BEFORE THE SECRETARY OF INTERIOR

PETITION TO LIST THE ALEXANDER ARCHIPELAGO WOLF (*CANIS LUPUS LIGONI*) AS THREATENED OR ENDANGERED UNDER THE UNITED STATES ENDANGERED SPECIES ACT

CENTER FOR BIOLOGICAL DIVERSITY, PETITIONER
GREENPEACE, PETITIONER
AUGUST 10, 2011

NOTICE OF PETITION

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__________________________ Date this 10 day of August 2011

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 and Greenpeace (collectively "Petitioners") hereby petition the Secretary of the Interior, through the United States Fish and Wildlife Service ("USFWS"), to list the Alexander Archipelago wolf (*Canis lupus ligoni*) as a threatened or endangered species and to designate critical habitat to ensure its survival and recovery.

The Center for Biological Diversity works through science, law, and policy to secure a future for all species, great or small, hovering on the brink of extinction. The Center has 41,000 members throughout Alaska and the United States. The Center and its members are concerned with the conservation of endangered species, including the Alexander Archipelago wolf, and the effective implementation of the ESA.

Greenpeace, Inc. is a non-profit environmental organization, and its mission is to raise public awareness of environmental problems and promote changes that are essential to a green and peaceful future. The organization's involvement in forest issues concerning the National Forest System generally and particularly the Tongass National Forest and other forests of Southeast Alaska dates back to the early 1990s. Greenpeace's concerns have included the effects of logging-associated road construction on the Alexander Archipelago wolf in particular, as well as on ecosystems, roadless areas, fish, wildlife and hunting, and the protection of the last remnants of old-growth forest in the United States.

USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on USFWS. Specifically, 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). 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. While Petitioners believe that the best available science demonstrates that listing the Alexander Archipelago wolf as endangered *is* in fact 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, 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.

As described in this petition, the Alexander Archipelago wolf (*Canis lupus ligoni*) of Southeast Alaska is a currently recognized subspecies of the gray wolf and should be considered for listing as a distinct subspecies. While we believe that the petition clearly demonstrates that the Alexander Archipelago wolf is threatened or endangered throughout its range in Southeast

Alaska, we request that the USFWS recognize Prince of Wales Island as a significant portion of the range and consider the entire subspecies for listing based on the criteria that the subspecies is threatened or endangered "throughout all or a significant portion of its range." (16 U.S.C. § 1532). We also request that USFWS consider Prince of Wales Island wolves as a DPS of the Alexander Archipelago wolf based on marked differences in genetic, physical, and ecological characteristics, where Prince of Wales Island includes the associated islands of Kosciusko, Tuxekan, Heceta, Suemez, Dall, and others proximate to Prince of Wales.

In this Petition, we follow the accepted taxonomic classification of *Canis lupus ligoni* as a distinct subspecies encompassing the coastal wolves of island and mainland Southeast Alaska. However, we recognize that the taxonomic relationship between coastal wolves of Southeast Alaska and British Columbia is still being resolved. Therefore, we have included information on natural history, population status, and threats to wolves of British Columbia in Appendix A, in the event that the USFWS determines that the coastal wolves of Southeast Alaska and British Columbia may be part of the same subspecies.

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Executive Summary

The Alexander Archipelago wolf (*Canis lupus ligoni*) is a rare subspecies of the gray wolf with a limited worldwide range confined to Southeast Alaska. Within Southeast Alaska, the Alexander Archipelago wolf (hereafter "AA wolf") occurs along the narrow mainland to the west of the Coast Range and on many islands south of Frederick Sound, excluding Coronation, Forester, and smaller, more isolated islands. Large water barriers between islands and the mainland appear to limit dispersal of AA wolves within the region, and the tall coastal mountain range, which includes glaciers and ice fields, limits inward and outward migration with the rest of Alaska and the interior of the continent. AA wolves on Prince of Wales Island and associated islands appear to be isolated from other populations. Recent genetic studies highlight the conservation importance of the AA wolf, which harbors a large percentage of the remaining genetic diversity in the gray wolf species.

The AA wolf is the only wolf species found within the Alaskan portion of the largest remaining tract of temperate rainforest in the world, and fills an important ecological role as an apex predator in this unique ecosystem. The AA wolf primarily uses low-elevation old-growth forests for denning, foraging, and movement. The Sitka black-tailed deer (*Odocoileus hemionous sitkensis*), the primary ungulate species in the region, is the principal prey of the AA wolf, constituting as much as 77% of its diet. Sitka black-tailed deer also rely on old-growth forest as habitat, particularly during winter when the dense canopy intercepts heavy winter snow. Unlike wolves in most of North America, AA wolves make use of spawning salmon during late summer and autumn.

Although population estimates are uncertain, a team of interagency scientists estimated less than 1,000 AA wolves throughout Southeast Alaska in the 1990s. Wolf densities are generally higher on the islands than the mainland. Prince of Wales Island and associated islets and the large islands of Kuiu, Kupreanof, Mitkof, Etolin, Wrangell, and Zarembo are thought to support 60% to 70% of the total wolf population in Southeast Alaska, while Revillagigedo Island and the Cleveland Peninsula may support another 15% to 25%. Although population trends are difficult to assess, wolves are thought to have declined on Prince of Wales Island since the advent of large-scale logging in the 1950s. Recent evidence of diminished wolf sign from scats and tracks suggests that wolves may have declined on Prince of Wales Island in recent years and that the current wolf population may number around 150 animals, down from the prior estimate of ~250 to 300 animals in the mid-1990s.

In 1993 the Biodiversity Legal Foundation and two individuals filed a petition with the U.S. Fish and Wildlife Service to list the AA wolf as a threatened species under the U.S. Endangered Species Act. In August 1997 the agency issued a long-delayed 12-month finding that a listing was not warranted, on the basis of provisions for AA wolf management that the Forest Service had made in its May 1997 revision of the Tongass Land Management Plan.

The AA wolf is now in immediate need of the protections of the Endangered Species Act. Due largely to the inadequacy of existing regulatory mechanisms and chronic failures in management by government agencies, the AA wolf faces high magnitude, ongoing threats from

logging, road building, legal and illegal harvest, small and isolated population structure, and climate change. As a result, the principal threats identified in the 1993 listing petition persist, and new threats such as climate change have emerged.

Large-scale logging on the Tongass National Forest ("Tongass NF") and private and state lands poses a primary threat to the AA wolf because logging diminishes and fragments the low-elevation forest habitat that wolves need for denning, pup-rearing, and foraging; reduces the long-term carrying capacity of the wolf's principal prey, the Sitka black-tailed deer; increases the density of roads, which facilitates unsustainable legal and illegal hunting and trapping; disturbs wolf dens; and injures salmon runs that provide an important seasonal food source for wolves. Direct mortality from legal and illegal hunting and trapping poses another primary threat to the AA wolf because hunting and trapping appear to be occurring at unsustainable levels, where illegal harvest may account for as much as half of human-caused wolf mortality on the Tongass NF.

The AA wolf is more vulnerable to population declines, extinctions, and loss of genetic diversity than wolf species that inhabit the interior of the continent, due to its small, isolated, and largely island-based population structure. Climate change is likely to result in the increased frequency of severe winter storm events and above-normal snowfalls that adversely affect the wolf's primary prey species, the Sitka black-tailed deer, and climate change is already leading to a significant change in forest composition and structure in Southeast Alaska due to climate-related die-offs of yellow cedar.

Regulatory mechanisms have proven inadequate to protect the AA wolf from threats. The 1997 and 2008 Tongass Land Management Plan ("TLMP") standards and guidelines for the AA wolf, which are the primary mechanisms governing AA wolf management in Southeast Alaska, have proven unenforceable, ineffective, and speculative due to the Forest Service's history of misinterpretation of scientific recommendations in establishing and applying the standards and guidelines, as well as its chronic failure to enforce them. There are at least four reasons that the 1997 and 2008 TLMPs are inadequate:

(a) They do not adequately protect wolf populations from logging of old-growth forests. The 2008 TLMP allows a large percentage of the remaining large-tree old-growth to be logged in core habitat for the AA wolf on Game Management Units 2, 3, and 1A, and does not consider the cumulative impact to deer carrying capacity of logging on both federal and non-federal lands. In addition, the 2008 TLMP affords no control over logging on non-federal land and its impacts.

(b) They do not protect the AA wolf from road construction leading to unsustainable wolf mortality. Under the 1997 TLMP, the Forest Service repeatedly ignored the science-based recommendations for setting road density guidelines to protect the AA wolf from unsustainable hunting and trapping. The 2008 TLMP road management guidelines are vaguely written and rely heavily on agency discretion in implementing the guidelines. As recent timber projects have demonstrated, the Forest Service has chosen not to implement the TLMP measures for protecting wolves and has misconstrued or disregarded wolf mortality concerns raised by Alaska Department of Fish and Game ("ADF&G") scientists. The 2008 TLMP affords no control over road construction on non-federal land and its impacts.

(c) They have inadequate guidelines to protect wolf dens from disturbance from logging and road building, and these are operative only on national forest lands.

(d) They treat AA wolves like continental wolf populations and fail to account for their increased vulnerability to population declines and loss of genetic diversity due to their small, isolated, island-based population structure.

State and federal regulatory mechanisms for hunting and trapping of the AA wolf are similarly inadequate for setting sustainable harvest rates. Bag limits and harvest caps for legal hunting are ineffective because as much as half of the AA wolf harvest is illegal and unreported. ADF&G only sets a harvest cap in GMU 2, and this cap is based on uncertain estimates of population size that likely lead to overestimates of sustainable harvest rates. The Federal Subsistence Board regulations that govern the Tongass NF set no harvest caps, leaving the AA wolf vulnerable to overexploitation despite the State cap.

The reinstatement of the Roadless Rule on the Tongass NF does not protect the AA wolf from levels of logging and road-building that jeopardize the subspecies; moreover, the permanence of protections for roadless areas remains uncertain. In addition, regulatory mechanisms at the national and international level do not require the greenhouse gas emissions reductions necessary to protect the AA wolf from climate change.

In sum, the Alexander Archipelago wolf is currently in danger of extinction throughout all or a significant portion of its range due to ongoing, high-magnitude threats from logging, road building, legal and illegal harvest, small and isolated populations, climate change, and the inadequacy of existing regulatory mechanisms. Petitioners Center for Biological Diversity and Greenpeace request that the U.S. Fish and Wildlife Service list the Alexander Archipelago wolf under the U.S. Endangered Species Act to provide it with essential and much-needed protections, with concurrent designation of critical habitat.

Natural History & Biology of the Alexander Archipelago Wolf

I. Species Description

The Alexander Archipelago wolf is smaller than the continental gray wolf. Adult wolves in Southeast Alaska weigh an average 39.5 kilograms (kg) with females weighing about 6.8 kg less than the males (Person et al. 1996 (1996 Wolf Conservation Assessment)).[1] Wolves from individual islands may be smaller than the average sizes for the entire region. For example, wolves on Kosciusko Island and Prince of Wales Island weighed an average 34 kg with females weighing 1 kg less than males (Person et al. 1996). Although AA wolves are generally darker in color than other wolves in Alaska, color phases vary throughout the range of the AA wolf. According to harvest records and accounts, wolves on southern islands in the archipelago have predominantly brown or gray color (80%), with some black wolves (20%) and white wolves (less than 1%) (Person et al. 1996). On northern mainland areas, the black color phase is more common (50%) (Person et al. 1996).

II. Systematics

A. Taxonomy

1. The Alexander Archipelago wolf is a subspecies of the gray wolf

The Alexander Archipelago wolf (*Canis lupus ligoni*) is widely recognized as a distinct subspecies of the gray wolf *Canis lupus.* The Alexander Archipelago wolf was first described as a distinct subspecies by Goldman (1937). This description was based on physical characteristics including smaller size, shorter hair, and darker coloration than wolves in northern and interior Alaska (Goldman 1937). Goldman (1944), Mech (1974), and Hall (1981) (an authority on subspecific mammal classification) described 24 subspecies of wolves for North America based principally on morphometric analysis of skull measurements, including the subspecies *Canis lupus ligoni* in the Alexander Archipelago and adjacent mainland of Southeast Alaska. Pedersen (1982) used morphometric analyses to determine the taxonomic validity of the four described subspecies of wolves in Alaska: *Canis lupus alces, C. l. pambasileus*, *C. l. tundrarum*, and *C. l. ligoni*. Pedersen (1982) found little variation between these subspecies except for the distinct *C. l. ligoni*. Based on the abrupt morphometric differences between *C. l. ligoni* and interior Alaskan wolves, Pedersen (1982) suggested that wolves from southeast Alaska constitute a distinct population. Nowak (1983) and Friis (1985) also concluded that *C. l. ligoni* is morphometrically distinct from interior Alaskan and Canadian wolves (cited in Person et al. 1996). Current

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[1] The 1996 Wolf Conservation Assessment is an interagency study by scientists from Alaska Dept. of Fish & Game, US Fish & Wildlife Service, the Pacific NW Lab of the Forest Service, and the Forest Service's planning team for the 1997 Tongass Forest Plan. After the Forest Plan was adopted, the scientists not affiliated with Forest Service wrote complaint letters (Person et al. 1997) to the Forest Service's Alaska Regional Forester and the Tongass Forest Plan team leader. The letters noted that wolf and deer science was not properly incorporated in the new forest plan and requested that this be rectified.

taxonomic summaries (MacDonald and Cook 2009) consider the Alexander Archipelago wolf a distinct subspecies.

Federal agencies, including the USFWS and the U.S. Forest Service ("Forest Service"), have confirmed the taxonomic 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" (12-month Finding of Aug. 28, 1997).[2] The Forest Service recognized *C. l. ligoni* in Southeast Alaska as a distinct subspecies in the 2008 Tongass Land and Resources Management Plan Final Environmental Impact Statement ("FEIS") (2008 TLMP FEIS: 3-236).

Recent taxonomic analyses using DNA support the genetic distinctiveness of the Alexander Archipelago wolf and corroborate its subspecific status (Weckworth et al. 2005, Weckworth et al. 2010). According to a microsatellite study by Weckworth et al. (2005), coastal wolves in Southeast Alaska (including those on Kupreanof, Mitkof, and Woewodski Islands, Prince of Wales Island, Revillagigedo Island, and the Mainland Coast) are genetically differentiated from adjacent continental wolf populations in northern and central Alaska and interior British Columbia. Based on mitochondrial DNA analysis of coastal and continental gray wolves, Weckworth et al. (2010) concluded that coastal wolves of Southeast Alaska are genetically distinct and largely isolated from continental gray wolf populations, and appear to comprise an endemic subspecies:

> Nuclear (Weckworth et al. 2005) and mitochondrial data [Weckworth et al. 2010] support the hypothesis that the Southeast Alaska Coastal wolves are distinctive and largely isolated from Continental populations. A morphological assessment described Coastal populations as an endemic subspecies (*C. l. ligoni*—Goldman 1944), a hypothesis that is consistent with the genetic data. (Weckworth et al. 2010: 372).

2. The wolves on Prince of Wales Island appear to be a distinct population segment of the Alexander Archipelago wolf

Recent genetic evidence indicates that AA wolves on Prince of Wales Island are isolated from other populations and represent a distinct population segment (Weckworth et al. 2005). Based on microsatellite analysis, Weckworth et al. (2005) found that wolves on Prince of Wales Island are genetically differentiated from nearby island populations on Kuiu, Kupreanof, and Mitkof islands, as well as mainland Southeast Alaska (Weckworth et al. 2005). Weckworth et al. (2005) suggested that the wolves on Prince of Wales Island belong to a distinct genetic cluster due to genetic and geographic isolation. According to Weckworth (2005), the genetic distinctiveness of Prince of Wales wolves is consistent with previous studies identifying Prince of Wales Island as a center of endemism (i.e., for flying squirrels, deer mice, ermine) because of its relative isolation from the rest of the region. Consistent with these genetic studies, Person et al. (1996) and Person (2001) found evidence for little to no migration of wolves between Prince

[2] Availability of this 12-month finding was noticed at Fed. Reg. 62:46709-46710.

of Wales and other islands based on telemetry data; the Clarence Straight seemed to provide an effective barrier to migration.

Based on this evidence, the Forest Service recognized wolves on Prince of Wales Island as a "population segment isolated from all other wolves in Southeast Alaska and coastal British Columbia" in the 2008 TLMP (2008 TLMP FEIS: 3-237, 3-281), and at least as early as 1996 (Iverson 1996(a)).[3] In addition, it is possible that other island AA wolf populations may act as discrete populations with little to no migration occurring. Genetic studies to date suggest that this is a plausible scenario, given the distinctiveness of wolves on Prince of Wales Island (Weckworth et al. 2005).

3. The coastal wolves of British Columbia may be related to Alexander Archipelago wolves

A recent analysis by Weckworth et al. (2011) indicates that coastal wolves of Southeast Alaska may be closely genetically related to the coastal wolves of British Columbia. Weckworth and colleagues analyzed mtDNA samples from coastal populations in Southeast Alaska and British Columbia and from continental populations from interior Alaska, British Columbia, and Yukon Territory to examine phylogenetic relationships, phylogeographic history, and the population dynamics of coastal wolves across their entire northwest North American distribution. The 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. The analyses suggested a single phylogeographic lineage along the North Pacific Coast that would encompass *C. l. ligoni, C. l. fuscus* and *C. l. crasodon*.

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). Haplotype differences between Southeast Alaska and British Columbia populations suggest some genetic divergence between these regions.

In sum, genetic 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. Further, within the *C. l. ligoni* subspecies, wolves from Prince of Wales Island represent a distinct population segment.

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[3] Iverson (1996, 14-March), memo beginning at JLM 510-0289, subject "Viability Effects Analysis Writeups." See at 293: "Short term management concern may however, be heightened because evidence suggests that wolves on POW most likely represent a 'distinct population segment'." Iverson was a high level TLMP IDT member.

In this Petition, we follow the accepted taxonomic classification of *C.l. ligoni* as a distinct subspecies encompassing the coastal wolves of island and mainland Southeast Alaska. We recognize that the taxonomic relationship between coastal wolves of Southeast Alaska and British Columbia is still being resolved. Therefore, we have included information on natural history, population status, and threats to wolves of British Columbia in Appendix A, in the event that the USFWS determines that the wolves of Southwest Alaska and British Columbia may be part of the same subspecies.

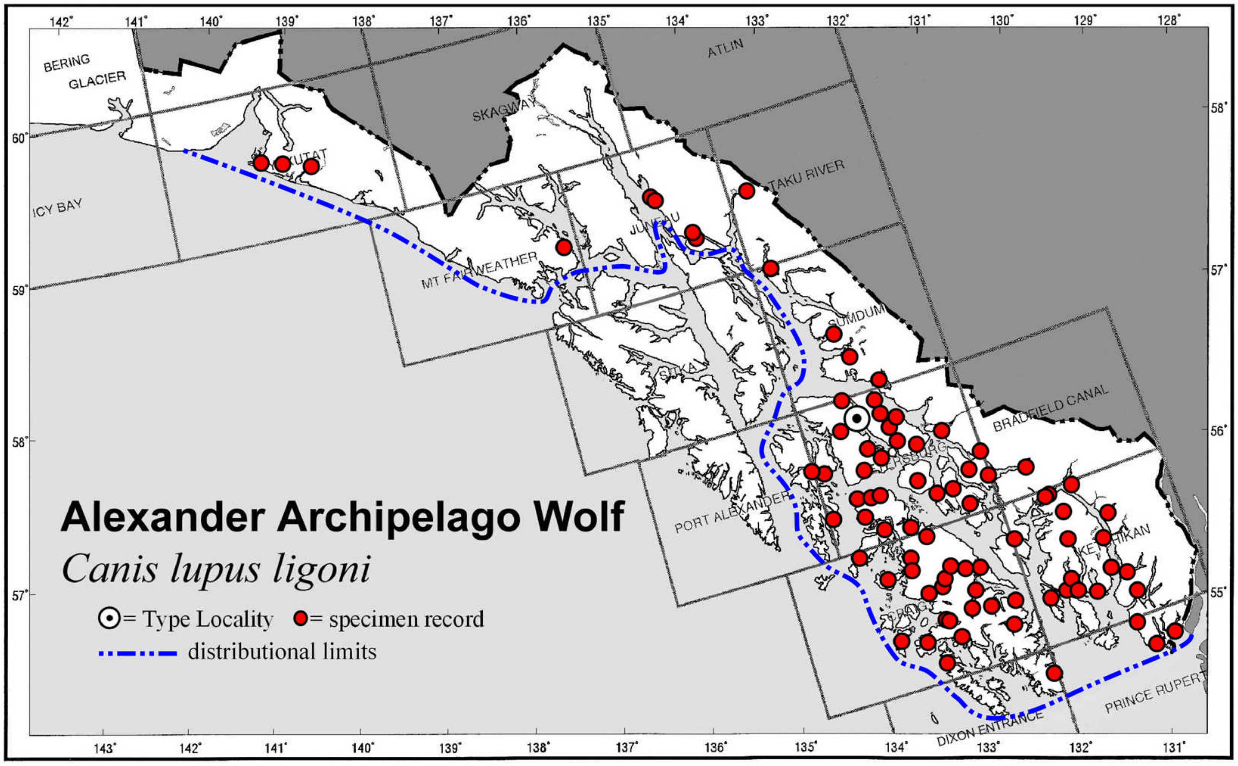
B. Evolutionary History

The AA wolf appears to have experienced a distinct evolutionary history from continental gray wolf populations (Weckworth et al. 2005, Weckworth et al. 2010). Weckworth et al. (2005) hypothesized that coastal wolves in Southeast Alaska represent the remnants of a formerly widespread group of wolves found in southern continental refugia in North America during the Pleistocene Epoch. These wolves recolonized Southeast Alaska less than 12,000 years ago and have since diverged from other wolf populations. Northern continental wolves, such as those found in interior Alaska and central British Columbia, are apparently the result of mixing between the recolonizing populations from both Asia and North America. Weckworth et al. (2010) hypothesized that some of the genetic diversity that has been lost in continental North America wolf populations, due to intensive harvest and resulting extirpation of many populations, remains intact in coastal wolves in the Alexander Archipelago. Thus, *Canis lupus ligoni* populations in Southeast Alaska appear to contain a significant portion of the remaining genetic diversity for the species *Canis lupus*.

III. Distribution

The known range of the AA wolf is within Southeast Alaska (Figure 1). Wolves in Southeast Alaska occur throughout the narrow mainland along the west side of the Coast Range as well as many of the islands south of Frederick Sound, excluding Coronation, Forester and smaller, more isolated islands (Schoen and Person 2007). The larger islands are the only islands known or suspected to sustain packs of wolves because of their larger prey base (Person et al. 1996). These islands include Prince of Wales, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, Zarembo and Dall Islands (Person et al. 1996, Person 1997, MacDonald and Cook 2007). However, packs have not been documented on all of these islands, and for many islands, historic or contemporary population numbers are not known. There are currently no substantiated records from islands north of Frederick Sound. Wolves were experimentally introduced to Coronation Island in 1960 and 1963 but none remained there by the early 1970s (Klein 1996 cited in Person et al. 1996). Wolf packs may include several smaller islands (e.g., Baker, Lulu, Noyes, Tuxekan, Marble, Thorne) in their home ranges or may exclusively inhabit smaller islands for a few years but are unable to persist permanently (Person et al. 1996).

Figure 1. Distribution of the AA wolves with specific specimen records. Dashed blue line indicates range of *Canis lupus ligoni* and red dots indicate museum records.
Source: MacDonald and Cook (2007)



IV. Abundance and Population Trends

A. Population size

Population estimates for AA wolves are based largely on annual surveys, anecdotal observations, and trapping records. However, population size estimates can be obtained from the number of packs, pack size, and home ranges of packs (Person et al. 1996). A team of interagency scientists estimated less than 1,000 wolves throughout Southeast Alaska in the 1990s (Person et al. 1996). Prince of Wales Island—which comprises ADF&G Game Management Unit ("GMU") 2—and the large islands of GMU 3 (Kuiu, Kupreanof, Mitkof, Etolin, Wrangell, and Zarembo Islands) are thought to support 60% to 70% of the total wolf population in Southeast Alaska (Person et al. 1996, Person 2001). Another significant portion of the wolf population inhabits GMU 1A (Revillagigedo Island and Cleveland Peninsula), and together the three units may support 85% of the region's wolf population (Person et al. 1996, Person 2001). Wolf densities are generally lower on the mainland and higher on islands in the southern half of the Tongass NF (Person et al. 1996).

On a regional basis, the best estimates for wolf population size are from Prince of Wales Island where Person et al. (1996) estimated a population of ~250 to 300 wolves in the mid-

1990s. For Prince of Wales and Kosciusko Islands combined, Person et al. (1996) estimated 269 wolves in autumn and 174 wolves in spring, after wolf numbers were reduced by hunting and trapping in autumn and winter. These estimates were based on the average of two methods of estimating wolf population size in the mid-1990s: simulations based on pack size from radio-collared wolves and observed wolf densities. More recently, Person and Russell (2008) essentially repeated the Person et al. (1996) estimate, at 250-350 wolves on Prince of Wales Island and a neighboring cluster of smaller islands "that are genetically isolated from other wolves in the region." However, in summer 2010 a significant reduction in the population was observed, although as yet unquantified. (Edwards 2010, notes of pers. comms with Dr. David Person). In the November 2010 regulatory proposals packet for the Alaska Board of Game, ADF&G suggested the Prince of Wales wolf population may be down to 150, although the number is surely imprecise (ADF&G 2010).

B. Population trends

Population trends are difficult to estimate given that population data are sparse or unavailable for many regions. According to the 2006 Tongass Conservation Strategy Review Workshop ("CSR Workshop"), "[m]onitoring information for wolves on the Tongass comes from 'guesstimates' by ADF&G area biologists, harvest statistics, and various research efforts, but each of these sources are limited in scope or unreliable so knowledge of population trends across the Forest are lacking" (CSR Report 2008: 73).

On Prince of Wales Island, wolves are thought to have declined since the beginning of the large-scale logging program beginning in the 1950s (Person 2001). Recent evidence based on diminished wolf sign from scats and tracks during recent years suggests that there have been declines in wolf numbers on Prince of Wales, and that the current wolf population may be around 150 animals, down from the prior estimate of ~250-300 animals made in the mid-1990s.

While a current population estimate of 150 wolves on Prince of Wales Island has been suggested, the regional wolf expert, ADF&G's Dr. David Person, has not yet verified this number through more accurate means such as radio collaring or DNA analysis of scats (Edwards 2010, Person 2010). During three months of field work on Prince of Wales in 2010, Dr. Person was unable to collect enough scats to do such an analysis, and the lack of scats "wasn't even subtle" (Id.). In his effort to find wolf sign on north-central Prince of Wales, he checked 11 dens (involving five packs), key wolf trails, and a road transect from Whale Pass to 12-Mile Arm and Thorne Bay to Winter Harbor (Id.). He found only a "small fraction" of the expected number of scats during this effort, and the only "activity indicating a large wolf pack was in Honker Divide just east of Logjam Creek and west of Lake Galea" (Id.). "Simply put there was usually no sign of wolf activity at the den sites," according to Dr. Person (Id.). Dr. Person stated that he "cannot tell if any packs are extirpated. [He] saw signs of wolves in many places but the level of activity is very low compared with previous years (1992-2004)" (Id.). Dr. Person further stated that "I won't speculate at this point about wolf viability because I need more data," and that he is placing 50 scent posts to help assess wolf activity and help collect more scats toward a DNA population analysis (Id.). He is conducting other work in cooperation with the Forest Service to update his earlier modeling of Prince of Wales wolf population dynamics "to project demographic viability into the future" (Id.). He suspects the illegal take of wolves and the contribution of high road density to that take are the primary causes of the apparent reduction of the wolf population (Edwards 2010 and Person 2010).[4]

The Forest Service did not anticipate population declines when preparing the 2008 TLMP; instead, population stability was projected forward. The Forest Service also relied on a misleading statement in its Forest-wide plan that creates a false impression of population stability; the 2008 plan stated that ADF&G estimates indicated that wolf populations "are thought to be stable in GMU 2 and increasing in GMU 3 (ADF&G 2003)" (2008 TLMP FEIS: 3-238). In fact, however, the ADF&G (2003) report concluded for Unit 2 that "[w]e believe that wolf populations have decreased slightly in Unit 2 during this report period [1999-2002]" (p. 32) and for Unit 3 that "[w]e have insufficient data to make a meaningful estimate for wolf populations" (p. 40). Person and Russell (2008) similarly reported for wolves in their Prince of Wales study area that "wolf populations still declined during 1999-2002" based on the ADF&G (2003) report, and also "declined significantly during 1993-1995" (p. 1547). The 2008 TLMP also did not take into account the warning of wolf researcher Dr. David Person that "[c]urrent healthy populations of wolves and deer are misleading indicators of future conditions as K [carrying capacity] for deer declines" (Person 2001: 96).

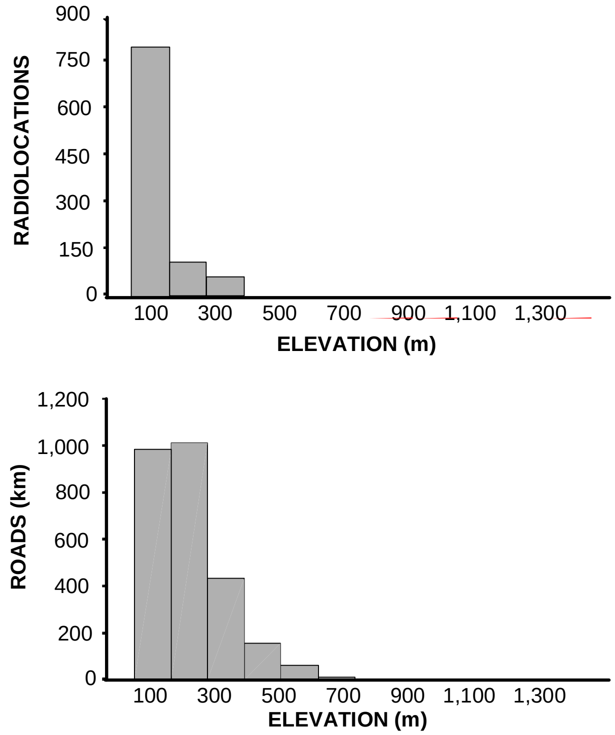
V. Habitat Use

Alexander Archipelago wolves in Southeast Alaska primarily use low-elevation old-growth forests for denning, foraging, and movement (Person et al. 1996, Person 2001). Habitat use is strongly associated with the availability and abundance of their primary prey, the Sitka black-tailed deer, as well as by snow conditions, logging treatments, road density, and human presence (Person et al. 1996, Person 2001).

Studies on Prince of Wales Island indicate that wolves select for old-growth forest at low elevations for denning, pup-rearing, and wintering activities (Person 2001). During the pup-rearing season, wolves selected for both open-canopy and closed-canopy old-growth forest at low elevations (Person 2001). Before and after pup-rearing, wolves appeared to select for closed-canopy old-growth forest and lakes and streams, but avoided seral forests and clearcuts (Person 2001). During winter from November 15 to March 15, wolf packs on Prince of Wales Island (where snow accumulated) selected for closed-canopy old growth, whereas a Kosciusko Island pack in an area of lower snow accumulation selected for open-canopy old growth (Person 2001). Wolves spent most of their time at low elevations during all seasons, with 50% of 920 radio-locations for resident wolves at less than 82 m in elevation and 95% less than 396 m in elevation (Figure 2) (Person 2001). When only low-elevation wolf locations below 328 ft (100 m) were analyzed, wolves on Prince of Wales and Kosciusko islands selected closed-canopy and open canopy old-growth forest and avoided clearcuts and roads, which they used most commonly at night (Person et al. 1996; Person 2001). While wolves rely heavily on these low elevation habitats, as described further below this is also where roads have become most highly concentrated (Figure 2) (Person 2001), leading to significant concerns over the effect of road access on wolf mortality.

[4] These documents are: (1) notes by Larry Edwards (Greenpeace) of an August 6, 2010 phone call and (2) October 15, 2010 e-mail correspondence with Dr. David Person (ADF&G).

Figure 2. Number of radio locations for wolves and length of roads at different elevations on Prince of Wales and Kosciusko islands, Southeast Alaska.
Source: Person (2001).



Populations of AA wolves appear to be dependent upon the presence of highly productive old-growth forests because this habitat is important for their primary prey species, the Sitka black-tailed deer (Person et al. 1996, Person and Bowyer 1997). Critical winter habitat for deer is therefore a useful measure for determining wolf habitat (Person 2001). Closed-canopy old-growth forests are characterized by high basal areas with uneven-aged trees, which allow for broken canopy cover where some light reaches the forest floor, promoting a mixed, diverse understory of forage plants, but which also provide enough cover to curtail heavy snow accumulation on the ground in winter (Kirchhoff and Schoen 1987, Schoen and Kirchhoff 2007). These forests are important for deer foraging at all times of the year (Schoen and Kirchhoff 2007). However, in winter deer concentrate in closed-canopy old-growth forests because they provide understory food sources that are not covered in snow, in addition to thermal cover (Schoen and Kirchhoff 2007). Because of the importance of closed-canopy old-growth forests to deer, wolves in Southeast Alaska heavily use this habitat type (Table 1) (Schoen and Kirchhoff 2007).[5]

Wolves tend to avoid clearcuts and second-growth forests created by clear-cutting (Table 1). The stem exclusion stage (closed-canopy second-growth “seral” forest) is largely devoid of

[5] Although much of the deer population migrates in the summer to high elevation to forage on high-quality forbs and shrubs in alpine habitat, wolves continue to utilize low-elevation old-growth and prey upon non-migratory deer, likely because they are constrained by the needs and mobility of the pups (Schoen and Person 2007).

forage for the Sitka black-tailed deer and thus unprofitable hunting grounds for wolves (Schoen and Kirchhoff 2007). Second-growth seral forests form 20 years to 30 years after logging and can persist for up to 140 years to 160 years (Schoen et al. 1988). Deer forage consisting of herbs, ferns, and shrubs are shaded out by young conifers that dominate forest patches 20 years to 30 years after logging (Schoen and Kirchhoff 2007). Lichens, which grow productively on old growth trees, are also very important in winter. (Id.) The absence of deer forage in second growth typically continues for more than a century following canopy closure (i.e., 130 years after logging) (Schoen and Kirchhoff 2007). Thus, clearcutting old growth and managing second growth on 100-year to 120-year rotations significantly reduces deer forages for 70% to 80% of the timber rotation interval (Schoen and Kirchhoff 2007). Although deer forage production may be prolonged by pre-commercial forest thinning, these benefits do not appear to last for more than 15 years to 25 years (Schoen and Kirchhoff 2007).

Table 1. Simplified habitat ranking matrix for wolf packs based on radio locations obtained before or after the pup-rearing period on Prince of Wales and Kosciusko islands. Matrix is based on results from logistic regression of radio locations compared with random locations. Signs indicate direction of selection and number of signs indicates significance of selection (Three = $P \leq 0.05$, two = $0.05 < P \leq 0.1$, one = $0.1 < P \leq 0.15$). Scores provide a qualitative comparison of direction and strength of habitat selection.
Source: Person (2001): Table 5.

	Habitat Type [a]						
Pack	Lks	Ocog	Ccog	Seral	Ccut	Priv	Road
Ratz Harbor	+ + +		+				
Twin Spurs					–		
Honker Divide							
Kosciusko I.	+			– – –	– – –		
Kasaan Penin.							
Steelhead Crk.			+ +				
Thorne River			+	– –			
Scores	+8	0	+12	-10	-8	0	0

[a] Alpine habitat is excluded from analysis because it is strongly correlated with elevation. Codes for habitat types are as follows: Lks = lakes and streams, Ocog = open-canopy old-growth forest and muskeg, Ccog = closed-canopy old-growth forest, Seral = second growth forest >25 years old, Ccut = second growth forest ≤25 years old, Priv = unspecified private land (mostly Ccut), and Road = road.

Denning site characteristics

Within a wolf pack's home range, wolves use a primary natal den where the pups are born as well as multiple additional dens in close proximity for pup rearing. These additional dens are close enough to minimize predation on the pups during the first few months of pup rearing

(Paquet and Darimont 2002). Alexander Archipelago wolves use denning sites between April and July, with peak activity in mid-June (Person 2001).

All denning sites documented in Southeast Alaska have been located in low elevation old-growth forests in proximity to freshwater sources and, in many cases, near beaver ponds or streams (Person 2001). On Prince of Wales and Kosciusko Islands, Person (2001) recorded 22 denning sites between 1992 and 1995, all within old-growth forest or muskeg, within 100 meters of a freshwater source, and below 250 m in elevation. One den site was found under a large log, and all other den sites were located in cavities that form beneath the roots of large trees (>80 cm dbh). Ten of eighteen active den sites were located adjacent to ponds with resident beaver colonies (Person 2001). Thus, old growth forest stands, especially those near freshwater sources, are important for the Alexander Archipelago wolf because they provide essential denning habitat for birthing and pup rearing.

Rendezvous sites are areas where pups are left with adult wolves while other members of the pack forage. Usually pups are moved to secondary dens or rendezvous sites when they are four to ten weeks old (Paquet and Darimont 2002). Rendezvous sites for gray wolves tend to be located in protected areas, at greater distances from roads and villages than random sites, and with a canopy cover greater than 70% (Capitani et al. 2006). For Alexander Archipelago wolves, activity is highest at rendezvous sites from mid-June to August (Person 2001). Both denning and rendezvous sites are used for multiple years (Paquet and Darimont 2002).

VI. Pack Size, Home Range and Dispersal

A. Pack Size

Wolves are social animals that form packs with particular social structures. A pack usually consists of one to three breeding females, although in many packs, only one female will breed (Paquet and Carbyn 2003). The Alexander Archipelago wolf forms packs that vary in size. Pack size on Revillagigedo Island averaged 5.4 wolves (Person et al. 1996). Pack sizes on Prince of Wales and Kosciusko islands were larger, averaging seven to nine wolves (Person and Ingle 1995). Pack size on Prince of Wales Island is positively correlated with available winter deer habitat (Person 2001).

B. Home Range

Wolf packs typically occupy stable home ranges, which are exclusive territories that they defend from encroachment by other individuals or packs. A wolf pack can meet all of its biological needs such as feeding, denning, and raising young within its home range. Core areas are the areas within home ranges most frequently used by wolves. In Southeast Alaska, wolf home ranges and core areas are generally smaller than those recorded for continental wolf populations (Person et al. 1996). Home ranges and core areas are also smaller during pup-rearing season in the spring and summer, and increase in size during fall and winter (Person 2001). Similar to what has been found in other studies, home range correlates positively with pack size (Person 2001).

On Prince of Wales and Kosciusko Islands, minimum convex polygon ("MCP") home ranges averaged 280 km^2 (109 mi^2) (range 101 km^2 to 419 km^2 [39 mi^2 to 163 mi^2]), and core areas averaged 124 km^2 (48 mi^2) and were 55% to 60% smaller than total home ranges (Person et al. 1996). On Revillagigedo Island, MCP home ranges averaged 279 km^2 (108 mi^2; range 79 km^2 to 447 km^2 [30 mi^2 to 170 mi^2]). On Prince of Wales and Kosciusko islands, MCP home ranges during the denning and pup-rearing period in spring and summer (April 15-August 1) were about 50% smaller than during fall and winter, which contrasts with studies in other regions that have found home ranges to be similar in size during summer and winter (Person et al. 1996). For example, on Prince of Wales Island, summer home ranges for five wolf packs averaged about 100 km^2 (39 mi^2) whereas winter home ranges for the same packs averaged about 240 km^2 (93 mi^2). The presence of pups may dictate these size changes (Person 2001).

Table 2. Home range, average pack size, and home range index for wolf packs on Prince of Wales and Kosciusko islands. Also shown are measures of area and dispersion of critical winter habitat for deer within wolf home ranges.
Source: Person (2001): Table 16.

Pack	Home Range[a] (km^2)	Pack Size[b]	Home-Range Index[c]	Deer Habitat[d]	Standard Radius[e]
Ratz Harbor	394.3	7	56.3	4.7	11.3
Twin Spurs	353.6	8	44.2	9.2	10.7
Honker Divide	353.8	12	29.5	11.7	8.5
Kosciusko Island	329.0	7	47.0	10.8	9.2
Kasaan Peninsula	150.8	4	37.7	3.6	6.9
Steelhead Creek	153.6	3	51.2	3.1	6.8
Thorne River	82.6	4	20.7	18.7	3.8
Mean	259.7	6.4	40.9	8.8	8.1
SE	47.5	1.2	4.7	2.1	2.6

[a] Mohr's convex polygon home ranges.
[b] Pack size in late summer averaged over number of years that data are available.
[c] Home range ÷ pack size.
[d] Percentage of home range composed of critical winter habitat for deer.
[e] Standard radius (km), a measure of dispersion of deer winter habitat about the weighted mean center of each wolf pack's home range. It is analogous to a standard deviation for nonspatial data.

C. Dispersal

Large water barriers between islands and the mainland appear to limit dispersal of AA wolves in Southeast Alaska (Person et al. 1996). Wolves in Southeast Alaska are capable of swimming up to 4 kilometers, but the shapes and distribution of land masses, currents, and the high frequency of storms act to impede dispersal among the major island groups in the archipelago (Person et al. 1996). Based on telemetry data, Person et al. (1996) and Person (2001) found that wolves on Prince of Wales Island appear to be isolated. No dispersing wolves left Prince of Wales Island or adjacent islands, and Clarence Strait appears to act as an effective barrier to dispersal (Person et al. 1996, Person 2001). On Coronation Island, wolves that were starving in the absence of deer failed to swim 900 m to the closest island with resident deer and eventually died out (Person et al. 1996). Person et al. (1996) suggested that exchange between mainland and island populations is probably greatest in the vicinity of Mitkof Island and the Stikine River Delta, where the swimming distance is short at low tide.

The Coast Range also provides a significant barrier for movement between wolves in Southeast Alaska and Interior Alaska and Canadian populations (Weckworth et al. 2005, Cook et al. 2006). The Coast Range is a large mountain range 1600 km long and more than 300 km in width that extends from southern Yukon through the Alaska panhandle and almost the entire coast of British Columbia. It includes mountains that are more than 4000 meters high and ice fields that span many kilometers. Much of the Coast Range is glaciated and presents a significant barrier for wildlife movement (Cook and MacDonald 2001).

While there appears to be little dispersal between islands, dispersal within islands can be quite high. Within Prince of Wales and adjacent islands, Person (2001) found that 60% of the wolves radio-collared between 1993 and 1994 exhibited extraterritorial behavior, which is much higher than the 10%-40% annual dispersal rate for wolves in other parts of North America (Fuller et al. 2003). Dispersal distances ranged between 7.2 km and 255.5 km with a median dispersal distance of 63.1 km (Person 2001). Almost 30% of the wolves observed were not resident members of a specific pack (Person 2001). Even wolves that were resident members of a pack often exhibited dispersal behavior. Person (2001) attributed the active dispersal behaviors to wolf harvest. If a resident pack is hunted or trapped out of an area, a new territory is freed up for a dispersing wolf to establish a home range. However, dispersing wolves are often more susceptible to hunting and trapping pressures (Person et al. 1996) and often mortality increases in dispersing wolves. Of the wolves that dispersed long distances and tried to establish home ranges, only one wolf survived longer than one year in the new territory, and this wolf was shot after 18 months in her new territory (Person 2001).

In a later study, Person and Russell (2008) raised concern that the high rate of mortality for dispersing wolves and other nonresident wolves may decrease the viability of AA wolf populations. Dispersing wolves play an important role in settling and pairing in territories that have been vacated by harvest. However, the high rate of mortality for dispersing wolves in Southeast Alaska decreases the probability of settling and delays recolonization. For example, three of four territories that became vacant due to harvest remained unoccupied for more than one year despite the existence of neighboring wolf packs. Although those territories eventually were recolonized, survival of the new occupants was very low and only half successfully reproduced within their new territories before being killed. Of those, most were killed before breeding a second time. Notably, all these territories had extensive road systems or were easily accessible by boat, highlighting the mortality risks from these factors. Person and Russell (2008) concluded that “high rates of mortality of nonresident wolves exposed to legal and illegal harvest may reduce or delay successful dispersal, potentially affecting linkages between small disjunct wolf populations or population segments occupying fragmented landscapes” (p. 1548).

VII. Reproductive Behavior

For Alexander Archipelago wolves, mating is estimated to take place in late February or early March, with a gestation period of ~63 days (Person 2001). Most packs include a pair of breeding adults plus additional adults that may or may not breed. Person (2001) found no evidence for multiple breeding pairs in packs on Prince of Wales or Kosciusko islands. Based on direct observations, pups are born in late April (Person 2001). On Prince of Wales Island, litter sizes for the Alexander Archipelago wolf ranged from one to six pups during 1995 (Person 2001). In 2000-2001, the Alaska Department of Fish and Game observed an average of 4.3 pups at seven den sites on Prince of Wales Island. Person (2001) concluded that four is likely the average number of pups per pack in early summer (Person 2001).

Wolf packs usually produce one litter of pups every year, even in large packs (Mech 1995). Some studies indicate that when packs are reduced in size due to human-caused mortality, more females may breed in the remaining packs, increasing pup numbers, and ultimately, increasing the size of the population (Rausch 1967). However, this trend has not been detected in Alexander Archipelago wolves (Person 2001:61)[6]. Abundant food supply may also increase productivity in a population. A surplus food supply may delay the dispersal of young wolves to new territories, increasing the potential for multiple breeding females within a pack (Mech et al. 1998). Pup survival depends on many factors but is also directly correlated with prey biomass. Where biomass is greater, pup survival increases, and where biomass is less, pup survival declines (Van Ballenberghe and Mech 1975).

VIII. Diet and Feeding Ecology

Wolves are obligate carnivores that depend on the availability and vulnerability of ungulates. Numerous studies have documented that the Sitka black-tailed deer (*Odocoileus hemionous sitkensis*), the primary ungulate species in the region, is the principal prey of the AA wolf in Southeast Alaska and represents the largest component of its diet, making up as much as 77% (Kohira 1995, Person et al. 1996). Person et al. (1996) estimated that the annual predation rate was approximately 26 deer per wolf. An interagency science team reviewing wolf diet data concluded that "[t]hese data strongly suggest that wolves occurring on the islands of southeast Alaska depend on the availability of deer and raise questions about the ability of alternative prey to sustain wolves in the absence of deer" (p. 8). Deer densities vary in Southeast Alaska, with more deer found on the islands than on the coastal mainland (Schoen and Kirchhoff 2007), and in parallel, island wolf populations likely occur at higher densities than mainland populations (Schoen and Person 2007).

In areas of mainland Southeast Alaska where deer are scarce, wolves may supplement their diet with beaver (*Castor canadensis*), mountain goat (*Oreamnos americanus*), and moose (*Alces alces*) (Kohira 1995, Person et al. 1996, Szepanski et al. 1999). Wolves in Southeast Alaska also appear to make seasonal use of spawning salmon (*Onchorynchus* spp.) during late summer and autumn, unlike wolves found in most of North America (Kohira 1995, Szepanski et

[6] This information is specific to Prince of Wales and Kosciusko Islands wolves and the packs observed. Whether or not it is also true for other populations is unknown to us.

al. 1999). Szepanski et al. (1999) found that mainland wolves ate more salmon than wolves on islands where deer densities were generally higher, and mainland wolves also had more varied diets than island wolves. Wolves feed opportunistically on harbor seals (*Phoca vitulina*), black bear (*Ursus americanus*), mustelids (e.g., ermine, marten, river otter), small mammals, birds, and marine invertebrates (Garceau 1960, Kohira 1995, Person et al. 1996).

IX. Causes of Mortality

A. Legal and Illegal Hunting and Trapping

Human-caused mortality from legal and illegal hunting and trapping is the highest cause of mortality in AA wolf populations in Southeast Alaska (Person 2001, Person et al. 1996, Person and Russell 2008). Studies by Person (2001) and Person and Russell (2008) have found that mortality rates of wolves from legal and illegal harvest are unsustainable and that risk of mortality increases with higher road density and proximity to clearcuts.

Person and Russell (2008) monitored the fates of 55 radio-collared gray wolves on Prince of Wales, Heceta, and Kosciusko Islands during March 1993–August 2002, and examined the mortality rates of resident and non-resident wolves as well as the influence of habitat use (roads, logged stands, and lakes and streams) on risk of death. This study estimated a mean annual survivorship of 0.54 for all wolves in their study, with annual survival of 0.65 for resident wolves and 0.34 for non-residents. Person and Russell (2008) acknowledged that these survival estimates may be high because only wolves older than 4 months old were included, and pup mortality could decrease the survivorship values. Although the mortality rate was higher during 1993-1995 (55%) than during 1999-2002 (38%), mortality rates during both these periods were greater than the sustainable rate of mortality (<34%) estimated for wolf populations, and wolf populations declined during both these periods (Person and Russell 2008).

In total, 87.1% of wolves that died during the study were killed by humans, making hunting and trapping the overwhelming cause of mortality for the AA wolf (Person and Russell 2008). Importantly, almost half of the wolves in the study were killed illegally, illustrating that legal harvest estimates underestimate the annual loss of wolves in Southeast Alaska by as much as 50%. Mortality due to each cause did not differ among social classes, age classes, or sexes. Overall, four out of the 12 monitored packs were eliminated by hunting and trapping during the study.

Person (2001) also noted that 851 wolves were reported killed by hunting or trapping between 1990 and 1998 in Unit 2, which has the highest road density of any island group in Southeast Alaska. About 60% of the mortality was from trapping (including snaring) and 40% was due to hunting (ground shooting). These figures do not include illegally harvested and unreported wolves. In winter 1992-1993, a single trapper killed 42 wolves on the north end of Prince of Wales Island (Person 2001: 58). Between 1990 and 1995, an estimated 1,163 wolves were reported killed throughout Southeast Alaska (Person et al. 1996: 9). These numbers correspond to an annual mortality rate of almost 50% in Southeast Alaska wolves (Person et al. 1996: 9).

The risk of death for non-resident wolves from hunting and trapping increased in clearcuts, likely because these habitats were closely associated with roads that enabled human access (Person and Russell 2008) and provided a clear line of sight for hunters (Brinkman 2009).[7] Because clearcuts are avoided by resident wolves, non-resident wolves are more likely to use these habitats, placing them at higher risk from hunting and trapping near clearcuts (Person and Russell 2008).

B. Natural Causes: Disease, Starvation, Fighting, Accidents

Mortality of wolves in exploited populations from natural causes (e.g., starvation, accidents, disease, and fighting) typically averages 5% to 10% of the population per year (Fuller 1989 cited in Person et al. 1996). Canine distemper, canine parvovirus ("CPV-2"), and other diseases have infected wild wolf populations, but mortality rates are often not reported (Kreeger 2003). Murie (1944) listed mange, canine distemper, and rabies as possible limiting factors in Alaska wolf populations.

X. Conservation Status

The Alexander Archipelago wolf is a rare subspecies of gray wolf with a limited worldwide range confined to the islands and narrow mainland coast of Southeast Alaska. NatureServe considers *C. l. ligoni* a vulnerable subspecies due to its small range in Southeast Alaska, low population abundance, and threats including increased hunting of wolves and deer due to increased hunter access along new logging roads, and extensive clearcut logging resulting in deer habitat loss and fragmentation.

In 1990, a Forest Service-sponsored interagency committee identified Tongass wolves as a species of concern because of extensive logging (Person et al. 1996). The 1997 and 2008 TLMPs designated the Alexander Archipelago wolf as a Management Indicator Species, meaning that the wolf's response to land management activities would be used to indicate likely responses of other species with similar habitat requirements. However, as discussed in detail below, the standards and guidelines for the AA wolf in the 1997 and 2008 TLMPs are inadequate and ineffective.

The AA wolf does not have Endangered Species Act protection. In 1993, the Biodiversity Legal Foundation, biologist Eric Holle, and Martin Bergoffen petitioned the USFWS to list the Alexander Archipelago Wolf as threatened under the ESA.[8] The petitioners' concerns pertained to specific risks to wolf viability associated with continued clearcutting on the Tongass: prey depletion and increased access for wolf trappers and hunters.[9]

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[7] Although this observation pertains to deer hunting on POW in particular, the same principle should apply when hunting wolves, either intentionally or opportunistically, in such areas.

[8] *Biodiversity Legal Foundation v. Babbitt*, 943 F.Supp. 23, 24 (D.D.C. 1996). For a procedural history of the listing process, see 59 FR 26476 (issuing the finding that the action may be warranted and soliciting public comment; 60 FR 10056 (issuing the not warranted finding) and 62 FR 6930 (February 14, 1997) (announcing that the USFWS intended to re-evaluate its previous status review in response to a lawsuit challenging the not warranted determination).

[9] *Biodiversity Legal Foundation v. Babbitt*, 943 F.Supp. 23, 24 (D.D.C. 1996).

The listing petition raised several key points: (1) there were specific concerns on Prince of Wales, as the Environmental Impact Statement ("EIS") for the Central Prince of Wales timber project provided for extremely high road densities in an area where recent legal wolf harvests reached up to 52% of the population; (2) forest-wide logging of well over half of the high-volume old growth forests and up to 71% of the old-growth forests over the life of the Tongass Land Management Plan resulted in projected deer population declines of up to 70% in some areas (i.e., Prince of Wales WAA 1422); (3) inadequate state regulatory mechanisms for wolf harvests and a Forest Plan failed to establish reserves or restrict road density; and (4) the combination of natural and manmade habitat fragmentation increased the susceptibility of island populations to extinction risks (Biodiversity Legal Foundation 1993).

The USFWS accepted the petition after making a finding "that the petition presented substantial information indicating that the requested action may be warranted" (Fed. Reg. 59: 26476). After a 12-month period of collecting data and public comment, the USFWS Juneau field office made a "warranted" recommendation to the regional office and indicated that "[t]he conversion of old growth forest into managed stands in southeast Alaska, which began on an industrial scale approximately 30 years ago, is expected to begin resulting in dramatic adverse effects on deer and wolf populations in 10 to 30 years."[10]

But in 1995, the USFWS issued a finding that listing was "not warranted" based on a memorandum from the regional director that rejected the field office's finding (Fed. Reg. 62: 46709). The regional director's memorandum did make the concession that "the long-term viability of the Alexander Archipelago wolf is seriously imperiled" unless the Forest Service made "significant changes" to the Forest Plan in effect at the time.[11] But the regional office relied primarily on a prospective revision of the Forest Plan in making the "not warranted" recommendation:

> The Service believes . . . that the amount of habitat degradation that has occurred to date has not resulted in significant population declines. Furthermore, we believe that the Forest Service's TLMP revision process together with subsequent implementation of the revised TLMP will provide sufficient opportunity to *reverse the declining population trend which we believe would occur under continued implementation of the current TLMP*.[12]

A coalition of environmental groups appealed the official finding (Fed. Reg. 62: 46709). A primary argument was that the USFWS relied on improper considerations – the promise of a future TLMP revision – in refusing to list the wolf pursuant to the ESA.[13] The court agreed, and remanded the decision to the USFWS to reconsider the finding in light of the existing TLMP and

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[10] *Biodiversity Legal Foundation*, 943 F.Supp. at 25; *see also* n.4 (indicating that the field office circulated an internal document listing the pros and cons of listing the wolf and that on the "pro" side the wolf appeared to meet all the requirements for listing under the Endangered Species Act but that on the "con" side the "not warranted" finding would be the "least controversial option" with the Alaska congressional delegation.

[11] *Biodiversity Legal Foundation*, at 25.

[12] *Biodiversity Legal Foundation* at 25 (emphasis added by the court); *see also* Fed. Reg. 60: 10056 (acknowledging that the then-existing TLMP would require significant changes or the long-term viability of the wolf would be "seriously imperiled").

[13] *Biodiversity Legal Foundation* at 26.

the current status of the wolf and its habitat.[14] But the Forest Service issued the 1997 TLMP Revision shortly after the court's ruling (Fed. Reg. 62: 46709). In 1997 USFWS declined to list the wolf as threatened after evaluating the revised TLMP (Fed. Reg. 62: 46709). The 12-month finding issued by the USFWS in the fall of 1997 acknowledged that ongoing large scale logging would reduce deer and wolf populations:

> Logging on the Tongass National Forest has been concentrated in high volume forests since industrial scale logging began in 1955. These forests are important winter habitat for deer because the multilayered canopies intercept snow and allow deer access to highly nutritious forage that is not available in most clearcuts and second-growth forests. Much of the harvest has occurred within the major island groups and adjacent mainland occupied by wolves. The projected logging of old growth in southeast Alaska will result in a decline of deer in southeast Alaska. Effects of logging will be particularly evident during winters with heavy snow that persists on the forest floor for long periods of time. Because wolves are inextricably tied to their prey, declines in deer are expected to eventually result in declines of wolves. (Fed. Reg. 62: 46710).

However, the finding ultimately concluded that the anticipated population decline would stop at an acceptable level and "[a]dditionally, wolves are known to persist in low numbers in healthy populations and to be resilient to the activities of man because of their high reproductive rate and high dispersal capability" (Fed. Reg. 62: 46710). As discussed below, these USFWS assumptions and conclusions are not valid for AA wolves. The finding also minimized the concern with excessive wolf harvest levels by noting that the Alaska Board of Game and the Federal Subsistence Board had revised hunting and trapping regulations (Fed. Reg. 62: 46710). However, unsustainable harvest levels still threaten the AA wolf despite these regulations.

Warranted: ESA Protection for the Alexander Archipelago Wolf

I. Why a New Petition Is Warranted

Fourteen years after the USFWS declined to list the Alexander Archipelago wolf under the Endangered Species Act, the AA wolf remains at risk of extinction. A new ESA status review by the USFWS is warranted not only because key assumptions and conclusions of the 1997 12-month finding have proven invalid, but also because the principal threats to the AA wolf have not been sufficiently abated by current regulatory mechanisms and management, jeopardizing the future of this rare subspecies.

Specifically, the Alexander Archipelago wolf merits listing under the ESA based on the best-available scientific information, including the following points:

(a) The AA wolf is a rare, endemic subspecies whose small, relatively isolated populations make it more vulnerable to anthropogenic threats, population declines and extinction, and detrimental loss of genetic diversity.

[14] *Id.*

(b) Less than 1000 wolves remain in Southeast Alaska. Evidence suggests that the Prince of Wales Island population has declined significantly in recent years.

(c) Recent genetic studies indicate that the AA wolf is of high conservation importance: it is genetically distinct and harbors a significant percentage of the remaining genetic diversity in the gray wolf species.

(d) Key assumptions and conclusions in the 1997 12-month finding have proven incorrect, and the mechanisms that USFWS relied on to address threats to the wolf have not been implemented or have not been effective.

(e) Due to the inadequacy of existing regulatory mechanisms and chronic failures in management by government agencies, the AA wolf faces high magnitude, imminent threats from logging, road building, legal and illegal harvest, small and isolated population structure, and climate change. As a result, principal threats outlined in the 1993 listing petition persist, and new threats such as climate change have emerged.

(f) The 1997 TLMP and 2008 TLMP do not adequately ameliorate the threats of logging and road building to the AA wolf; state hunting and trapping regulations are ineffective in maintaining sustainable harvest rates; and the increased risk of population declines, extinction, and loss of genetic diversity due to the wolf's small, isolated populations have not been adequately taken into account by current management.

II. The Alexander Archipelago Wolf Is a Species Eligible For Listing, And Prince of Wales Island Wolves Are a DPS

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 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.

Petitioners request that the USFWS recognize the Alexander Archipelago wolf as the distinct subspecies *C. l. ligoni* comprised of wolves from Southeast Alaska. We request that USFWS recognize Prince of Wales Island as a significant portion of the range of the Alexander Archipelago wolf. We also request that the USFWS consider whether wolves on Prince of Wales Island and associated islands (e.g., Kosciusko, Tuxekan, Heceta, Suemez, Dall and others proximate to Prince of Wales) (see Person et al. 1996, Person & Bowyer 1997, and Person 2001) constitute a distinct population segment of the Alexander Archipelago wolf based on marked differences in genetic, physical and ecological characteristics.

A. The Alexander Archipelago Wolf Is a Subspecies of Gray Wolf

As detailed above, the Alexander Archipelago wolf (*Canis lupus ligoni*) is widely recognized as a distinct subspecies of the gray wolf *Canis lupus.* Genetic analyses using nuclear and mitochondrial DNA support the genetic distinctiveness of the Alexander Archipelago wolf and corroborate its status as a subspecies (Weckworth et al. 2005, Weckworth et al. 2010). Indeed, Alexander Archipelago wolves are of particular conservation importance because they harbor a significant portion of the overall genetic diversity for the entire gray wolf species throughout North America (Weckworth et al. 2010). Federal agencies, including the USFWS and the Forest Service, have 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" (Fed. Reg. 62: 46710). The Forest Service recognized *C. l. ligoni* in Southeast Alaska as a distinct subspecies in the 2008 Tongass Land and Resources Management Plan:

> Two Alaskan subspecies of the gray wolf are currently recognized (Weckworth et al. 2005). The wolf found in Southeast Alaska is known as the Alexander Archipelago wolf (*Canis lupus ligoni*). It inhabits the mainland and the larger islands south of Frederick Sound (MacDonald and Cook 2007). However only the largest islands, including Prince of Wales, Kuiu, Kupreanof, Mitkof, Etolin, Revillagigedo, Kosciusko, Zarembo, and Dall islands, are thought to support persistent wolf populations (Person et al. 1996). (2008 TLMP FEIS: 3-236, 3-237).

The Alexander Archipelago wolf is markedly separated from other gray wolves not only due to its genetic distinctiveness but also because of physical, ecological, and behavioral factors. It is endemic to the islands and coastal mainland of southeast Alaska and is separated from Interior Alaska and Canadian populations by the Coast Range. It is smaller than the continental gray wolf. The vegetation, prey and climate in the range of the Alexander Archipelago wolf are all highly distinct. The Northwest coast of North America is home to two-thirds of the world's remaining temperate rainforests (Kirk and Mauzy 1996). These forests are defined by immense rainfall, mild winters, and an extremely high accumulation of biomass, both in the size of living trees, as well as the amount of understory and woody debris found on the forest floor (Alaback 1991). The Alexander Archipelago wolf is the only wolf species found within the Alaskan portion of this largest tract of remaining coastal temperate rainforest. Along with wolves in coastal British Columbia, it fills a niche that is not occupied by any other member of this taxon. Few apex predators are found in these coastal temperate rainforests, and wolves play an important ecological role in these distinctive communities.

B. Prince of Wales Island Is a Significant Portion of the Range of the Alexander Archipelago Wolf

The ESA does not define "a significant portion of the species' range," but the USFWS has identified it as "an area that is important to the conservation of the species because it contributes meaningfully to the representation, resiliency or redundancy of the species" (Fed. Reg. 72: 63128). Representation refers to "conserving the breadth of the genetic makeup of the species needed to conserve its adaptive capabilities;" resiliency means the species' ability "to recover from periodic disturbances or environmental variability;" and redundancy refers to a "margin of safety for the species to withstand catastrophic events."

The Prince of Wales Island population comprises a significant portion of the range of the AA wolf based on representation, resiliency, and redundancy. In terms of representation, AA wolves harbor a significant portion of the genetic diversity left in the gray wolf species (Weckworth et al. 2010), and Prince of Wales Island supports a genetically distinct population segment of the AA wolf (Weckworth et al. 2005) that contributes significantly to the genetic makeup of the subspecies and species. In terms of resiliency and redundancy, Prince of Wales Island and associated islands represent a geographically large percentage of the range of the AA wolf in Southeast Alaska, estimated in the mid-1990s to support one-third of the entire population in Southeast Alaska (~300 of 900 to 1000 total wolves). In addition, Northern Prince of Wales still harbors the greatest amount of large-tree old-growth forest of any province in Southeast Alaska (Albert and Schoen 2007), and thus helps support much of the remaining best habitat for the AA wolf and its principal prey, the Sitka black-tailed deer.

C. Prince of Wales Island Wolves are a DPS of the Alexander Archipelago Wolf

Based on genetic studies, the wolves on Prince of Wales Island are clearly a distinct population segment of the Alexander Archipelago wolf. 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 warrant listing under the ESA. These populations form Distinct Population Segments under the Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act (Fed. Reg. 61: 4721). 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. (Fed. Reg. 61: 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 <u>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</u>.
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. (Fed. Reg. 61: 4725) (emphasis added).

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. (Fed. Reg. 61: 4725).

In terms of discreteness, genetic studies clearly indicate that AA wolves on Prince of Wales Island are genetically distinct from other Southeast Alaska populations, including evidence of historical and contemporary physical isolation (Weckworth et al. 2005). Based on this evidence, the Forest Service in 2008 recognized that "wolves on Prince of Wales Island (GMU 2) are a population segment isolated from all other wolves in Southeast Alaska and coastal British Columbia (Weckworth et al. 2005)" (2008 TLMP FEIS: 3-236). Consistent with these genetic studies, Person et al. (1996) and Person (2001) found that Prince of Wales Island wolves do not move between Prince of Wales (including its associated islands, supra) and other islands based on telemetry data, and form an isolated interbreeding unit. In relation to the gray wolf in the Northern Rocky Mountains, the USFWS recently asserted that the absence of evidence of connectivity with other wolf packs is critical to finding a "marked separation" (Fed. Reg. 74: 15128), providing more support for the discreteness of Prince of Wales wolves.

In terms of biological and ecological significance, clearly Prince of Wales wolves meet significance criterion (2) since Prince of Wales Island represents a geographically large percentage of the range of the AA wolf in Southeast Alaska and supports an estimated one-third of the entire AA wolf population in Southeast Alaska. Prince of Wales wolves also clearly meet criterion (4) since they differ markedly from other AA wolves in genetic characteristics (Weckworth et al. 2005).

Based on their genetic difference and marked separation from other AA wolves, as well as the fact that POW hosts as much as one third of the entire population of AA wolves, the wolves on POW constitute a DPS of AA wolves and should be protected as such.

III. 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).[15]

This section describes threats to the Alexander Archipelago wolf in the context of the five listing factors and demonstrates that the wolf is in danger of extinction within all or a significant portion of its range, or will be in the foreseeable future. The greatest threats to the wolf are the past and ongoing loss of old-growth forests from logging (which will contribute to the long-term deterioration of the wolf's prey base) and the proliferation of roads (which facilitate unsustainable legal and illegal hunting and trapping pressure, leading to increased mortality). These impacts are being felt acutely on Prince of Wales Island and other islands of the Alexander Archipelago and will continue through the foreseeable future (USFS 2010a[16]). Other threats, including the susceptibility of small, isolated populations, the elevated risk of the introduction of diseases (e.g., canine parvovirus, distemper) into wolf populations, and climate change, will interact with threats from habitat loss and degradation to further imperil Alexander Archipelago wolves. As explained below, current regulatory mechanisms are worse than inadequate to control these problems; they are, in fact, actively contributing to risks to the wolf. The regulatory problems stem both from the inadequacy of the regulatory mechanisms themselves, as well as from a failure of agencies to properly implement the protections that are in place for the wolf.

A. Present or Threatened Destruction, Modification or Curtailment of Habitat or Range

A primary threat to the Alexander Archipelago wolf is habitat destruction from large-scale logging on the Tongass NF and on private and state lands. In Southeast Alaska, 80% of the wolf's range falls under the jurisdiction of the Tongass NF, and thus logging on Forest lands profoundly affects the AA wolf. Logging (a) diminishes and fragments the habitat elements for

[15] While the ESA does not define the "foreseeable future," USFWS must use a definition that is reasonable, that ensures protection of the petitioned species, and that gives the benefit of the doubt regarding any scientific uncertainty to the species. In the case of the wolf, the forest plans that affect it project out to 100 years (2008 TLMP) and studies regarding impacts to wolves regularly project out to 50 to 100 years (e.g., Person 2001, 2008 TLMP FEIS (e.g., Table 3.10-9)). USFWS should therefore consider 100 years or beyond as the foreseeable future.

[16] The "*The Integrated 5-Year Vegetation Plan: 2010-2014*" was issued in draft form in October 2010, with an opportunity for public comment by Nov. 5. This is essentially what used to be called a Five-Year Timber Sale Schedule, which was issued annually, but with stewardship and service contract projects added. The agency's intent was to finalize the schedule on Nov. 17; however, a final schedule has not yet been issued. Included maps are labeled "FY10 Thru FY 14 Transition Plan." The draft includes 442 mmbf of traditional old-growth timber sales over the next five years, of which 149 mmbf is on Prince of Wales Island. Because the schedule has not been finalized ten months later, an open question is what schedule the agency is actually pursuing. Planning is ongoing on large timber sale projects such as Tonka, Wrangell Island, and Big Thorne. The documentation can be found at: http://www.fs.fed.us/r10/tongass/newsroom/newsroom_specialreports_5YearPlan.shtml.

denning, pup-rearing, and foraging that wolves need for survival, which is particularly detrimental to island populations in this already fragmented landscape; (b) reduces the long-term carrying capacity of the wolf's principal prey, the Sitka black-tailed deer; (c) increases the density of roads, which can push wolf mortality rates from hunting and trapping to unsustainable levels; (d) disturbs wolf dens; and (e) harms salmon runs that provide an important seasonal food source for wolves. This section describes the threats to wolves from logging on the Tongass NF. Section III.E describes how current regulatory mechanisms, including the 2008 TLMP, do not adequately address these threats.

1. Logging in mature, old growth forests diminishes essential habitat

The Alexander Archipelago wolf dens and rears young in old-growth forest and relies on a prey species (the Sitka black-tailed deer) that is an old-growth associated species; the AA wolf is therefore an old-growth obligate species, adapted to survive in mature, old-growth, coastal temperate rainforests along the North Pacific Coast (Person et al. 1996, Person 2001). Logging of old-growth forests on the Tongass NF and on private lands has already drastically reduced essential habitat in core areas for the AA wolf, and the committed changes (the "succession debt") from this past logging will continue to unfold over the coming decades. Future logging under the 2008 TLMP will be most intensive in the regions that support most of the AA wolf population, jeopardizing the future of the AA wolf.

a. A history of disproportionately logging highly productive forest on the Tongass has greatly impacted essential wolf habitat, including extirpation of an estimated 40% to 50% of large-tree forests in the AA wolf's range

As discussed above, AA wolves depend on low-elevation forest, especially stands of relatively tall, large-canopied trees, which provide essential habitat for their principal prey, the Sitka black-tailed deer (Kiester and Eckhardt 1994, Person et al. 1996, Sisk 2007b). These ecologically important stands have been disproportionately logged in comparison to their relative abundance throughout Southeast Alaska, and an indicator of the broader problem with high-grading is that stands of the largest trees have been largely extirpated by logging (Albert and Schoen 2007, Sisk 2007a). As detailed below, logging of large-tree forests has been most extensive in the regions that support 85% of the AA wolf population—GMUs 1A, 2, and 3—and these GMUs have already lost an estimated 40% to 50% of their large-tree forests.[17] Thus, the history of disproportionate logging on Tongass NF has eliminated a significant portion of AA wolf habitat in core wolf regions.

Albert and Schoen (2007) conservatively estimated that a minimum of 28% of the large-tree, old-growth forest has been logged in Southeast Alaska since 1954, and that realistically the percentage of logged old-growth is probably more than 50%. Based on logging rates since 1986, Albert and Schoen (2007) estimated that large-tree forests were logged at rates that exceeded

[17] Albert and Schoen (2007) defines large-tree forest as Class 6/7 under the Forest Services Size-Density Model, which is trees with a quadratic mean diameter in a stand of 53 cm (21 inches). There has also been within-class high-grading in the medium-tree forest (SDM classes 5, 5H and 4, with quadratic mean diameters of stands of 43-53 cm (17-21 inches)). (Id.)

their proportional abundance by 2.89 times and exceeded the proportional rate of logging on medium-tree and small-tree forest types by 333% and 720% respectively. Moreover, most large-tree logging prior to 1979 occurred at the lower elevations used by the AA wolf, including the logging of more than 50% of large-tree flood plain forests and karst old-growth forests during the last century in some regions (Albert and Schoen 2007). The largest individual trees (>12 ft [3.6 m] in diameter) that once occurred in Southeast Alaska are thought to have largely been extirpated (Albert and Schoen 2007). Moreover, scientists have recognized that, to the extent that logging continues on the Tongass, there is a need for compensatory low-grading of timber in order to compensate for the high-grading of high-productivity forest ecosystems (Powell et al. 1996; Powell et al. 1997; Holmberg 1996).

The highest rates of logging occurred in the GMUs that support most of the AA wolf population—GMUs 1A, 2, and 3 (Table 3) (Albert and Schoen 2007). North Prince of Wales Island in GMU 2 originally contained 14% of the productive forest lands in Southeast Alaska but has been the location of 38% of all logging in this region. As a consequence, 32% of all productive old growth, and within it, a conservatively estimated 40% of all large-tree forests, have been logged within the North Prince of Wales Island province,[18] which historically had the most abundant large-tree forests in Southeast Alaska. In other core wolf regions, Kupreanof and Mitkof islands (GMU 3) lost 16% of all productive old-growth forests[19] and 48% of large-tree forests; Etolin and Zarembo islands (GMU 3) lost 15% of all productive old-growth forests and 50% of large-tree forests; and Revilla Island and Cleveland Peninsula (GMU 1A) lost 11% of all productive old growth forests and 40% of large-tree forests.

b. Planned logging under the 2008 TLMP jeopardizes a significant portion of the remaining highly productive old-growth forests essential to the AA wolf

The remaining essential habitat in old growth forests in GMUs 2 and 3 that support most AA wolves are at the greatest risk of continued habitat loss under the 2008 TLMP amendment. Under the 2008 TLMP, 267 million board feet ("MMBF") of timber are allowed to be sold each year (2008 TLMP: Tables 2-14 and 2-20). Logging will occur within the 21% of Tongass NF lands that are designated as "development" land-use designations ("LUDs") (2008 TLMP: 3-2),[20] and 81,000 acres (21%) within the development LUDs is considered suitable and available for old-growth logging (2008 TLMP FEIS: 3-321). This amounts to 4.7% of the Tongass, as often

[18] This "Northern Prince of Wales Province" nomenclature by Albert and Schoen (2007) is the same area as the Forest Service's nomenclature "North Central Prince of Wales Province," and is the bulk of the island, excluding its southern quarter or so. (See also: 2008 TLMP).
[19] Because "productive forest" is a coarse classification of forest, the use of this classification conceals high-grading of various kinds besides that described here for large-tree forest. Although 16% may seem to suggest little impact, it is a poor indicator that underestimates the extent of high-grading.
[20] A table here shows that development LUDs are 3.45 million acres of the 16.8 million acre Tongass.

Table 3. Distribution of productive old-growth forest types and percent of logging within Southeast Alaska provinces.
Source: Albert and Schoen 2007: Table 5.

TABLE 5. Distribution of productive old-growth forest types and percent of timber harvest within 20 biogeographic provinces[a] in southeastern Alaska.

Province	Large-tree forests (acres)	Productive old growth (POG) (acres)	(%)	Timber harvest (acres)	(%)	% of original POG harvested (%)	% of original large-tree forest harvested[b] (%)	Index of Selectivity[c]
North Prince of Wales	130,649	632,303	11.33%	295,782	37.76%	31.87%	39.84%	2.59
Dall Island Complex	9,654	108,864	1.95%	26,885	3.43%	19.81%	44.89%	1.61
Yakutat Forelands	27,576	82,841	1.48%	18,290	2.33%	18.08%	16.25%	1.47
Kupreanof / Mitkof Islands	21,302	357,721	6.41%	67,619	8.63%	15.90%	48.15%	1.29
Etolin / Zarembo Island	12,128	230,651	4.13%	41,300	5.27%	15.19%	49.90%	1.23
E. Chichagof Island	37,775	438,249	7.85%	71,483	9.13%	14.02%	35.63%	1.14
Outside Islands	13,573	118,490	2.12%	18,404	2.35%	13.44%	28.40%	1.09
E. Baranof Island	2,016	91,309	1.64%	13,797	1.76%	13.13%	66.69%	1.07
Chilkat River Complex	20,984	138,538	2.48%	19,940	2.55%	12.58%	21.75%	1.02
Revilla Is. / Cleveland Pen.	32,045	580,282	10.40%	72,838	9.30%	11.15%	39.93%	0.91
South Prince of Wales	43,490	168,570	3.02%	17,881	2.28%	9.59%	10.74%	0.78
Kuiu Island	36,331	290,855	5.21%	29,670	3.79%	9.26%	19.28%	0.75
W. Baranof Island	4,795	236,137	4.23%	19,445	2.48%	7.61%	54.26%	0.62
Taku River / Mainland	23,914	344,340	6.17%	21,540	2.75%	5.89%	20.85%	0.48
Stikine River / Mainland	21,207	334,943	6.00%	15,031	1.92%	4.29%	17.17%	0.35
Admiralty Island	99,937	606,438	10.87%	27,103	3.46%	4.28%	7.35%	0.35
Lynn Canal / Mainland	16,748	212,334	3.80%	6,282	0.80%	2.87%	9.89%	0.23
North Misty Fiords	16,449	217,164	3.89%		0.00%	0.00%	0.00%	0.00
South Misty Fiords	14,171	316,370	5.67%		0.00%	0.00%	0.00%	0.00
W. Chichagof Island	2,023	74,397	1.33%		0.00%	0.00%	0.00%	0.00
All Provinces	586,766	5,580,795	100.00%	783,288	100.00%	12.31%	28.08%[b]	

[a] Glacier Bay and Fairweather Icefield provinces have little productive old growth and are not included

[b] Estimated by extrapolating the rate of logging of large-tree forests after 1986 from areas with known forest structure (29.3%) to all areas logged. This conservative approach substantially underestimates the actual extent of logging in these relatively rare forest types.

[c] index of selectivity equals the % of timber harvests divided by the % of original distribution of productive forests among provinces.

mentioned by the timber industry, but the statistic is meaningless because of the vast acreage of ice, rock, other non-forest lands, and unproductive forest in the Tongass. Limited development, such as roads for certain purposes, limited logging or mineral entries, are also permitted within another 44% of Tongass NF lands that are designated as "natural setting" LUDs (i.e., recreational river and scenic river LUDs allow logging if the adjacent LUD allows logging; other natural setting LUDs may allow salvage logging including removal of trees after insect and disease outbreaks; several LUDs are open to mineral exploration and development and/or only valid existing claims).[21] Logging and road building are not allowed on the 35% of Tongass NF lands that are designated as Wilderness (2008 TLMP: 3-2) and on roadless lands recently protected by the federal court order that terminated the exemption of the Tongass National Forest from the Roadless Rule. However, the permanence of roadless area protection on the Tongass is uncertain.[22]

Of concern for the AA wolf, a significant portion of the lands slated for intensive logging in development LUDs occur in core wolf habitat in GMUs 2 and 3 (Table 4, Figure 3). These GMUs have very few lands protected from logging by wilderness designations (Table 4, Figure 3). In estimates based on the LUD map provided in the 2008 TLMP FEIS, Prince of Wales Island/GMU 2 appears to have 43% of its total area in development LUDs, 36% in "natural setting" LUDs, and only 6% in wilderness LUDs (Table 4). GMU 3 appears to have 53% of its total area in development LUDs, 29% in "natural setting" LUDs, and only 15% in wilderness LUDs (Table 4). It is not only the number of acres that will be logged or miles of road that will be built that matter to the AA wolf, but also the effect of this development on wolf habitat and connectivity in already heavily fragmented landscapes in the region.

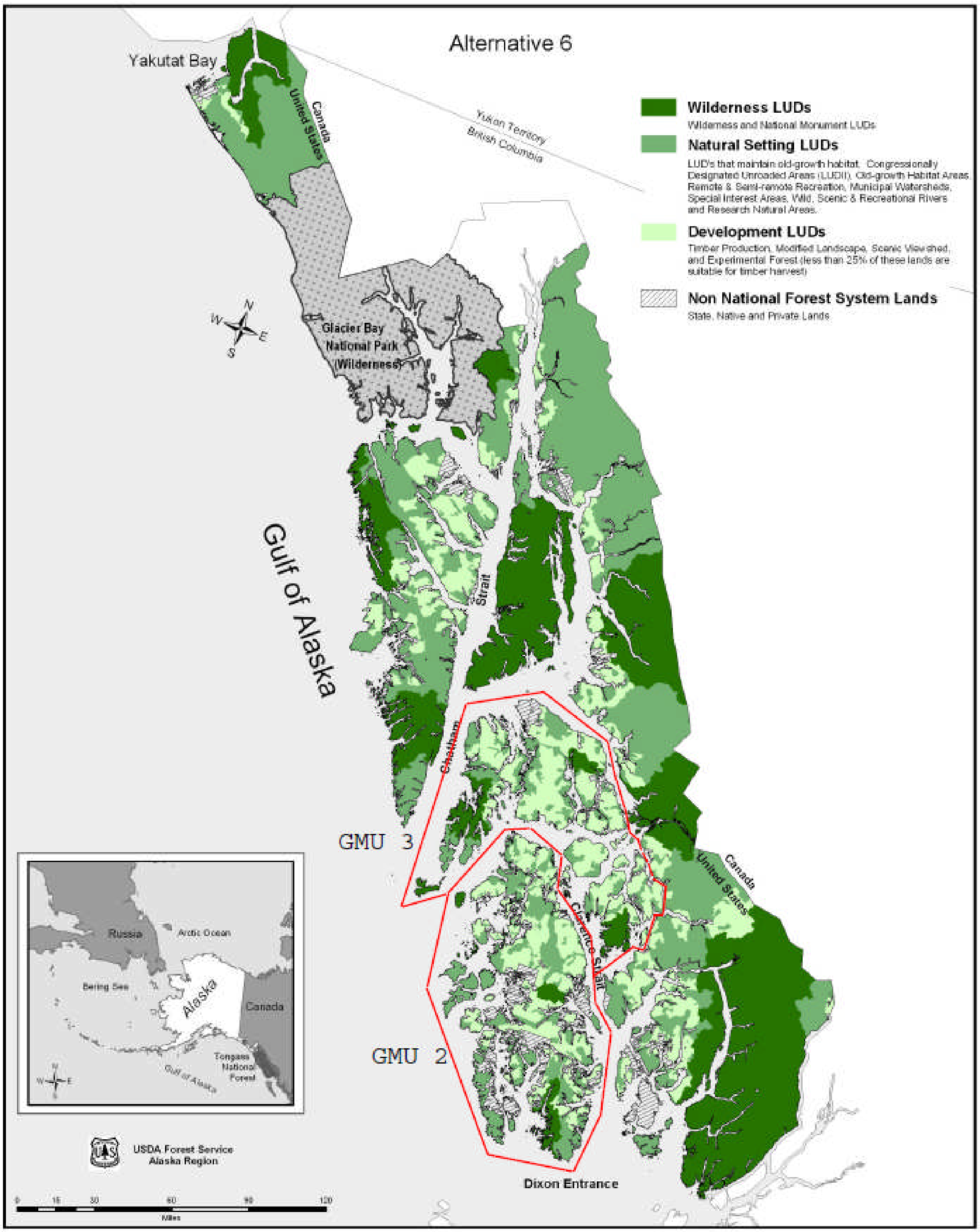
Table 4. Estimates of the total land area in each of four land use designations in GMUs 2 and 3 based on the LUD map for Alternative 6 presented in Figure 2.6 of the 2008 TLMP FEIS. These estimates of land area were derived by digitizing the LUD map and estimating areas in ArcGIS.

Land Use Designation	GMU	Acres	% of Total
Development (national forest)	2	986,811	43
Non-federal land	2	330,394	14
Wilderness & National Monument	2	143,595	6
Natural Setting (other)	2	828,504	36
Development (national forest)	3	1,000,523	53
Non-federal land	3	64,778	3
Wilderness & National Monument	3	275,284	15
Natural Setting (other)	3	541,586	29

[21] See the Natural Setting LUD Group, less the LUD II acreage in the table at 2008 TLMP: 3-2 and descriptions of these LUDs at 3-34 to 94. If application of the Roadless Rule on the Tongass survives legal and legislative challenges, some but not all of the mentioned activities will be precluded on some of this land.
[22] See Roadless Rule section at p. 68 below.

Figure 3. Wilderness, Natural Setting, and Wilderness Land-Use Designations under Alternative 6 of the 2008 TLMP. GMUs 2 and 3 are outlined in red.
Source: 2008 TLMP FEIS: Figure 2.6.

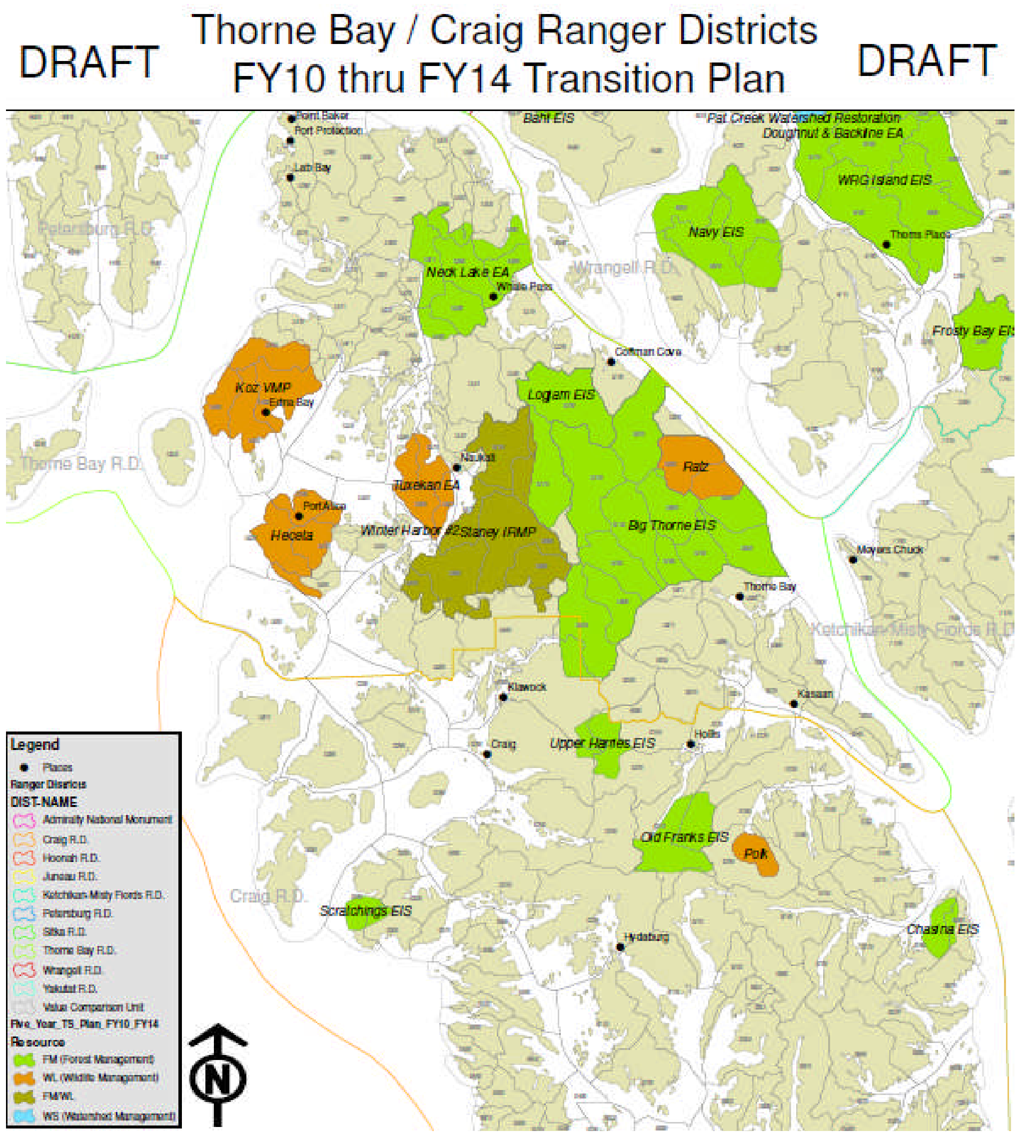
Figure 2-6
Wilderness, Natural Setting, and Development LUDs on the Tongass National Forest under Alternative 6



c. The Integrated Five-Year Vegetation Plan for Tongass NF relies heavily on old-growth logging on Prince of Wales Island

The draft Integrated 5-year Vegetation Plan for the Tongass NF for 2010-2014 relies heavily on old-growth logging on Prince of Wales Island and proposes to build 103 miles of roads on Prince of Wales (USFS 2010a), which has the potential to greatly impact the AA wolf population. Several large timber sales are proposed in core regions for the AA wolf on Prince of Wales, including the Logjam project and the 100-MMBF Big Thorne[23] project, which would be the biggest timber sale on the Tongass in many years (Figure 4).

Figure 4. Timber sales in GMU 2 planned under the Integrated 5-year Vegetation Plan for the Tongass NF. Source: www.fs.fed.us/r10/tongass/newsroom/SpecialReports/5YearPlan/Five_Year_Plan_POW.pdf



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23 *See* http://www.fs.fed.us/r10/tongass/projects/nepa_project.shtml?project=31542.

d. The old-growth reserve system is not adequate to protect the AA wolf

In the 1996 Wolf Conservation Assessment, interagency scientists recommended that large, unfragmented, unroaded, old-growth habitat reserves be established to protect the long-term viability of wolf populations in Southeast Alaska (Person et al. 1996, Person 2001). The 1997 TLMP established an old-growth reserve system that was modified by the 2008 TLMP. However, this reserve system does not adequately protect the AA wolf from habitat destruction caused by logging and road construction.

First, none of the old-growth reserves created by the 1997 TLMP and modified by the 2008 TLMP encompasses an entire wolf pack home range (CSR Report 2008: 75). Consequently, all wolf pack home ranges contain developed lands that are impacted by logging and intersected by roads. Moreover, as discussed above, logging and road-building under the 2008 TLMP will impact wolves on development and some natural setting LUD lands within wolf home ranges. The Forest Service has not conducted an assessment of whether the matrix of reserve and non-reserve lands under the 2008 TLMP is adequate to protect wolves, but existing evidence raises cause for concern that the reserve system is not sufficient.

The map in Figure 5 shows for Prince of Wales Island the 2008 TLMP's explicit old growth reserves ("OGRs") (brown) and other protective congressional designations including wilderness (blue), wild and scenic rivers (purple), and LUD-II (red). This reserve network also includes other natural setting LUDs, not shown because they are more subject to change in subsequent forest plans, including LUDs for remote and semi-remote recreation, research, natural areas, etc. (Iverson 1997; Iverson & DeGayner 1997; 2008 TLMP: 3-2 to 3-94). However, the congressionally protected areas were designated for various purposes and do not necessarily wholly meet old growth reserve criteria, or may not be of high value to wolves. An example is the Outer Islands (Fig.5; Iverson & DeGayner 1997:18). Even explicitly designated OGRs may not meet all criteria for OGR allocation, such as being more circular than linear (Fig. 5; Iverson 1997:64) or lacking sufficient productive old growth ("POG"), high-value POG, or other characteristics (Interagency team 2002; Person et al. 1996; Person 2008[24]).

At the 2006 Tongass Conservation Strategy Review Workshop, Dr. David Person presented evidence that wolf packs with home ranges containing more than 25% of developed land had higher mean annual harvest rates and lower ratios of reproduction to harvest than wolf packs with less than 25% of developed lands (CSR Report 2008: 75, Person 2006). When the percentage of developed land in a wolf home range reached 41%, Person found that wolf populations shifted from a source to a sink (*Id*). Dr. Person warned that among 11 wolf pack home ranges on the Tongass in 2006, the median percentage of undeveloped land was 76% (range: 49% to 88%), and that under current land use plans this could decrease to a median of 23% (range: 3% to 58%) (*Id*). Indeed, under the 2008 TLMP, many of the most important regions for AA wolves will be subject to development on more than 25% of their total lands, including 43% or more of lands on Prince of Wales Island/GMU 2 and 53% or more of lands on GMU 3 (Table 4). If the 2008 TMLP's timber allowances are fully implemented, 43% of

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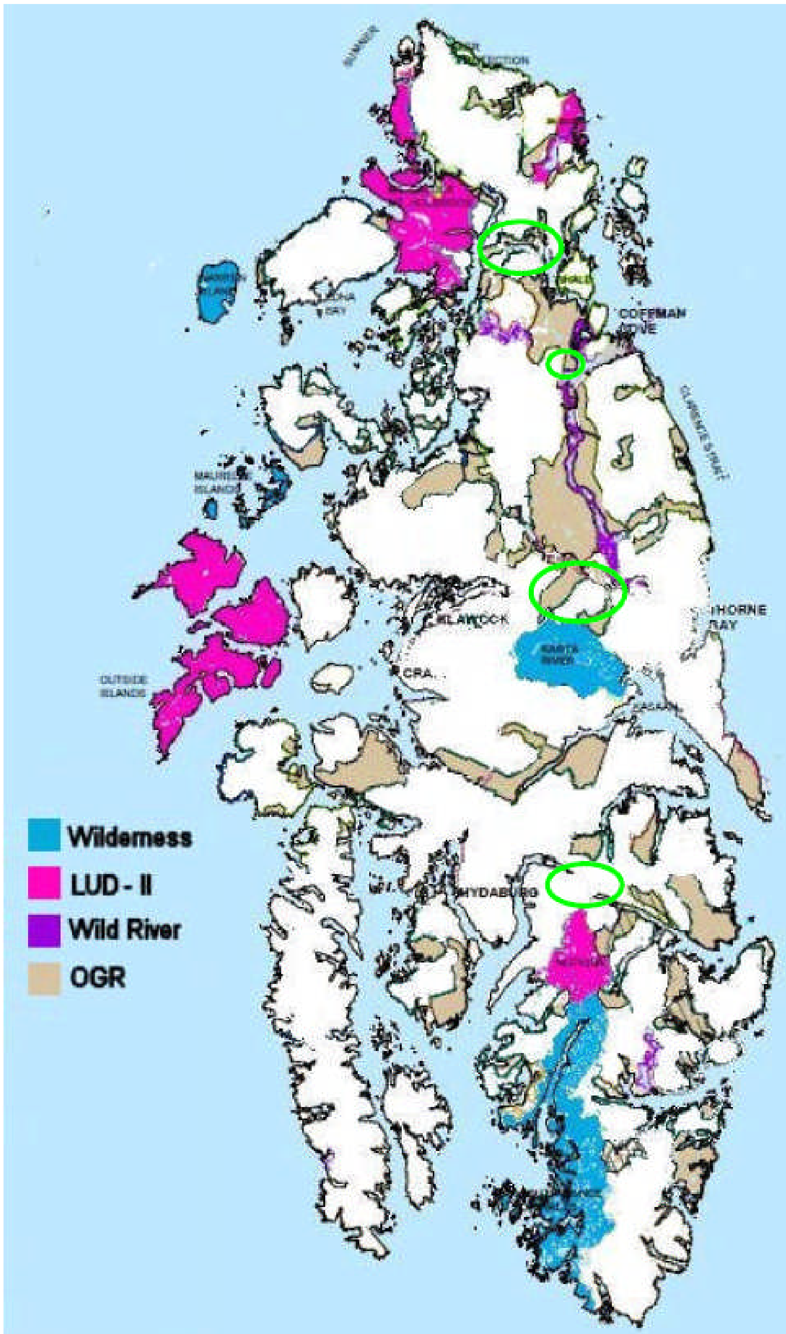
[24] An e-mail message to a Forest Service biologist saying, "The large reserves of Sarkar and Honker Divide are the only ones on POW Island that are sufficiently large to encompass most of a pack territory. . . ."

Figure 5. Old-growth reserves (OGRs) and congressionally designated Wilderness and LUD-II lands on Prince of Wales Island and associated islands. Note: (1) Map made by whiting out other LUDs on the TLMP record of decision ("ROD") map;[25] (2) some OGRs include past logging; (3) portions of Wilderness & LUD-II areas do not meet OGR criteria and may include past logging.



[25] The ROD map is: http://tongass-fpadjust.net/Maps/Map_Images/ROD_887040_300dpi.pdf

the biogeographic provinces on the Tongass NF (10 of 23) will have less than 75% of POG remaining, and 30% of biogeographic provinces (7 of 23) will have only 30% to 50% of POG remaining (2008 TLMP FEIS: Table 2-20).

A 2007 analysis of the reserve system also indicated that it inadequately protects remaining AA wolf habitat from destruction from logging and road construction (Albert and Schoen 2007). Northern Prince of Wales, which contains the greatest amount of large-tree old growth of any province in Southeast Alaska, has little protection for the remaining old-growth forest habitat. Only 13.5% of large-tree stands on Prince of Wales occur in watershed-scale reserves while 41% still exist in the timber base (Albert and Schoen 2007). Etolin/Zarembo and Kupreanof/Mitkof Islands also have less than 25% of their remaining large-tree old growth in watershed-scale reserves while more than 40% exists in the timber base (Albert and Schoen 2007). Thus, according to this analysis, much of the important remaining habitat in GMUs 2 and 3 that should be protected in reserves for the AA wolf (as well as the Sitka black-tailed deer and other species) is subject to future logging.

Connectivity as a factor in wolf mortality and viability is a concern that is an intimate part of old-growth reserve system design (Iverson 1997), but which has not been adequately accommodated in the actual system, particularly regarding four pinch points on Prince of Wales Island. In Fig. 5 these are the green ovals, from top to bottom: the Neck Lake surroundings; a constricted area westward of Sweetwater Lake that is confined by past and recent logging and part of the corridor between Sarkar Lakes and Honker Divide;[26] the Rio Roberts area between Honker Divide and the Karta Wilderness; and Sulzer Portage.

Neck Lake pinch-point:

> Neck Lake (is) sandwiched within a narrow piece of land between Whale Passage and El Capitan Passage. The landscape surrounding Neck Lake is heavily fragmented by past timber harvest (38 percent harvested), and landscape connectivity at this "pinchpoint" has been compromised. . . . Connectivity in this landscape is fragmented not only by previous harvest and roads, but also by the lake itself, which constitutes 39 percent of the proposed reserve acreage. Protecting the remaining old growth in this landscape, which has been largely converted to even-aged second-growth stands, may minimize impacts to remaining deer winter range and will help to maintain travel corridors for wildlife. Beach fringe in this area is also heavily compromised by previous cutting, and should be targeted for management to hasten its return to old-growth characteristics (Interagency team 2002).

Sarkar Lakes to Honker Divide pinch-point:

> TLMP emphasized the importance of connectivity between reserves and highlighted the relatively undeveloped corridor connecting the Sarkar LUD 2 area and the Honker Divide old-

[26] See: Figure 7, a photo of past and current logging in the corridor area westward of Sweetwater Lake.

growth forest reserve. That feature was an important consideration when the U. S. Fish and Wildlife Service ruled that the petition to list wolves in SE Alaska was unwarranted because TLMP offered a potential land management template that might successfully conserve wolves, particularly on Prince of Wales Island. The Logjam sale area proposes new roads, reconstruction of old roads, and timber harvesting within that corridor. Consequently, we have concerns that road access may impact the connectivity between two of the major OGRs in central POW Island. (Barten 2009).

Rio Roberts pinch-point:[27]

It is important to note that none of the alternatives or proposed changes to Small OGR protect pinch points at Anita Bay on Etolin Island or at Rio Roberts on Prince of Wales Island (see also the Alexander Archipelago Wolf section below). Therefore, we recommend that the Final EIS and the Final Forest Plan (1) retain protection for pinch points identified in the 1997 Forest Plan and the Proposed Forest Plan, and (2) add protection for pinch points identified during the Small OGR review, including pinch points at Anita Bay on Etolin Island and at Rio Roberts on Prince of Wales Island. . . .

Landscape pinch points are important to wolf movement and dispersal across the landscape. The largest and most complex system of OGRs is associated with Honker Divide on Prince of Wales Island. These OGRs provide refugia in which wolves produce enough offspring to supplement areas with higher risk and less stable populations (Person et al. 1996). The Rio Roberts watershed is an important denning area and provides for dispersal through a pinch point created by timber harvest from the Honker Divide area to the southern half of Prince of Wales Island, as confirmed by ADF&G telemetry studies from 1998 to 2002 (D. Person, ADF&G, Personal Communication, 2006). Therefore, we recommend that the Final EIS and the Final Forest Plan adopt the Interagency Small OGR Work Group-recommended Small OGR for VCU 5960 (see Attachment B, Table 3) to protect the Rio Roberts watershed (USDOI 2007: 7, 8, 13).

Sulzer Portage pinch-point:

Sulzer Portage is between the West Arm Cholmondeley Sound and Portage Bay at the head of Hetta inlet, on Prince of Wales Island. This relatively narrow neck of land joins the southeast part of Prince of Wales Island to the remainder of the island, connecting North Central and South Prince of Wales biogeographic provinces. This area has had considerable timber harvesting on both National

[27] Although we focus here on Prince of Wales Island and the Rio Roberts area, wolf viability on Etolin Island and nearby Wrangell Island is also a concern in terms of habitat and habitat connectivity, in view of ongoing planning of large timber projects and past logging on those islands.

> Forest and adjacent private lands, and due to a recent transfer of land ownership the pinch-point itself is now all private land. This region is now all private land, dividing the northcentral and south portions of Prince of Wales Island with a non-National Forest strip 1-2 miles wide. Continued timber harvesting is anticipated on these private lands, with the potential creation of potential dispersal barriers. However, clearcuts and advanced second growth forests (50-100 years old) are unlikely to create complete barriers to movement for deer, wolves, marten and squirrels or other species of concern (Iverson 1997).

2. Logging reduces the long-term carrying capacity of the wolf's principal prey, the Sitka black-tailed deer

Reductions in the long-term carrying capacity of the Sitka black-tailed deer under intensive logging pose a significant, ongoing threat to the survival of the AA wolf. Because logging reduces forage habitat for deer, which in turn reduces the amount of prey available for wolves, declines in deer populations due to habitat loss can result in declines in wolf numbers (Person et al. 1996, 2008 TLMP FEIS). The 1996 Wolf Conservation Assessment concluded that wolf populations will not remain sustainable in the event of a deer population decline in Southeast Alaska (Person et al. 1996). As discussed below, past logging has already committed deer populations in southeast Alaska to significant declines in carrying capacity, and future logging under the 2008 TLMP will worsen these declines.

a. Deer declines due to past logging

In the 1996 Wolf Conservation Assessment, the interagency scientists cautioned that declining deer carrying capacity after extensive logging would result in declines in deer numbers and reproductive rates, with resulting impacts on wolves (Person et al. 1996: 27-28). The interagency scientists expected declines in deer carrying capacity and numbers after logging because there is "an expansive body of research spanning 30 years on forest succession following logging . . . in southeast Alaska" indicating that the conversion of old growth forest habitat to second-growth stands reduces the quality and quantity of deer winter habitat. The quality of winter habitat relates to the availability of forage and thermal cover during times of heavy snow and snow-depth-dependent effects on mobility. At times (and sometimes for a period of decades) deer populations may be significantly or greatly reduced (Person et al. 1996). At first, clearcuts produce summer foraging habitat for deer, but within 30 years regenerating conifers create poor habitat conditions for deer that persist for more than a century following canopy closure (Person et al. 1996). Therefore, second-growth that is managed on 100-year to 120-year rotations creates unsuitable deer foraging habitat for approximately 70%-80% of the rotation (Wallmo and Schoen 1980, Alaback 1982, Schoen and Person 2007), and because a substantial acreage of logging is less than 30 years old, much continuing habitat loss is already committed to occur, even if logging were to cease now (Person 2001). Person (2001) called this "succession debt" because the full impacts to wildlife, particularly deer, are not immediately experienced but will continue to unfold over several decades after logging, as seral succession progresses to the stem exclusion phase. An important conclusion of the 1996 Wolf Conservation

Assessment was that current deer populations are not indicators of future population trends because there is a lag time in the effects of logging, and particularly clearcutting, on deer populations (Person et al. 1996). Moreover, "[c]urrent healthy populations of wolves and deer are misleading indicators of future conditions as K for deer declines" (Person 2001: 96).

This latent loss of habitat, yet to be realized as an impact, combined with the further latent and immediate effects of continuing logging and the future effects on deer (and therefore wolves) is what led a USFWS status review team to recommend that AA wolves be listed under the ESA in response to the 1993 ESA petition. According to the status review team, "the conversion of old growth forest into managed stands in southeast Alaska, which began on an industrial scale approximately 30 years ago, is expected to begin resulting in dramatic adverse effects on deer and wolf populations in 10 to 30 years."[28] We are now 15 years into that danger period.

b. Logging will reduce deer densities below the science-based guideline for AA wolves

Based on recommendations from interagency scientists, a habitat carrying capacity of 18 deer per square mile is necessary to provide wolves with adequate foraging opportunities (Person et al. 1996),[29] and this science-based recommendation is part of the AA wolf standards and guidelines in the 2008 TLMP (2008 TLMP: 4-95, 2008 TLMP FEIS: 3-282). However, under the 2008 TLMP, continued logging will reduce deer carrying capacity below this guideline in GMUs 2, 3, and 1A, which are the areas that currently support the most AA wolves. Considering only logging activity on federal lands, the 2008 TLMP FEIS predicts that the Forest Service timber program will:

- reduce deer carrying capacity below the guideline of 18 deer per square mile in GMUs 2, 3, and 1A, including North-central Prince of Wales, Kupreanof/Mitkof Island, Kuiu Island, and Revilla Island/Cleveland Peninsula (Table 5)[30] (2008 TLMP FEIS: Table 3.10-9);
- cause a decline in GMU 2 deer carrying capacity of up to 60% due to past and current logging (2008 TLMP FEIS: 3-283); and
- result in a Forest-wide 22% increase in the number of WAAs that fall below the guideline of 18 deer per square mile (Table 5) (2008 TLMP FEIS: Table 3.10-9).

The FEIS discloses that most of the WAAs which currently meet the guideline but which will likely fail to meet it in the future are located in North-central Prince of Wales and Revilla Island/Cleveland Peninsula:

> All of the alternatives increase the number of WAAs that do not maintain habitat capable of supporting 18 deer per square mile. . . . Most of the WAAs that

[28] *Biodiversity Legal Fndtn. v. Babbit*, 943 F. Supp. 23, 25 (D.D.C. 1996).
[29] The necessary minimum actual density of deer is 13 deer/sq-mile (Person et al. 1996), which equates through deer population dynamics to a carrying capacity of 18 deer/sq-mile (Person et al. 1997).
[30] Note that results for Table 5, as in the items above, would be worse if cumulative effects including logging on non-federal lands were taken into account.

currently meet the Wolf guideline, but may not meet it in the future after 100+ years of implementation, are located in the North Central Prince of Wales and Revilla Island/Cleveland Peninsula biogeographic provinces (2008 TLMP FEIS: 3-283 to 3-284).

Importantly, the 2008 FEIS did not conduct a cumulative impact analysis on deer carrying capacity. As explained in the next section, non-federal lands were not considered in any manner in the calculation of deer carrying capacity, although these lands have been heavily logged and logging is ongoing. This crucial oversight has caused impacts to deer (and consequently to wolves) to be greatly underestimated, and this is especially a problem in GMU 2, which contains a large amount of heavily logged non-federal land.

Table 5. Comparison of alternatives in terms of their long-term ability to meet the wolf guideline.
Source: 2008 TLMP FEIS: Table 3.10-9.

Table 3.10-9.
Comparison of Alternatives in terms of their Long-term Ability to Meet the Wolf Guideline of Providing Sufficient Habitat to Support 18 Deer per Square Mile after 100+ Years of Forest Plan Implementation [1]

	Increase in Percent of WAAs, Relative to 1954 Conditions, with Model-generated Habitat Capability <18 Deer/Sq. Mi. [2]	Biogeographic Provinces of WAAs Affected by Implemention of the Alternatives [3]
1954 Conditions[4]	--	-
Current Conditions	+12%	-
Alternative 1	+16%	14, 15
Alternative 2	+17%	11,14, 15, 18
Alternative 3	+25%	11, 14, 15, 18
Alternative 4	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 5	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 6	+22%	9, 10, 11, 12, 14, 15, 18, 20
Alternative 7	+25%	9, 10, 11, 12, 14, 15, 18, 20

[1] Assumes full implementation of Forest Plan at ASQ levels.
[2] Excludes WAAs where wolves do not occur (Admiralty, Baranof, and Chichagof islands and associated small islands) and WAAs with naturally very low deer densities (WAAs 4302-4607). Habitat capability in terms of deer density calculated using a multiplier of 100 deer per square mile equating to a habitat suitability index score of 1.0.
[3] Biogeographic Provinces: 9 = Northern Coast Range; 10 = Kupreanof/Mitkof Island; 11 = Kuiu Island; 12 = Central Coast Range; 14 = North Central Prince of Wales; 15 = Revilla Island/Cleveland Peninsula; 18 = South Prince of Wales; 20 = South Misty Fiords (some WAAs may overlap more than one biogeographic province)
[4] Approximately 69 out of 122 WAAs (57%) were estimated to have had deer habitat capabilities <18 deer per square mile in 1954.

Under the 2008 TLMP, deer habitat capability and high quality winter habitat will also be disproportionately reduced on the GMUs that support the majority of AA wolves. Compared to the 1954 baseline, the 2008 TLMP FEIS estimates that Alternative 6 (the selected alternative) will reduce Forest-wide deer habitat capability from the 2008 level of 88% remaining to 82% remaining after 100 years (2008 TLMP: Table 2-20). However, GMUs 2 and 3 have and will continue to experience a disproportionate amount of these habitat capability reductions. According to Tables 3.10-7 and 3.10-8 in the 2008 TLMP FEIS, deer habitat capability in the

Wildlife Analysis Areas ("WAAs") that comprise Prince of Wales Island (GMU 2) will be reduced to an average of 73% of the 1954 value (range: 40% to 100%), while deer habitat capability in the WAAs that comprise GMU 3 will be reduced to an average of 79% of the 1954 value (range: 51% to 100%) (Table 6). However, as mentioned, this TLMP analysis failed to take into account the cumulative impacts that include logging on non-federal lands, so the impacts are substantially greater than these numbers suggest.

In addition, a disproportionate percentage of high quality deer winter range habitat will be subject to logging in GMUs 2 and 3. The TLMP FEIS estimates that Forest-wide 8% of high quality winter deer habitat will be subject to intensive logging under Alternative 6 (2008 TLMP FEIS: 3-267). In comparison, 17% of the high quality winter deer habitat in GMU 2 and GMU 3 will be subject to intensive logging (Table 6). As acknowledged by the FEIS, the highest levels of logging of high quality winter deer habitat will occur on Prince of Wales island, Cleveland Peninsula, Mitkof Island, and Baranof Island (2008 TLMP FES: 3-267)—the first three of which are in GMUs 2, 3, and 1A respectively. The 2008 TLMP FEIS warns that reductions in deer habitat capability and high value deer winter range will decrease the number of deer available to wolves:

> Over the long-term, reductions in habitat capability and logging of high value deer winter range could reduce carrying capacity, or the numbers of deer in areas capable of supporting them given the available resources, such that deer populations would decrease in areas that could no longer support the current population. This would primarily be a concern during severe winters, when resources are already limited. Ultimately reductions in the deer population resulting from decreased habitat capability could reduce the number of deer available to wolves and hunters. (2008 TLMP FEIS: 3-267).

Table 6. Changes in deer habitat capability predicted in GMUs 2 and 3 wildlife analysis areas after implementation of the 2008 TLMP. Source: 2008 TLMP: Table 2-20.

GMU	REGION	WAA	% 1954 deer habitat capability in 2006	% deer habitat capability in 100 years	% high quality winter deer habitat suitable for harvest
2	Central Prince of Wales	1107	98	90	15
	Central Prince of Wales	1212	100	92	17
	Central Prince of Wales	1213	98	88	13
	Central Prince of Wales	1214	70	64	19
	Central Prince of Wales	1315	55	47	23
	Central Prince of Wales	1316	100	100	0
	Central Prince of Wales	1317	54	47	22
	Central Prince of Wales	1318	92	75	25
	Central Prince of Wales	1319	74	64	17
	Central Prince of Wales	1332	85	78	13
	North Prince of Wales	1525	51	46	24
	North Prince of Wales	1526	91	89	3
	North Prince of Wales	1527	73	59	26

	North Prince of Wales	1003	66	52	22
	North Prince of Wales	1528	77	71	11
	North Prince of Wales	1529	73	59	14
	North Prince of Wales	1530	62	55	14
	North Prince of Wales	1531	61	52	21
	North Prince of Wales	1420	52	40	26
	North Prince of Wales	1421	74	63	16
	North Prince of Wales	1422	60	47	28
	South Prince of Wales	1108	99	99	0
	South Prince of Wales	1209	100	98	4
	South Prince of Wales	1210	100	88	16
	South Prince of Wales	1211	91	74	19
	Outer Islands	901	97	78	26
	Outer Islands	902	100	99	1
	Outer Islands	1105	99	97	3
	Outer Islands	1106	99	99	0
	mean		**81**	**73**	**15**
3	Kuiu	5012	76	59	25
	Kuiu	5013	94	84	12
	Kuiu	5014	96	75	24
	Kuiu	5015	100	100	0
	Kuiu	5016	98	98	0
	Kuiu	5017	98	98	0
	Kuiu	5018	93	81	20
	Kupreanof	5130	98	87	19
	Kupreanof	5131	90	82	13
	Kupreanof	5132	73	67	15
	Kupreanof	5133	98	85	22
	Kupreanof	5134	92	87	10
	Kupreanof	5135	98	89	14
	Kupreanof	5136	86	66	30
	Kupreanof	5137	98	97	1
	Kupreanof	5138	88	68	31
	Kupreanof	2007	79	65	26
	Kupreanof	2008	99	78	43
	Etolin	1901	91	77	19
	Etolin	1910	96	94	2
	Wrangell	1903	86	71	23
	Woronofski Is.	1904	59	51	16
	Zarembo	1905	77	65	23
	mean		**90**	**79**	**17**

c. The 2008 TLMP significantly underestimates declines in deer habitat capability due to logging

Of concern for AA wolves, the 2008 TLMP significantly underestimates the impacts of logging on deer habitat capability due to the use of a flawed methodology for calculating habitat capability. The 2008 TMLP FEIS models deer habitat capability in the WAAs in a two-step process (2008 TLMP FEIS: 3-265 to 3-268). The Forest Service first assumes that no winter deer habitat exists on non-federal lands since most of these lands have been or will be intensively logged—a fair assumption. However, the Forest Service then calculates deer habitat capability for the *entire WAA* based on the acreage only of federal lands, disregarding non-federal lands in determining the impacts to deer habitat capability. This results in an often severe underestimation of deer habitat capability for the WAA because non-federal lands typically have, or will have in the future, a much lower capacity to support deer as a result of intensive logging. The underestimates are especially significant in WAAs that have a large percentage of non-federal lands. Although the Forest Service claims that its deer carrying capacity analysis is conservative because a zero carrying capacity was assumed for non-federal lands (2008 TLMP FEIS: 3-266), that assumption is negated by the agency's second assumption that the amount of non-federal lands in a WAA can be simply and entirely ignored when calculating the WAA's habitat capability (TLMP FEIS: 3-267). The correct method would entail the Forest Service modeling the maximum number of deer the WAA's federal lands can support, and then dividing that number by the total acreage of the WAA, including the non-federal lands. With the current method, the Forest Service fails to account for the cumulative impacts to deer populations from logging and other impacts on non-federal lands that are additive to those on the national forest.

As an illustration of the error in evaluating deer carrying capacity, the 2008 TLMP FEIS claims that Long Island, which is part of GMU 2 and comprises its own WAA, still retains 99% of its deer winter carrying capacity and that it will continue to do so throughout the 100-year time horizon viewed by the plan (see WAA 1106 in Table 3.10-8 of TLMP FEIS at 3-269). However, approximately 75% of Long Island is non-federal land that was almost entirely clearcut 20 years ago. Clearly, the 1% loss of carrying capacity for the Long Island WAA estimated in the 2008 TLMP FEIS is incorrect because the loss of old-growth habitat has been extensive on the island. The error arose because the Forest Service considered only the 25% of the island that is federal and the small amount of development that has occurred on that portion.

Overall, the Forest Service's evaluation of wolf viability under the 2008 TLMP is flawed because of such inaccurate, overly optimistic calculations of changes in deer habitat capability. Of particular concern on Prince of Wales Island, many of the WAAs have a significant percentage of non-federal land (Table 7),[31] meaning that existing and anticipated future losses of deer carrying capacity on those lands are greatly underestimated by the 2008 TLMP. This is a critical problem because each WAA on Prince of Wales Island contributes to the viability of the island's genetically distinct wolf population. Correction of the deer habitat capability analysis

[31] The total acres in each WAA is from a 1992 document in the 1997 TLMP planning record ff. JLM-016-1977. In those tables the acreage of non-federal land in each WAA is no longer accurate because of subsequent land conveyances from federal ownership. The non-federal acreages were therefore obtained from 2008 TLMP planning record document 603_0935.pdf, in which the "Acres" column is the federal acres. The correct current non-federal acres (as of 2006) is the difference between the WAA total (from the 1992 document) and the latter.

Table 7. Petitioners' Corrections to TLMP Deer Carrying Capacity Estimates for POW WAAs, Based on Forest Service Data

Current POW whole-WAA Deer Carrying Capacity (Col-C from: JLM_016-1977 (1992); Cols-D & I from TLMP Doc 603_0935)

POW WAAs		Total WAA Acres (JLM_016-1977 et seq.)	WAA acres in National Forest (Doc 603_935)	Non-Federal WAA Acres (calculated)	% Non-Federal (calc.)	Fractional Percent (if <= 1%)	TLMP Federal Carr. Cap. (Doc 603_935)	Whole WAA Carr. Cap. (calc, 2006)	Shortfall from 18 D/sq-mi	Area weight (for calc.)
1529	POW, north tip	71,166	68,677	2,489	**3%**		20.0	**19.3**		1,375,600
1528	Salmon Bay	24,587	24,522	65	**0%**	0.26%	10.3	**10.2**	**-43%**	251,596
1525	Kosciusko, west	48,269	41,103	7,166	**15%**		27.7	**23.6**		1,139,786
1526	Kosciusko, east	67,547	66,998	549	**1%**		20.8	**20.6**		1,390,209
1527	Caulder	44,659	39,448	5,211	**12%**		21.0	**18.5**		827,619
1530	Whale Pass	64,787	59,148	5,639	**9%**		14.6	**13.3**	**-26%**	864,744
1003	Heceta	44,574	40,828	3,746	**8%**		30.8	**28.2**		1,257,094
1531	Sea Otter Sound	36,749	34,007	2,742	**7%**		33.1	**30.7**		1,126,652
1422	Sarkar, Naukati, Staney	126,082	120,638	5,444	**4%**		17.6	**16.8**	**-7%**	2,119,610
1421	Logjam	92,689	89,942	2,747	**3%**		18.1	**17.5**	**-3%**	1,626,151
1420	Coffman Cove	47,017	42,413	4,604	**10%**		12.1	**10.9**	**-39%**	512,773
902	San F., Maurelles, Baker, Lulu, Noyes	107,963	105,519	2,444	**2%**		30.8	**30.1**		3,248,930
1323	Nossuk Bay (west of Staney & Shaheen)	40,880	37,831	3,049	**7%**		25.1	**23.2**		947,667
1318	Craig, Klawock, Big Salt	127,108	55,668	71,440	**56%**		13.6	**6.0**	**-67%**	757,641
1319	S. Honker & the Rios	104,462	103,324	1,138	**1%**	1.09%	16.0	**15.8**	**-12%**	1,650,084
1315	Kassaan & Thorne Bay	97,479	54,571	42,908	**44%**		16.8	**9.4**	**-48%**	915,701
1316	Karta	40,888	39,589	1,299	**3%**		14.8	**14.4**	**-20%**	587,501
901	Suemez	37,184	36,146	1,038	**3%**		26.7	**25.9**		963,291
1332	Soda Bay	85,080	60,959	24,121	**28%**		17.4	**12.5**	**-31%**	1,063,125
1317	12-Mile & Soda Nick	70,377	60,279	10,098	**14%**		10.6	**9.1**	**-49%**	640,163
1214	12-Mile & Skowl Arm	97,556	73,123	24,433	**25%**		13.5	**10.1**	**-44%**	987,161
1212	Cholmondeley, north	37,584	36,491	1,093	**3%**		15.1	**14.6**	**-19%**	550,284
1105	Dall Island	164,258	104,481	59,777	**36%**		29.5	**18.8**		3,082,190
1106	Long Island	31,000	7,280	23,720	**77%**		27.3	**6.4**	**-64%**	198,526
1107	Hydaburg area	213,684	139,674	74,010	**35%**		23.6	**15.4**	**-14%**	3,293,513
1211	Cholmondeley, south	60,876	37,804	23,072	**38%**		24.8	**15.4**	**-15%**	935,649
1213	Cholmondeley, west	34,747	30,282	4,465	**13%**		18.1	**15.8**	**-12%**	549,013
1210	Moira Sound	89,410	85,927	3,483	**4%**		17.7	**17.0**	**-5%**	1,522,626
1108	S. POW Wilderness	85,446	85,251	195	**0%**	0.23%	22.5	**22.4**		1,914,737
1209	Cape Chacon	82,973	82,521	452	**1%**		23.0	**22.8**		1,895,507
		2,277,081					**POW Avg. in 2006 =**	**16.8**		38,195,143 = Sum

The table is organized from N. to S., in tiers running generally W. to E. ***NOTE*: "<u>Succession debt" on federal lands not included</u>.** **60.0% of WAAs fail S&G**

WAAs with no non-federal land are not shown, except two where subsequent land conveyances are known to have occurred.
WAA descriptions and the various calculations have been added

(Source: Edwards. Greenpeace, May 2011)

and a re-evaluation of wolf viability under the 2008 TLMP are urgently needed.

For 2006, in Table 7 we correct the Forest Service's error of ignoring non-federal lands. The result is that, for an average winter, in 2006 the overall deer carrying capacity of Prince of Wales and associated islands was 16.8 deer per square mile, which is less than the TLMP's standard and guideline of 18 deer per square mile. This does not include the already committed succession debt on the federal lands that is yet to be realized.[32] Table 7 shows that 60% of POW WAAs already fail the standard and guideline, and most of the failed WAAs have double-digit percentage shortfalls from that threshold, some being as high as two-thirds short. These significant shortfalls underscore the need to reassess the sustainability of the wolves on the Tongass, and on these islands in particular.

3. Habitat modification through road building directly increases wolf mortality

Although the 1993 AA wolf ESA petition and listing decision focused heavily on logging of old growth habitat and the subsequent reduced carrying capacity for Sitka black-tailed deer, a number of studies have demonstrated that logging on the Tongass NF poses an even more direct and immediate threat to wolves: increased hunting and trapping mortality fueled by increased road density. The combination of decreased habitat for prey and increased hunting and trapping pressure from roads has likely already led to decreases in wolf numbers in parts of Southeast Alaska, especially in GMUs 2 and 3.

Numerous studies have concluded that both open and closed roads negatively affect AA wolves in southeast Alaska by increasing access for legal and illegal hunting and trapping (Person et al. 1996, Person and Russell 2008). Wolves on Prince of Wales Island in particular have a history of heavy harvest, which is thought to be facilitated by the high density of roads that provide easy access to remote parts of the island. As acknowledged by the Forest Service, "[l]ocal declines on Prince of Wales Island have been linked to the influence of road densities that provide greater trapping and hunting access to significant proportions of the wolf range, which increases wolf vulnerability to both legal and illegal mortality" (2008 TLMP FEIS: 3-281).

As detailed below, studies indicate that total road densities (i.e., open, closed, stored, decommissioned and temporary roads) of 0.7 mi/mi^2 or more are unsustainable for wolves.[33] These road densities have already been exceeded in many regions of GMUs 2 and 3, and under the 2008 TLMP, additional road construction will be concentrated in these GMUs. As discussed

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[32] The Forest Service's assumption of zero carrying capacity on non-federal lands (when properly implemented) already takes succession debt into account on those lands.

[33] The TLMP wolf standard and guideline includes a range of 0.7 mi/mi^2 to 1.0 mi/mi^2; however, scientists who have studied wolves in the region hold to the smaller of those densities. (Pers. comms. Dr. David Person, Person et al. 1996, Person 2006: 18, 20, 21). The 1.0 density that the Forest Service prefers to rely upon comes from wolf studies in Minnesota, where ecological and social factors affect both the legal and illegal take of wolves differently than in Southeast Alaska. "These studies show that wolves generally failed to survive in areas with road densities >0.6 kilometer per square kilometer (0.9 mi/mi^2) whereas they persist in similar areas with lower densities of roads." (Person et al. 1996). Because this suggests a risk of local extinction instead of providing for viability, scientists outside the Forest Service use 0.7 mi/mi^2, not the range of values used in TLMP.

in section III.E below, a chronic history of failure by the Forest Service to implement road density guidelines on the Tongass NF poses a significant threat to the AA wolf.

a. Studies informing harmful road density levels for AA wolves

The 1996 Interagency Wolf Conservation Assessment identified and demonstrated a clear correlation between road densities and high wolf mortality rates (Person et al. 1996, Person 2001). The interagency scientists found that wolves in GMUs 2 and 3 experienced significantly higher mortality from hunting and trapping in WAAs that have higher road densities. Table 8 presents the road density relationships described in the following paragraphs.

Table 8. Road Density Effects on Wolves, From POW Field Studies.

Road Density (miles/mile^2)	Effect	Citation
0.49	Sharp increase in harvest	Person et al. (1996:24)
0.66	Reported hunting/trapping **mortality doubles.**	Person et al. (1996:25)
0.70	Lower value in TLMP S&G. Value recommended by wolf scientists. May be too high.	2008 TLMP (4-95); Person et al. (1996); Person (2006)
0.90	Wolves generally fail to survive at road densities greater than this.	Person et al. (1996:22)
1.00	Upper value in TLMP S&G	2008 TLMP (4-95)
1.19	Reported hunting/trapping **mortality triples**.	Person et al. (1996:25)
1.44	Four POW packs eliminated at densities >= this.	Person & Russell (2008)
1.63	Reported hunting/trapping **mortality quadruples**.	Person et al. (1996:25)

Harvest rates increased sharply in WAAs where road density level exceeded 0.49 mi/mi^2 (Person et al. 1996: 24). Modeling results indicated that wolf mortality due to hunting and trapping doubled at densities of 0.66 mi/mi^2, tripled at 1.19 mi/mi^2, and quadrupled at 1.63 mi/mi^2, although the scientists noted that these were rough estimates (Person et al. 1996: 25).

Although the 1996 Assessment did not specify a road density at which wolf populations become non-viable, observations on the Tongass indicated that road densities greater than 0.9 mi/mi^2 (0.6 km/km^2) cause unsustainable mortality. Studies from the Midwest had shown that wolves generally fail to survive in areas with road densities of more than 0.9 mi/mi^2 but will persist in similar areas with lower road densities (Person et al. 1996: 22). Consistent with the Midwest studies, in two areas on Prince of Wales Island that exceeded the 0.9 mi/mi^2 threshold, trappers and hunters eliminated all known resident wolves, and then killed female wolves that tried to establish packs in the vacant areas (Person et al. 1996: 24). Although wolves on Prince of

Wales Island did utilize areas exceeding the threshold, their core areas were located in the least densely roaded portions of the home range, and wolf activity in densely roaded areas occurred primarily at night (Person et al. 1996: 23). Raising cause for concern, interagency scientists found road densities in half of the WAAs in Prince of Wales Island/GMU 2 and 17% of the WAAs in GMU 3 exceeded the 0.9 mi/mi² threshold in 1996 (Person et al. 1996: 22).

Based on observations and modeling results, the 1996 Wolf Conservation Assessment recommended that road density analyses on the Tongass NF incorporate closed roads and focus on low elevation areas (Person et al. 1996: 24). The interagency scientists concluded that road management to control access could help to reduce mortality, but they emphasized that road closures are not fully effective (Person et al. 1996: 28). Direct observations and traffic sensors on the Tongass revealed that motorists frequently utilize roads posted as closed to motorized traffic, and in several cases motorists destroyed gates for the purpose of enabling access (Person et al. 1996: 26). In addition, the construction of gates and the removal of culverts proved insufficient to eliminate all-terrain vehicle and snowmobile traffic (Person et al. 1996: 26). Overall, the scientists recommended developing “a systematic access management approach” on the Tongass that incorporated the needs of wolf populations by (a) acquiring reliable information about core wolf activity areas and (b) prohibiting road construction or closing existing roads in these areas (Person et al. 1996: 28).

At the 2006 Interagency Conservation Strategy Workshop, Dr. David Person presented evidence that the road density guideline in the 1997 TLMP to not exceed 0.7 to 1.0 mi/mi² 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 (2008 TLMP FEIS: 3-237, CSR Report 2008: 74, Person 2006).[34] The model indicated that 32% of the 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 (2008 TLMP FEIS: 3-237, CSR Report 2008: 74, Person 2006). 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: 74, Person 2006). As the Forest Service acknowledged: “[l]ocal declines on Prince of Wales Island have been linked to the influence of road densities that provide greater trapping and hunting access to significant proportions of the wolf range, which increases wolf vulnerability to both legal and illegal mortality” (2008 TLMP FEIS: 3-237).[35] Nonetheless, Dr. Person’s recommendations were not worked into the TLMP standard and guideline.

In 2008, Drs. Person and Russell published a study on Prince of Wales wolves to follow up on the 1996 Conservation Assessment’s discussion of hunting and trapping mortality in relation to road densities (Person and Russell 2008). This study made a stronger statement about

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[34] The Tongass Conservation Strategy Review Workshop was held in 2006, and the final report is dated January 2008, document 603_1610 in the 2008 TLMP planning record.

[35] The decline noted in the 2008 TLMP FEIS is not a reference to the recent dramatic decline in the population, which was unexpected and not discovered until the summer of 2010.

morality risks than previous work in concluding that “[r]oads clearly increased risk of death for wolves from hunting and trapping and contributed to unsustainable rates of harvest” (Id.).

This study demonstrated a linear increase in wolf harvests in areas with road densities up to a threshold of 1.44 mi/mi² in a wolf pack home range (Person and Russell 2008). At threshold road densities of 1.44 mi/mi², the study predicted a harvest of 1.2 wolves/100 km^2, which would equate to a harvest rate of 3.5 wolves within an area the size of wolf pack home ranges (300 km^2) in this region. With an average pack size in autumn of 8 wolves plus an additional 1–2 nonresident wolves, this harvest rate would eliminate about 35%–39% of the autumn population. The authors concluded that after accounting for natural mortality and illegal kills, “total mortality could greatly exceed 38% of the autumn wolf population and be unsustainable at that level of roads.” The authors hypothesized that the absence of further increases in harvest rates at road densities above the 1.44 mi/mi² threshold suggested localized depletions. The four packs eliminated during the study utilized areas where road densities exceeded the 1.44 mi/mi² threshold.

Importantly, the study predicted that unsustainable mortality would occur under the 1997 TLMP road density guideline range of 0.7 mi/mi² to 1.0 mi/mi² for open roads. The TLMP guideline for open roads of 0.7 mi/mi² equates roughly to a total road density of 1.35 mi/mi², given that on average the density of open roads on federal lands represents 53% of all roads. The 2008 model predicted a harvest rate of 2.9 wolves per pack home range at a road density of 1.35 mi/mi^2, which is 29% to 32% legal reported mortality for an autumn pack. This mortality does not include illegal harvest, additional wolves killed by hunters and trappers using boats, and natural mortality which could make total mortality 50% higher. Person and Russell (2008) concluded that the “the TLMP guideline entails considerable risk of facilitating chronic unsustainable mortality.”

Although Person and Russell (2008) hypothesized that wolf mortality was more strongly associated with open roads, they emphasized that closed roads were also detrimental to wolves. In the Tongass NF, hunters and trappers frequently used closed and overgrown roads because they believed wolf activity was higher in these areas, and road closures were frequently bypassed by riders on ATVs, trail bikes and snowmobiles (Person and Russell 2008).

Person and Russell (2008) highlighted several management implications for Alexander Archipelago wolves based on their study: (1) high rates of illegal harvest indicate that reported harvest significantly underestimates mortality due to hunting and trapping; (2) high road densities facilitate the legal and illegal harvest of wolves; (3) high mortality rates for dispersing wolves may create more isolated and disjunct wolf populations in this fragmented landscape; (4) wildlife managers should consider effects of roads and other habitat features on harvest of wolves when developing harvest recommendations; and (5) “a combination of conservative harvest regulations and large roadless reserves likely are the most effective measures for conserving wolves where risks from human-caused mortality are high.”

b. Road densities on the Tongass NF already cause unsustainable mortality and will continue to increase under the 2008 TLMP

As of 2008, there were 4,942 miles of existing roads on the Tongass NF. Under the 2008 TLMP, road construction on the Tongass NF is expected to increase by another 3,744 miles of road over a 100-year period, which represents a 76% increase over current conditions (2008 TLMP: 2-47). The proposed Integrated 5-year Vegetation Plan for the Tongass NF for 2010-2014 issued in October 2010 plans for 234 miles of new road forest-wide, including the construction of 103 miles of road on Prince of Wales Island (68 miles from traditional timber sales and 35 from wildlife restoration and young growth projects) and 88 miles of road in GMU 3 (USFS 2010a). Of concern for the AA wolf, road densities in GMUs 2 and 3 are already high, and new road construction will concentrate in these regions. Currently, 19 out of 54 WAAs (35%) in GMUs 2 and 3 have total road densities greater than 1.0 mi/mi², including both Forest Service and non-Forest-Service lands (2008 TLMP FEIS: 3-285)—a density threshold that is known to have harmful effects on wolves. After full implementation of the 2008 TLMP, more than half of the WAAs in GMUs 2 and 3 (28 of 54) would exceed the road densities of 1.0 mi/mi² (2008 TLMP FEIS: 3-285). In addition, under the 2008 TLMP an expected 24% (2.3 million acres) of existing roadless areas would be subject to potential road construction since these areas are allocated to moderate and intensive development land use designation. Thus the roads will increase in the already heavily impacted GMUs 2 and 3, and the network of existing roadless areas will be compromised.

4. Logging and road building jeopardize wolf dens

The best-available science indicates that the AA wolf requires den sites that are protected from logging and road-building. The 1997 TLMP included standards and guidelines for den buffers and timing restrictions that "required" buffers of 1200 feet surrounding active dens from April 15 to July 1 and prohibited road construction within 600 feet during this time period, but allowed for site-specific exceptions (1997 TLMP: 4-117). The 1997 TLMP also allowed for the abandonment of the buffer restriction after two years of monitored inactivity (1997 TLMP: 4-117). However, at the interagency 2006 Conservation Strategy Review Workshop, Dr. David Person presented modeling results (based on a wolf denning area resource selection function) that indicated that (a) the road buffer of 600 feet was too small; (b) inactivity at a den site for two years does not imply that the den is abandoned, meaning that lifting den buffer restrictions after two years of inactivity was unjustified; and (c) dens are used between April 15 and October 1, suggesting that the timing restrictions lasting only through July 1 were too short (CSR Report 2008: 74-75). Dr. Person reported that areas on the Tongass NF with a 75% probability of wolf use had a median distance of 2,000 feet from roads and 1,535 feet from other developments, and that the probability of a wolf selecting a suitable den site within 600 feet from a road fell to 45% (CSR Report 2008: 74-75). Dr. Person concluded that both road-building and logging affected den site selection, and that "the current [1997 TLMP] Forest Plan guidelines pertaining to den sites are unsupported by evidence and should be updated" (CSR Report 2008: 75).

As discussed in the "Inadequacy of Existing Regulatory Mechanisms" section below, the 2008 TLMP retained the inadequate 1997 TLMP den buffer guidelines, including the 600-foot road buffer and the removal of the buffer after two years of monitored inactivity (2008 TLMP: 4-95).

5. Logging harms salmon runs that provide an important autumn food source for wolves

Salmon provides an important seasonal food resource to AA wolves (Kohira 1995, Szepanski et al. 1999).[36] Logging and road-building have well-documented negative effects on salmon stream habitat (see review in Bryant and Everest 1998), and past and continued logging and road construction on the Tongass NF pose a threat to salmon populations in Southeast Alaska, which in turn jeopardize this food source for AA wolves.

During the first 20 years of large-scale logging on the Tongass NF (i.e., 1950s to 1970s), most logging occurred in the easily accessible, low-elevation valley bottoms where low-gradient streams are concentrated (Bryant and Everest 1998). Low-gradient streams and their associated riparian habitats are the most productive locations for anadromous salmonids (Bryant and Everest 1998). Bryant and Everest (1998) concluded that concentrated logging in valley bottoms on the Tongass NF has left a "legacy of streams with deteriorating habitat" (p. 249). As noted by Bryant and Everest (1998), the loss of habitat quality due to logging has long-term impacts that are "likely to continue for more than 100 years after logging, until riparian trees become large enough to maintain stream channel complexity" (p. 262). Other studies have found that logging has altered salmon stream characteristics and morphology on the Tongass NF, including changes in woody debris amounts and in sediment distribution (Gomi et al. 2001). Gomi et al. (2001) also warned that current forest practices on the Tongass NF, including failure to require riparian buffer zones, do not adequately protect headwater streams with salmonids:

> Forest practices in and around headwater streams are inconsistently regulated, and management is based on very limited scientific knowledge. For instance, steep headwater streams without salmonids do not typically require riparian buffer zones. Even when riparian buffer strips are left, the relatively narrow riparian corridor may be highly susceptible to windthrow. Wide riparian buffers in headwater systems will reduce the amount of timber available for harvest. To effectively manage headwater streams, information on geomorphic processes, hydrology, and riparian vegetation dynamics needs to be systematically integrated. (Gomi et al. 2001: 1398).

Roads and culverts are also likely to be affecting fish passage between spawning and wintering habitat. Another concern for salmon is that escapement records on specific watersheds, especially those most severely affected by management, are non-existent or qualitative (Bryant and Everest 1998). As a result of inadequate monitoring, negative impacts on salmon populations from habitat loss and degradation caused by logging are likely to go undetected.

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[36] Coastal British Columbia wolves are also reliant on salmon and show a shift in diet from deer toward salmon in the fall, with salmon occurring in at least 40% of all feces and up to 70% of feces for some groups. (Darimont et al. 2008).

B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes

Direct mortality from legal and illegal hunting and trapping is by far the highest cause of mortality for the AA wolf (Person 2001, Person and Russell 2008). As detailed below, there is ample evidence that illegal harvest accounts for more than half of human-caused wolf mortality on the Tongass NF, that legal and illegal harvest are occurring at unsustainable levels, that high mortality rates for dispersing wolves may create more isolated and disjunct wolf populations, and that harvest regulations are ineffective for addressing the threat of illegal harvest or for regulating legal harvest (Person and Russell 2008).

1. Past hunting and trapping

According to scientific literature pertaining to wolves in general, mortality levels averaging between 25% and 40% annually over a multi-year period can result in population declines (Person et al. 1996: 10). For AA wolves on the islands of Southeast Alaska, a precautionary approach is required because of their increased vulnerability to overexploitation due to low immigration rates from other areas (Person et al. 1996: 10). In the 1996 Wolf Conservation Assessment, interagency scientists recommended a total annual mortality level of no more than 30% to 35% for AA wolves in order to maintain current population levels at the estimated per capita birth rate (Person et al. 1996).

However, over the past several decades, hunting and trapping appear to have exceeded these recommended sustainable levels. The Tongass NF timber program facilitated access by building 3,000 miles of road on private and federal lands between 1954 and 1996 (Person et al. 1996: 26). Harvest pressures increased as the human population on Prince of Wales Island grew from 1,000 people in 1960 to more than 7,000 by 1996 (Person et al. 1996: 26). Annual average wolf harvest rates quintupled from the late-1970s to the mid-1990s with a peak take of 132 wolves in 1996 (1997 TLMP FEIS Appendix N: 35-36). ADF&G's annual wolf harvest reports account only for the voluntarily reported, legal take;[37] however, wolf researchers have at a few points in time estimated the total legal plus illegal take. According to the 1996 Wolf Conservation Assessment, ease of access and continued trapping effort resulted in high levels of exploitation of Prince of Wales wolves with total annual mortality exceeding 45% during the 1990s (Person et al. 1996: 26). A 1995 study cited in the 1996 Wolf Conservation Assessment estimated legal, illegal, and natural mortality in radio collared wolves at 50% annually in GMU 2 (Person et al. 1996: 9-11). Person and Russell (2008) estimated a mortality rate of 55% during 1993-1995 and 38% during 1999-2002. The mortality rates during both these periods were greater than the sustainable rate of mortality (<34%) estimated for wolf populations, and wolf populations declined during both these periods (Person and Russell 2008).

In the 1996 Wolf Conservation Assessment, interagency scientists cautioned that reported mortality levels "may substantially underestimate total mortality" (Person et al. 1996: 9). The 1996 assessment projected increases in both legal and illegal take as the area's human populations and access expanded (Person et al. 1996: 26). There was also ample indication that

[37] See recent harvest reports, e.g., www.adfg.alaska.gov/static/home/library/pdfs/wildlife/mgt_rpts/09_wolf.pdf.

declines in deer numbers associated with habitat loss could exacerbate both legal and illegal wolf harvest levels as deer hunters began to perceive wolves as "undesirable competitors" (Person et al. 1996: 26-28). Interagency scientists concluded that the ability of wolf harvest regulations to reduce mortality could be limited by a lack of enforcement, particularly as road densities continued to increase (Person et al. 1996: 28).

2. Current hunting and trapping

A recent analysis by Person and Russell (2008) found that legal harvests currently remove 25% to 30% of the Prince of Wales wolf population on an annual basis (Person and Russell 2008). However, this estimate did not include illegal take. Person and Russell (2008) estimated that illegal kills and natural mortality could be as much as 50% of the reported legal harvests of AA wolves. As noted above, the mortality rate was 38% during 1999-2002, which was greater than the sustainable rate of mortality (<34%) estimated for wolf populations (Person and Russell 2008). The researchers cautioned that "[w]ildlife managers . . . should expect substantial illegal harvest where wolf habitat is accessible to humans" (Person and Russell 2008).

Person and Russell (2008) also raised concern that the high rate of legal and illegal mortality for dispersing wolves may decrease the viability of AA wolf populations: "high rates of mortality of nonresident wolves exposed to legal and illegal harvest may reduce or delay successful dispersal, potentially affecting linkages between small disjunct wolf populations or population segments occupying fragmented landscapes" (p. 1548). They also cautioned that harvest regulations are not effective for reducing illegal harvest rates.

C. Disease or predation

AA wolves are vulnerable to mortality from canine diseases introduced by dogs and other domesticated animals on the Tongass NF. In the Tongass, rising human habitation and numbers of domesticated animals is increasing the potential exposure of wild wolves to introduced diseases (Cook et al. 2006). Isolated AA wolf populations on islands and coastal mainland localities in Southeast Alaska are particularly susceptible to disease due to their decreased genetic diversity and isolation from other wolf populations. Climate change may also result in changes in parasite and pathogen relationships in high latitude species (Kutz et al. 2009).

It is well-documented that domesticated dogs can transmit diseases to wild wolf populations that can lead to wolf population declines (Fuller et al. 2003). Canine parvovirus ("CPV-2") is a recent disease that is common in domestic dogs across the globe. Wolves in Alaska have tested positive for the virus (Zarnke et al. 2004). Canine parvovirus causes high rates of mortality in captive wolves, as in other canid species. In the late 1980s, an outbreak of canine parvovirus in domestic dogs in Houghton, Michigan, is thought to have contributed to the sudden and drastic decline of wolves on nearby Isle Royale National Park. More than 52 individual wolves died within a two-year period, reducing the population to a record low of 14 individuals (Peterson 1995). The threat of CPV being spread from domestic dogs to wildlife on the Tongass NF, a factor that is related to the density of roads access the landscape, was raised by Dr. Joseph Cook at the 2006 Tongass Conservation Strategy Workshop.[38] CPV also plays a role in pup survival. In areas where canine parvovirus is prevalent, summer pup survival can be low (Mech et al. 1998).

Canine distemper is transmitted through many members of the canid family, including domestic dogs, wolves, and coyotes. Choquette and Kuyt (1974) first reported the presence of canine distemper in wild wolves in northern Canada. Carbyn (1982) found that canine distemper causes mortality in wild wolf populations, and was responsible for a 50% decline of the wolf population in Riding Mountain National Park, Manitoba. The disease usually infects pups between the ages of three to nine weeks, so it is probable that the number of wolf mortalities due to the disease is unknown because it happens prior to pup emergence from dens.

D. Other natural or manmade factors affecting its continued existence

1. Island endemism: small, isolated populations

The AA wolf is a Southeast Alaska endemic subspecies that has heightened vulnerability to losses of genetic diversity, population declines, and extirpations due to its small population size, minimal or non-existent movement between populations, and the magnified effects of anthropogenic threats on islands. Wolves on Prince of Wales Island appear to be an isolated, genetically distinct population due to the lack of movement to other island groups or the mainland (Person et al. 1996, Weckworth et al. 2005, CSR Report 2008) and are therefore particularly susceptible. Wolves in Southeast Alaska are not a functioning metapopulation because of the complete isolation of Prince of Wales Island and the relative isolation of other island populations. However, current regulatory mechanisms and management do not adequately address the higher risk of genetic loss and higher probability of population declines and extinctions of AA wolves due to their small, isolated, largely island-based population structure.

Island populations are more vulnerable to extirpation than mainland populations due to their isolation, demographic stochasticity, and the increased magnitude of anthropogenic threats on islands (Cook and MacDonald 2001). An estimated 75% of species that have gone extinct since 1600 have been island species (Reid and Miller 1989), and more than 60% of mammalian extinctions have been island endemics (Cook and MacDonald 2001). For AA wolves, low or non-existent dispersal of individuals among populations decreases the probability that populations will be recolonized after declines, unlike most continental gray wolf populations. The 2008 TLMP acknowledged the increased vulnerability of AA wolves to declines from anthropogenic threats due to their isolation:

> Recent research (*Alexander Archipelago Wolf*, presented at the Tongass Conservation Strategy Review Workshop 2006) has shown that the population on

[38] "Emerging pathogens and disease. A number of things I've shown you, like marten and ermine, are things that could catch canine distemper. Canine distemper is what was a major problem for the black-footed ferret. We've got humans with canines on these islands. Do we have a real rigorous plan to get this issue dealt with? We've got parvovirus. We've got a number of things that we should be thinking about with regard to our wildlife." See videotape shot by Greenpeace of the Other Mammals & Endemics panel discussion, or notes from the videotape by Larry Edwards.

> Prince of Wales Island is genetically isolated from other Tongass populations, which presents profound implications for maintaining well-distributed wolf populations in light of local declines, given that these populations are more sensitive to human activity and habitat disturbance than wolf populations elsewhere in the state (Schoen and Person 2007). (2008 TLMP FEIS: 3-281).

Since 1997, scientific publications have emphasized the need for science-based management on the Tongass National Forest that focuses on individual islands or island groups (Cook et al. 2001, Cook and MacDonald 2001, Cook et al. 2006). The best available science has found that Southeast Alaska supports ecological niches and locally adapted species on individual islands or island groups (Cook et al. 2006). This highly fragmented region is home to 27 originally described endemic mammals found only within the North Pacific Coast region, including the AA wolf (*Canis lupus ligoni*). Many of the species found in the region have declined, become threatened, or gone extinct in southern portions of their ranges (MacDonald and Cook 2009). Hence, many of the taxa found in Southeast Alaska represent significant portions of range and diversity for a host of species (Cook et al. 2006). Appropriate management is particularly important for the AA wolf given its important genetic legacy: the AA wolf is thought to represent a significant portion of the evolutionary potential and diversity for the gray wolf species as a whole (Weckworth et al. 2010). As summarized by Weckworth et al. (2005), "Our genetic data, when interpreted in light of past morphological research, are consistent with patterns of variation observed in other mammalian species inhabiting southeastern Alaska, and suggest that coastal wolves (*Canis lupus ligoni*) may represent a previously unrecognized and significant component of diversity in North American wolves" (Weckworth et al. 2005: 926-927).

The importance of considering the genetic and demographic isolation of AA wolves in Southeast Alaska, particularly on Prince of Wales Island, in management has been emphasized by many researchers, but is not currently occurring: "Certainly, the contemporary demographic independence of the wolves of Prince of Wales should be considered in any plan used to manage those populations or substantially alter habitat, because insular populations cannot be expected to easily recruit from neighbouring mainland populations" (Weckworth et al. 2005: 926-927).

2. Climate change

Anthropogenic climate change poses a long-term threat to the Alexander Archipelago wolf. Climate change is likely to result in the increased frequency of severe winter storm events and above-normal snowfalls that adversely affect the wolf's primary prey species, the Sitka black-tailed deer. Climate change is also leading to a significant change in forest composition and structure in the Alexander Archipelago due to climate-related die-offs of yellow cedar. The thinning of the canopy due to yellow cedar die-offs may have detrimental impacts on deer populations that rely on closed-canopy old-growth forests in winter. The section below summarizes the best-available science on climate change including studies (i) indicating that climate change is having greater impacts than assessed by the IPCC Fourth Assessment Report, (ii) documenting current and projected climate change in Southeast Alaska, and (iii) discussing climate change threats to the AA wolf. As described in section III.E.5, existing regulatory mechanisms are inadequate to address these climate change threats.

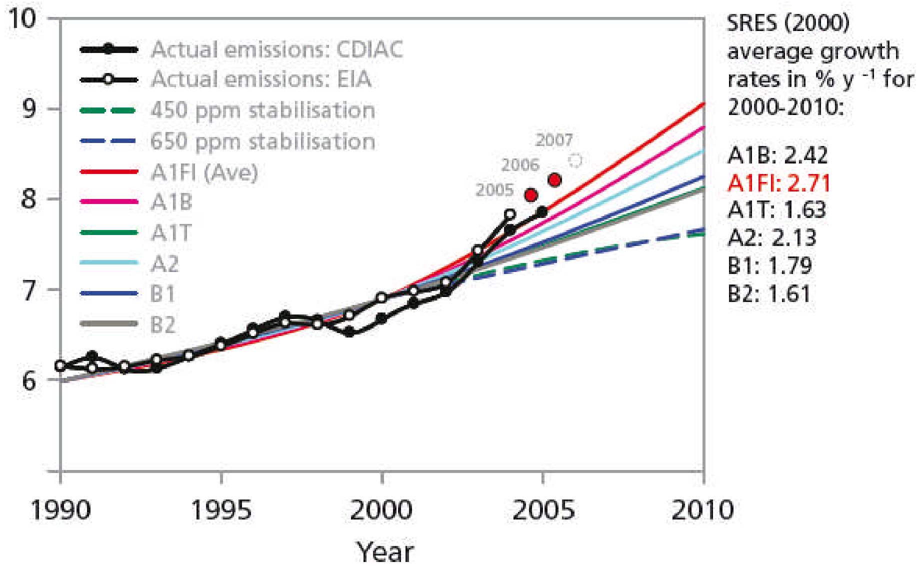
a. Climate change is unequivocal and is having greater impacts than assessed by the IPCC in 2007

In the 2007 Fourth Assessment Report ("AR4"), the Intergovernmental Panel on Climate Change ("IPCC") expressed in the strongest language possible its finding that global warming is occurring: "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007: 30). The international scientific consensus of the IPCC is that most of the recent warming observed has been caused by human activities (IPCC 2007). The U.S. Global Change Research Program in its 2009 report *Climate Change Impacts in the United States* also stated that "global warming is unequivocal and primarily human-induced" (USGCRP 2009: 12).

Although the IPCC AR4 provides an important synthesis of the climate change science, numerous studies published since the AR4 indicate that many climate change risks are substantially greater than assessed in the AR4. Key updates that synthesize the most recent climate science include *Climate Change Science Compendium* compiled by the United Nations Environment Programme (McMullen and Jabbour 2009), *Climate Change: Global Risks, Challenges and Decisions Synthesis Report* compiled by the International Alliance of Research Universities (Richardson et al. 2009), *The Copenhagen Diagnosis* (Allison et al. 2009), Smith et al. (2009), Lenton et al. (2008), and Fussel (2009). These updates indicate that many climate impacts are occurring at lower surface temperatures than previously estimated; temperature change during this century will be greater than previously projected; and the climate is approaching tipping points beyond which the climate system will switch to a different state.

In addition, the rate of increase of total atmospheric carbon dioxide concentration is accelerating, with especially rapid increases observed in the 2000s (Canadell et al. 2007, Raupach et al. 2007). The emissions growth rate rose from 1.1% per year from 1990 to 1999 to 3.5% per year from 2000 to 2007 (McMullen and Jabbour 2009). The emissions growth rate since 2000 has tracked that of the most fossil-fuel intensive IPCC Synthesis Report emissions scenario, A1FI (Figure 6) (Raupach et al. 2007, Richardon et al. 2009, McMullen and Jabbour 2009). These increased emissions have been attributed to rises in fossil fuel burning and cement production (average proportional growth increased from 1.3% yr^{-1} to 3.3% yr^{-1}) rather than emissions from land-use change, which remained approximately constant (Canadell et al. 2007). During the past 50 years, carbon dioxide sinks on land and in the oceans have become less efficient in absorbing atmospheric carbon dioxide, which is also contributing to the observed rapid rise (Canadell et al. 2007). With atmospheric carbon dioxide at ~390 parts per million (ppm) and worldwide emissions continuing to increase by more than 2 ppm each year, rapid and substantial reductions are clearly needed immediately.

Figure 6. Observed CO_2 emissions from 1990-2007 from U.S. Department of Energy Information Administration ("EIA") data and U.S. Department of Energy Carbon Dioxide Information and Analysis ("CDIAC") data, compared with six IPCC emissions scenarios (SRES) and with stabilization trajectories describing emissions pathways for stabilization of atmospheric CO_2 at 450 and 650 ppm.
Source: Richardson et al. (2009): 11.



b. Observed and projected climate change in the range of the AA wolf in Southeast Alaska

Climate change is profoundly affecting Alaska. The U.S. Global Change Research Program's 2009 report *Climate Change Impacts in the United States* found that Alaska has warmed at more than twice the rate of the rest of the United States' average during the past 50 years, with annual average temperature increases of 1.9 ºC (3.4 °F) and winter temperature increases of 3.5 ºC (6.3 °F) (USGCRP 2009).

In the range of the AA wolf in Southeast Alaska, climate conditions during the 20th century were characterized by warmer winters, often lower but more variable snowfall, and a higher occurrence of freeze-thaw events, based on data from low-elevation weather stations (data were not available for higher elevation regions). Beier et al. (2008) analyzed winter climate data, including daily minimum and maximum temperature, precipitation, and snowfall, from six weather stations in Southeast Alaska during the 20th century; all stations were located near sea level from 3 meters to 35 meters in elevation. Significant winter warming trends were observed in the Ketchikan-Annette and Wrangell-Petersburg regions, with February experiencing warming of the largest magnitude. In Ketchikan-Annette, warming trends in January through April ranged from 2.3 ºC to 2.9 ºC per 100 years, and in Wrangell-Petersburg significant warming trends in February and March were 1.5 ºC and 1.3 ºC per 100 years, respectively.

Mean winter snowfall in Southeast Alaska near sea level has declined by 21.2 mm/year since 1950, with a 20-year periodicity that has steadily downtrended (Beier et al. 2008). Despite this downward trend, mean winter snowfall has also been highly variable from year to year, and recent observations suggest that winter snowfall may be becoming more extreme.[39] Based on snowfall records in Juneau, four of the five lowest snowfall winters occurred in the last 15 years, but the highest snowfall on record occurred in the winter of 2006-2007. In 2006-2007, Juneau had snowfall of 10 feet at sea level. Freeze-thaw events also appear to be becoming more common. From 1950-2004, nine of the top 10 years of freeze-thaw impact occurred since 1983, characterized by years in which snowfall was relatively low, and uncommonly warm thaws were followed by hard freezes. As also shown by recent very cold or deep snow winters in the US east coast, the UK and Europe, problematic winter conditions can still be expected despite global warming (Seager et al. 2010; Guan et al. 2010; Boos 2011). For Southeast Alaska, climate models predict increased humidity and precipitation, which in winter can lead to increased snowfall (Salathé 2006(a), (b)).

Cherry et al. (2010) reported climate projections for Southeast Alaska based on Scenarios Network for Alaska Planning data (http://www.snap.uaf.edu/about), which used five of fifteen models used in the Coupled Model Intercomparison Project that best represented historical (1958-2000) surface air temperature, surface air pressure, and precipitation in Alaska. An A1B scenario was downscaled to 2 km using a biased map statistical technique based on the 1961-1990 PRISM monthly climatologies for Alaska. According to these projections, Southeast Alaska is projected to warm considerably by the end of the century (3 ˚C to 8 ˚C per model), with much of this warming concentrated in winter (4.6 ˚C multi-model mean). Mean annual precipitation is expected to increase 30% to 50% by the end of century (Cherry et al. 2010).

c. Climate change threats to the AA wolf

Increased frequency of severe winter storms and deep snowfall

A primary concern from climate change is the increased frequency of extreme weather events, including severe winter storm events that result in above-normal snowfalls that cause deer populations to decline. Extreme winters, not average winters, affect Sitka black-tailed deer the most, and the effects of hard winters can be very long-lasting (2008 TLMP FEIS: 3-267, 268, 282, 296; Juday et al. 1998). Stochastic events (e.g., storm- or snowfall-related events) have been identified by scientists as very significant concerns for wolves and deer (Ford 1995; Nichols 1995 (in Iverson 1996(b)); Klein 1997; Gillingham 1997; Marcot 1997; Grossman 2005). Significantly, the 2008 TLMP deer model considers only average winters, and not extreme ones (2008 TLMP at 3-231; Grossman 2005; ADF&G 2007). Deer depletion caused by severe winters 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). Studies have shown that predator-prey dynamics on islands are extremely vulnerable to changes in predator and prey numbers (Darimont et al. 2004), and decreases or losses of deer on islands in Southeast Alaska could reduce wolf populations. For example, in the early 1970s, a series of hard winters caused deer population crashes in GMU 3 (Kuiu, Kupreanof and Mitkof islands) (Olson 1979). The relatively low numbers of deer that continue to persist within this management area reflect the long-term consequences of these climatic events (Schoen and

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[39] Petersburg Pilot: 12/7/06, 12/10/06, 3/8/07, 3/17/07, 4/5/07. KFSK: 11/30/06, 2/23/07, 3/2/07,3/14/07, 4/17/08. Juneau Empire: 12/10/06, 3/17/07, 4/5/07. Ketchikan Daily News: 5/10/08. KCAW: 3/21/07. ADF&G NE Chichagof deer hunting restrictions: 2006 through 2010; see also KCAW 10/27/08.

Kirchhoff 2007). Since high deer mortalities in the extraordinary winter of 2006-2007, deer seasons have been restricted in northeastern Chichagof Island (USDA 2010).[40] This area near the village of Hoonah has been heavily logged on both national forest and private lands (Hoonah Indian Association 1996).

Changes in forest composition and canopy cover

Southeast Alaska is an ecoregion currently defined by coastal temperate rainforests, but forest structure is changing as a result of climate change (Juday et al. 1998), with potential impacts on the AA wolf. Yellow cedar (*Chamaecyparis nootkatensis*), an important component of the coastal temperate rainforest, has declined across 200,000 hectares of rainforests in Southeast Alaska since the early 1900s, primarily in the low elevations (i.e., below 300 m) important to the AA wolf (Beier et al. 2008). 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. Beier et al. (2008) found evidence that warmer winters result in early thaws, subsequent freezes, and low snow cover that promote cedar decline. Snow cover typically insulates forest soils from temperature extremes including hard freezes; however, in the absence of snow cover, yellow cedar appear to be especially vulnerable to freezing because of their shallow rooting in saturated soil. Freeze-thaw events can result in extensive mortality of fine roots in upper soil, which triggers foliar browning in the crowns and eventual tree die-offs. Dead and declining yellow cedar have been observed across large island and mainland regions of Southeast Alaska that overlap the range of the AA wolf. Studies project that yellow cedar decline will expand with continued climate warming (Beier et al. 2008).

A loss of yellow cedar will significantly change the structure of forests in Southeast Alaska, including the potential creation of a thinner canopy 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.

Changes in landscape-scale habitat structure due to changing climate

Juday et al. (1998) have documented increasing storm intensity and frequency in forests of Southeast Alaska over recent decades, as the climate changes. This raises the specter of stochastic loss of important habitats or corridors that are import to wolf viability in the region generally or the sustainability of the population on particular islands (Person et al. 1996; Person 2001). The mechanism for such losses could be windthrow (see Kramer et al. 2001; Nowacki & Kramer 1998; Harris 1999) or landslides (see Swanston 1974) exacerbated by increases in precipitation expected for the region (Salathé 2006(a)(b)) in combination with the above greater wind intensity and storm frequency. Such potential habitat and connectivity losses, cumulative over time and additional to losses from past and future logging, have yet to be taken into account in Forest Service planning for the Tongass (see, e.g., the 2008 TLMP and FEIS) or in the State of Alaska's forestry regulations.

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[40] Although this island does not harbor wolves, this episode illustrates that exceptional snow falls are still possible in a warming climate, and the loss of quality winter habitat is an important factor.

E. Inadequacy of Existing Regulatory Mechanisms

The USFWS declined to list the AA wolf in 1997, largely based on the provisions of the Forest Service 1997 Tongass Land Management Plan, which the USFWS relied on to assert that primary threats to the wolf were being controlled. Indeed, because the AA wolf is found predominantly on Forest Service lands, the Forest Service is in the best position to control threats to the AA wolf, including logging of old-growth forests, which destroys essential wolf habitat and reduces Sitka black-tailed deer densities, and road construction that facilitates legal and illegal hunting and trapping. However, the Forest Service has failed to control these threats to the AA wolf under the 1997 and 2008 TLMPs, and thus the 1997 and 2008 TLMPs have proven inadequate in addressing threats to the AA wolf. As clearly demonstrated below, the 1997 and 2008 TLMP standards and guidelines for the AA wolf have proven utterly unenforceable, ineffective, and speculative due to the Forest Service's history of willful misinterpretation of scientific recommendations in setting the AA wolf standards and guidelines and its chronic failure to enforce them.

In addition, hunting regulations are not adequate to keep wolf mortality from legal and illegal hunting and trapping to sustainable levels. Current management and regulatory mechanisms do not adequately consider the increased risks of population declines, extinctions, and loss of genetic diversity due to the AA wolf's small, isolated, and largely island-based population structure, nor do they mitigate impacts from climate change. As a result, the threats to the AA wolf identified in the 1993 listing petition still persist today because mechanisms to address those threats have not been implemented or have not been effective, and new threats such as climate change have emerged.

1. The 1997 and 2008 Tongass Land Management Plans are Inadequate

a. ***Intensive logging: The 2008 TLMP does not protect the AA wolf from intensive logging resulting in significant loss of low elevation, large-tree old-growth habitat for the AA wolf***

The 2008 TLMP allows a large percentage of the remaining large-tree old-growth to be logged in core habitat for the AA wolf on GMUs 2, 3, and 1A. This habitat destruction will jeopardize the AA wolf by removing a significant portion of its remaining habitat. As discussed above, intensive logging in GMUs 2, 3 and 1A has already removed an estimated 40% to 50% of large-tree forests in these core regions (Albert and Schoen 2007), and other types of high productivity forest have also been high-graded. Under the 2008 TLMP, the most intensive logging will continue to occur in GMUs 2 and 3. Based on estimates from the LUD map for Alternative 6 provided in the 2008 TLMP FEIS, it appears that 43% of the total area of Prince of Wales Island (GMU 2) is zoned in development designations that are open to intensive logging, while only 6% of the land area is designated as off-limits to logging. In GMU 3, it appears that 53% of the total area has land designations that are open to intensive logging, and that logging is precluded on only 15% of the land area.

In addition, the old-growth reserve system is inadequate to protect the AA wolf. None of the reserves encompasses an entire wolf pack home range on the Tongass NF, and wolves are highly vulnerable to logging and other human activities on non-reserve lands (CSR Report 2008: 75). The 2006 Tongass Conservation Strategy Review Workshop emphasized that the reserve system is inadequate: "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). Wolves should be considered in the designation of LUDs. Degrading old growth reserves will only make wolf populations decrease" (CSR Report 2008: 115).

b. ***Reduced deer carrying capacity: The 2008 TLMP does not protect the AA wolf from logging that leads to significant reductions in Sitka black-tailed deer carrying capacity***

The 2008 TLMP is insufficient to protect the AA wolf from declines in Sitka black-tailed deer populations resulting from logging of large-tree old-growth habitat. The 1997 TLMP standards and guidelines for deer carrying capacity were set significantly below the science-based guidelines recommended by interagency scientists, which resulted in significant degradation to deer habitat under the 1997 TLMP. More recently, although the 2008 TLMP adjusted the deer carrying capacity guidelines to meet scientific recommendations, the 2008 TLMP nonetheless permits the Forest Service to reduce deer carrying capacity in core wolf areas below these science-based guidelines for maintaining viable wolf populations.

Although 1997 TLMP standards and guidelines for deer carrying capacity were supposed to be based on the interagency 1996 Wolf Conservation Assessment, the TLMP misinterpreted and disregarded the assessment in several important ways. First, the 1997 TLMP and its FEIS incorrectly asserted that a *carrying capacity* of 13 deer per square mile met assessment criteria when the assessment had actually recommended a *minimum deer density* of 13 deer per square mile, or a minimum carrying capacity of 18 deer per square mile.[41] Further, the FEIS was misleading in asserting that the provisions were conservative in terms of protecting wolf populations because it falsely claimed that a carrying capacity of 13 deer per square mile provided an additional buffer.[42]

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[41] Person, D., M. Kirchhoff, V. Van Ballenberghe & T. Bowyer. 1997. Letter to Beth Pendleton, Tongass Land Management Team. September 19, 1997 (adding that the FEIS contained statements throughout the document that misconstrued how the scientists used the population equilibrium model in the assessment); *see also* 1997 TLMP FEIS, Appx. N at N-33-34 (indicating that the Forest Service also ran the model using a 17 deer/mi² threshold and found that only 24 of the 43 WAAs in GMUs 2 and 3 would have sufficient habitat capability at that threshold); *see also* Person, D. & T. Bowyer. 1997. Population Viability Analysis of Wolves on Prince of Wales & Kosciusko Islands, Alaska. University of Alaska, Fairbanks. Final Report to the U.S. Fish & Wildlife Service. Appx. 1 at 67 (establishing that a habitat capability of 18 deer/square mile "corresponds" to 13 deer/square mile minimum population density prescribed in Person et al. (1996)).

[42] Person, D., M. Kirchhoff, V. Van Ballenberghe & T. Bowyer. 1997. Letter to Beth Pendleton, Tongass Land Management Team. September 19, 1997 (questioning the assumption in the FEIS that deer harvests by humans may decline and pointing out that the assumption was fallacious in light of the assessment's point that human populations were increasing on Prince of Wales Island, causing an increase rather than decrease in demand for deer and also pointing out that statements made in the FEIS asserting that deer habitat capability predictions underestimated carrying capacity were inaccurate and instead deer habitat capability models were more likely to overestimate deer carrying capacity). In their more detailed comments, the interagency scientists also pointed out the deer density guideline was not based on the 1995 estimated fall population on Prince of Wales of 269 wolves, but rather was based on the assumption that wolf populations would be reduced to a fall population of 200 wolves by the end of the

A directive of the Tongass Forest Supervisor in August 2002 finally clarified that the Forest Service should maintain a deer habitat capability to support 18 deer per square mile to maintain sustainable wolf populations. However, as discussed above, the 2008 TLMP allows deer carrying capacity to be reduced below the guideline of 18 deer per square mile in the regions that support the most AA wolves, including North-central Prince of Wales, Kupreanof/Mitkof Island, Kuiu Island, Revilla Island/Cleveland Peninsula (2008 TLMP FEIS: Table 3.10-9). As acknowledged by the 2008 TLMP FEIS, the highest levels of logging of high quality winter deer habitat will occur in core AA wolf areas on Prince of Wales island, Cleveland Peninsula, and Mitkof Island (2008 TLMP FES 3-267, 284).

During the time span between the 1997 and 2008 TLMPs, the Forest Service misapplied the "deer multiplier," a conversion factor used to convert the deer model's unitless result ("habitat suitability index") to carrying capacity. This error caused carrying capacities to be overestimated by 30% and losses of carrying capacity due to logging to be underestimated by the same amount. Beginning in 2004, Greenpeace consistently requested correction of the error in comments and appeals of every major Tongass timber sale[43] and correspondence with the Alaska Regional Forester and the Tongass Forest Supervisor.[44] It took the Forest Service four years to correct the error in its new 2008 TLMP, but the agency continued to repeat the error in the planning for the Navy and Logjam timber projects until late 2009. Greenpeace sued the Forest Service, and in August 2011 the 9th Circuit Court of Appeals held that the Forest Service's application of the deer model was irrational and remanded four Tongass timber projects because of this error. *Greenpeace v. Cole*, No. 10-35567, slip op. at 2-7 (9th Cir. Aug. 2, 2011).

With adoption of the 1997 TLMP, the Forest Service began using its Vol-Strata vegetation dataset in the deer model, replacing the TimTyp dataset. This spatially-referenced vegetation data is a key component of the deer model, representing the quality of thermal cover and forage in winter. The Vol-Strata dataset had been suspect for this application from the beginning (Ford 1995). A statistical examination by the Forest Service in 2000 determined that Vol-Strata, although adequate for inventorying timber volume, is uncorrelated to habitat quality or forest structure (the purposes for which it was used in the deer model) (Caouette et al. 2000). Nonetheless, and despite the urgings of environmental organizations and ADF&G, the agency continued to use Vol-Strata in the deer model until the 2008 TLMP was adopted (and even into 2009 in some projects) and never disclosed in its environmental impact statements the severe problem with this use of the dataset (e.g., CSR Report).

The 2008 TLMP continues to underestimate the impacts of logging on deer habitat capability, see Part III.A.2.C, which in turn provides an underestimate of the impacts of logging on the viability of AA wolf populations. In a current example, the Forest Service failed to account for the cumulative impacts to deer populations from logging and other human activities

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planned period and stated that "our recommendation for density of deer assumes that wolf populations will be reduced by the end of the planning period and is hardly conservative."

[43] See, e.g., Couverden Project, Greenpeace 2004, Greenpeace 2005(a); Traitors Cove Project, Sitka Conservation Society (SCS) et al. 2006, Greenpeace et al. 2007; Navy Project, SCS et al. 2008, Greenpeace et al. 2009; Logjam Project, Greenpeace et al. 2009, Juneau Group of the Sierra Club et al. 2009.

[44] Greenpeace 2005(b); Bschor 2005; Cole 2005; Greenpeace 2006(a)(b)(c); Cole 2006.

on non-federal lands in the Logjam timber sale area or on Prince of Wales Island generally by excluding non-federal lands from its habitat models. Because non-federal lands on Prince of Wales Island are highly developed and likely to provide poor deer habitat, assuming these non-federal lands have the same deer carrying capacity as federal lands drastically overestimates deer habitat capability and underestimates the impacts of the further logging on wolves.

The Sealaska Land Bill

The Southeast Alaska Native Land Entitlement Finalization and Jobs Protection Act ("Sealaska Land Bill") poses an additional threat to the AA wolf. On April 5, 2011, Senator Lisa Murkowski reintroduced legislation that would allow Southeast Alaska's Sealaska Native Regional Corporation to make land selections in the Tongass under the Alaska Native Claims Settlement Act ("ANCSA"). Congressman Don Young followed suit with a companion bill in the House. If passed, the Sealaska Land Bill would convey to the Sealaska Native Corporation some of the richest and most biologically productive lands in the Tongass National Forest, including inventoried roadless areas, for clearcut logging. It targets for private development important habitat areas for AA wolves on POW and throughout the Tongass. Commentary on the Sealaska Land Bill has pointed out that it could lead to ESA listing of the AA wolf.[45]

c. <u>Excessive road density</u>: The 2008 TLMP does not protect the AA wolf from road construction that leads to unsustainable wolf mortality

Under the 1997 and 2008 TLMPs, the Forest Service repeatedly ignored the science-based recommendations for setting road density guidelines to protect the AA wolf from unsustainable hunting and trapping, and has repeatedly failed to implement road density guidelines on the Tongass NF.

Under the 1997 TLMP, the Forest Service provided standards and guidelines for road density management, but these standards and guidelines kick in only after "wolf mortality concerns have been identified":

> Where wolf mortality concerns have been identified, develop and implement a Wolf Habitat Management Program. To assist in managing legal and illegal wolf mortality rates to sustainable levels, integrate the Wolf Habitat Management Program (including road access management) with season and harvest limit proposals submitted to federal and state boards.
> a) Participate in interagency monitoring of wolf populations on the Forest.
> b) Where wolf population data suggest that mortality exceeds sustainable levels, work with the Alaska Dept. of Fish and Game and the U.S. Fish and Wildlife Service to identify probable sources of mortality. Examine the relationship among wolf mortality, human access, and hunter/trapper

[45] See, e.g., Wayne Regelin, Opinion: Sealaska Lands Bill is Bad Deal for Hunters and Fisherman, in *Juneau Empire* (June 1, 2011), available at: http://juneauempire.com/opinion/2011-06-01/sealaska-lands-bill-bad-deal-hunters-and-fishermen. ("Creation of numerous old-growth reserves in the current Tongass Land Management Plan was a critical factor in the decision to not list the Alexander Archipelago wolf as endangered. The old-growth reserves provided the necessary protection to insure the long-term survival of the wolf in Southeast Alaska. The proposed legislation authorizes selection of several old-growth reserves by Sealaska.")

harvest. Conduct analyses for smaller islands (e.g., Mitkof Island) portions of larger islands, or among multiple wildlife analysis areas (WAAs).

c) Where road access has been determined, through the analysis, to significantly contribute to wolf mortality, implement effective road closures to reduce mortality, incorporate this information into Travel Management planning and hunting/trapping regulatory planning. Open road densities of 0.7 to 1.0 miles per square mile of landscape or less may be necessary to reduce mortality to sustainable levels. Effective road closure prohibits motorized traffic (e.g. removing culverts or bridges versus only signing). Off-Highway Vehicle travel restrictions may also be necessary (1997 TLMP: 4-116).

The 1997 TLMP FEIS explained the proposed implementation of the guideline:

> The Forest Plan contains a forest-wide standard and guideline that outlines a cooperative interagency analysis to identify regions where wolf mortality is apparently excessive. In such areas we would attempt to determine if mortality is unsustainable and identify the probable causal factors of the excessive mortality. If road access and specific roads are identified as contributing to excessive mortality, then road closures or access management recommendations can be made and actions taken. In addition, seasons, harvest methods and bag limits need to be considered as population management tools by the ADF&G and Federal Subsistence Board as a cooperative approach to managing wolf mortality at a sustainable level (1997 TLMP FEIS, Appx. N: N-36).

Although purportedly based on the interagency 1996 Wolf Conservation Assessment (Person et al. 1996), the 1997 TLMP guidelines misinterpreted and disregarded the Assessment's road management recommendations in several important ways. First, the Forest Service failed to follow the interagency scientists' recommendation to consider *total road density* rather than just *open road density*, since both closed and open roads had been shown to contribute to legal and illegal hunting and trapping. In addition, the Forest Service declined to impose a rigid road density limit, and instead vaguely recommended a non-binding limit: "Open road densities of 0.7 to 1.0 miles per square mile of landscape or less *may be necessary* to reduce mortality to sustainable levels." Further, the 1996 Wolf Conservation Assessment recommendations had required consideration of total road density at lower elevations at a spatial scale of WAAs. Instead, under the 1997 TLMP, the Forest Service had calculated road density using open roads without excluding higher elevation, and it often calculated road density at much larger scales than WAAs.

The 2006 Tongass Conservation Review Strategy Workshop highlighted that the road management measures in the 1997 TLMP were inadequate, poorly implemented, or completely ignored. Based on the best available science, the interagency scientists recommended that the Forest Service reconsider the 1997 TLMP road density guideline as follows:

> Reconsider the road density Standard and Guideline in the Tongass Land Management Plan. According to the best available science, the threshold of

> 0.7mi/mi^2 for open road density should be changed to total road density. Also, the road density should be applied at the scale of an average wolf home range size (approximately 300km^2) (CSR Report 2008: 115).

The 2008 TLMP revision made improvements to the 1997 TLMP by clarifying that total road densities should be used and that densities should be measured at the WAA scale. However, the 2008 TLMP road management guidelines are vaguely written and thus rely heavily on agency discretion in implementing the guidelines. As recent timber projects have shown, the Forest Service has chosen not to implement the TLMP measures for protecting wolves. Worse, the Forest Service has shown a pattern of disingenuousness in wolf management, appearing to purposely miscalculate road densities and misconstrue or disregard wolf mortality concerns raised by ADF&G scientists. As the recent Logjam timber project demonstrates, the 2008 TLMP is utterly inadequate to address mortality threats from roads to the AA wolf. The remainder of this section describes the text of the 2008 TLMP standards and guidelines for wolves, highlights areas where the standards and guidelines are too vague or otherwise inadequate to protect wolves, and concludes with a case study of the Forest Service's improper implementation of the standards and guidelines in the Logjam project.

Although the broadest directive of the wolf standard and guideline requires 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," more than a decade of inaction demonstrates that the Forest Service sees this directive as discretionary.[46] However, even in the absence of a forest-wide wolf program, the wolf standards and guidelines describe a process that should be followed in site-specific instances "[w]here wolf mortality concerns have been identified":

> Where wolf mortality concerns have been identified, develop and implement a Wolf Habitat Management Program in conjunction with ADF&G. To assist in managing legal and illegal wolf mortality rates to sustainable levels, integrate the Wolf Habitat Management Program (including road access management) with season and harvest limit proposals submitted to federal and state boards. . . .
>
> c) Where 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, incorporate this information into Travel Management planning and hunting/trapping regulatory planning. The objective is to reduce mortality risk and a range of options to reduce this risk should be considered. Total road densities of 0.7 to 1.0 miles per square mile or less may be necessary. Options shall likely include a combination of Travel Management regulations, establishing road closures and promulgating hunting and trapping regulations to ensure locally viable wolf populations. Local knowledge of habitat conditions, spatial locations of roads, and other factors need to be considered by the

[46] 2008 TLMP at 4-95; over a period of nearly 12 years, the 1997 and 2008 Forest Plans have both included an identical directive in the first sentence of the wolf standard and guideline to implement a forest-wide wolf management program. The Forest Service has yet to initiate this overarching program.

> interagency analysis rather then relying solely on road densities. Road management objectives would be developed and implemented through an interdisciplinary Access and Travel Management or comparable process (See Transportation Forest-Wide Standards and Guidelines). Suggested wolf hunting and trapping changes would be developed and forwarded to the Federal Subsistence Board and the Alaska Board of Game.[47]

Although the current Wolf Habitat Management Program *could* provide a measure of protection for Alexander Archipelago wolves, the standards and guidelines as written are vague, highly discretionary, and do not provide any real protection. For example, there is no clear guideline for determining when "wolf mortality concerns have been identified." A review of the final 2008 standard and its draft predecessor makes clear that the three agencies (Forest Service, ADF&G, and the Federal Subsistence Board) are to make a finding as to whether road access and human-caused mortality is "a significant contributing factor to locally unsustainable wolf mortality." 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(c)).[48] In litigation over the Logjam project, the Forest Service claimed that only it can raise a mortality concern that triggers these standard and guideline provisions, and dismissed the mortality concern raised by ADF&G and the principal Alexander Archipelago wolf researcher (USFS 2010b).

Another problem with the Wolf Habitat Management Program 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 "incorporate this information into Travel Management planning and hunting/trapping regulatory planning." Forest Service personnel weakened the road density guideline several times during the TLMP amendment process. The version in the 1997 Forest Plan provided that "where road access has been determined, [through interagency analysis], to significantly contribute to wolf mortality, *<u>implement effective closures to reduce mortality</u>*" (USFS 2008(d):4-127, emphasis added).[49] A second version would have required "an effective road management plan to reduce mortality risk."[50] Moreover, although the best available science specifies a critical road density of 0.7

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[47] *Id.* The 2007 draft provided a more stringent requirement on the Forest Service: "[w]here road access and associated human caused mortality has been determined, through this analysis, to be the significant contributing factor to unsustainable wolf mortality, design an effective road management plan to reduce mortality risk. In these landscapes, consider open road densities of 0.7 to 1.0 per square mile or less to meet these objectives. To meet this objective, develop and implement road management objectives through an interdisciplinary Access and Travel Management process (see Transportation Forest-wide Standards & Guidelines)."

[48] "Comment Tracking Form" of internal Forest Service comments on a draft of the 2008 TLMP FEIS. TLMP planning record document #1265 at 75.

[49] This document shows, in track changes, the differences between the 1997 and 2008 TLMPs. See also USFS 2008(e) which similarly compares the USFS 2007 proposed (draft) TLMP and the adopted 2008 TLMP. The documents are described in the TLMP planning record index at 603_1608 and 1607, respectively.

[50] *Id.*

miles/square-mile (Person et al. 1996, CSR Report 2008, Person 2006), the standard and guideline uses a range of 0.7 to 1.0 miles per square mile.

Internal agency comments by Forest Service personnel expressed confusion about the guideline (USFS 2008(c)).[51] Some expressed outright hostility to managing by road density, and suggested shifting the entire burden of wolf conservation to ADF&G: "[h]ere we are again, managing wildlife by road density. What about bag limits, game regulations and enforcement??"[52] Patricia O'Connor[53] stated that "[t]his will be clarified and language added to make it clear that we do road management only where its [sic] been determined to be a significant issue."[54]

The 2008 final EIS explained that "the standard clarifies that consideration of access as an issue for wolf management should only occur when it is demonstrated that mortality is exceeding sustainable levels and that the most significant factor causing this human access is roads" (2008 (TLMP FEIS, Appx. D: D-49). However, this view of the road density guidelines is short-sighted and inadequate because the key concern is not just unsustainable mortality now, but whether road construction will increase access and lead to unsustainable mortality in the future. A single new road can lead to hunter and trapper access that can eliminate an entire pack, and because total road density (including all roads – open, closed, stored, decommissioned) is the scientific concern because easy foot access is a significant factor, road construction is an essentially irreversible act contributing to long-term cumulative consequences where the density is excessive.

The 2008 TLMP did manage to clarify that *total* road density must be considered, and the FEIS explicitly stated that the wolf standards and guidelines "incorporated information from the Conservation Strategy Review[55] that indicated that both open and total road density were important factors to consider when assessing road effects on wolves."[56] The FEIS also stated that "consideration should be given to excluding high elevations when calculating road densities" (2008 TLMP FEIS: 3-238). Further, the TLMP FEIS provided some guidance as to the appropriate scale for the road density guideline, noting that the guideline was "appropriately

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[51] USFS 2008(c). "Comment Tracking Form" of internal Forest Service comments on a draft of the 2008 Forest Plan EIS, June 28, 2008, planning record document 603_1265. (Commenting that "the less than 0.7 – m mile/mi² open road density is weird – wouldn't it be more clear to say less than 1mile/mi², and lower is better? . . . And, this is causing considerable lack of consistent analysis approaches among the project IDTs now – about how to calculate this – below 1200 ft.? by WAA?").

[52] *Id.* at 77 (Tierney).

[53] A biologist and at the time a high-level Tongass NF official, now the Tongass Deputy Forest Supervisor, and reportedly soon to be the Forest Supervisor.

[54] *Id.* (O'Connor); *see also id.* at 78 (exhibiting agency biologist Tiffany Benna's dissatisfaction with road access and wildlife management in general: "[A]gain I would encourage the wolf language that not only talks about road access as the mortality factor but that the associated hunting/trapping pressure needs to be part of the solution. . . . We want to make sure if there is such a mortality concern that the State is co-responding. If we are closing roads in response, the State (ADFG) need to be limiting harvest/seasons, etc. Again, we don't want the responsibility of controlling/fixing mortality concerns with road access/density alone."); see also *id.* (Brainard: "[w]e should not be unilaterally making changes to road access. ADF&G needs to step up to the plate. If they are unwilling to change hunting and trapping regulations than why should we limit access. They need to become full partners, not stand back and throw stones!").

[55] Conducted in 2006 by the Forest Service.

[56] 2008 TLMP FEIS.

applied at the project level to areas that are the approximate size of a wolf pack territory (about 74,000 acres; Person et al. 1996)" (2008 TLMP FEIS: 3-285). The TLMP recommended calculating total road densities by WAAs, which have an average size of 90,000 acres (2008 TLMP FEIS: 3-285).[57] Despite these clarifications about calculating road density, the Forest Service continues to disregard road density concerns, thereby obscuring the real threats posed by logging projects. The recent Logjam timber project provides a striking example.

The Logjam Timber Project

One of the first timber sales proposed under the 2008 TLMP revision was the Logjam project in eastern central Prince of Wales Island, home to a distinct and significant segment of the Southeast Alaska wolf population, including the critically important Honker Divide wolf pack. As detailed below, the project (now largely logged) increases an already-high road density, creating serious concerns for wolf viability, as hunting and trapping mortality in the project area was already above sustainable levels. Because of the threats the project poses to AA wolves, ADF&G requested (Person 2009) that the Forest Service institute a joint agency "Wolf Habitat Management Program" as specified in the 2008 TLMP (2008 TLMP: 4-95). As explained below, in order to move the project forward the Forest Service not only declined to institute such a program before deciding to proceed with the Logjam timber project, but it also systematically downplayed in both the draft and final EIS the risks to wolves.

The draft EIS for the Logjam project indicated that current road density in the area directly affected by the project (WAA 1421) was 1.37 miles per square mile for roads in all land ownerships, and that action alternatives would increase the density of total[58] roads below 1200 feet elevation from 1.6 to 1.8 miles per square mile (USFS 2009).[59] Model simulations from 2008 indicated that these densities posed a significant risk of chronic overkills and periodic destructive harvests, even before accounting for illegal harvests (Person and Russell 2008). After accounting for illegal harvest, the increases in density associated with project implementation rise to the level identified by Person and Russell (2008) as "unsustainable" and in fact known to entirely eliminate wolf packs.[60]

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[57] 2008 TLMP FEIS: 3-285 (acknowledging that the WAA calculations "are slightly lower than what could actually be experienced within a wolf pack territory").

[58] "Total roads" means all roads regardless of their status, including roads that are open, closed, temporary, decommissioned, etc. Roads that are not designated as open still afford foot access and often some sorts of vehicle access (e.g. ATV, snow machine) that contributes to wolf mortality (Person 2006; Person & Russell 2008).

[59] Logjam FEIS at 3-41 and 3-63, with Alternative 5 being the selected alternative. Post-decision, the road density was further increased. Note that the DEIS had estimated the existing total road density to be 1.37, versus the 1.6 in the FEIS.

[60] *See* Person and Russell (2008) at 1548.

These numbers are especially concerning because of the importance of one of the wolf packs that would be impacted. The proposed Logjam timber sale project overlaps considerably with the home range for the Honker Divide wolf pack (Person 2009), and part of the project occupies a key wildlife corridor (Fig. 7). The Honker Pack is of key importance because its home range includes one of only two sufficiently large reserves on Prince of Wales Island and is remote from the tidewater shoreline where most human take of wolves occurs. The pack serves as a source population that helps to repopulate other areas that have become population sinks as a result of habitat alterations and mortality from increased human access (Person and Russell 2008).

Fig. 7: New and old logging units in the wildlife corridor west of Sweetwater Lake, Logjam timber project, Prince of Wales Island. Sept. 2010. (Edwards/Greenpeace)

The Honker Divide Pack is therefore a lynchpin for wolf viability on the island. Higher mortality associated with road construction has consequences beyond the home range of this pack because of a likely increase in the mortality rate of wolves dispersing from this source pack. Dispersing wolves are especially subject to mortality, yet their survival is important to viability of the island-wide population in the long term (Person et al. 1996, Person & Bowyer 1997, Person et al. 1997, Person 2001, Person 2006, Person & Russell 2008). Roads (existing or proposed) and clearcuts in parts of the Logjam project area that aren't even in the Honker Pack's home range are therefore as much a concern as those that are.

Furthermore, harvest regulations have proven ineffective at protecting wolves in this area. As ADF&G biologist Dr. David Person explained, game management regulations "are very difficult to enforce and make effective" at the WAA geographic scale, and it would be "impossible" to enforce any special game management regulations issued specifically for the Logjam area (Person 2008). In Dr. Person's view, "managing human access is the key," meaning that "the [TLMP] road guideline and [TLMP] roadless reserve network are the primary tools" for protecting wolves (Person 2008).

For all of these reasons, Dr. Person expressed concerns to the Forest Service about the proposed sale and associated road construction and suggested that the project would be cause for instituting a joint agency wolf mortality and habitat management plan as specified in the 2008 TLMP (Person 2009). ADF&G had already instituted harvest control measures prior to the project. ADF&G supported a 30% harvest cap and closed the season in 1999 by emergency order to prevent overharvest (Person 2009).

The Forest Service, however, did not institute a joint agency wolf mortality and habitat management plan, despite the TLMP's mandate that such a plan be instituted "where wolf mortality concerns have been identified." In fact, the Forest Service went so far as to deny that any such concerns had been identified. In the Logjam draft EIS the Forest Service acknowledged that "[b]oth the current road density and the road density as a result of the project are above the standard and guideline when wolf mortality has been identified as a concern (0.7 to 1.0 miles per square mile)." However, the draft EIS went on to assert that "wolf mortality has not been identified as a concern by the State of Alaska in WAA 1421" (USFS 2009).[61] ADF&G biologist Dr. Person strongly disputed this statement:

> The Logjam EIS states in chapter 3 that the State of Alaska does not have mortality concerns for wolves on Prince of Wales. **That is patently untrue**. . . . As my e-mail to Marla Dillman shows, we definitely have concerns about roads and the Logjam sale. We even suggested that the project would be reason to initiate a joint agency wolf mortality and habitat management plan specified by TLMP.[62]

Between publications of the draft EIS and final EIS, the Tongass Forest Supervisor corresponded with ADF&G (Cole 2009), and ADF&G replied (Barten 2009). The Forest Supervisor, relying on ADF&G documentation, contended that there was no cause for alarm over wolf as a result of the project. In its reply ADF&G said that information the Forest Supervisor relied upon was in error, and reiterated the department's concern over wolf mortality. In the Logjam final EIS, the Forest Service acknowledged that it had incorrectly stated in the draft EIS that the state did not have a mortality concern; however, the agency attributed that earlier concern to individual biologists at ADF&G, and did not disclose the later correspondence between the two agencies, which reaffirmed ADF&G's mortality concerns. Thus, both the draft EIS and final EIS were misleading on the critical issue of the impact of a large timber sale project on wolf mortality on Prince of Wales Island.

d. Wolf den disturbance: The 2008 TLMP does not protect the AA wolf from den disturbance from logging and road building

The 2008 TLMP is inadequate to protect wolf dens from disturbance from logging and road building on the Tongass NF. The 1997 TLMP included standards and guidelines for den buffers and timing restrictions that "required" buffers of 1200 feet surrounding active dens from April 15 to July 1 and prohibited road construction within 600 feet during this time period, but allowed for site-specific exceptions (1997 TLMP: 4-117). The 1997 TLMP also allowed for the abandonment of the buffer restriction after two years of monitored inactivity (1997 TLMP: 4-117).

At the 2006 Interagency Conservation Strategy Workshop, the interagency scientists concluded that the AA wolf den site standards and guidelines were not science-based or adequate and should be changed. Dr. David Person presented modeling results (based on a wolf denning area resource selection function) that indicated that (a) the road buffer of 600 feet was too small; (b) inactivity at a den site for two years does not imply that the den is abandoned, meaning that

[61] Logjam DEIS at 3-95.
[62] Person 2009, e-mail response to Larry Edwards of Greenpeace. January 2, 2009. Emph. added. He refers to his April 1 reply to Marla Dillman, the Forest Services project biologist for Logjam.

lifting den buffer restrictions after two years of inactivity was unjustified; and (c) dens are used between April 15 and October 1, suggesting that the timing restrictions lasting only 2.5 months from April 15 through July 1 were too short (CSR Report 2008: 74-75). Dr. Person reported that areas on the Tongass NF with a 75% probability of wolf use had a median distance of 2,000 feet from roads and 1,535 feet from other developments, and that the probability of a wolf selecting a suitable den site within 600 feet from a road fell to 45% (CSR Report 2008: 74-75). Dr. Person concluded that both road-building and logging affected den site selection, and that "the current [1997 TLMP] Forest Plan guidelines pertaining to den sites are unsupported by evidence and should be updated" (CSR Report 2008: 75). The 2006 Tongass Conservation Strategy Review Workshop concluded that "[t]he den site Standard and Guideline in the 1997 Conservation Strategy should be reconsidered to include new scientific information that reveals denning and rendezvous sites can be re-used after two years, and the use of these sites occurs between April 15 and October 1st" (CSR Report 2008: 115).

In 2007, ADF&G requested that the Forest Service revise the guideline because the 600-foot road buffer was inadequate and because wolves may reoccupy dens after vacant periods of up to five years:

> The den buffer guideline has not been supported by scientific data. Information presented at the CSR Workshop indicated that the guideline needs revision. The guideline for roads is the most important because roads facilitate chronic disturbances long after timber harvesting activities are completed. Suitable areas for dens would have a 45% probability of selection by wolves if a road was within 600 feet of the den (Person in prep, Conservation Strategy Review Workshop). Moreover, as presented during the CSR Workshop, dens may be unused for up to 5 years before being used again (ADF&G 2007, Comments on the 2007 TLMP DEIS at 22-23 of the attachment to State of Alaska's comments).

Despite this evidence, the 2008 TLMP retained the 1997 TLMP den buffer guidelines, including the 600-foot road buffer and the removal of the buffer after two years of monitored inactivity (2008 TLMP: 4-95). The 2008 TLMP FEIS simply stated that standards and guidelines "include buffers of 1,200 feet surrounding active dens from April 15 to July 1, no road construction within 600 feet during this time period and protection for active dens with no disturbance" (2008 TLMP FEIS: 3-238). Not only are the 2008 TLMP den buffer guidelines inadequate, but pre-NEPA wolf den inventories are not required, and locating dens can be difficult (CSR Report 2008: 76). Thus, it is likely that a subset of dens are not being identified or protected at all according to TLMP guidelines.

2. The Roadless Rule is Inadequate to Protect the AA Wolf

In March 2011 a federal judge struck down the Roadless Rule exception in the Tongass National Forest, reinstating protections for roadless areas that had been blocked since 2003. *Organized Vill. of Kake v. United States Dep't of Agric.*, 2011 U.S. Dist. LEXIS 22244 (D. Alaska 2011). There are 109 inventoried roadless areas in the Tongass National Forest, covering about 9.6 million acres (2008 TLMP FEIS at 3-443). More than 50% of federal lands in the Tongass are roadless.

However, because a large proportion of the protected roadless lands are at elevations greater than is generally utilized by wolves (below 1200 feet, with most radio-collar relocations below 800 feet) or by their primary prey in winter (1500 feet), the protection the Roadless Rule provides for wolves is much less than the above acreage and proportion suggest (Person 2006, slide 18; Person 2001, abstract). Although we have found no numeric analysis by the Forest Service regarding the percentage of roadless area that provides important habitat for wolves and deer, it is clear from the lay of the land that much of the roadless acreage is of high enough elevation to not be significantly threatened by development or to benefit wolves.[63]

Even at the lower, timbered elevations, because the Roadless Rule only protects inventoried roadless areas, critical wolf habitat areas on Prince of Wales Island and elsewhere remain unprotected even with the Roadless Rule reinstated. Today, many non-roadless areas on POW that are slated for logging still provide important wolf habitat. Although any roads lead to higher wolf mortality, the 2008 TLMP sets a total road density threshold of 0.7 to 1.0 miles per square mile to maintain wolf viability. Thus, areas in the Tongass, though not roadless, can still support wolf populations if road density is low enough.

As noted above, the proposed Integrated 5-year Vegetation Plan for the Tongass NF for 2010-2014 proposes the construction of 103 miles of road on the already-roaded Prince of Wales island, including 68 miles from traditional timber sales and 35 from wildlife restoration projects and young growth projects (USFS 2010a). The intent may have been to build some of these roads in what the Forest Service calls "lower value inventoried roadless areas," with the implementation of TLMP Phase 1, which allows road building and logging in these areas (2008 TLMP: 37-43, 64-66). Thus, some amount of planned roadless area road construction may be affected by reinstatement of the Roadless Rule in the Tongass, but the length of affected planned roads is not known, nor are the acreages of "lower value" and other roadless areas.

Deer winter habitat will also be lost, despite reinstatement of the Roadless Rule. Although the 5-Year Plan proposes no new old-growth sales in roadless areas, it does propose to expand old-growth logging above current levels, calling for sales averaging 91 MMBF per year, (USFS 2010a), which is more than three times the average cut level of 28 MMBF per year over the last four fiscal years (2007-10).

Thus, while the Roadless Rule, if it remains in effect, will provide real conservation benefits for the Tongass National Forest, it is not likely to have a great impact on the viability of Alexander Archipelago wolves. Moreover, the fate of the Roadless Rule in Alaska is uncertain. The State of Alaska has appealed the court's decision to reinstate the Roadless Rule. The State has also filed a separate legal challenge against the rule, asserting that it violates a number of laws, including the Alaska National Interest Lands Conservation Act ("ANILCA"), the Tongass Timber Reform Act ("TTRA"), the Wilderness Act, the National Forest Management Act ("NFMA"), and the National Environmental Policy Act ("NEPA"). *State of Alaska v. U.S. Department of Agriculture, et al.*, No. 1:11-cv-1122 (D. D.C. filed June 17, 2011). In addition to

[63] See, e.g., TLMP FEIS at 3-138 (stating that "POG [productive old growth] forest stands, particularly low elevation stands, have been affected the most by human modification through timber harvest").

these legal challenges, Alaska's congressional delegation has signaled its intent to fight the rule legislatively.[64]

3. Harvest Caps and Bag Limits are Inadequate

Current regulatory mechanisms are inadequate to regulate both legal and illegal hunting and trapping of the AA wolf. In Alaska, wolves are hunted as big game and trapped as furbearers. On state lands, the Alaska Department of Fish and Game has the ability to regulate harvest through season lengths, harvest caps, and bag limits. There is currently a bag limit of five wolves taken by hunting and no bag limit for trapping (2008 TLMP FEIS: 3-238). Since 1997 there has been a 30% harvest cap on AA wolves in GMU 2, based on the estimated size of the autumn wolf population (2008 TLMP FEIS: 3-238). In 1999, ADF&G closed the wolf season early when the harvest cap was reached. The objective is to maintain an average annual harvest of 39 wolves in GMU 2 based on the average harvest from 1984 to 1990 (2008 TLMP FEIS: 3-238).

The Federal Subsistence Board regulates subsistence hunting and trapping on federal lands including Tongass NF lands, and subsistence regulations can diverge from state hunting regulations. For example, Federal Subsistence Board regulations that govern the Tongass NF do not set a harvest cap for AA wolves in GMU 2.[65] Instead the regulations state that the "federal hunting and trapping season may be closed when the combined Federal-State harvest quota is reached," but the closure is not required.[66] Moreover, getting timely and adequate regulations approved by both the Alaska Board of Game and the Federal Subsistence Board is often difficult.

These hunting and trapping regulations are ineffective for a number of reasons. First, the ADF&G harvest cap only applies to AA wolves in GMU 2, and this cap is based on an estimate of autumn wolf population size. The State does not have good estimates of autumn population size from its current monitoring program, and thus the State may be overestimating the numbers of wolves that can be taken. This is a particular concern given the evidence suggesting that the AA wolf population on GMU 2 has declined to perhaps 150 wolves, despite the harvest cap. Second, Federal Subsistence Board regulations that govern the Tongass NF do not set a harvest cap for GMU 2, which leaves the AA wolf vulnerable to overharvest despite the State cap.

Third, bag limits and harvest caps are ineffective because as much as half of the AA wolf harvest is illegal and unreported (Person and Russell 2008). Thus, a 30% reported harvest could represent an actual harvest of as much as twice that amount. ADF&G biologists have repeatedly stated that harvest regulations are not practically enforceable on the Tongass and that the best way to control harvest is to control road density (Person 2008, 2009). ADF&G has expressed a longstanding concern that high road densities and altered habitat caused by logging on all land ownerships on Prince of Wales "have profoundly changed the harvesting patterns of hunters and trappers, and increased the risk of unsustainably harvesting wolves" (Barten 2009). According to

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[64] See, e.g., "Alaska Delegation Seeks Roadless Rule Repeal in Tongass, Chugach," *Juneau Empire* (July 13, 2011) available at http://juneauempire.com/state/2011-07-13/alaska-delegation-seeks-roadless-rule-repeal-tongasschugach.
[65] Federal Subsistence Management Program Laws and Regulations for Units 1, 2, and 3, available at http://alaska.fws.gov/asm/law.cfml?law=2&wildyr=2010.
[66] *Id.*

Person and Russell (2008), "harvest regulations are unlikely to have much effect on rates of illegal harvest. Where roads and other features facilitate access by humans, wildlife managers should expect high rates of illegal harvest of wolves." A growing recent concern is that illegal harvest is increasing because of the perception by hunters and trappers on Prince of Wales Island that deer are declining in number. As clearcuts fill in, hunters are not able to see deer as easily, which can lead to the perception that wolves and bears are killing more deer, spurring more hunting of these predators. All of these factors demonstrate that hunting and trapping regulations are inadequate to prevent overharvest of wolves.

4. Management and regulation do not account for increased vulnerability due to small and isolated population structure

The 1997 USFWS listing decision and the 1997 and 2008 TLMP do not adequately account for the increased vulnerability of the AA wolf to anthropogenic threats, population declines and extinction, and loss of genetic diversity due to their small, isolated, often island-based populations. As discussed below, the 1997 USFWS listing decision made the invalid conclusion that AA wolves can persist in low numbers in healthy populations and be resilient to human threats. Although the 1997 and 2008 TLMP acknowledged the insular structure of AA wolf populations on the Tongass NF, these Forest Plans treat AA wolves like continental wolf populations and fail to account for their small, isolated population structure in their management of the AA wolf, its habitat, and its prey species.

a. The assumptions and conclusions of the 1997 USFWS listing decision are invalid

The 1997 USFWS 12-month finding denied protection to the AA wolf based in part on the claim that "wolves are known to persist in low numbers in healthy populations and to be resilient to the activities of man because of their high reproductive rate and high dispersal capability" (Fed. Reg. 62: 46710). The USFWS based its claims that wolves could persist in low numbers as healthy populations largely on recovery plans for continental gray wolf populations that supported minimum viable population levels of 100 wolves in two or more subpopulations:

> It is unclear how applicable the recovery thresholds for other wolf populations are to southeast Alaska, but they do provide some general guidance. All of the existing plans have as a "base" two or more subpopulations of at least 100 wolves. We believe these recovery plans are relevant to the Alexander Archipelago Wolf because we hypothesize that wolves in southeast Alaska may exist in a metapopulation structure with two or more subpopulations of wolves that have interchange at the genetically significant level. Wolves inhabiting Prince of Wales and adjacent islands are potentially the most isolated. (USFWS 1997: 10).

However, the referenced recovery plans for continental gray wolves emphasized that "genetically significant" interchange among populations is critical to maintaining the viability of the metapopulation (Fed. Reg. 74: 15130-15131). For example, for the Northern Rocky Mountains DPS of the gray wolf, the population recovery goal of a minimum of 30 breeding pairs and 300 individuals distributed among the three subpopulations required connection among populations by genetically effective dispersal (i.e., migrants that successfully reproduce) (Vonholdt et al. 2010). A critical requirement of delisting and metapopulation dynamics was genetically effective dispersal among populations (Vonholdt et al. 2010). In a 2002 review of this recovery strategy, the USFWS emphasized that the broadest spectrum of reviewing scientists "repeatedly recognized connectivity among the core recovery areas as critical" (Fed. Reg. 74: 15131).

However, the AA wolf in Southeast Alaska does not function as a metapopulation. The Prince of Wales population does not experience genetically significant interchange with other populations. Moreover, in Southeast Alaska, successful dispersal within or among other island populations may be low due to natural factors (i.e., water barriers among islands, competition, etc.) and anthropogenic stressors such as habitat fragmentation, hunting and trapping, and road building, limiting genetically effective migration in this region. Indeed, research on the Tongass NF indicates that road construction, hunting and trapping, and habitat fragmentation can reduce the success of wolf dispersal in Southeast Alaska by reducing survival and increasing social disruption (Person et al. 1996, 2001, Person and Russell 2008). Because the USFWS failed to account for low or non-existent dispersal and lack of metapopulation structure for AA wolves in Southeast Alaska, the assumptions of the 1997 12-month finding that AA wolves can persist in low numbers in healthy populations and be resilient to human threats are invalid.

b. The 2008 TLMP does not adequately account for the vulnerability of small, isolated AA wolf populations

The 2008 TLMP has failed to set appropriate management standards and guidelines for the AA wolf that take into account the vulnerability of small, often isolated AA wolf populations to declines and extinction and loss of genetic diversity. First, the 2008 TLMP does not treat the islands of the Tongass NF as individual communities, even though research indicates that island populations are isolated, movement between islands may be minimal or non-existent, and in some cases, relictual populations of mammals on islands may have extremely high evolutionary significance for the entire species' diversity (Cook et al. 2006), as in the case of the AA wolf (Weckworth et al. 2005). This is particularly problematic for the Prince of Wales Island wolf population, which functions as an isolated, genetically distinct, interbreeding unit.

Second, the 2008 TLMP 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: 926-927).

Third, the 2008 TLMP fails to address the increased risk of detrimental loss of genetic diversity to AA wolf populations. Genetic studies suggest that small, isolated wolf populations are vulnerable to loss of genetic integrity over time, especially if they are suppressed to low numbers due to threats (Vonholdt et al. 2008). For the Yellowstone National Park subpopulation of Northern Rocky Mountain wolves, Vonholdt et al. (2008) predicted that if the wolf subpopulation remained "relatively constant at 170 individuals (estimated to be the park's carrying capacity), the population would demonstrate substantial inbreeding effects within 60 years." The study predicted that the inbreeding coefficient would rise to 0.1 after 60 years without gene flow from outside the park with an associated increase of between 23% and 40% in juvenile mortality. Although the USFWS had some disagreements with the study because it expected some genetic interchange at Yellowstone, it agreed "that any totally isolated wildlife population that is never higher than 170 individuals which randomly breeds will lose genetic diversity over time . . . [s]uch outcomes sometimes, but not always result in demographic problems that threaten population viability" (Fed. Reg. 74: 15133). Importantly, the Vonholdt study suggested that the small, isolated Prince of Wales Island population would be similarly susceptible to detrimental loss of genetic diversity over time if it were to be reduced to a low population size (i.e., ~170 animals). Weckworth et al. (2005, 2010) indicate that the Prince of Wales population already has low genetic diversity. As discussed above, recent evidence suggests that the Prince of Wales population may have declined from ~300 wolves to ~150 wolves in recent years, raising concern that continuing population suppression at these low levels may make this population susceptible to further loss of genetic diversity and a resultant decline in population viability.

According to the best-available science, 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. 2010). Important management actions to promote successful dispersal and pack stability include: (a) the maintenance of high quality core habitat including buffer zones around source populations and dispersal corridors; and (b) 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. 2010). 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). However, the 2008 TLMP does not ensure the adequate protection of core habitat and dispersal corridors for AA wolves, nor does it adequately address unsustainable hunting and trapping mortality.

5. Regulatory mechanisms do not protect the AA wolf from climate change threats

Greenhouse gas emissions threaten the AA wolf and yet are among the least regulated threats. Regulatory mechanisms at the national and international level do not require the greenhouse gas emissions reductions necessary to protect the AA wolf from climate change.

a. National and international emissions reductions are needed to protect the AA wolf

The best-available science indicates that atmospheric CO_2 concentrations must be reduced to at most 350 ppm to protect species and ecosystems (Warren 2006, Hansen et al. 2008, Lenton et al. 2008, Jones et al. 2009, Smith et al. 2009, Warren et al. 2011). In order to reach a 350 ppm CO_2 target or below, global CO_2 emissions must peak before 2020, and likely by 2015, followed by rapid annual reductions bringing emissions to or very close to net zero by 2050 (CBD and 350.org 2010, UNEP 2010). The IPCC found that to reach a 450 ppm CO_2eq target, the emissions of the United States and other developed countries should be reduced by 25% to 40% below 1990 levels by 2020 and by 80% to 95% below 1990 levels by 2050 (Gupta et al. 2007); thus, reductions to reach a 350 ppm CO_2 target must be more stringent. Baer et al. (2009) outlined a trajectory to reach a 350 ppm CO_2 target by 2100 that requires 2020 global emissions to reach 42% below 1990 levels, with emissions reaching zero in 2050. They concluded that Annex I (developed country) emissions must be more than 50% below 1990 levels by 2020 and reach zero emissions in 2050 (Baer et al. 2009).

b. United States climate initiatives are ineffective

The United States, with only 4.5% of world population, is responsible for approximately 20% of worldwide annual carbon dioxide emissions (U.S. Energy Information Administration 2010, http://www.eia.gov), yet does not currently have adequate regulations to reduce greenhouse gas emissions. This was acknowledged by the Department of Interior in the final listing rule for the polar bear, which concluded that regulatory mechanisms in the United States are inadequate to effectively address climate change (Fed. Reg. 73: 28287-28288). While existing 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., these agencies are either failing to implement or only partially implementing these laws for greenhouse gases. For example, the EPA has issued a rulemaking regulating greenhouse gas emissions from automobiles (Fed. Reg. 75: 25324, Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule), has initiated a process for issuing rules for greenhouse gas emissions from power plants and oil refineries (see, e.g., Fed. Reg. 75: 82392, Proposed Settlement Agreement, Clean Air Act Citizen Suit), and on January 2, 2011, began implementing, in a slow, cautious, and phased manner, the new source review program for greenhouse gases (Fed. Reg. 75: 17004, Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs). However, the EPA has as yet failed to implement the critically important criteria air pollutant/national ambient air quality standards program for greenhouse gases, and has failed to issue any greenhouse rules for many other stationary and mobile sources, and there is no evidence that existing and currently proposed rulemakings would provide anything close to the greenhouse reductions needed to avert the warming that imperils the AA wolf. While full implementation of the nation's flagship environmental laws, particularly the Clean Air Act, would provide an effective and comprehensive greenhouse gas reduction strategy, due to their non-implementation, existing regulatory mechanisms must be considered inadequate to protect the AA wolf from climate change.

c. International climate initiatives are insufficient

The primary international regulatory mechanisms addressing greenhouse gas emissions are the United Nations Framework Convention on Climate Change and the Kyoto Protocol. As acknowledged by the Department of Interior in the final listing rule for the polar bear, these international initiatives are inadequate to effectively address climate change (Fed. Reg. 73:

28287-28288). The Kyoto Protocol's first commitment period only sets targets for action through 2012. Importantly, there is still no binding international agreement governing greenhouse gas emissions in the years beyond 2012. While the 2009 U.N. Climate Change Conference in Copenhagen called on countries to hold the increase in global temperature below 2 °C (an inadequate target for avoiding dangerous climate change), the *non-binding* "Copenhagen Accord" that emerged from the conference failed to enact binding regulations that limit emissions to reach this goal. Even if countries did meet their pledges, analyses of the Accord found that collective national pledges to cut greenhouse gas emissions are inadequate to achieve the 2°C limit, and instead suggest emission scenarios leading to 2.5 °C to 5 °C warming (Rogelj et al. 2010, UNEP 2010). Thus international regulatory mechanisms must be considered inadequate to protect the AA wolf from climate change.

Critical Habitat

The ESA mandates that, when the USFWS lists a species as endangered or threatened, the agency generally must also concurrently designate critical habitat for that species. Section 4(a)(3)(A)(i) of the ESA states that, "to the maximum extent prudent and determinable," the USFWS "shall, concurrently with making a determination . . . that a species is an endangered species or threatened species, designate any habitat of such species which is then considered to be critical habitat . . . ." 16 U.S.C. § 1533(a)(3)(A)(i); *see also id.* at § 1533(b)(6)(C). The ESA defines the term "critical habitat" to mean:

> i. the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
>
> ii. specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species.

Id. at § 1532(5)(A).

The Petitioners expect that USFWS will comply with this unambiguous mandate and designate critical habitat concurrently with the listing of the Alexander Archipelago wolf. We believe that all current and historic areas utilized by the species for foraging and breeding meet the criteria for designation as critical habitat and must therefore be designated as such.

Critical habitat for the Alexander Archipelago wolf is needed to ensure that federal actions avoid jeopardizing the species and help promote its conservation. Designation would help inform federal and state governments and private landowners on conservation planning, habitat management, and other actions needed to secure habitat, and help address conflicts that undermine its protection and restoration.

Conclusion

The Alexander Archipelago wolf is a rare, endemic subspecies of the gray wolf that is currently in danger of extinction throughout all or a significant portion of its range as a result of logging, road building, legal and illegal harvest, small and isolated populations, climate change, and other threats. Existing regulatory mechanisms do not adequately address the threats that imperil the Alexander Archipelago wolf. Petitioners Center for Biological Diversity and Greenpeace request that the U.S. Fish and Wildlife Service list the Alexander Archipelago wolf under the U.S. Endangered Species Act with concurrent designation of critical habitat.

Appendix A. Coastal Wolves of British Columbia

I. Natural History and Biology

A. Description

The wolves of coastal British Columbia are similar in appearance to Alexander Archipelago wolves. Morphological affinities between coastal wolves from Southeast Alaska and British Columbia were first noted by Jolicoeur (1959), which found that coastal populations in Southeast Alaska and British Columbia were closer to each other morphologically than they were to inland wolves in Canada or Alaska. Darimont and Paquet (2000) noted that 16 of 64 (25%) wolves sighted on islands and the mainland of their study area in British Columbia were black, and that many of the gray wolves had a conspicuous brownish red tinge.

B. Systematics

1. Taxonomy

Muñoz-Fuentes et al. (2009) found strong genetic differentiation between gray wolves of coastal and interior British Columbia, based on mitochondrial DNA analysis, and concluded that British Columbia coastal wolves represent a distinct evolutionary unit. According to the study, "[c]oastal wolves are highly distinct and representative of a unique ecosystem, whereas inland British Columbia grey wolves are more similar to adjacent populations of wolves located in Alaska, Alberta and Northwest Territories." The researchers proposed that habitat discontinuity between the coastal and interior regions is the most likely factor explaining this differentiation, as opposed to geographic distance or physical barriers to dispersal. Muñoz-Fuentes et al. (2009) concluded that "[g]iven their unique ecological, morphological, behavioural and genetic characteristics, grey wolves of coastal British Columbia should be considered an Evolutionary Significant Unit ("ESU") and, consequently, warrant special conservation status." Muñoz-Fuentes et al. (2009) hypothesized that the genetically distinct wolves of coastal British Columbia may represent an extension of the range of *Canis lupus ligoni*.

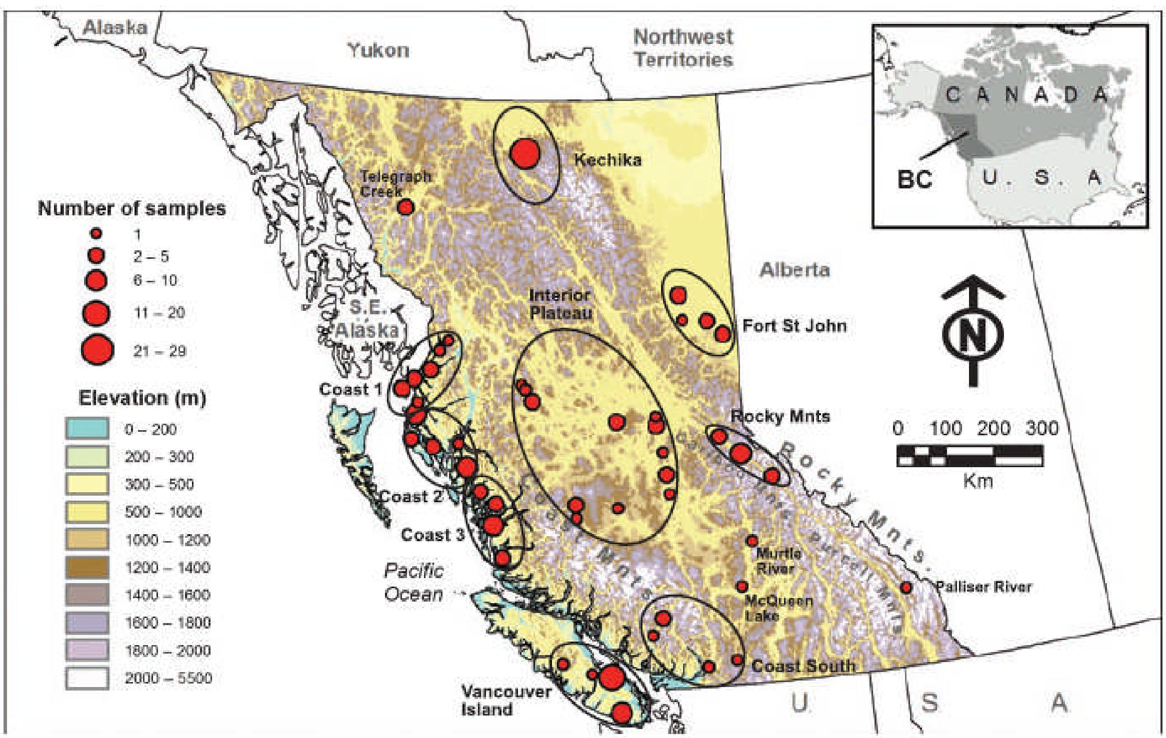
2. Evolutionary history

Muñoz-Fuentes et al. (2009) hypothesized that the wolves of the Pacific Northwest recolonized the region from south of the ice sheets after the Cordilleran glacier receded, likely following the northern expansion of deer less than 10,000 years ago. This study suggested that the strong differentiation between coastal wolves and other North American wolf populations evolved in the Holocene.

C. Distribution

Wolves in Coastal British Columbia occupy a narrow region that includes the mainland coast along the west side of the Coast Range and near-shore island habitats covered by temperate rainforest that extend from Vancouver Island in the south to the Alexander Archipelago in the north (Figure 8) (Muñoz-Fuentes et al. 2009). Darimont and Paquet (2002) surveyed 36 islands and 42 mainland watersheds on the central and north coast of British Columbia and found recent wolf sign in 34 of 36 islands and on all mainland watersheds. This study concluded that the potential for an island to support a persistent wolf population likely depends on the presence and abundance of black-tailed deer, which is influenced by island area, isolation and topography, and the effects of logging. The study suggested that "the distribution of wolves on islands may be dynamic, with occupancy by solitary wolves or packs being ephemeral." Darimont and Paquet (2000) suggested that islands without deer would not support even one wolf, citing the small, isolated Moore Islands as an example, and that wolves seem unable to persist on small and isolated islands, even if they do have deer, citing the small, isolated Goose Group archipelago as an example. Darimont et al. (2008) also suggested that the presence of wolves on islands appears to be linked to island area, where larger islands tended to have greater food resources overall and more stable prey populations, allowing wolves to maintain longer residency times on those islands. Island isolation was less important than island area due to the proximity of most islands.

Figure 8. Map of British Columbia showing the elevation and distribution of wolf sampling localities, as indicated by red circles. British Columbia coastal wolves occupy sampling localities in the Coast 1, Coast 2, Coast 3, Coast South and Vancouver Island regions.
Source: Muñoz-Fuentes et al. 2009: Figure 1.



D. Abundance and population trends

1. Population size

There have not been systematic surveys of wolf population size in coastal British Columbia. Darimont and Paquet (2000) approximated wolf population size in a large, 19,300-km^2 study area encompassing both mainland and islands from Gribbell Island in the north to Cape Caution in the south by applying density estimates from Person (1997) and McCrory et al. (2000). A density estimate of 30-35 wolves/1000 km^2 was applied to the islands (60% of the total land base) and half that density to the mainland because mainland areas have greater rock, ice, and other unproductive habitat and lower deer densities. Based on these density estimates, Darimont and Paquet (2000) estimated 406 to 473 wolves in the 19,300-km^2 study area during late winter and the presence of 325 to 378 resident animals in the total population. They estimated 51 to 59 packs in the study area.

2. Population trend

We found information on population trend only for Vancouver Island. The wolf population on Vancouver Island was thought to be extirpated or near-extirpated by 1950 due to multiple eradication attempts beginning in the 1920s (Muñoz-Fuentes et al. 2010). Between 1950 and 1970, wolf reports were infrequent and never confirmed. Wolves from adjacent coastal British Columbia are thought to have slowly recolonized Vancouver Island between 1950 and 1970, when sightings increased. Genetic evidence also suggests that wolves were extirpated on Vancouver Island by 1950, followed by a recolonization by mainland wolves after ~20 years, likely by less than 8 reproducing females (Muñoz-Fuentes et al. 2010). Hunting and trapping were permitted in the late 1970s and the provincial government initiated a wolf control program in the 1980s (Muñoz-Fuentes et al. 2010), likely reducing the population size once again.

E. Habitat Use

Darimont and Paquet (2000) found abundant wolf sign in low elevation (<300-m) old-growth forests, particularly near water bodies. Wolves also left scat and tracks on inactive logging roads, and in and next to many estuaries. Denning sites documented in coastal British Columbia were located in low elevation (below 50 m elevation) old-growth forests near freshwater sources under the roots or fallen trunks of large-diameter trees (Darimont and Paquet 2000). Rendezvous sites were found in salmon-bearing estuaries in coastal British Columbia (Darimont and Paquet 2000).

F. Reproduction

Darimont and Paquet (2000) estimated minimum litter sizes at one den site in early July and at two rendezvous sites in late July and mid September at a mean of 3.3 pups (i.e., two groups of four and one group of two).

G. Diet and Foraging Behavior

Sitka black-tailed deer appear to constitute the principal prey of coastal British Columbia wolves, although salmon provide an important seasonal food resource. Based on sampling of 30 mainland watersheds and 29 islands in coastal British Columbia for wolf feces (n = 595) in summers 2000 and 2001, Darimont et al. (2004) found that black-tailed deer was the most common item in occurrence per feces (63%) and occurrence per item (53%), representing about 63% of mammalian biomass. Wolves consumed more deer on nearshore islands (65% occurrence per item) than on the mainland (39%) and outer islands (45%). Wolves supplemented their diets with smaller, mostly marine mammals as well as salmon when seasonally available (Darimont et al. 2004). Because the probability of detecting deer in feces on islands was influenced primarily by island distance to mainland rather than by area or inter-landmass distance, the researchers hypothesized that deer populations on islands may be limited by colonization from the mainland.

A subsequent study by Darimont et al. (2008) sampled wolf feces (n = 2205) across all seasons over three years (2001-2003) in a mainland and inner island area of 3000 km^2. The study found that deer remains occurred in 90% to 95% of feces during spring and summer. In autumn, wolf diets shifted toward more salmon, which occurred in 40% of all feces and up to 70% of feces for some groups. The magnitude of this seasonal dietary shift was related primarily to estimates of salmon availability, not deer availability, meaning that wolves actively targeted salmon when they were seasonally available, likely due to safety, nutrition, and energetic benefits (Darimont et al. 2008). Darimont et al. (2008) also found that adult diet differed from that of pups during summer, when pups were provisioned disproportionately more fawn (juvenile deer) than the adults consumed, perhaps to limit parasite transfer to developing pups.

H. Sources of Mortality

Reporting of human hunting and trapping is not well-tracked in British Columbia. Using conservative assumptions, Darimont and Paquet (2000) estimated that resident hunters killed ~220 wolves in a 19,300 km^2 study area (i.e., mainland and islands from by Gribbell Island in the north to Cape Caution in the south) during a 24-year period, and that non-resident hunters killed ~26 wolves over the same study period, averaging 10 wolves killed per year in the study area. Hayes and Gunson (1992) estimated that annual human-caused mortality was 11% for BC as a whole.

II. Coastal British Columbia Wolves Warrant Listing Under the Endangered Species Act

This section describes threats to the wolves of coastal British Columbia in the context of the five ESA listing factors. The wolves of coastal British Columbia face similar threats to Alexander Archipelago wolves. The greatest threats to BC coastal wolves are the past and ongoing logging of old-growth forests and the proliferation of roads, which add legal and illegal hunting and trapping pressure (Darimont and Paquet 2000, Muñoz-Fuentes et al. 2009). Other threats include oil development, overexploitation of salmon runs, hybridization with domestic dogs on Vancouver Island, isolated populations, and the inadequacy of existing regulatory mechanisms to sufficiently mitigate habitat loss by logging, overexploitation from hunting and trapping, and other threats.

A. Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Similar to the Alexander Archipelago wolf, the most significant threat to viable wolf populations in coastal British Columbia is clearcut logging, which (a) reduces forage and habitat for Sitka black-tailed deer, leading to declines in long-term carrying capacity; (b) destroys important habitat for wolves and their prey; (c) causes area abandonment due to disturbance from logging activities; and (d) leads to increased mortality by providing greater access of hunters and trappers to wolves on logging roads (Darimont and Paquet 2000). As discussed in detail for the Alexander Archipelago wolf, clearcut logging leads to limited forage for deer in mid-successional stands that may persist for 150 to 200 years if no additional logging occurs (Darimont and Paquet 2000). Early successional forage for deer in clearcuts are thought to be of poorer nutritional quality than old-growth stands because of increased tannins that reduce available digestible protein, while the depth of logging slash in clearcuts can affect accessibility and usability to deer (Darimont and Paquet 2000). Logging also results in the physical loss of habitat for wolves and deer, where the impacts may be instantaneous and severe (Darimont and Paquet 2000). Human disturbance from logging activities including the use of machinery and explosives can cause stress and area abandonment for wolves (Darimont and Paquet 2000). Finally, the construction of logging roads leads to higher mortality rates for wolves since hunters use logging roads to increase their hunting efficiency, and large proportions of wolves are directly killed from the road system (Darimont and Paquet 2000).

Logging practices in British Columbia were reviewed by the USFWS in the Status Review for the Queen Charlotte goshawk (USFWS 2007). The USFWS found that habitat loss due to logging posed a threat to the long-term viability of the British Columbia DPS of the Queen Charlotte goshawk due to the significant loss of old-growth forest habitat to logging and the inadequacy of existing regulatory mechanisms to protect old-growth forest habitat for wildlife species (Fed. Reg. 76: 56761). Similarly, Darimont and Paquet (2000) concluded that forestry activities threaten the viability of BC wolf populations due to the high "Annual Allowable Cut" permitted in BC coastal forests (currently set at 8,402,305 m^3/year in the Coast Forest Region inhabited by BC coastal wolves (http://www.for.gov.bc.ca/hts/tfls.htm)) and the inadequacies in management and regulation to protect forest habitat for wolves and their prey:

> We contend that current forestry activities threaten the future of viable and well distributed populations of deer and wolves. Available evidence suggests that large-scale clearcutting will likely reduce the forest's *long-term* carrying capacity for deer. Moreover, logging roads will provide access for increased legal and illegal killing of wildlife, including deer and wolves. Current BC Ministry of Environment and forest company management efforts are likely ineffective at comprehensively and effectively addressing the threats we identify. (Darimont and Paquet 2000: 31).
>
> Under current management regimes, we believe that BC's coastal forests will

> become similar to those in the Tongass in which deer numbers have declined and continue to do so (Person et al. 1996). (Darimont and Paquet 2000: 37).

B. Overutilization for Commercial, Recreational, Scientific or Educational Purposes

The Ministry of Forests, Lands, and Natural Resources Operations is charged with administering and enforcing wolf hunting and trapping activities within British Columbia under the provincial Wildlife Act. The Ministry manages the population with inadequate information about how many animals exist and how many are killed annually (Darimont and Paquet 2000). The Ministry has never attempted a census of coastal wolf populations. Estimates of mortality are based on generalized hunter surveys with small sample sizes, and significant data gaps exist for many regions (Darimont and Paquet 2000).

Accordingly, wolf hunting and trapping regulations are not science-based and have the potential to result in over-exploitation of wolf populations. For example, wolves are legally designated as “Big Game” and “Furbearer” animals in BC, and low value is placed on the wolf. It is the only big game animal for which resident hunters do not require a species license, and it has the lowest license fee for nonresident hunters ($50) (B.C. Ministry of Natural Resource Operations 2010). Of particular concern, there are no trapping limits. The wolf is classified as a “class 3” trapping species defined as “generally . . . not vulnerable to over-trapping,” and trappers are “encouraged to trap these species, especially in areas of chronic animal damage control problems”(B.C. Ministry of Natural Resource Operations 2010). Bag limits for hunting are currently set at three wolves per resident hunter per season, and wolves are granted immunity from hunting only during a short 6 to 12 week period during the reproductive season. In the four management regions inhabited by coastal wolves (Skeena, Cariboo, Lower Mainland, Vancouver), hunting wolves is permitted in all months except from June 16 to July 31 in region 5 and 6 (Cariboo and Skeena) and from June 16 to September 9 in regions 1 and 2 (Vancouver and Lower Mainland).

There are also no restrictions against killing adults with dependent young or the young themselves (B.C. Ministry of Natural Resource Operations 2010). Killing adults with dependent young may ultimately result in the death of the young, particularly in a small pack or packs with large litters (Darimont and Paquet 2000). Wolves killed by humans are often dominant pack members, and the frequent replacement of key individuals may disrupt wolf social structure, with potential long-term fitness consequences (Darimont and Paquet 2000).

Legal and illegal wolf hunting are predicted to increase as the human population grows and as hunters gain more access through logging roads (Darimont and Paquet 2000). Although Darimont and Paquet (2000) found a low incidence of human-caused mortality in their study area in British Columbia, these researchers concluded that “the laissez faire management of wolves, elevated hunting pressure, increased human access to wilderness, and expanded forestry activity could combine to create conditions as adverse for wolves as those in southeast Alaska” (p. 44).

C. Disease or predation

Similar to the Alexander Archipelago wolf, British Columbia coastal wolves are vulnerable to mortality from canine diseases introduced by dogs and other domesticated animals. Rising human habitation and numbers of domesticated animals increases the potential exposure of wild wolves to introduced diseases (Cook et al. 2006, Muñoz-Fuentes et al. 2009). Wolf populations on islands and coastal mainland localities may be particularly susceptible to disease due to decreased genetic diversity and isolation from other wolf populations.

D. Other natural or manmade factors affecting its continued existence

1. Oil development

Oil development poses a growing threat to British Columbia coastal wolves by increasing the risk of oil spills in their terrestrial and coastal marine habitats. A primary threat comes from Enbridge's proposed Northern Gateway Project, which is currently being considered by the government (Raincoast Conservation Foundation 2010). The project proposes to construct a 1,170 km (727 mi) twinned pipeline from the oil sands in Alberta to Kitimat on the British Columbia central coast. One pipeline would carry 83 million liters (525,000 barrels) per day of tar sands oil to Kitimat to be stored in a tank farm until ready to transport to tankers. Two to three times per week, supertankers would enter Kitimat to load ~318 million liters (2 million barrels) of oil for shipment to California and overseas. Loaded tankers would pass through Wright Sound. Smaller tankers would bring condensate, a petroleum-based product used to dilute thick crude so it flows through the pipeline more readily. A second pipeline would carry more than 30 million liters (193,000 barrels) of condensate from the central coast to the Alberta tar sands.

The project poses a significant risk of oil spills on land and especially in the coastal marine region used by wolves (Raincoast Conservation Foundation 2010). The marine approaches to the northern BC coast and the port of Kitimat are dangerous for ships due to the prevalence of severe weather and the narrowness of the Douglas Channel (only 1.35 km (0.84 mi) wide at the narrowest point). In addition, oil spill response capabilities are limited. Between 1999 and 2008, 812 vessel incidents were reported to Transport Canada, most of which were grounded ships, and which included the LeRoy Trucking Barge spill and the sinking of the Queen of the North ferry. An oil spill near the islands or mainland of British Columbia could be devastating to the coast. Because of its complex morphology, British Columbia's 900 km of linear shoreline include 27,000 km of actual seaboard that are at risk of fouling. Coastal wolves of British Columbia make extensive use of marine resources, and particularly rely on the seasonal abundance of salmon. The proposed project poses a significant risk to salmon populations through a vessel spill or a spill from the pipelines that cross salmon rivers in the Skeena, Kitimat, and Upper Fraser watersheds.

2. Overexploitation of salmon runs

Overexploitation by fisheries poses a threat to salmon populations in coastal British Columbia and to coastal wolves that rely on salmon as a seasonal food resource. Salmon populations in British Columbia have been and continue to be heavily exploited (Price et al. 2008). Salmon are considered extinct in 142 watershed systems throughout BC; commercial catches in BC between 1995 and 2005 were the lowest on record; and the number of stocks contributing to the catch is shifting from many runs of diverse size to fewer large runs (Price et al. 2008). In two management areas, 48% of salmon runs were classified as either "highly exploited" or of "conservation concern" (Price et al. 2008).

A recent study revealed a history of inadequate management of BC salmon runs by Fisheries and Oceans Canada ("DFO") over the past 55 years that threatens the continued viability of salmon populations (Price et al. 2008). Price et al. (2008) found that less than 4% of monitored streams in their BC study regions have consistently met escapement targets since 1950, and that the number of streams monitored by DFO had decreased over time. Importantly, the erosion of monitoring effort has been biased toward excluding smaller runs that failed to meet target escapements in the previous decade, which resulted in a biased evaluation of salmon population health. The authors warned that current exploitation pressures and mismanagement by DFO may lead to the extirpation of small salmon runs in BC: "if current exploitation levels and monitoring efforts remain unchanged, waterways along BC's central and north coasts might host only ghost runs" (p. 2717).

In addition to overexploitation, salmon are also threatened by the introduction of exotic Atlantic salmon (*Salmo salar*), the transmission of salmon diseases via aquaculture, and the development of oil and gas resources that increase risks of oil spills (Paquet et al. 2004).

3. Hybridization with domestic dogs on Vancouver Island

The potential for hybridization of wild wolves with domestic dogs poses a conservation concern for coastal BC wolves, particularly on Vancouver Island where human-caused wolf population declines set the conditions for hybridization to occur. A genetics study by Muñoz-Fuentes et al. (2010) found evidence suggesting that at least one successful hybridization event between a wolf and a female dog or a female hybrid took place on Vancouver Island. Wolves were extirpated or near-extirpated on Vancouver Island by 1950 due to an extirpation campaign, and slowly recolonized thereafter. The researchers attributed the hybridization event to the small size of the Vancouver Island population during recolonization, which resulted in the lack of sufficient mates for recolonizing wolves, known as the Allee effect. Muñoz-Fuentes et al. (2010) emphasized that the wolf population on Vancouver Island is morphologically, behaviorally, and genetically distinct from the dog population, and thus deserves full recognition and protection as a population of wild wolves. Importantly, the researchers warned that hybridization with dogs is detrimental to wolf populations because it can disrupt wolves' behavioral and physiological adaptations. This study highlighted the importance of maintaining wolf population sizes that are sufficient to avoid Allee effects and detrimental hybridization events (Muñoz-Fuentes et al. 2010).

4. Island endemism: small, isolated populations

Similar to the Alexander Archipelago wolf, the wolves of coastal British Columbia are an isolated population uniquely adapted to the temperate rainforests of the northwest coast of North

America and have unique ecological, morphological, behavioral, and genetic characteristics (Muñoz-Fuentes et al. 2009). Isolated populations are more vulnerable to loss of genetic diversity, population declines, and extirpation due to lower movement between populations, stochastic demographic processes, and the higher magnitude of anthropogenic threats on islands.

E. Inadequacy of Existing Regulatory Mechanisms

Regulatory mechanisms in British Columbia, including Canada's Species at Risk Act, land management plans, and the Forest and Range Practices Act are inadequate to protect coastal gray wolves from logging and other threats. As detailed above, hunting and trapping regulations are inadequate to protect wolves from overexploitation.

The coastal wolves of British Columbia are not federally listed under the Species at Risk Act. Coastal gray wolves in British Columbia were last evaluated under the Species at Risk Act in 1999 and were classified as *Canis lupus nubilus*. Despite recent genetic studies indicating that coastal and interior gray wolves are genetically distinct, it does not appear that a new review is scheduled (http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=607).

Land use planning is the primary method identified by the British Columbian government for establishing protected areas and limits on development to conserve biodiversity across the Province (USFWS 2007: 112). However, the Central Coast Land and Resource Management Plan ("CCLRMP") (http://archive.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/cencoast/index.html) and Vancouver Island Land Use Plan (http://www.ilmb.gov.bc.ca/slrp/lrmp/nanaimo/vancouver_island/index.html) are inadequate to protect coastal wolves or their habitat.

An evaluation of the efficacy of the CCLRMP to protect three key habitats for coastal wolves—deer winter range, wolf reproductive habitat, and salmon reproductive and rearing habitat—found that the proposed protected areas under the plan "fail to provide sufficient long-term protection of secure habitat for deer, wolves, and salmon" (Paquet et al. 2004). The evaluation, which included the input of scientific experts on British Columbia coastal wolves, made the following conclusions:

> Seventy percent (70%) of deer winter range, a non-renewable natural resource under current forestry management regimes, remains unprotected.
>
> Likewise, protection of wolf habitat important for successful reproduction is seriously deficient. Only six of 13 known homesites occur in proposed protected areas. Moreover, only 34% of 5 km buffers and 27% of 15 km buffers around wolf dens are included in protected areas. The buffers represent areas that denning wolves depend on to support newborn and growing pups.
>
> Analysis of salmon spawning and rearing habitat shows that 75% of chum and chinook, 74% of coho, 72% of pink, and 67% of sockeye populations are not protected under the plan. Because we lack complete information regarding distribution of salmon populations, the number of unprotected salmon runs is

> likely much higher than analyses show. Moreover, conservation priority of salmon populations has not been sufficiently considered by proposed protected areas. The CCLRMP fails to acknowledge the importance of genetic structure of salmon populations. Because of this, the lack of watershed protection could result in lost habitat for unique salmon populations.
>
> Coastal islands overall, and outer islands in particular, are poorly protected by the proposed CCLRMP. Yet, ecologists regard islands as among the most fragile of all environments. Considering that the Central Coast is largely an archipelago ecosystem, such a fundamental error in conservation planning is difficult to understand.
>
> Remarkably, the proposed protected areas do not prohibit the killing of carnivores for sport and profit. Consequently, these areas provide little or no protection for wolves, black bears, grizzly bears or smaller carnivores. Failure to include these measures indicates that these areas are not in fact protected.
>
> The CCLRMP is relying on Ecosystem Based Management (EBM) to compensate for the low level of protection provided by the plan. Although we support the theory behind EBM and the need for ecologically sound management across the landscape, we cannot endorse EBM as a surrogate for protected areas. There is simply too much uncertainty as to how EBM will be implemented on the ground. EBM in the context of industrial forestry is an unproven and potentially dangerous strategy to preserve biodiversity outside of protected areas.
>
> (Paquet et al. 2004: 2-3).

An analysis of the Vancouver Island Land Use Plan by the USFWS similarly concluded that the plan does not adequately protect remaining forest habitat (USFWS 2007). According to the USFWS, "[t]he current land management plan allocates only a small minority of habitat (13 percent) to strict protection, much of which is at high elevation and on low-productivity sites. Little or none is in the most productive forest zones on the eastern side of the island (nearly all of which has already been logged)" (USFWS 2007: 113). Specifically, 13% of the landscape is in protected status, 8% is in "Special Management" zones that stress non-timber values, 55% is in land uses that stress timber production, and 18% is private forestland that has little or no government oversight on logging methods (USFWS 2007: 112).

Coastal gray wolves are also not considered or protected under the Identified Wildlife Management Strategy. Under the Forest and Range Practices Act, the Minister of Environment is authorized to establish two categories of wildlife that require special management attention to address the impacts of forest and range activities on Crown land. These two categories of wildlife are (1) the Category of Species at Risk, which includes endangered, threatened, or vulnerable species of vertebrates and invertebrates, and endangered or threatened plants and plant communities that are negatively affected by forest or range management on Crown land and are not adequately protected by other mechanisms; and (2) the Category of Regionally Important Wildlife, which includes species that are considered important to a region of British

Columbia, rely on habitats that are not otherwise protected under the FRPA, and may be adversely impacted by forest or range practices. According to the government, the Strategy attempts to minimize the effects of forest and range practices on Identified Wildlife and maintain their limiting habitats through the establishment of wildlife habitat areas ("WHAs") and the prescription of management measures in those areas (http://www.env.gov.bc.ca/wld/frpa/iwms/index.html). However, coastal gray wolves are not identified as Species at Risk or Regionally Important Wildlife under the Identified Wildlife Management Strategy (http://www.env.gov.bc.ca/wld/frpa/iwms/accounts.html).

In sum, British Columbia's coastal gray wolves may be part of the same subspecies as Alexander Archipelago wolves. They face many of the same threats as AA wolves and thus also warrant listing under the Endangered Species Act.

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