

PETITION TO LIST THE
Prince of Wales Flying Squirrel (*Glaucomys sabrinus griseifrons*)
UNDER THE U.S. ENDANGERED SPECIES ACT



**Petition Submitted to the U.S. Secretary of Interior
Acting through the U.S. Fish and Wildlife Service**

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INTRODUCTION

WildEarth Guardians petitions to list the Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) as “threatened” or “endangered” under the Endangered Species Act (“ESA”).¹

The Prince of Wales flying squirrel is a genetically distinct subspecies of the common northern flying squirrel (*Glaucomys sabrinus*) that is found throughout North America. Howell identified the Prince of Wales subspecies in 1934, noting its distinctive coloration.² It is endemic to Prince of Wales Island and a few of the small neighboring islands in the Alexander Archipelago in southeast Alaska. Genetic research indicates the subspecies originated from an early founder that established an isolated population in the moist temperate rain forests of Prince of Wales Island during the Holocene. The evidence of genetic divergence between the Prince of Wales flying squirrel and other subspecies found on the Alaskan mainland suggest that it has been isolated for some time. The subspecies exhibits unique morphological characteristics such as a grayer neck and head, a darker dorsal side, and a whiter ventral side. The subspecies is also genetically distinct.³ Individuals on Prince of Wales and its neighboring islands all exhibit unique mitochondrial haplotype as well as unique microsatellite alleles from their mainland cousins.⁴

The northern flying squirrel is a keystone species in the Pacific Northwest because of its consumption and dispersal of fungal spores and conifer seeds, as well as providing a food source to many predators, including the endangered northern spotted owl (*Strix occidentalis caurina*).⁵ Less is known about the Prince of Wales subspecies, but presumably, it plays an equally important role in forests on the archipelago islands.

The Prince of Wales flying squirrel faces significant threats to its continued existence. The U.S. Fish and Wildlife Service (FWS) has identified threats to the subspecies since at least 1974 when the agency designated it a category ‘2’ candidate species for listing as threatened or endangered. FWS subsequently removed the subspecies from the candidate list in 1986 due to a lack of available information. More is known about the subspecies today. Based on this additional information, NatureServe ranks the squirrel as “G5T2” (species as a whole is not threatened, but subspecies “imperiled”)⁶ and the International Union for the Conservation for Nature (IUCN) designates the subspecies as “endangered.”⁷

¹ Endangered Species Act, 16 U.S.C. §§ 1531-1544 (2006).

² Arthur H. Howell, *Description of a New Race of Flying Squirrel from Alaska*, 15 JOURNAL OF MAMMALOGY 64 (1934).

³ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247 (2002).

⁴ Bidlack & Cook (2002).

⁵ UNITED STATES DEP’T OF AGRIC., TONGASS LAND AND RESOURCE MANAGEMENT PLAN: FINAL ENVIRONMENTAL IMPACT STATEMENT 3-243 to 3-244 (2008) [hereinafter “2008 EIS”].

⁶ _____. *Glaucomys sabrinus griseifrons*, NatureServe, www.natureserve.org [hereinafter “NatureServe”].

⁷ DAVID J. HAFNER ET AL. IUCN, NORTH AMERICAN RODENTS: STATUS SURVEY AND CONSERVATION ACTION PLAN 37-39 (1998).



Figure 1. Aerial view of Prince of Wales Island in the Alexander Archipelago in southeast Alaska. The range of the Prince of Wales flying squirrel is naturally fragmented by water. Prince of Wales Island itself provides the largest block of contiguous habitat.⁸

The greatest threat facing the Prince of Wales flying squirrel is the destruction and fragmentation of its habitat. The subspecies needs old growth temperate rain forests of the Alexander Archipelago—particularly forests with the largest, oldest trees.⁹ As an island inhabitant, the squirrel must also contend with natural habitat fragmentation where large water bodies separate island populations. Old growth forests in the squirrel’s range are under intense logging pressure due to the presence of large diameter trees and over the last 50 years, approximately 37 percent of the high volume old growths forests on the islands have been clearcut (39 percent of forests on Prince of Wales Island have been cut). Over the next 100 years, the amount of old growth forests expected to be cut will rise to 52 percent of the range of Prince of Wales flying squirrels (with higher percentages locally) (*see* Table 3). From above, the archipelago islands resemble a checkerboard of clearcuts, second growth forests, and small reserves of old growth forests (*see* Figure 2 and Figure 7). Continued timber harvesting on these islands threatens the habitat and continued existence of the subspecies.

⁸ NATALIE G. DAWSON ET AL., THE COASTAL FORESTS AND MOUNTAINS ECOREGION OF SOUTHEASTERN ALASKA AND THE TONGASS NATIONAL FOREST: ENDEMIC MAMMALS OF THE ALEXANDER ARCHIPELAGO CHAPTER 6.7, 1 (John W. Schoen & Erin Dovichin eds. 2007).

⁹ 2008 EIS at 3-244.



Figure 2. Aerial photo of Prince of Wales Island. Clear cuts like these cover much of the historic range of the Prince of Wales flying squirrel. Destruction of habitat is one of the main threats to this subspecies.¹⁰

Increased predation further threatens an already stressed subspecies. Individual squirrels attempting to cross the disturbed areas between old growth forest reserves face increased exposure to predation as they are forced to abandon their preferred gliding movement for ground-level quadrupedal movement, which also requires significantly more energy. Prince of Wales flying squirrels generally rely on the cover of a closed forest canopy for protection from predators, but movement across large clearcuts exposes them to watchful raptors and terrestrial predators. One of these, the non-native American marten (*Martes americana*), has established on Prince of Wales and nearby islands. American marten in the Pacific Northwest prey on northern flying squirrels, but do not naturally inhabit the islands where the Prince of Wales flying squirrel resides. Martens have not (yet) been recorded preying on Prince of Wales flying squirrels, but given the marten's propensity for preying on mainland flying squirrel subspecies, it is likely to take Prince of Wales flying squirrels as well.

Current regulatory mechanisms are inadequate to protect the Prince of Wales flying squirrel. The U.S. Forest Service (USFS) has declined to recognize the subspecies as a "sensitive species" or "Management Indicator Species" for planning purposes on Forest Service lands. The state of Alaska allows unlimited hunting of Prince of Wales flying squirrels and there are no protections on important private lands. The USFS 2008 Tongass National Forest Land Management Plan (2008 Land Management Plan) leaves much of the islands open to logging, setting aside some small "old growth reserves" of mostly low volume forests in isolated areas and on rugged terrain that is less suitable for timber harvesting. The plan, based on information developed in an

¹⁰ JOHN W. SCHOEN ET AL., THE COASTAL FORESTS AND MOUNTAINS ECOREGION OF SOUTHEASTERN ALASKA AND THE TONGASS NATIONAL FOREST: NORTHERN FLYING SQUIRREL (*GLAUCOMYS SABRINUS*) CHAPTER 6.6, 6 (John W. Schoen & Erin Dovichin eds. 2007).

associated environmental impact statement (2008 EIS), assumes that species reliant on old growth forest, such as the Prince of Wales flying squirrel, will move across the disturbed areas and maintain connectivity between populations.¹¹ New research since the EIS was completed suggests that there are significant limitations to the movements of the subspecies across disturbed areas with the accompanying energy requirements, lack of food availability, lack of denning opportunities, exposure to predation, and limited olfactory perception. Populations on the smaller islands separated by large water bodies face additional connectivity problems with the main population on Prince of Wales Island.

In addition to habitat loss and fragmentation, predation and inadequate regulatory mechanisms, the effects of climate change, while uncertain, are likely to impact the subspecies as well. USFS forecasts climate change may subject the Alexander Archipelago to a higher frequency of destructive fires, more windy weather events that blow down trees (especially near edges of clearcuts), and warmer temperatures that will prevent narrow water bodies between Prince of Wales Island and neighboring islands from freezing, potentially closing off a connective corridor for the Prince of Wales flying squirrel. This subspecies has adapted to a stable ecosystem in the Alexander Archipelago and is not as well prepared for the effects of rapid environmental change.

The U.S. Forest Service (USFS) recognizes the Alexander Archipelago as a biological “hotspot” due to its high rate of species diversity and endemism.¹² Other endemic and sensitive species in the archipelago include the Alexander Archipelago wolf (*Canis lupus ligoni*) and the Queen Charlotte goshawk (*Accipiter gentilis laingi*), which rely on the same old growth forests as the Prince of Wales flying squirrel. Protecting the Prince of Wales flying squirrel would have the umbrella effect of protecting other endemic species and their habitat in the archipelago.

PETITIONER

WildEarth Guardians is a nonprofit environmental advocacy organization that works to protect wildlife, wild places and wild waters. The organization has more than 12,000 members and supporters and maintains offices in New Mexico, Colorado and Arizona. WildEarth Guardians has an active endangered species program that works to protect imperiled species and their habitat throughout the United States and its territories.

THE ENDANGERED SPECIES ACT AND IMPLEMENTING REGULATIONS

The Endangered Species Act of 1973 (ESA) protects plants and animals that are listed by the federal government as “endangered” or “threatened” (16 U.S.C. § 1531 et seq.). Any interested person may submit a written petition to the Secretary of the Interior requesting him to list a species as “endangered” or “threatened” under the ESA (50 C.F.R. § 424.14(a)). An “endangered species” is “any species that is in danger of extinction throughout all or a significant portion of its range” (16 U.S.C. § 1532(6)). A “threatened species” is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (16 U.S.C. § 1532(20)). “Species” includes subspecies and distinct population segments of sensitive taxa (16 U.S.C. § 1532(16)).

¹¹ 2008 EIS.

¹² 2008 EIS at H-163.

The ESA sets forth listing factors under which a species can qualify for protection (16 U.S.C. § 1533(a)(1)):

- A. The present or threatened destruction, modification, or curtailment of habitat or range;
- B. Overutilization for commercial, recreational, scientific, or educational purposes;
- C. Disease or predation;
- D. The inadequacy of existing regulatory mechanisms; or
- E. Other natural or manmade factors affecting its continued existence.

A taxon need only meet one of the listing criteria outlined in the ESA to qualify for federal listing.

If the Secretary determines that a species warrants a listing as “endangered” or “threatened” under the ESA, he is obligated to designate critical habitat for that species based on the best scientific data available (16 U.S.C. § 1533(b)(2)).

CLASSIFICATION , NOMENCLATURE AND SPECIES DESCRIPTION

Common Name. The common name for *Glaucomys sabrinus griseifrons* is the “Prince of Wales flying squirrel,” which is a subspecies of *Glaucomys sabrinus*, also known commonly as the “northern flying squirrel.”

Taxonomy. The Prince of Wales flying squirrel is a subspecies of *Glaucomys sabrinus* that is found throughout North America. Multiple subspecies have been identified including the Carolina flying squirrel (*G. s. coloratus*),¹³ and the Virginia northern flying squirrel (*G. s. fuscus*),¹⁴ which are both listed as “endangered” under the ESA. In Alaska, three subspecies of *Glaucomys sabrinus* have been identified, including the Alaska coast flying squirrel (*G. s. zaphaeus*) and the Yukon flying squirrel (*G. s. yukonensis*), neither of which is considered imperiled. The third subspecies is the Prince of Wales flying squirrel (*G. s. griseifrons*).

Genetic research on mitochondrial cytochrome *b* corroborates morphological differences between the Prince of Wales flying squirrel (*G. s. griseifrons*) and its nearby cousin (*G. s. yukonensis*). Bidlack and Cook collected 53 individuals near Prince of Wales Island in 2001 and mapped the cytochrome *b* sequences.¹⁵ They found that all individuals shared a distinct mitochondrial haplotype with the same two base pair changes (one transition, one transversion). In contrast the individuals collected from the mainland and other nearshore islands did not share those two base pair changes.¹⁶ In addition, in 2002, Bidlack and Cook tested the microsatellite

¹³ *Carolina Northern Flying Squirrel (Glaucomys Sabrinus Coloratus)*, UNITED STATES FISH & WILDLIFE SERV., <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A09M> (last updated May 19, 2011).

¹⁴ The FWS approved a rule to delist this subspecies, but a federal court vacated the rule in early 2011. *Virginia Northern Flying Squirrel (Glaucomys Sabrinus Fuscus)*, UNITED STATES FISH & WILDLIFE SERV., <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A09R> (last updated May 19, 2011).

¹⁵ Allison L. Bidlack & Joseph A. Cook, *Reduced Genetic Variation in Insular Northern Flying Squirrels (Glaucomys Sabrinus) Along the North Pacific Coast*, 4(4) ANIMAL CONSERVATION 283 (2001).

¹⁶ Bidlack & Cook (2001).

alleles of individuals collected in the Prince of Wales Island area and noted similarity, even among individuals collected from some of the neighboring islands, suggesting regular genetic flow between the islands.¹⁷ However, when compared to the mainland individuals, the alleles were quite different. In fact, Bidlack and Cook discovered an allele completely unique to the Prince of Wales flying squirrel.¹⁸ In their results, Bidlack and Cook stated, “[t]his again suggests that the [Prince of Wales Island] populations have been isolated for a period of time sufficient not only for a reduction in genetic variation (due to drift in a smaller population), but enough time for accumulation of new mutations to become fixed in the island population.”¹⁹ These mitochondrial haplotype and microsatellite allele differences suggest that the Prince of Wales flying squirrel is a genetically distinct lineage of *Glaucomys sabrinus*.

Furthermore, this research suggests that the Prince of Wales flying squirrel subspecies originates from an early Holocene founder that established in the area around 18,000-22,000 years ago. As the sea level rose, populations became isolated from the mainland and over time became genetically distinct.²⁰ Bidlack and Cook hypothesized that *Glaucomys sabrinus* is not an adept over-water disperser and that water barriers in the Alexander Archipelago prevent genetic flow. Clarence Strait separates Prince of Wales Island from the mainland and is 6 kilometers or about 4 miles at the narrowest point, creating an impenetrable genetic barrier between the Prince of Wales flying squirrel and its mainland cousin.²¹ In contrast, Prince of Wales Island and its neighboring islands are much closer, and occasionally the water bodies between them freeze over, creating a possible corridor for dispersal.²²

Table 1. Taxonomy of Prince of Wales Flying Squirrel.

Kingdom	Animalia
Phylum	Vertebrata
Class	Mammalia
Order	Rodentia
Family	Sciuridae
Genus	<i>Glaucomys</i>
Species	<i>Glaucomys sabrinus</i>
Subspecies	<i>Glaucomys sabrinus griseifrons</i>

Morphology. The Prince of Wales flying squirrel also exhibits morphological differences from its closest mainland cousin, the Alaska coast flying squirrel (*G. s. zaphaeus*). First identified in 1934²³ for its unique coloration, the Prince of Wales subspecies has whiter coloring on its ventral

¹⁷ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247, 253-54 (2002).

¹⁸ Bidlack & Cook (2002) at 255.

¹⁹ Bidlack & Cook (2002).

²⁰ See Bidlack & Cook (2002) at 254.

²¹ Bidlack & Cook (2002).

²² Bidlack & Cook (2002) at 256.

²³ Arthur H. Howell, *Description of a New Race of Flying Squirrel from Alaska*, 15 JOURNAL OF MAMMALOGY 64 (1934).

side, darker coloring on its dorsal side, and the head and neck tend to be grayer in color than other subspecies.²⁴

Length and weight. Adults generally measure from 25 to 37 centimeters in length, and 110 to 230 grams in weight.

Range distinctions. The Prince of Wales flying squirrel is only found in the Prince of Wales Island complex in the Alexander Archipelago in southeast Alaska, including Prince of Wales Island and some nearby islands: the Barrier Islands, Dall Island, El Capitan Island, Heceta Island, Kosciusko Island, North Island, Orr Island, Suemez Island, and Tuxekan Island. The subspecies range does not overlap with the Alaska coast flying squirrel that are found on the mainland of southeast Alaska.

LIFE HISTORY

Habitat. The Prince of Wales flying squirrel resides in moist, cool temperate rain forests of the southern islands of the Alexander Archipelago in southeast Alaska. This area receives between 200-600 cm (80-250 inches) of precipitation per year, with a mean monthly temperature range from 1°C (34°F) in January to 13°C (55°F) in July.²⁵ These forests are found from shoreline to about 600 meters (2,000 feet) in elevation.²⁶ The predominant tree species include Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), red cedar (*Thuja plicata*), and yellow cedar (*Xanthocyparis nookatensis*).²⁷

²⁴ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247, 289 (2002).

²⁵ Winston P. Smith & Jeffrey V. Nichols, *Demography of the Prince of Wales flying squirrel, an Endemic of Southeastern Alaska Temperature Rain Forest*, 84(3) JOURNAL OF MAMMALOGY 1044, 1046 (2003).

²⁶ Winston & Nichols (2003).

²⁷ Elizabeth A. Flaherty et al., *Diet and Food Availability: Implications for Foraging and Dispersal of Prince of Wales Northern Flying Squirrels Across Managed Landscapes*, 91(1) JOURNAL OF MAMMALOGY 79, 80 (2010).



Figure 4. The Prince of Wales flying squirrel uses old growth forests with large diameter. This forest type is abundant in food resources, provides excellent denning opportunities, and offers protection from predators.²⁸

The current range of the Prince of Wales flying squirrel is a mosaic of clearcuts, second growth forests, and different old growth forests types, from Sitka spruce/western hemlock forests to peatland/mixed conifer forests.²⁹ The subspecies strongly prefers the old growth forests that have tall trees and a closed canopy. They provide ample food and opportunities for denning, protection from predators, and facilitate easy movement.³⁰ Although the subspecies prefers conifer forests, it has also been found in mixed forests with deciduous trees.³¹

Food requirements. Northern flying squirrels are mycophagous, feeding primarily on the fruiting bodies of fungi, known as “truffles.”³² They are also known to feed on lichens, tree seeds, berries, bird eggs and chicks, carrion, insects, buds, and flowers.³³ The squirrel’s

²⁸ JOHN W. SCHOEN ET AL., THE COASTAL FORESTS AND MOUNTAINS ECOREGION OF SOUTHEASTERN ALASKA AND THE TONGASS NATIONAL FOREST: NORTHERN FLYING SQUIRREL (*GLAUCOMYS SABRINUS*) CHAPTER 6.6, 3 (John W. Schoen & Erin Dovichin eds. 2007).

²⁹ Shoen et al. (2007).

³⁰ See generally Winston P. Smith & David K. Person, *Estimated persistence of Northern Flying Squirrel Populations in Temperate Rain Forest Fragments of Southeastern Alaska*, 137 *BIOLOGICAL CONSERVATION* 626 (2007). See also Elizabeth A. Flaherty et al., *Diet and Food Availability: Implications for Foraging and Dispersal of Prince of Wales Northern Flying Squirrels Across Managed Landscapes*, 91(1) *JOURNAL OF MAMMALOGY* 79 (2010).

³¹ See Winston P. Smith & Jeffrey V. Nichols, *Demography of the Prince of Wales flying squirrel, an Endemic of Southeastern Alaska Temperature Rain Forest*, 84(3) *JOURNAL OF MAMMALOGY* 1044 (2003).

³² Sanjay Pyare et al., *Diets of Northern Flying Squirrels, *Glaucomys Sabrinus*, in Southeast Alaska*, 116 *THE CANADIAN FIELD – NATURALIST* 98 (2002).

³³ Elizabeth A. Flaherty et al., *Diet and Food Availability: Implications for Foraging and Dispersal of Prince of Wales Northern Flying Squirrels Across Managed Landscapes*, 91(1) *JOURNAL OF MAMMALOGY* 79, 80 (2010).

consumption of fungal spores and conifer seeds is an especially critical function in forest ecology that makes them a keystone species.³⁴ The spores/seeds are able to survive passage through the digestive tract and then benefit from dispersal in the forest to establish new colonies or provide new genetic material to existing colonies.

One interesting difference between the Prince of Wales flying squirrel and its mainland cousins is that it does not consume as many truffles, appearing to have adopted a more generalist feeding pattern.³⁵ This may be due to a combination of factors including a lower abundance of truffles as well as reduced competition from other *sciuridae* species than on the mainland.³⁶

K-selected species. The Prince of Wales flying squirrel is a *K*-selected species. *K*-selected species tend to have delayed sexual maturity, fewer offspring, repeated reproduction, slower growth and development, larger size, and a longer life expectancy.³⁷ These characteristics are ideal for stable environments such as old growth forests with limited environmental disturbance.³⁸ In contrast, *R*-selected species are adapted to significant environmental disturbance by having limited lifespans but producing lots of offspring.³⁹ In a stable old growth forest, a *K*-selected species such as the Prince of Wales flying squirrel survive and flourish in stable environments, but may have difficulty competing with *R*-selected species and persisting in altered and/or changing environments.⁴⁰ Elimination and fragmentation of stable, old growth forests has deleterious effects on the Prince of Wales flying squirrel, a *K*-selected species.

Behavior. Exhibiting characteristics common to *K*-selected species, the Prince of Wales flying squirrel has a relatively long life expectancy of 7 years with delayed sexual maturity.⁴¹ Breeding is seasonal (once a year) with litters of 2-3 offspring produced after a 37-42 day gestation period.⁴² Females invest a significant amount of energy in their offspring.

The subspecies spends most of its life in the high canopy of old growth temperate rain forests. It is active year-round, even in winter, tolerating temperatures as low as -26°C (-15°F).⁴³ The subspecies is mostly nocturnal with peak activity just before sunrise and just after sunset. The squirrel's strong olfactory sense helps it to navigate and locate food.⁴⁴

³⁴ Winston P. Smith, *Ecology of Glaucomys Sabrinus: Habitat, Demography, and Community Relations*, 88(4) JOURNAL OF MAMMALOGY 862, 863 (2007).

³⁵ Sanjay Pyare et al., *Diets of Northern Flying Squirrels, Glaucomys Sabrinus, in Southeast Alaska*, 116 THE CANADIAN FIELD – NATURALIST 98, 101 (2002).

³⁶ Winston P. Smith et al., *The Northern Flying Squirrel as an Indicator Species of Temperature Rain Forest: the Test of an Hypothesis*, 15(2) Ecological Applications 689, 696 (2005).

³⁷ DALE D. GOBLE & ERIC T. FREYFOGLE, WILDLIFE LAW: CASES AND MATERIALS 1059 (2nd ed. 2010).

³⁸ Goble & Freyfoogle (2010) at 1058.

³⁹ Goble & Freyfoogle (2010).

⁴⁰ Goble & Freyfoogle (2010).

⁴¹ Winston P. Smith, *Ecology of Glaucomys Sabrinus: Habitat, Demography, and Community Relations*, 88(4) JOURNAL OF MAMMALOGY 862 (2007).

⁴² Smith (2007).

⁴³ Smith (2007).

⁴⁴ Elizabeth A. Flaherty et al., *Experimental Trials of the Northern Flying Squirrel (Glaucomys Sabrinus) Traversing Managed Rain Forest Landscapes: Perceptual Range and Fine Scale Movements*, 86 CANADIAN JOURNAL OF ZOOLOGY 1050, 1055 (2008).

The Prince of Wales flying squirrel rests in dens during inactivity. This helps to avoid predators, as well as regulate body temperature and store food—important to a species that does not hibernate.⁴⁵ Research on den selection suggests the subspecies prefers tall trees in old growth forests.⁴⁶ Selected sites are generally cavities or holes in snags or live trees. Females will also build nests for raising their offspring in these dens.

Gliding is the squirrel's preferred method of movement. Like all *Glaucomys sabrinus*, the Prince of Wales flying squirrel has a patagium, a thin membrane that extends on both sides of the abdomen from the front legs to the rear legs. To glide, the Prince of Wales flying squirrel will climb to the top of a high tree (mean is approximately 38 meters or 124 feet), then launch with its patagium spread, and glide up to twice the distance of the height of the tree.⁴⁷ Thus, a long glide might be 76 meters (250 feet). The subspecies prefers this method of movement because it requires less energy and offers protection from predators.⁴⁸



Figure 5. The Prince of Wales flying squirrel prefers to glide, which requires less energy and offers greater protection from predators than other forms of movement.

Mortality/Predation. *Glaucomys sabrinus* is prey for a variety of predators, including the endangered northern spotted owl (*Strix occidentalis caurina*). The Prince of Wales flying squirrel is also prey for a number of predators in the Alexander Archipelago, including the great

⁴⁵ Sanjay Pyare et al., *Den Use and Selection by Northern Flying Squirrels in Fragmented Landscapes*, 91(4) JOURNAL OF MAMMALOGY 886, 887 (2010).

⁴⁶ Pyare (2010) at 894.

⁴⁷ Elizabeth A. Flaherty et al., *Experimental Trials of the Northern Flying Squirrel (Glaucomys Sabrinus) Traversing Managed Rain Forest Landscapes: Perceptual Range and Fine Scale Movements*, 86 CANADIAN JOURNAL OF ZOOLOGY 1050, 1057 (2008).

⁴⁸ See generally Flaherty et al. (2008).

horned owl (*Bubo virginianus*) and the Queen Charlotte goshawk (*Accipiter gentilis laingi*), whose continued existence is in question.⁴⁹

GEOGRAPHIC DISTRIBUTION

The Prince of Wales flying squirrel is a subspecies of *Glaucomys sabrinus* that is endemic to the Alexander Archipelago in southeast Alaska. The subspecies' historically occurred in low elevation temperate rain forests of the far southern islands of the archipelago, including Prince of Wales Island, the Barrier Islands, Dall Island, El Capitan Island, Heceta Island, Kosciusko Island, North Island, Orr Island, Suemez Island, Tuxekan Island, and some other small islands in the vicinity. Prince of Wales Island is the largest of the group with a size of 6,674 square kilometers (2,577 square miles). The other islands are significantly smaller with Dall Island the largest at 658 square kilometers (254 square miles). The entire historic range of the subspecies is less than 10,000 square kilometers (3,860 square miles).

The Prince of Wales flying squirrel continues to reside on the largest islands in its historic range. Local extirpation on the smaller islands are possible, but has not yet been documented. Within the larger islands, habitat loss and modification has significantly reduced the species distribution. Approximately 37 percent of old growth forests have been cleared. The proportion may be as high as 50 percent for forests below 400 meters (1300 feet) in elevation.⁵⁰

⁴⁹ Some apparently dispute the fact that goshawks prey on Prince of Wales flying squirrels because the goshawks are diurnal, while the Prince of Wales flying squirrels are primarily nocturnal. However, during Alaska's long summer days, the two species are active at the same time and without the cover of darkness, the Prince of Wales flying squirrels are easy prey for goshawks. Riley Woolford, *Fly-By-Night Squirrels Favor Truffles and Lichens*, ALASKA DEP'T OF FISH AND GAME, http://www.adfg.alaska.gov/index.cfm?adfg=wildlifeneews.view_article&articles_id=73&issue_id=18 (last visited May 18, 2011). See also 2008 EIS at 3-244.

⁵⁰ Pyare et al. (2010) at 894.

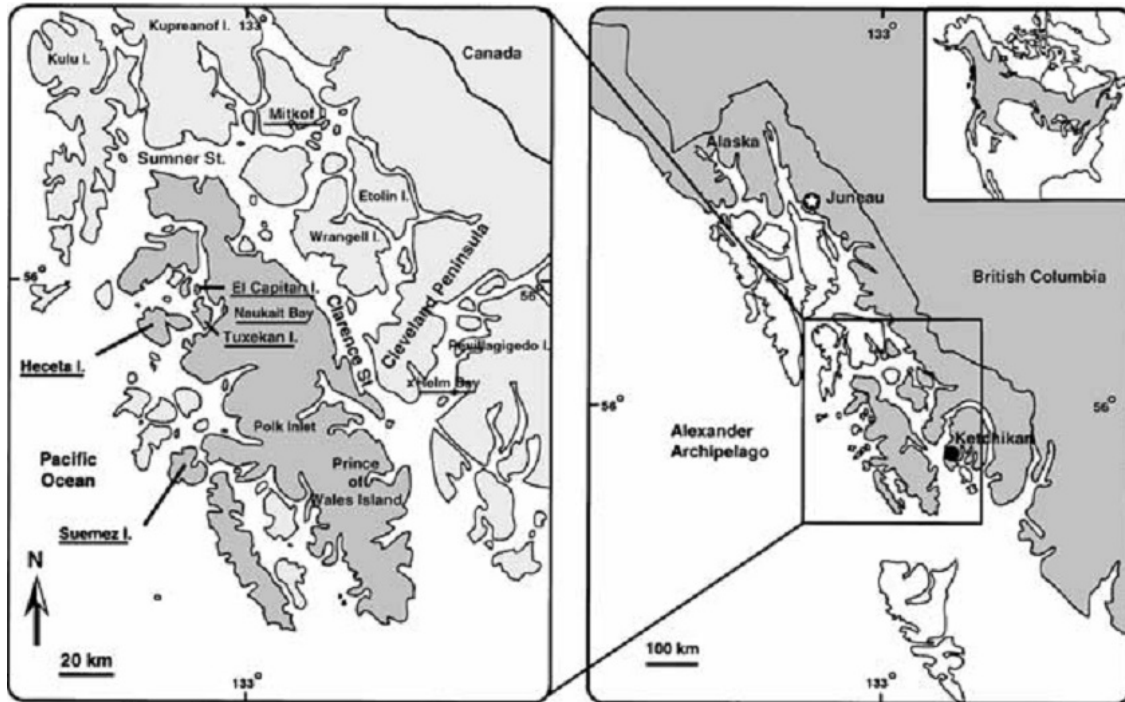


Figure 3. Maps of historic range of Prince of Wales flying squirrel. Shading represents the range of *Glaucomys sabrinus* on the right map. The map on the left is an inset with the darker shade representing the historic range of the Prince of Wales flying squirrel (*G.s. griseifrons*). The range includes Prince of Wales Island and smaller neighboring islands.⁵¹

POPULATION TRENDS

Smith and Nichols conducted a population study of Prince of Wales flying squirrels in 2003 and found very high numbers of squirrels in old growth conifer forests and even in other forest types, such as peatland/mixed conifer old growth forests.⁵² However, the researchers concluded that old growth conifer forests are the subspecies' preferred habitat and the other forests are actually population sinks for the squirrel.⁵³ Although there is little research on population trends for the Prince of Wales flying squirrel, the rangewide population is probably experiencing significant declines due to widespread destruction and fragmentation of its habitat. NatureServe suggests a short-term decline of 10-30 percent in total population.⁵⁴ The IUCN forecasts the population will decline by 50 percent in the next 10 years.⁵⁵

⁵¹ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247, 248 (2002).

⁵² See Winston P. Smith & Jeffrey V. Nichols, *Demography of the Prince of Wales flying squirrel, an Endemic of Southeastern Alaska Temperature Rain Forest*, 84(3) JOURNAL OF MAMMALOGY 1044(2003). See also Pyare (2010) at 887.

⁵³ Winston P. Smith & Jeffrey V. Nichols, *Demography of the Prince of Wales flying squirrel, an Endemic of Southeastern Alaska Temperature Rain Forest*, 84(3) JOURNAL OF MAMMALOGY 1044, 1052(2003).

⁵⁴ NatureServe.

⁵⁵ DAVID J. HAFNER ET AL. IUCN, NORTH AMERICAN RODENTS: STATUS SURVEY AND CONSERVATION ACTION PLAN 37-39 (1998). See also *1994 Categories & Criteria (Version 2.3)*, INTERNATIONAL UNION FOR CONSERVATION OF NATURE, http://www.iucnredlist.org/apps/redlist/static/categories_criteria_2_3 (last visited May 19, 2011).

CONSERVATION STATUS

FWS classified the Prince of Wales flying squirrel as a category '2' candidate species for listing under the ESA in 1974. In 1986, the FWS removed the subspecies as a candidate due to lack of available scientific research. Much more information is available today to assess the subspecies.

The squirrel is classified as "T2" or "imperiled" by NatureServe. "Imperiled" is defined by NatureServe as "[a]t high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors." NatureServe listed the following factors that contributed to its assessment: "[i]nsular subspecies; Alaska endemic with range restricted to Prince of Wales and adjacent islands in Southeast Alaska. Population abundance and trends unknown; suspected rare and potentially declining. Associated with mature and old-growth forests. Imminent threats include significant habitat loss and fragmentation as a result of timber harvest and associated activities."⁵⁶

The IUCN lists the Prince of Wales flying squirrel as "endangered" which it defines as "*not critically endangered but is facing a very high risk of extinction in the world in the near future....*" The classification is based on the following four factors:

- (A)(1)(c): an observed, estimated, inferred, or suspected population reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on a decline in area of occupancy, extent of occurrence and/or quality of habitat;
- (A)(2)(c): A population reduction of at least 50%, projected or suspected to be met within the next 10 years, or three generations, whichever is the longer, based on a decline in area of occupancy, extent of occurrence, and/or quality of habitat;
- (B)(1): extent of occurrence estimated to be less than 5000 km² or area of occupancy estimated to be less than 500 km² and estimates indicating severely fragmented or known to exist at no more than five locations;
- (B)(2)(c): extent of occurrence estimated to be less than 5000 km² or area of occupancy estimated to be less than 500 km² and estimates continuing decline, inferred, observed or projected in area, extent and/or quality of habitat.⁵⁷

USFS considered classifying the Prince of Wales flying squirrel as a "sensitive species" on Forest Service lands in 2009, but determined that the subspecies' viability wasn't immediately threatened due to higher population densities discovered in a 2003 study and some mitigation measures included in the 2008 Land Management Plan.⁵⁸ The USFS also declined to classify the subspecies as a "Management Indicator Species" which would have required monitoring for the

⁵⁶ NatureServe.

⁵⁷ DAVID J. HAFNER ET AL. IUCN, NORTH AMERICAN RODENTS: STATUS SURVEY AND CONSERVATION ACTION PLAN 37-39 (1998). *See also 1994 Categories & Criteria (Version 2.3)*, INTERNATIONAL UNION FOR CONSERVATION OF NATURE, http://www.iucnredlist.org/apps/redlist/static/categories_criteria_2_3 (last visited May 19, 2011).

⁵⁸ UNITED STATES FOREST SERV., 2009 FOREST SERVICE ALASKA REGION SENSITIVE SPECIES LIST 34 (2009), available at http://www.fs.fed.us/r10/ro/policy-reports/documents/2009_revised_r10_ss_report.pdf. *See also* Winston P. Smith & Jeffrey V. Nichols, *Demography of the Prince of Wales flying squirrel, an Endemic of Southeastern Alaska Temperature Rain Forest*, 84(3) JOURNAL OF MAMMALOGY 1044 (2003), which was the 2003 study that the USFS based its decision on.

squirrel. For the reasons explained below, this decision was unsupported and new research suggests that assumptions made in the 2008 Land Management Plan were wrong.

IDENTIFIED THREATS TO THE PETITIONED SPECIES: CRITERIA FOR LISTING

The Prince of Wales flying squirrel is affected by all five listing factors identified in ESA Section 4 (16 U.S.C. §1533(a)(1)).

(Factor A) Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range

Island species are especially vulnerable to habitat fragmentation. In many archipelagos around the world species are especially vulnerable to extinction and conservation is critical to their survival.⁵⁹ The Prince of Wales flying squirrel is endemic to a few islands in the southern Alexander Archipelago. Connectivity between the islands is limited and the squirrel is not adept at dispersal over water.⁶⁰ The Clarence Strait that separates Prince of Wales Island from the mainland is an impenetrable barrier preventing interaction between the Prince of Wales flying squirrel and its mainland cousin, the Alaska coast flying squirrel.

Further habitat fragmentation can significantly reduce connectivity between intra- and inter-island populations and threaten the viability of the species. Unfortunately, over the last 50 years much of the old growth forests in the southern Alexander Archipelago have been logged—39 percent on Prince of Wales Island (*see* Table 3). This represents a significant portion of the range of the Prince of Wales flying squirrel. Views of the islands from above (*see* Figure 6) reveal a habitat that is criss-crossed with logging roads and vast stretches of cleared forests separating small reserves of remaining old growth trees, mostly in remote areas or on rugged terrain that is less desirable for logging. Some second growth forests have emerged, but lack most of the important characteristics of old growth forests that are necessary for Prince of Wales flying squirrels.⁶¹

USFS acknowledged the effects of habitat fragmentation and the need for maintaining connectivity for endemic island species. It is especially important to preserve biological “pinchpoints,” narrow land corridors connecting larger areas of old growth forests.⁶² In its 2008 Environmental Impact Statement, USFS identified two major pinchpoints on Prince of Wales Island. These are:

- **Neck Lake Area** (coordinates: 56°11'58.38" N, 133°07'07.01" W) is in the northern part of Prince of Wales Island. The Neck Lake area is a narrow strip of habitat connecting the northern part of the island to the rest of the island. The area has already seen a significant amount of development and logging and future development is

⁵⁹ Allison L. Bidlack & Joseph A. Cook, *Reduced Genetic Variation in Insular Northern Flying Squirrels (Glaucomys Sabrinus) Along the North Pacific Coast*, 4(4) ANIMAL CONSERVATION 283 (2001).

⁶⁰ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247, 254 (2002).

⁶¹ Elizabeth A. Flaherty et al., *Diet and Food Availability: Implications for Foraging and Dispersal of Prince of Wales Northern Flying Squirrels Across Managed Landscapes*, 91(1) JOURNAL OF MAMMALOGY 79, 81 (2010).

⁶² 2008 EIS at 3-222.

planned. This corridor is extremely important for connecting old growth reserves on the northern tip of the island with the rest of the island. USFS has set aside a small old growth reserve around Neck Lake and another reserve around the neighboring Sarker Lakes. While these reservations should help to maintain connectivity, the problem is that the lakes themselves, which run perpendicular to the corridor, are a major obstacle to squirrel movement. The Prince of Wales flying squirrel is not adept at crossing water bodies and it generally will not cross any distance of more than 76 meters (250 feet) due to glide mode limitations. There are two passages on the east and west side of Neck Lake through which the Prince of Wales flying squirrel could move. The eastern passage is bifurcated by a large stream which serves as a partial barrier. The western passage is almost entirely private land, and none of it is protected reserves. In fact, these private lands have already been subject to intense logging, and further development is expected.

- **Sulzer Portage Area** (coordinates: 55°16'27.46" N, 132°31'23.51" W) is the narrow isthmus that connects the southern part of Prince of Wales Island to the rest of the island. West Arm Cholmondeley Sound and Portage Bay in Hetta Inlet surround the isthmus, which is 3.75 miles in width at the narrowest point. This is an especially precarious corridor for Prince of Wales flying squirrel because of the large gap between old growth reserves. The gap is 400-800 meters (1,320 – 2,640 feet). The difficulties of passing through this corridor are further compounded by rugged terrain and mountains rising 1200 meters (about 4,000 feet) in elevation. Most of the old growth forests that existed in the corridor are gone. Additionally, this area is almost entirely on private land and none of it is protected. USFS set aside some old growth reserves on the periphery, but they are not located close enough together to facilitate wildlife movement through the corridor. It is likely that the Sulzer Portage area no longer serves as a corridor for Prince of Wales flying squirrels, which means the southern population is no longer connected to the main population on the island.

The size of disturbed areas makes it increasingly difficult for Prince of Wales flying squirrels to move between old growth reserves. The subspecies usually relies on its ability to glide for movement, preferring that to quadrupedal movement because of the reduced energy requirements and safety from predators. But the subspecies has a limited gliding range (perhaps 76 meters/250 feet), while the average clearcut is more than 360 meters across (1180 feet).⁶³ Crossing large, disturbed areas requires quadrupedal movement, which requires more energy and increases exposure to predators.⁶⁴ USFS's 2008 Land Management Plan opens more old growth forests to logging, which would further fragment the habitat of the Prince of Wales flying squirrel and increase the distance between the remaining old growth reserves.⁶⁵ Under the plan, USFS projects that over 52 percent of old growth forests (54% on Prince of Wales Island) will be cleared in the next 100 years.⁶⁶

⁶³ Elizabeth A. Flaherty et al., *Experimental Trials of the Northern Flying Squirrel (Glaucomys Sabrinus) Traversing Managed Rain Forest Landscapes: Perceptual Range and Fine Scale Movements*, 86 CANADIAN JOURNAL OF ZOOLOGY 1050, 1057 (2008).

⁶⁴ See generally Flaherty et al. (2008).

⁶⁵ UNITED STATES DEP'T OF AGRIC., TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (2008). See also Table 3.

⁶⁶ UNITED STATES DEP'T OF AGRIC., TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (2008).

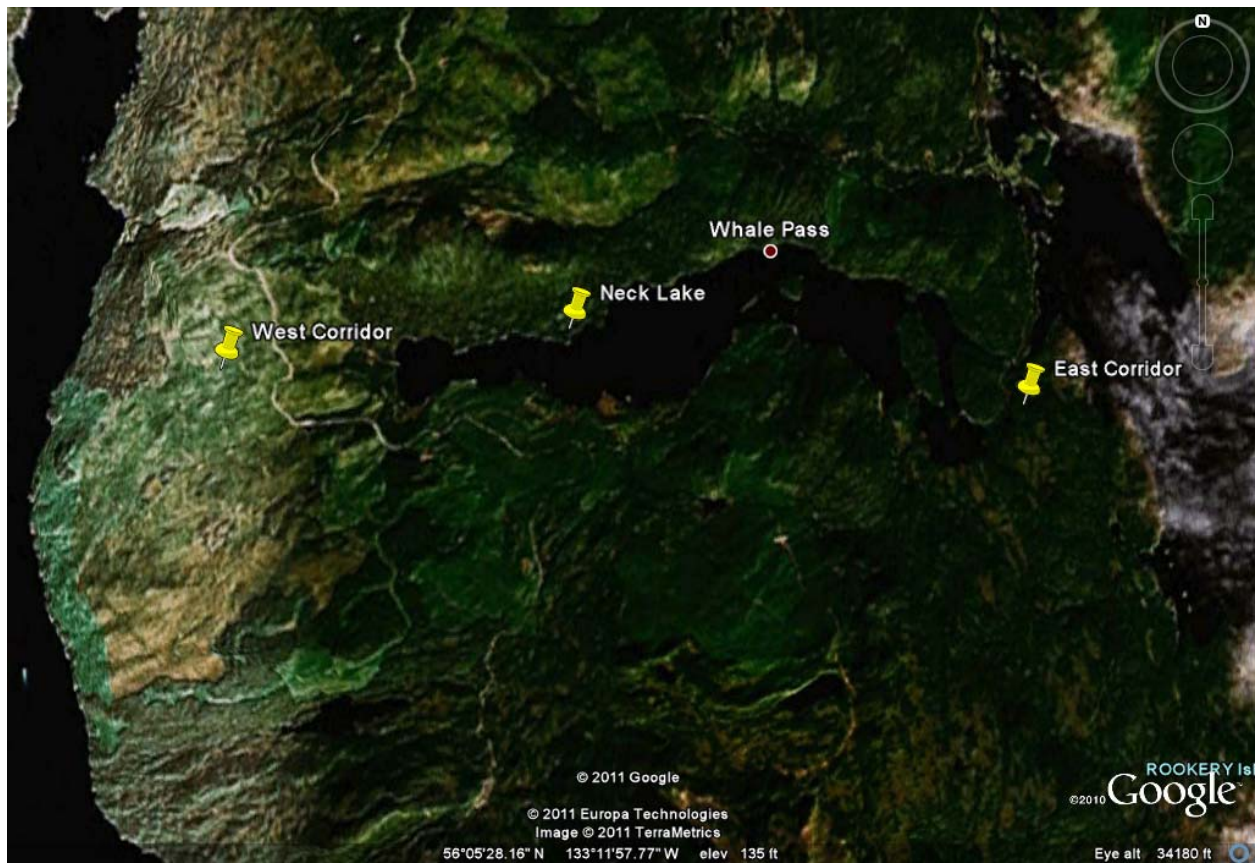


Figure 6. USFWS identifies the Neck Lake Area as an important wildlife corridor on Prices of Wales Island. The darker shades are the remnant forests, some of which are old growth forests. The lighter shades are clear cuts. This pinchpoint is the narrow isthmus of habitat connects forests in the northern part of Prince of Wales Island to forested areas to the south. The isthmus is 8 miles in width at the narrowest point, Neck Lake and the Sarker Lakes run perpendicular to the isthmus and are a barrier to connectivity. The lakes are generally about 0.25 miles across (1,320 feet) which is far beyond the glide range of the Prince of Wales flying squirrel. The way for the squirrels to traverse the area is either east or west of the lakes. The “West Corridor is 1.3 miles wide and the “East Corridor” is only 0.5 miles wide. While the East Corridor is partially protected with old growth reserves, it is bifurcated by a stream that is at least 200 feet wide for most of its length. The West Corridor is almost entirely on private lands and there are no protections in place to prevent further development of the sparse forests in this area. Image created using Google Earth®.

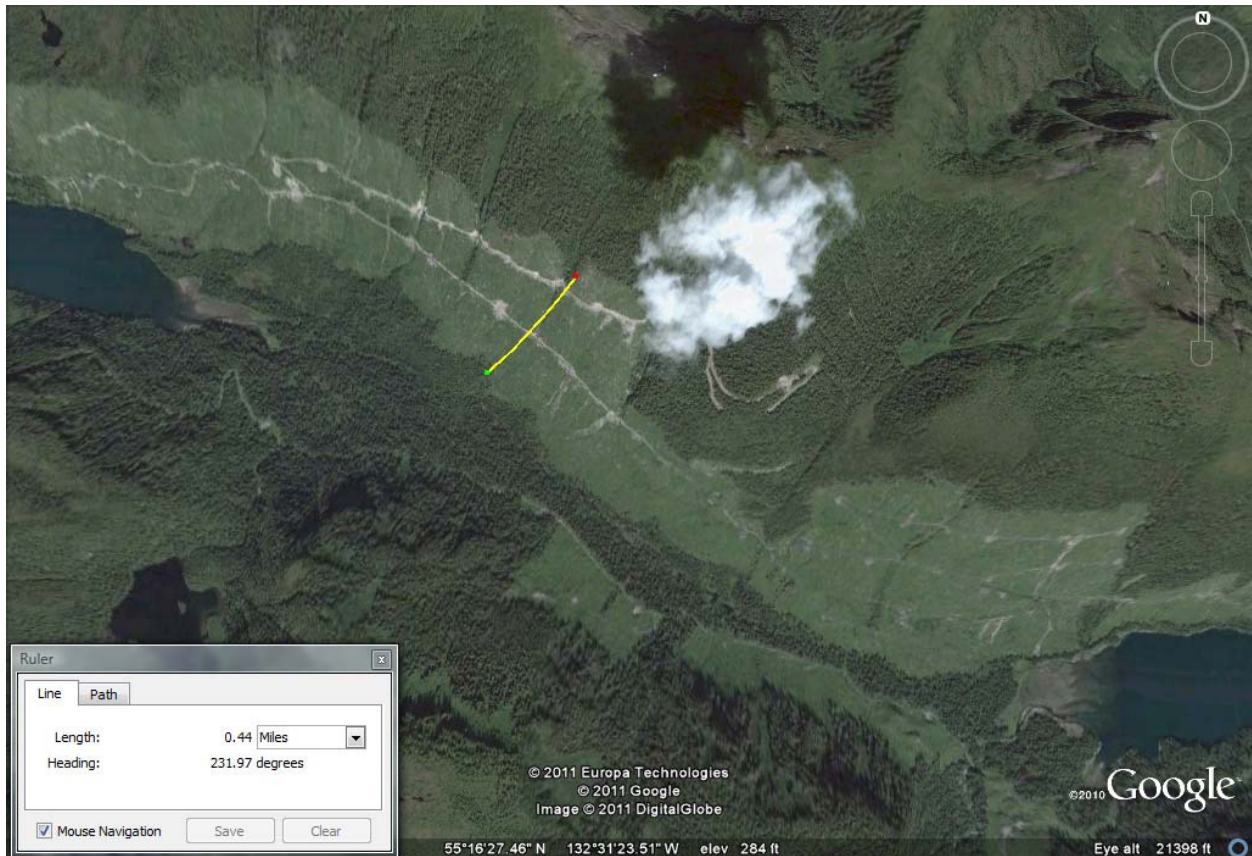


Figure 7. USFS identifies the Suzler Portage Area as a critical wildlife corridor on Prince of Wales Island. This pinchpoint is the narrow isthmus that connects the southern part of Prince of Wales Island to the rest of the island. The two bodies of water are West Arm Cholmondeley Sound and Portage Bay in Hetta Inlet. The isthmus is 3.75 miles in width at the narrowest point. Most of the old growth forests that existed here are gone. The lighter green areas of this image are clearcuts and the pale lines are logging roads. The distance across the clearcuts between the forest patches (as shown by the yellow line) is 0.25-0.50 miles (1,320 – 2,640 feet), open country that is difficult for the Prince of Wales flying squirrel to cross. Further, this important wildlife corridor area is almost entirely private land that is not protected. Image created using Google Earth®.

(Factor B) Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The State of Alaska does not offer any protections for the Prince of Wales flying squirrel. In fact, the state allows unlimited hunting of “flying squirrels” year round with no bag limit.⁶⁷ While the Prince of Wales flying squirrel is not highly sought after for hunting, the additional pressure from hunting could heighten the threat of extinction to this *K*-selected species. Hunting can have a significant impact on small local populations and contribute to local extirpation.

⁶⁷ ALASKA DEP’T OF FISH & GAME, FUR ANIMALS, SMALL GAME, UNCLASSIFIED GAME AND DELETERIOUS EXOTIC WILDLIFE 1 (2011), available at <http://www.adfg.alaska.gov/static/regulations/wildliferegulations/pdfs/smggame.pdf> (last visited May 19, 2011).

(Factor C) Disease and Predation

Predation on the Prince of Wales flying squirrel may increase as a result of habitat destruction and fragmentation. As discussed above, the Prince of Wales flying squirrel primarily relies on gliding for movement, an evolutionary advantage to escape predators and conserve energy.⁶⁸ Most of its movement is under the closed canopy of old growth forests where it is more protected. While the Prince of Wales flying squirrel does naturally cross open areas such as streams or meadows, it mostly prefers to do so by gliding. However, it is unable to glide across large open (disturbed) areas and must resort to quadrupedal movement, exposes them to predators.

Another threat to the Prince of Wales flying squirrel is the introduction of non-native predators on Prince of Wales Island, including raccoon (*procyon lotor*) and the American marten (*Martes Americana*).⁶⁹ The American marten is native to the Pacific Northwest and the Alaskan coast, but was not historically found on most of the islands of the Alexander Archipelago. The marten preys on *Glaucomys sabrinus* on the mainland. Now established on Prince of Wales Island and some neighboring islands, there is concern that it will prey on Prince of Wales flying squirrels.⁷⁰ Feral cats and dogs could also pose a threat to the subspecies.⁷¹

(Factor D) Inadequacy of Existing Regulatory Mechanisms

The 2008 Land Management Plan leaves open large areas of public land in the Alexander Archipelago to logging and sets aside only some small reserves of old growth forests.⁷² The forests of the archipelago are generally managed in checkerboard scheme with sections of clearcuts intermixed with old growth forests. USFS drafted the 2008 Land Management Plan under the belief that the small old growth forest reserves could support “meta populations” that would disperse across the disturbed areas to interact with the other populations.⁷³

There have been a number of studies on the Prince of Wales flying squirrel and its viability under this plan and its 1997 predecessor. As discussed above, the Prince of Wales flying squirrel is capable of crossing cross open areas and does so naturally in areas such as meadows or riparian zones. But the subspecies prefers to glide for movement and it cannot glide across larger clearings. In addition, there are limits to the squirrel’s sensual perception that might prevent it from crossing large open areas. The Prince of Wales flying squirrel relies on its olfactory, auditory, and visual senses for movement. Flaherty et al. (2008) suggested that the perceptive range of individuals in clearcut areas is about 100-150 meters (328-492 feet) and even shorter for

⁶⁸ See generally Elizabeth A. Flaherty et al., *Experimental Trials of the Northern Flying Squirrel (Glaucomys Sabrinus) Traversing Managed Rain Forest Landscapes: Perceptual Range and Fine Scale Movements*, 86 CANADIAN JOURNAL OF Zoology 1050 (2008).

⁶⁹ DAVID J. HAFNER ET AL. IUCN, NORTH AMERICAN RODENTS: STATUS SURVEY AND CONSERVATION ACTION PLAN 38 (1998).

⁷⁰ Hafner et al. (1998).

⁷¹ Hafner et al. (1998).

⁷² UNITED STATES DEP’T OF AGRIC., TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (2008).

⁷³ UNITED STATES DEP’T OF AGRIC., TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (2008). See also 2008 EIS at D-73.

second growth forests at about 25-50 meters (82-164 feet).⁷⁴ This perceptual range may be further limited by weather events, which are especially common in an environment that receives upwards of 600 centimeters (250 inches) of precipitation per year.⁷⁵ Flaherty et al. (2008) speculated that individuals would be hesitant to venture across large clearcut areas that extend beyond their perceptual range.⁷⁶ That presents a problem, as most clearcut areas are larger than 360 meters (1180 feet) across.⁷⁷ If individuals will not cross large clearings, then populations will become isolated and may be extirpated.⁷⁸

There are other problems with the 2008 Land Management Plan. Not all old growth forests are equal in ecological value. For the squirrel, there are significant differences between mature Sitka spruce/western hemlock forests and the low density mixed conifer-peatland forests. Smith speculated that the mixed conifer-peatland forests act as population sinks and are incapable of supporting a population without Sitka spruce/western hemlock forests nearby.⁷⁹ Under the 2008 Land Management Plan, most of the tall stands of mature Sitka spruce/western hemlock are selected for logging, while less suitable habitat that are either too remote or deemed undesirable for logging, are set aside as old growth reserves.⁸⁰ The viability of the Prince of Wales flying squirrel depends on reserving a sufficient amount of Sitka spruce/western hemlock old growth forests.

A flawed assumption in the 2008 Land Management Plan is that second growth forests will provide lesser but sufficient quality habitat for Prince of Wales flying squirrels. Unfortunately, this appears to be incorrect. Second growth forests take about 200-300 years to regain old growth characteristics, such as tall trees, a closed canopy, ample fungi, and old snags that are often used for denning and nesting.⁸¹ While Prince of Wales flying squirrels may utilize second growth forests, they depend on the adjacent old growth forests for their survival. Flaherty et al. (2010) did not find any truffles, an important food source for Prince of Wales flying squirrels, in second growth forests.⁸²

There are no habitat protections for privately owned forests in the range of the Prince of Wales flying squirrel. The habitat pinchpoints identified by USFS as critical wildlife corridors on Prince of Wales Island are mostly private land that has been heavily logged (*see* Figure 6 and 7). If the pinchpoints cease to function as wildlife corridors, then remaining squirrel populations will become further fragmented, with the concomitant dangers of small, isolated populations.

⁷⁴ Flaherty et al. (2008) at 1055.

⁷⁵ Flaherty et al. (2008) at 1057.

⁷⁶ Flaherty et al. (2008).

⁷⁷ Flaherty et al. (2008).

⁷⁸ Flaherty et al. (2008). *See also* Sanjay Pyare et al., *Den Use and Selection by Northern Flying Squirrels in Fragmented Landscapes*, 91(4) JOURNAL OF MAMMALOLOGY 886, 887 (2010).

⁷⁹ Winston P. Smith, *Ecology of Glaucomys Sabrinus: Habitat, Demography, and Community Relations*, 88(4) JOURNAL OF MAMMALOLOGY 862, 871-72 (2007).

⁸⁰ UNITED STATES DEP'T OF AGRIC., TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (2008). *See also* Table 3.

⁸¹ Sanjay Pyare et al., *Den Use and Selection by Northern Flying Squirrels in Fragmented Landscapes*, 91(4) JOURNAL OF MAMMALOLOGY 886, 894 (2010).

⁸² Elizabeth A. Flaherty et al., *Diet and Food Availability: Implications for Foraging and Dispersal of Prince of Wales Northern Flying Squirrels Across Managed Landscapes*, 91(1) JOURNAL OF MAMMALOLOGY 79, 87-88 (2010).

USFS presented forest inventory, including remaining forests and areas logged in the Tongass National Forest based on Biogeographic Provinces. The Prince of Wales flying squirrel is found in four of these provinces: North Central Prince of Wales, Southern Outer Islands, Dall Island and Vicinity, and South Prince of Wales Island.

USFS Biogeographic Provinces	Original Acres of All Old Growth Forests	Remaining Acres of All Old Growth Forests (2006)	Percentage of All Old Growth Forests Lost (2006)	Remaining Acres of All Old Growth Forests (2106)	Percentage of All Old Growth Forests Lost (2106)
North Central Prince of Wales	598,645	389,119	35%	305,309	49%
Southern Outer Islands	118,338	100,587	15%	89,937	24%
Dall Island and Vicinity	99,621	74,716	25%	54,792	45%
South Prince of Wales	173,174	157,588	9%	133,344	23%
Totals for Prince of Wales Island	771,819	546,707	31%	438,653	44%
Totals for All Provinces	989,778	722,010	27%	583,382	42%

Table 2. This table is based on USFWS data and shows the original extent of *all* old growth forests in the historic range of the Prince of Wales flying squirrel, followed by the remaining acreage as of 2006, percentage of old growth forest lost as of 2006, estimated remaining acreage of old growth forests as of 2106, and percentage lost by 2106.⁸³

USFS Biogeographic Provinces	Original Acres of HV Old Growth Forests	Remaining Acres of HV Old Growth Forests (2006)	Percentage of HV Old Growth Forests Lost (2006)	Remaining Acres of HV Old Growth Forests (2106)	Percentage of HV Old Growth Forests Lost (2106)
North Central Prince of Wales	453,890	254,178	44%	186,095	59%
Southern Outer Islands	58,072	44,715	23%	38,328	34%
Dall Island and Vicinity	63,691	43,310	32%	31,846	50%
South Prince of Wales	94,158	82,859	12%	68,735	27%
Totals for Prince of Wales Island	548,048	337,037	39%	254,830	54%
Totals for All Provinces	669,811	425,062	37%	325,004	52%

Table 3. This table is based on USFWS data and shows the original amount of *high volume* old growth forests in the historic range of the Prince of Wales flying squirrel, followed by the remaining acreage as of 2006, percentage lost as of 2006, estimated remaining acreage as of 2106, and percentage lost by 2106. “High volume” old growth forest is the preferred habitat of the Prince of Wales flying squirrel because large trees provide more food resources and denning opportunities. These high volume old growth forests are under greatest pressure for logging.⁸⁴

⁸³ 2008 EIS at 3-201.

⁸⁴ 2008 EIS at 3-202.

(Factor E) Other Natural or Man-made Factors Affecting the Prince of Wales Flying Squirrel's Continued Existence

USFS in its 2008 EIS recognized many possible effects from climate change on the Tongass National Forest, including increased temperatures, increased fires, more heavy winds, warmer sea temperatures, sea level rise, etc.⁸⁵ These effects may impact Prince of Wales flying squirrels. Fires are natural vectors of environmental disturbance that clear forests. Increased fire could cause too much disturbance by exceeding the natural fire regime and burn too much old growth forest inhabited by Prince of Wales flying squirrels. Heavy winds also cause disturbance by blowing down large trees, opening forests and restarting succession. Heavy winds can also exacerbate the “edge effect” of clearcuts in old growth forests. The trees at the edge of a clearcut more vulnerable to wind. Pyare et al. hypothesized that Prince of Wales flying squirrels generally avoid the edges of clearcuts due to their vulnerability to weather events.⁸⁶ Increased air temperatures and warmer water temperatures create another problem for the Prince of Wales flying squirrel. Since the subspecies is not adept at dispersal over water, it probably disperses across water during cold weather events when the water surface between the islands freezes.⁸⁷ With increasing temperatures, these cold events may become less frequent or cease altogether, potentially isolating inter-island squirrel populations.

The American red squirrel (*Tamiasciurus hudsonicus*) is introduced to Prince of Wales Island and may compete with Prince of Wales flying squirrel for some food resources.

REQUESTED DESIGNATION

WildEarth Guardians requests that the U.S. Fish and Wildlife Service list the Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) as “endangered” or “threatened” under the Endangered Species Act. Petitioner also requests designation of critical habitat concurrent with final ESA listing.

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⁸⁵ 2008 EIS at 3-12.

⁸⁶ Sanjay Pyare et al., *Den Use and Selection by Northern Flying Squirrels in Fragmented Landscapes*, 91(4) JOURNAL OF MAMMALOGY 886, 894 (2010).

⁸⁷ Allison L. Bidlack & Joseph A. Cook, *A Nuclear Perspective on Endemism in Northern Flying Squirrels (Glaucomys Sabrinus) of the Alexander Archipelago, Alaska*, 3(3) CONSERVATION GENETICS 247, 256 (2002).

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