have "intermediate" resilience, and only wolves in GMUs 1 and 5A were considered to have "high" resilience. (USFWS SSA 2015 at Table 26). Importantly, wolves in GMU 2 represent roughly one-third of entire population in Southeast Alaska, wolves in GMU 3 represent another third, and wolves in GMUs 1 and 5A represent the final third—meaning that two-thirds of Southeast Alaska's wolves were considered to have low to intermediate resilience, compared with all of British Columbia's wolves considered to have high resilience. The USFWS compared the reasons for differential resilience for these regions, noting that British Columbia wolves have "few disruptions to demographic and genetic connectivity" and "ungulate species other than deer available as prey." (USFWS SSA 2015 at Table 26).

In contrast, GMU 2 wolves have a "high percent of forest logged with expected declines in deer," "high rates of unreported harvest documented," "deer serve as only ungulate species for prey," and "high insularity of population." (*Id.*). For GMU 3, the USFWS reported factors including "intermediate level of timber harvest," "boat access is high, but road access is low," and "intermediate insularity of population." (*Id.*).

In characterizing future conservation status, the USFWS determined that Archipelago wolves in British Columbia have higher levels of resiliency, redundancy and representation than wolves in Southeast Alaska. In terms of redundancy, the Service noted that the GMU 2 population is more insular than others, and GMUs 2 and 3 "probably experience the least connectivity with other populations." (*Id.*). In regard to representation, the Service found that genetic variation is greatest in populations in coastal British Columbia and "lowest in the highly insular GMU 2 population" and representation is highest in coastal British Columbia. (*Id.*).

Furthermore, the USFWS reported that trapping and hunting mortality—the primary cause of death for Archipelago wolves—is significantly lower in coastal British Columbia than in Southeast Alaska. Across coastal British Columbia, trapping and hunting mortality occurs at relatively low levels, ranging from 2% to 8% of the population. (81 Fed. Reg. 447). In contrast, legal trapping and hunting in Southeast Alaska is many times those levels, averaging 17% of the population in GMU 2, 19% in GMUs 1 and 5A, and 21% in GMU 3 between 1997 and 2014. (*Id.*). As a result, the USFWS concluded that hunting and trapping does not appear to be having a negative effect on wolves in coastal British Columbia currently and into the future:

> In Regions 1 and 2 [of British Columbia], where reporting is required, few wolves are being harvested on average relative to the estimated population size; in Region 1, approximately 8 percent of the population was harvested annually on average between 1997 and 2012, and in Region 2, the rate is even lower (4 percent). It is more difficult to assess harvest in Regions 5 and 6 because reporting is not required; nonetheless, based on the minimum number of wolves harvested annually from these regions, we estimated that 2 to 7 percent of the populations are harvested on average with considerable variation among years, which could be attributed to either reporting or harvest rates. Overall, we found no evidence indicating that harvest of wolves in coastal British Columbia is having a negative effect on the Alexander Archipelago wolf at the population level and is not likely to have one in the future. (81 Fed. Reg. 447).

In contrast, due to the high legal and illegal trapping and hunting mortality in GMU 2, the USFWS found “compelling evidence” to suggest that wolf harvest likely contributed or caused the GMU 2 population decline. (81 Fed. Reg. 447). The USFWS concluded that “wolf harvest has impacted the GMU 2 wolf population and, based on the best available information, likely will continue to do so in the near future.” (*Id.*). Confirming this prediction, instead of enforcing the 2017 Wolf Habitat Management Program recommendations (*see* Wolf Technical Committee 2017), in 2019 ADFG and the Federal Subsistence Board (directing Forest Service in-season management) eliminated any limit on the number of wolves that could be killed in GMU 2 during the 2019-2020 trapping season, and eliminated monitoring of in-season trapping, which led to an unprecedented number of wolves killed in GMU 2, as discussed further in the Factor B threats analysis to follow.

In addition, significant differences exist across the U.S. and Canada border in habitat management and regulatory mechanisms governing timber production, road construction, and hunting and trapping management. For example, Roffler and Gregovich (2019) identified significant differences in recommendations for wolf den habitat buffers between Southeast Alaska and British Columbia. They noted that buffers of 1.6 to 10 km have been recommended to reduce disturbance surrounding den sites in British Columbia and other parts of Canada, whereas the current buffer recommendation in the 2016 Tongass Forest Plan is much smaller (and as described above, inadequate) at only 366 meters. (Roffler and Gregovich 2019 at 9).

2. The USFWS has Determined in Similar Cases that a DPS Meets the Discreteness Criteria Based on Differences across the International Boundary.

In cases similar to that of the Alexander Archipelago wolf, the USFWS has on numerous occasions determined that the species meets the discreteness criteria of the DPS policy based on differences across an international boundary. Across the U.S.-Canada boundary, examples include the Queen Charlotte goshawk, Canada lynx, marbled murrelet and American wolverine, as well as the Peninsular desert bighorn across the U.S.-Mexico border.

In the case of the Queen Charlotte goshawk, the USFWS determined that Queen Charlotte goshawks in Southeast Alaska were distinct from those in British Columbia due to differences in conservation status, habitat management, and regulatory mechanisms. (72 Fed. Reg. 63123, 77 Fed. Reg. 45870, 45878, 45879). The USFWS also determined that the population segments in Southeast Alaska and British Columbia were both significant under the DPS policy and concluded that two valid DPSs exist. (72 Fed. Reg. 63123, 77 Fed. Reg. 45870, 45878, 45879).

In designating a contiguous U.S. DPS of Canada lynx, the USFWS determined that the DPS met the discreteness criteria due to differences in the management of lynx and lynx habitat across the international boundary with Canada. In its 2000 Final Rule, USFWS wrote:

> In Canada, management of forest lands and conservation of wildlife habitat varies depending on Provincial regulations. Canada has no overarching forest practices legislation, such as the United States National Forest Management Act, governing management of national lands and/or providing for consideration of wildlife habitat requirements. Additionally, in Canada, lynx harvest regulations, such as length of season and quotas, vary, being regulated by individual Provinces or, in some cases, individual trapping districts. Therefore, we conclude that the contiguous United States population of the lynx is discrete based on the international boundary between Canada and the contiguous United States due to differences in management of lynx and lynx habitat. (65 Fed. Reg. 16060).

In the case of the marbled murrelet, the USFWS listed the Washington, Oregon, and California populations as threatened in 1992 before the 1996 DPS policy was in place. (57 Fed. Reg. 45328). However, the USFWS in 2019 5-Year Review affirmed that it considers the "Washington, Oregon, and California population of murrelets to be a valid distinct population segment under the 1996 DPS Policy." (USFWS 2019 at 10). Furthermore, it determined that the DPS meets the discreteness criteria based on differences across the international border with Canada, including several differences that are analogous for the Alexander Archipelago wolf such different rates of habitat loss and regulatory mechanisms:

> This population of murrelets is discrete at the international border because: (1) the coterminous U.S. has a substantially smaller population of murrelets than does

> Canada; (2) breeding success of the murrelet in Washington, Oregon, and California is considerably lower than in British Columbia; and (3) there are differences in the amount of habitat, the rate of habitat loss, and regulatory mechanisms between the countries. The coterminous U.S. population of murrelets is also considered significant in accordance with the criteria of the DPS Policy, as the loss of this distinct population segment would result in a significant gap in the range of the taxon and the loss of unique genetic characteristics that are significant to the taxon. (USFWS 2019 at 10).

The USFWS proposed a contiguous U.S. DPS of American wolverine based on differences in conservation status across the U.S.-Canada border: "The wolverine within the contiguous United States meets the second DPS discreteness condition because of differences in conservation status as delimited by the Canadian-United States international governmental boundary." (78 Fed. Reg. 7873). The USFWS further noted that differences in the control of exploitation and conservation status result in greater vulnerability for the U.S. population which is similar to concerns for the Alexander Archipelago wolf across the U.S.-Canada border:

> In our 12-month finding for the North American wolverine DPS (75 FR 78030) we conducted a complete analysis of the discreteness of the wolverine DPS that we incorporate here by reference. In that analysis we concluded that the international boundary between Canada and the United States currently leads to division of the control of exploitation and conservation status of the wolverine. This division is significant because it allows for potential extirpation of the species within the contiguous United States through loss of small populations and lack of demographic and genetic connectivity of the two populations. This difference in conservation status is likely to become more significant in light of threats discussed in the five factors analyzed below. Therefore, we find that the difference in the conservation statuses in Canada and the United States result in vulnerability to the significant threat (discussed below) in the U.S. wolverine population but not for the Canadian population. Existing regulatory mechanisms are inadequate to ensure the continued existence of wolverines in the contiguous United States in the face of these threats. Therefore, it is our determination that the difference in conservation status between the two populations is significant in light of section 4(a)(1)(D) of the Act, because existing regulatory mechanisms appear sufficient to maintain the robust conservation status of the Canadian population, while existing regulatory mechanisms in the contiguous United States are insufficient to protect the wolverine from threats due to its depleted conservation status. As a result, the contiguous United States population of the wolverine meets the discreteness criterion in our DPS Policy (61 FR 4725). Consequently, we use the international border between the United States and

> Canada to define the northern boundary of the contiguous United States wolverine DPS. (78 Fed. Reg. 7873)

Although the USFWS subsequently withdrew the listing proposal, the withdrawal did not contest the DPS determination for the wolverine. (79 Fed. Reg. 47522).

In the case of the Peninsular desert bighorn, the USFWS designated a "Peninsular bighorn sheep" DPS of bighorn sheep (*Ovis canadensis*) occupying the Peninsular Ranges of southern California, determining that this DPS met the discreteness criteria due to "significant differences between the United States and Mexico in regard to the species' conservation status." (63 Fed. Reg. 13136).

3. A Southeast Alaska DPS Meets the Significance Criteria of the DPS Policy.

A Southeast Alaska DPS meets several of the criteria for significance. Clearly, the loss of a Southeast Alaska DPS would result in a significant gap in the range of the taxon—both in terms of percentage of range area and percentage of the wolf population. If British Columbia is factored into the Archipelago wolf range, Southeast Alaska represents a third of the Archipelago wolf's total range in terms of land area, according to range estimates in the 2015 Status Assessment. (USFWS SSA 2015 at Appendix I). The only rangewide population estimate for Archipelago wolves in Southeast Alaska, based on habitat capability models of wolf prey, estimated 908 individuals in Southeast Alaska (USFWS SSA 2015 at 18, Table 4). Based on an empirical approach that used prey biomass, the USFWS reported a mean population estimate of 875 wolves in coastal British Columbia, although the agency suspected this estimate was biased high (USFWS SSA 2015 at 18, Table 4). Therefore, even factoring in the recent declines in GMU 2 wolves, Southeast Alaska supports approximately half of the rangewide Archipelago wolf population.

Furthermore, Southeast Alaska wolves differ in genetic characteristics from British Columbia wolves, and persist in a unique ecological setting, fulfilling two additional significance criteria. As discussed in Part I of the petition, Southeast Alaska wolves differ in genetic characteristics from British Columbia wolves. The 2015 Status Assessment pointed to Weckworth et al. (2011) as the "the most comprehensive analysis of mtDNA from wolves in southeastern Alaska (n=130) and coastal British Columbia (n=75)." (USFWS SSA 2015 at 11). Weckworth et al. (2011) determined that coastal wolves in Southeast Alaska and British Columbia are divergent from continental populations, share a close evolutionary relationship, and represent a distinct portion of the genetic diversity for all wolves in North America. However, Weckworth et al. (2011) also found that within this putative phylogeographic lineage, genetic diversity differed between wolves of Southeast Alaska and coastal British Columbia. "Populations of island wolves in coastal British Columbia generally possessed multiple haplotypes, whereas most island wolves in Southeast Alaska were monotypic for the common coastal haplotype, suggesting that either gene flow between mainland coastal and island wolves is higher in British Columbia than Southeast Alaska, or that island wolves in Southeast Alaska have been subjected to extreme genetic drift, perhaps due to small founding populations or subsequent bottlenecks." (Weckworth et al. 2011 at 5). In short, haplotype differences between Southeast Alaska and British Columbia populations suggest genetic divergence between these regions.

Geneticist, ecologist, and wolf expert Dr. Byron Weckworth and colleagues in a 2015 publication highlighted that coastal Southeast Alaska wolves are genetically and ecologically distinctive. (Weckworth et al. 2015). The scientists highlighted "scientific evidence of discreteness and significance of the coastal Alaskan wolves within the criteria necessary for agency protection under the Endangered Species Act (Federal Register 1996)." (Weckworth et al. 2015 at 413). Specifically, Southeast Alaska wolves are characterized by:

> 1) A large set of characters (morphological, behavioral, and ecological), including a series of independent genetic analyses, consistently demonstrates that coastal southeast Alaska wolves are distinctive from continental wolves (those populations found interior of Pacific coastal mountain ranges); and 2) these populations harbor a disproportionately large amount of unique genetic variation of this carnivore in North America. Both points represent scientific evidence of discreteness and significance of the coastal Alaskan wolves within the criteria necessary for agency protection under the Endangered Species Act (Federal Register 1996). These biological findings are not surprising as this region has a dynamic geologic history characterized by isolation of organisms from the continent throughout the late Quaternary. Isolation, which continues today due to high coastal mountains and Holocene fragmentation of the Alexander Archipelago, has produced considerable faunal complexity and a disproportionately large number of endemic lineages (e.g., *Mustela erminea*; Cook and MacDonald 2001; Dawson et al. 2014). Endemics for a number of taxonomic groups are only now being discovered and described due to newly available specimens and novel molecular approaches (e.g., Barry and Tallmon 2010; Sikes and Stockbridge 2013). (Weckworth et al. 2015 at 413).

Archipelago wolf experts Dr. Joseph Cook and Dr. Byron Weckworth, in a letter to the USFWS in November 2015 highlighted the genetic and ecological distinctiveness of Archipelago wolves, which have retained fairly high genetic variation, exhibit greater geographical structuring than continental populations, and represent a distinct ecotype including significant local adaptation to their temperate rainforest habitat:

> We reiterate that DNA (microsatellites, mtDNA and SNPs) analyses to date (Weckworth et al. 2005, 2010, 2011; Cronin et al. 2015; Schweizer et al. 2015), as well as behavioral, and morphological studies prior to Nowak's work, identified coastal and island wolves as distinctive from other wolves in North America. The Alexander Archipelago wolves have retained fairly high genetic variation, and exhibit greater geographical structuring than continental populations (Weckworth et al 2005, Cronin et al., 2015).These wolves are also demonstrated to be a distinct ecotype among all North American wolves, including significant local adaptation endemic to the temperate rainforest biome (Schweizer et al. 2015). Consequently, these wolves contain unique genetic variability that is restricted to this region and important for the overall genetic diversity of the species. An emphasis needs to be placed on the maintenance of adaptive diversity in wolves (Crandall *et al*. 2000), such as the genetic, behavioral and morphological differences already documented. This variability is essential for maintaining evolutionary processes and diversity over time. The Alexander Archipelago wolves are a special component of the species and their decline would constitute an unrecoverable loss of significant diversity and adaptive potential to the species. (Cook and Weckworth 2015).

These experts urged "special caution" in permitting old-growth logging in Southeast Alaska, particularly for the "genetically distinctive island populations of the AA wolf (GMUs 2 and 3) which have a limited range and have been heavily impacted by human activities, including increased human access to their populations due to USDA Forest Service logging roads." (Cook and Weckworth 2015).

In addition, within Southeast Alaska, Prince of Wales wolves represent their own distinct genetic cluster. Based on microsatellite analysis, Weckworth et al. (2005) found that wolves on POW are genetically differentiated from nearby island populations on Kupreanof and Mitkof islands, as well as mainland Southeast Alaska. Weckworth et al. (2005) suggested that the wolves on POW belong to a distinct genetic cluster due to genetic and geographic isolation. Weckworth et al. 2005 at 926). According to Weckworth (2005), the genetic distinctiveness of Prince of Wales wolves is consistent with previous studies identifying POW as a center of endemism (i.e., for flying squirrels, deer mice, ermine) because of its relative isolation from the rest of the region. (*Id.*).

In their 2015 letter to the USFWS, Dr. Joseph Cook and Dr. Byron Weckworth reiterated that POW alone represents a distinct population segment and, given their unique genetic composition, POW wolves are "likely critical to the species to ensure adaptive capabilities and resiliency into the future, especially in light of rapidly changing environmental conditions on our planet:

> The POW archipelago populations constitute a critical and significant portion of range of the *C. l. ligoni* subspecies. These populations alone represent a distinct population segment, a condition that we have also identified for a series of other species on POW alone or on the POW archipelago, ranging from invertebrates to vertebrates (Cook and MacDonald 2013). Given the substantial variation held by POW archipelago wolves and their unique genetic composition (e.g., Weckworth et al. 2005, Cronin et al. 2015), these populations are likely critical to the species to ensure adaptive capabilities and resiliency into the future, especially in light of rapidly changing environmental conditions on our planet. Finally, having multiple island populations of wolves ensures redundancy under meta-population dynamics, that would allow for a "rescue" effect should one or a few of these populations be lost in the future. (Cook and Weckworth 2015).

Furthermore, a new genetics study by Zarn (2019) that examined variation in genome-wide single nucleotide polymorphisms (SNPs) in Southeast Alaska wolves found significant genetic differences among Archipelago wolf populations. The study determined that genetic differences supported three ancestral populations of wolves across Southeast Alaska. These included a POW group that consisted of 15 individuals from POW, Dall, Long, and Suemez Islands (GMU 2). A southeast group consisted of 31 individuals from Kuiu, Kupreanof, Mitkof, and Duke Islands with one wolf from POW, and the mainland east of Lynn Canal (GMUs 1A, 1B, 1C, 2, 3). A northwest group consisted of 13 individuals from Pleasant Island, Spurt Cove, and the mainland west of Lynn Canal (GMUs 1C, 1D, 4Z, 5A). (Zarn 2019 at 9). The study found that wolves in the POW and southeast groups had lower heterozygosity than wolves in the northwest group. (Zarn 2019 at 11), including marked differences in recent inbreeding and total genomic inbreeding among these groups (Zarn 2019 at 14), as detailed in the Part IV threats analysis.

Zarn (2019) stated that the study "results support the conclusion that wolves on POW are a discrete population segment" based on the genetic differences between POW wolves and other Southeast Alaska wolf populations. (Zarn 2019 at 16). Zarn (2019) noted that "without further analyses on population demographic history we are not yet able to determine whether this discreteness is the result of recent genetic drift or if the wolves on POW represent an older, distinct evolutionary lineage potentially originating from a glacial refugium." (Zarn 2019 at 16).

In sum, a Southeast Alaska DPS squarely meets three of the four criteria for the significance prong of the DPS Policy.

4. A Southeast Alaska DPS Warrants Listing as Threatened or Endangered Across All or a Significant Portion of Its Range.

The threats analysis in Part IV of this petition clearly demonstrates that a Southeast Alaska DPS warrants listing as threatened or endangered throughout all or a significant portion of its range. The best-available science and information on threats summarized in the 2011 ESA Petition, the 2015 Status Assessment, and significant new information since the 2016 Finding—such as inadequate regulatory mechanisms under the 2016 Tongass Forest Plan, massive timber sales, the proposed revocation of the Roadless Rule, and unprecedented trapping mortality in GMU 2 during the 2019-2020 season paired with inadequate regulatory mechanisms for trapping and hunting, and new evidence of inbreeding—demonstrate that Archipelago wolf populations across Southeast Alaska face immediate, high-magnitude threats from habitat destruction from logging and road construction, trapping and hunting mortality, inbreeding depression, anthropogenic climate change, and inadequacy of existing regulatory mechanisms. Threats are particularly severe and well-documented in GMUs 2, 3 and 1A which are estimated to support 85% of the Archipelago wolf population in Southeast Alaska (*See* Population Abundance and Trends) and which clearly constitute a significant portion of the range of a Southeast Alaska DPS in terms of percentage of range and population.

D. Alexander Archipelago Wolves in Southeast Alaska Constitute a Significant Portion of the Range of the Subspecies.

In the 2016 Finding, the USFWS used an unlawful definition of Significant Portion of Range (SPR) and narrowly limited its SPR analysis to the GMU 2 population. Due to these deficiencies and in light of the new evidence since the 2016 Finding—including new information on habitat requirements, population trends, and threats—Petitioners request that, in the alternative to listing a Southeast Alaska DPS, the USFWS evaluate the entire Alexander Archipelago wolf subspecies for listing, where Southeast Alaska and coastal British Columbia constitute the range and Southeast Alaska constitutes a significant portion of the range. As described throughout this petition, Archipelago wolves in Southeast Alaska face immediate, high-magnitude threats, which are particularly severe and well-documented in GMUs 2, 3, and 1A, and constitute a significant portion of the range in terms of percentage of range and population.

Notably, since 2016, federal courts have invalidated the SPR definition used by the USFWS in the 2016 Finding. The ESA defines an "endangered" species as one that is "in danger of extinction throughout all *or a significant portion* of its range," and a "threatened" species as a species that is "likely to become an endangered species within the foreseeable future throughout all *or a significant portion* of its range." (16 U.S.C. § 1532(6), (20) (emphasis added)). Consistent with the plain language of these definitions, courts have made clear that the determination of whether a species is threatened or endangered "throughout a significant portion of its range" cannot be conflated with the question of whether it is threatened or endangered throughout its entire range. (*See, e.g.*, *Defenders of Wildlife v. Norton*, 258 F.3d 1136, 1145 (9th Cir. 2001)).

In 2014, the USFWS published a final policy that purported to interpret the phrase "significant portion of its range" consistent with the statute and the courts. (Final Policy on Interpretation of the Phrase "Significant Portion of Its Range" in the Endangered Species Act's Definitions of "Endangered Species" and "Threatened Species", 79 Fed. Reg. 37,578 (July 1, 2014)). Under the policy, a portion of range is significant "if the species is not currently endangered or threatened throughout all of its range, but the portion's contribution to the viability of the species is so important that, *without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range*." (79 Fed. Reg. 37,579 (emphasis added)). The USFWS argued in the policy that this definition provided a distinction between a species that is threatened or endangered in a significant portion of its range and a species that is at risk in all of its range. This distinction, however, is not plain from the language and the courts have since concluded the definition suffers from the same flaw found in previous court findings. In a challenge of denial of protection for the cactus ferruginous pygmy owl, the court concluded:

> The Final SPR Policy purports to avoid this problem and 'leave[] room for listing a species that is not currently imperiled throughout all of its range.' *Id.* at 37,582. It does so by specifying that a portion of a species' range can be "significant" only "if the species is not currently endangered or threatened throughout all of its range," and by requiring examination of the effects of the hypothetical extirpation of the species in the portion at issue. *Id.* These attempts to distinguish the Final SPR Policy from the 'clarification interpretation' rejected by the Ninth Circuit in *Defenders of Wildlife* are illusory. (*Ctr. for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946, 956 (D. Ariz. 2017)).

A second court has since found the policy invalid for the same reason. (*Desert Survivors v. U.S. Dep't of Interior*, 336 F. Supp. 3d 1131, 1133-37 (N.D. Cal. 2018)). Because the USFWS's 2016 Finding relied on a legal interpretation of SPR that the courts have overturned, the 2016 Finding is likely to be set aside by a federal court.

Additionally, the 2016 Finding narrowly limited its SPR analysis to the GMU 2 population. The USFWS excluded consideration of areas of Southeast Alaska outside GMU 2 by summarily stating that "[w]e considered adjacent parts of the range that are contained in GMUs 1 and 3, but, based on the best available information, we did not find any concentrations of stressors in those parts that were similar in magnitude or frequency to the potential threats in GMU 2." (81 Fed. Reg. 455). However, the best-available science summarized in the 2011 ESA Petition, the 2015 Status Assessment, and new information—including on habitat requirements, population status and trends, and threats—demonstrate that wolf populations across Southeast Alaska face immediate, high-magnitude threats from habitat destruction from logging and road construction, trapping and hunting mortality, inbreeding, climate change, and inadequacy of existing regulatory mechanisms, which are particularly acute in GMUs 2, 3 and 1A which are estimated to support 85% of the Archipelago wolf population in Southeast Alaska. (*See* Population Abundance and Trends). Therefore, an evaluation of Southeast Alaska as a SPR based on the best-available science supports the determination that the Archipelago wolf warrants listing because it is threatened across a significant portion of its range.

Moreover, the USFWS's failure to take a hard look at whether southeast Alaska constitutes an SPR cannot be reconciled with previous determinations made by the agency. In particular, given that the agency had, for 20 years, considered the range of the Archipelago wolf to be limited to Southeast Alaska, the agency should have taken a closer look at the significance of this portion of the Archipelago wolf's range. In other words, because the USFWS had long considered "wolves in southeastern Alaska as a listable entity under the Endangered Species Act," (*see, e.g.*, 62 Fed. Reg. at 46,710), it follows that the agency should have at least considered whether Southeast Alaska constitutes a significant portion of the Archipelago wolf's range.

Part IV. Threats Analysis: The Alexander Archipelago Wolf Is Threatened or Endangered Based on the Five ESA Listing Factors

Under the ESA, 16 U.S.C. § 1533(a)(1), USFWS is required to list a species for protection if it is in danger of extinction or threatened by possible extinction in all or a significant portion of its range. In making such a determination, USFWS must analyze the species' status in light of five statutory listing factors:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms;
(E) other natural or manmade factors affecting its continued existence.

(16 U.S.C. § 1533(a)(1)(A)-(E); 50 C.F.R. § 424.11(c)(1) - (5).)

A species is "endangered" if it is "in danger of extinction throughout all or a significant portion of its range" due to one or more of the five listing factors. 16 U.S.C. § 1531(6). A species is "threatened" if it is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1531(20).

Part IV focuses on presenting new information published since the 2016 USFWS Finding which demonstrates that the primary threats to the Alexander Archipelago wolf in Southeast Alaska have worsened since the 2016 Finding and that these wolves need urgent protection as a threatened or endangered species under the ESA. The primary high-magnitude threats to the wolf are past and continuing industrial logging and associated road development on the Tongass National Forest and adjacent state and private lands which destroy and fragment essential habitat, reduce the wolf's prey base, and facilitate high levels of trapping and hunting mortality. Legal and illegal trapping and hunting have contributed to the observed population decline of Archipelago wolves on Prince of Wales Island and are likely contributing to population declines in other parts of the region. Climate change threatens key wolf prey species—the Sitka black-tailed deer and salmon—and is leading to a significant change in forest composition and structure due to climate-related die-offs of yellow cedar, which may have detrimental impacts on deer populations that rely on closed-canopy old-growth forests in winter. New genetic evidence indicates that wolves on POW are experiencing high levels of inbreeding and are at risk of inbreeding depression due to geographic isolation and population declines caused by habitat loss and high trapping and hunting mortality, while wolves on the islands of GMUs 3 and 1A also show evidence of inbreeding. Existing regulatory mechanisms at the federal and state levels are completely inadequate to mitigate these threats—and the harms to wolves have been compounded by federal and state agency failures to implement the insufficient mechanisms that do exist. As a result, the threats to the Archipelago wolf have only worsened over time.

A. Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range: Logging and Road Development Threaten the Continued Existence of the Archipelago Wolf in Southeast Alaska.

A primary, ongoing threat to the Alexander Archipelago wolf is habitat destruction, modification, and curtailment of habitat and range caused by industrial logging and associated road development on the Tongass National Forest and adjacent state and private lands. Decades of intensive clear-cut logging of old-growth forests, the continuation of high levels of old-growth and young-growth clear-cut logging, and extensive logging-road development harm Archipelago wolves in Southeast Alaska in several well-established ways: (1) old-growth logging creates unsuitable habitat in the long-term for Sitka black-tailed deer, the Archipelago wolf's primary prey, leading to declines in deer and wolves; (2) logging road construction increases road densities which causes higher wolf mortality from trapping and hunting; (3) logging reduces denning and rendezvous habitat and creates disturbances that risk den abandonment and reduced reproductive success; (4) logging fragments wolf habitat resulting in loss of in loss of traditional movement corridors and habitat connectivity; and (5) logging harms salmon which are in important seasonal prey source.

This section discusses the evidence for each of these impacts, the deficiencies in the 2016 USFWS Finding, and presents new information since the 2016 Finding on the intensive ongoing habitat loss and degradation from logging and road-building occurring under the 2016 Tongass Forest Plan, recent timber sales, and the Forest Service's 2019 proposal to revoke roadless protections on the Tongass National Forest. This habitat destruction, modification, and curtailment of habitat and range pose imminent, high-magnitude threats to the continued existence of Archipelago wolves in Southeast Alaska and necessitates their protection under the Endangered Species Act.

1. Decades of Intensive Clear-cut Logging and Road-Building Threaten Archipelago Wolves.

a. Industrial logging has disproportionately targeted Archipelago wolf habitat.

The Alexander Archipelago wolf in Southeast Alaska primarily uses lower-elevation, large-tree, old-growth forests for denning, pup-rearing, and hunting. (Person and Ingle 1995, Person et al. 1996, Person 2001, Roffler et al. 2018, Roffler and Gregovich 2019, 81 Fed Reg. 441). A 2018 study by Roffler et al. (2018) concluded that Archipelago wolves selected for "natural forest and land cover," including a strong preference for old-growth forest, high-quality deer habitat, and low-elevation flat terrain, and "limited use or avoidance of young-growth forests" (e.g., logged forests). (Roffler et al. 2018 at 197). The study corroborated previous research (e.g., Person and Ingle 1995, Person et al 2001) showing that Archipelago wolves are closely associated with old-growth forest and consistently select this habitat type "significantly more than expected based on its availability." (Roffler et al. 2018 at 197). New research on denning habitat use concluded that wolves select den sites in low elevation, flat terrain, in old-growth forests adjacent to open habitats (e.g. meadows and muskegs) and freshwater streams or lakes, and avoid high density road areas. (Roffler and Gregovich 2019 at 3). Wolf habitat use is strongly associated with the availability and abundance of their primary prey, the Sitka black-tailed deer which also rely on old-growth forest habitat, particularly during winter when the dense old-growth forest canopy intercepts heavy winter snow. (Person et al. 1996, Person 2001).

As acknowledged in the 2015 Status Assessment, over the past 60 years industrial-scale clear-cut logging has targeted the lower-elevation, large-tree old-growth forests[7] that provide the

[7] A discussion of old-growth habitat on the Tongass National Forest benefits from precise terminology. Productive Old-growth (POG) is old-growth forest that is capable of producing a certain annual unit of timber harvest, and contains seven size classes. The lower volume POG are small size classes made up of small trees that are relatively less suitable as wildlife habitat. High-volume Productive Old-growth (HPOG) is comprised of the three highest size classes and has relatively more value as wildlife habitat. Size class 67 (SD67) is also called "large-tree old-growth" and is comprised of the big old trees that most people bring to mind when they hear the term "old-growth forests". Large-tree old-growth has the highest biological value, particularly to species like wolves. Likewise, contiguous POG and contiguous large-tree old-growth are critically important, as wildlife species like wolves benefit from large unbroken tracts of

best habitat for Archipelago wolves (USFWS SSA 2015 at 50-55), causing disproportionate harms to wolves. From 1954 to the early 2000s, more than 315,000 hectares of Tongass rainforest were logged. (Albert and Schoen 2007 at Table 5). According to a detailed assessment by Albert and Schoen (2007), during this time, clear-cut logging removed a minimum of 28% of the large-tree old-growth forest in Southeast Alaska, although "it is likely that that actual percentage may be greater than 50%" given the long practice of selectively cutting large-tree stands. (Albert and Schoen 2007 at 10-11). Large-tree forests were logged at rates exceeding their proportional abundance in southeast Alaska by at least 2.89 times, and as a result, the largest individual trees—with diameters greater than 12 feet that once occurred throughout Southeast Alaska—have now been mostly extirpated. (Albert and Schoen 2007 at 10-11). Moreover, prior to 1979, most large-tree logging occurred at lower elevations in low-elevation valley floors and along coastlines that are prime habitat for Archipelago wolves, including logging of ~ 50% of karst old-growth forests and disproportionate logging of large-tree flood plain forests. (Albert and Schoen 2007 at 10-11).

Importantly, the provinces that support the majority of the Archipelago wolf population in Southeast Alaska—North Prince of Wales, Dall Island Complex, Etolin/Zarembo, Kupreanof/Mitkof, and Revilla/Cleveland in GMUs 2, 3 and 1A—have at minimum lost from 40% to 50% of their original large-tree forests. (Albert and Schoen 2007 at 11). North Prince of Wales Island in GMU 2 originally contained 14% of all productive old-growth forests in southeast Alaska but has been the target of 38% of all logging (Albert and Schoen 2007 at Table 5). As a result of this heavy logging toll, northern POW lost 32% of its productive old growth and a minimum of 40% of its large-tree forests. (Albert and Schoen 2007 at Table 5). GMUs 3 and 1A were logged at lower rates, but lost equivalent proportions of large-tree forests due to high-grading: Kupreanof and Mitkof Islands in GMU 3 lost 16% of their productive old-growth and 48% of large-tree forests; Etolin and Zarembo Islands in GMU 3 lost 16% of their productive old-growth and 50% of large-tree forests; and Revilla Island and the Cleveland Peninsula in GMU 1A lost 11% of their productive old-growth and 40% of large-tree forests. (Albert and Schoen 2007 at Table 5).

b. Intensive clear-cut logging has drastically reduced long-term carrying capacity for Sitka black-tailed deer, with the largest impacts in Archipelago wolf habitat.

As acknowledged in the 2015 Status Assessment and 2016 Finding, an expansive body of research on forest succession following clear-cut logging has concluded that conversion of old growth forest habitat to second-growth stands reduces the quality and quantity of forage habitat

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forest that are connected across a landscape. Although it is important to consider the among of POG left in biogeographic provinces in the Tongass National Forest, it is vitally important to consider the extent of contiguous POG and contiguous large-tree old-growth.

and winter habitat for Sitka black-tailed deer, the principal prey of Archipelago wolves. (USFWS SSA 2015 at 54-55, 61-62; 81 Fed. Reg. 433-444). Because logging reduces forage habitat for deer, which in turn reduces the amount of prey available for wolves, declines in deer populations due to logging can result in declines in wolf numbers. (*Id.*).

In young clear-cuts less than 25 to 30 years old, understory shrubs regenerate providing forage for deer in summer, but the lack of a forest canopy fails to intercept snow in winter, allowing burial of deer browse and increasing the energetic costs of deer movement, particularly during severe winters. (*Id.*). In older clear-cuts more than 25 to 30 years old, dense even-aged canopies impede sunlight and the growth of deer forage, creating poor-quality low-forage habitat for deer. (*Id.*). This "stem exclusion" phase may last for 100 to 150 years until logging or natural disturbance disrupts the uniform canopy structure. (FWS SSA 2015 at 54-55, Wolf Technical Committee 2017 at 5-6). As summarized by Roffler et al. (2018), clear-cut logging and the creation of second-growth forest produces a "succession debt" where the delayed effects of past logging predict "long-term and largescale declines of deer, and subsequently wolves":

> Old-growth forests are heterogeneous in stand age and canopy structure, allowing sufficient light to penetrate to the forest floor and support diverse understory species including shrubs, forbs, and lichens that are important deer forage (Alaback, 1982). Understory shrubs regenerate in young clearcuts (age 0–25–30 years), particularly during summer and mild winters (Alaback, 1984; Farmer and Kirchhoff, 2007; Cole et al., 2010), but during severe winters, early successional forests lack a canopy capable of intercepting snow (Kirchhoff and Schoen, 1987), allowing shrub burial (White et al., 2009) and increasing energetic costs of deer movement (Parker et al., 1999). Older clearcuts (> 25–30 years) grow into even-aged stands with dense canopies which block sunlight and impede growth of deer forage (Alaback, 1982; Schoen et al., 1988, Farmer and Kirchhoff, 2007). This is also known as the stem-exclusion phase and may last>100 years (Wallmo and Schoen, 1980; DellaSala et al., 1996). These second-growth forests are unproductive for many old-growth associated wildlife species, and the delayed effects of past timber harvest (termed "succession debt") predicts long-term and largescale declines of deer, and subsequently wolves (Person, 2001).
> (Roffler et al. 2018 at 190-191).

Even if logging were to stop immediately, the "succession debt" means that the more than 300,000 hectares of forest already logged on the Tongass are or soon will be unsuitable as deer and wolf habitat for 100 to 150 years. Importantly, as discussed further below, the 2016 Tongass Forest Plan authorizes the continued logging of old-growth, worsening the succession debt for deer and wolves, and promotes high levels of second-growth logging in the long-term, rather than allowing logged forests to regenerate past the stem exclusion phase. As a result, much young-growth forest will be permanently kept in a state of poor habitat quality for deer and wolves.

Although silvicultural treatments of young-growth are often promoted as a way to increase deer forage, a study by Gretchen Roffler and colleagues explained that precommercial thinning of young-growth forest—intended to enhance deer habitat by delaying stem exclusion and prolonging forage production—does not appear to enhance habitat for wolves. (Roffler et al. 2018). The study warned that approximately 1500 km^2 of forest—representing over one third of the old-growth available prior to industrial logging—is predicted to enter the stem exclusion phase over the next two decades on POW and the surrounding islands, raising concern for the long-term abundance of wolves and deer (Roffler et al. 2018 at 197):

> Thus far, the benefits of thinning treatments on maintaining understory vegetation have proven to be short-term (5–10 years), diminishing the potential for sustaining wildlife through the long-lasting stem exclusion phase (Hanley, 2005; Farmer et al., 2006; Cole, 2010). In this study we demonstrate that thinning treatments do not thus far appear to enhance habitat for wolves. Thinning treatments recommended by the interagency Wolf Technical Committee (2017) for Prince of Wales Island include thinning prior to 25 years post-harvest in medium to high productive stands, prioritizing landscapes with low proportions of high quality winter deer habitat, and conditions that would favor understory regeneration. These treatments warrant continued evaluation for the benefits provided to both deer and wolves. Approximately 1500 km^2 of forest (representing over one third of the old-growth available prior to industrial logging) is predicted to enter the stem exclusion phase over the next two decades on POW and the surrounding islands (Smith et al., 2016) raising concern for the long-term abundance of predator and prey populations in logged temperate forests. (Roffler et al. 2018 at 197).

The study further warned that "use of human-caused early succession forests had a short time frame, seral forests >30 years were avoided, and forestry management to enhance habitat value in older seral forests did not extend the period of favorable conditions. Thus, the amount of habitat available to wolves could decline with an increasing proportion of the forest transitioning to the stem exclusion phase, with potential population-level consequences for wolves." (Roffler et al. 2018 at 199).

In evaluating the impacts of logged stands on deer habitat capability and wolves, the age distribution of logged stands is important given that clear-cut stands less than 25-30 years old are used by deer, but clear-cut stands greater than 30 years old are avoided by deer and wolves due to low-forage conditions lasting 100 to 150 years. Logging in Southeast Alaska peaked in the

1980s and 1990s as shown in Figure 3 below, with 780 km^2 (78,000 hectares) logged in the 1980s and ~630 km^2 (63,000 hectares) logged in the 1990s. (USFWS SSA 2015 at Figure 7). Therefore, nearly half of the forested area in the Tongass that was previously clear-cut was logged in the 1980s and 1990s, and these 141,000+ hectares have just recently entered or are soon to enter the long 100 to 150 year stem exclusion phase of providing unsuitable habitat for deer and wolves.

Figure 3. Age Distribution of Logged Forests Across All Land Ownerships in Southeast Alaska. Source: USFWS SSA 2015 at Figure 7.

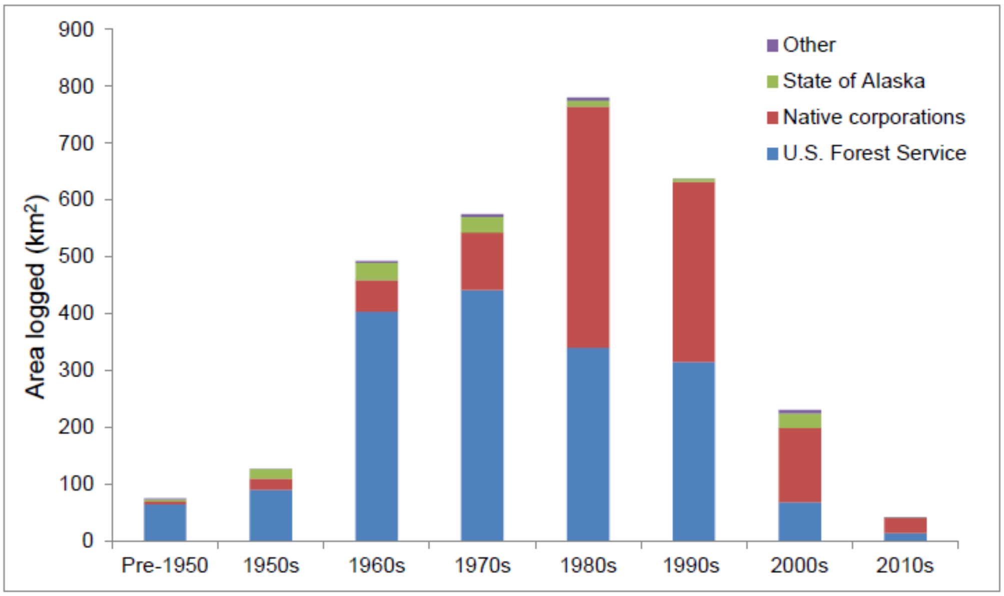

Figure 7. Age distribution of logged forest across all land ownerships in southeastern Alaska (Shanley 2015). Data from 2010s reflects harvest through 2013.

Estimates of long-term declines in deer numbers due to logging are typically based on "deer habitat capability" modeling, which estimates deer habitat capability as a proxy of deer carrying capacity during winter when deer populations are assumed to be most limited. To provide context for the following discussion, ground-truthing of deer habitat capability model projections suggests that the model likely overestimates deer carrying capacity because it fails to account for important ecological factors such as patch size, connectivity, density edge, adjacency, and risk of death. (USFWS 2015a at 13),[8] suggesting model projections are too optimistic.

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[8] In the September 18, 2015 "Response to external peer review of Gilbert et al. (2015) titled "Future population trends and drivers of change for Alexander Archipelago wolves on and near Prince of Wales Island, Alaska," Dr. David Person in his peer review commented extensively on the deficiencies of the HCI model: "the model has some serious deficiencies and almost certainly over estimates the value of some habitats to deer. In an appendix to Person and Bowyer (1997), you will find a brief analysis comparing deer HCI values to a measure of deer activity (pellet group counts). This is the only attempt ever done to evaluate deer model output against a measure of deer density (or activity). I needed to at

Albert and Schoen (2007) modeled deer habitat capability in two time periods (1954 and 2002) across federal, state, and private lands in Southeast Alaska. According to Albert and Schoen (2007), between 1954 and 2002, logging resulted in the largest reductions of deer habitat capability on northern POW to 62% of its 1954 capability, with reductions to 78% and 89% of 1954 capability on the Dall Island Complex and Southern POW respectively. (Albert and Schoen 2007 at Table 8). In GMU 3 in 2002, deer habitat capability on Etolin, Zarembo, Kupreanof and Mitkof had been reduced to 77% to 78% of 1954 capability, and in GMUs 1A and 1B were reduced to 85% of 1954 capability. (*Id.*). In 2002, the highest remaining deer capability was in GMU 2 (47%), followed by GMU 3 (34%), and the remainder in parts of GMUs 1A and 1B (19%). (*Id.*). Most of the mainland of southeastern Alaska was not included in their analysis because it was considered as generally poor winter habitat for deer.

In short, intensive clear-cut logging has drastically reduced long-term carrying capacity for Sitka black-tailed deer, and these impacts are highest in the habitat areas most important for Archipelago wolves.

c. The 2016 USFWS Finding's conclusion that logging and resulting reductions in deer habitat capability do not threaten Archipelago wolves is flawed.

The 2016 FWS Finding for Factor A concluded that logging is not affecting or likely to affect the range-wide wolf population, despite ongoing, long-term reductions in deer habitat capability that will cause deer populations to continue to decline. (81 Fed. Reg. 445). Although the USFWS determined that the GMU 2 wolf population "likely is being impacted and will continue to be impacted by reduced numbers of deer, the only ungulate prey available," it problematically discounted the loss of the GMU 2 as insignificant to the range-wide population. (81 Fed. Reg. 446). For populations outside GMU 2, the USFWS asserted that wolves would use other prey that would not be significantly impacted by logging, increasing road densities, climate change, or other stressors: "although deer populations likely will decline in the future as a result

least assure myself before doing the wolf-deer modeling that deer HCI had some connection with reality, and it does, albeit with a lot of noise to signal. However, it almost certainly over estimates K that is actually available to deer. The reason is that it does not take into account measures of landscape context such as patch size, connectivity, density of edge, adjacency, and risk of death. It is basically a large lookup table containing model coefficient values for different habitats at different elevations, nested within different aspects, nested within low, medium, and deep snow areas. You simply add up the coefficient values for each pixel of your GIS layer covering the project area and divide the sum by the total number of pixels. That gives you the average HCI value for the area. Consequently, a single isolated pixel of productive old growth has an equal value to similar pixels lumped into a larger patch. This despite the fact it may be a tiny island surrounded by clearcut, muskeg, or water. It is also important to know if the USFS layer you have contains USFS manipulations of HCI value for "thinned" clearcuts and other second growth. None of those manipulations were the result of interagency cooperation. They were done unilaterally by the USFS to boost HCI values for second growth."

of timber harvest, we found that most wolf populations will be resilient to reduced deer abundance because they have access to alternate ungulate and non-ungulate prey that are not impacted significantly by timber harvest, road development, or other stressors that have altered or may alter habitat within the range of the wolf." (81 Fed. Reg. 446). In sum, the USFWS "postulate[d] that they have sufficient prey to maintain stable populations and are not being impacted by timber harvest." (81 Fed. Reg. 444).

However, this determination for wolves outside GMU 2 is not based on the best-available science and contains key logical flaws. First, the USFWS acknowledged that deer are the Archipelago wolf's "primary prey" (81 Fed. Reg. 443, 453) and that timber harvest is the "principal stressor modifying wolf and deer habitat in southeastern Alaska and coastal British Columbia." (81 Fed. Reg. 443). The diet studies reviewed in the 2015 Status Assessment show that deer are by far the most important prey in the diet of Southeast Alaska wolves, with the exception of the northern mainland where both deer and wolves are scarce. (USFWS SSA 2015 at 27).

Furthermore, the Status Assessment itself concludes that a study of Archipelago wolves on Coronation Island indicates that wolves cannot maintain high densities without sufficient deer prey:

> As deer became less numerous on the island as a result of predation by the introduced wolves, birds, seals, marine invertebrates and small mammals constituted the major food remains in scats. With declining deer numbers, wolves even resorted to cannibalism. As deer declined on Coronation Island, the wolf population declined from a maximum of 13 to one individual. To the best of our knowledge, this study is the only one on Alexander Archipelago wolves that indicates an inability of wolves to maintain high densities in response to a declining deer herd. (USFWS SSA 2015 at 29).

Indeed, Archipelago wolves occur in the highest densities in Southeast Alaska on the large islands in GMUs 2 and 3 where deer habitat capabilities are highest.

However, the USFWS asserted that, despite intensive logging in Southeast Alaska—which has been impacting and will continue to impact deer populations—wolves outside GMU 2 still have an adequate prey base. (81 Fed. Reg. 444, 446). And the USFWS's "adequate prey base" argument was based on the presumed stability of the wolf population outside of GMU 2. The USFWS's circular reasoning thus took the form of a syllogism: (1) wolves outside GMU 2 are stable; (2) because wolves are stable, they must have an adequate prey base; (3) because wolves have an adequate prey base, timber harvest is not significantly affecting wolves. (*See* "Thus, although we lack estimates of trend in these wolf populations, we postulate that they have sufficient prey to maintain stable populations and are not being impacted by timber harvest." (81 Fed. Reg. 444).

The root of the USFWS finding, therefore, is the presumed stability of the non-GMU 2 wolf populations. Yet the only empirical data on population trends of Archipelago wolf populations are for GMU 2—where the FWS acknowledged that timber harvest is affecting the population (81 Fed. Reg. 445 ("[T]imber harvest is affecting the GMU 2 wolf population by reducing its ungulate prey and likely will continue to do so in the future")) and where the wolf population has declined precipitously (81 Fed. Reg. at 440). In contrast, in non-GMU 2 Southeast Alaska, "the trend of wolf populations is not known." (81 Fed. Reg. 440; USFWS SSA 2015 at 19 ("Outside of GMU 2, few quantitative data on population size, trend, and densities from field studies are available.")). Despite the fact that population trends outside GMU 2 are unknown, the USFWS incorrectly used a presumption of stability to assert that logging was not affecting these populations.

i. The FWS failed to demonstrate that the availability of other prey sufficiently mitigates against threats from logging.

The "adequate prey base" conclusion is linked to an assumption about the availability of prey species other than deer. In its finding on logging threats, the agency relied on the "resiliency" of wolves, owing to their ability to feed on alternative ungulate (other than deer) and non-ungulate species. (81 Fed. Reg. 444). But this conclusion, too, erroneously rested on the alleged stability of the wolf population. To take the above syllogism one step further (in *italics*): (1) wolves are stable; (2) because wolves are stable, they must have an adequate prey base; *(3) although logging is affecting deer populations, wolves prey on species other than deer*; *(4) where* wolves have an adequate, *non-deer* prey base, timber harvest is not significantly affecting wolves.

But the finding that non-GMU 2 wolf populations "will be resilient to reduced deer abundance because they have access to alternative ungulate and non-ungulate prey" (81 Fed. Reg. 446) is based on nothing more than the alleged stability of the population. (81 Fed. Reg. 444 ("We attribute the stability of wolf numbers, in part, to the availability of other ungulate species…")). The USFWS points to no studies supporting its "resiliency" hypothesis. The USFWS cites no evidence of wolf persistence in areas where deer populations have been depleted, and in fact, the study of Archipelago wolves on Coronation Island indicates that wolves cannot maintain high densities without sufficient deer prey. (USFWS SSA 2015 at 29). Further, the USFWS offers no support for the proposition that if deer populations decline past a certain threshold, wolves will simply shift their diet and that diet shift will have no fitness consequences.

Further, the USFWS's assertion that alternate prey including moose, mountain goats, beavers, and salmon will not be significantly impacted by logging, road construction, climate change, habitat fragmentation, or other habitat stressors is simply not supported by the evidence in the Status Assessment or in the record. For the mountain goat, the USFWS vaguely states: "Thus, although forests adjacent to cliffs provide critical habitat for mountain goats during the winter, it is unlikely that timber harvest has had or will have a population level effect on mountain goats within the range of the Alexander Archipelago wolf, but some individuals or local populations (e.g., Cleveland Peninsula) may be impacted." (USFWS SSA 2015 at 66). For salmon which experience well-documented harms from logging, road-building, and climate change, as discussed extensively below, the USFWS without providing any citations simply asserts: "Although timber harvest can affect physical characteristics of freshwater streams used by salmon, it is less clear whether or not these habitat alterations result in reduced survival, reproduction, or abundance of salmon." (USFWS SSA 2015 at 66). Nor is there any evidence or guarantee that these alternate prey will not be hunted or fished to levels that reduce their availability to wolves. In short, the best-available evidence does not support the conclusion that wolf populations outside of GMU 2 will be able to "maintain stable populations" in the face of long-term deer declines.

ii. The USFWS finding on logging impacts to GMU 2 wolves likely underestimates the harms.

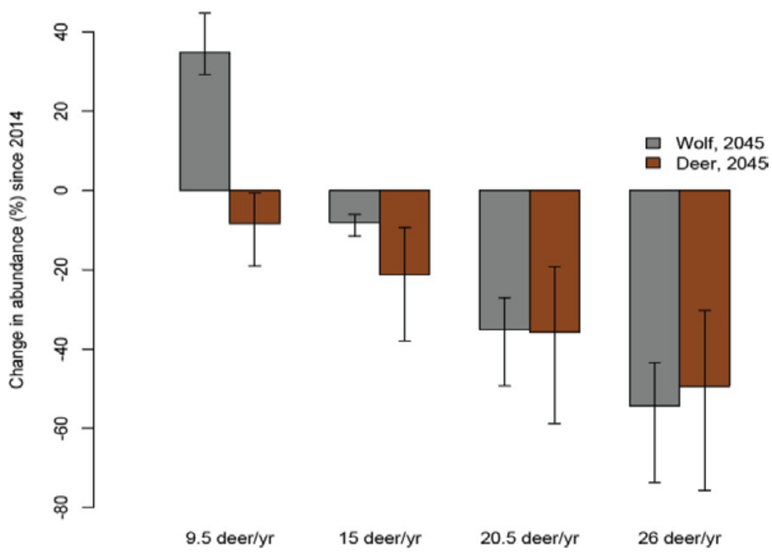
It is also important to note that while the USFWS correctly determined that GMU 2 will be impacted by declining deer numbers, the Service's analysis for GMU 2 almost certainly underestimates these harms. The USFWS relied extensively on an unpublished modeling analysis by Gilbert et al. (2015) to evaluate the effects on wolves in GMU 2 of past and future logging as well as roads, winter severity, and trapping and hunting regulations. Based on these model results, the USFWS concluded that "as a result [of logging], in GMU 2, deer are projected to decline by approximately 21 to 33 percent over the next 30 years, and, correspondingly, the wolf population is predicted to decline by an average of 8 to 14 percent (Gilbert *et al.* 2015, pp. 19, 43)." (81 Fed. Reg. 444). However, as explained by multiple peer reviewers, the assumptions made by the modeling team make the model results overly optimistic and misleading for both deer and wolves.[9] (USFWS 2015a at 9, 11-12, 14, Amec Foster Wheeler 2015 at 7, 13, 16, 21, 22, 28, 29).

For example, Gilbert et al. (2015) ran the model using a low per-capita wolf predation rate of 15 deer/wolf/year (i.e., 45% deer in wolf diet, based on stable isotope analysis by Szepanski et al. 1999). However, Dr. David Person and several other experts noted that this predation rate was not supported by the best-available evidence and would lead to "very optimistic" and "misleading" results. (USFWS 2015a at 9, 11-12, 14, Amec Foster Wheeler 2015

[9] *See* USFWS, Draft Summary Report, Peer Review of Draft Status Assessment for the Alexander Archipelago Wolf, August 27, 2015 *and* USFWS, Response to external peer review of Gilbert et al. (2015) titled "Future population trends and drivers of change for Alexander Archipelago wolves on and near Prince of Wales Island, Alaska," September 18, 2015.

at 29). Dr. Person recommended using mean predation rate of at least 20 deer/wolf/year, and cautioned that diet volume from stable isotope data (i.e., the Szepanski et al. 1999 study results) does not equate to rate of predation. (USFWS 2015a at 11-12, 14). Using a realistic wolf predation rate is important because Gilbert et al. (2015) found that the mean population change in wolves was highly sensitive to wolf diet composition, as shown in Figure 4 below. Projected wolf population declines in GMU 2 were significantly higher using a predation rate of 20 deer/wolf/year compared with the default rate of 15 deer/wolf/year. (Gilbert et al. 2015 at 20, Figure 12).

Figure 4. Modeled estimates of percent change in mean abundance of wolves and deer based on four rates of wolf predation on deer between 2015 and 2045 in Game Management Unit 2, southeastern Alaska. Error bars denote 95% confidence intervals. Modeled estimates of change in mean abundance of wolves and deer are highly dependent on the wolf predation rate assumed. Source: USFWS SSA 2015 at Figure 12, Gilbert et al. 2015 at Figure 7d.



Similarly, Gilbert et al. (2015)'s estimates of changes in deer habitat capability on POW between 1995 and 2015 appear to be underestimates. The study estimated that large amounts of post-logged stands on POW entered the stem-exclusion phase between 1995 and 2015, for a 215% increase in stem-excluded stands during this time period. (Gilbert et al. 2015 at 24-25). As a result, the study projected that the 2015 carrying capacity for deer was 88% of what it was in 1995 and 73% of what it was in 1954. (Gilbert et al. 2015 at 24). The study projected that with no additional logging assumed after 2014, stem-excluded second growth was projected to increase 355% from 1995 conditions, with an additional 6% decrease in deer carrying capacity below 2014 levels in 2045 (Gilbert et al. 2015 at 24-25, Figure 4).

Perhaps due to differences in methodologies, the estimates of Gilbert et al. (2015) appear to be significant underestimates compared with Albert and Schoen (2007). Albert and Schoen

(2007) estimated that in 2002 that deer habitat capability on POW had fallen to 62% of its 1954 capability. (Albert and Schoen 2007 at Table 8). In contrast, Gilbert et al. (2015) estimated that in 2015—when many more tens of thousands of hectares of logged forests had entered the stem exclusion phase compared with 2002—that deer carrying capacity on POW had fallen to 73% of its 1954 capability. Gilbert et al. (2015) do not explain this apparent contradiction. In addition, Gilbert et al. (2015)'s estimate of an additional 6% decline in deer carrying capacity below 2014 levels to account for the remaining post-2015 succession debt from pre-2015 logging also appears to be a notable and unexplained underestimate, given the extensive amount of forest entering the stem-exclusion phase post-2015. As a reminder, logging on the Tongass peaked in the 1980s and 1990s, and clear-cut patches enter the stem-exclusion phase 25 to 30 years post-clear-cut. As noted above, that means that 141,000+ hectares have just recently entered or are soon to enter the long 100 to 150-year stem exclusion phase, which should result in continuing large-scale reductions in deer habitat capability.

d. Increasing road densities lead to higher wolf mortality from trapping and hunting.

Numerous studies have established that roads increase the risk of death for Archipelago wolves from hunting and trapping. (Person and Russell 2008, Person and Logan 2012, Gilbert et al. 2015, Wolf Technical Committee 2017). High road densities and the greater hunting and trapping mortality they facilitate have been identified as the key driver of wolf mortality in GMU 2 that has contributed to the observed population decline. *Id.* As detailed below, construction of logging roads has led to high and increasing road densities in Archipelago wolf habitat—particularly in GMUs 2, 3, and 1A—that surpass the recommended road densities in the 2016 Tongass Forest Plan standards and guidelines. Although the USFWS in its 2016 Finding determined that road construction does not threaten Archipelago wolves, the USFWS relied on a road density threshold that was contrary to the best-available scientific research as well as the standards and guidelines in the 1997 Forest Plan, 2008 Forest Plan, current 2016 Forest Plan and 2017 Wolf Habitat Management Program. Instead, the best-available science demonstrates that past and ongoing logging-associated road construction threatens the continued existence of Archipelago wolves in Southeast Alaska.

i. The USFWS 2016 Finding used a spurious road density threshold unsupported by scientific research to incorrectly conclude that road-building does not threaten the Archipelago wolf in Southeast Alaska.

The 2015 Status Assessment and 2016 Finding squarely failed to use the best-available science in the impact analysis of road density to Archipelago wolves. Instead these analyses used an unsupported road density threshold that vastly underestimates the impacts of current and increasing road densities on wolves. Specifically, the USFWS cited Person and Russell (2008) to assert that a road density of 1.45 mi/mi^2 (0.9 km/km^2) was the "recommended road density threshold for wolves" (81 Fed. Reg. 448) "above which wolf harvest rates can be problematic."

(USFWS SSA 2015 at 69). The USFWS then used 1.45 mi/mi^2 (0.9 km/km^2) as a threshold in its road impact analyses (81 Fed. Reg. 448, USFWS SSA 2015 at 68-71) throughout Southeast Alaska. Using this incorrect threshold, the USFWS concluded that road construction does not threaten Archipelago wolves: "we find that destruction and modification of habitat due to road development likely is not affecting wolves at the population or range-wide level," and "we conclude that roads are not a threat to the habitats used by the Alexander Archipelago wolf, although we address the access that they afford to hunters and trappers as a potential threat to some wolf populations under Factor B" (81 Fed. Reg. 445) although it is important to point out that road construction was not determined to be a threat under Factor B. (*See* 81 Fed. Reg. 448).

Importantly, 1.45 mi/mi^2 (0.9 km/km^2) is not and was not a "recommended road density threshold" under the 1997 Forest Plan, 2008 Forest Plan or 2016 Forest Plan, under the 2017 Wolf Habitat Management Program, or according to Person and Russell (2008). Person and Russell (2008) demonstrated a strong positive linear relation between road density less than or equal to 1.45 mi/mi^2 (0.9 km/km^2) and trapping and hunting mortality rates. (Person and Russell at 1546-1547, Figure 3). Above 1.45 mi/mi^2, road densities appeared to have little additional effect on trapping and hunting mortality rates, likely because hunters and trappers are unable to make more effective use of higher road densities and wolf packs became so depleted in those areas. (*Id.*). Importantly, Person and Russell (2008) did not recommend 1.45 mi/mi^2 (0.9 km/km^2) as a road density threshold for determining "problematic" trapping and hunting rates. Instead, the researchers made clear that at this level of road density, trapping and hunting would eliminate about 35%–39% of the autumn population, not counting natural mortality or illegal kills which are known to be extremely high on POW. (*Id.* at 1548). After accounting for natural mortality and illegal kills, total mortality at 1.45 mi/mi^2 "could greatly exceed 38% of the autumn wolf population." (*Id.*).(emphasis added).

In further support that Person and Russell (2008) did not recommend a 1.45 mi/mi^2 (0.9 km/km^2) road density threshold, the study explained that the lower 1997 LRMP road density guideline of 0.7 mi/mi^2 (0.43 km/km^2) could "facilitate chronic unsustainable mortality." (*Id.* at 1549).

In addition, at the 2006 Interagency Conservation Strategy Workshop, Dr. David Person presented evidence that the guideline in the 1997 Forest Plan for road densities not to exceed 0.7 to 1.0 mi/mi^2 was inadequate. Dr. Person presented modeled probabilities of an overkill event (i.e., average harvest exceeding 30% of the population) and a destructive harvest event (i.e., harvest of greater than 90% of the population occurring once during a 15-year period) based on road density and access. (LRMP FEIS 2008 at 3-237, CSR Report 2008 at 74).[10] The model

[10] The 2008 Tongass LRMP FEIS at 3-237 states that "Recent analyses presented at the Tongass Conservation Strategy Review Workshop (2006) have modeled the probability of an overkill (average harvest of greater than 30 percent of the population) or destructive harvest (harvest greater than 90

indicated that 32% of the Wildlife Analysis Areas (WAAs) on Prince of Wales Island had road densities that suggested a high probability of overkill and that more than half of the WAAs had road densities at levels indicating a high probability of at least one destructive harvest occurring over a fifteen-year period. *Id.* Dr. Person concluded that "[t]he open road density guideline of 0.7 mi/mi² needs to be adjusted for total road density and access and may be too high. The guideline should also consider the risk of destructive harvest, particularly for isolated wolf populations such as on Prince of Wales Island." (CSR Report 2008 at 74). Dr. Person and other experts have further recommended that road densities should be calculated for elevations below ~1,200 feet since wolves spend most of their time at low elevations (e.g., Person et al. 1996 at 24),[11] but the 1.45 mi/mi^2 threshold used by the USFWS in the 2016 Finding did not reflect this. In sum, the USFWS's use of a road density threshold of 1.45 mi/mi² (0.9 km/km^2) for determining "problematic" or "negative" trapping and hunting rates is completely unsupported and leads to the spurious determination that road construction does not threaten the Archipelago wolf.

Instead, scientific research indicates that increasing road densities increase mortality risk for Archipelago wolves and have contributed to the observed population decline in GMU 2. (Person and Russell 2008, Person and Logan 2012, Gilbert et al. 2015, Wolf Technical Committee 2017). In addition to Person and Russell (2008), Person et al. (1996) reported that trapping and hunting rates increased sharply in WAAs where road density levels exceeded 0.49 mi/mi^2. (Person et al 1996 at 24). Wolf mortality from hunting and trapping doubled when total road density below 1,200 feet elevation on GMUs 2 and 3 exceeded 0.66 mi/mi^2, tripled at 1.19 mi/mi^2, and quadrupled at 1.63 mi/mi^2. (Person et al 1996 at 25). Person and Logan (2012) found that an increase in road density of 0.3 mi/mi^2 (0.2 km/km^2) resulted in a 167% increase in risk of chronic unsustainable harvest on POW. (Person and Logan 2012 at 18).

Instead of the 1.45 mi/mi^2 threshold used in the 2016 Finding, the best-available science and the standards and guidelines in the 2016 Tongass Forest Plan and 2017 Wolf Habitat Management Program indicate that 0.7 mi/mi^2 is the road-density threshold beyond which negative impacts to wolves are likely to occur. The 2016 Tongass Forest Plan standards and guidelines state that road densities of 0.7 to 1.0 mi/mi^2 or less may be necessary to reduce trapping and hunting-related mortality where locally unsustainable wolf mortality has been

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percent of the population occurring once between 1985 and 1999) of the wolf population on Prince of Wales Island taking into account road density and whether the road system was connected to a main road system with access to a ferry. Results indicated that 32 percent of WAAs on Prince of Wales Island have road densities indicative of a high probability of overkill and 52 percent have road densities indicating a high probability of having had at least one destructive harvest between 1985 and 1999. These results indicated that roads exert a strong influence on wolf mortality, particularly when connected to main road systems."

[11] Person et al. 1996 at 24 ("We calculated road density by using the area within a WAA below 370 meters (>1,200 feet) elevation as the denominator. Wolves spend most of their time at low elevations (Person, in prep.), and calculations of road density should reflect this relation.")

identified—and that road densities should factor in both open and closed roads. (LRMP 2016 at 4-91). The 2017 Wolf Habitat Management Program for POW recommended that management should aim to "avoid increasing road densities where total road densities (including temporary roads) exceed 0.7 miles per square mile within GMU 2 Wildlife Analysis Areas." (Wolf Technical Committee 2017 at 21).

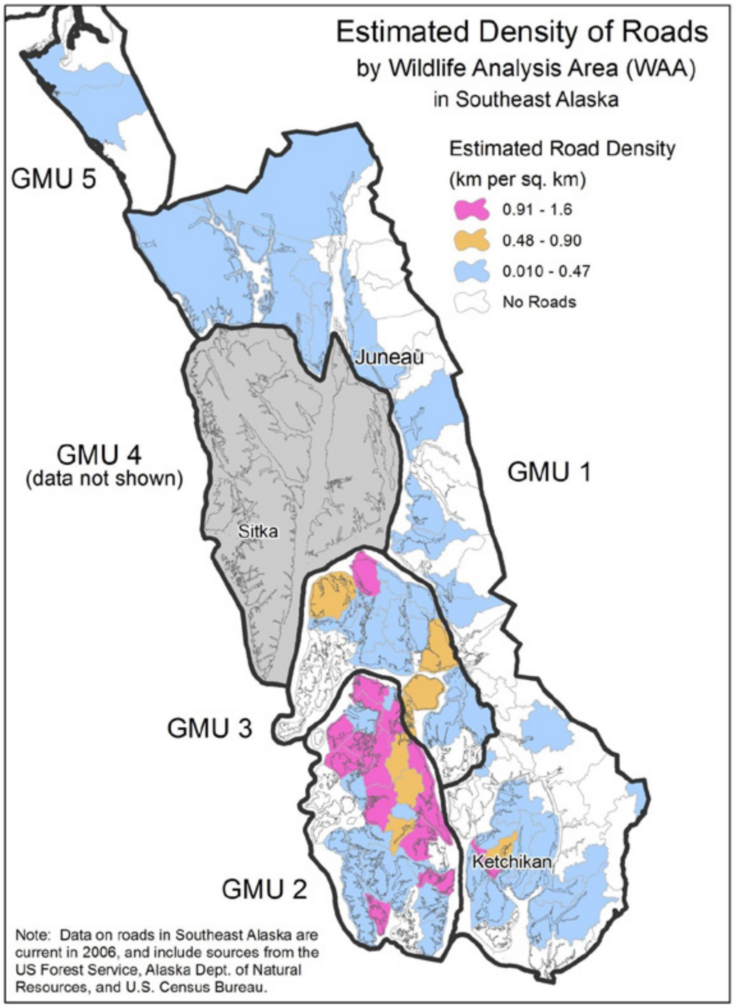
ii. Road Densities exceed the 0.7 mi/mi^2 threshold throughout much of GMUs 2, 3, and 1A, which support the majority of Archipelago wolves in Southeast Alaska.

Existing road densities in many parts of GMUs 2, 3, and 1A, which support most of the Archipelago wolf population, already exceed the 0.7 mi/mi^2 road density threshold at which negative impacts to wolf populations are more likely to occur. Therefore, any additional road construction puts Archipelago wolves at further risk of levels of hunting and trapping mortality that can cause population declines.

The 2015 Status Review reports that 6,820 miles (10,975 km) of roads crisscross the range of the Archipelago wolf in Southeast Alaska, with most roads (52%) in GMU 2, followed by GMUs 3 (23%), GMU 1 (22%), and GMU 5A (3%). (USFWS SSA 2015 at 69). In terms of road density, the USFWS estimated mean road density across all lands in each GMU: 1.00 mi/mi^2 (0.62 km/km^2) in GMU 2, 0.42 mi/mi^2 (0.26 km/km^2) in GMU 3, 0.13 mi/mi^2 (0.08 km/km^2) in GMU 1, and 0.06 mi/mi^2 (0.04 km/km^2) in GMU 5A. (USFWS SSA 2015 at Table 20). In Figure 5 below, the areas shown in orange and pink exceed mean road densities of 0.77 mi/mi^2 (0.48 km/km^2), considering all elevations and not including additional areas which may exceed a 0.7 mi/mi^2 (0.43 km/km^2) threshold.

In GMU 2, the Wolf Technical Committee found that about two-thirds of WAAs exceed the recommended 0.7 mi/mi^2 road density threshold, considering both total roads (20 of 31 WAAs) and open roads (19 of 31 WAAs) below 1,200 feet in elevation relevant to wolves. (Wolf Technical Committee 2017 at Table 1).

Figure 5. Estimated road density in km/km^2 by Wildlife Analysis Area in Southeast Alaska. WAAs shown in orange and pink exceed 0.77 mi/mi^2. Source: USFWS SSA 2015 at Figure 13.



e. Logging and road development jeopardize wolf denning and reproductive success.

The best available science, including studies published after the 2016 Finding, indicates that Archipelago wolves require den sites that are protected from logging, road construction, and other human disturbances. (Person and Russell 2009, Roffler et al. 2018, Roffler and Gregovich 2019). A study on habitat use by wolves during denning emphasized that the protection of den sites is important for "maintaining viable wolf populations." (Roffler and Gregovich 2019 at 1). The researchers explained that "den sites have ecological importance because survival of wolf pups is most variable during early denning season through late summer, and this component of reproductive success has a large effect on the demographic trajectory of the population." (Roffler and Gregovich 2019 at 1). Access to high-quality habitat with limited disturbance during denning are important factors in increasing wolf reproductive success. (Roffler and Gregovich 2019 at 1).

Numerous studies have documented that Archipelago wolves avoid logged areas and roads during denning. (Person and Russell 2009, Roffler et al. 2018, Roffler and Gregovich 2019). The Wolf Technical Committee warned of the risks of den abandonment and relocation, and associated impacts to pup survival and growth, resulting from disturbance from logging operations including sawing, using large machinery, hauling, helicopter logging and associated overflights, and road construction:

> [L]oss of pups can occur during (Smith 1998, river crossing) or after den relocations (Argue et al. 2008, drowned in new den site), so a conservative approach to management is warranted. Because nearby freshwater is a selection factor for GMU 2 den sites and sites are often situated on peninsulas and islands (Person and Russell 2009), the potential for a disturbance-caused relocation requiring negotiation of water crossings by small pups also warrants caution. Other negative effects on long-term pup growth and survival could occur if the alternate site is of lesser quality, is in an area with lower prey density, or the relocation results in fewer pack helpers (Habib and Kumar 2007). (Wolf Technical Committee 2017 at 27).

> Person and Ingle (1995) reported a den relocation shortly after the start of road building activity nearby, though they acknowledged that this may have occurred at the normal time that wolves depart their dens (July). These authors also observed reduced year-round activity in the area thereafter and use of a poorer quality site 7 miles away the following year, suggesting wide-scale displacement from road construction affecting the use area of this pack. (Wolf Technical Committee 2017 at 28).

The Wolf Technical Committee (2017) recommended that "management should aim to protect den sites, as well as sufficient foraging habitat to successfully rear pups at each den in perpetuity" particularly because logging has made many areas unsuitable for den sites and quality den sites appear to be limited:

> Wolf den sites are frequently used in multiple consecutive years and intermittently over long periods (Mech and Packard 1990), suggesting both high den-site fidelity and the importance and perhaps rarity of suitable den sites on the landscape. Within GMU 2, dens are typically located in loose, dry soils, under root-wad cavities of large living or dead trees, within dense canopies of old-growth forest, near freshwater, often on peninsulas or islands, on gentle, low-elevation slopes, and farther from logged stands and roads than random sites (Person and Russell 2009). Large proportions of the GMU 2 landscape are considered unsuitable for den sites due to logging and topography, and

> availability of the combined characteristics that provide quality den sites may be limited (Person and Russell 2009). Therefore, management should aim to protect den sites, as well as sufficient foraging habitat to successfully rear pups at each den in perpetuity. (Wolf Technical Committee 2017 at 26).

As detailed above, the USFWS in its 2016 Finding concluded that road development is not a threat to Alexander Archipelago wolves. (81 Fed. Reg. 445). As justification, the USFWS stated in its 2015 Status Assessment that it "found little information indicating a negative and consistent demographic response of wolves to roads" as a basis for concluding that "road development is not impacting Alexander Archipelago wolves directly at the population level." (USFWS SSA 2015 at 74). Specifically, the USFWS cited a study of den site selection by Archipelago wolves in GMU 2 by Person and Russell (2009) to assert that "the authors did not report any demographic consequences such as lower reproductive success or pup survival associated with denning closer to roads or logged stands." (USFWS SSA 2015 at 74). However, this statement is spurious because Person and Russell (2009) did not look at reproductive success or pup survival, and therefore drew no conclusion about demographic consequences.

f. Logging and road development harm salmon which provide an important autumn food source for Archipelago wolves.

Salmon provide an important seasonal food resource to Archipelago wolves. (Roffler et al. 2018). Logging and road-building have well-documented negative effects on salmon stream habitat. (ADFG 1985, Bryant and Everest 1998, Albert and Schoen 2007, Person and Brinkman 2013, Schoen et al. 2017). Past and continued logging and road development on the Tongass threaten salmon populations in Southeast Alaska.

From the 1950s to the 1970s, large-scale logging in the Tongass occurred mostly in the low-elevation valley floors, which provided easily accessible terrain and large diameter, old-growth timber. (Bryant and Everest 1998, Albert and Schoen 2007). These the valley floors contained predominantly low-gradient streams and were the most productive habitat for salmonids (Schoen et al. 2017 at 551). Concentrated logging in valley bottoms left a "legacy of streams with deteriorating habitat" for salmon, including loss of stream channel complexity and simplification of habitat. (Bryant and Everest 1998 at 262). Logging has long-lived harms. The loss of habitat quality due to logging will likely "continue for more than 100 years after logging, until riparian trees become large enough to maintain stream channel complexity." (Bryant and Everest 1998 at 262). Many studies have found that logging has altered salmon stream characteristics and morphology on the Tongass, including changes in woody debris amounts and in sediment distribution, and roads may impair movement of fish throughout watersheds:

> Clear-cuts and roads can change patterns of runoff and water flow and remove trees that are the sources of large woody debris in streams (Heifetz *et al*. 1986;

> Murphy and Koski 1989). In logged areas, streams may become channelized, banks destabilized, and pools for rearing fish lost, although unlogged forest buffers along streams and rivers can provide a source of woody debris and stabilize banks if they are wind firm (Murphy *et al.* 1986). Logged hillsides and roads increase the frequency of landslides, leading to soil erosion and sedimentation (Montgomery 1994; Swanston 1997). More immediately, roads may impair movement of fish throughout watersheds when culverts and other stream crossing structures are improperly designed or installed or become blocked because of inadequate maintenance (Flanders and Cariello 2000; USDA Forest Service 2002). Many species of anadromous and resident fish must be able to migrate seasonally within watersheds to reach spawning and rearing habitats (Armstrong 1974; Bryant and Lukey 2004). (Person and Brinkman 2013 at 150-151).

Research from 2013 estimated that, in the Tongass National Forest, permanent roads cross anadromous fish streams more than 920 times, not including temporary roads, roads built on state and private lands, and roads crossing streams where fish populations have not been documented. (Person and Brinkman 2013 at 151). Importantly, many culverts and bridges are not adequate for adult and juvenile anadromous fish passage:

> Abundant rainfall in the region creates high densities of streams and rivers that must be crossed when roads are built. In the Tongass National Forest, permanent roads cross anadromous fish streams more than 920 times and resident (nonanadromous) fish streams more than 1700 times (Flanders and Cariello 2000). Those numbers do not include temporary roads designed for short-term use, roads built on state and private lands, or roads crossing streams in which fish populations have not been documented. A survey of road conditions on national forest lands, including Prince of Wales Island, indicated that only 34% of culverts and bridges intersecting anadromous fish-bearing streams were adequate for adult and juvenile fish passage, and only 15% were adequate for passage of resident fish (Flanders and Cariello 2000). Surveys of forest roads on private lands on Prince of Wales Island showed similar results (Nichols and Frenette 2003). Most culverts were perched above the water level of the stream or the slope gradient was too steep to accommodate fish. Structures that did not block fish generally were recent installations, indicating that current standards may be adequate. Nonetheless, the legacy of older bridges and culverts is a persistent problem that affects the functioning of riparian ecosystems and may influence fish populations over the long term. (Person and Brinkman 2013 at 151).

2. Continued Intensive Clear-cut Logging and Road Development Under the 2016 Tongass Forest Plan and Associated Timber Sales Jeopardize the Archipelago Wolf.

The historical destruction of essential Archipelago wolf habitat is being compounded by continuing intensive logging and road construction authorized by the 2016 Tongass Forest Plan that is destroying remaining old-growth forest habitat on the Tongass. It is not only the number of acres that will be logged or miles of road that will be built that matter to the Archipelago wolf, but also the effect of this development on wolf habitat and connectivity in already heavily fragmented landscapes in the region.

a. The 2016 Tongass Forest Plan worsens habitat loss and degradation.

The 2016 Tongass Land and Resource Management Plan ("2016 Forest Plan" or "LRMP") threatens the continued existence of the Archipelago wolf in Southeast Alaska in several fundamental ways: (1) It perpetuates destructive clear-cut logging of remaining old-growth forest habitat on the Tongass National Forest; in fact, the Tongass is the last National Forest to allow large-scale clear cut logging of ancient old-growth trees. (2) It concentrates future old-growth and young-growth logging in essential wolf habitat in GMUs 2, 3 and 1A which have already suffered disproportionate losses of old-growth forests. (3) It authorizes high levels of second-growth logging in the long-term that in practice will permanently convert cut forests into habitat not suitable for deer and wolves rather than allowing these forests habitats to recover. (4) It permits second-growth logging in sensitive and rare remaining wolf habitat including old-growth habitat LUDs, riparian management areas, and estuary and beach fringe. (5) It worsens habitat fragmentation, destroys movement corridors, and degrades habitat and population connectivity.

As detailed below, the continued high levels of logging of old-growth and second-growth forests authorized by the 2016 Forest Plan will worsen the cumulative loss and degradation of habitat for Archipelago wolves and Sitka black-tailed deer, spurring population declines and jeopardizing the continued existence of wolves in Southeast Alaska.

i. The 2016 Forest Plan perpetuates destructive clear-cut logging of remaining old-growth habitat on the Tongass and authorizes high levels of second-growth logging in the long-term that permanently convert forests into unsuitable habitat.

The 2016 Tongass Forest Plan guides all natural resource management activities and establishes management direction for the Tongass National Forest, amending and replacing the 2008 Forest Plan. The 2016 Forest Plan was intended to transition away from decades of destructive clearcutting of old-growth forests over 10 to 15 years, based on the direction by former USDA Secretary Vilsack's July 2013 memorandum.[12] However, the Plan delays this

[12] USDA Secretary Vilsack's July 2013 memorandum directed the Tongass National Forest "to expedite the transition away from old-growth timber harvesting and towards a forest products industry that uses predominantly second-growth … forests." It cites a "goal" of making the transition occur over a 10 to 15 year period but also directed the Forest Service to consider ways to "effect a more rapid transition."

transition for 16 years until 2031, meanwhile allowing for continued high levels of old-growth clearcutting. In total, the Plan projects that 430 million board feet (mmbf) of remaining old growth forest will be cut over 15 years on federal lands alone. Specifically, the Forest Service expects to sell an average of 34 mmbf of old growth per year and about 12 mmbf of young growth per year during the first ten years of the Plan, totaling 46 mmbf per year. From Year 11 through Year 15, it expects to sell an average of 18 mmbf of old growth per year and 28 mmbf of young growth. At Year 16, the Forest Service expects to sell an average of 5 mmbf of old-growth and to continue old-growth sales at that level thereafter. At Year 16, young-growth sales are expected to reach 41 mmbf and "continue to increase at a rapid rate," reaching an expected upper limit of 98 mmbf about Year 18. (LRMP FEIS 2016 at ES-11, Table 1).

In terms of acreage logged, the Forest Service expects to allow clearcutting of 28,813 acres of old-growth forest and 43,316 acres of young-growth on Tongass National Forest lands over 25 years (2016-2040). (LRMP FEIS 2016 at Table C-2 at C-9). Over 100 years (2016-2115), the Forest Service expects to allow clearcutting of 42,479 acres of old-growth and 284,144 acres of young-growth. (LRMP FEIS 2016 at Table C-2 at C-9). In addition to the liquidation of these federal forestlands, the Forest Service projects that logging of primarily old-growth forest[13] will occur on 56,234 acres of state and private lands over 25 years (2016-2040) and 224,937 acres over 100 years (2016-2115). (LRMP FEIS 2016 at Table C-2 at C-9). In total, an additional 85,047 acres of old-growth forest are projected to be cut by 2040 and 267,416 acres by 2115.

In addition, the Forest Plan's logging projections may be underestimates because the Plan fails to guarantee an end to old-growth logging and instead sets non-binding objectives for old-growth and second-growth logging. The Plan's projected timber sale quantity (PTSQ) does not set a maximum limit or ceiling on timber harvest. In fact, the Plan makes clear that "PTSQ is not a target nor a limitation on harvest." (LRMP 2016 at A-5 to A-6). Instead, the agency defines PTSQ as "[t]he estimated quantity of timber meeting applicable utilization standards that is expected to be sold during the plan period." (LRMP 2016 at A-5). PTSQ is different from the "allowable sale quantity," or ASQ, which in forest plans, revisions, and amendments previously developed under the 1982 Planning Rule—for the Tongass and all other national forests—set an upper limit on timber sale volumes. PTSQ is, instead, functionally just a prediction. The only maximum limit on logging in the Tongass Forest Plan under the agency's current planning directives is the "sustained yield limit" of 248 mmbf per year (*id.*) which is significantly higher than the Plan's PTSQ of 46 mmbf per year for the first ten years.

(adding that the purpose of a timeframe is to "conserve old growth forests while allowing the forest industry time to adapt").

[13] Table C-2 states that "The majority of state and private harvest will be old growth."

Furthermore, the Plan has no binding requirement that timber companies such as Viking and Alcan reduce their take of old-growth over the 16-year transition period. (LRMP FEIS 2016 at 2-40, 3-508, Table 3.22-16). Instead, the FEIS makes clear that the "relative speed of the transition" depends on voluntary business choices made by Viking and Alcan. (LRMP FEIS 2016 at 3-511). The FEIS estimated that timber industry mills in southeast Alaska have capacity to process 120.4 mmbf annually (LRMP FEIS 2016 at Table 3.22-6)—more than double the Tongass PTSQ—meaning that industry capacity will not limit logging in excess of projected amounts under the PTSQ. On top of that, while export of unprocessed logs is generally banned from western national forests (GAO 2018), the Forest Service has authorized, and aggressively pursues, export of unprocessed logs from the Tongass to overseas markets. (USFS 2010, LRMP FEIS 2016 at 3-22, 3-489, 3-491).[14] In short, the Plan fails to provide sufficient direction that would guarantee an end to old-growth logging, instead allowing for status quo old-growth timber sale volumes for the next decade and setting non-binding aspirational reductions by 2030. The Forest Plan's authorization of the continued decimation—rather than recovery—of the essential remaining habitat for Archipelago wolves jeopardizes their continued existence.

ii. The 2016 Forest Plan permits second-growth logging in sensitive and rare remaining wolf habitat including old-growth habitat LUDs, riparian management areas, and beach and estuary fringe.

Moreover, the 2016 Forest Plan authorizes logging of second-growth forests in sensitive and rare wolf habitat, namely old-growth habitat LUDs, riparian management areas, and the beach and estuary fringe. (LRMP 2016 at 5-6, LRMP FEIS 2016 at Appendix D, LRMP ROD 2016 at 7). As discussed above, large-tree forests at low elevations in valley floors, along coastlines and in floodplains have been disproportionately logged. (Albert and Schoen 2007 at 10-11). These are particularly important habitats for wolf denning, as Archipelago wolves choose den sites in low elevation, flat terrain, in old-growth forests adjacent to open habitats (e.g. meadows and muskegs) and freshwater streams or lakes. (Roffler and Gregovich 2019 at 3).

iii. The 2016 Forest Plan concentrates future old-growth and young-growth logging in essential wolf habitat in GMUs 2, 3 and 1A which have already suffered disproportionate losses of old-growth forests.

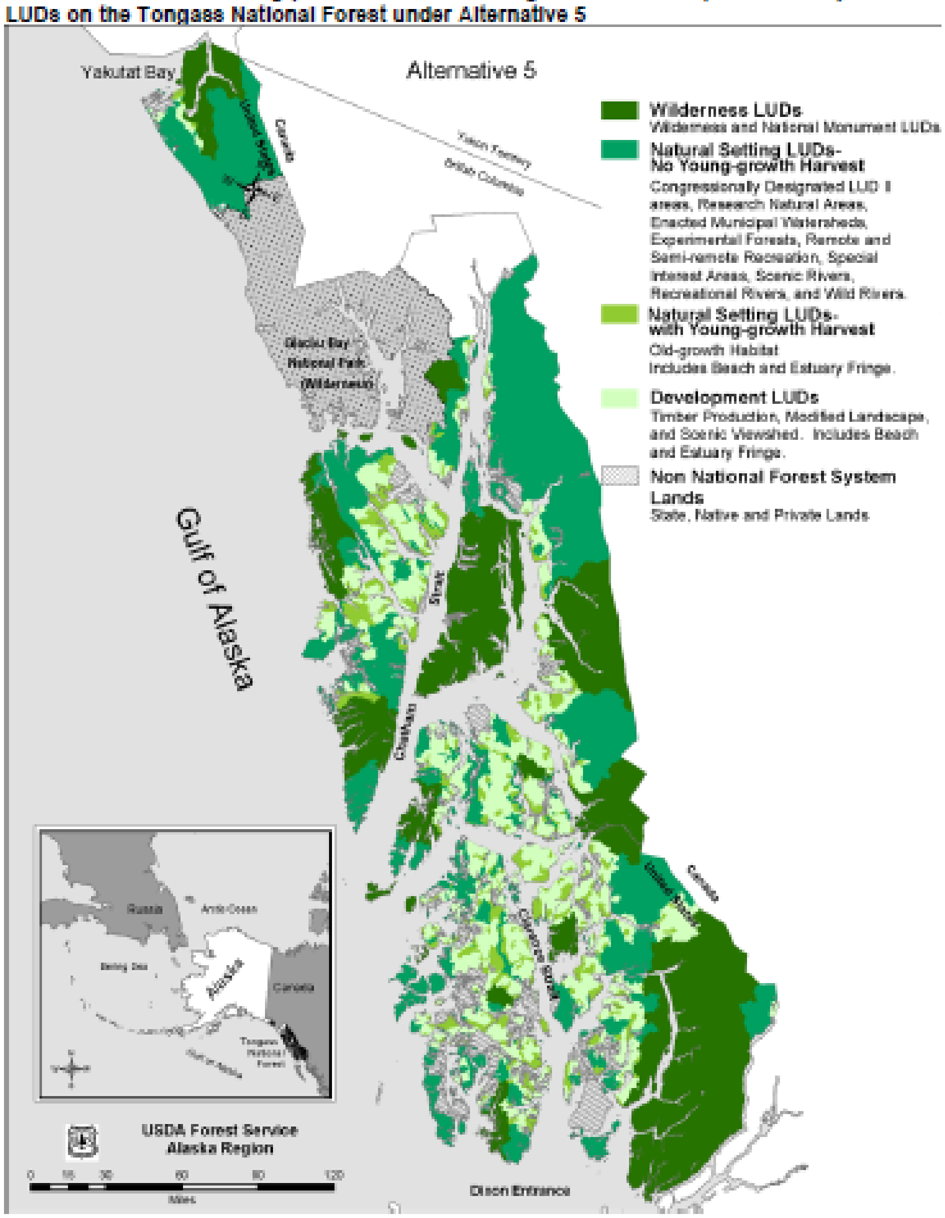
Under the Forest Plan, 20% of Tongass National Forest lands have been designated for intensive logging under the category of Development LUDs, totaling 13,595 km^2 (3.36 million acres). (LRMP FEIS 2016 at Table 2-15). High-levels of second-growth logging over the long-term will essentially convert these areas to permanent second-growth stands. In addition, another 7% of national forest lands, totaling 4,866 km^2 (1.2 million acres), are designated as Natural

[14] *See for example* LRMP FEIS 2016 at 3-491 ("Softwood sawlogs. The majority of timber harvested in Southeast Alaska is exported to Pacific Rim (China, Japan, South Korea) destinations as unprocessed sawlogs. More than 90 percent of exported logs were sent to Pacific Rim destinations in 2005 and 2011, mainly China. Modest shipments were also sent to Canada").

Setting LUDs with Young-growth Logging. *Id.* In these areas, second-growth logging is authorized within remaining old-growth areas (Old-growth LUDs), including logging of beach and estuarine fringe and riparian management areas. As illustrated by Figure 6, the 2016 Forest Plan continues to concentrate future logging in core remaining habitat areas for Archipelago wolves, particularly in in GMUs 2, 3, and 1A.

Figure 6. Development LUDs (lightest green) and Natural Setting LUDs with Young-growth Harvest under the 2016 Forest Plan are Concentrated in GMUs 2, 3 and 1A. Source: LRMP FEIS 2016 at Figure 2-10. Alternative 5 was the selected alternative.

Figure 2-10
Wilderness, Natural Setting (with and without Young Growth Harvest), and Development LUDs on the Tongass National Forest under Alternative 5



Importantly, the Forest Service projects that most foreseeable logging projects and associated road-building on federal, state, and private lands will be concentrated on Prince of Wales (GMU 2), the wolf islands of GMU 3, and GMU 1A which are areas that have already been harmed by disproportionate logging. According to the Plan, the vast majority (83%) of the 24 timber sales on federal lands that are "being implemented or in planning stages for the next five years" are located in GMUs 2, 3 and 1A: 8 in GMU 2 (33%), 7 in GMU 3 (29%), 5 in GMU 1A (21%), 4 in GMU 4 (13%), and 1 in GMU 1B (4%). (LRMP FEIS 2016 at Appendix C, Table C-2). Similarly, almost all the 21 foreseeable timber sales on state and private lands are located in GMUs 2, 3 and 1A: 15 in GMU 2 (71%), 3 in GMU 1A (14%), 2 in GMU 3 (10%), and 1 in GMU 1B (5%). (LRMP FEIS 2016 at Appendix C, Table C-2).

In terms of road construction, on federal lands the Forest Plan FEIS projects construction of 369 miles of roads and reconstruction of 219 miles of roads over 25 years (2016-2040) and the construction of 1,520 miles of roads and re-construction of 1,058 miles of roads over 100 years (2016-2115). (LRMP FEIS 2016 at Table C-2 at C-9). On state and private lands, the Forest Service projects the construction of 584 miles of roads and reconstruction of 61 miles of roads by 2040, and 2,335 miles of roads and reconstruction of 245 miles of roads by 2115. (LRMP FEIS 2016 at Table C-2 at C-9). In total, an additional 953 miles of road will be constructed and 280 miles reconstructed by 2040, and an additional 3,855 miles of roads constructed and 1,303 reconstructed by 2115. Currently, 6,820 miles of roads exist within the range of the Alexander Archipelago wolf (USFWS SSA 2015 at 69), so the projected road construction represents an enormous increase.

As acknowledged by the 2016 Forest Plan, road densities below 1,200 feet are representative of the low-elevation habitat used by wolves and deer. (LRMP FEIS 2016 at 3-276). Under the Plan, the mean density of all roads below 1,200 feet on NFS lands is projected increase from 0.39 mi/mi^2 to 0.46 mi/mi^2. Importantly, the cumulative impact of logging road construction across all lands (federal, state, and private) would be an increase from 0.63 mi/mi^2 to 0.85 mi/mi^2. (LRMP FEIS 2016 at Table 3.10-15). Therefore, logging road construction would push the mean road density above the 0.7 mi/mi^2 threshold for wolves recommended in the 2016 Tongass Forest Plan Standards and Guidelines (LRMP 2016 at 4-91), meaning that many more areas will have road densities that facilitate higher rates of hunting and trapping mortality that could lead to population declines. Although the FEIS does not provide an analysis of increases in road density below 1,200 feet at the WAA-scale relevant to wolves, construction of logging roads will be concentrated in areas with the highest projected logging levels—and therefore road densities would be expected to increase most in GMUs 2, 3 and 1A.

iv. Concentrated logging and road construction in Archipelago wolf habitat jeopardizes the wolf's continued existence.

The continued disproportionate logging and road-building in essential Archipelago wolf habitat, which is particularly concentrated in GMUs 2, 3, and 1A, will exacerbate long-term habitat loss and fragmentation, worsen declines in deer populations, increase wolf mortality via road construction, and disturb denning behavior, jeopardizing the continued existence of Archipelago wolves.

The Forest Plan's cumulative impacts analysis for the Archipelago wolf admits that continued old-growth logging, combined with past logging, will lead to further declines in deer habitat capability in some biogeographic provinces, as well as declines in the wolf population on Prince of Wales Island. (LRMP FEIS 2016 at 3-287, 3-294). The Forest Service concludes that the greatest impacts to deer habitat capability from logging will occur in GMU 2 "where concentrated past timber harvest has occurred" which "may result in local declines in the deer population, due to reduced habitat capability which could affect wolves and thus hunters and trappers." (LRMP FEIS 2016 at 3-287). Further, the wolf population in GMU 2 is anticipated to decline by another 8 to 14 percent of current levels over the next 30 years according to population modeling (Gilbert et al. 2015), which could result in local wolf extirpations ("gaps in wolf distribution within GMU 2"). (LRMP FEIS 2016 at 3-287, 3-294).

The Forest Service further concludes that additional young-growth and old-growth logging on North Central POW (GMU 2) and Kupreanof/Mitkof Islands (GMU 3)—combined with high levels of past logging—could result in lower habitat connectivity and localized extirpations ("gaps in species distributions"), particularly when logging is adjacent to previously logged areas:

> [T]here are portions of the Tongass where cumulative effects become more important due to the level of past harvest that has occurred. Specifically, the North Central Prince of Wales and Kupreanof/Mitkof Islands biogeographic provinces have experienced some of the highest reductions in original (1954) POG forest on the Tongass and are also where much of the young-growth suitable for commercial timber production is located (see the Suitable Land maps in the Map Packet that accompanies this EIS). Additional timber harvest (young-growth and POG forest), particularly when located adjacent to previously harvested areas, has a greater potential to result in localized reductions in landscape connectivity and gaps in species distributions in these more heavily harvested areas compared to portions of the Tongass that have less cumulative past timber harvest. (LRMP FEIS 2016 at 3-289).

In addition to these admissions, a close examination of the cumulative impacts analysis reveals just how damaging past and continued logging will be for deer and wolves under the 2016 Forest Plan due to reduced deer habitat capability. Interagency wolf experts have long determined that a habitat capability that supports a minimum of 18 deer per square mile is necessary to provide wolves with adequate foraging opportunities. (Person et al. 1996). This science-based recommendation has long been part of the Tongass Forest Plan standards and guidelines for Archipelago wolves (LRMP 2008 at 4-95, LRMP FEIS 2008 at 3-282, LRMP 2016 at 4-91, LRMP FEIS 2016 at 3-238). As summarized in the 2016 Forest Plan FEIS, "[d]eer winter habitat was considered by Person et al. (1996) and Person (2001) to be a good measure of habitat quality for wolves in southern Southeast Alaska. Blacktailed deer are present in all Southeast Alaska GMUs where wolves occur. Forest Plan standards and guidelines state that where possible, the provision of sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support a minimum of 18 deer per square mile (using interagency deer habitat capability model outputs." (LRMP FEIS 2016 at 3-238). As detailed below, the intensive continued logging authorized under the 2016 Tongass Forest Plan will further reduce deer habitat capability below this recommended guideline in WAAs important for wolves.

There are 15 biogeographic provinces in total that support wolves: eight island provinces and seven mainland provinces. The seven mainland provinces, which fall within GMUs 1 and 5A, have historic (1954)—and current—deer habitat capabilities below the 18 deer per square mile threshold, support lower-density wolf populations, and generally have lower levels of logging: North Coast Range, South Misty Fiords, Central Coast Range, Yakutat Forelands, Lynn Canal, North Misty Fiords, and Yakutat uplands.

In contrast, seven wolf island provinces—which fall within GMUs 2 and 3—that historically supported deer habitat capabilities above 18 deer per square mile and the highest-density wolf populations, bear the brunt of past and future logging: North Central POW, South POW, Kuiu, Kupreanof/Mitkof Island, Etolin Island, Southern Outer Islands, and Dall Island and Vicinity. For example, according to the FEIS, when considering all lands (federal, state, and private), North Central POW has only about half (54%) of its "original" (1954) deer habitat capability remaining, Dall Island and Vicinity have 66% left, and Kupreanof/Mitkof have 76% left. (LRMP FEIS 2016 at Table 3.10-16).

Due to decades of clear-cut logging, four of these seven island provinces now have mean deer habitat capabilities at the province level below the 18 deer per square mile threshold recommended for wolves when considering all lands (federal, state, and private), leaving *only three* provinces with mean deer habitat capability above that threshold: Kuiu, Southern Outer Islands, and Southern Prince of Wales. (LRMP FEIS 2016 at Table 3.10-16). Despite the higher deer habitat capability on Kuiu, the deer population has been nearly extirpated on Kuiu due to a series of stochastic harsh winters over the past three and a half decades, combined with habitat loss and fragmentation from logging. (ADFG 2015 at 1). Due to a combination of harsh winters and habitat loss, the deer populations on Mitkof, Kupreanof, and GMU 1A are also at low numbers that have proven resistant to recovery. (ADFG 2018a,b).

The FEIS indicates that continued logging under the 2016 Forest Plan will further reduce deer habitat capability on many wolf island provinces: North Central POW, South POW, Southern Outer Islands, and Kupreanof/Mitkof. (LRMP FEIS 2016 at Table 3.10-16). Although the analysis should have included all lands (federal, state and private) and focused on habitat below 1,200 feet in elevation, the FEIS indicates that logging under the Plan on national forest lands will reduce the number of WAAs with deer habitat capability above 18 deer per square mile on the seven island provinces from 45 to 39. (LRMP FEIS 2016 at Table 3.10-14).

In sum, the cumulative harms from past clear-cut logging, combined with continued high levels of old-growth and second-growth logging authorized by the 2016 Forest Plan, disproportionately degrade and fragment the remaining core habitat for Archipelago wolves, further compromising deer populations and jeopardizing the continued existence of wolves in Southeast Alaska.

b. Massive Timber Sales Authorized under the 2016 Tongass Plan Jeopardize Wolves.

The Forest Service has authorized or proposed numerous massive timber sales under the 2016 Tongass Forest Plan in Archipelago wolf habitat, particularly in GMUs 2, 3, and 1A. Adding to the intensive habitat destruction from past timber sales, the new timber sales under the 2016 Tongass Plan jeopardize wolves and illustrate the inadequacy of existing regulatory mechanisms to mitigate threats from logging and road-building.

i. 2013 Big Thorne Timber Sale in GMU 2

The Big Thorne Timber Sale is a massive logging project located in north-central POW, authorized under the 2008 Tongass Forest Plan, consisting almost entirely of old-growth logging, that wolf experts have warned is likely to cause the collapse of predator-prey relationship between wolves and deer on POW. In 2013 the Forest Service approved logging 148.9 million board-feet (mmbf) of timber over roughly 8,500 acres, including 120 mmbf of old-growth trees on approximately 6,186 acres of old-growth forest, 46 miles of new road, and 36.6 miles of reconstructed road, on central POW (USFS 2013 at 4), which already has been severely logged. At the time it was authorized in 2013, the Big Thorne Project was the largest volume timber sale project approved in the Tongass National Forest since 1993, and the largest volume timber sale project that the Forest Service has approved in the national forest system in the past 20 years. The Big Thorne Project will harvest most of the best remaining mid- and low- elevation deer winter old-growth habitat on the north-central part of POW, putting the continued existence the Archipelago wolf population in peril.

As detailed above, the population of wolves on POW has declined substantially, and this is especially true within north-central POW. In the mid-1990s, the area of the Big Thorne Project had the habitat to support 45-50 wolves. (Person 2013 at 9-10). In the fall of 2012, researchers estimated there were approximately 29 wolves in the area of the Big Thorne Project. (*Id.*). By the spring of 2013, researchers could only account for six to seven wolves left in the area of the Big Thorne Project. (*Id.*). After the 2013-14 field season, researchers concluded only four wolves remained in the Big Thorne Project area. (*Id.*).

Deer habitat capability in all WAAs coinciding with the Big Thorne Project fall below the Forest Plan's standard of 18 deer per square mile. (USFS 2012 at 3-110). In fact, the North Central Prince of Wales Island biogeographic province as a whole falls below the Forest Plan standard of 18 deer per square mile. The Big Thorne Project will drive both the project area WAAs and the North Central POW biogeographic province further below the 18 deer per square mile standard.

Total road density below 1,200 feet elevation on Prince of Wales Island is 0.99 mile per square mile, ranging from 0.7 to 2.5 miles per square mile for the WAAs in the Big Thorne Project area. (USFS 2012 at 3-112). Despite the fact that the Project area WAAs already exceed the 0.7 mi/mi road density threshold recommended in the 2016 Tongass Forest Plan Standards and Guidelines (LRMP 2016 at 4-91), the Forest Service approved of constructing approximately 46 miles of new roads and reconstructing approximately 37 miles of existing roads for the Big Thorne Project. (USFS 2013 at 4).

Dr. David Person, a wolf biologist with ADFG with more than two decades of experience studying wolves and deer in Southeast Alaska, warned that the Big Thorne project will increase the risk of collapse of the predator-prey relationship between wolves and deer on POW:

> Prince of Wales Island, including the Big Thorne project area, is at a tipping point with regard to a viable predator-prey dynamic between wolves and deer. The wolf populations on Prince Wales have been declining precipitously, and wolves are already facing the possibility of extinction on Prince of Wales Island. Big Thorne logging, if it goes forward, will remove the most important remaining deer winter habitat in many of the affected watersheds, which will further reduce the abundance of deer in the project area (especially following severe winters), perhaps for decades to come. As a result, the predator-prey relationship between wolves and deer on Prince of Wales is likely to collapse. (Person 2013 at 15)

ii. Prince of Wales Landscape Level Analysis Project in GMU 2

Under the 2016 Tongass Forest Plan, the 2019 Prince of Wales Landscape Level Analysis Project ("POW LLA Project") authorizes 15 years of logging on Prince of Wales Island and smaller surrounding islands such as Kosciusko and Dall. It covers a vast project area of 1.8 million acres of NFS lands and 480,000 acres of non-NFS lands, totaling ~2.3 million acres (FEIS at 1-2), making it the biggest timber sale decision authorized anywhere on the national forest system in 30 years. Notably, in approving the project in March 2019, the Forest Service selected the project alternative with the largest amount of old-growth and overall logging, despite the impacts to clear impacts to wolves, deer, and the ecological integrity of the entire ecosystem. Overall, the POW LLA Project authorizes production of 656 mmbf of timber, including 235 mmbf of old-growth (USFS 2018 at Table 2 (Alt. 2)). The amount of old-growth forest alone that will be lost to logging—23,269 acres—equals an area one and a half times the size of Manhattan. Put in context of the 2016 Forest Plan, the timber volume authorized under the POW LLA Project alone over 15 years accounts for most of the timber volume projected forest-wide over the first 15 years of the 2016 Forest Plan.[15] In addition, the POW Project will construct 164 miles of new roads. (USFS 2018 at Table 2 (Alt. 2)).

The Forest Service acknowledges that the vast majority—89 percent—of project area WAAs have some level of wolf mortality concern due to logging and road-building:

> Of the WAAs in the project area, six are calculated to be in the ranking of greatest concern (#1) according to Person and Logan 2012. These are WAAs that have risked pack depletion (greater than or equal to seven wolves per 300 square kilometers for at least 2 years) at least five times from 1985 and 2009. Eight WAAs are included in Concern Level #2 for WAAs that have experienced high risk of pack depletion (greater than or equal to seven wolves per 300 square kilometers) from 1985 to 2009. The WAAs in Concern Level #1 is equal to 19 percent of the WAAs in the project area, and the WAAs in Concern Level #2 is equal to 58 percent of the project area. Two WAAs, about 6 percent of project area WAAs, are included in Concern Level #3; these are WAAs that have experienced harvest that could have resulted in pack turnover or pack depletion (greater than or equal to seven wolves per 300 square kilometers). Two WAAs (about 6 percent of project area WAAs) are in Concern Level #4, WAAs that have experienced unsustainable harvest (greater than or equal to three wolves per 300 square kilometers) at least once from 1985 to 2009. Overall, about 89 percent of the project area WAAs have some level of wolf mortality concern as defined by Person and Logan 2012. (USFS 2018 at 3-235).

The POW LLA Project impacts analysis, including for Sitka black-tailed deer and Archipelago wolves, is fundamentally flawed, incomplete and inadequate on multiple fronts.

[15] The 2016 Forest Plan projects a total logging amount of 430 mmbf old-growth and 260 mmbf young growth over 15 years; the POW LLA Project timber volumes over 15 years account for 55% of old-growth and 162% of the young-growth logging projected under the Forest Plan.

(Alaska Rainforest Defenders et al. 2018). Nonetheless, the harms from the project to wolves and deer are clear. For example, considering only NFS lands, the POW LLA Project is projected to increase the number of WAAs with less than 50% of their 1954 HPOG and deep snow habitat from 7 to 10, and increase the number of WAAs with less than 50% of their 1954-level large tree (SD67) habitat from 4 to 7 (USFS 2018 at Tables 41, 42, 44). Importantly, in the cumulative context considering all lands in the project area (federal, state, and private), logging under the project will result in nearly half the WAAs in the Project area (15 of 32) being left with less than 50% of their 1954-level deep snow habitat, and one-quarter (8 of 32) will have less than 30% remaining. (USFS 2018 at Table 45).

Specific to wolves, the Forest Service predicts that the impacts of the Project on the Alexander Archipelago wolf will be "moderate to major" due to the downward trend in deer resulting from logging as well as "the effects of an increase in road density." (USFS 2019 at 13-14). Similarly, the agency predicts that impacts on Sitka black-tailed deer will be "moderate to major" due to impacts on the "abundance and availability of deer either indirectly from forest treatments of habitat or directly from harvest." (USFS 2019 at 15).

Importantly, in its wolf analysis, the Forest Service acknowledges that the POW Project threatens the maintenance of a sustainable wolf population due to the "direct effects [of logging on] deer habitat" and "increased access for hunters and trappers." (USFS 2018 at 3-235). Specifically, reductions in deer habitat capability will result in "reduction in the ability of project area WAAs to maintain a sustainable wolf population" and increases in road density have the potential to increase wolf harvest mortality risk.":

> Project-related effects to deer habitat capability under the action alternatives, and reductions due to forest succession in previously harvested stands, have the potential to reduce the prey base for wolves. Accordingly, there would be some reduction in the ability of project area WAAs to maintain a sustainable wolf population, based on deer habitat capability alone. (USFS 2018 at 3-235).
>
> Cumulatively, road densities may increase under all action alternatives and be similar under all alternatives. Road densities in many project area WAAs (below 1,200 feet elevation) currently exceed the Forest Plan recommended level of 0.7 to 1.0 mile per square mile for managing harvest-related morality risk, both when considering only NFS lands and all landownerships. Further increases in road density have the potential to increase wolf harvest mortality risk. (USFS 2018 at 3-235).

We note that the U.S. District Court for the District of Alaska issued a decision in earlier this year finding that the Forest Service violated the National Environmental Policy Act, the

Alaska National Interest Land Claims Act (ANILCA), and the National Forest Management Act in approving the POW LLA Project. (*Se. Alaska Conservation Council v. United States Forest Serv*., 2020 U.S. Dist. LEXIS 43499, 2020 WL 1190453 (D. Ak. Mar. 11, 2020)). That same court in June set aside both the project Record of Decision and the Final EIS on which it relied. However, the Forest Service may yet appeal the ruling, and apparently intends to proceed with logging in the project area following future NEPA analysis. It is therefore reasonably foreseeable that logging of old growth on POW on the Tongass National Forest will continue in the coming years.

iii. Central Tongass Logging Project in GMUs 3, 1A, and 1B

The Central Tongass Project is a proposal under the 2016 Tongass Forest Plan to authorize logging up to 230 million board of Tongass timber—150 million board feet from old-growth forests and 80 million board feet of young growth—over 15 years from somewhere inside the Petersburg and Wrangell Ranger Districts, a 3.7 million acre project area. (USFS 2019a at 2.-23). The project also calls for building up to 25 miles of new road and 93 miles of temporary roads, as well as approving 128 miles of off-highway vehicle trails on roads currently closed or planned for closure. (USFS 2019a at 2-23). This intensive logging and road-building jeopardizes wolves in GMUs 3, 1A and 1B which occur in the project area.

Archipelago wolves in GMU 3 and 1A are already vulnerable to population declines due to multiple threats. The USFWS's 2015 Status Review and 2016 Finding categorized wolves in the GMU 3 region as facing "intermediate" levels of stressors. (USFWS SSA 2015 at 120). Key sources of stress to wolves in GMUs 3 and 1A include: (1) substantial prior logging which has significantly reduced deer habitat capability; (2) very low deer population numbers in portions of GMU 3 and 1A; (3) highest reported wolf trapping and hunting mortality in GMU 3, with the mean annual mortality rate estimated at 21% of the population, not including unreported killing; (4) high road densities in many parts of GMU 3 such as Mitkof, Wrangell and Zarembo Islands; (5) high ratio of shoreline to land area in GMU 3 which allows more boat access for hunters and trappers and thus increases wolf mortality risks; and (6) approved deer management plans for GMU 3 and GMU 1A that, if activated, would essentially extirpate wolves in extensive predator control areas. (USFWS SSA 2015 at 88).

Recognizing these threats, wolf expert Dr. Dave Person's statement regarding the Big Thorne Project identified GMUs 3 and 1A as areas of significant concern for Archipelago wolves:

> Other areas of Southeast Alaska where wolves historically were abundant have conditions similar to the Prince of Wales Archipelago. Extensive logging and road construction have similarly changed conditions for deer and wolves on Kuiu, Kupreanof, Mitkof, Zarembo, Revillagigedo, and Wrangell Islands. In

> conjunction with the Prince of Wales Archipelago, those islands sustain most of the wolf population in Southeast Alaska. (Person et al. 1996). Decay in sustainable predator-prey communities will occur throughout the most productive areas for deer and wolves in Southeast Alaska because those areas are correlated with the most productive forest stands selected for timber harvest. (Person 2013 at 7).

Similar to the POW LLA Project, the impacts analysis for the Central Tongass Project is fundamentally flawed on multiple levels. (Southeast Alaska Conservation Council et al. 2019). Nonetheless, the harms from the project to wolves are clear. The majority (29 of 40) of WAAs in the Project Area already have deer habitat capability less than 18 deer per square mile, and all but two WAAs where timber harvest is planned have deer habitat capability below 18 deer per square mile. (USFS 2019a at 3-141). The DEIS concludes that this "suggests the project would result in higher risk that there could be insufficient numbers of deer for sustainable wolf populations and human harvest. This concern exists despite the availability of alternative prey (such as moose and salmon) due in part to the fact that alternative prey may delay a decline in wolf numbers." (USFS 2019a at 3-141).

Intensive logging under the Project will further lower deer habitat capability in 13 WAAs, including large-scale declines in areas such as Portage Bay (18.6% reduction), Zarembo (14.8% reduction), and Mitkof (11.5% reduction). (USFS 2019a at 3-142). The DEIS reports that two of the top three most affected WAAs (Zarembo and Mitkof) have high trapper and hunter usage, with "Zarembo receiving more deer harvest demand than any other WAA in the project area." (USFS 2019a at 3-142). In sum, the DEIS concludes that "[t]he alternatives would further reduce the theoretical deer density, thus increasing the risk that a severe winter would cause declines in the deer population." (USFS 2019a at 3-146).

Only three of the 13 WAAs in the Project Area with proposed new road construction have road densities below 0.7 mi/mi^2, and the Project would push two of them above the 0.7 mi/mi^2 thresholds. (USFS 2019a at 3-145, Table 34). When all land ownerships below 1,200 feet are considered, four WAAs have road densities below 0.7 mi/mi^2, and the Project would push three of them above the threshold. (USFS 2019a at 3-145, Table 35). The DEIS concludes that "[r]oad density would increase the risk of overharvest of wolves in certain WAAs. The risk would likely be greatest in WAAs near communities, on western Kupreanof Island, Mitkof Island, and Wrangell Island." (USFS 2019a at 149).

In addition, the Project authorizes 128 miles of routes to be designated as open to OHV use, which will increase hunter access. The DEIS highlights that OHV trails are often used for hunting: "OHV use has grown in popularity especially in association with subsistence hunting" and "OHV owners from Wrangell transport OHVs to Zarembo and Etolin Islands to ride the road systems and OHV trails, often in search of deer." (USFS 2019a at 3-274). Thus, the Project will increase hunting and trapping pressure due from the significant increase in lands open and adjacent to OHV routes. Furthermore, the DEIS acknowledges that the Project has "the potential to directly and indirectly affect den sites" and that "project activities under either action alternative could cause disturbance to denning." (USFS 2019a at 3-139).

In sum, the intensive logging and road-building authorized by this Project will exacerbate declines in deer habitat capability in a region with already low deer populations and increase road densities in already heavily roaded areas in close proximity to population centers, which threatens to increase human-caused wolf mortality to levels that deplete wolf populations.

Following the District of Alaska's decision on the POW LLA Project (*Se. Alaska Conservation Council*), the Tongass National Forest listed the Central Tongass Project as "on hold," presumably because the analysis approach utilized for the Central Tongass Project was similar to that used for the POW LLA Project.[16] The Tongass National Forest has not withdrawn the project, however, and a final EIS and a decision to approve the project could occur at any time. Logging of old growth in the region covered by the Central Tongass Project therefore remains reasonably foreseeable.

iv. South Revilla Project in GMU 1A

In 2019, the Forest Service issued an updated notice of intent for the South Revilla Project under the 2016 Tongass Forest Plan, which proposes to log up to 5,500 acres of old-growth forest and about 1,000 acres of second-growth forest over 15 years in the Project area encompassing 56,282 acres on Revillagigedo Island located in GMU 1A. (84 Fed. Reg. 31288-31289). The Project proposes almost exclusively clear-cut logging ("even-aged management"). (84 Fed. Reg. 31289). In addition, the Project proposes about 128 miles of road construction, including about 10 miles of new roads, 65 miles of reconditioned roads, 45 miles of new temporary roads, and 8 miles of temporary roads. (84 Fed. Reg. 31288-31289). The Project further proposes to reduce the area of an old-growth reserve (84 Fed. Reg. 31289, USFS 2019b) that maintains a large block of highly productive old growth, important Class I riparian habitat, south facing winter range at low elevations, features such as large tree SD67 habitat, and provides important habitat connectivity. A draft EIS for the South Revilla Project is scheduled for publication in September 2020, according to the Forest Service's current Schedule of Proposed Actions. (USFS 2020 at 6).

These timber sale projects underscore that the 2016 Tongass Forest Plan is failing to protect wolves from threats from logging and road development and to prevent ongoing declines

[16] *See* Central Tongass project webpage, available at https://www.fs.usda.gov/project/?project=53098&exp=detail (last viewed June 11, 2020)).

in deer and wolf numbers. As a result, the cumulative impacts to Archipelago wolves from past logging and road construction, paired with the intensive logging and road development authorized or foreseeable under these massive timber projects, threatens the continued existence of Archipelago wolves.

v. Alaska Mental Health Trust Land Exchange

The Alaska Mental Health Trust Land Exchange Act of 2017 and Alaska Senate Bill 88 (2017) authorized a land exchange of approximately 20,580 acres of Tongass National Forest land for 18,258 acres of Alaska Mental Health Trust Authority ("Trust") lands in Southeast Alaska. This exchange gives away three large tracts of forestlands located on Prince of Wales Island and Revillagigedo Island in areas important for wolves, in exchange for smaller scattered parcels of Trust lands. The Tongass forestlands that were given away include a 10,833-acre block and a 1,538-acre block on north-central Prince of Wales Island and an 8,224-acre block on Revillagigedo Island. (Alaska Mental Health Trust Act 2017). The 8,224-acre Revillagigedo block is immediately adjacent to an enormous clear-cut of almost 4,000 acres recently logged by the Trust. (Greater Southeast Alaska Conservation Community 2017).[17] Because the Alaska Forest Resources and Practices Act (FRPA) has no limitation on clear-cut size, these important blocks of forest habitat given to the Trust are almost certain to be destroyed and fragmented by industrial clear-cutting. As detailed above, past intensive, industrial-scale logging has already harmed the forest ecosystems of both islands, and this land exchange will further increase habitat loss for wolves and deer.

3. The Forest Service's Proposed Elimination of Roadless Rule Protections on the Tongass National Forest Further Jeopardizes the Archipelago Wolf.

In October 2019 the Forest Service proposed to eliminate the Roadless Area Conservation Rule ("Roadless Rule") protections from road-building and logging on all 9.2 million acres of inventoried roadless areas on the Tongass National Forest ("Roadless Rule Rollback") (USFS 2019c). The Roadless Rule Rollback would convert a net total of 165,000 old-growth acres and 20,000 young-growth acres previously identified as unsuitable timber lands to suitable timber lands to be logged. (USFS 2019c at ES-9). In effect, the Roadless Rule Rollback would allow the logging industry to bulldoze roads and clear-cut old-growth in areas of the Tongass that have been off-limits to these threats for years**.**

The Roadless Rule Rollback jeopardizes the Archipelago wolf by exacerbating key threats, making an already dire situation worse. Opening vast areas of previously protected roadless areas to logging and road construction would cause further declines in deer habitat capability, increase trapping and hunting mortality by enabling access into previously

[17] Greater Southeast Alaska Conservation Community was the former name of Petitioner Alaska Rainforest Defenders.

inaccessible areas, destroy denning habitat with associated impacts to reproductive success, amplify fragmentation, and degrade habitat and population connectivity. Although the Forest Service's impacts analysis is fundamentally flawed (Alaska Wilderness League et al. 2019), the Forest Service briefly acknowledges that the Roadless Rule Rollback would result in the "largest adverse effects" for Archipelago wolves compared with the leaving the Roadless intact because of "greater road lengths, penetration into remote roadless areas, and habitat fragmentation" compared with leaving the Roadless Rule intact. (USFS 2019c at 3-10).

a. The Roadless Rule Rollback is likely to have a disproportionate impact on essential Archipelago wolf habitat.

The Forest Service estimates that implementation of the Roadless Rule Rollback would increase total suitable acres of old-growth open for logging on the Tongass National Forest by 72% with the addition of 165,000 old-growth acres, while total suitable acres of young-growth open to logging would increase by 6% with the addition of 20,000 acres, relative to leaving the Roadless Rule in place. (USFS 2019c at 3-67). Suitable high-volume POG open for logging would increase by 60%, adding 59,000 acres, and suitable large-tree POG open for logging would increase by 31%, adding 9,800 acres. (USFS 2019c at 3-67). Suitable young-growth acres open for logging in Old-growth LUDs would increase by 12%, and by 5% to 6% in Riparian Management Areas and estuary and beach fringe. (USFS 2019c at 3-67).

The DEIS tries to claim that impacts to wolves would be minimized because "there would be no increase in overall harvest [timber production] relative to the 2016 Forest Plan." (USFS 2019c at 3-99). However, exempting the Tongass from the Roadless Rule would almost certainly increase overall logging, and old-growth logging in particular. For example, it is likely and foreseeable that the Forest Service would increase the PTSQ—and change other parts of the Tongass Forest Plan to facilitate increased logging above and beyond the 165,000 acres of old-growth forest or altering the young growth transition to account for the additional old growth—after adoption of an Alaska Roadless Rule Rollback.

Furthermore, shifting timber production from already roaded areas to roadless areas would inevitably result in more road-building to access previously inaccessible timber. For example, in the FEIS for the 2016 Tongass Forest Plan, the Forest Service estimated that logging in young growth requires an additional mile of new road for every 400 acres cut, while logging old growth requires one mile of new road for every 150 acres cut—or more than 2.5 times as many miles of new roads in areas that are newly cut. (LRMP FEIS 2016 at B-26-27). Similarly, where there are decommissioned roads, fewer miles or new road are required. *Id.*

In addition, the Roadless Rule Rollback is likely to concentrate old-growth logging in areas of the Tongass that are important for wolf populations, such as POW and surrounding islands. The Forest Service repeatedly states that changing management of roadless areas would provide flexibility to allow for more economic timber sale offering. (USFS 2019c at 2-21, 3-44, 3-47, 3-48). It also acknowledges that some areas, including those closer to existing roads or logging operations, are more likely to be economic than others (USFS 2019c at 3-44, 3-45), and that a third of the most economic areas are on POW. (USFS 2019c at 3-47, 3-48).

b. The Roadless Rule Rollback would reduce deer habitat capability.

The Roadless Rule Rollback would have significant negative impacts to Sitka black-tailed deer and deer winter range. An independent analysis estimated that the large inventoried roadless areas that would be affected by the Roadless Rule Rollback contain approximately half of the remaining winter deer habitat. (Albert 2019 at 14). In GMU 2, 52% of remaining winter deer habitat is in large roadless areas and 47% in development areas, while in GMUs 3 and 1A ("Central Islands"), 61% of remaining winter deer habitat is in large roadless areas and 43% in development areas. (Albert 2019 at 5). Winter deer habitat areas identified at highest cumulative risk from the Roadless Rule Rollback are in areas important for wolves: North Prince of Wales (71.1%), Dall Island Complex (64.9%), N. Kuiu (62.6%) and Kupreanof/Mitkof Islands (62.6%). (Albert 2019 at 14, Table 5).

c. Opening previously inaccessible areas to road-building would increase wolf mortality from legal and illegal hunting and trapping.

The current suite of roadless areas on the Tongass provide a critical refuge for wolves from hunting and trapping. The foreseeable increase in road-building under the Roadless Rule Rollback makes wolves more vulnerable to legal and illegal killing by increasing access to hunters and trappers. The Forest Service briefly acknowledges that "species that are vulnerable to overharvest (e.g., wolf, marten, and spruce grouse) would be affected by potential increased hunter and trapper access along new or reconstructed roads, whether for young-growth or old-growth harvest." (USFS 2019c at 3-90).

d. The Roadless Rule Rollback would cause dangerous increases in habitat fragmentation and loss of connectivity.

The Forest Service briefly acknowledges that the Roadless Rule Rollback would lead to increased habitat fragmentation and decreased connectivity that is harmful to wildlife: "Timber harvest in newly opened areas and associated road construction or reconstruction has the potential to decrease the value of these roadless areas to wildlife through increased habitat fragmentation and reduced landscape connectivity." (USFS 2019c at 3-90). The Forest Service further admits the Roadless Rule Rollback would increase habitat fragmentation, with cumulative impacts that include more patchy forest, more edge effects, and a reduction in biodiversity over time. (USFS 2019c at 3-68, 3-105). The DEIS also notes the importance of connectivity for wildlife (USFS 2019c at 3-69),[18] especially for endemic species like the Archipelago wolf.[19] (USFS 2019c at 3-10).

In relation to Archipelago wolves, the Forest Service highlights the importance of the current system of roadless areas for wolves in creating refugia from logging and hunting and trapping. (USFS 2019c at 3-10). The Forest Service briefly acknowledges that the Roadless Rule Rollback would result in the "largest adverse effects" among the alternatives considered because of "greater road lengths, penetration into remote roadless areas, and habitat fragmentation" compared with the status-quo:

> Remote roadless areas often represent optimum habitats for them and may serve as important refugia for populations under harvest and development pressures. Of greatest concern on the Tongass is the Alexander Archipelago wolf, particularly on Prince of Wales and surrounding islands. Although the alternatives would be similar in terms of overall harvest levels, Alternatives 4, 5, and 6 [where Alternative 6 is the proposed action] would result in the largest adverse effects on these species because of greater road lengths, penetration into remote roadless areas, and habitat fragmentation that they would produce relative to Alternatives 1, 2, and 3. (USFS 2019c at 3-10).

The devastating cumulative impacts of industrial logging and road-building in Archipelago wolf habitat are illustrated in Figure 7 below. This map highlights the areas that have already been logged on the Tongass National Forest, the areas under the 2016 Tongass Forest Plan that are authorized for continued old-growth and second-growth clear-cut logging, and the previously protected roadless areas that would imminently be opened up to logging and road-building under the Forest Service's proposal to rollback the Roadless Rule on Tongass National Forest lands.

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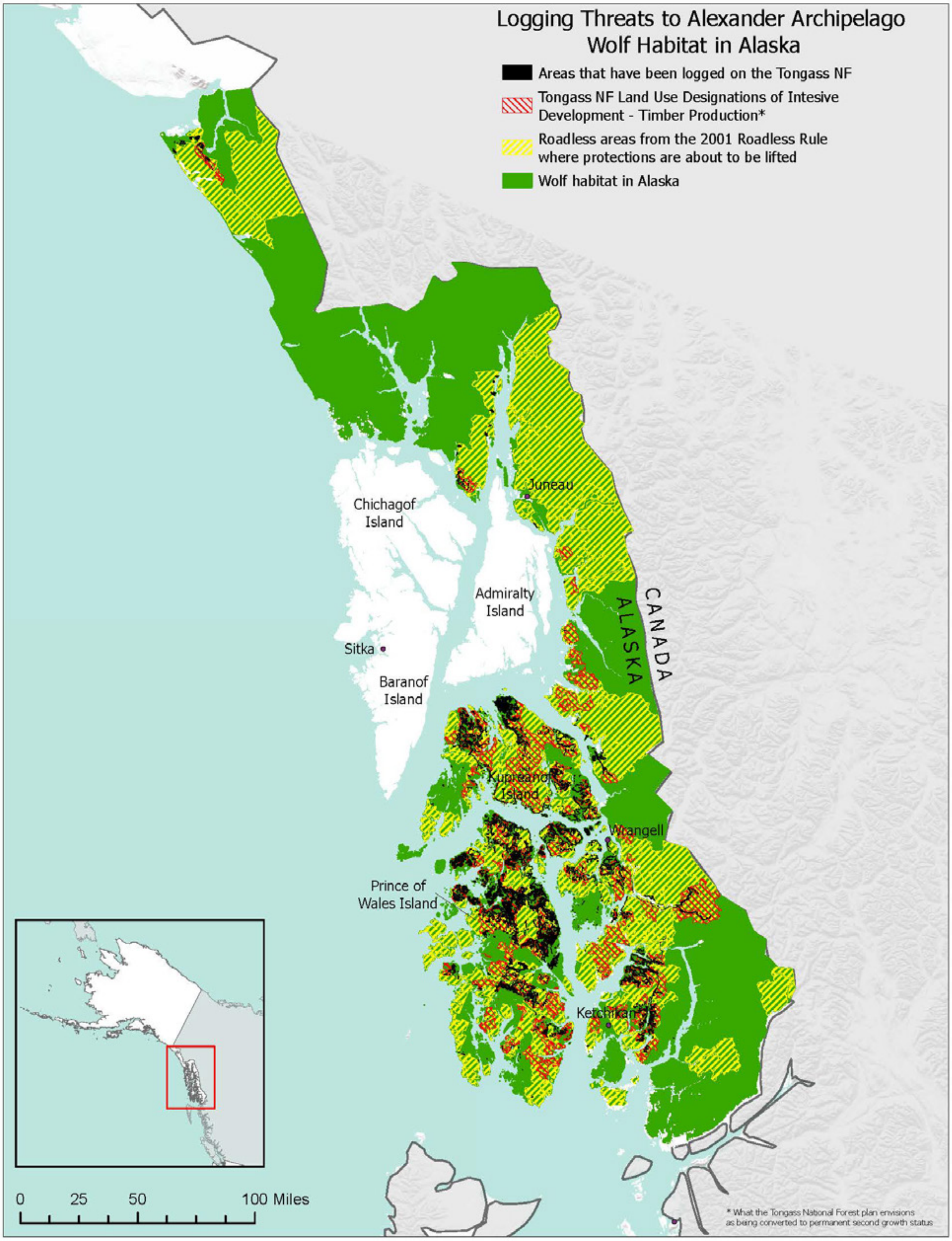
[18] USFS 2019c at 3-69 ("maintaining connectivity and roadless refugia will become increasingly important, particularly for wide-ranging species whose distribution depends on some level of connectivity across the landscape.").

[19] USFS 2019c at 3-10 ("Although timber harvest levels are the same among all alternatives, Alternatives 4, 5, and 6 would have the greatest potential for effects on endemics because the degree of fragmentation is likely to be higher under these alternatives").

Figure 7. Cumulative impacts of industrial logging and road-building in Archipelago wolf habitat in Southeast Alaska.



B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes: Trapping and Hunting Threaten the Archipelago Wolf

1. GMU 2 Wolves Are Threatened by High Levels of Legal and Illegal Trapping and Hunting.

High levels of legal and illegal hunting and trapping are by far the greatest cause of mortality for the Archipelago wolf. (Person 2001, Person and Russell 2008). The USFWS in its 2015 Status Assessment determined that wolves in GMU 2 face high levels of legal and illegal hunting and trapping that reach unsustainable rates in some years, as well as the highest levels of road access for hunters and trappers across the wolf's range. (USFWS SSA 2015 at 83). The USFWS in its 2016 Finding determined that trapping and hunting is impacting GMU 2 wolves and contributing to the observed population decline. (81 Fed. Reg. 448).

Adding to this already precarious situation, during the 2019-2020 trapping season, an unprecedented number of wolves were killed in GMU 2, totaling 165 wolves legally trapped from a population last estimated at 170 wolves in fall 2018, and not including additional wolves killed illegally. (ADFG 2020). As detailed below, this unprecedented trapping occurred after ADFG eliminated trapping and hunting limits and in-season mortality monitoring for this vulnerable population and failed to follow the recommendations of the Wolf Habitat Management Plan developed for GMU 2 wolves.

In 2017, the Forest Service, USFWS, and ADFG issued a Wolf Habitat Management Program ("Wolf Program") for GMU 2 wolves, as required by the 2016 Tongass Forest Plan when a mortality concern is identified. (Wolf Technical Committee 2017). The finalized 2017 Wolf Program considered annual trapping and hunting limits, in-season mortality monitoring, and increased enforcement to be important management tools in minimizing mortality as reflected in the Wolf Program's recommendations:

> • We recommend ADF&G and USFS biologists establish a science-based management strategy with population objectives for wolves in GMU 2, using input from affected and concerned stakeholders.
>
> • Maintain flexibility in quota management to alter quotas on a yearly basis to ensure wolf population and harvest sustainability.
>
> • Continue to incorporate unreported human-caused mortality rates in developing wolf harvest quotas using best available data.
>
> • Monitor the wolf population to help evaluate program effectiveness.

> • Prioritize and increase enforcement in pre-season and beginning of season, increase enforcement capabilities, and prioritize wolf trapping season patrols in GMU 2.
>
> • Work with advisory groups and law enforcement agencies to determine need and effectiveness of wolf trap marking requirements for GMU 2 in both State and Federal regulations.
>
> • Continue to consider additional ways to minimize unreported human-caused mortality of wolves in GMU 2.
>
> • Consider the roaded portion of central and northcentral POW for a regulatory regime (e.g., controlled use area) separate from the rest of GMU 2 to facilitate regulatory changes specific to this area. (Wolf Technical Committee 2017 at 25).

The agencies also collaborated to establish hunting and trapping limits designed to help the wolf population rebound. During regulatory years 2015 to 2018, the Forest Service and ADFG kept the legal limit at or below the maximum rate allowed by regulation at the time: 20% of the preseason autumn population estimate. (ADFG 2018). The wolf population increased somewhat but remained well below the population estimates during the 1990s and early 2000s. The GMU 2 population estimate increased from a low of 89 wolves in fall 2014 to 108 wolves in fall 2015, 231 in fall 2016, 225 in fall 2017, and only 170 in fall 2018. (ADFG 2017, ADFG 2018, ADFG 2019, Roffler et al. 2019).

Despite the low wolf numbers in fall 2018 and ongoing threats, ADFG and the Alaska Board of Game abandoned the recommendations of the Wolf Program for the 2019-2020 season and ADFG's own management plan. In January 2019 ADFG proposed and the Board of Game approved changing the management objectives and approach for GMU 2 wolves. (Alaska Board of Game 2019a at 43, 44, Alaska Board of Game 2019b at 5). ADFG now manages to achieve a population objective of 150-200 wolves in GMU 2 (5 AAC 92.008(1)) and has abandoned any trapping and hunting limit (5 AAC 84.270(13)) (Alaska Board of Game 2019a at 43, 44, Alaska Board of Game 2019b at 5), departing from the Wolf Program and its own wolf management plan which also envisions using quotas to manage wolf hunting and trapping. (Porter 2018 at 13).[20] It also repealed the requirement that GMU 2 wolves be sealed within 14 days after the date of taking, instead moving to a requirement to seal trapped wolves within 30 days after the close of the season (5 AAC 92.170) which eliminates in-season trapping information and monitoring. (Alaska Board of Game 2019a at 44, Alaska Board of Game 2019b at 5, ADFG 2020a at 24).

[20] *See* Porter (2018) at 13 (stating the management goal is to "Maintain a population that supports sustainable harvest and viewing through regulation of hunting and trapping seasons, bag limits, and harvest guidelines.").

This departure from the Wolf Program and past practice predictably resulted in the highest trapping mortality ever recorded for this population. (ADFG 2020). The legal trapping of 165 wolves—from a population estimated at 170 animals in fall 2018—vastly exceeded the prior record high of the past 20 years of 77 wolves killed in 2004. (*Id.*). In fact, if the 20% limit had been applied for the 2019-2020 season, the legal maximum take would have been 34 wolves. Additionally, the 165 reported wolves trapped does not include animals killed by illegal hunting and trapping, which has been documented at a high level in GMU 2. Yet ADFG apparently plans to continue to manage GMU 2 wolves with no trapping limit for whatever duration it opens the season in 2020-2021. Furthermore, in April 2020, the Federal Subsistence Board which manages subsistence hunting and trapping on federal lands in Alaska including the Tongass National Forest, approved the elimination of any quota on wolf hunting and trapping in GMU 2, and changed the sealing period for wolf trapping in GMU 2 from within 14 days of taking to within 30 days of the end of the season. (Federal Subsistence Board 2020 at 142-157). In sum, although the Wolf Program needs updating and strengthening to adequately protect wolves, the agencies failure to implement the Wolf Program puts Archipelago wolves in GMU 2 in jeopardy.

2. Legal and Illegal Trapping and Hunting Threaten Archipelago Wolves Outside of GMU 2.

In its 2016 Finding, the USFWS concluded that trapping and hunting ("overutilization") is not a threat to the AA wolf, nor is it likely to become a threat in the foreseeable future: "Overall, we found that wolf harvest is not having an effect on the Alexander Archipelago wolf at the rangewide level, although we recognize that the GMU 2 population likely is being harvested at unsustainable rates, especially given other stressors facing the population (*e.g.*, reduced prey availability due to timber harvest)." (81 Fed. Reg. 448). However, the agency's rationale for this determination is problematic in several ways.

First, the 2015 Status Assessment found that legal trapping and hunting rates were actually higher in GMUs 1, 3, and 5A than in GMU 2. Between 1997 and 2014, hunting and trapping mortality was 17% for GMU 2, 19% for GMUs 1 and 5A, and 21% for GMU 3. (81 Fed. Reg. 447). However, the USFWS determined that these legal rates were within "sustainable" levels. (81 Fed. Reg. 447). The USFWS defined "sustainable" hunting and trapping mortality rates for Archipelago wolves as 20% to 30% of the total population based on gray wolf studies:

> Because the biological circumstances of each wolf population are different, we assessed wolf harvest statistics of individual populations relative to 20% and 30% of the estimated population size in a given year. These thresholds were chosen based on findings presented by Person and Russell (2008, pp. 1545–1547), harvest guidelines applied in GMU 2 between 1997 and present (described in more detail below), and on relevant literature for gray wolf (e.g., Fuller et al.

> 2003, p. 182; Adams et al. 2008, pp. 19, 22). We note here that they are presented as guidelines only to aid in interpreting the wolf harvest data; we do not know what constitutes sustainable harvest levels for most populations of Alexander Archipelago wolf because populations are not monitored regularly. (USFWS SSA 2015 at 75).

Yet it is important to note that the rates of *legal* trapping and hunting for GMUs 1 and 5A are already very close to the sustainability threshold of 20% to 30%, while the rate in GMU 3 potentially exceeds the threshold. However, the 2016 Finding does not address this problem.

Second, in determining that trapping and hunting was not a threat, the USFWS relied on the assumption that rates of illegal trapping and hunting in GMUs 1, 5A, and 3 are *not* occurring at the same high level as GMU 2. The USFWS justified its decision not to apply the known illegal trapping and hunting rate in GMU 2 to the other GMUs, despite this being the best-available science, under the assumption that GMU 2 has more access for trappers and hunters and therefore higher rates of illegal killing: "although we recognize that some level of unreported harvest likely is occurring along the mainland of southeastern Alaska and in GMU 3, we do not know that rate at which it may be occurring, but we hypothesize that it is likely less than in GMU 2 because of reduced access." (81 Fed. Reg. 448). However, the problem with the agency's rationale is brought into stark focus when considering rates of *legal* killing. The GMUs outside of GMU 2 actually had higher rates of reported trapping and hunting between 1997 and 2014. The agency never reconciled how rates of legal killing in GMUs 1, 5A, and 3 could be higher than GMU 2, if levels of access were allegedly so much worse than GMU 2. Stated differently, how can hunter and trapper access be relevant to levels of illegal trapping and hunting, but not to legal killing?

Third, while the agency acknowledged that some rate of illegal trapping and hunting does occur outside of GMU 2—albeit at rates below GMU 2—it failed entirely to apply *any* rate of illegal trapping and hunting into its overall findings. While the agency offered justification for not applying GMU 2 illegal trapping and hunting rates to other GMUs, it never provided a basis for its decision not to apply *any* rate of illegal trapping and hunting at all, particularly since any added mortality pushes all the GMUs toward exceeding the sustainability threshold.

Fourth, in estimating access for hunters and trappers for the different GMUs, the USFWS does not explain why it uses different metrics from other studies that have evaluated correlates of trapping and hunting rates. The USFWS used three metrics for estimating hunter and trapper access—road density, ratio of shoreline to land area, and number of communities. (81 Fed. Reg. 447-448). While road density is a frequently used proxy of access, the two other metrics used by USFWS are not. For example, Person and Russell (2008) found that rates of harvest increased with road access, open habitats (e.g., muskegs and clear-cuts), and habitats further from the relative safety of stream corridors and lakeshores. Person and Logan (2012) found a positive correlation between harvest rate and road density and the proportion of a WAA comprised of alpine habitat.[21] Even for its own population modeling, the USFWS examined road density and distance via ocean from the nearest human settlement—not ratio of shoreline to land area. (Gilbert et al. at 12–13.) And in USFWS's 90-day AA wolf finding, the agency identified road density, ocean distance from towns, amount of clear-cut and muskeg habitat present, and distance from water as primary factors contributing to mortality risk for wolves. (USFWS 2014 at Appendix 3). In sum, rather than using known rates of illegal killing based on on-the-ground research, the USFWS devised an approach for measuring rates of unreported trapping and hunting—and for determining the relative levels of trapper and hunter access in general—that did not reflect the best-available science.

Finally and significantly, ADFG information indicates that high levels of wolf trapping and hunting in GMUs 3 and 1A are being facilitated by intensive deer management programs in those regions. In 2013 the Alaska Board of Game established two intensive deer management programs in Southeast Alaska with predator control areas targeting the Archipelago wolf: the Gravina Island Predator Control Area in GMU 1A, and the Mitkof Island, Woewodski Island, and Lindenberg Peninsula (eastern Kupreanof Island) Predator Control Area in GMU 3. (ADFG 2018a, 2018b).

In GMU 3, the wolf reduction area encompasses approximately 1,680 km^2 (648 mi^2) or approximately 22% of the total land area in Unit 3, and includes Woewodski Island, Mitkof Island, and the Lindenberg Peninsula on eastern Kupreanof Island. (ADFG 2018a at 2). In GMU 1A, the wolf reduction area encompasses Gravina Island (248 km^2 or 96 mi^2), approximately 2% of the land area in Unit 1A. (ADFG 2018b at 2). The effectiveness measure for these programs is that "most wolves have consistently been removed from the treatment area each year." (ADFG 2018a, 2018b at 4).

To date ADFG has not activated the wolf killing component of these programs "pending refinement of techniques for accurately measuring changes in deer and wolf abundance." (ADFG 2018a, 2018b at 2). However, as acknowledged by the 2015 Status Assessment, if these programs were activated, they would essentially extirpate wolves in the large predator control areas, jeopardizing the continued existence of wolves in these regions and lowering immigration into GMU 2:

> Intensive management of black-tailed deer, which includes the culling of wolves with the aim of increasing deer populations and deer harvest by humans, is

[21] Wolves generally do not use alpine habitat, and thus tend to concentrate in narrow valley bottoms and beach fringes, in areas with more mountainous terrain. Person and Logan (2012) at 24 ("If those areas are accessible to trappers, they likely increase risks that wolves are harvested and elevate harvest rates.")

authorized for GMU 1A (ADFG 2013a) and in GMU 3 (ADFG 2013b). Currently, these programs are inactive, but operational plans exist and could be implemented in the future… In GMU 3, the treatment area constitutes 22% of the total land area and is located in the northern portion of the unit including Woewodski, Mitkof, and part of Kupreanof Island (ADFG 2013b, p. 6). Within the GMU 3 treatment area, up to 80% (or ~50 wolves in 5–6 packs) would be removed; duration of the culling effort would be a minimum of five years (ADFG 2013b, pp. 8–9). (USFWS SSA 2015 at 88).

Although the program currently is inactive, if implemented the GMU 3 wolf population would be reduced, given that it is the goal of the program, potentially having an effect on the GMU 2 population because GMU 3 provides the most reasonable transit path for wolves to move or disperse between the mainland and GMU 2 (Figure 2). Therefore, maintaining or reducing current rates of wolf harvest in GMU 3 would benefit the rangewide population of Alexander Archipelago wolves; an increase in mortality rates likely would lower immigration rates to GMU 2, which apparently are uni-directional (Breed 2007, p. 22), thereby increasing the vulnerability of the GMU 2 wolf population. (USFWS SSA 2015 at 120).

Moreover, although the wolf control programs have not yet been activated, since 2012 ADFG staff in GMU 3 have been "encouraging public trappers to increase their wolf harvest efforts" including baiting wolves:

In addition to soliciting increased public participation, the Petersburg Area office has been assisting wolf trappers by providing trap bait whenever possible. We collect and hold butcher scraps from hunter harvested moose and deer (heads, bones, trimmings, etc.) and make them available to wolf trappers. We also make available for use as wolf trapping bait the carcasses of road-killed deer that are so badly damage or tainted as to be unfit for human consumption. (ADFG 2018a at 16).

Likely as a result of these efforts, wolf populations appear to have declined in these regions. In 2018 ADFG staff reported record-high wolf trapping and killing in Unit 3 during 2011 to 2013 followed by declining numbers of killed wolves which "may signify a reduction from previous levels of wolf abundance." (ADFG 2018a at 16). On Gravina Island in GMU 1A, ADFG in 2018 similarly reported that the number of trapped wolves has remained extremely low after trapping reached highs between 2007 and 2011. (ADFG 2018b at 12). The number of wolves on Gravina Island is estimated at only 3 to 5 animals and no evidence of reproduction has been detected. (ADFG 2018b at 17).

C. Inadequacy of Existing Regulatory Mechanisms Threatens the Archipelago Wolf

The Archipelago wolf in Southeast Alaska is threatened by a long history of inadequate regulatory mechanism at the federal and state levels addressing the primary threats to wolves—logging and associated road construction, hunting and trapping mortality, inbreeding depression, and climate change—and these harms have been compounded by federal and state agency failures to implement the insufficient mechanisms that do exist. As a result, the threats to the Archipelago wolf identified in the 1993 and 2011 ESA listing petitions (Biodiversity Legal Foundation 1993, Center for Biological Diversity and Greenpeace 2011) have only worsened.

1. Existing Regulatory Mechanisms Are Inadequate to Mitigate Threats From Habitat Destruction And Modification From Logging and Road Construction.

a. The 2016 Tongass Forest Plan is inadequate due to lack of science-based regulatory mechanisms and failures in implementation.

Similar to the 1997 and 2008 Forest Plans, the 2016 Tongass Forest Plan relies on the Old-Growth Habitat Conservation Strategy to mitigate threats from habitat destruction and modification to Alexander Archipelago wolves, as well as address the National Forest Management Act directive for the Forest Service to manage wildlife habitat on national forest lands to maintain "viable" and "well-distributed" populations.[22] The Habitat Conservation Strategy has two components. One is the Old-Growth Reserve Network that is comprised of large, medium, and small Old-Growth Reserves allocated to the Old-Growth Habitat LUD and other non-Development LUDs. The second component is the Standards and Guidelines that are applied to the "matrix" lands outside of the Old-Growth Reserve Network where commercial logging is allowed. (LRMP FEIS 2016 at Appendix D, D-2). Both have proven inadequate to mitigate habitat threats to Archipelago wolves.

i. Forest Plan Standards and Guidelines for Archipelago wolves are inadequate.

The overarching directive of the 2016 Forest Plan standards and guidelines for the Archipelago wolf is for the Forest Service to "[i]mplement a Forest-wide program, in cooperation with ADF&G and USFWS, to assist in maintaining long-term sustainable wolf populations." (LRMP 2016 at 4-91). Three distinct requirements of this Forest-wide program are

[22] 1982 NFMA Implementing Regulations Sec. 219.19 ("Fish and wildlife resource. Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area. In order to insure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.")

to (1) develop and implement a Wolf Habitat Management Program where wolf mortality concerns have been identified, in partnership with ADFG; (2) provide sufficient deer habitat capability to first maintain sustainable wolf populations, considered to equate to the habitat capability to support 18 deer per square mile, in provinces where deer are the primary prey of wolves; and (3) management activities to avoid abandonment of wolf dens. (*Id*).

However, the 2016 standards and guidelines for the Archipelago wolf, like the 1997 and 2008 versions, have proven unenforceable, ineffective, and speculative due to the Forest Service's history of willful exclusion of scientific recommendations in setting the Archipelago wolf standards and guidelines and its chronic failure to enforce them.

Wolf Habitat Management Program

Although the Wolf Habitat Management Program provision of the standards and guidelines *could* provide a measure of protection for Alexander Archipelago wolves and their habitat, this provision is vague, highly discretionary, and has failed to provide real protections on the ground. For example, the standards and guidelines fail to provide clarity on how agencies determine when "wolf mortality concerns have been identified." (*Id*). The standards and guidelines state that there is to be an interagency analysis in which the three agencies—Forest Service, ADFG, and the Federal Subsistence Board—are to make a finding as to whether road access and associated human-caused mortality are "a significant contributing factor to locally unsustainable wolf mortality." (*Id*). However, as indicated by Forest Service personnel in internal comments on the standard, "[c]urrently, our 'analysis' on this topic consists of asking ADFG biologists whether or not they have a mortality concern. If a particular analysis is to be done besides this that involves processing road density and harvest data, perhaps it needs to be outlined more clearly for consistent application across the forest." (USFS 2008 at 75).

Another problem with the Wolf Habitat Management Program provision is the vague, discretionary road density guideline, which requires only that "[w]here road access and associated human-caused mortality has been determined, through an interagency analysis, to be a significant contributing factor to locally unsustainable wolf mortality," the Forest Service should "incorporate this information into Travel Management planning and hunting/trapping regulatory planning." (LRMP 2016 at 4-91). Although purportedly based on the interagency 1996 Wolf Conservation Assessment (Person et al. 1996), the 2016 road density guideline (like the 2008 version) continues to disregard the Conservation Assessment's science-based road management recommendations in several important ways. First, the Wolf Conservation Assessment specified using a critical road density of 0.7 miles per square-mile (Person et al. 1996, CSR Report 2008, Person 2006), yet the Forest Service declined to impose a rigid road density limit, and instead recommended a non-binding limit range: "Total road densities of 0.7 to 1.0 mile per square mile or less *may be* necessary." (LRMP 2016 at 4-91). Further, the 1996 Wolf Conservation

Assessment recommendations required consideration of total road densities at lower elevations (less than 1,200 feet in elevation which is most relevant for wolves) (CSR Report 2008 at 74) and using a spatial scale matched to wolf home range size such as WAAs:

> Reconsider the road density S&G [Standards and Guidelines in the Tongass Land Management Plan.] Threshold of 0.7mi/mi^2 for open road density should be changed to total road density. Consider potential for destructive harvest, particularly for isolated populations. Apply road density guideline at scale equal to 300km^2, the average size of wolf home range. (CSR Report 2008 at 115).

However, the 2016 Forest Plan standards and guidelines did not incorporate these recommendations. Because the guidelines are so vaguely written, they rely heavily on agency discretion for implementation, and the Forest Service has repeatedly failed to implement road density guidelines on the Tongass.

2017 Wolf Habitat Management Program for GMU 2

In 2017 the Forest Service, ADFG and USFWS finalized a Wolf Habitat Management Program ("Wolf Program") for GMU 2 to address the long-standing requirement under the standards and guidelines that the Forest Service "develop and implement" a Wolf Program where mortality concerns have been identified. The Wolf Technical Committee acknowledged that mortality concerns for GMU 2 wolves had been identified going back at least to 2008. (Wolf Technical Committee 2017 at 1). The Committee provided examples of wolf mortality concerns including the high trapping and hunting mortality documented by Person and Russell (2008) and Person and Logan (2012); the 1993 and 2011 petitions to list the Archipelago wolf under the Endangered Species Act; and the 2015 USFWS Status Review and 2016 Finding that indicated "concerns about the sustainability of the GMU 2 wolf population." (*Id.*). The Committee reported that "[a]fter the USFWS decision in 2016 that listing was not warranted, and based on continued GMU 2 wolf population concerns, USFS leadership within the Tongass National Forest and Alaska Region directed staff to proceed with developing the Wolf Habitat Management Program and wolf management recommendations for GMU 2." (*Id.*).

The Wolf Program developed recommendations addressing deer management, road management, hunting and trapping management, and den buffer management. Although these recommendations do not fully reflect the best-available science on Archipelago wolves and their habitat, the Wolf Program recommendations make improvements over the Forest Plan standards and guidelines on a number of management issues such as road density, dens buffers, and trapping and hunting mortality.

For example, the recommendations for road density reflect the best-available science in setting a road density threshold of 0.7 miles per square mile for total roads within WAAs and enforcing effective road closures. (*Id.* at 21). The Wolf Program explained the importance of including the density of all roads, rather than just open roads, in evaluating risks to Archipelago wolves: road closures are often ineffective at preventing motorized access because many do not include physical barriers (i.e., administratively closed roads) or existing physical barriers have become ineffective or are vandalized. (*Id.* at 19). Furthermore, closed roads near open roads are still effectively open to hunting and trapping on foot, and are frequently used because hunters and trappers believe wolf activity is higher on closed roads. (*Id.*). Barriers used to close roads are also often bypassed by people riding ATVs, trail bikes, and snowmobiles. (Person and Russell 2008 at 1548). The Wolf Program further discussed the importance of managing core wolf habitats for low road densities. (Wolf Technical Committee at 20). The Program recommended mapping core wolf habitat—such as current and past pack activity centers, productive habitats for deer, elevation and habitat preferences, and focused seasonal use areas such as salmon streams—and managing these core areas for low road densities by limiting new road construction and reconstruction and prioritizing this habitat for road closures. (*Id.* at 20). The Program also suggested regulatory closure of roads to wolf hunting and trapping in WAAs where wolf trapping and hunting morality is unsustainable. (*Id.* at 21).

However, after finalizing the Wolf Program in 2017, the Forest Service, ADFG and USFWS have completely failed to implement this program. One key example is the failure of the Forest Service under the POW LLA Project to implement the Wolf Program for POW wolves, despite the mandate under the 2016 Forest Plan standards and guidelines and the Forest Service's own acknowledgment in the Project impacts analysis that 89 percent of project area WAAs have some level of wolf mortality concern due to logging and roadbuilding. (LRMP FEIS 2018 at 3-235). Instead, the Forest Service refused to implement any of these Wolf Program components when it approved the Project. (LRMP FEIS 2016 at iii, LRMP 2016 ROD at 16-17). Another disastrous example is the failure of the ADFG and Forest Service to implement the Wolf Program recommendations on trapping and hunting. Instead, ADFG and the Forest Service flouted these recommendations in eliminating any quota on trapping and eliminating in-season monitoring of trapping mortality during the 2019-2020 trapping season, which led to unprecedented wolf killing in GMU 2, as detailed above.

Deer Habitat Capability

The 2016 Forest Plan standards and guidelines require that the Forest Service provide sufficient deer habitat capability to maintain sustainable wolf populations—long considered to be at least 18 deer per square mile—using field validation of local conditions:

> Provide, where possible, sufficient deer habitat capability to first maintain sustainable wolf populations, and then to consider meeting estimated human deer harvest demands. This is generally considered to equate to the habitat capability to support 18 deer per square mile (using habitat capability model outputs) in biogeographic provinces where deer are the primary prey of wolves. Use the most recent version of the interagency deer habitat capability model and field validation of local deer habitat conditions to assess deer habitat, unless alternate analysis tools are developed. Local knowledge of habitat conditions, spatial location of habitat, and other factors need to be considered by the biologist rather than solely relying upon model outputs. (LRMP 2016 at 4-91).

First, this standard is inadequate in failing to require the Forest Service to evaluate deer habitat capability across both federal and non-federal forest lands as the appropriate measure of cumulative impacts of logging on deer and wolf populations. Because private and state lands on the Tongass are often logged at high rates, the repeated Forest Service practice of excluding non-federal forests from deer habitat capability calculations allows the agency to drastically overestimate deer habitat capability on the landscape and underestimate the cumulative impacts of logging on wolves.

Second, the Forest Service—in the 2016 Forest Plan and federal timber sales such as the POW LLA Project and Central Tongass Project—continues to authorize more and more logging despite analyses showing that these logging projects will push deer habitat capability below the 18 deer per square mile threshold in WAAs important for Archipelago wolves, as detailed above.

Wolf Den Buffers

The 2016 Forest Plan standards and guidelines require the maintenance of a 1,200-foot forested buffer, where available, around known active wolf dens, within which road construction is discouraged. Road construction is permitted up to 600 feet from active dens, with exceptions allowed for even closer road construction if "local landform or other factors will alleviate potential adverse disturbance." (LRMP 2016 at 4-91). Furthermore, buffers are not required for dens judged to be inactive for two consecutive years:

> (a) Maintain a 1,200-foot forested buffer, where available, around known active wolf dens. Road construction within the buffer is discouraged and alternative routes should be identified where feasible. No road construction is permitted within 600 feet of a den unless site-specific analysis indicates that local landform or other factors will alleviate potential adverse disturbance.
>
> (b) If a den is monitored for two consecutive years and found to be inactive, buffers

> described in a), above, are no longer required. However, in the spring, prior to implementing on-the-ground management activities (timber harvest or road construction), check each known inactive den site to see if it has become active. (*Id.*).

However, these standards and guidelines for wolf den buffers and timing restrictions do not reflect the best-available science and are inadequate to mitigate threats to wolf dens and reproductive success, as long pointed out by wolf biologists. At the 2006 Conservation Strategy Review Workshop, wolf expert Dr. Dave Person presented modeling results indicating that den buffers were inadequate. According to Person, the road buffer of 600 feet was too small, the Forest Service's criteria for determining active dens was inaccurate because inactivity at a den site for two years does not mean that the den is abandoned, and the date range was too short because wolves use dens between April 15 and October 1. (CSR Report 2008 at 74-75), Person reported that areas on the Tongass with a 75% probability of wolf use had a median distance of 2,000 feet from roads and 1,535 feet from other developments. (*Id.*) Thus, road-building and logging affected den site selection, and "current Forest Plan guidelines pertaining to den sites are unsupported by evidence and should be updated." (*Id.* at 75).

The Wolf Technical Committee (2017) acknowledged that the 2016 Forest Plan standards and guidelines are insufficient to adequately protect wolf dens in several aspects, particularly the "guidelines allowing den buffers to be dropped after 2 years of den inactivity, and the buffer distances for road construction and other potentially disturbing management activities." (Wolf Technical Committee 2017 at 26). The Wolf Committee recommended that "management should aim to protect den sites, as well as sufficient foraging habitat to successfully rear pups at each den in perpetuity":

> Wolf den sites are frequently used in multiple consecutive years and intermittently over long periods (Mech and Packard 1990), suggesting both high den-site fidelity and the importance and perhaps rarity of suitable den sites on the landscape. Within GMU 2, dens are typically located in loose, dry soils, under root-wad cavities of large living or dead trees, within dense canopies of old-growth forest, near freshwater, often on peninsulas or islands, on gentle, low-elevation slopes, and farther from logged stands and roads than random sites (Person and Russell 2009). Large proportions of the GMU 2 landscape are considered unsuitable for den sites due to logging and topography, and availability of the combined characteristics that provide quality den sites may be limited (Person and Russell 2009). Therefore, management should aim to protect den sites, as well as sufficient foraging habitat to successfully rear pups at each den in perpetuity. (*Id.* at 26).

Research by Roffler and Gregovich (2019) on Archipelago wolf movements and spatial use during the denning season make clear that current den buffer recommendations in the 2016 Forest Plan and 2017 Wolf Habitat Management Program are inadequate to protect Archipelago wolves. In their 2019 study, wolf biologists Gretchen Roffler and David Gregovich concluded that current recommended den buffer distances and time restrictions fall far short of protecting the core habitat used by breeding wolves and non-breeding helpers. (Roffler and Gregovich 2019). They warned that "[w]olf managers should recognize the current protection buffer around dens constitutes only a portion of the core area used by breeding wolves, and habitat alterations near den sites may force breeding wolves to use sub-optimal habitat they would normally avoid." (Roffler and Gregovich 2019 at 1). Based on their research findings, Roffler and Gregovich (2019) made a series of critical recommendations for den habitat management:

(1) For all wolves associated with an active den, the median distance between the den and the core home range edge was 3,756 meters (~12,300 feet); "therefore, land managers working to protect den sites should consider expanding the much smaller guideline den site buffers in place now to this larger size";

(2) The shape of the protected polygon surrounding the den should be selected to maximize high quality denning habitat: flat, low elevation terrain, in old growth forests, near freshwater and distant from high density road areas; "therefore, the buffer width…should not be less than 734 m [~2,400 feet] (the minimum buffer width for breeding wolves)";

(3) To maintain foraging habitat for wolves during denning season, "the proportion of old growth forest should not be reduced below the current values (61% of the core home range area for wolves associated with an active den)";

(4) "The recommended period for seasonal management activity restrictions around active dens is 15 March to 15 July based on earlier work by Person and Russell (2009; Wolf Technical Committee 2017); however, wolves were documented during this study at dens as late as 21 July, and the mean den occupancy was nearly two months; thus extending the restriction period to late July would be a conservative management action";

(5) Because wolves display a flexible response to road density throughout the year by avoiding areas with high road densities during denning season, but selecting these areas during winter (Roffler et al. 2018), timing is also a consideration in road closures as a management action; and

(6) Measures to maintain old-growth habitats surrounding documented den sites will help maintain the potential for successful wolf reproduction, considering the pattern of repeated historical den site and habitat use. (Roffler and Gregovich 2019 at 9).

Although the den management recommendations of the 2017 Wolf Habitat Management Program improve upon those in the 2016 Forest Plan, both the 2016 Forest Plan standards and guidelines and Wolf Program fail to incorporate the science-based recommendations made by Roffler and Gregovich (2019) and are inadequate to reduce habitat threats to wolf denning and reproductive success.

ii. The Old-Growth Reserve System is inadequate to protect wolves.

The Old-Growth Reserve System is inadequate to protect the Archipelago wolf. Importantly, none of the reserves encompasses an entire wolf pack home range on the Tongass National Forest (CSR Report 2008 at 75) or adequately accounts for habitat connectivity. The 2006 Tongass Conservation Strategy Review Workshop emphasized that the reserve system did not sufficiently consider wolves and is inadequate for wolf viability: "Lower wolf and deer populations are likely in the future under current land use plans. Old-growth reserves and other non-development LUDs serve as population sources for wolves (and possibly deer). Eliminating or degrading old-growth reserves and other non-development LUDs will exacerbate the problem. High quality habitat for deer must be maintained within and outside the non-development LUDs. The wolf should be considered in the design and monitoring of OGRs." (CSR Report 2008 at 75, 115).

Moreover, Old-Growth Reserves have been repeatedly modified to accommodate timber sales. The original network of reserves had to be revised soon after its conception due to various reasons including timber harvest, or to allow for more timber harvest.[23] The Big Thorne Timber Sale on POW included modifying the small old-growth reserves in the area. (LRMP FEIS 2016 at Appendix D, at D-6). Land exchanges have also impacted the Strategy. In 2015, the transfer of 69,585 acres of Tongass National Forest lands to Sealaska Corporation included modifications to old-growth reserves on POW and nearby islands. The Sealaska Land Exchange removed acreage from old-growth reserves, requiring the agency to expand or establish new old-growth reserves which did not necessarily contain the same quality or contiguous forest as the lands that were exchanged away.[24] Although this legislation passed in 2015, the bill was pending before Congress for years prior. At a hearing in 2009 on an essentially equivalent bill, the Forest Service asserted that the land exchange would degrade the Habitat Conservation Strategy.[25] The

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[23] LRMP 2008, Appendix D, at D-10 ("Modifications were made [to the original HCA] for several reasons: . . . The integrity of the original HCA was substantially compromised by recent timber harvest that was inconsistent with HCA objectives (Game Creek Large HCA; and The reserve location was adjusted to achieve multiple-use objectives such as timber harvest.").

[24] See LRMP FEIS 2016, Appendix E, at 35-40 (the land exchange removed acreage from the Old Thom's Medium OGR; the Forest Service selected new acreage nearby to establish the new Cholmondeley Medium OGR which was much more spread out than the Old Thom's OGR it was designed to replace).

[25] Jay Jensen, Deputy Under Secretary for Forestry, Natural Resources and Environment, Department of Agriculture, *Responses of Jay Jensen to Questions from Senator Murkowski*, Hearing before the

Alaska Mental Health Trust Land Exchange in 2017 also impacted a small old-growth reserve on POW that was helping to provide connectivity to a large old-growth reserve complex from the coasts and islands. (Interagency OGR Review Team 2018 at 7). The replacement acres are north of the impacted acres and do not provide the same level of connectivity between reserves on POW and reserves on Tuxekan Island.

b. Roadless Rule Rollback

The Roadless Rule Rollback jeopardizes the viability of Archipelago wolves in Southeast Alaska and health of the entire Tongass ecosystem. Roadless protections have long been recognized as integral to the species viability on the Tongass. In 1997 roadless protections were seen as connected to the Old-Growth Habitat Conservation Strategy under the Tongass Forest Plan. According to the 1997 Forest Plan, "[t]he Comprehensive Old-Growth Habitat Strategy in the Forest Plan also is responsive to the PNW Review recommendation to not further fragment existing blocks of high-volume old growth by incorporating many existing roadless areas in reserves." (LRMP FEIS 1997 at Appendix N, at N-25). In 2001, the rationale for adopting the Roadless Rule and applying it to the Tongass particularly recognized the importance of inventoried roadless areas to the overall ecosystem health of the Tongass, explaining that the natural fragmentation of the Tongass makes it uniquely sensitive to further fragmentation. (66 Fed. Reg. 2354-2355, USFS 2000 at 3-372). The FEIS for the 2001 Roadless Rule stated that with intensive logging in some areas of the Tongass (like Prince of Wales), allowing further logging in roadless areas could pose a risk to species viability. (USFS 2000 at 3-374-375).

Most recently, in a 2016 evaluation of the Old-Growth Habitat Conservation Strategy, the Forest Service recognized that the Roadless Rule contributed to the effectiveness of the conservation strategy: "[M]ost importantly, with the 2001 Roadless Rule in effect, inventoried roadless areas (approximately 2,143,000 acres of development LUDs in roadless areas containing about 823,000 acres of POG) make a major contribution to the maintenance and ecological function on the Tongass National Forest but do so outside of the elements of the conservation strategy." (LRMP FEIS 2016 at D-20). The review also stated that, "inventoried roadless areas maintain additional old-growth forest that augment the amount maintained by the contributing elements of the conservation strategy (USDA Forest Service 2008c, page 21)." (LRMP FEIS 2016 at D-7). These conclusions are all based on the assumption that roadless areas will be protected; that assumption is erroneous given that impending rollback of Roadless Rule protections.

Subcommittee on Public Lands and Forests of the Committee on Energy and Natural Resources, United States Senate, 111th Congress (Oct 8, 2009), Appendix I, at 88, available at https://books.google.com/books?id=ip7Vh1HzKL4C&pg ("These lands represent a significant component of the TLMP conservation strategy area for wildlife. Loss of these old-growth areas would likely undermine the conservation strategy in TLMP and potentially lead to threatened and endangered species listings [for the goshawk and wolf].").

c. Regulatory mechanisms governing logging and road construction on state and private lands are inadequate.

The 2015 USFWS Status Assessment acknowledges that logging on State and private lands is "often more intensive than on the Tongass" because the Alaska Forest Resources and Practices Act (FRPA) is "generally less restrictive" than the Tongass Forest Plan. (USFWS SSA 2015 at 49). For example, the FRPA has no limitation on clear-cut size. As a result, rates of logging are even higher on state and private lands than on Tongass National Forest lands. For example, Native Corporations, which own 3% of the land area, account for roughly one-third of the area logged in Southeast Alaska. (USFWS SSA 2015 at 49). To date, Native Corporations have logged 56% of productive forest while the state of Alaska has logged 13% of productive forest. *Id.* In the FEIS for the 2016 Forest Plan, the Forest Service projected that 75% of the remaining productive old-growth would be logged on Native Corporation lands and 50% would be logged on state lands, other private lands, and lands owned by municipalities over the life of the Forest Plan (100 years). (LRMP FEIS 2016 at 3-216). The FEIS further noted that "Native corporation lands adjacent to the Tongass National Forest support extensive timber harvest operations and old-growth forest wildlife habitat capability on Native corporation lands (especially that for deer) has declined," particularly on Prince of Wales and Kupreanof. (LRMP FEIS 2016 at 4-340). High levels of logging and road construction on state and Native Corporation lands demonstrate that management of non-federal lands, with few mechanisms for wolf protection, cannot be relied on to protect wolves.

2. Existing Regulatory Mechanisms Are Inadequate to Mitigate Overexploitation from Trapping and Hunting.

In its 2016 Finding, the USFWS determined that trapping and hunting regulations in GMU 2 are "inadequate to avoid exceeding sustainable harvest levels of Alexander Archipelago wolves." (81 Fed. Reg. 450). The USFWS recommended more precautionary regulations that "consider total harvest of wolves, including loss of wounded animals, not just reported harvest." (81 Fed. Reg. 450).

The inadequacy of existing regulation for trapping and hunting was underscored during the 2019-2020 trapping and hunting season, when ADFG and the Board of Game abandoned the recommendations of the Wolf Habitat Management Program developed for GMU 2 and eliminated trapping limits and in-season monitoring of trapping mortality. As a result, an unprecedented 165 wolves were legally killed in GMU 2 during the two-month trapping season, not including wolves illegally killed and unreported.

Current regulatory mechanisms are inadequate to regulate both legal and illegal hunting and trapping of the Archipelago wolf across Southeast Alaska for a number of reasons. First, the state does not monitor wolf populations outside GMU 2, set a hunting and trapping quota for wolves, or conduct in-season monitoring of trapping and hunting mortality. Even in GMU 2, previous wolf quotas (now eliminated) were set based on wolf numbers during fall of the prior year rather than estimates that more closely reflect abundance at the beginning of hunting and trapping seasons. Second, there is a lack on-the-ground enforcement during wolf trapping and hunting season to reduce illegal killing. To address this, the Wolf Program for GMU 2 recommends increasing the number of enforcement personnel on the ground during wolf trapping and hunting season, including at the beginning of the season and pre-season to help ensure limits are not surpassed, as well as requiring identification of trap ownership. (Wolf Technical Committee 2017 at 24). Third, regulations for road densities and road closures are inadequate. The Wolf Program suggests establishing regulatory closures to wolf hunting and trapping along roads within WAAs where there are wolf mortality concerns. (*Id.* at 25). The Wolf Program also suggests establishing a controlled use area within the roaded portion of central and northcentral POW, within which a motorized vehicle cannot be used to assist with wolf hunting or trapping. (*Id.*). Yet none of the trapping and hunting recommendations in the Wolf Program are being implemented by the responsible state and federal agencies.

3. Existing Regulatory Mechanisms are Inadequate to Mitigate the Harms of Anthropogenic Climate Change to the Archipelago Wolf.

The United States has contributed more to climate change than any other country. The U.S. is the world's biggest cumulative emitter of greenhouse gas pollution, responsible for 25 percent of cumulative global CO_2 emissions since 1850 and is currently the world's second highest emitter on an annual and per capita basis. (LeQuéré et al. 2018). However, U.S. climate policy is wholly inadequate to meet the international Paris Agreement target to avoid the worst damages from the climate crisis. As summarized by the Fourth National Climate Assessment, efforts to mitigate greenhouse gas emissions do not approach the scale needed to avoid "substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades":

> Climate-related risks will continue to grow without additional action. Decisions made today determine risk exposure for current and future generations and will either broaden or limit options to reduce the negative consequences of climate change. While Americans are responding in ways that can bolster resilience and improve livelihoods, neither global efforts to mitigate the causes of climate change nor regional efforts to adapt to the impacts currently approach the scales needed to avoid substantial damages to the U.S. economy, environment, and human health and well-being over the coming decades. (USGCRP 2018 at 34).

In 2016, the U.S. committed to holding the long-term global average temperature to well below 2°C and "to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" under the international Paris Agreement.[26] Existing U.S. domestic laws including the Clean Air Act, Energy Policy and Conservation Act, Clean Water Act, Endangered Species Act, and others provide authority to executive branch agencies to require greenhouse gas emissions reductions from virtually all major sources in the U.S., sufficient to meet the Paris Agreement climate targets.

However, the Trump administration has focused on pushing through harmful rollbacks of federal climate policy, and federal agencies are either failing to implement or only partially implementing domestic law and policy mandating greenhouse gas reductions. Trump administration rollbacks of federal climate policy include rescinding the Climate Action Plan, repealing and replacing the Clean Power Plan, a plan to dramatically expand offshore oil drilling in all oceans along U.S. coast, an attempt to rescind the Obama-era withdrawal of offshore drilling in U.S. federal waters in most of the Arctic and parts of the Atlantic, lifting of the moratorium on new federal coal leases, weakening emissions standards for cars and light duty trucks, delaying the implementation of methane emissions standards for new and modified oil and gas facilities, and the intended withdrawal from the Paris Agreement. (Wentz and Gerard 2019).

As a result, current U.S. climate policy has been ranked as "critically insufficient" by an international team of climate policy experts and climate scientists who concluded in 2017 that "[t]hese steps represent a severe backwards move and an abrogation of the United States' responsibility as the world's second largest emitter at a time when more, not less, commitment is needed from all governments to avert the worst impacts of climate change." (Climate Action Tracker 2017 at 1).

4. Existing Regulatory Mechanisms are Inadequate to Protect Archipelago Wolf Populations from Inbreeding Depression.

The 2016 Tongass Forest Plan fails to set adequate management standards and guidelines for Archipelago wolves that protect wolf populations—particularly on islands—from loss of genetic diversity and inbreeding depression. First, the 2016 Tongass Forest Plan does not treat the wolf islands of the Tongass National Forest as individual communities, even though research indicates that movement between islands may be minimal and, in some cases, relictual populations of mammals on islands may have high evolutionary significance for the entire species' diversity (Cook et al. 2006 at 1), as in the case of the Archipelago wolf. (Weckworth et al. 2005 at 927). This is particularly problematic for the POW wolf population, which functions as an isolated, genetically distinct, interbreeding unit. (Zarn 2019). In addition, the 2016 Tongass

[26] United Nations Framework Convention on Climate Change, Conference of the Parties Nov. 30-Dec. 11, 2015, Adoption of the Paris Agreement Art. 2, U.N. Doc. FCCC/CP/2015/L.9 (Dec. 12, 2015) ("Paris Agreement"). The United States signed the Paris Agreement on April 22, 2016 as a legally binding instrument through executive agreement, and the treaty entered into force on November 4, 2016.

Forest Plan does not adequately address the heightened risk of declines and extinctions of small, isolated wolf populations. Not only are human threats often magnified on islands, but insular populations cannot easily be recolonized or “rescued” by neighboring populations if population numbers fall to low levels. (Weckworth et al. 2005 at 926-927).

Further, the 2016 Tongass Forest Plan fails to address the increased risk of detrimental loss of genetic diversity in Archipelago wolf populations, as is already apparent in the POW population. Management measures to counteract loss of genetic variation in gray wolf populations should reduce threats, promote natural dispersal dynamics, and maintain wolf social dynamics to promote inbreeding avoidance and normal pack formation and function. (Vonholdt et al. 2008 at 268-270). Important management actions to promote successful dispersal and pack stability include the maintenance of high-quality core habitat including buffer zones around source populations and dispersal corridors; and regulations to prevent unsustainable hunting and trapping. Maintaining high quality habitat helps to sustain recent levels of genetically effective dispersal and enhance natural evolutionary processes and ecological dynamics in large protected areas. (Vonholdt et al. 2008 at 270, Vonholdt et al. 2010 at 4423). Preventing unsustainable hunting and trapping helps to protect the continuity of pack systems and their genetic health. For example, the removal of breeding pairs may alter the stability of pack dynamics, leading to higher breeder turnover and more frequent occurrence of inbreeding as mating choices become limited to close relatives. (Vonholdt et al. 2008 at 270). However, the 2016 Tongass Forest Plan does not ensure the adequate protection of core habitat and dispersal corridors for Archipelago wolves, nor does it adequately address unsustainable hunting and trapping mortality.

D. Other Natural or Manmade Factors Threaten the Continued Existence of the Archipelago Wolf: The Climate Crisis and Inbreeding Depression.

1. The Climate Crisis Threatens the Archipelago Wolf.

Anthropogenic climate change poses an intensifying threat to the Archipelago wolf. Climate change may result in the increased frequency of severe winter storm events that adversely affect the wolf’s primary prey species, the Sitka black-tailed deer. Climate change threatens salmon—an important seasonal food sources for wolves—by increasing water temperatures, decreasing summer stream flows, increasing sea levels, and the increasing frequency, intensity and duration of marine heat waves. Climate change is also leading to a significant change in forest composition and structure in Southeast Alaska due to climate-related die-offs of yellow cedar, which may have detrimental impacts on deer populations that rely on closed-canopy old-growth forests in winter.

a. Alaska is on the front lines of the climate crisis.

The U.S. federal government has repeatedly recognized that human-caused climate change is causing widespread and intensifying harms across the country in the authoritative National Climate Assessments, scientific syntheses prepared by hundreds of scientific experts and reviewed by the National Academy of Sciences and federal agencies including the Department of Interior. Most recently, the Fourth National Climate Assessment, comprised of the 2017 *Climate Science Special Report* (Volume I)[27] and the 2018 *Impacts, Risks, and Adaptation in the United States* (Volume II),[28] concluded that "there is no convincing alternative explanation" for the observed warming of the climate over the last century other than human activities. (USGCRP 2017 at 10). It found that "evidence of human-caused climate change is overwhelming and continues to strengthen, that the impacts of climate change are intensifying across the country, and that climate-related threats to Americans' physical, social, and economic well-being are rising." (USGCRP 2018 at 36).

The Fourth National Climate Assessment highlighted the extreme pace of climate change occurring in Alaska. As summarized by the Alaska chapter of the Climate Assessment:

> Alaska is on the front lines of climate change and is among the fastest warming regions on Earth. It is warming faster than any other state, and it faces a myriad of issues associated with a changing climate.
>
> The rate at which Alaska's temperature has been warming is twice as fast as the global average since the middle of the 20th century.
>
> In Alaska, starting in the 1990s, high temperature records occurred three times as often as record lows, and in 2015, an astounding nine times as frequently. (Markon et al. 2018 at 1190).

b. Extreme snowfall events harm deer populations.

Anthropogenic climate change may increase the frequency of extreme weather events, including severe winter storm events that result in above-normal snowfalls that cause deer populations to decline. As summarized by the Wolf Technical Committee, "snow conditions are likely to change in southeast Alaska in the coming decades. While most models for southeast Alaska predict reductions in snowpack, earlier snow melt, and lengthened growing season, most also predict more severe and more frequent periodic storm events (Haufler et al. 2010, Wolken et

[27] U.S. Global Change Research Program, Climate Science Special Report: Fourth National Climate Assessment, Vol. I (2017), https://science2017.globalchange.gov/.
[28] U.S. Global Change Research Program, Impacts, Risks, and Adaptation in the United States, Fourth National Climate Assessment, Volume II (2018).

al. 2011, Shanley et al. 2015)." (Wolf Technical Committee 2017 at 6). Other studies project that extreme snowfalls will continue to occur in Alaska even as temperatures warm due to climate change. (O'Gorman 2014, Winski et al. 2017, Lader et al. 2018 at 184). Extreme winters, not average winters, affect Sitka black-tailed deer the most, and the effects of hard winters can be very long-lasting. (LRMP FEIS 2008 at 3-267, 268, 282, 296). Stochastic events (e.g., storm- or snowfall-related events) have been identified by scientists as very significant concerns for wolves and deer.

Deer depletion caused by heavy snowfall on islands in Southeast Alaska is especially concerning because immigration and emigration are often low, making deer susceptible to long-term population crashes. (Person et al. 1996). For example, in the early 1970s, a series of hard winters caused deer population crashes in GMU 3 on Kuiu, Kupreanof and Mitkof islands. (Schoen and Kirchoff 2007 at 2). The relatively low numbers of deer that continue to persist within this management area reflect the long-term consequences of these climatic events. (*Id.*). As summarized by Person and Brinkman (2013):

> Mortality of deer from malnutrition, disease, and predation often is high during [severe] winters (Schoen *et al.* 1988; Farmer *et al*. 2006; Person *et al*. 2009; Brinkman *et al*. 2011). Climate change may bring milder winter conditions on average, and it is tempting to speculate that winter habitat will become less important in the future (Scenarios Network for Alaska Planning 2009). Nonetheless, precipitation and probability of extreme storms may increase, and with it, risks of deep snow. Indeed, despite almost 30 consecutive years of relatively mild conditions, extreme snowfall occurred during the winter of 2006–2007 that substantially reduced deer numbers throughout southeast Alaska. Predation during and shortly after those winters can drive ungulate populations to very low levels, from which it may take years to recover. Consequently, it is not average conditions that really matter, but the probability of extreme events. (Person and Brinkman 2013 at 149).

c. Climate change threatens salmon by increasing water temperatures, decreasing summer stream flows, increasing sea levels, and increasing the frequency, intensity and duration of marine heat waves.

Climate change is likely to have adverse impacts on salmon populations in Southeast Alaska (Bryant 2009, Crozier et al. 2018) which provide an important seasonal food source for Archipelago wolves. Climate change is increasing stream, lake and ocean temperatures, decreasing summer stream flows, and increasing sea levels which are predicted to have a wide variety of harmful impacts to salmon in Southeast Alaska including likely risks of pre-spawner and egg and embryo mortality events for pink and chum and degraded sockeye lake habitat and juvenile coho rearing habitat. (Bryant 2009 at 176-181). A review of climate change impacts on

Southeast Alaska salmon highlights that "most pervasive anthropogenic effect" on salmon habitat is logging (*Id.* at 182) and that habitat conservation will be important to the survival of sustainable populations (*Id.* at 169):

> The response of anadromous salmonids will differ among species depending on their life cycle in freshwater. For pink and chum salmon that migrate to the ocean shortly after they emerge from the gravel, higher temperatures during spawning and incubation may result in earlier entry into the ocean when food resources are low. Shifts in thermal regimes in lakes will change trophic conditions that will affect juvenile sockeye salmon growth and survival. Decreased summer stream flows and higher water temperatures will affect growth and survival of juvenile coho salmon. Rising sea-levels will inundate low elevation spawning areas for pink salmon and floodplain rearing habitats for juvenile coho salmon. Rapid changes in climatic conditions may not extirpate anadromous salmonids in the region, but they will impose greater stress on many stocks that are adapted to present climatic conditions. Survival of sustainable populations will depend on the existing genetic diversity within and among stocks, conservative harvest management, and habitat conservation. (*Id.* at 169).

In addition, Sergeant et al. (2017) described monitoring results for dissolved oxygen regimes in relation to salmon density in small streams of southeastern Alaska with high densities of spawning pink and chum salmon. The modeling results indicated that low summertime river discharge is a precursor to density-induced oxygen depletion. Climate models predict that snowfall in winter and rainfall in summer are likely to decrease in southeastern Alaska. These projected decreases in precipitation are expected to lead to lower summertime flows and a higher frequency of hypoxic conditions for salmon.

Importantly, marine heatwaves (MHWs)—persistent extremely warm ocean temperatures—are already having severe negative impacts on coastal and ocean ecosystems, including the Gulf of Alaska, and pose escalating threats to salmon populations in Southeast Alaska. Long-term ocean warming since the early 20th century due to human-induced increase in greenhouse emissions has led to widespread increases in MHW frequency, intensity and duration. (Frolicher et al. 2018, Oliver et al. 2018). Globally, the frequency of MHWs has doubled since 1982, and is projected to dramatically increase under continued global warming—by a factor of 16 for global warming of 1.5°C relative to preindustrial levels and by a factor of 41 for global warming of 3.5°C which is projected to occur under current national climate policies. (Frolicher et al. 2018 at 360). A recent study of MHWs by Frolicher et al. (2018) concluded that "our results suggest that MHWs will become very frequent and extreme under global warming, probably pushing marine organisms and ecosystems to the limits of their resilience and even beyond, which could cause irreversible changes." (Frolicher et al. 2018 at 360).

In Southeast Alaska, a large MHW in the northeast Pacific known as the “blob” occurred off the coast of Alaska from 2013 to 2015 (Walsh et al. 2017) and had negative impacts on salmon populations. (Cavole et al. 2016). It was the largest MHW globally since 1982 with sea surface temperature anomalies of over 6°C. (Cheung and Frolicher 2020 at 1). The anomalously high temperatures increased upper ocean stratification, leading to a decrease in nutrient supply to the surface ocean and causing a decrease in net primary production and community production. (Cheung and Frolicher 2020 at 1). This MHW was found to be up to fifty times more likely due to anthropogenic warming. (Oliver et al. 2018 at S44). The sequence of consecutive record-breaking temperatures in 2014–2016 had a negligible (<0.03%) likelihood of occurring in the absence of anthropogenic warming. (Mann et al. 2017 at 7936).

Because coho salmon rely on lipid-rich, cold-water copepod species to sustain their growth, particularly during their early life stages, the decline in cold-water copepod abundance during the 2013-2015 MHW decreased coho salmon recruitment and increased mortality rates. (Cavole et al. 2016 at 278). During warm-water conditions, Chinook salmon substitute preferred lipid-rich krill with lower-quality prey when krill are not available, leading to decreases in body condition. (Cavole et al. 2016 at 278). During the 2013-2015 MHW, Chinook salmon were observed to consume less krill and to move northward, likely searching for suitable ocean conditions and food. (Cavole et al. 2016 at 278).

A modeling study by Cheung and Frolicher (2020) projected that MHWs will have large and escalating negative impacts on salmon populations in the Gulf of Alaska. Overall, the study showed that MHWs cause biomass decreases and shifts in biogeography across 22 fish species in the northeast Pacific that are at least four times faster and bigger in magnitude than the effects of decadal-scale mean changes throughout the 21st century. (Cheung and Frolicher 2020 at 1). The study concluded that “MHWs can more than double the magnitude of the impacts on fish stocks by 2050 due to long-term climate change.” (Cheung and Frolicher 2020 at 5).

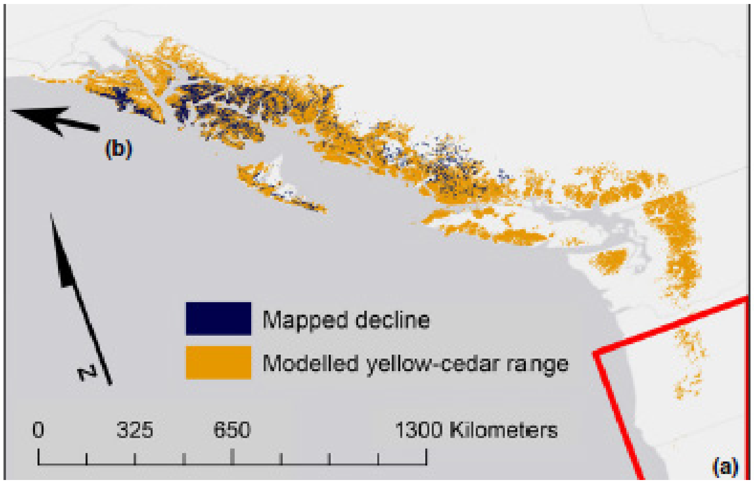
Among the five studied Pacific salmon species in the Gulf of Alaska, projected biomass of sockeye salmon (*Oncorhynchus nerka*) decreased most substantially and most consistently under MHWs, followed by coho salmon (*O. kisutch*), chum (*O. keta*), and pink salmon (*O. gorbuscha*). (Cheung and Frolicher 2020 at 5, Figure 4). Biomass of sockeye salmon in Gulf of Alaska was projected to drop by 30% by 2100 relative to 2000 due to MHWs in addition to the long-term population decreases under RCP8.5 warming scenario. (Cheung and Frolicher 2020 at 5, Figure 5). Due to both MHWs and changes in mean conditions, biomass of sockeye salmon was projected to drop by more than 40% by 2100 relative to 2000 under RCP8.5. (Cheung and Frolicher 2020 at 5). The study noted that “MWHs will exert large impact ‘shocks’ while fish stocks are already impacted by long-term mean climate change.” The study concluded that “our findings provide theoretical support to the empirical observations from scientific surveys and anecdotal accounts from fishers that fisheries important fish stocks such as Pacific cod and sockeye salmon had been impacted by the 2013–2015 northeast Pacific" and that "previous vulnerability and impact assessments have therefore greatly underestimated the risk to future fish stocks and fisheries in the northeast Pacific under climate change." (Cheung and Frolicher 2020 at 5). Because climate change threatens an important prey for Archipelago wolves, it threatens the survival of the wolves themselves.

4. Climate change is driving changes in forest composition and canopy cover due to yellow cedar die-offs.

New information since the 2016 Finding on observed and projected climate-change-driven losses of yellow cedar (*Chamaecyparis nootkatensis*) in Southeast Alaska raise cause for concern that continuing yellow cedar die-offs may significantly change forest structure, including the potential creation of thinner canopies and more open forest stands. Given the importance of closed canopy old-growth stands for the Sitka black-tailed deer in winter, the creation of more open forest stands may have detrimental impacts on deer abundance with resulting adverse impacts on wolf populations.

Buma et al. (2017) presented the first high-resolution range map of yellow cedar documenting the magnitude and location of observed mortality in Southeast Alaska. Yellow cedar declines have been linked to climate change as warmer winters, reduced snowpack and increasing freeze-thaw events make trees susceptible to root damage and early dehardening. Buma et al. (2017) concluded that snow-cover-loss-related mortality of yellow cedar spans approximately 10° latitude (half the native range of the species), appears linked to the snow–rain transition across its range, and mortality is commonly >70% of basal area in affected areas. (Buma et al. 2017 at 2903). The mapped decline of yellow cedar illustrated in Figure 8 below clearly shows that observed yellow cedar losses are concentrated in important wolf habitat in GMUs 2, 3, 1A and 1B. (Buma et al. 2017 at Figure 2).

Figure 8. Observed mortality of yellow cedar in Southeast Alaska. Source: Buma et al. 2017 at Figure 2.



Furthermore, by 2070, substantial areas of yellow-cedar forests in Southeast Alaska are expected to shift to above-freezing mean winter temperatures, increasing yellow cedar vulnerability to mortality. (Buma et al. 2017 at 2908, Figure 4). Importantly, the study noted that "[r]egardless of climate change scenario, little of the range which is expected to remain suitable in the future (e.g., a climatic refugia) is in currently protected landscapes (<1–9%)." (Buma et al. 2017 at 2908). In short, the concentration of observed and projected climate-change-driven yellow cedar die-offs in Archipelago wolf habitat in Southeast Alaska raises cause for concern that loss of canopy cover during winter may further harm deer populations and wolves.

2. Loss of Genetic Diversity and Inbreeding Depression Threaten the Archipelago Wolf.

Archipelago wolves in Southeast Alaska are vulnerable to loss of genetic diversity and associated inbreeding depression due to small population size, minimal movement among some island populations, and the magnified effects of anthropogenic threats to island ecosystems. New genetic evidence indicates that wolves on POW are presently at risk of inbreeding depression, and that wolves on the islands of GMUs 3 and 1A also show evidence of inbreeding, putting them at risk for loss of genetic diversity.

Specifically, a new genetics study by Zarn (2019) concluded that wolves on POW are already experiencing high levels of inbreeding and are at risk of inbreeding depression due to population declines spurred by habitat loss and high trapping and hunting mortality, combined with the relative isolation of the POW population. (Zarn 2019 at 13, 15). Zarn (2019) also found that wolves primarily from the islands of GMUs 3 and 1A had the highest level of total genomic inbreeding, followed by POW wolves. (Zarn 2019 at 12). Zarn (2019) stated that their study results refute the 2016 USFWS Finding's conclusion that inbreeding is likely not affecting the POW population (Zarn 2019 at 16), and instead cautioned that the consideration of inbreeding risks must be integrated into the management of POW wolves to avoid the population entering an extinction vortex. (Zarn 2019 at 17).

Zarn (2019) noted that "Alexander Archipelago wolves on Prince of Wales Island (POW) in Southeast Alaska are a small, isolated population of conservation concern that have experienced habitat loss and high harvest rates." (Zarn 2019 at iii). Given the geographic isolation, habitat loss, and high trapping and hunting levels on POW, the study used genome-wide single nucleotide polymorphism (SNP) genotypes to "understand whether wolves on POW were more inbred than wolves elsewhere in Southeast Alaska." (Zarn 2019 at 5).

The study used the F_{ROH} measure of inbreeding to quantify the proportion of the Archipelago wolf genome that is identical by descent. To avoid problems inherent in traditional measures of inbreeding using F_P and F_H, the F_{ROH} approach provides a direct—and more accurate and precise—measure of the proportion of an individual's genome that is identical by descent by using genomic sequence data to identify runs of homozygosity throughout the genome and to make inferences about the number of generations back to the common ancestor(s) of the parents of inbred offspring. The length of "runs of homozygosity" or "ROHs" indicates the level of inbreeding. Inbreeding events (where there are recent common parental ancestors) produce long stretches of the genome that are identical, while more distant common parental ancestors produce shorter ROHs. Longer ROHs (greater than 10 million base pairs)—indicating recent inbreeding events—contribute more to inbreeding depression and decreased fitness because they contain disproportionately higher fractions of deleterious alleles that have disproportionately strong and negative effects on fitness. (Zarn 2019 at 6, 14).

The study sampled wolves from across Southeast Alaska and determined that genetic differences supported three ancestral populations of wolves. These included a POW group that consisted of 15 individuals from POW, Dall, Long, and Suemez Islands (GMU 2). A southeast group consisted of 31 individuals from Kuiu, Kupreanof, Mitkof, and Duke Islands with one wolf from POW, and the mainland east of Lynn Canal (GMUs 1A, 1B, 1C, 2, 3). A northwest group consisted of 13 individuals from Pleasant Island, Spurt Cove, and the mainland west of Lynn Canal (GMUs 1C, 1D, 4Z, 5A). (Zarn 2019 at 9). The study found that wolves in the POW and southeast groups had lower heterozygosity than wolves in the northwest group. (Zarn 2019 at 11). Importantly, there were marked differences in recent inbreeding (represented by $F_{ROH} \geq$ 10Mb, meaning runs of homozygosity greater than 10 million base pairs) and total genomic inbreeding (represented by $F_{ROH} \geq$ 100kb, meaning runs of homozygosity greater than 100,000 base pairs) among these groups. (Zarn 2019 at 14).

The study's "most striking result" was that "POW wolves have experienced very high levels of inbreeding in the recent past, and are comparable to a population of wolves on Isle Royale National Park (IRNP) that was founded by just two to three individuals" (Zarn 2019 at 13) and "is known to have exhibited severe inbreeding depression."[29] (Zarn 2019 at 14). Specifically, the POW group had significantly higher amounts of very long ROHs greater than 10 million base pairs (i.e., $F_{ROH} \geq$ 10Mb) than wolves in the southeast or northwest groups, indicative of recent inbreeding events. The study concluded that the similar inbreeding patterns between POW and IRNP indicate that POW wolves "may be at high risk for exhibiting inbreeding depression." (Zarn 2019 at 15). Furthermore, based on medium-length ROH ($F_{ROH} \geq$ 1Mb, meaning 1 million base pairs), wolves on POW have the highest genomic inbreeding estimates, even when compared to IRNP wolves. (Zarn 2019 at 14).

[29] As Zarn (2019) notes at 14-15: "the IRNP population was founded by just two or three individuals in the late 1940s (Wayne et al. 1991), peaked at 50 individuals in 1980 (Peterson et al. 2014), and received one immigrant in 1997 (Adams et al. 2011) before successful reproduction stopped in 2014 as the result of severe inbreeding depression (Peterson and Vucetich 2016)." It is important to note that the National Park Service recently approved supplementing the population through wolf introductions after the population plummeted to just two individuals (*see* https://www.nps.gov/isro/learn/news/press-release-national-park-service-releases-record-of-decision-to-introduce-wolves-at-isle-royale-national-park.htm).

The study attributed the loss of genetic diversity and vulnerability to inbreeding depression on POW to geographic isolation paired with high levels of habitat loss from logging and high levels of trapping and hunting mortality. (Zarn 2019 at iii, 3, 5, 6, 15, 17). The study noted that wolves on Prince of Wales Island are isolated from the mainland by one long swim (~6.2 km) or at least five shorter swims (longest straight-line swim 2.7 km) through strong ocean currents. Although it is likely that wolves can move between the mainland and POW, the study results "show that there is sufficient isolation between the mainland and POW that the two groups are readily distinguished from one another in both PCA and Admixture analyses, and migration from the mainland population does not appear to be mitigating inbreeding on POW." (Zarn 2019 at 15). The study emphasized that old-growth forests on POW have been heavily logged since the 1950s, resulting in decreased habitat for both wolves and their main prey, Sitka black-tailed deer, and that the wolf population on POW has also experienced heavy trapping and hunting mortality in recent years. (Zarn 2019 at 3, 5, 6, 7, 15, 17). The study warned that the "low population estimate of 2014 likely resulted in increased mating events between related individuals in subsequent years, and it is therefore probable that wolves currently on POW have higher inbreeding coefficients than reported in this study unless recent successful migration from the mainland has also occurred." (Zarn 2019 at 15).

Zarn (2019) concluded that wolves on POW may be reaching a point of showing signs of inbreeding depression: "In context of previous studies on inbreeding and inbreeding depression in wild wolf populations, our data suggest that wolves on POW may be approaching a point at which they have already or will soon begin to exhibit signs of inbreeding depression given their geographic isolation, recent low population estimates, and evidence of high proportions of the genome being in long runs of homozygosity." (Zarn 2019 at 15). Zarn (2019) noted that at least three wolves in the POW complex have been observed with shortened tails in recent years, which could be the result of "skeletal malformations with a genetic basis and caused by inbreeding, and are perhaps similar to the vertebral defects that have been observed in the highly inbred wolves on IRNP." (Zarn 2019 at 15).

Zarn (2019) also found that measures of total genomic inbreeding (i.e., the highest mean $F_{ROH} \geq$ 100,000 base pairs) indicated that the southeast group—wolves on GMUs 1A, 1B, 1C, 2, 3 primarily from Kuiu, Kupreanof, Mitkof, and Duke Islands with a few from the mainland east of Lynn Canal—had the highest level of total genomic inbreeding, followed by the POW group with an intermediate level of total genomic inbreeding, followed by IRNP, followed by the northwest group. (Zarn 2019 at 12). The study noted that "it is unclear what might be driving heightened total inbreeding in this region [i.e., the southeast group], but there is potential historic geographic isolation may be driving this pattern. Geographic barriers like large inlets and fjords may reduce connectivity between packs in this region, resulting in decreased opportunities for wolves to mate with unrelated individuals." (Zarn 2019 at 14). Finally, wolves in the northwest group had the lowest F_{ROH} estimates "indicating that this population is relatively large and/or genetically connected with nearby populations." (Zarn 2019 at 14).

Zarn (2019) specifically stated that these study results "are strongly contrary" to the USFWS conclusion in the 2016 Finding that inbreeding is likely not affecting the POW population:

> The FWS also found that "inbreeding likely is not affecting the [POW] population despite its comparatively small size and insularity" based on the fact that wolves on POW had lower FH estimates than wolves in GMU 1 (the southeast region of our study area; Breed 2007; Fish and Wildlife Service 2016). The data we present are strongly contrary to this conclusion. We observed that POW wolves have the highest $F_{ROH} \geq 1$Mb and $F_{ROH} \geq 10$Mb estimates compared to the other two Alaska populations in our study. We also observed that POW wolves have similar $F_{ROH} \geq 10$Mb as IRNP wolves, which have demonstrated severe inbreeding depression (Räikkönen et al. 2009; Robinson et al. 2019). (Zarn 2019 at 16).

The study instead concluded that "inbreeding "can pose significant threats" to small, isolated populations such as POW wolves, and that inbreeding must be considered when managing these populations to avoid spiraling into an extinction vortex:

> [I]nbreeding is potentially a hidden and insidious threat to small, isolated populations, especially for populations which are difficult to monitor, like POW wolves. Inbreeding can pose significant threats to small, isolated populations, and these threats are difficult to rectify without substantial and costly management action (e.g. translocation of individuals from outside populations) to provide a genetic rescue to the inbred population. There are many challenges involved with translocating individuals, including risk of mortality during translocations and ensuring that translocated individuals are genetically compatible to the recipient population. It is therefore important to consider inbreeding when defining minimum population targets and to monitor inbreeding to avoid allowing a population to enter an extinction vortex. (Zarn 2019 at 17).

In sum, new genetic evidence indicates that wolves on POW are at high risk of inbreeding depression, and that wolves on the islands of GMUs 3 and 1A are also vulnerable.

Conclusion

The best-available science demonstrates that the Alexander Archipelago wolf in Southeast Alaska is threatened by immediate, high-magnitude threats—principally logging, road building, legal and illegal trapping and hunting, anthropogenic climate change, inbreeding depression, and the inadequacy of existing regulatory mechanisms—and needs the urgent protections of the U.S. Endangered Species Act with concurrent designation of critical habitat to ensure its survival and recovery.

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