United States Department of Agriculture

# Proposed Species of Conservation Concern Draft Evaluations

## Tongass National Forest Plan Revision



Forest Service | Alaska Region | Tongass National Forest | March 2026

**Cover Photo:** Mountain Lady's-slipper (*Cypripedium montanum*), a species proposed as a Species of Conservation Concern for the Tongass National Forest. Photograph by Rosalee de la Forêt. CC-BY-SA-3.0.

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# Preface

The USDA Forest Service is pleased to share the individual draft species evaluations of Proposed Species of Conservation Concern (SCC) for the Tongass National Forest. This document presents the collection of draft species evaluations prepared for the Tongass National Forest as part of the Species of Conservation Concern identification process. Each draft evaluation summarizes the best available scientific information relevant to a species' distribution, habitat conditions, population trends, and ecological needs within the Tongass.

The purpose of these draft evaluations is to provide a clear, science-based foundation for determining whether there is substantial concern for a species' long-term persistence in the plan area, as required under the 2012 Planning Rule. Each assessment follows a consistent format—documenting conservation status, key threats and stressors, habitat and population trends, and life-history factors that may influence vulnerability.

Together, these draft evaluations reflect a comprehensive effort to understand the conservation needs of native species across the Tongass and to support a forest plan that sustains ecological integrity, resilience, and biodiversity for generations to come.

## Why are we sharing these evaluations?

We are now inviting review and feedback from Tribes, Alaska Native Corporations, cooperating agencies, local knowledge holders, partners, and the public. Your insight is essential. Incorporating Indigenous knowledge through traditional ecological knowledge (TEK), place-based observations, and new scientific information strengthens our understanding of species' ecological needs and helps refine both the Proposed SCC List and the foundations of the revised Forest Plan.

## What we are asking from you

We welcome any information that may help verify, refine, or supplement what is presented in the draft evaluations, including:

- Recent observations or monitoring data
- Traditional ecological knowledge, including long-term or place-based species observations
- Information about species distributions, declining or expanding populations, or changes noticed over time
- Knowledge of habitat conditions, disturbances, or local stressors
- Documentation of threats such as climate-related changes, invasive species, recreation impacts, or habitat loss
- Information indicating that a species may have been overlooked or mischaracterized

This stage of engagement is an opportunity to highlight species that may need additional attention or to identify where information gaps remain. All input received will be reviewed and incorporated into draft species evaluations or the Proposed SCC List where appropriate, before the list moves forward to the Regional Forester for consideration.

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## How to Participate

All SCC-related documents—including the full report, species evaluations and background materials—are posted on the Tongass Plan Revision SCC Identification Process webpage. Comments and supporting information may be submitted through the Tongass Plan Revision Comment Site.

Thank you for taking the time to review these evaluations and for contributing your knowledge to help shape a forest plan that reflects the ecological, cultural, and community values of Southeast Alaska. Your involvement is vital to ensuring that the Tongass continues to sustain resilient ecosystems, vibrant communities, and thriving populations of native species for generations to come.

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# Aquatic Species Draft Evaluations

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# *Thaleichthys pacificus*

photo: James Crippen



*Thaleichthys pacificus* [Richardson, 1836]

**Eulachon**

Global Rank: **G5**
Alaska State Rank: **S3S4**

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Patchy OR gaps.<br>The eulachon (also referred to as hooligan smelt, candlefish or smelt, among other names; Thaleichthys pacificus) is seasonally abundant in several drainages throughout southeast Alaska (Alaska Department of Fish and Game [ADFG] 2025), where they are known to spawn in approximately 16 rivers (Willson et al. 2006). Known spawning rivers include the Unuk, Stikine, Taku, Mendenhall, Lace, Chilkat, Chilkoot, Bradfield, Grant, Hooligan, Klahini, Chiokamin, Eyak, Alaganik, Susitna, and the Wilson/Blossom rivers (Moody and Pitcher 2010; National Oceanic and Atmospheric Administration [NOAA] 2010; ADFG 2025). Other rivers where eulachon may spawn include the Skagway, Taiya, Ferebee, Berners and the Antler River (Meredith Pochardt, pers. comm.). In addition, evidence of eulachon spawning has been documented in the estuary of the Antler River (Spangler 2020). There are no known eulachon spawning rivers found on any of the coastal islands of the Alexander Archipelago (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2011). |
| 2<br><br>Distribution in surrounding | B | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass N.F.<br><br>Global Rank G5, Alaska State Rank S3S4 |

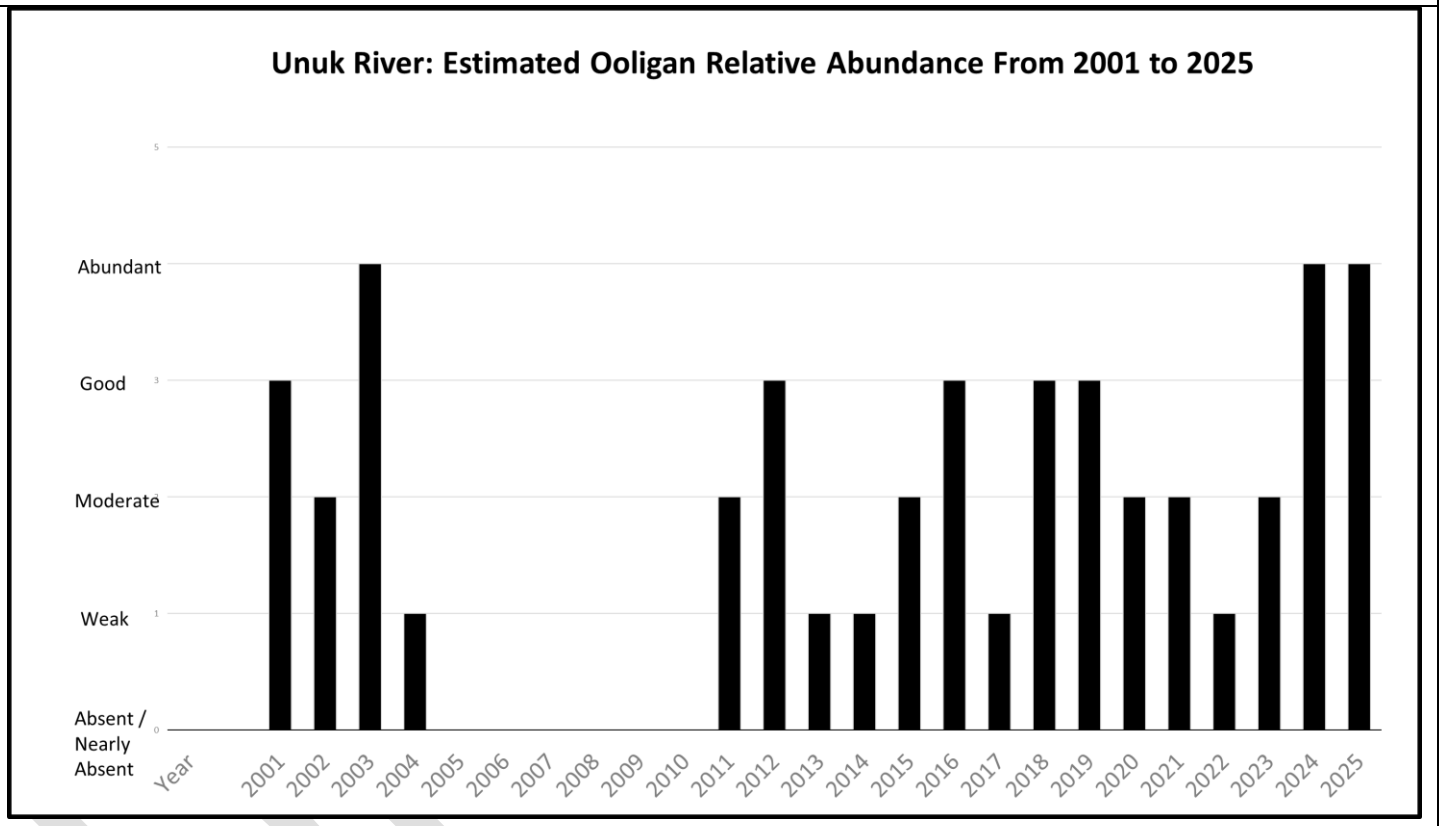
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| geographic area | | In Alaska, eulachon are seasonally abundant in several drainages throughout southeast Alaska, west to the Copper River Delta and westward out to the beaches of Nome in the Bering Sea. In addition to several watersheds in Southeast Alaska (mentioned above), the eulachon migrations can be found in the Situk and Alsek near Yakutat; the Copper River Delta area near Cordova; and the Kenai, Susitna, and Twentymile rivers in Cook Inlet (ADFG 2025). Moreover, the Alaska Department of Fish and Game manages a commercial fishery for eulachon which targets fish returning to the Susitna River each spring (ADF&G 2025).<br><br>Historically, approximately 95 rivers are considered to have spawning populations along the northwest Pacific coast, and the entire range of eulachon covers from northern California to the eastern Bering Sea in Alaska (Hay and McCarter 2000a; Moody and Pitcher 2000; COSEWIC 2011). In addition, eulachon have been observed to spawn in estuaries, specifically in the estuaries of the Twentymile and Antler rivers (Spangler 2020). However, note that most populations south of southeast Alaska have declined significantly or been extirpated, making an already genetically disjunct taxon (Sutherland et al. 2020) even more disconnected (see Conclusion Rationale). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>Watersheds with known eulachon migrations in southeast Alaska include approximately 16 rivers (but see above; Willson et al. 2006) and spawning occurs in coastal rivers that are associated with glaciers or snowpack, and which contribute to strong spring freshets (COSEWIC 2011; Hay and McCarter, 2000a; Willson et al. 2006). |
| 4<br><br>Abundance on Tongass NF | B/C | B = Uncommon - current abundance is large enough that demographic stochasticity is not likely to lead to rapid local extinction, but, in combination with highly variable environmental factors, could pose a threat/ C = Common – current abundance is large enough that species persistence is not threatened by demographic stochasticity in combination with environmental variation.<br><br>Overall strength of eulachon returns to rivers for spawning vary across Alaska by year and location. It is unclear why run strength remains strong in some areas/seasons while weak in other areas/seasons (ADFG 2025). Although there are now Tribally-led eulachon population monitoring programs in different rivers across southeast Alaska (see below), historical systematic studies on the abundance of eulachon across southeast Alaska are generally lacking, with most of the available information limited to a few rivers based on total fish catch records and visual or DNA surveys. |

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| *Criteria* | *Rank* | *Rationale* |
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| | | For example, in the Ketchikan area and more than twenty years ago, the Unuk River had reported total catches of eulachon that varied from 7 to 30 tons per year, whereas the 2005 season saw no catch and eulachon were reported to be virtually absent on the Unuk River (Morphet 2005; Van Alen 2011). In fact, in 2005, the eulachon population in the Unuk River collapsed, with less than 150 fish observed each year between 2005 and 2010, resulting in State and Federal closures to fishing beginning in 2005 (US Forest Service [USFS] 2022, 2023). In 2011, however, eulachon began returning to the Unuk River in greater numbers, but annual monitoring has documented variable return levels between 2011 to 2022, though stock sizes remain at levels lower than those observed prior to the 2005 population collapse (USFS 2022, 2023). After 2011, estimated relative abundance of eulachon has been dominated by "weak" to "moderate" runs (<500 to 500-1,000 fish observed) and some "good" runs (1,000-10,000 fish observed; Fig. 1; USFS 2025). In 2024 and 2025, returns of eulachon to the Unuk River were estimated to be abundant. The Federal subsistence fishery was opened on the Unuk river in 2021 and limited to federally qualified subsistence users (FQSUs) The fishery implemented conservative household harvest limits and gear restrictions to prevent overharvest. Harvest and gear restrictions have been implemented each year since the fishery was re-opened in 2021 (2021-2024). At their March 2022 meeting, ADF&G's Board of Fish passed proposal 142, establishing a 50-pound daily and possession limit for Eulachon for Alaskan residents harvesting through the State Personal Use fishery. However, Federal managers have used emergency special actions each year since this time to close the personal use fishery due to conservation concerns. In 2025, a proposal (FP25-02) was submitted by the Southeast Alaska Subsistence Regional Advisory Council (Southeast Council), requesting that the Federal public waters of the Unuk River be closed to the harvest of eulachon except by federally qualified subsistence users. |

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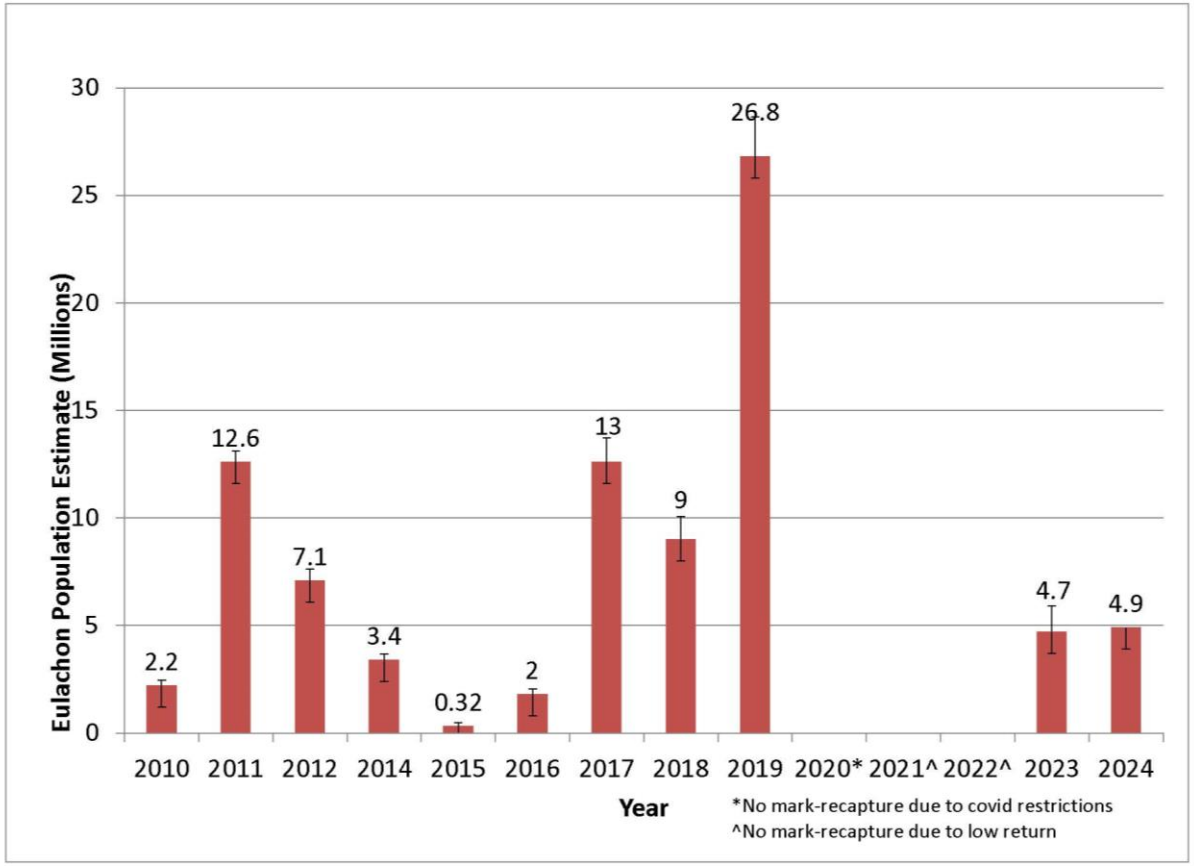
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| | |  <br>**Figure 1**: Estimated relative abundance from visual observations of eulachon in the Unuk River between 2001 to 2025. From USFS (2025). Definitions: 4-Abundant = large high density schools (>10,000 fish) widespread along multiple major channels and present beyond one week; 3-Good = moderately large high density schools (1,000 – 10,000) spread throughout one or more major channels and present for at least a week; 2-Moderate = Some high density schools, small to moderate in size (500-1,000 fish), spread out over multiple channels and present for at least a week; 1-Weak = small schools of fish (<500 fish), scattered, no large high density schools, and present less than a week; 0-Absent/Nearly Absent = Little to no fish observed, or small pockets of individuals seen throughout the run. |

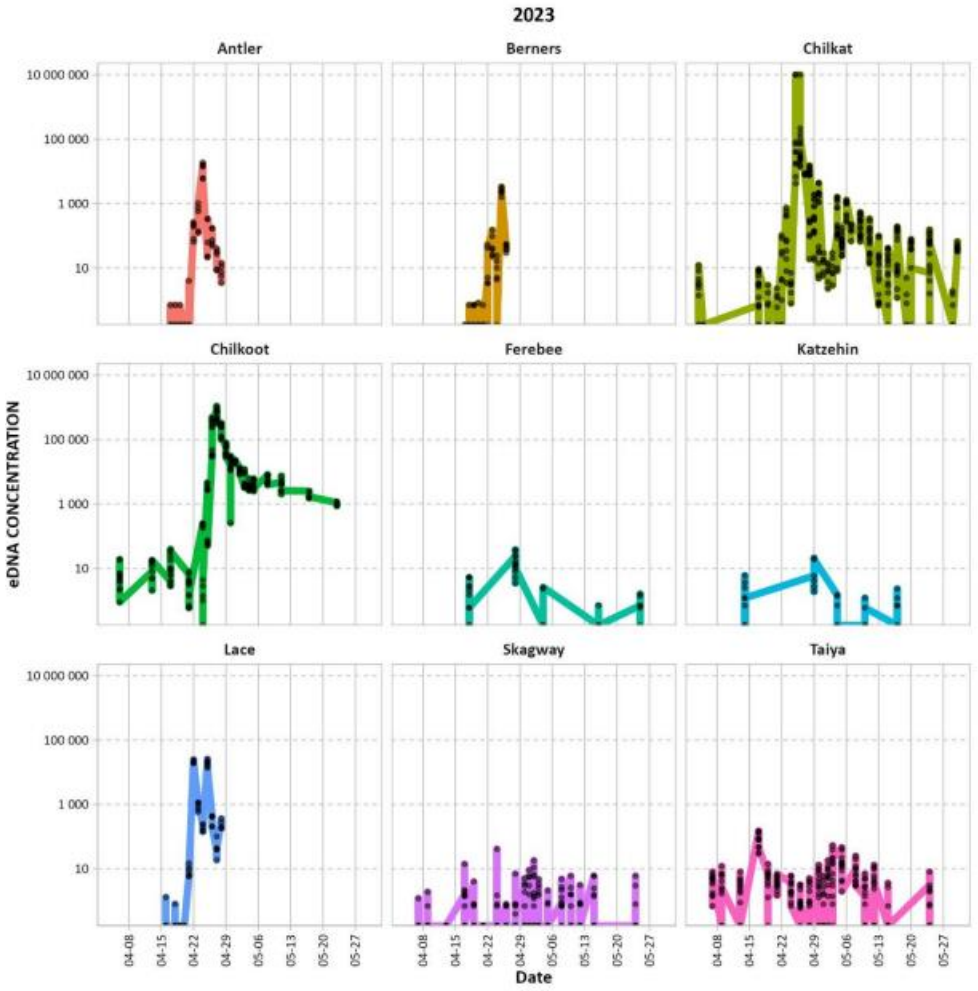
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| | | In the Lynn Canal/Berners Bay area, which includes the Chilkat and Chilkoot rivers, presence and abundance of eulachon has varied throughout the years (Moody and Pitcher 2010), with some years where the eulachon runs have failed to materialize and others where the rivers were described as choked with eulachon (Morphet 2006; Pochardt 2019). Mills (1982) estimated the total catch of eulachon for Klukwan and Haines at 6 tons in 1983 and 5.4 tons in 1987. Historic documents and reports from this area indicate that catch levels were once much larger during the early part of the twentieth century (Moody and Pitcher 2010). Past studies in Berners Bay seemed to indicate a reduction in abundance of eulachon in the Berners, Lace and Antler rivers (Moody and Pitcher 2010). For example, the mean index of eulachon abundance calculated in 1996 by Martson et al. (2002) was found to be more than twice of that calculated in 1997. Moreover, in 2002, Sigler et al. (2004) showed that eulachon abundance was higher (300 tons) compared to that in 2003 (113 tons). This seems to still be reflected in recent years (2017, 2018 & 2023), where eulachon abundance in the Berners, Lace and Antler rivers seem to remain low, but note that no reduction in abundance between years has been observed since 2017 (Chilkoot Indian Association [CIA] 2023; see below for details).<br><br>More recently, a mark-recapture study from 2010-2024 in the Chilkoot River started by the Chilkoot Indian Association resulted in a mean eulachon population estimate of 7.8 million individuals showing high variation between years (range: 319,000 to 26.8 million) (Pochardt 2019; CIA 2023, 2024). The study has continued and 2019 saw the biggest return of eulachon (estimated at 26.8 million individuals) followed by two consecutive years of extremely low returns (2021 & 2022; mark-recapture analysis was not possible) and a subsequent return in 2023 and 2024, although in lower numbers (estimated at 4.7 & 4.9 million individuals, respectively; 2020 was not sampled due to COVID restrictions; CIA 2023, 2024). Moreover, researchers used environmental DNA to look at the abundance of eulachon in the Lynn Canal from Berners Bay to north of the Taiya River (Skagway), and indicated larger eulachon runs in 2017 when compared to 2018, with concentrations of environmental DNA declining by 65% (also reflected in the mark-recapture study in the Chilkoot River; Pochardt 2019). Since 2017, the environmental DNA surveys were expanded into 9 rivers in total and is ongoing to date, exhibiting spatial and temporal variation in eulachon numbers (including the Chilkoot River, where mark-recapture continues as well; CIA 2023, 2024; see *Population trend on Tongass NF* below). There are now continuous Tribally-led eulachon population monitoring programs on the Unuk/Eulachon rivers, Alsek and Situk, Berners, Lace, Antler, Chilkoot, Chilkat, Ferebee, Katzehin, Taiya, and Skagway rivers (Meredith Pochardt, pers. comm.). |

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| 5<br><br>Population trend on Tongass NF | A | A = Significant downward or suspected downward population trend<br><br>Overall, and as mentioned above with regards to abundance, long-term systematic studies across southeast Alaska looking at the population trends of eulachon are generally lacking (but see Pochardt 2019; CIA 2023; discussed below). However, and as suggested by the declining trends in abundance (given total catch and surveys) above, eulachon populations are suspected to exhibit a downward population trend in some areas of southeast Alaska (Hay and McCarter 2000a). So much so, that in 2005 the population of eulachon in the Unuk River collapsed, and it wasn't until 2011 that eulachon returned in significant numbers to the Unuk, albeit stock size remains lower than the levels observed prior to the 2005 collapse (USFS 2022).<br><br>Recently, and to fill the gaps of information regarding population trends of eulachon, the Chilkoot Indian Association began monitoring eulachon populations in the Chilkoot River in 2014 using mark-recapture techniques and later expanded to 9 other rivers and their estuaries in northern southeast Alaska using environmental DNA techniques by partnering with other organizations (Podchardt 2019; CIA 2023, 2024). The Chilkoot River shows high variation in the mark-recapture eulachon estimates (standard deviation, SD = 7,404,009), with some years in which runs failed to materialize (2021 & 2022), years were the runs are relatively low (320,000 individuals; 2015) and years where the run estimates are very high (maximum of 26.8 million individuals; 2019) (Fig 2; CIA 2023, 2024). This variation may resemble boom-and-bust cycles, which can increase the likelihood of local population extinctions, and has been associated with systems where there is a synergistic effect of environmental variation and fishing, especially in recruitment rates and mortality (Shelton and Mangel 2011). Therefore, and despite large populations estimates for some years, this population cannot be considered stable.<br><br>Comparing the mark-recapture study in the Chilkoot with environmental DNA concentrations, they found that environmental DNA area under the curve and peak concentration (log) are significantly correlated to the mark-recapture population estimates (log), and are thus useful to monitor the annual eulachon spawning biomass (Podchardt 2019; CIA 2023, 2024). Looking at all the rivers sampled, which includes the Chilkoot, Chilkat, Taiya, Skagway, Ferebee, Katzehin, Berners, Lace, and Antler, we can observe that there is high variation within rivers and between rivers across time in terms of environmental DNA concentrations with no clear pattern other than the Chilkoot and Chilkat appearing to have larger concentrations of eulachon than the other rivers (CIA 2023; but note that comparison between rivers is only advisable for those where there are reliable discharge measurements of flow to correct for the difference in river discharge, something that CIA is currently working on; CIA 2024). This pattern of spatial heterogeneity with higher |

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| | | concentrations in the Chilkoot and Chilkat can be seen in the results from the 2023 environmental DNA survey (Fig. 3; CIA 2023). In the case of the Berners, Lace and Antler rivers, abundances appear to have been much higher than what they currently are (see *Abundance on the Tongass NF* above).<br>  <br><br>**Figure 2**: Chilkoot River mark-recapture eulachon population estimate results 2010-2024. From CIA 2023 & CIA 2024. Error bars are the standard error (95% confidence interval are much more variable; see Pochardt 2019 for details). |

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| | |  <br>**Figure 3**: Northern southeast Alaska eulachon non-flow corrected environmental DNA concentration from nine rivers surveyed in 2023. From CIA 2023. For reference, the Chilkoot population estimate in 2023 was 4.7 million individuals. |

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| 6<br><br>Habitat trend on Tongass NF | B | B = Stable amounts of suitable or potential habitat, relatively unchanged habitat quality.<br><br>Eulachons are anadromous, usually spawning in the lower reaches of rivers, but spend 95% of their lives in marine waters (COSEWIC 2011). Two to three years pass between hatching and spawning, and this time appears to be mainly spent in near-benthic habitats in open marine waters (COSEWIC 2011), although eulachons likely spawn at 4-5 years from hatching in southeast Alaska (Meredith Pochardt, pers. comm).<br><br>Unlike salmon species, which strictly "home" to their natal stream for spawning, eulachon appear to use streams in the general area of their natal stream that have the best habitat conditions (Flannery et al. 2013; Southeast Regional Advisory Council [SERAC] 2023). Research indicates that eulachon may be limited by water velocity greater than 0.4 m/s making them unable to travel through long stretches of high-velocity waters (Lewis et al. 2002). Spawning sites in Southeast Alaska occur in the slower moving, lower elevations of the rivers or streams predominantly in sandy substrate, although spawning has been observed in silt, sand, and gravel (Langer et al. 1977; Lewis et al. 2002) Generally, eulachon swim between 1.5-14 km upstream, with the longest distances recorded in rivers with long and flat deltas (Pochardt 2019; Spangler 2020).<br><br>In Alaska and British Columbia, eulachon spawning rivers have few common features, and can be large and/or turbid, with high sediment loads as well as small and/or clear (COSEWIC 2011). One factor common to nearly all rivers is that all have spring freshets, which are characteristic of rivers draining glaciers or large snowpacks (COSEWIC 2011).<br><br>In addition, Spangler (2020) found that eulachon also spawn in the estuarine area with brackish waters between the Antler and Twentymile rivers, so it's possible that they do the same elsewhere. Moreover, in some years, spawning in the estuary was higher than spawning upstream in the rivers (Spangler 2020). Spangler (2020) characterized the habitat in these areas, and reported that salinity varied from 0 Practical Salinity Units (PSU) at low tide to a maximum of 25 PSU at high tide, eggs were attached primarily to pebbles (4-64 mm) substrates and secondarily to cobble (64-256 mm) and granule (2-4 mm).<br><br>According to Chestnut (2025), the integrity of freshwater ecosystems, including rivers and estuaries, is generally high, and are expected to continue delivering highly functioning conditions and services. However, the integrity of glaciers, nearshore and marine ecosystems is moderate. |

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| 7<br><br>Habitat vulnerability or modification; other threats | B | B = Habitat modification is likely to result in ecological patterns similar to the range of historical conditions but is being impacted by modern stressors.<br><br>Of importance to eulachon, given that all spawning rivers are fed from glaciers or snowpack, are glacier, river, stream and nearshore marine ecosystems on the Tongass, which were assessed by Chestnut (2025). Although the integrity of freshwater ecosystems is high, and that of glaciers, nearshore and marine ecosystems is moderate, extreme weather events and changes in climate have affected water temperatures, the timing of runoff, flooding and water chemistry throughout these ecosystems, and these changes are expected to continue without all potential effects being understood. Glaciers fed rivers and streams have more stable base flows and temperatures, which keeps water cooler during the summer. Moreover, cooler summer temperatures allow for higher dissolved oxygen in the water, which supports conditions needed for healthy fish runs. In addition, melting water from glaciers and snowfields provide downstream environments with a fresh supply of sediments, minerals and nutrients. Glaciers are dynamic and currently they are receding and losing mass balance at various rates on the Tongass. In the long-term, they are projected to recede and disappear entirely in some cases in watersheds across the Tongass. As a consequence, and in watersheds with smaller glaciers where peak water discharge has already occurred, glacier meltwater contribution to rivers is declining.<br><br>According to Bellmore et al. (*In draft*), as glaciers recede, some streams will initially have harsher conditions. However, as glaciers shrink past a certain size relative to watershed area, glacier-fed streams will become less harsh and likely become more biologically productive and have a greater capacity to support fish. Although this may be associated with an increase in average biological productivity as streams warm, it could also reduce the unique foraging and growth opportunities that these systems are likely to provide, especially for cold-water fish species. For example, warmer streams may reduce the diversity of available foraging and growth opportunities for juvenile salmon and other freshwater fishes. Moreover, shifts in food availability for juvenile salmonids could decrease the capacity of watersheds to provide favorable year-round habitat.<br><br>Drivers and stressors to rivers and streams on the Tongass include both natural and human induced influences (see Chestnut 2025). Some natural influences include changes in climate conditions, increasing temperatures and frequency of landslides whereas some human influences include land management activities such as road building, timber harvest and mining. Shallow stream flows and warm temperatures in rivers and streams can lead to low dissolved oxygen and fish die-offs. |

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| | | Another potential threat that eulachon may face in the planning area is pile driving noise from construction activities at the mouth of the rivers, which seems to make them avoid rivers where construction activities are taking place and likely go to other rivers to spawn (Meredith Pochardt, pers. comm.). This was observed in the Chilkoot and Chilkat rivers during monitoring (Meredith Pochardt, pers. comm). Although the direct effects remain largely unknown, potential effects from intense sound sources on fish, such as pile driving, include immediate death, tissue damage that might or might not result in death but that might make the fish less fit resulting in lower chances of survival, temporary hearing loss which could also lower fitness, behavioral changes resulting in animals leaving feeding or reproduction grounds, and the possibility of no effect at all (Popper and Hastings 2009). However, a controlled experiment simulating impulsive sound (e.g., pile driving) on chinook salmon (*Oncorhynchus tshawytscha*) found injuries from barotrauma (caused by sudden changes in barometric pressure) that ranged from mild hematomas at the lowest sound exposure levels to organ hemorrhage at the highest exposure levels, indicating that pile driving may have significant negative effects on exposed fish (Halvorsen et al. 2012). Fish, of course can avoid such noise exposure by swimming and staying away from the source, but this could result in the loss of opportunities for feeding or spawning in preferred habitats, as indicated above. |
| 8<br><br>Life history and demographics | B | B = Low reproductive rate or high mortality (e.g., susceptible to disease, predation, or competition), but not both; OR life history characteristics that suggest populations have an intermediate ability to recover from disturbance events and no other demographic risk factors are known.<br><br>Eulachon are anadromous, usually spawning in the lower reaches of rivers, but spend 95% of their lives in marine waters (NOAA 2010; COSEWIC 2011). They are considered semelparous, and most fish die after spawning (NOAA 2010). Eulachon return to most rivers in the early spring to spawn (Moody and Pitcher 2010) and runs in southeast Alaska peak between February and May, with multiple runs reported in some rivers (NOAA 2010, and references therein). The one common aspect of these rivers is that they have a spring freshet that is typical of rivers fed by melting snowpack or glaciers (COSEWIC 2011; Hay and McCarter, 2000a; Willson et al. 2006). Eulachon have a regional stock structure, and unlike salmonids, they do not necessarily spawn in their natal streams (Flannery et al. 2013). Spawning occurs primarily over small gravel and coarse sand in moderately flowing water (Smith and Saalfeld 1955). In southeast Alaska, incubation of eggs was estimated at 47-50 days (Spangler 2002; Spangler et al. 2003). Ichthyoplankton surveys indicate that larval eulachon may be retained for weeks or months in estuaries (McCarter and Hay 1999, 2003). Counting the annual rings of scales or the spatial deposition of rings on hard structures such as otoliths, as well as examining the seasonal oscillation of Barium to Calcium concentrations in otoliths have been used to estimate the age of eulachon |

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| *Criteria* | *Rank* | *Rationale* |
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| | | maturity between three and five years in the Copper River, Alaska (Joyce et al. 2004; Clarke et al. 2007). Mean fecundity of eulachon in the Copper River (Alaska), was estimated at between 35,520 and 36,200 in 2000 and 2001, respectively (Moffitt et al. 2002) and in the Twentymile River it ranged from 8,530 to 67,510 (Spangler 2002; Spangler et al. 2003). Eulachon are short-lived, high-fecundity, high mortality forage fish and such species typically have extremely large population sizes (NOAA 2010). Moreover, different aspects of their biology indicate that large aggregations of adults are necessary for the maintenance of normal reproductive output (NOAA 2010)<br><br>Eulachon are an important prey species for marine and freshwater fish, mammals and birds as they provide a large amount of energy-rich food during the spring when food supplies are low (Moody and Pitcher 2010, and references therein). For example, in southeast Alaska, eulachon are an important prey species for the Steller sea lions (Sigler et al. 2004), which is considered endangered and has critical habitat on the Tongass (Western distinct population segment), and whose major threats are, among others, environmental variability in prey and competition with fisheries (National Marine Fisheries Service [NMFS] 2008). Moreover, in 1997, the area-wide bird and mammal tallies for Berners Bay in southeast Alaska, during eulachon runs to the Berners, Lace and Antler Rivers, were 36,500 avian predators, including 536 bald eagles, and 422 marine mammals (Steller sea lions and harbor seals) (Marston et al. 2002). Elsewhere, in marine waters, fish such as dogfish (*Squalus acanthias*), salmon (*Oncorhynchus spp.*), hake (*Merluccius productus*), Pacific cod (*Gadus macrocephalus*) and lingcod (*Ophiodon elongates*) have also been identified as eulachon predators (Barraclough, 1964) and in fresh water eulachon are a large part of a sturgeon's (*Acipenser transmontanus*) diet during the spring (Prince 1899, cited in Moody and Pitcher 2010). More recently, in 2023, a study in northern southeast Alaska reported that the peak of mew gull (*Larus canus*) counts in rivers overlaps with peak environmental DNA concentrations, and that the species is the most abundant and reliable indicator of eulachon presence (CIA 2023).<br><br>Eulachon are also particularly important to the Tribes of southeast Alaska and to federally qualified subsistence users (USFS 2022). They are eaten fresh, dried, smoked, salted, and are frozen whole, but the product of greatest cultural, nutritional, social and economic value is the 'grease' rendered from the fish (Moody and Pitcher 2010). The grease is used as a staple in many First Nations diets and is distributed widely in potlatches, traded with neighboring Tribes and is relied upon as a medicine (Moody and Pitcher 2010). Eulachon have also been exploited commercially in southeast Alaska in the past (Moffitt et al. 2002; Armstrong and Hermans 2007, cited in NOAA 2010).<br><br>After spawning, egg mortality is generally very high, and survival from egg to larva may vary (3-5%), and may be less than 1% in large egg masses (Willson et al. 2006). The substrate where eggs are laid may affect their mortality, and for |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | example, eggs laid in areas of silt or organic debris reportedly suffer much higher mortality than those laid over sand or gravel (Langer et al. 1977). Similarly, and like in other marine pelagic fish species, eulachons may experience high mortality during the transition period from larva to juveniles (NOAA 2010). Mortality of adults mainly comes from predation and harvest (see above; NOAA 2010), but no estimates of pre-spawning mortality were found in the literature. Moreover, elevated temperatures may increase eulachon mortality, especially on adults, and prevent spawning (NOAA 2010). Adult eulachons are more sensitive to temperature changes than eggs and increases in temperature of 2.8℃ and 5.6℃ killed 50% and 100% of adult fish, respectively, within 8 days (Snyder 1970). In addition, females exposed to elevated temperatures failed to deposit eggs within 50 hours in contrast with females under (control) stable temperatures (Snyder and Blahm 1971).<br><br>It is worth mentioning that the Biological Review Team of the 2010 eulachon status review in Washington, Oregon and California (NOAA 2010) believed that high eulachon minimum viable population sizes are necessary 1) to ensure that a critical threshold density of adult eulachon are available during breeding events for maintenance of normal reproductive processes, 2) to produce enough offspring to counteract high in-river egg and larval mortality and planktonic larval mortality in the ocean, and 3) to produce enough offspring to buffer against the action of local environmental conditions which may lead to random sweepstake recruitment events, where only a small minority of spawning individuals contribute to subsequent generations. Species with this life history pattern exhibit a genetically effective population size that can be several orders of magnitude lower than the census size, and minimum viable census sizes may therefore be on the order of 50,000 to 500,000 (NOAA 2010, and references therein). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

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## Conclusion Rationale

Many spawning eulachon populations along the Pacific northwest coast have suffered declines, but as their historic status is relatively unknown and the fisheries are poorly documented, it is difficult to identify contributing factors (Moody and Pitcher 2010). As a result of these declines, the southern distinct population segment of eulachon, including California, Oregon and Washington, was listed as threatened under the Endangered Species Act. Moreover, and closer to southeast Alaska, in 2011, the Canadian Committee on the Status of Endangered Wildlife listed three British Columbia populations for protection (COSEWIC 2011). As of now, all populations that once spawned south of the Nass River in British Columbia are considered severely depleted or extinct (Hay and McCarter 2000b), leaving the populations of eulachon in Alaska as their last stronghold (Pochardt 2019).

In southeast Alaska, and on the Tongass, the status of eulachon populations seems to be context-dependent, depending on the rivers and regions where the species spawn. The following factors were used to determine if there is substantial concern over the long-term persistence of the species on the Tongass:

- **Significant threats/Other factors**: In general, significant threats to eulachon populations include the synergistic effects of high mortality due to predation and harvest, and possibly in the future, the negative effects of rising temperatures due to climate change and environmental variability. Another factor that should be considered is that, in terms of life history strategies, eulachons are short-lived, high-fecundity, high mortality forage fish, and that minimum viable census sizes required for the species are quite large. Moreover, eulachon seem to be sensitive to intense anthropogenic sound sources such as pile driving, which may prevent them from spawning in rivers if occurring at the mouth.
- **Declining populations or habitat trends**: Eulachon populations are thought to be in decline in some parts of southeast Alaska, which is supported by observations of total catch and surveys when we compare historic with current numbers, and the fact that the eulachon population in the Unuk River (southern Tongass, in the Ketchikan-Misty Fjords area) collapsed between 2005-2010. These observations also indicate that some populations in southeast Alaska might be under the minimum viable census sizes recommended for the species. In contrast, the mean population size of eulachon in the Chilkoot River (northernTongass) has been estimated at 7.8 million individuals, albeit with high variation throughout the years, which may respond to the regional stock structure of the species. However, it should be noted that the population in the Lynn Canal/Berners Bay area, where the Chilkoot River is found along with 8 other spawning rivers, exhibits very high variation in estimates across years, raising questions about the stability of the regional stock. Moreover, the habitat of eulachon on the Tongass, which consists of rivers and estuaries, seems to be currently stable and exhibit high to moderate ecological integrity. However, and although habitat modification is likely to result in ecological patterns similar to the range of historical conditions, habitat may be impacted by modern stressors such as environmental (climatic)- and anthropogenic-mediated changes.
- **Restricted range**: Eulachon are historically distributed across approximately 95 spawning rivers in the northwest Pacific coast, from northern California to Alaska. However, most populations south of southeast Alaska have declined significantly, making an already

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genetically disjunct taxa even more disconnected. Known spawning sites are found across Alaska, and occur in approximately 16 rivers and some estuarine areas and tidal reaches in southeast Alaska (but note that there are likely more spawning rivers, see above).

- **Low populations or restricted ecological conditions**: There is spatial heterogeneity on the Tongass in terms of eulachon abundance. Eulachon exhibit a regional stock structure, and for example, some rivers in the Lynn Canal/Berners Bay (northern parts of the Tongass) can have relatively low abundances (in the hundred thousand individuals) whereas other rivers within the same region can have very high abundances (in the millions of individuals, albeit with high variation across time). The story in the southern parts of the Tongass is different, and for example, low abundances have been recorded in the Unuk River since the population crashed between 2005-2010. Another factor that should be taken into account is that, in some years, spawning can fail to materialize in some rivers, with eulachon subsequently returning to spawn, and the reasons for this remain unclear. In terms of habitat, spawning areas are limited to rivers and estuarine areas that are fed from glaciers or snowpack, which contribute to strong spring freshets, so the ecological conditions are somewhat restricted. Climate change is poised to affect these, albeit the potential effects that this may have on eulachon populations is not well understood. However, decreased snowpack and receding glaciers are expected to negatively affect spring freshets dynamics, which is the one common characteristic that all eulachon-spawning rivers have in southeast Alaska.

Taken together, especially considering the contrasting information on- and differences in- abundances across spawning rivers and years, and the fact that eulachon has a regional stock structure, the scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area and we are thus recommending eulachon as a species of conservation concern. We recommend the continued monitoring of the abundances and population trends of the species, and expanding studies on these to other regions of the Tongass to get a more complete understanding of the status of eulachon populations in their last stronghold of southeast Alaska.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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# Wildlife Species Draft Evaluations

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# *Astur atricapillus laingi*

*Astur* (*Accipiter*) *attricapillus laingi* [Taverner, 1940]

**Queen Charlotte Goshawk**

photo: Robert Post



Global Rank: **T2**
Alaska State Rank: **S2**

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Patchy OR gaps. Habitat is broadly distributed across the planning area, but gaps exist within this distribution.<br><br>The Queen Charlotte Goshawk was formerly classified as *Accipiter attricapillus* (*gentilis*) subspecies *laingi*, however, based on recent genetic data the subspecies is now placed under the genus *Astur* and recognized as *Astur atricapillus laingi* (Catanach et al. 2024; Chesser et al. 2025).<br><br>The Queen Charlotte Goshawk ranges from a line between Mount Fairweather and Mount Foster in northern Southeast Alaska south to the international border. Understanding of distribution and habitat use along with ecological inference, suggests the species is broadly distributed with relatively continuous distribution in forested terrestrial environments that support old forests at lower elevations (Webster 1988, Titus et al. 1994, Titus et al. 1999, Flatten et al. 1998, Flatten et al. 2001, Flatten et al. 2002, Flatten and McClaren 2003 and Iverson et al. 1996). |
| 2<br><br>Distribution in | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank T2, Alaska State Rank S2<br>British Columbia Province Rank S2 |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| surrounding geographic area | | Queen Charlotte Goshawks occur along the Pacific Coast from Vancouver Island north to the Alexander Archipelago in southeast Alaska, coastal mainland Alaska and Lynn Canal (Webster 1988, Titus et al. 1994, Iverson et al. 1996, Ethier 1999). British Columbia contains a large portion of the Queen Charlotte Goshawk population worldwide (McClaren 2004). The Queen Charlotte Goshawk occurs on Vancouver Island, the Queen Charlotte Islands, and smaller coastal islands between Vancouver Island and mainland British Columbia (McClaren 2004). Range may extend to the Olympic Peninsula and western Oregon as well, however more inventory is needed (Cooper and Stevens 2000). |
| 3<br><br>Dispersal capability | C | C = Readily disperses across landscapes with few habitat-related limitations.<br><br>Goshawks fly long distances during non-breeding season or as juveniles. Movements of juveniles over 100 miles are recorded in S.E. Alaska (Flatten et al. 2001). They will cross unsuitable habitat. Year-round home ranges can be very large in Southeast Alaska (47,563 acres for females; 15,719 acres for males, Lewis and Flatten 2004), reflecting low prey densities and the need for larger home ranges to meet foraging needs. These dramatic differences between the sexes reflect longer-distance movement of females, which appear to be less tied to individual nesting areas during the non-breeding season, as compared to males, which appear to remain largely resident in their chosen nest area (though often expanding their use area during the winter, Kennedy 2003). |
| 4<br><br>Abundance on Tongass NF | C | C = Common – current abundance is large enough that species persistence is not threatened by demographic stochasticity in combination with environmental variation.<br><br>Handel et al. (2021) estimates the North America breeding population of the American Goshawk species-level to be 210,000, with 34% (71,400) breeding in Alaska, which includes Queen Charlotte and American Goshawk subspecies. Queen Charlotte goshawks are found in low density across the Tongass (Titus 1994). Recent estimates of goshawk abundance in the Tongass range from 100–800 breeding pairs (Crocker-Bedford 1990, 1994; Iverson 1990). Although an interagency study of goshawks on the Tongass found 61 nesting areas within an approximately 30,000 $mi^2$ (77,000 $km^2$) study area (Flatten et al. 2001), it must be emphasized that this number does not represent a density estimate. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 5<br><br>Population trend on Tongass NF | B | B = Mostly stable population, past declines likely in some areas.<br><br>Queen Charlotte goshawks are assumed to have declined in abundance from historic levels due to timber harvest, which began removing habitat in the 1950's and peaked in the 1980's. Using the amount of productive old growth (POG) on the Forest in 1954 (over 5 million acres) as a baseline for the original amount of POG, only around 12 % has been logged region wide (Albert and Schoen 2013). However, loss of large-tree and the highest volume contiguous old growth that are important to goshawks has been more substantial, at about 18 and 66%, respectively. During the past two to three decades, the rate of timber harvest has declined considerably; therefore, the rate of population decline in goshawks is likely to be leveling off or in a less steep decline (USFWS 2007).<br><br>Forest succession and development of older, young-growth stands especially as they move into understory reinitiation phases may result in a trend of recovering goshawk habitat, though it can take over a century for young growth to develop conditions suitable for goshawk, especially without forest thinning and restoration treatments (Doyle 2006). Goshawks in coastal rainforest environments rely on high-quality nesting and foraging habitat in old forest. Based on goshawk ecology across the globe, however, advanced 'young-growth' can be expected to provide nesting and foraging habitat (Kennedy 2003). Thinned young-growth stands develop goshawk habitat characteristics sooner (Doyle 2006). |
| 6<br><br>Habitat trend on Tongass NF | B | B = Stable amounts of suitable habitat, relatively unchanged habitat quality. Declined habitat quality and quantity since historic levels, but trend is stabilizing.<br><br>Tongass-wide habitat quality and quantity for goshawk has declined since 1954. Substantial modification of habitat has occurred largely on the southern end of the Forest and less so on the northern end. With the decline in the timber industry on the Tongass in the last two decades, the decline in goshawk habitat across the Forest has largely leveled off with some localized impacts and continued decline in habitat where significant clearcut harvest of old forest takes place (USFS 2021).<br><br>In the Tongass, 13 to 17% of reported goshawk nests were in mature young growth, typically >90 years old but notably with residual old growth forest structure or mixed productive old-growth (POG) with young growth (Titus et al. 1994, Iverson et al. 1996). Thinned young-growth stands develop goshawk habitat characteristics sooner (Doyle 2006). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Large areas of old-growth habitat are distributed across the Tongass that are protected within reserves under current Forest Plan direction. These areas also have management intent to accelerate successional development of mature and maturing young growth towards late-seral conditions. Important areas of old-growth for prey such as beach and estuary fringe and riparian buffers are also largely protected on the Tongass. However, the sufficiency of Forest Plan protections has been questioned for goshawks and one of their key prey, northern flying squirrels (Smith 2013, Smith and Flaherty 2023).<br><br>Timber harvest has been disproportional across the Tongass, with some biogeographic provinces more heavily logged than others. For example, the northern Prince of Wales Island biogeographic province has been subject to substantial reductions in contiguous high-volume forest (reduced by 94%) and average patch sizes (decreased from 264 ha in 1954 to 73 ha in 2004; Albert and Schoen 2013). These changes have very likely resulted in goshawk population declines in this biogeographic province, which are reflected here and in other more heavily logged biogeographic provinces by changes in source-sink dynamics (Sonsthagen et al. 2012). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV<br><br>In coastal British Columbia, thinned young-growth stands on good growing sites can become suitable for nesting Queen Charlotte Goshawks after >50 years, as several nests have been found in such stands on Vancouver Island (McClaren 1999; Doyle 2006, Northern Goshawk Recovery Team 2008). It is becoming increasingly common for young-growth stands that are just coming into size and structure that support goshawks, to be logged because of the timber values represented by trees of that size. The result is that once an old-growth stand is logged, it may be continually logged as second growth just as it is becoming suitable for goshawks. Consequently, these stands would not recover sufficiently to provide habitat suitable for nesting goshawks.<br><br>Some areas of the Tongass have had substantial harvest of goshawk habitat. The disturbance regime of the region is dominated by wind events. The pattern of clearcut harvest differs from wind events and results in substantial differences in stand recovery – hence landscapes with clearcut harvest differ from historical conditions (differ from common patterns under NRV). The Conservation Strategy and associated reserve design in the Forest Plan results in protections for other areas of the Forest – characteristics of these areas would be similar to historical patterns (not substantially different from NRV). Areas most heavily impacted by harvest are also areas with historically the best goshawk habitat. Habitat protection measures of the 1997 and 2008 Tongass Forest Plan lead USFWS to conclude in 2007 that listing under ESA for the Alaska distinct population segment of the Queen Charlotte goshawk was not warranted. In addition, |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | the USFWS determined that, based on protections in the 1997 Tongass Forest Plan, the ESA criterion for listing that "the species is imperiled by present or threatened destruction, modification or curtailment of its habitat or range" was not met for the Alaska distinct population segment of Queen Charlotte Goshawk. In their determination the USFWS relied on the amount of land available for nesting and foraging and protected from harvest. The Tongass Old Growth Conservation Strategy and associated standards and guidelines in the Forest Plan were integral to the USFWS finding.<br><br>Goshawks have been documented as sensitive to old growth composition within their home ranges. Studies across the western United States indicate that goshawk home ranges typically contain between 40 – 60 % mature and old-growth foraging habitat (USFWS 2012 with citations). Goshawks in Southeast Alaska have also been shown to select breeding areas with very high, high, or moderately productive old growth as well as mature young growth and avoid clearcuts (Iverson et al. 1996). In nearby coastal British Columbia, breeding home ranges averaged 74% mature-old forest and all had >60% mature-old-growth (Doyle et al. 2020 unpublished data). Further, territory abandonment occurred with harvest of >40% of the mature-old growth forest within their breeding home ranges (Doyle et al. 2020 unpublished data) and abandoned territories had significantly more harvest than occupied territories at summer home range and breeding area scales (4,000 and 314 hectares, respectively; Doyle 2022 unpublished data). Smith and Flaherty (2023) found forest-wide standards and guidelines provide about half the breeding habitat needed, of which only half of that is secure.<br><br>Climate change on the Tongass may influence the habitat characteristics of queen Charlotte goshawks (Halofsky et al. 2025). For example, it may favor goshawk habitat with warmer, wetter conditions that will likely favor gains in coniferous forests (Buma and Barrett 2015). More of the annual precipitation is likely to be rain, rather than snow, and spring runoff is likely to be earlier than it currently is (Halofsky et al. 2025). Increased landslides, windthrow, and insect outbreaks may create canopy gaps but could also reduce old-growth continuity (Baer et al. 2025), potentially impacting nesting habitat. According to Bennetsen et al. (2025), goshawks are listed as having low vulnerability to climate change on the Tongass. Moreover, transition toward young-growth management and restoration of previously clearcut forests may accelerate the return of old-growth forest functions, enhancing future climate resilience for goshawk habitat (Bennetsen et al. 2025). Current understanding of climate change does not suggest strong evidence for declines in primary prey species (Bangerter et al. 2021). However, McClure et al. (2022) found raptors might be altering migration due to climate change and the species that have the sharpest declining population trends, including American goshawks, inhabit more northerly latitudes. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 8<br><br>Life history and demographics | B | B = Low reproductive rate or high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>Goshawks are long-lived, have low productivity, and occur at low densities. The Queen Charlotte goshawk in Southeast Alaska appears to have higher mortality, lower productivity, and lower densities than goshawks elsewhere. Demographic sensitivity analysis of species with these life history traits shows that adult survival rates greatly affect population growth. Adult survival is more important than reproduction in individual years.<br><br>Modest changes in adult survival may greatly affect population dynamics. Therefore, habitat changes that affect adult survival rates might adversely affect the probability of persistence of the population. Documented adult survival in Southeast Alaska is relatively low compared to other populations. If this is the case over the long-term, then age at breeding will need to be on the younger end for goshawks and/or juvenile survival will need to be higher than documented in Southeast Alaska and/or periodic reproduction will need to be high for the population to exhibit long-term stability. Periodic immigration could also influence the demographic status of the population. Genetic data suggest some interchange between the American goshawk and the Queen Charlotte goshawk. |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☒ | ☐ |
| Restricted range | ☐ | ☒ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

- **Significant threats**: In the absence of old growth, Queen Charlotte goshawks prefer to nest in mature young growth forests. It is becoming increasingly common for young-growth stands that are just coming into size and structure that support goshawks, to be logged because of the timber values represented by trees of that size. The result is that once an old-growth stand is logged, it may be continually

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logged as second growth just as it is becoming suitable for goshawks. Consequently, these stands would not recover sufficiently to provide habitat suitable for nesting goshawks.

- **Declining populations or habitat trends**: Historically there has been a downward trend in Queen Charlotte goshawk populations in correlation with heavy timber extraction. However, population numbers have stabilized in the past two to three decades in conjunction with much limited timber extraction practices. Forest succession and development of older, young-growth stands especially as they move into understory reinitiation phases may result in a trend of recovering goshawk habitat, though it can take over a century for young growth to develop conditions suitable for goshawk.
- **Restricted range**: The range of Queen Charlotte Goshawks extends throughout southeast Alaska and coastal British Columbia. It is widely distributed outside the TNF.
- **Low populations or restricted ecological conditions**: Current abundance on the TNF is large enough that species persistence is not threatened by demographic stochasticity. However, these birds live at low densities and have low productivity. The Queen Charlotte goshawk in Southeast Alaska appears to have higher mortality, lower productivity, and lower densities than goshawks elsewhere.

## Conclusion

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| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# *Brachyramphus marmoratus*

*Brachyramphus marmoratus* [Gmelin, 1789]

**Marbled Murrelet**

Global Rank: **G3**
Alaska State Rank: **S3**



photo: Martin Renner

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | C | C = Contiguous.<br><br>Marbled Murrelets are found throughout southeast Alaska, and within the Tongass National Forest (Tongass NF), they nest along the coast on the mainland and in the Alexander Archipelago (Nelson 1997; Piatt et al. 2007; Barbaree et al. 2014). |
| 2<br><br>Distribution in surrounding geographic area | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G3, Alaska State Rank S3<br><br>Marbled Murrelets occur long the Pacific coast of North America, and breed from central California through Oregon, Washington, British Columbia (Canada) and Alaska (Nelson 1997; Gaston and Jones 1998; Burger 2002). In Alaska, Marbled Murrelets are found on the Aleutian Islands, including the Near (Attu), Andreanof (Adak, Atka, Kagalasta) and Fox (Unalaska) islands group east to the Alaska Peninsula, Cook Inlet, Kodiak, the Kenai Peninsula and Prince William Sound, and south through the Alexander Archipelago (Nelson 1997). |

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| *Criteria* | *Rank* | *Rationale* |
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| 3<br><br>Dispersal capability | C | C = Readily disperses across landscapes with few habitat-related limitations.<br><br>In general, Marbled Murrelets are found foraging within 5 km from shore in waters less than 60 m deep, but migrational movement patterns in Alaska are largely unknown, with some birds remaining near breeding sites while others move south or offshore (Piatt et al. 2007). Major shifts in seasonal distribution occur throughout the range of Marbled Murrelets and they are capable of long-distance dispersal (Piatt et al. 2007). For example, in southeast Alaska, radio-tagged adults from Port Snettisham area moved 200 km north, and 160 km south in the early post-breeding movement period (from July-August; Newman et al. 2006). During the breeding season, they may travel up to 75 km inland from the coast to find suitable nesting habitat (Nelson 1997; Piatt et al. 2007). |
| 4<br><br>Abundance on Tongass NF | C | C = Common – current abundance is large enough that species persistence is not threatened by demographic stochasticity in combination with environmental variation.<br><br>Although Marbled Murrelets range widely in southeast Alaska, they concentrate in the Alexander Archipelago within the Tongass NF during the breeding season, and, together with concentrations in Prince William Sound and lower Cook Inlet (Kodiak Archipelago; also during the breeding season) are believed to account for 95% of the total Alaskan population (Piatt et al. 2007). Using historic population estimates from Agler (1998) and Hodges and Groves (unpub. data, 1997-2001), Piatt et al. (2007) reported that in 1994 there were about 687,061 Marbled Murrelets in southeast Alaska, with a density of 18.66-19.22 birds/km$^2$, and that by 2001, the population was estimated at 369,708 murrelets with a density of 10.42 birds/ km$^2$. However, in Glacier Bay National Park (in the total survey area), Marbled Murrelets density between 2009-2019 averaged 51.8 birds/km$^2$, showing no clear trend, and with a reported density of 55.4 birds/km$^2$ in 2019 (Hoekman et al. 2023). The same study reported an increase in Marbled Murrelet density (to 64 birds/km2) in the high-density survey area, suggesting a range shift towards upper areas of Glacier Bay (Hoekman et al. 2023). |
| 5<br><br>Population trend on Tongass NF | B | B = Stable population.<br><br>Few population-scale surveys have been repeated in Alaska for Marbled Murrelets, but in southeast Alaska, where the population was estimated at 687,061 in 1994, using data from eight trend sites within or near the populations, Piatt et al. (2007) projected that the population would decrease by 66% by 1999, and decrease by 79% by 2006. Comparing surveys from 1994 and from 2001 (two years sampled), Piatt et al. (2007) reported a significant decrease in population size with a 46% decrease between all years and an -11.5% average rate of change (percent per year) in southeast Alaska (as a whole, which includes areas within and outside Tongass NF). Estimated Marbled Murrelet densities in southeast Alaska |

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| *Criteria* | *Rank* | *Rationale* |
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| | | declined from 19.22 birds/km$^2$ in 1994 to 10.42 birds/km$^2$ in 2001 (Piatt et al. 2007). Moreover, populations of Marbled Murrelets found in areas adjacent to the Tongass NF, in Icy Strait (8 years sampled; 1993-2001) and Glacier Bay (7 years sampled; 1991-2001) showed a more pronounced significant decline of -65% and -79% between all years, respectively (Piatt et al. 2007). However, and although also showing negative trends, populations in south-central Alaska and the Aleutians did not exhibit statistically significant changes in population trends from 1976-2006 (Piatt et al. 2007). Declines were also recorded in 2016 by ADF&G in Tracy and Endicott Arms of southeast Alaska; about half as many marbled murrelets were recorded in July 2016 (Nesvacil et al. 2018) as in July 2002 (Kissling et al. 2011), although annual variation in bias arising from uncertain identification may contribute to variability in abundance estimates from year to year.<br><br>However, the US Fish and Wildlife Service (USFWS 2013) re-analyzed long-term datasets from 1989 to 2012 and concluded that the populations of Marbled Murrelets in southeast Alaska were stable, after removing problematic years where there were high proportions of unidentified murrelets (not differentiation between Marbled and Kittlitz's Murrelet). Moreover, Hoekman et al. (2023) indicate that Marbled Murrelet density estimates in Glacier Bay National Park remained robust in the high-density sampled area in 2021, and although not apparent in estimates for the total survey area (where there is no clear trend), Marbled Murrelets showed and increasing trend from 2011 to 2021 in terms of density estimates, with an estimated abundance of 21,710 (±2,421). The same study reported that, for the total survey area, the abundance was estimated at 64,868 (±12,725 SE), with an average of 60,417 (±5,167 SE) birds for 2009-2019). |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>The Tongass NF is considered to be the single most important forest habitat for Marbled Murrelets in Alaska because it is located in the center of the species' distribution and contains the State's majority of old growth western hemlock and Sitka spruce (Piatt et al. 2007). Murrelets are most abundant within the foraging range of large coastal old-growth conifer forests (Piatt and Ford 1993), and the majority nest in trees within old-growth forest that are found within 60 km of the coast (Lank et al. 2003; McShane et al 2004). Moreover, Marbled Murrelets visit their nesting habitat in old growth forest during most months of the year (Doerr and Walsh 1994; DeGange 1996; Brown et al. 1999).<br><br>There have been historic losses of suitable nesting habitat for Marbled Murrelets in the Tongass NF from timber harvest of old-growth forests, which focused on low-elevation karst and riparian forest – which in turn are likely the forest types most preferred by murrelets (Piatt et al. 2007). Although a considerable proportion of large old-growth forest has been harvested since the 1950s, estimated at 364,500 ha (DeGange 1996; Piatt et al. 2007 and references therein), in recent |

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| *Criteria* | *Rank* | *Rationale* |
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| | | years, demand and harvest in the Tongass NF has decreased significantly (Hanley et al. 2005). At the regional scale (E. Baranof, W. Baranof, Etolin/Zarembo, Kupreanof/Mitkof, Dall Island Complex, Revilla/Cleveland Peninsula, North Prince of Wales, and E. Chichagof) it has been estimated that 35-70% of the original large-tree forests have been removed, and four of those regions (Etolin/Zarembo, Kupreanof/Mitkof, Revilla/Cleveland Peninsula, and North Prince of Wales) still harbor ≥30% of the large-tree old-growth stands in the timber base (see Piatt et al. 2007 for details by province).<br><br>According to Turner and Mallott (2025), well drained, poorly drained and riparian forest ecosystems have a high ecological integrity in general, , meaning the ecosystem is expected to continue delivering major functions and services, including supporting biodiversity and productivity, without human interference (except for areas that have been logged, where it decreases). Drivers, stressors, and key characteristics exhibit the range of variation common in the past (Turner and Mallott 2025).<br><br>Off land in Alaska, and although not exclusively, Marbled Murrelets frequent waters less than 200 m from shore and prefer waters with no ice with temperatures greater than 60℃ and salinity greater than 17% for foraging (Day and Nigro 2000; Day et al. 2003). When foraging, and compared to Kittlitz's Murrelet (*Brachyramphus brevirostris*), Marbled Murrelets prefer clearer waters and avoid waters of high turbidity that limits visibility to <2 m (Day et al. 2003). Marbled Murrelets also forage to some degree on salmon smolt (*Oncorhynchus* spp.) in freshwater lakes during the summer (Piatt et al. 2007). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>On land, within the Tongass NF, Marbled Murrelets are tightly associated to coastal coniferous forest, and old-growth forest is especially important for nesting (Piatt et al. 2007). They primarily nest in mountain hemlock (*Tsuga mertensiana*) or western hemlock (*T. heterophylla*) (Piatt et al. 2007). Timber harvest, especially of old-growth forests, has been linked to population decreases of Marbled Murrelet across their range, and although timber harvest has resulted in historical decreases of old-growth coastal forest habitat in the Tongass NF, current legislation and land management practices have limited the amount of timber harvest and an estimated 57% of the Tongass NF is protected under the TLMP (Szaro et al. 2005; Piatt et al. 2007). Moreover, although much has already been lost and timber harvest continues to a lesser |

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| *Criteria* | *Rank* | *Rationale* |
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| | | degree, current evidence indicates that coniferous forests in the Tongass NF are growing (gains exceeding losses; Buma and Barrett 2015; Bennetsen et al. 2025). It should be noted, however, that Marbled Murrelets also nest on the ground (see below; Barbaree et al. 2014).<br><br>On the other hand, Marbled Murrelets mainly forage in saltwater habitats, and these habitats are experiencing rapid changes in terms of increasing temperatures (increasing magnitude and frequency of anomalous heating events) and acidification from atmospheric $CO_2$ uptake (Bellmore et al. 2025). These changes, along with loss of tidewater glaciers, result in changes in upwelling patterns, nutrient circulation, and oxygen concentration, which in turn may affect prey availability for Marbled Murrelets (Bennetsen et al. 2025). According to Tongass Bennetsen et al. (2025), the Marbled Murrelet is likely moderately vulnerable to climate change due to combined and cumulative effects from climate-related changes in the marine ecosystem (most likely the 1977 regime shift) and human activities (logging, gillnet bycatch, oil pollution; Piatt et al. 2007). |
| 8<br><br>Life history and demographics | A | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>The Marbled Murrelet is a small alcid seabird that typically nests on moss-covered boughs in the canopy or large-diameter trees within low elevation stands of structurally complex coastal old-growth forest (Hamer & Nelson 1995; DeGange 1996; Burger 2004; Nelson & Newman 2009). In the Tongass NF, however, Marbled Murrelets nest with similar frequency on ground nest sites such as rocky cliff faces, steep alpine scree, or rocky slopes near or above tree line as on platform branches of large old-growth trees (Barbaree et al. 2014). Moreover, on some treeless islands in southeast Alaska marbled murrelets lay eggs on bare talus slopes in mountainous areas (Piatt et al. 2007). Murrelets spend most of their lives at sea but may disperse inland up to 60 km to nest (Piatt et al. 2007). In addition, and different from other alcid species, Marbled Murrelets may visit their nesting habitats during most months of the year (Piatt et al. 2007), stressing their dependence on coastal old-growth forest.<br><br>Because they are solitary nesters with secretive breeding habits and use remote nest sites, information on the reproductive biology of Marbled Murrelets is scarce, especially in southeast Alaska (Piatt et al. 2007). Marbled Murrelets have a characteristic clutch of one egg (Sealy 1974; DeSanto and Nelson 1995), and upon losing their first clutch, some pairs can produce a replacement egg during the same season and may raise a chick successfully (McFarlane Tranquilla et al. 2003). Compared to other alcid species, Marbled Murrelet exhibit low reproductive success values (Piatt et al. |

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| *Criteria* | *Rank* | *Rationale* |
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| | | 2007). In Alaska, out of 11 nests for which the outcome was known, only 2 (18%) produced a fledglings (Piatt et al. 2007), suggesting a low reproductive success. Outside Alaska, 39% of the 23 nesting attempts for which the fate was known produced fledglings (Piatt et al. 2007).<br><br>Southern populations appear to be declining primarily because of diminishing old-growth nesting habitat and increased predation on eggs and chicks due to logging (Peery and Henry 2010, Peery et al 2004, Andrén 1994). Marbled murrelets also experience direct mortality as by-catch in nearshore drift gill nets (Carter et al. 1995) and reduced survival and productivity from declines in key forage fish species from ocean warming and acidification (Peery et al 2004). Similar pressures exist in Southeast Alaska, although old-growth forest in Southeast Alaska is still relatively abundant, and marbled murrelets in Alaska may have a lesser dependence on old-growth trees for nesting than birds in the Lower 48 (Barbaree et al. 2014). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☒ | ☐ |
| Restricted range | ☐ | ☒ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

Because of its unique association with old-growth forests, low reproductive output, and declining population trend, the Marbled Murrelet is a species of conservation concern at statewide, national, and international levels (BirdLife International 2024, Kirchhoff & Padula 2010). The marbled murrelet is currently listed in the Lower 48 states as a threatened species under the Endangered Species Act, IUCN rank is 'Endangered' and is ranked by NatureServe as 'Vulnerable' both globally and in Alaska (G3, S3). We used the following factors to determine whether there is substantial concern over their long-term persistence in the planning area:

- **Significant threats:** Historic threats on land include timber harvest of low-elevation old-growth forests, which are likely the preferred nesting habitats. Current threats are primarily in marine environments due to climate change impacts such as increasing water

temperatures, acidification, and changes in upwelling patterns, which affect prey availability. The species also faces mortality from gillnet bycatch and oil pollution.

- **Declining trends:** Population trends are conflicted across different studies. Some analyses show a significant historical decline in southeast Alaska populations between 1994 and 2001. Other, more recent re-analyses suggest populations have been stable in southeast Alaska and Glacier Bay National Park. The habitat trend is considered to be declining in quality or quantity due to past old-growth harvest, but current forest management practices mean that overall gains in forest volume are exceeding losses within the Forest.
- **Restricted ranges:** The species has a wide and contiguous distribution throughout southeast Alaska and along the Pacific coast of North America, from California to Alaska. Its range is extensive within and outside the Tongass National Forest.
- **Low population numbers or restricted ecological conditions:** While the overall population abundance in southeast Alaska is large enough that persistence is not threatened by demographic stochasticity alone, the species has life history characteristics that are a basis for concern. These include a low reproductive rate and generally low reproductive success, which means populations may not recover rapidly from disturbances.
- **Other factors:** The species' unique association with old-growth forests for nesting and its low reproductive output are key concerns. It is a species of conservation concern at state, national, and international levels, listed as threatened or endangered in other regions. Multiple potential stressors within the Forest may interact synergistically with marine and climate change stressors.

Given their low reproductive output, and multiple potential stressors in the Tongass NF that may interact synergistically with stressors in the ocean and climate change, we find that there is substantial concern for the long-term persistence of Marbled Murrelets in the plan area, and therefore, recommend the species as a potential Species of Conservation Concern.

# Conclusion

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| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# *Falcipennis canadensis islebi*

*Falcipennis (Canachites) canadensis islebi*
[Dickerman & Gustafson, 1996]

**Prince of Wales Spruce Grouse**

Global Rank: SNR
Alaska State Rank: SNR



photo: Milo Burchman

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Patchy OR gaps.<br><br>The Prince of Wales (POW) Spruce Grouse is a genetically confirmed endemic species restricted to temperate forests in some islands of the Alexander Archipelago in southeast Alaska (Dickerman and Gustafson 1996; Barry and Tallmon 2010). Individuals of POW Spruce Grouse have been sighted or collected on Prince of Wales, Dall, Grindall, Heceta, Tuxecan, Suemez, Hecta, Warren, Kosciusko, Zarembo, San Fernando and Mitkof islands, and the species probably occurs on other islands in the southern portion of the Alexander Archipelago (Dickerman and Gustafson 1996; Kissling 2010, and references therein; Fig. 1).<br><br>The habitat of the POW Spruce Grouse shares few similarities with that of other related species, and is the only Spruce Grouse subspecies to inhabit temperate forests with no history of fire disturbance (Russell 1999; Nelson 2010). They are habitat generalists and use a variety of habitats including old-growth and second-growth forests, mixed conifer (scrub) and muskegs (wetland bogs) (Russell 1999). However, they prefer high-volume old-growth forest and bogs (<30% tree cover) over homogeneous second-growth forest, make use of mixed-conifer forest (scrub; as available, not preferred) and avoid clearcuts (Russell 1999). Within unharvested old-growth forests, they also make use of roads, and avoid forest edges (Nelson 2010). During the breeding season, females make use of open forest stands with relatively low tree density, medium canopy cover and a dense shrub layer (Rusell 1999; Wiliamson et al. 2008). Brood rearing female |

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| *Criteria* | *Rank* | *Rationale* |
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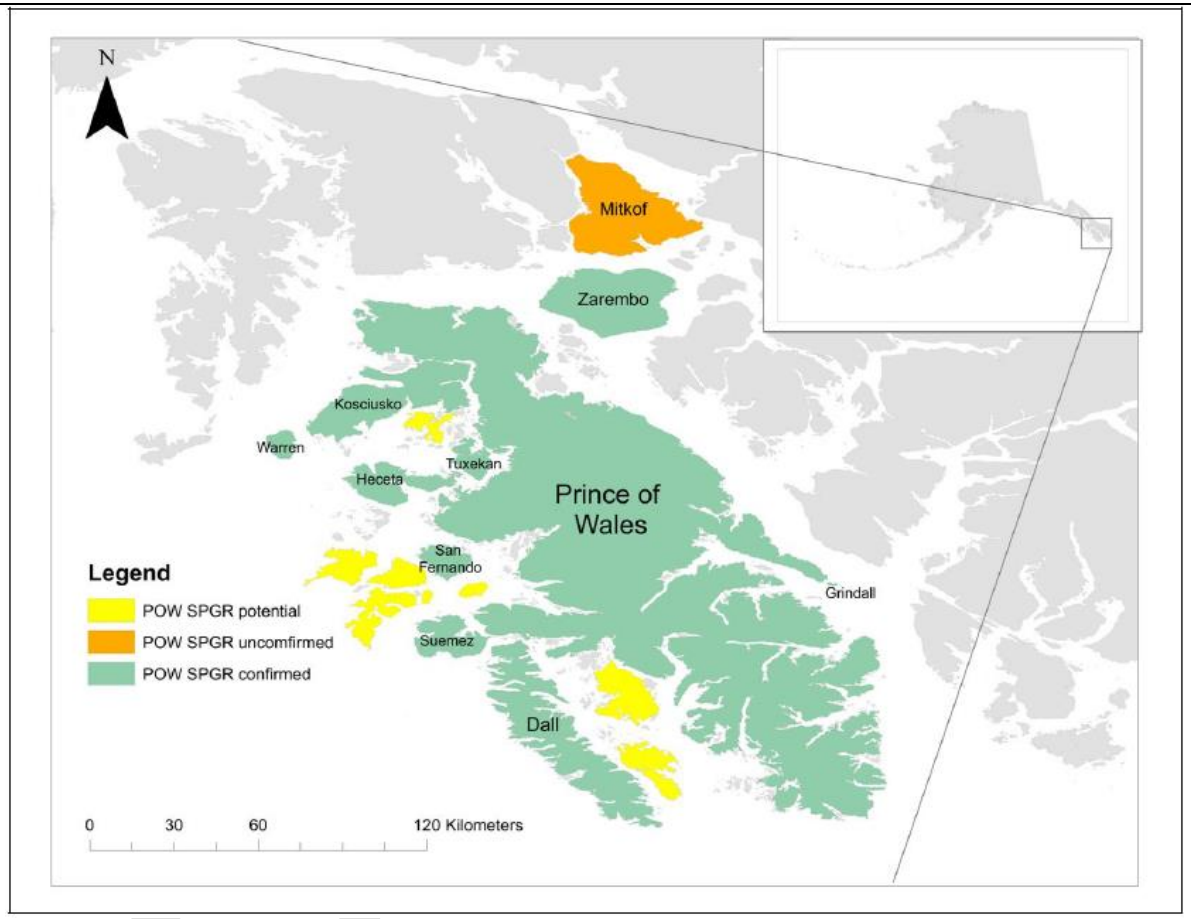



**Figure 1**: Distribution of Prince of Wales Spruce Grouse in southeast Alaska based on museum specimens and documented sightings. From Kissling 2010.

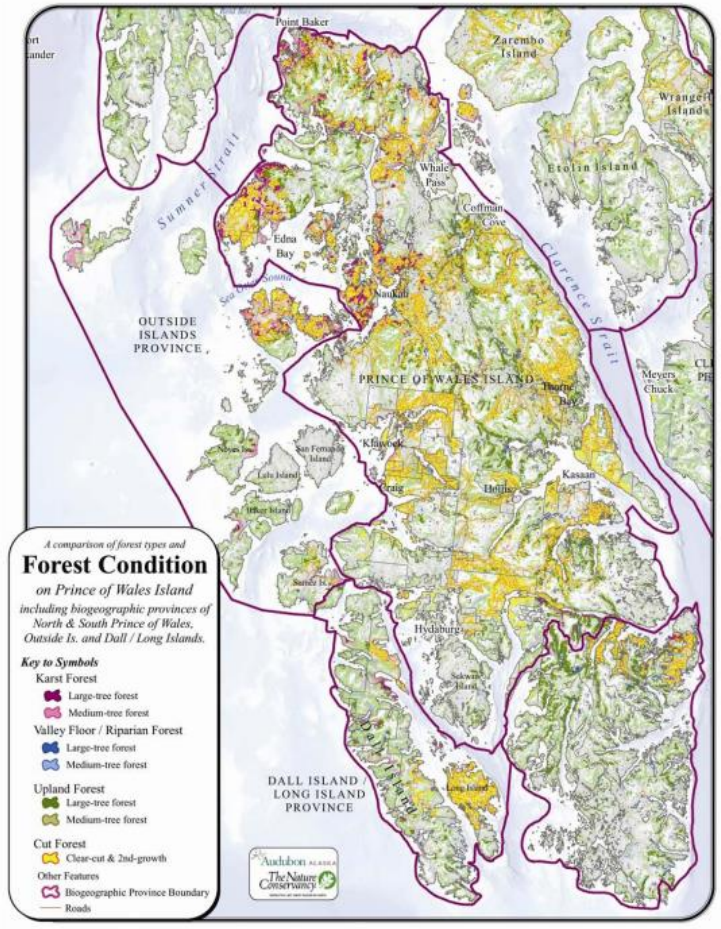
POW Spruce Grouse use scrub forest habitat more often than other types of habitats, and Russell (1999) attributed this to the higher abundance of invertebrates in this habitat type. Males, on the other hand, make use of a matrix of open and closed forests during the breeding season, and use stands with scarce mid-story vegetation, but relatively high tree

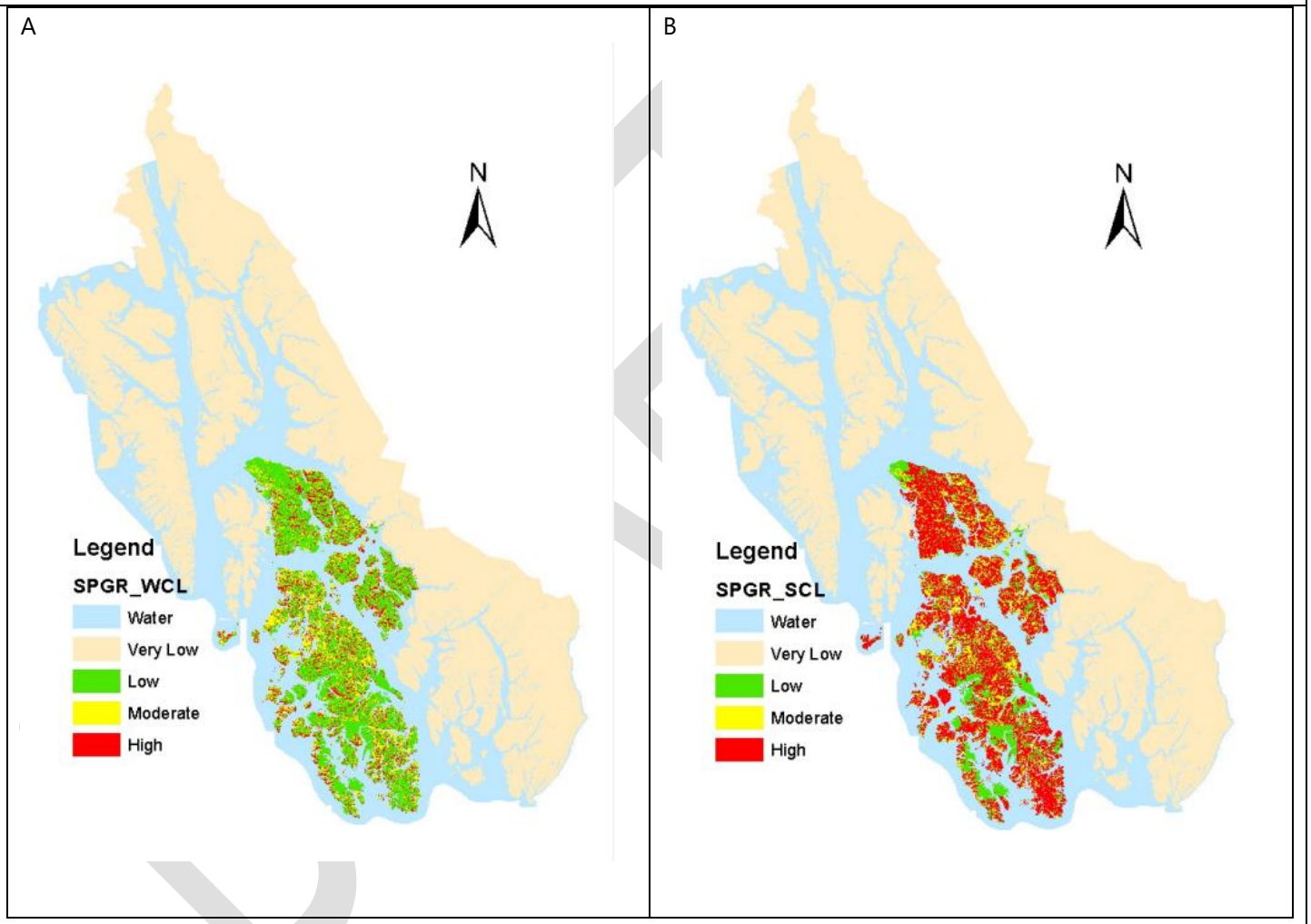
| *Criteria* | *Rank* | *Rationale* |
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| | | density and canopy cover interrupted by forest openings, with the latter associated to their mating displays (Russell 19999; Williamson et al. 2008). Both males and females appear to favor open canopy scrub forest during the breeding season (Russell 1999). |
| 2<br><br>Distribution in surrounding geographic area | A | A = Only within the boundaries of the Tongass National Forest (local or regional endemics).<br><br>Global Rank SNR, Alaska State Rank SNR. Considered a Species of Greatest Conservation Need and a Stewardship Species by the Alaska Department of Fish and Game (ADF&G 2015).<br><br>The Prince of Wales (POW) Spruce Grouse is a genetically confirmed endemic species restricted to temperate forests in some islands of the Alexander Archipelago in southeast Alaska (Dickerman and Gustafson 1996; Barry and Tallmon 2010). The POW Spruce Grouse is absent in islands of the Alexander Archipelago to the east and in the adjacent mainland, and the Franklin's Grouse, the closest other spruce grouse, occurs in drier habitats east of the coastal range in British Columbia (Russell 1999). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>Spruce Grouse in general are considered poor long-distance flyers, and outside Alaska, they can be found on islands ~1 mile from the mainland (Dickerman and Gustafson 1996). In Prince of Wales Island, they prefer to walk over flying between habitats, clearcut habitat may act as a dispersal barrier, and connectivity of scrub and high-volume old-growth forest within the matrix of managed forest stands may be an important factor minimizing negative effects to POW Spruce Grouse populations in southeast Alaska (Russell 1999). Moreover, genetic differentiation between individuals from Prince of Wales and Zarembo islands indicate that any influence of dispersal to gene flow is extremely low (Barry and Tallmon 2010).<br><br>In terms of home range, POW Spruce Grouse on Prince of Wales Island had a mean home range size of 211 ha, and there was no difference between sexes (Russell 1999). |

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| *Criteria* | *Rank* | *Rationale* |
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| 4<br><br>Abundance on Tongass NF | A | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>POW Spruce Grouse are regarded as cryptic and considered rare on Prince of Wales Island (Russell 1999; Armstrong 2008, cited in Kissling 2010; Nelson 2010). Moreover, the POW Spruce Grouse is rarely detected on region-wide surveys, such as the Noth American Breeding Bird Survey on Zarembo and Prince of Wales islands (Kissling 2010). The population of POW Spruce Grouse has been estimated at less than 8,300 individuals in southeast Alaska, but no information on how this estimate was reached is provided (ADF&G 2015). On Prince of Wales Island, density is low, estimated at 3 birds/100 ha during the breeding season, but this estimate is likely on the lower end of the real density because POW Spruce Grouse were often difficult to detect (Russell 1999). Aside from this, there is no additional information on the abundance of POW Spruce Grouse on the Tongass. |
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>The population trend of the Prince of Wales Spruce Grouse is unknown, but it is an island endemic considered to have a small population and vulnerable to extinction (ADF&G 2015). This is supported by the low genetic variation observed on Prince of Wales Spruce Grouse compared to mainland populations, which reflects small effective population sizes and could reduce their capacity to respond to a changing environment (Barry and Tallmon 2010). |
| 6<br><br>Habitat trend on Tongass NF | A/B | A = Decline in habitat quality or quantity./ B = Stable amounts of suitable or potential habitat, relatively unchanged habitat quality.<br><br>Habitat degradation and small population sizes and the principal threats for Spruce Grouse populations throughout their range (Storch 2007). Prince of Wales Island, the largest island of the Alexander Archipelago, is considered the core of the range of the POW Spruce Grouse (Russell 1999). The land ownership by category within the assumed range of the POW Spruce Grouse was estimated using the Alaska General Land status map of 2008 by the U.S. Fish and Wildlife Service (USFWS) and consists of approximately 75% federal lands (8,075 $km^2$; all within the Tongass), 16% Alaska Native Corporation lands (1,767 $km^2$), 5% private lands (479 $km^2$), 4% state lands (411 $km^2$) and <1% native and state combined lands (27 $km^2$) (Kissling 2010). Although only 4% of forested acres on the Tongass have been logged in the past (Engelmann 2024), most of the intense logging (up to 3,000 ha/year) has occurred since the early 1970s on Prince of Wales Islands (Russell 1999), especially on the northern end (Smith 2016). Between 1954 and 2005 approximately 20% of the total land area and 25% of the productive old-growth forest on Prince of Wales and surrounding islands was logged (Brinkman et al. 2009). |

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| *Criteria* | *Rank* | *Rationale* |
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| | |  <br>**Figure 2**: Forest condition on Prince of Wales Island and surrounding islands. From Carstensen et al. (2007). |

| *Criteria* | *Rank* | *Rationale* |
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| | |  <br>**Figure 3**: Map of the known distribution and potential habitat of the Prince of Wales Spruce Grouse (*Falcipennis canadensis islebi*) in southeast Alaska during winter (A) and during summer (B). Obtained from Suring (2014).<br><br>Similarly, logging practices in surrounding islands where POW Spruce Grouse are known or expected to occur has taken place, with productive old-growth forest logged by 20% on the Dall Islands complex, 13% on the Outside Islands |

| *Criteria* | *Rank* | *Rationale* |
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| | | (Kosciusko, Warren, Heceta, Tuxekan, San Fernando and Suemez islands) and 16% on Etolin and Zarembo islands (Albert and Schoen 2007).<br><br>Clearcutting was the main method used for logging in southeast Alaska, and its effect on forest structure can be seen for over 30 years when second-growth forest develops and continues for more than a century following canopy closure with decreased horizontal structural complexity (Smith 2016). This has led to a complex mosaic of harvested and unharvested lands with a network of roads and populated areas that have further fragmented old-growth forest on Prince of Wales and surrounding islands (Carstensen et al. 2007; Fig. 2).<br><br>Although there is no information on the effects of logging on the population of POW Spruce Grouse, other than they avoid the use of clearcut areas (Russell 1999), it is worth noting that timber harvest through large-scale clearcutting was thought to extirpate local populations of Spruce Grouse in Minnesota (Pietz and Tester 1982), and clearcuts in central British Columbia do not support populations of Spruce Grouse >25 years after harvest (Harrison 2001). Also, habitat fragmentation due to logging has been negatively correlated elsewhere with Spruce Grouse survival and their occupancy of residual forest patches (Huggard 2003), so the negative effects of managed edges on habitat selection in southeast Alaska suggests that POW Spruce Grouse also prefer patches of continuous habitat (Huggard 2003; Nelson 2010; Suring 2014).<br><br>After the adoption of the 1997 Forest Plan on the Tongass, very low levels of harvest have occurred on the National Forest System (NFS) lands from the early 2000s through the present (Engelmann 2024; Turner and Mallott 2025). This has to do in part with the adoption of the Old-Growth Conservation Strategy, which aims to protect old-growth forests by balancing ecological, economic and cultural interests and reducing large-scale old-growth logging while transitioning to young-growth harvesting (Berkley et al. 2023). However, recent policy changes may open additional NFS lands to future logging projects, including on the Tongass. Also, there is an ongoing timber industry legal challenge that seeks to revive old-growth logging on the Tongass, which has been met by legal opposition from the government and conservation groups (Center for Biological Diversity 2025). In addition, on private lands, logging can occur as these are not covered by the Old-Growth Conservation Strategy (Smith 2016).<br><br>Taking into account the confirmed distribution of the POW Spruce Grouse, as well as its seasonal habitat quality and various habitat variables, Suring (2014) created a distribution model using Bayesian networks which indicates that the |

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| *Criteria* | *Rank* | *Rationale* |
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| | | potential distribution seasonally patchy and especially limited during winter in the islands where the species is found in southeast Alaska (Fig. 3A-B).<br><br>Taken all together, a decline in habitat quality and quantity of the POW Spruce Grouse has occurred between ca. 1970-2000. Although clearcut logging has been greatly reduced, legal challenges and changes in policy may open new areas to logging, in addition to areas being logged on private lands. Therefore, although we expect that the amounts of suitable or potential habitat have been stable during the past 20 years, the uncertainty around the possibility of additional logging in Prince of Wales Island should be taken into consideration. |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>One of the main threats that Spruce Grouses are facing throughout their range is habitat degradation (Storch 2007). As discussed above, logging (and associated road construction) has been the main factor causing substantial modifications of habitat in the past, and although it has been greatly reduced in recent years, there is uncertainty on how logging may affect the habitat of the POW Spruce Grouse in the future.<br><br>Moreover, POW Spruce Grouse is expected to be potentially negatively affected by climate change through reduced snow persistence and subnivium refugia (Bennetsen et al. 2025). For example, the Ruffed Grouse (*Bonasa umbellus*) in central Wisconsin was found to use snow burrows to roost when the snow was deep and powdery to protect themselves from the stress related to harsh temperatures and from predation, but the snow conditions necessary for roosting and the occurrence of snow roosting behavior were relatively rare and declined over the study period (Shipley 2021). Moreover, it was found that levels of fecal corticosterone metabolites (indicative of stress) increased in Ruffed Grouse with shallower snow depths, less dense snow and colder ambient temperatures (Shipley 2021). Another climate change-mediated stressor that may negatively affect POW Spruce Grouse is the expectation of more severe storms (increased frequency and intensity) in southeast Alaska, especially in winter, as these may affect the survival of resident species that do not migrate (Bennetsen et al. 2025, and references therein). |
| 8<br><br>Life history | A | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern. |

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| *Criteria* | *Rank* | *Rationale* |
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| and demographics | | On Prince of Wales Island, annual survival of non-breeding birds was 0.72 while for breeding birds it was 0.08 between 2007-2009, and logging did not appear to significantly affect survival of individuals (Nelson 2010). Road-related mortality (hunter harvest and vehicle strikes) was the largest known source of deaths for POW Spruce Grouse (42%), followed by predation (25%) (Nelson 2010). The POW Spruce Grouse has known and probable predators that include the Queen Charlotte Goshawk (*Accipiter gentilis laingi*), American marten (*Martes americana*), ermine (*Mustela erminea*), Alexander Archipelago wolf (*Canis lupus ligoni*), Barred Owl (*Strix varia*), Bald Eagle (*Haliaeetus leucocephalus*) (Kissling 2010), some of which are being considered as potential Species of Conservation Concern on the Tongass. Moreover, Spruce Grouse in general tend to have a small clutch size compared to other tetraonids, and the POW Spruce Grouse follows this with an average clutch size of 5.6 eggs (Johnsgard 1983 cited by Russell 1999; Boag and Schroeder 1992, cited in Kissling 2010; Russell 1999), but there is no information on reproductive success on the Tongass.<br><br>The Prince of Wales Spruce Grouse was proposed as a distinct subspecies endemic to some islands of the Alexander Archipelago based on morphological information (Dickerman and Gustafson 1996). This has been confirmed genetically, and birds from the Alexander Archipelago shared unique haplotypes and pairwise genetic differentiation values from mitochondrial and nuclear markers showed the highest levels of differentiation between island and mainland populations (Barry and Tallmon 2010). Thus, the potentially low levels of dispersal into insular populations from the mainland implies that there may be little opportunity for genetic rescue that many mainland grouse populations rely on to persist (Storch 2007; Barry and Tallmon 2010). Moreover, it should be noted that spruce grouse populations at the edge of their range may be particularly vulnerable to extirpation (Bouta and Chambers 1990, cited in Suring 2014). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

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## Conclusion Rationale

The POW Spruce Grouse is recommended to be considered as a Species of Conservation Concern. There is substantial concern for the persistence of the subspecies within the plan area based on the following:

- **Significant threats**- The POW Spruce Grouse has been exposed to a disproportionate amount of habitat loss due to logging on Prince of Wales Island in the past, which is considered the core of its range. Although logging has been greatly reduced since the 2000s, changes in policy and legal challenges make uncertain whether this will continue to be the case in the near future. Moreover, the POW Spruce Grouse is susceptible to mortality from road strikes and hunting, especially during the breeding season, and this is exacerbated by the extensive road network that has been built on Prince of Wales Island, and surrounding islands, as part of logging operations. In addition, climate change may negatively affect the species via reduced snowpack that serves as winter refuge and increased storm severity which could result in the extirpation of small populations.
- **Declining trends**- There is no information on the population trends of the POW Spruce Grouse, but their habitat has been reduced and fragmented in their range, especially on Prince of Wales Island, due to logging and road building in the past. Although logging and road building have been greatly reduced, and habitat trends are expected to have been stable since the 2000s, it is possible for new logging activities to occur throughout their range, especially considering that there is existing infrastructure to support this activity.
- **Restricted ranges**- The POW Spruce Grouse is a narrow endemic restricted to at least 11 islands of the Alexander Archipelago, so it is considered a narrow endemic. They inhabit separate islands around Prince of Wales Island, and genetic differentiation between Prince of Wales and Zarembo populations indicate that there is little connectivity between island populations so they appear to be disjunct. Moreover, the range of this subspecies is considered to be peripheral to the range of the parent species (*Falcipennis canadensis*), and is the only subspecies that inhabits temperate rain forests.
- **Low population numbers or restricted ecological conditions-** Although there are no recent direct estimates of the population of POW Spruce Grouse, according to ADF&G the population estimate is very low (<8,300 individuals) and other studies suggest that they are rare in terms of abundance on Prince of Wales Island (which is the core of their range). Moreover, their habitat has been fragmented by past logging activities, especially potential winter habitat. Therefore, there is reason to believe that they al vulnerable to extirpation by stochastic events and/or land use changes.
- **Other factors**- Taxonomically-speaking, the POW Spruce Grouse is a distinct subspecies that is highly genetically divergent from the mainland populations of Spruce Grouse and represents a distinct evolutionary lineage. The combined factors including low genetic diversity compared to mainland populations, presumed small population size, high mortality and presumed low reproductive rates, reduced and fragmented potential habitat (especially winter habitat) and the possibility climate change-mediated negative effects and future logging may act synergistically in detriment to the long-term persistence of the POW Spruce Grouse.

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## Conclusion

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| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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# *Glaucomys sabrinus griseifrons*

*Glaucomys sabrinus griseifrons* [Howell, 1934]

**Prince of Wales flying squirrel**

Global Rank: **G5T4**
Alaska State Rank: **S2**



photo: Jeff Nichols

## Species Assessment

| Criteria | Rank | Rationale |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Patchy or gaps. Habitat exists primarily as patches, some of which are small or isolated to the degree that species interactions are limited by movements between patches. Local sub-populations in most of the species' range interact as a metapopulation or patchy population, but some patches are so disjunct that sub-populations in those patches are essentially isolated from other populations.<br><br>Prince of Wales (POW) flying squirrel is found on Prince of Wales and adjacent westerly islands, including the Barrier Islands (off southwest Prince of Wales), Dall Island, El Capitan Island, Heceta Island, Kosciusko Island, North Island, Orr Island, an unnamed island south of Garden Island, Prince of Wales Island, Suemez Island, Mitkof, and Tuxekan Island (MacDonald and Cook 1996, MacDonald and Cook 2007, USDI FWS 2012). The size of this area is ~14,000 square kilometers (5,400 square miles). This taxon was established as genetically distinct through analyses of nuclear and mitochondrial DNA (Demboski et al. 1998, Cook et al. 2001, Bidlack and Cook 2001, 2002 in Suring 2014) accepted by the US Fish and Wildlife Service in their review of the taxon (USDI FWS 2012). Prince of Wales flying squirrel is believed to have colonized the Alexander Archipelago following the last glacial maximum after the Holocene (Bidlack and Cook 2002, pages 253-254). |
| 2<br><br>Distribution | A | A = Only within the boundaries of the Tongass NF (local or regional endemic).<br><br>Global Rank G5T4, Alaska State Rank S2 |

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| Criteria | Rank | Rationale |
|---|---|---|
| in surrounding geographic area | | The Prince of Wales flying squirrel is endemic to the southern part of the Alexander Archipelago in Southeast Alaska (MacDonald and Cook 1996, MacDonald and Cook 2007, USDI FWS 2012, NatureServe 2023) and is restricted to Prince of Wales and adjacent westerly islands, including the Barrier Islands (off southwest Prince of Wales), Dall Island, El Capitan Island, Heceta Island, Kosciusko Island, North Island, Orr Island, an unnamed island south of Garden Island, Prince of Wales Island, Suemez Island, Mitkof, and Tuxekan Island (MacDonald and Cook 1996, MacDonald and Cook 2007, USDI FWS 2012). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>The persistence of POW squirrels in a managed landscape relies heavily on their ability to disperse to suitable habitats (USDI FWS 2012). Studies suggest that POW flying squirrels are capable of dispersing through suitable habitat. Pyare et al. (2010, page 891) used radio marking to show successful movement of adults and juveniles on Prince of Wales Island between den sites and within core den areas, which could be as large as ~14 hectares (36 acres). It is important to note that the area of this study was comprised of only 1% clearcut and 49% old growth forest, so dispersal across significant gaps in habitat was not recorded by these telemetry studies.<br><br>A study of perceptual range and fine-scale movement data, energetics measurements related to the costs of running versus gliding, telemetry data, and dispersal modeling concluded that northern flying squirrels in southeast Alaska actively avoid young-growth forests (Flaherty et al. 2008, Flaherty et al. 2010 in Suring 2014). Flaherty et al. conclude that it is unlikely squirrels will attempt to cross clearcuts because clearcut sizes are greater than the squirrels' perceptual range. With an average gliding range around 37 meters (USDA 2016, page 3-284), crossing habitat gaps is accomplished mostly over ground, which is associated with increased energetic costs, higher risks of predation, and reduced foraging efficiency (Flaherty et al. 2008).<br><br>According to the Fish and Wildlife Service's 90-Day Finding on a Petition to List the Prince of Wales Flying Squirrel as Threatened or Endangered, however, conclusions of dispersal limitations are not fully supported by findings that POW flying squirrels have moved successfully across managed landscapes (Bidlack and Cook 2002, pages 250-252). The US Fish and Wildlife Service concluded that "while there is presumably a fragmentation threshold in which flying squirrel dispersal would cease (or be drastically reduced), there is no information available that quantifies this threshold, and there is no evidence that this threshold has been reached on the highly managed forested landscapes within the POW |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | Complex" (USDI FWS 2012). Genetic testing by Bidlack and Cook (2002, pages 250-252) showed contemporary gene flow across the POW complex, indicating that dispersal is occurring through suitable habitat. |
| 4<br><br>Abundance on Tongass NF | C | C = Common. Current abundance is large enough that species persistence is not threatened by demographic stochasticity in combination with environmental variation.<br><br>Mark-recapture studies of the Prince of Wales flying squirrel report spring population densities averaging 1.80 squirrels per hectare in upland old-growth forest, and 1.15 squirrels per hectare in unproductive forest (Smith and Nichols 2003), with spring population densities reaching a high of 2.8 squirrels per hectare in upland old forest and 1.9 squirrels per hectare in unproductive forest (Smith and Nichols 2003). Autumn population density of northern flying squirrels in southeast Alaska was 3.2 squirrels per hectare in upland old forest and 1.8 squirrels per hectare in unproductive forest (Smith and Nichols 2004). There are no density estimates of the POW flying squirrel in managed forests, such as young or second growth stands (USDI FWS 2012).<br><br>Overall, the density of POW flying squirrels is one of the highest recorded densities of flying squirrel in North America (Smith 2007, page 863), with a total population estimated at greater than 10,000 individuals (ACCS 2018, NatureServe 2023). Prince of Wales flying squirrels are not likely to produce more than a single litter of about 3 young per summer, and with annual survival generally at less than 40% (Villa et al. 1999), indicating that their populations may be more vulnerable to stochastic events than other species (Suring 2014). However, the range of this taxon on the Tongass National Forest is broad, reducing the potential for stochastic events that would impact most or all populations within its range. |
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>The population trend of Prince of Wales flying squirrels is unknown (USDI FWS 2012, NatureServe 2023). However, removal of 39% of old-growth forests on Prince of Wales Island and 27% of old-growth forests within the Prince of Wales complex (USDI FWS 2012), one of the species' principal habitats, suggests that populations may have declined in some areas. Because logging continues within its range, it is suspected that a declining trend continues, although it may have diminished in recent years (Suring 1992, Smith et al. 2011). Existing reserves established by the 2016 Tongass NF |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | Plan are cited as having played a role in population stabilization, preserving suitable habitat and enabling dispersal across landscapes (USDI FWS 2012).<br><br>A panel convened for the 2008 Forest Plan identified this species as having the greatest viability concern among the endemic mammals of the Tongass National Forest. The panel noted the presence of the reserve system and the level of old growth timber harvest in the Forest Plan as important factors in maintaining viable, well-distributed populations (USDA 2016 p. 3-295). |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Unlike the North American flying squirrel, the POW flying squirrel is not thought to be a strict old-growth obligate, although it maintains a close association with old-growth forest structure and processes because of its specific habitat requirements for efficient movement (USDA FS 2016, page 3-249). Though productive old-growth forest is a primary habitat, relatively similar densities were recorded in peatland-mixed-conifer forests (Smith and Nichols 2003, pages 1049 and 1052). No density measurements, however, have been made in more heavily managed forests, such as younger or second growth stands. The POW flying squirrel differs further from its mainland counterparts in that its population density seems to be less tied to complex, multi-factorial habitat conditions, and more correlated with large tree density and *Vaccinium* shrub cover (Smith et al. 2004, p. 667; Smith et al. 2005, p. 689).<br><br>Much of the variation in population density of northern flying squirrels in the temperate rainforest of southeast Alaska has been associated with the volume of decayed down wood on the forest floor and the density of large-diameter (greater than 74 cm) trees (Smith et al. 2004 in Suring 2014). The flying squirrel plays an important role in the dynamics of coniferous forest ecosystems (Carey 2000) because it, along with other animals, disperses ectomycorrhizal fungi (Maser and Maser 1988), a food source that is lacking in young-growth forest (Flaherty et al. 2008 in USDA FS 2016). Areas not used as habitat by northern flying squirrels were characterized by high densities of medium-diameter conifers (young-growth areas of stem exclusion and suppression mortality) (Carey et al. 1999 in Suring 2014). Microhabitat use by northern flying squirrels in southeast Alaska was highly correlated with understory cover of *Vaccinium* species and with high densities of large-diameter snags (Smith et al. 2004 in Suring 2014). The largest fragments of old forest were selected by northern flying squirrels at both local and broad scales in southeast Alaska (Shanley et al. 2013). Shanley et al. (2013) reported that patches of old forest habitat greater than 73 hectares were associated with occurrences of northern flying squirrels. |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | An analysis of habitat quality for northern flying squirrel on the Tongass NF estimated variable amounts of moderate to high habitat quality across the range of POW flying squirrel (Suring 2014). These estimates are as follows, listed from low to high proportions of good quality habitat: Dall Island (44%), South Prince of Wales Island (48%), Etolin Island and Vicinity (51%), North-Central Prince of Wales Island (57%), and Southern Outer Islands (60%). This represents a decline over time in good quality habitat due to the timber harvest of old growth forests, including 39% of Prince of Wales Island (USDI FWS 2012) and other islands that have been substantially clear-cut (Smith and Nichols 2004). The resulting landscape is a mosaic of stands varying in age, muskeg, and an increase in roads (USDI FWS 2012). Approximately 50% of lands within the Prince of Wales Complex are within either wilderness or old-growth reserves under the current Forest Plan and Old Growth Conservation Strategy (USFWS 2012).<br><br>The authors of the current Tongass National Forest Plan named the POW flying squirrel as having the greatest viability concern among the endemic mammals of the Tongass National Forest. This concern was largely due to concern that many reserves on Prince of Wales Island may be too small or spaced too far apart to support populations of Prince of Wales flying squirrels over the long term or maintain functional connectivity to support a back-and-forth exchange between flying squirrel populations (Pyare and Smith 2005, Smith et al. 2011 in USDA FS 2016). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>The current Tongass Land and Resource Management Plan (USDA FS 2016b, pages 2-4) designated a series of small, medium and large reserves of old growth and other forested habitat types, a partial goal of which was to sustain POW flying squirrel populations (Julin 1997, page 19). These reserves were noted in the plan as being an important factor in maintaining viable, well-distributed populations through habitat connectivity and habitat protection, but the effectiveness of them has been questioned, and the current reserve system may be insufficient according to some research (Smith and Flaherty 2023, page 413 in USDA FS 2016a, page 3-250, Trapp et al. 2019). Though the full impact of these reserves is unknown, the presence of Forest Reserves was cited as the USFWS as one of the reasons not to list the POW flying squirrel (USDI FWS 2012).<br><br>Smith and Person (2007) ran population viability models based on isolating the *small* reserves, and assuming no immigration or emigration from or to reserves. This model predicted populations would be extirpated in roughly 25 years. But this particular model is not reflective of the true situation on Prince of Wales Island, and surrounding islands, |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | which include reserves of varying sizes, as well as recorded instances of dispersal. The true goal of these small reserves is to provide connectivity to larger areas of suitable habitat (Smith et. al. 2011, page 412) but efforts to empirically record the effectiveness of these reserves have been unsuccessful (Smith et. al. 2011, page 413). Recent modeling suggests that the distances between reserves, coupled with the configuration of timber harvest on lands outside of reserves or wilderness, are likely to lead to reductions in dispersal capability and ultimately, occupancy (Trapp et al. 2019). Squirrels prefer to establish dens in forests of higher volume and with lower levels of fragmentation, though the increased amount of forest edge associated with logging does not seem to affect habitat use by squirrels (Pyare et al. 2010). This suggests that habitat fragmentation remains a significant threat to the persistence of this species.<br><br>Invasive species have the potential to predate or compete with Prince of Wales flying squirrels. To date there are no red squirrels on Prince of Wales Island. Introduction of red squirrels could create competition for food sources, and care should be given to prevent such an introduction. Racoons were introduced to Prince of Wales Island in 1941 (Paul 2009, page 110), but the high density of squirrels on the island suggests zero to minimal adverse effects to the population. Marten were introduced to the island in 1934 and are now well established. Latest studies estimate that squirrels make up between five and nine percent of the martens' overall diet. The marten were initially introduced for trapping (Paul 2009, pages 104–105), and trapping continues to this day. If trapping were to stop or decrease, it stands to reason that more squirrels would be predated. Barred owls pose a relatively new threat to squirrels (Kissling and Lewis 2009, page 80). Though squirrels are likely a source of prey, there is currently no information available on the diet of local barred owls.<br><br>It is unclear how climate change will affect this subspecies. While models predict that the amount of habitat will increase by the end of this century (Murray et al. 2017), climate change could negatively impact the availability of truffles if drought years become more common (K. Mohatt, USFS, personal communication in ACCS 2018).Climate change may increase the risk of wildfire within Prince of Wales flying squirrel habitat (Haufler et al. 2010, page18). Historically, wildfires have been uncommon in southeast Alaska (Haufler et al. 2010, page 18). Given the restricted range of Prince of Wales flying squirrels, a stochastic event like a single widespread fire in an otherwise historically fire-free landscape could have large consequences to POW flying squirrel populations and habitat. It is unknown how other expected changes, such as warmer temperatures, decreased snowfall, and rising sea levels may affect squirrels or their habitat.<br><br>Threats general to endemic mammal taxa such as POW flying squirrel include reduced genetic diversity, limited ability to disperse, and highly divergent or relatively restricted lineages (Suring 2014). |

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| Criteria | Rank | Rationale |
|---|---|---|
| 8<br><br>Life history and demographics | C | C = High reproductive rate and not especially susceptible to disease, predation, or competition; OR species has life history characteristics that suggest populations will have a high ability to recover from disturbance events and no other demographic risk factors are known.<br><br>The Prince of Wales flying squirrel produces one litter per year of one to six young (with an average of two to four). Flying squirrels are a relatively K-selected rodent, with delayed age at first reproduction, seasonal breeder (one litter/year), relatively small litter, and large maternal investment into each offspring (Wells-Gosling and Heaney 1984, Smith 2007). A study on Prince of Wales Island reported a maximum lifespan of 30 months, during which time reproduction had already occurred (Smith and Nichols 2003).<br><br>Squirrels in the Prince of Wales complex subsist on a diet of conifer seeds, lichens, and both epigeous and hypogeous fungi (truffles). This diet is more general compared with that of other subspecies of northern flying squirrels, which specialize in truffles (Flaherty et al. 2010, page 85, ACCS 2018). This varied diet and ability to shift diet with availability allows the Prince of Wales flying squirrel to occupy a wider variety of habitats than other subspecies of northern flying squirrels, and provides resilience to changes in food sources and abundances (ACCS 2018, USDI FWS 2012). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☐ | ☒ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

- **Significant threats**: The range of POW flying squirrel intersects with portions of the Tongass NF where substantial logging of old-growth forests occurred in the 20th century. A panel convened for the 2008 Forest Plan identified this species as having the greatest viability concern among the endemic mammals of the Tongass National Forest. As documented by Suring (2014), habitat quality has been reduced,

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particularly on Dall Island, Prince of Wales Island, and Etolin Island. Old Growth Reserves established under the current Tongass Forest Plan were established in part to maintain viable, well-distributed populations of POW flying squirrel through habitat connectivity and habitat protection, but may be insufficient according to some research. Recent modeling suggests that the distances between reserves, coupled with the configuration of timber harvest on lands that are outside of reserves or wilderness, are likely to lead to reductions in dispersal capability and ultimately, occupancy. While habitat fragmentation remains a threat, there is no evidence that invasive predators and competitors are significantly impacting squirrel population, but invasives could become a problem in the future, particularly the recently introduced barred owl.

- **Declining populations or habitat trends**: The population trend of Prince of Wales flying squirrels is unknown. However, removal of old-growth forests, one of the species' principal habitats, suggests that populations could have declined areas such as Prince of Wales Island, where 39% of old-growth forest has been harvested. Because logging continues within range outside of Old Growth Reserves and wilderness it is suspected that declining trend continues, albeit diminishing. An evaluation of taxon status by the USFWS in 2012 noted the presence of the Tongass NF reserve system and persistence of old growth forests within them as important factors in maintaining viable, well-distributed populations.
- **Restricted range**: This taxon is endemic to the southern part of the Alexander Archipelago in Southeast Alaska.
- **Low populations or restricted ecological conditions**: Prince of Wales Flying Squirrels are relatively common within their small range, with mark-recapture studies informing population estimates at over 10,000 individuals. While not considered a strict old-growth obligate, POW flying squirrel maintains a close association with old-growth forest structure because of its specific habitat affinities (decayed down wood, *Vaccinium* cover, density of large diameter trees). Suitable ecological conditions have been maintained within old-growth reserves in the taxon range.

# Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# *Martes caurina*

*Martes caurina* [Merriam, 1890]

**Pacific marten**

Global Rank: G4G5
Alaska State Rank: SNR

photo: Alaska Department of Fish and Game



## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce and isolated.<br><br>On Tongass National Forest, Pacific martens (*Martes caurina* Merriam 1890, Dawson and Cook 2012, Colella et al. 2018a) are known to occur only on Admiralty and Kuiu Islands (Colella et al. 2018b, 2021). Populations of American martens (*Martes americana*) occur on Baranoff, Chichagof, Dall, Prince of Wales and Suemez Islands, although Baranoff, Chichagof, and Prince of Wales Islands received translocations – at his time, it is unknown if naturally-occurring populations of *M. caurina* existed at these locations prior to translocations of *M. americana* (Colella et al. 2018b). Hybrid populations of Pacific marten and American marten occur on Kuiu and Kupreanof Islands (Colella et al. 2018b). |
| 2<br><br>Distribution in surrounding geographic area | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G4G5, Alaska State Rank SNR<br>British Columbia Province Rank S5<br><br>In addition to Pacific marten populations on islands of the Alexander Archipelago, Pacific martens occur on Graham and Moresby Islands in British Columbia's Haida Gwaii (formerly Queen Charlotte Islands) Archipelago and Vancouver Island and along the Pacific Northwest coast of North American with disjunct populations found southward into California and eastward into the southern Rocky Mountains (Hoberg et al. 2012, Dawson et al. 2017, Colella et al. 2018b, 2021) . |

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| *Criteria* | *Rank* | *Rationale* |
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| 3<br><br>Dispersal capability | A | A = Very limited dispersal ability.<br><br>The Kuiu Island marten population, including both Pacific marten and American marten, is somewhat isolated from other marten populations (Alaska Department of Fish and Game 2016) as is the Pacific marten population of Admiralty Island because martens generally do not cross water barriers (Buskirk and Ruggiero 1994). |
| 4<br><br>Abundance on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>There is limited information regarding Pacific marten abundance specific to the Tongass National Forest. Marten densities vary throughout their range in southeast Alaska depending on habitat conditions, prey densities, and trapping pressure (Schoen et al. 2007). Flynn et al. (2004) estimated marten densities at 8 sites throughout southeast Alaska between 2001 and 2003. Kuiu Island (2001 and 2002) had the lowest capture rates. Two females and 1 male were captured (0.7 and 0.4 captures per 100 trap nights, respectively) in 2001, 1 female and 1 male were captured (both 0.3 captures per 100 trap nights) in 2002. Estimated densities were low: 0.6 (0.20 var) females and 0.2 (0.06 var) males per 1000 hectares in 2001 and 0.3 females (0.09 var) and 0.2 (0.06 var) males per 1000 hectares in 2002. Similarly, average marten harvest for the population including Kuiu Island was low relative to other islands in the study.<br><br>A 6-year marten research project on Kuiu Island was initiated by the Alaska Department of Fish and Game in 2007. The interim research report (Flynn et al. 2012) did not differentiate between Pacific marten and American marten haplotypes or hybrids between the two species. Mean capture rates were compared as a measure of abundance. Catch rates did not change much over the study period (range 2.0-2.1 captures per 100 trap nights). Density estimates for Kuiu Island ranged from 0.25-0.70 martens/$mi^2$ over the course of the study, indicating a low population. However, density estimates were relatively imprecise due to the low number of recaptures. By comparison, American marten densities between 0.44/$mi^2$ and 1.42/$mi^2$ have been observed on Chichagof Island (Flynn et al. 2009).<br><br>From 49 carcasses collected from the Admiralty National Monument in 2007-2008, Thomas (2009) estimated the abundance of Pacific martens in the area of carcass collection (Hawk Inlet, Hasselborg Lake, and Mole Harbor) was relatively high at 28-50 individuals. Although low genetic variation in long-term isolated populations, like that observed in the Admiralty Pacific marten population, is usually a result of low effective population size, the numbers of Pacific martens on Admiralty Island are unlikely to be low given the high habitat quality and size of the island (i.e., 4,264.1 $km^2$; |

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| | | Thomas 2012). Admiralty Island has both State (Alaska Department of Fish and Game 2023) and subsistence (USDA Forest Service 2022) trapping seasons. |
| 5<br><br>Population trend on Tongass NF | A | A = Significant downward or suspected downward population trend.<br><br>On Kuiu Island, Flynn et al. (2012) computed mean age for captured martens (2007-2011) and percentages of juveniles (2007-2012) as a measure of recruitment. Mean age ranged from 1.2 (2007, 2010) to 2.1 in 2008. They expected the mean age to be higher in 2012 based on field aging methods. They observed an increase in recruitment (0.71 percent in 2011), but in 2012 recruitment declined to low levels (0.25 percent), similar to 2007 and 2008 (0.32 percent and 0.23 percent, respectively).<br><br>Annual survival rates by sex were also calculated. Although survival analysis was not complete at the time of report preparation, natural mortality of martens on Kuiu Island had been substantial for the previous 5 years, ranging from 12 to 63 percent.<br><br>At this time, population trend information specific to Pacific martens on Admiralty Island is unavailable. |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Before the restoration of Pacific marten as a species distinct from American marten (Small et al. 2003, Dawson and Cook 2012, Colella et al. 2108a), martens were often grouped together as a single species for the purpose of describing habitat.<br><br>Although marten habitat selection is variable across the continent, most models indicate that habitat selection occurs at 3 spatial scales: landscape (i.e., home range scale), stands within home ranges (i.e., stand scale), and at the site scale within a stand. The strongest patterns of selection occur at the landscape scale, suggesting a strong connection between home range composition and individual fitness (Thompson et al. 2012).<br><br>Suring (2012) and Koch (2016) summarized the findings habitat selection by martens in North America at the home range scale. Both species prefer heterogeneous, mature, uneven aged, closed-canopy forests. Several authors described association between denning and resting sites and mature uneven aged forests which provide cavities in large trees and coarse woody debris. Downed logs and other coarse woody debris, characteristic of old-growth stands provide |

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| | | subnivean resting sites with concealment from predators as well as opportunities for foraging. Martens tend to avoid non-forest habitats, including on Chicagoff Island (Flynn and Schumacher 2016).<br><br>In Southeast Alaska, maintaining sites for resting and denning are considered important for the conservation of marten (Schoen et al. 2007). These sites, including large trees, snags, and down wood, are primarily found in old forests. Suring (2012) developed a Bayesian Belief Network to estimate the potential capability of Tongass National Forest land cover classes to provide these habitat components at the home-range scale; Size Density Model (SDM) landcover classes SD5N and SD67, associated with moderately- to highly-productive older upland forests with moderate to high canopy closures, are more likely to be selected as preferred habitats by martens to provide these habitat components. While SDM landcover classes SD4S and SD5S can also provide these components, their quality is likely to be less than SD5N and SD67.<br><br>Connectivity among preferred habitats enables martens to acquire sufficient resources (Moriarty 2015). Forest fragmentation impacts marten movement patterns and habitat use. Andruskiw et al. (2008) found the frequency of prey encounter, prey attack, and prey kill by American martens in Ontario, Canada, were higher in old uncut forests, despite the fact that small-mammal density was similar to that in younger logged forests. The differences in predation efficiency were associated with higher amounts of coarse woody debris, which seemed to provide sensory cues to martens, thereby increasing the odds of hunting success. Moriarty et al. (2016) found Pacific martens selected home ranges with fewer openings compared to the study area overall. Within home ranges, complex stands were selected over simple stands and openings. Moriarty (2015) found movement of resident adult Pacific martens was largely restricted to forested stands with dense, structurally complex cover, especially in summer when adult marten survival may be most at risk; adult survival is most important for marten population sustainability (Buskirk et al. 2012).<br><br>Estimated approximate timber harvest by decade on the Kuiu Island Biogeographic Province includes 28,494 acres on National Forest System (NFS) lands (prior to 1950, 2,570 acres; 1950s, 344 acres; 1960s, 3,428 acres; 1970s, 8,989 acres; 1980s, 7,852 acres, 1990s, 4,644 acres; 2000s, 667 acres) and 144 acres on state, private, and other lands (USDA Forest Service 2016a).<br><br>Koch (2016), studied the effects of forest management practices on martens on northern Kuiu Island. Since 1929, 8,863 hectares (21,900 acres) of old-growth forest stands on the island had been commercially clear-cut with the majority occurring between 1970 and 1990. Of the 55,000 hectare (135,908 acre) study area, 16 percent was clearcut prior to the |

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| | | year 2000 with 54 percent of stands subsequently thinned with a 3.0 to 4.9 meter (10 to 16 feet) spacing among regenerating trees.<br><br>Koch (2016) found that martens, in the fall, preferred closed-canopy old-growth forests in areas with higher densities of salmon streams and nearer to coast. Juveniles consumed the highest proportion of salmon and use habitat with higher stream densities than adults. In contrast, adult females consumed the lowest proportion of salmon and used habitat further from the coast with lower densities of salmon streams. He concluded, "The influence of prey availability and demography on habitat selection patterns by martens on Kuiu Island constrains the overall population habitat use to a fraction of this fragmented landscape," and recommended that Tongass National Forest managers, "strongly consider retaining high volume forest classes especially in valley bottoms within proximity to salmon streams and the shore" to conserve the viability of marten populations on Kuiu Island.<br><br>Estimated approximate timber harvest by decade on the Admiralty Island Biogeographic Province includes 8,595 acres on National Forest System lands (prior to 1950, 3,202 acres; 1950s, 771 acres; 1960s, 3,305 acres; 1970s, 1,108 acres; 1980s, NA, 1990s, 17 acres; 2000s, 105; and 88 acres undated) and 20,190 acres on state, private, and other lands (USDA Forest Service 2016a). Admiralty Island was designated as a National Monument in 1978. In 1980, most of Admiralty Island was designated by Congress as a National Monument and Wilderness.<br><br>Since 2008, total volume harvested across the Tongass National Forest has averaged 32 MMBF annually, only 12 percent of the allowable harvest level of 267 MMBF. The 2008 Forest Plan Record of Decision states that there is no expectation that timber will be harvested at a continuous rate of 267 MMBF over the next planning cycle of 15 years. (USDA Forest Service 2021, 2019, 2017).<br><br>Large-tree forests, and landscapes with the highest volume of contiguous old growth have been reduced by 28 and 66 percent, respectively across Southeast Alaska and some bioregions have been more heavily harvested (Albert and Schoen 2013). For example, in the Northern Prince of Wales bioregion, contiguous high-volume forest was reduced by 94 percent (Albert and Schoen 2013). |

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| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Key threats to Pacific marten on the Tongass National Forest include genetic swamping/introgression; past timber harvest; potential future young-growth harvest; only two unconnected populations, one imperiled by gene swamping, both with low genetic diversity; risk of American marten introduction to Admiralty; and climate change.<br><br>Heavy clearcutting can negatively impact connectivity and viability of old-growth-associated species (Marcot and Raphael 2012). Most of Admiralty Island is within national monument and wilderness status. However, "extensive logging" occurred between 1984 and 2002 on a private 22,000-acre inholding in the Cube Cove area of the Admiralty Island National Monument prior to its acquisition and return to the Kotznoowoo Wilderness area in 2016 (USDA Forest Service 2016b).<br><br>Due to their typically small size and isolation, island populations often exhibit reduced genetical variability and elevated levels of inbreeding. These, along with low levels of immigration, may increase the probability of extirpation. Significant inbreeding has been documented on both Kuiu and Admiralty Islands (Dawson et al. 2017, Thomas 2012). Additionally, Kuiu Island is now an area of sympatry for Pacific marten and American marten as well as a natural genetic hybrid zone (Dawson 2008, Dawson et al. 2017). Hybridization can lead to decreased hybrid fitness, extinction of parental species, or prevention of adaptation. The Kuiu Island Pacific marten population is apparently being introgressed by American marten (Dawson 2008, Dawson et al. 2017). Colella et al. (2018b) found unidirectional, asymmetric introgression (i.e., genetic swamping) favoring American marten when American marten and Pacific marten are placed into contact. Mainland to island translocations, without understanding evolutionary relationships among managed species, could further jeopardize the persistence of Pacific marten alleles by increasing the frequency of hybridization beyond natural zones of introgression (Colella et al. 2018b).<br><br>Timber harvests specific to Kuiu Island and elsewhere in the Alexander Archipelago could further impact the genetic structure of *Martes* (e.g., inbreeding, loss or fragmentation of critical habitat). Timber harvest and catastrophic fires, in general, impact western forest species assemblages increasing the possibility of maladaptive hybridization. (Colella et al. 2018b). |

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| | | Marten are easily caught by trappers and allowing trapping along roads is known to result in high catch rates (Flynn and Schumacher 2009). The road system on the northern end of Kuiu Island makes the marten population vulnerable to trapping in that area because nearly all marten home ranges intersect roads (Flynn et al. 2013). The Alaska Board of Game closed marten trapping annually on Kuiu Island in 2008-2012 due to conservation concerns, and Kuiu Island (Unit 3) currently has no open State marten trapping season (Alaska Department of Fish and Game 2023). Similarly, the Federal Subsistence Board reduced the marten trapping season to one month (December) beginning in 2013. Subsistence trapping (no limit) continues to be allowed on Kuiu Island in December (USDA Forest Service 2022). Thomas (2012) recommended abolishing harvest of martens on Admiralty Island to "remove the temptation to introduce other martens that through hybridization will change the genetic uniqueness of this endemic." The Island (Unit 4) has a December 1-31 State marten open season with no limit (Alaska Department of Fish and Game 2023) and a December 1-February 15 (no limit) subsistence trapping season (USDA Forest Service 2022).<br><br>Local populations of Pacific marten on Tongass National Forest are likely moderately vulnerable to climate change (Bennetsen et al. in prep. 2024). Large tree, old-growth forests that have been a past focus for timber harvest provide structure and function critical for survival and reproduction of marten. This non-climate stressor will exacerbate climate change impacts on species dependent on large-tree conifer forests. Other vulnerable habitats Pacific marten are associated with include freshwater and tidelands. Pacific marten could be negatively impacted by changes in snow impacting their movement or access to subnivean resting areas. Reductions in snow persistence could also influence insulating snow cover for small mammal prey. Pacific marten could also be negatively impacted by changes in salmon prey phenology and ocean warming and acidification effects to intertidal invertebrate prey. |
| 8<br><br>Life history and demographics | A | A = Life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>Both sexes reach sexual maturity by age one, although effective breeding may not occur before age 2. Alaska marten mate in July and August and give birth in April or early May. Breeding occurs shortly after giving birth; however, implantation is delayed. Males are polygynous (Woodford 2008). Average litter size is three (Flynn and Schumacher 2009).<br><br>Martens are most influenced by adult survival; therefore, stable conditions and long time periods are required for population growth or recovery (Buskirk et al. 2012). |

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| | | Marten densities vary throughout their range in southeast Alaska depending on habitat conditions, prey densities, and trapping pressure (Schoen et al. 2007). Food availability, particularly of small mammals, has been linked to numerical responses in several marten studies, with lower ovulation rates found during years of decline in prey abundance in several populations (Koch 2016). The composition and relative abundance of small mammal communities in southeast Alaska differs substantially by island (Flynn et al. 2004). Flynn and Schumacher (2009) found that similar to other marten populations across North America, American marten abundance on northeast Chichagof Island in Southeast Alaska fluctuated in response to long-tailed vole (*Microtus longicaudus*) abundance. However, marten will seasonally broaden their diets to alternative prey, including salmon, Sitka black-tailed deer, passerines, and even introduced species, when availability of preferred prey declines (Flynn et al. 2004).<br><br>Mammalian prey available to Kuiu martens includes long-tailed voles, Keen's mice, and red squirrels; the availability of deer is low (Flynn et al. 2004). Koch (2016) found high consumption of salmon, relative to other locations in Southeast Alaska, by Kuiu Island martens in the fall.<br><br>Flynn and Schumacher found annual survival of American martens on Chichagof Island (1990-1998) varied greatly among years, ranging from 0.34 in 1991-1992 to nearly 1.0 in 1997-1998. Although annual survival was not correlated with population numbers, population growth was preceded by several years of higher survival and numbers dropped steeply during years with poor survival. Survival rates were reduced by natural and trapping mortality. During the 3 years with lowest survival (1991–1992, 1992–1993, and 1996–1997), mortality from trapping was 62.5%, 93.8%, and 76.9% of the total mortality. Ease of trapping of martens can lead to overharvest (Schoen et al. 2007).<br><br>Of 12 Pacific and American marten hybrid specimens, Colella et al. 2018 found all but 1 had American marten mtDNA, suggesting that hybrid offspring are primarily the result of female American marten and male Pacific marten crosses. This bias could be driven by genetic incompatibilities, demography (e.g., mate availability, unequal effective population size), or asymmetrical mating preferences (Pacific marten males may disproportionally contact more American marten females (i.e., "desperation hypothesis"). Genetic swamping can lead to loss of genetic signatures of introgression within 4 generations of backcrossing (20 years for marten; Colella et al. 2018). |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

- **Significant threats**: The Pacific marten populations on the TNF suffer from low genetic diversity due to low effective population size and isolated island habitats. Significant inbreeding depression has been documented on both Kuiu and Admiralty Islands. Hybridization with American marten is also a concern, particularly on Kuiu island where it has been specifically documented. Marten populations are vulnerable to over trapping, and there is some evidence to support the opinion that a large percentage of annual mortality is due to trapping. Habitat loss due to timber harvest is an additional risk, particularly on Kuiu island, which is not protected by wilderness or National Monument status.
- **Declining populations or habitat trends**: Dispersal capability is limited because martens generally do not cross water barriers. Significant downward trend in population has been recorded on Kuiu island. No such studies have been conducted on Admiralty Island, though abundance was thought to be high in 2012. Local populations of Pacific marten on Tongass National Forest are likely moderately vulnerable to climate change, and vulnerable populations, such as those on Kuiu Island, could be driven by a multitude of stressors to local extirpation.
- **Restricted range**: Although Pacific marten occurs but is declining across most western states, on the Tongass National Forest, it only occurs on Admiralty and Kuiu Islands.
- **Low populations or restricted ecological conditions**: Although population study data on Kuiu Island are now over 10 years old, estimated marten densities from Kuiu Island were low. There is no population data for Admiralty Island.

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## Conclusion

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| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# *Onychoprion aleuticus*

*Onychoprion aleuticus* [Baird, 1869]

**Aleutian tern**

Global Rank: G4
Alaska State Rank: S3B



photo: Jay McGowan

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Habitat exists primarily as patches, some of which are small or isolated to the degree that species interactions are limited by movements between patches. Local sub-populations in most of the species' range interact as a metapopulation or patchy population, but some patches are so disjunct that sub-populations in those patches are essentially isolated from other populations<br><br>Aleutian tern nesting colonies are located along the coast on the Yakutat Ranger District of the Tongass National Forest. Nesting colonies in the region are typically less than one kilometer inland from the coast, though distances of 3.2 – 3.8 kilometers inland have been reported (Renner et al. 2015, North 2020). There is limited suitable nesting habitat within this narrow band of coastline, intermixed with broad swathes of non-habitat (forest/shrublands) (S. Oehlers, personal communication, March 28, 2024). The largest known colony in Alaska is in Yakutat, Alaska (Black Sand Spit, Italio, and Ankau) (Renner et al. 2015, USDA FS 2019, Fleishman and McKown 2020, USDA FS 2020b, Fleishman et al. 2021, Renner et al. 2021, USDA FS 2021, USDA FS 2022). |
| 2<br><br>Distribution in surrounding geographic | B | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass National Forest.<br><br>Global Rank G4, Alaska State Rank S3B<br><br>The Aleutian tern is a colonial nesting seabird with a breeding distribution limited to coastal areas of Alaska and eastern Russia. There are an estimated 110 Aleutian tern colonies in Alaska (Renner et al. 2015). The Tongass National Forest is |

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| *Criteria* | *Rank* | *Rationale* |
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| area | | located on the southern periphery of the species' breeding range. Locally, Aleutian tern breeds from Glacier Bay to Cordova, in widely dispersed nesting areas. At least 26 colonies that included Aleutian terns were documented during a 2023 aerial and ground-based survey of this area, which spanned 4,600 kilometers. The majority of these colonies (n=18) were small (≤ 100 estimated total terns) (McDonald and Schaefer, in prep., 2023). The non-breeding range of the Aleutian tern is widely distributed from Indonesia to the Philippines and coastal Thailand toto Papa New Guinea (Goldstein et al. 2019, North 2020, NatureServe 2023). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat.<br><br>This tern species readily disperses, but breeding is strictly limited to specific coastal habitats, usually within one kilometer and up to 3.2 kilometers inland from the coastline (Renner et al. 2015, North 2020). Aleutian tern colonies may be located on flat vegetated islands, dwarf-shrub tundra, grass and sedge meadows, sandy spits and islands, and freshwater marshes (North 2020). Breeding colonies often shift year to year, though the Yakutat has been consistently used by breeding birds. Observations near Yakutat indicate both inter and intra colony areas used by breeding birds (Renner et al. 2015, North 2020, USDA FS 2020a, USDA FS 2022, USDA FS 2023). |
| 4<br><br>Abundance on Tongass NF | A/B | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment /B = Uncommon - current abundance is large enough that demographic stochasticity is not likely to lead to rapid local extinction, but, in combination with highly variable environmental factors, could pose a threat.<br><br>Population "rare to uncommon" - the Yakutat population has been monitored consistently since the early 2000s, though there are accounts since at least 1916. Population estimates have ranged from no terns present (early season colony abandonment, as was observed in 2016) to over 2,000 Aleutian terns (2013) since consistent monitoring began in the early 2000s (USDA FS 2022, USDA FS 2023), with estimated numbers of 3,000 recorded in 1980 (Patton 1982). Attendance at breeding colonies is highly variable between and within seasons. For example, annual counts of Aleutian terns since 2019 have documented from 242 to over 1,000 breeding birds at Black Sand Spit colony in Yakutat (USDA FS 2022, USDA FS 2023). Nesting locations occur along coastal spits and margins, as well as just inland (e.g., 9-mile meadows). There are 5,529 total breeding birds estimated in Alaska, constituting 18% of the estimated minimum worldwide breeding population of Aleutian terns (Renner et al. 2015, Renner et al. 2021). Observations on the Yakutat Ranger District as well as the on the Kodiak Archipelago in Alaska indicate instances of high nest predation and failed breeding in some years (Renner et al. 2021, USDA FS 2022, Corcoran 2024). |

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| *Criteria* | *Rank* | *Rationale* |
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| 5<br><br>Population trend on Tongass NF | A | A = Significant downward or suspected downward population trend.<br><br>The overall Alaskan population of Aleutian terns has declined at known colonies by 8% annually since 1960, or 92.9% over three generations (Renner et al. 2015). In particular, surveys in the Cordova area at Copper River Delta (also in the Gulf of Alaska region) have declined from approximately 2,400 in the 1980s to three birds in 2013 (Renner et al. 2015). Black Sand Spit in Yakutat on the Tongass National Forest continues to be the largest consistently used breeding colony known in Alaska. It has been noted that "numbers of Aleutian terns have remained stable in Yakutat since first reported in 1914" (Renner et al. 2015), though the colony has not been known to reach its previously reported peak size of 3,000 birds (1980) (Patton 1982) since consistent monitoring began in the early 2000s. There have also been reports of consistently low breeding success (S. Oehlers, personal communication, March 5, 2024). Aleutian tern attendance at the Black Sand Spit colony is highly variable between and within seasons. Since the early 2000s, estimates of Aleutian terns at this colony have ranged from no terns present (early season colony abandonment, as was observed in 2016) to over 2,000 birds observed (2013). Most recently in 2023, 633 Aleutian terns were estimated at Black Sand Spit (Renner et al. 2015, Renner et al. 2021, USDA FS 2022, USDA FS 2023). |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Increased human use of coastal areas across the Alaska region may result in increased nest disturbance (e.g., four wheeling at Black Sand Spit) or increased nest predation and depredation (e.g., ravens at Ankau). The availability of suitable nesting habitat is not known to be a limiting factor for Aleutian terns at the population level; however, there have been instances of physical habitat changes that have created local-scale effects with the potential to influence long-term nesting success of terns (Renner et al. 2015, Renner et al. 2021). As described in Renner et al. (2015), examples include tectonic uplift in the Copper River Delta (Holtan 1980), coastal and fluvial processes at Situk River, Yakutat (Oehlers 2007), and storm tides and erosion on coastal barrier islands in the Bering Sea (Gill 2008). Within the plan area, the amount of suitable habitat is generally declining due to natural succession, though new coastal habitat is also being created in some areas such as at Black Sand Spit (S. Oehlers, personal communication, March 28, 2024). In the near future, isostatic rebound and coastal uplift from glacial recession could result in more rapid succession of Aleutian tern breeding areas into unsuitable vegetation characteristics (Bennetsen et al., in prep., 2024). |

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| *Criteria* | *Rank* | *Rationale* |
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| 7<br><br>Habitat vulnerability or modification; other threats | B | B = Habitat modification is likely to result in ecological patterns similar to the range of historical conditions but is being impacted by modern stressors.<br><br>Coastal areas are expected to experience increases in human recreation, and may be vulnerable to oil spills, tidal garbage debris, and shifts in prey abundance (ALTE Conservation Working Group 2015, Renner et al. 2015, North 2020, NatureServe 2023). Threats to Aleutian tern on the species' migration route and in overwintering areas also include declining prey abundance, contaminant and radiation exposure, entanglement in fishing gear, market hunting, and mortality and/or disorientation from wind farms (e.g., Goldstein et al. 2019). As suggested by Jezierski and others (2010) from the State of the Birds 2010 Report on Climate Change United States (NABCI 2010), coastal seabirds such as Aleutian tern are vulnerable to climate change due to their low reproductive potential and reliance on marine food webs and coastal habitats that are also threatened by climate change. Bennetsen et al. (in prep.) recently summarized potential climate-related effects and vulnerabilities for Aleutian tern, stating that: "[o]cean warming and marine heatwaves, along with associated algal blooms and toxins are affecting forage fish in the North Pacific Ocean, decreasing food availability and causing starvation, mass-mortality events, and breeding failure of seabirds. Aleutian terns are also impacted by marine heatwave changes in food availability, and climate change has been identified to observed population declines in Alaska. Isostatic rebound and coastal uplift from glacial recession could also result in more rapid succession of Aleutian tern breeding areas into unsuitable vegetation coverage. Increasing summer precipitation and intensity and frequency of storm events, are also likely to impact reproductive success via increased chick and egg mortality from exposure and from high surf and flooding conditions. Other non-climate stressors include predation, contaminants, egg harvesting, and human and domestic dog disturbance." In addition, ocean warming due to climatic changes may result in elevated concentrations of paralytic shellfish toxins in prey, such as observed in Arctic terns near Juneau in 2019 (Van Hemert et al. 2022), and there are concerns for plastic-derived contaminants (i.e., phthalates) in the prey base (Padula et al. 2020). Overall, Aleutian tern is considered "very vulnerable" to climate change due to its association with climate-vulnerable habitats and potential climate-mediated changes to biological processes (Bennetsen et al., in prep., 2024). There is a need for better understanding of potential stressors to Aleutian tern populations in Alaska including from egg harvesting, contaminants, variability in the marine prey-base, and mortality on the species' wintering grounds (ALTE Conservation Working Group 2015). However, the current science suggests that the Alaskan breeding population of Aleutian terns may continue to decline as the effects of climate change alter the North Pacific Ocean (Tengeres 2022). |

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| *Criteria* | *Rank* | *Rationale* |
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| 8<br><br>Life history and demographics | A | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>Aleutian tern is a long-lived seabird with a low reproductive rate and high mortality (i.e.., susceptible to predation and disease). Hatching success of Aleutian tern colonies each year can be variable, and that success or failure can result in population fluctuations over the long term (North 2020). The species is vulnerable to nest failure due to predation (Renner et al. 2015, Renner et al. 2021, Corcoran 2024) and reproductive consequences from climate change effects on prey availability and quality (Tengeres 2022). For instance, observations on the Yakutat Ranger District indicate instances of high nest predation and failed breeding within the plan area (Renner et al. 2021, USDA FS 2022). Aleutian tern is also vulnerable to disease, and a die-off from avian influenza could have a disproportionate effect on the species given the limited worldwide population (S. Oehlers, personal communication, March 28, 2024). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

There is substantial cause for concern for the long-term persistence of *Onychoprion aleuticus* within the plan area based upon the following:

- **Significant threats**: There is significant concern for impacts to Aleutian tern populations from climate change. Aleutian tern is considered "very vulnerable" to climate change due to the species' association with climate-vulnerable habitats and climate-mediated changes to biological processes. Isostatic rebound and coastal uplift from glacial recession could result in more rapid succession of Aleutian tern breeding areas into unsuitable vegetation characteristics. In addition, Aleutian tern is vulnerable to reproductive consequences from

climate change effects on prey availability and quality. Increasing summer precipitation and intensity and frequency of storm events may also affect reproductive success, with increases in mortality of chicks and eggs from exposure and from high surf and flooding conditions.

- **Declining populations or habitat trends**: Overall, the Alaskan population of Aleutian terns have decreased over 90% over three generations. Yakutat populations have reported remained stable since the 1910s, but the population reached peak numbers around 1980 and has never recovered to that size since consistent monitoring began in the 2000s. It has also been suggested by local knowledge that breeding success has been consistent low. Population numbers are reportedly highly variable between and across seasons, ranging between zero terns and up to 2,000 terns present. Increased human use coastal areas across Alaska may result in negative impacts to Aleutian tern nests and nesting habitat.
- **Restricted range**: The Tongass National Forest is at the southern extent of the species' range.
- **Low populations or restricted ecological conditions**: Colonies of Aleutian terns in Alaska are highly variable in size within and across seasons, with some periods seeing zero birds. While present, Aleutian tern breeding is strictly limited to specific coastal habitat typically within 1 kilometer of the coastline. The Tongass National Forest has limited suitable nesting habitat intermixed with large areas non-habitat.
- **Other factors**: Increased human activity along the Alaskan coastline may be negatively impacting the Aleutian tern and its capacity to successfully nest. Contaminants, egg harvesting, and increased dog activity have been cited as additional threats to the persistence of the species.

# Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# *Oreamnos americanus*

*Oreamnos americanus* [Blainville, 1816]

**Mountain goat**

Global Rank: **G5**
Alaska State Rank: **S4**

Photo: Alaska Department of Fish and Game



## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | B | B = Patchy or gaps.<br><br>The range of the Mountain goat extends throughout the southeast panhandle, with their range continuing further north and west along coastal mountains into Cook Inlet (Alaska Department of Fish and Game [ADFG] 2024). Within the Tongass National Forest (TNF), they are found in suitable habitat along the mainland coast of southeast Alaska (McDonald and Cook 2007). On islands, a single individual was observed in Wrangell Island (Klein 1965) and on Baranof Island, according to recent genetic data, Mountain goats may have occurred since the last ice age in a "cryptic refugia" and in 1923 a transplant took place to augment the population (McDonald and Cook 1996; 2007; ADFG 2024). Mountain goats have been introduced to different areas in the TNF, including Kodiak and Revillagigedo islands, where populations have established, and to Chichagof Island, where the population failed to establish (ADFG 2024). |
| 2<br><br>Distribution in surrounding geographic | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G5, Alaska State Rank S4 |

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| *Criteria* | *Rank* | *Rationale* |
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| area | | The native range extent of the Mountain goat includes the mountains of northwestern North America, from southeast Alaska to Washington, western Montana, and southern Idaho, and they have been introduced to South Dakota, Colorado and parts of Washington (Rideout and Hoffman 1975; Gross et al. 2002). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>Mountain goats have very specialized habitat requirements, and exhibit sex-dependent differential selection pressures because of differences in their morphology and associated life history strategies, which in turn results in substantial differences in movement rates and home range sizes between males and females (White 2006). In general, mountain goats select areas close to cliffs with moderately steep and rugged slopes with moderate-high solar exposure and exhibit seasonal movements from low elevation areas that are typically vegetated with closed canopy conifer forest during winter (which have reduced snow depths) to moderate-high elevation areas during summer (White et al. 2012a). These terrain characteristics are considered a key prerequisite for predicting mountain goat habitat (White et al. 2012a). However, and although both males and females avoid valleys, males move readily across the landscape during the breeding season whereas females use smaller areas and move less, using safe terrain habitat features to presumably avoid predation risks or find lower snow depths in these habitat types during the winter (White 2006; Shafer et al. 2012). Moreover, in the nearby Glacier National Park, climate modelling predicted that climate change is likely to degrade the suitability of movement corridors that facilitate gene flow between subpopulations by increasing the cost of travel (Young et al. 2022). |
| 4<br><br>Abundance on Tongass NF | B | B = Uncommon - current abundance is large enough that demographic stochasticity is not likely to lead to rapid local extinction, but, in combination with highly variable environmental factors, could pose a threat.<br><br>Few studies have documented the abundance of mountain goats in the Tongass National Forest. According to the Alaska Department of Fish and Game, most mountain goats in Alaska occur in the southeast (which includes the Tongass National Forest), with an estimated 13,500-20,000 individuals (ADFG 2024). However, note that no information on how these estimates were reached is provided. In 1977, goat density was estimated to be 0.5/km$^2$ at Chilkat, 1.4/km$^2$ at Herbert Glacier, 2.1/km$^2$ at Dixon Harbor and 0.7/km$^2$ at Lituya Bay (Streveler and Smith 1980; Fox 1984). White et al. (2012a) conducted a long-term study in eastern Lynn Canal and the Berners Bay area in southeast Alaska, where they estimated the population size in four study areas from 2005-2011 and these showed high variation. Population size in East Berners ranged from (minimum-maximum, not sequentially) 137-264 mountain goats, in Lion's Head from 102-171 |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | goats, Sinclair Mountain from 151-383 and Mount Villiard from 131-391. This variation was associated to severe winters (see below). On the other hand, the upper Mahoney Lake population of Mountain goats was estimated at 100-140 individuals (Porter 2004). |
| 5<br><br>Population trend on Tongass NF | A | A = Significant downward or suspected downward population trend.<br><br>Only a few localized studies offer insights into the population status and trend of mountain goats in southeast Alaska. In general, mountain goats are considered to have low population growth rates relative to other ungulates (White et al. 2012a), and studies have demonstrated that population growth is highly sensitive to adult survival rates, especially those of adult females, relative to other rate parameters (Hamel et al. 2006). The upper Mahoney Lake population of mountain goats is estimated at 100-140 individuals and is expanding (Porter 2004). However, the most comprehensive study done to date in the eastern Lynn Canal and the Berners Bay area in southeast Alaska, White et al. (2012a) documented a study-wide population decline of approximately 47% between 2006 (n= 1,136) and 2010 (n = 604) following a succession of severe winters, with field data indicating that adult survival rates were negatively influenced by winter severity. Similarly, in the nearby Glacier Bay National Park in southeast Alaska, climate modelling predicts that mountain goat demographic productivity is likely to be reduced (Young et al. 2022).In addition, a study of mountain goats in the Cleveland Peninsula that integrated genetic data and demographic modelling found that the populations there were isolated by distance with low effective population sizes and reduced genetic diversity along the peninsular extremity to mainland gradient and that they were prone to overharvesting, especially if females are targeted, potentially leading to population declines (White et al. 2021). This seems to be the general case in southeast Alaska, where three sub-populations were identified using genetic markers, distinct from populations in southcentral Alaska (Young et al. 2024). |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Mountain goats occupy steep, rocky areas with cliffs or bluffs in alpine or sub-alpine regions, prefer areas with sufficient escape terrain (steep rocky areas), moderate slopes, mid-elevations and southern exposures and migrate between lowland winter areas and high elevation summer areas (Gross et al. 2002). The summer ranges are high elevation alpine areas whereas the winter ranges are at or below the tree line, typically in old growth forest habitat near escape terrain (ADFG 2024). |

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| *Criteria* | *Rank* | *Rationale* |
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| | | Key losses in alpine habitats have been described recently, with the conversion of alpine habitat from advancing shrub- and tree-line elevations in the Tongass National Forest (Baer et al. 2025). However, as glaciers retreat and with decreased snowpack, alpine areas are also being created (Baer et al. 2025), albeit not necessarily with the habitat (vegetation) characteristics needed by some wildlife if the right substrate and soils are not present (Halofsky et al. 2011; Bennetsen et al. 2025). Coniferous forests, on the other hand, are expanding in the Tongass National Forest despite losses due to prior land use practices such as clear cutting (Buma and Barrett 2015; Baer et al. 2025). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Climate change is expected to result in habitat conditions departing from expectations based on NRV for mountain goats, where alpine and sub-alpine habitats are lost due to increasing shrub- and treeline (Bennetsen et al. 2025), snow depths may increase due to higher frequency and magnitude of winter storms though snow persistence is expected to diminish (Bennetsen et al. 2025; Littell and Johnson 2025), landslides and possibly also avalanches are expected to increase due to increased storm magnitudes, and phenological mismatch where alpine plants emerge earlier and have accelerated maturity reducing the browsing nutritional quality of forage available to mountain goats (White et al. 2011; 2018), thus increasing vulnerability to harsh winter conditions (Bennetsen et al. 2025). Moreover, snow avalanches have been shown to be a primary climate-linked driver of mountain goat populations, with population-level avalanche mortality averaging 8% annually and exceeding 22% under severe conditions (White et al. 2024). In addition, increasing summer temperatures may induce heat stress in mountain goats, and although upslope range shift can be an efficient way of decreasing heat stress, this is only on the short term as the total usable area available decreases with increasing temperatures (Michaud et al. 2023).For example, modelling the effects of increase summer temperatures and reduced winter snow fall on the demography of mountain goats indicates that increasing summer temperatures had stronger negative effects on the population trajectories than the positive effects of reduced winter snowfall (White et al. 2018).<br><br>Mountain goats have also been shown to be susceptible to recreational land use and suffer negative impacts (Boyd 2020). In southeast Alaska, for example, the number of helicopter flights to gain access to backcountry has increased in recent years, as has tourism in general, and these result in disturbances to mountain goat maintenance behavior (Goldstein et al. 2005), presumably affecting their fitness. Additionally, and associated with human population increase and economic expansion, planned developments such as mining projects and access road construction for mining |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | activities and highways are expected to negatively impact goat populations, and alternatives to minimize these impacts have been proposed (White et al. 2012a; 2012b). |
| 8<br><br>Life history and demographics | A | A = Low reproductive rate **and** high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>In general, mountain goats have specialized habitat requirements, exhibit a conservative life history strategy, have low population growth rates compared to other ungulates and show a high degree of sensitivity to natural and anthropogenic disturbances (Fox et al. 1989; Festa-Bianchet and Côté 2012; White et al. 2012).<br><br>Mountain goats display changes in diet associated with seasonal changes (Fox and Smith 1988). Forbs and ferns decline as diet elements as snow depth decreases, however, conifers, lichens, and mosses, which are associated to timber areas, remain an important part of the diet (Fox and Smith 1988).<br><br>Prior and during the breeding season, males compete for females by fighting side-by-side and stabbing each other's flanks (Côté and Festa-Bianchet 2001). Courtship starts in September, with males attempting to join small bands of females and in October females start accepting the courtship of males (Geist 1964). Mountain goats have a polygynous mating system, and the breeding season begins in late November, lasting until early January, and gestation is about 150-180 days with 1 kid born in May to June (twinning is rare; White et al. 2012b). Sexual maturity in both sexes is reached after 30 months, but kid production is highest among female goats 8-9 years of age (Côté and Festa-Bianchet 2001). In the wild, mountain goats live on average 12-15 years, until their teeth have been worn down (Smith 1986).<br><br>Mortality comes from different sources, including malnutrition, male-male competition during the breeding season, accidental falls (e.g., from avalanches), predation (e.g., by wolves and bears), and hunting (Fox and Streveler 1986; Cote and Festa-Bianchet 2001; White et al. 2011; ADFG 2024). Survival rate estimates vary by age class and sex in southeast Alaska (0.61-0.98), with older goats (9+ years of age) exhibiting lower estimated survival rates (0.61 and 0.72 for males and females, respectively) and sub-adults (2-3 years of age) showing the highest estimated survival rates (0.98 for both |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | males and females; White et al. 2011). Mountain goat kid survival rates are not available for southeast Alaska, but in Alberta, estimated kid survival rate to one year was 0.65 for both sexes (Côté and Festa-Bianchet 2001). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☐ | ☒ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

In Alaska, mountain goats are one of the most culturally and economically important large mammal species, and account for a broad range of human uses such as subsistence, sport hunting, wildlife viewing and native customary uses (White et al. 2012). We used the following factors to determine whether there is substantial concern over their long-term persistence in the planning area:

- **Significant threats:** Substantial threats have been identified. The primary concern is climate change, which is expected to cause habitat loss due to advancing shrub- and tree-lines, increase the frequency and magnitude of winter storms resulting in higher avalanche and landslide risks, cause summer heat stress and a phenological mismatch in forage quality. Anthropogenic threats include disturbances from increased tourism and recreational land use (such as helicopter overflights), and potential developments like mining projects and road construction.
- **Declining trends:** A significant downward population trend has been observed in localized studies, including a documented 47% population decline in one area following severe winters. Habitat trends are also declining in quality and quantity, particularly in alpine and sub-alpine regions due to habitat conversion.
- **Restricted ranges:** The species has a wide distribution globally and within Alaska, but its distribution on the Tongass National Forest is patchy and contains gaps.

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- **Low population numbers or restricted ecological conditions:** While the overall abundance across Alaska is large, local populations are considered uncommon. Their abundance is large enough that demographic stochasticity alone is not a primary threat, but in combination with highly variable environmental factors and hunting pressure, it poses a risk. The species has specialized habitat requirements (steep, rugged cliffs near forests for winter cover) and low reproductive rates.
- **Other factors:** The mountain goat has a conservative life history strategy with low population growth rates and high sensitivity to natural and anthropogenic disturbances. It is a culturally and economically important species for subsistence, sport hunting, and native customary uses in Alaska.

Taken together, the scientific information indicates that there is substantial concern over the long-term persistence of the Mountain Goat in the plan area, and therefore, we recommend the species as a potential Species of Conservation Concern.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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# Botanical Species Draft Evaluations

(Inclusive of vascular plants, bryophytes, lichens and fungi)

DRAFT

# *Acroscyphus sphaerophoroides*

*Acroscyphus sphaerophoroides* [Leveille]

**Crab-eye lichen**

Global Rank: **G3**
Alaska State Rank: **S1**



photo: Brad Kriekhaus

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce or isolated.<br><br>*Acroscyphus sphaerophoroides* is known from two estimated occurrences on the Tongass National Forest (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). Both occurrences are on alpine ridges on North Admiralty Island above Greens Creek Mine (USDA FS 2023a, ACCS 2023, Spribille et al. 2023).<br><br>Many of the tops of high mountains of Admiralty and other islands of the Alexander Archipelago may have been nunataks protruding above the ice during the Last Glacial Maximum (Carrara et al. 2007); this may have contributed to the current distribution of species such as *Acroscyphus sphaerophoroides* (Anderson 2012).<br><br>Occurrences range between 795 meters (2610 feet) and 964 meters (3160 feet) in elevation. The northern occurrence is on carbonate rock with quartz veins, and the southern occurrence is on greenstone outcrops (Anderson 2012). |
| 2<br><br>Distribution in | B | B = Limited distribution outside the Tongass National Forest and widely disjunct taxa.<br><br>Global Rank G3, Alaska State Rank S1<br>British Columbia Province Rank S2, Red List; Washington State Rank S1 |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| surrounding geographic area | | *Acroscyphus sphaerophoroides* has a wide global distribution in high elevation areas of S. Africa, Japan, southern China, Bhutan, India, Patagonia, and Peru, however across this range, few populations have been confirmed (CPNWH 2023, BCCDC 2023, NatureServe 2023, Singh et al. 2018). It grows in cold temperate regions as well as in tropical latitudes on mountain ranges (Sato 1967, Tibell 2001). In British Columbia this species occurs in wetland complexes, subalpine forest and subalpine parkland (B.C. Ministry of Climate Change 2022).<br><br>In North America, in addition to the Tongass occurrences, it occurs in the forests of Veracruz, Mexico, and alpine habitats of British Columbia (8 locations) and Washington (1 location) (Goward et al. 1994, Joneson and Glew 2003). The Tongass occurrences are the most northerly sightings worldwide (Anderson 2012). The closest occurrences in British Columbia, are disjunct from the Tongass occurrences by approximately 250 miles (400 kilometers) (B.C. Ministry of Climate Change 2022). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat<br><br>Fungal spores are expected to disperse passively, as they are heavy and unornamented. Spores need to land and germinate in the preferred habitat along with the algal partner to create the lichen, further limiting germination success. Suitable alpine habitat patches for this species are separated by forests, saltwater, and ice.<br><br>Bird droppings have been observed with the lichens, indicating that large raptors have perched on the rock outcrops where the lichen is found. This suggests that birds may be a dispersal agent for the lichen, picking up fungal spores as they perch upon the thallus. The body of the lichen is likely solid and tough enough to withstand the repeated perching of birds (Tibell 1994, Anderson 2011, Anderson 2012).<br><br>Fruiting individuals have been documented in both locations on Admiralty Island. |
| 4<br><br>Abundance on Tongass NF | A | A = Rare. Current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>Two occurrences are known, one each on the ridges to the north and south of the mine (Anderson 2012). Each occurrence is made up of seven rock outcrops with lichen. The total number of individuals or area covered by the lichen is unclear, but the patches are described as “clumps” or “compact mounds”, “ranging in size from ~8cm diameter to ~35 cm diam”. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>Monitoring of the species has not occurred. It is unknown if the two occurrences have been affected by mining activities. |
| 6<br><br>Habitat trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>Exploratory drilling has been conducted in the vicinity of the mine, including in suitable habitat for *Acroscyphus sphaerophoroides* (approximately .35 miles from known occurrences). It is unknown if those activities have impacted known or unknown occurrences.<br><br>Lichen tissue biomonitoring has detected heavy metals above the wilderness threshold values near the mine site, and fugitive dust has been found up to 2 miles away from the mine site (Dillman 2007). It is unknown whether fugitive dust reaches *Acroscyphus sphaerophoroides*. Many lichens are sensitive to air quality (hence their utility for air quality biomonitoring) but they vary in their sensitivity and the degree to which *A. sphaerophoroides* would be impacted by fugitive dust is unknown.<br><br>Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). Whether changes in alpine climate have impacted *Acroscyphus sphaerophoroides* is unknown. |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat is anticipated with conditions departing from expectations based on NRV.<br><br>Alpine habitat at the Green's Creek mine is currently open for drilling exploration. The exploration area is about 5,000 acres, of which close to 600 acres is alpine habitat where this lichen is found (Anderson 2011).<br><br>Alpine habitat in some areas on the Tongass are vulnerable to development. These modern stressors include other mine explorations (e.g. Bokan, Niblack), communication sites (ATT, APT, FAA, and FS) and energy development of hydroelectric dams. These stressors may affect potential habitat elsewhere on the Tongass National Forest. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Ground disturbance from site construction or drilling could damage or bury plants located in or near the drill pad. This could also occur in very limited areas from soil sampling. Plants can also be crushed, buried, or damaged because of vegetation clearing in or near the drilling sites and paths for ground- based geophysical surveys.<br><br>Predicted temperature increases associated with climate change are expected to result in the encroachment of shrubs and trees into existing alpine habitat, as well as the creation of additional alpine habitat as glaciers melt (Halofsky et al DRAFT). Alpine ridgeline occurrences of *Acroscyphus sphaerophoroides* in the Greens Creek area are close to the shrub/tree ecotone, and may be vulnerable to habitat changes associated with climate change. Encroachment by shrubs and trees could change the existing microenvironment for the lichen, although the specific habitat requirements for this lichen are not known. Tree encroachment could also change patterns of wildlife use at known sites. Additional tree cover may result in decreased bird use of rock outcrops as perches. Because this species is thought to be bird-dispersed, changes in habitat use by birds may affect the dispersal of fungal spores and impede the ability of existing occurrences to colonize other suitable habitat.<br><br>This species is epiphytic in Washington and British Columbia, so there is a chance it could grow on wood in the subalpine of the Tongass, however it has not been observed on tree substrates on the Tongass National Forest. |
| 8<br><br>Life history and demographics | D | D = Insufficient information to draw inferences about criterion.<br><br>This lichen is separated from other members of Caliciaceae and Caliciales by its dactyliform thallus, immersed ascocarps on podetia, and yellow to orange medulla. The lichen has a cushion-like appearance made up of fertile and sterile podetia with a gray to orange cast. The podetia branch as the thallus matures and the ascospores are smooth and unornamented, which is rare for Caliciales. *Acroscyphus* has a diverse secondary chemistry and contains substances not found in other genera of Caliciales such as chloro-atranorin, rugulosin, zeorin, and chrysophanic acid (Joneson and Glew 2003, Tibbell 1994, Tibbell 1984).<br><br>Fruiting individuals have been documented in both locations on Admiralty Island. Growth rates and reproductive rates are unknown.<br><br>There is insufficient information to determine how populations might respond to disturbance events. |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Acroscyphus sphaerophoroides* in the plan area based on the following:

**Significant threats:** The only known occurrences are within the Greens Creek Exploration area. Ground disturbance from site construction or drilling could damage or bury plants located in or near drilling sites. Potential habitat across the Forest may also be vulnerable to future mining exploration activities. Known populations are near tree line and may be vulnerable to shrub and tree encroachment.
**Declining trends in population or habitat:** Monitoring for this species has not been conducted on the Tongass NF. Exploratory drilling has occurred near known occurrences (approximately 0.35 miles away) but it is unknown if this has impacted individuals or potential habitat.
**Restricted range**: The Tongass occurrences are the most northerly occurrences worldwide and the next nearest occurrences are approximately 250 miles away in British Columbia. The species is rare in North America and elsewhere within its range.
**Low population numbers or restricted ecological conditions:** There are two known occurrences on the Tongass NF, both in one small area of Admiralty Island near Greens Creek Mine. The species appears to be restricted to high elevation rock outcrops on the Tongass NF.
**Other factors:** It is unknown whether other factors may exist that impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |

| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **CPNWH_Mar25 (UAAH13157)[8/03/2011]** | **Alexander Archipelago, Admiralty Island, on south ridge of Greens Creek Mine area, alpine** | **on isolated rock outcrop, an obvious bird perch.** | **NA** | **NA** |
| 1 | CPNWH_Mar25 (UAAH13158)[8/03/2011] | Alexander Archipelago, Admiralty Island, on south ridge of Greens Creek Mine area, alpine | on isolated rock outcrop, an obvious bird perch. | | |
| 1 | TESP_Mar25 (100533P000931)[8/27/2010] | | on tip of isolated rock outcrop | | |
| 1 | TESP_Mar25 (100533P000932)[8/03/2010] | Admiralty Island, Ridge south of Greens Creek Mine | 6 rock outcrops with from 1 - 7 patches on each, ranging in size from ~8cm diameter to ~35 cm diam. Nearly all with apothecia. | | |
| **2*** | **TESP_Mar25 (100533P000915)[8/04/2009]** | | | **1 dense clump on top of rock outcrop** | |
| 2 | TESP_Mar25 (100533P000914)[8/04/2009] | | | 1 compact mound on top of rock outcrop | |
| 2 | TESP_Mar25 (100533P000937)[7/20/2010] | | | | |
| 2 | TESP_Mar25 (100533P000943)[7/21/2010] | Admiralty Island, ridge north of Greens Creek Mine; approximately 2.5miles north east of occurrence 1 | | | |
| 2 | TESP_Mar25 (100533P000941)[7/21/2010] | | | 1 large and 2 small clumps | |
| 2 | TESP_Mar25 (100533P000944)[7/21/2010] | | | | |
| 2 | TESP_Mar25 (100533P000942)[7/21/2010] | | | 1 large clump and a couple small clumps | |
| 2 | TESP_Mar25 (100533P000940)[7/21/2010] | | | 3 or more clumps on | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | tip of rock outcrop | |
| 2 | TESP_Mar25 (100533P000938)[7/21/2010] | | | | |

DRAFT

# *Ambrosia chamissonis*

*Ambrosia chamissonis* [(Less.) Greene]

**Silver bursage**

Global Rank: **G5**

Alaska State Rank: **S2**



photo: Stephanie Govier

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce OR isolated. Habitat or population connectivity is limited due to factors such as environmental gradients, introduced species, disease, habitat loss, or habitat degradation.<br><br>*Ambrosia chamissonis* is known from nine estimated occurrences on the Tongass NF, two of which are likely extirpated (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile).<br><br>This species grows in sandy beach habitat that overall occupies a small total area in the region and represents a unique habitat type. Sandy beaches on the Tongass are isolated by miles of rocky shoreline, interior forested habitats, or open ocean between neighboring islands. |
| 2<br><br>Distribution in surrounding | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G5, Alaska State Rank S2<br>British Columbia Province Rank S5, Yellow ranking<br>Washington State SNR, Oregon State SNR, California State SNR |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| geographic area | | *Ambrosia chamissonis* is found on sandy or gravelly beaches along the coast of North America from British Columbia to Baja California (E-Flora BC 2024, NatureServe 2024, Calflora 2024).<br><br>The Tongass represents the far northern edge of this species' range. |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat<br><br>Dispersal capability is limited by specialization to sandy beach habitat, as well as life history characteristics such as passive seed dispersal and wind pollination. Sandy beaches on the Tongass are isolated by miles of rocky shoreline, interior forested or wetland habitats, or open ocean between neighboring islands.<br><br>Populations along the coast of California are abundant, yet distinct chemotype differences in populations to the north and south of Monterey suggests unsuitable habitat may inhibit dispersal of the species (Payne et al. 1973). |
| 4<br><br>Abundance on Tongass NF | A | A = Rare – current abundance is low enough that stochastic and other factors could lead to imperilment.<br><br>There are nine occurrences on the Forest, two of which are likely extirpated.<br><br>Kruzof Island has the most occurrences and the largest known populations on the Tongass, with four occurrences along the western and southern coast on the Tongass National Forest, plus one additional occurrence on state land. Population counts for these occurrences are spotty but the largest was described in 2008 as "five patches ranging in size from 10 square feet to 4 square feet".<br><br>Other occurrences are isolated and scattered across the Forest with either small population sizes, revisits that did not relocate the population, or no population size notes. One location on the eastern coast of Prince of Wales Island, originally documented in 2009 as one individual, was revisited in 2020 and the plant was not relocated. Another location on the southern coast of Misty Fjords was first visited in 2003 without population notes, then revisited in 2005 with the comment "rare in area, one small population found on this and local islands". A location on the eastern Dall Island complex has one visit in 2010 with the note "single small ambrosia stem found just above the beach logs". A location on southern Etolin Island was found in 2006, does not have population size notes, and has not been revisited. A location near Yakutat was first documented in 1993. It was revisited in 2016 with these comments "coordinates for EO are now inundated by saltwater in the surf zone. Possible beach erosion since last visit several years ago" (USDA FS 2023, CPNWH 2023, ACCS 2023). |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 5<br><br>Population trend on Tongass NF | A | A = Significant downward or suspected downward population trend.<br><br>Although consistent surveys are lacking, revisits and research grade observations to the largest population on the southern coast of Kruzof Island suggest this population has persisted for at least two decades. The population on the southern coast of the Misty Fjords has been documented as persisting for at least 2 years (USDA FS 2023). However, during the most recent revisits to the single populations near Yakutat and on the eastern coast of Prince of Wales, the plant was not found (USDA FS 2023, CPNWH 2023, ACCS 2023). Due to the disappearance of those populations, as well as a lack of new populations being discovered, a downward population trend is suspected. |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Revisits to two of the occurrences on the Tongass (on east Prince of Wales and near Yakutat) were unable to relocate *Ambrosia chamissonis*. In both cases, erosion was cited as a potential reason for the plants' disappearance. While a natural part of this habitat type, sea level is predicted to change and rates of erosion to increase (Boggs 2019, Turner and Mallott 2024).<br><br>Invasive species like reed canarygrass (*Phalaris arundinacea*) are another threat to this species' habitat. Further establishment in upper beach meadows is a growing concern as this highly aggressive species can, among other impacts, affect community composition (Alaska Center for Conservation Science [ACCS] 2011; Greenstein and Schake 2021; Spellman and Swenson 2012).<br><br>One of the locations on Kruzof Island sees recreational use, including from OHVs (off-highway vehicles). Another location on Kruzof likely receives some recreational foot traffic (Jacqueline Foss pers. comm). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on natural range of variation, and/or habitat is impacted by modern stressors such as herbicides, non-native species, water diversions, recreation, etc.<br><br>The coastal habitat of southeastern Alaska is vulnerable to modification and/or loss due to future predictions of sea level change, as well as changes in temperature and precipitation. Along the northern coast of the Tongass NF, sea levels are projected to fall as much as 5.9 feet as a result of rapid isostatic rebound. However, the southern coast may see sea levels rise as much as 0.7 feet (Halofsky et al 2025). Additionally, projections suggest an increase in average temperatures and precipitation over southeast Alaska (USDA FS 2023, Boggs et al. 2019). As a result, the coast may see |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | more frequent and intense storm surges which could lead to a higher chance of modification as sand is moved further upland, or loss occurs by means of erosion (Carter 1991).<br><br>Beach habitat in some locations may also be threatened by human development and recreational use, including off-road vehicles (Boggs et al. 2019, USDA FS 2014). Upper beach meadows are vulnerable to infestation by invasive species. Invasive plants can establish and spread in these meadows, and several species are readily dispersed by air or carried by tidewater to other beaches (Turner and Mallott 2024). The natural disturbance regime, sandy soil, and high light environment contribute to the invasibility of this habitat (Spellman and Swenson 2012). |
| 8<br><br>Life history and demographics | B | B = Life history characteristics that suggest populations have an intermediate ability to recover from disturbance events and other demographic risk factors are known.<br><br>This species is a perennial subshrub and moderately specialized dune stabilizer. It is tap rooted and supported by sand with weak sprawling rhizomes. Individuals can withstand slow sand burial and have long been found to thrive under severe environmental conditions with little soil stability, high wind, temperature, and light intensity (Purer 1936). Barbour and DeJong (1977) proposed that winter die-back may allow foliage to avoid the greatest storm surges along the Pacific coast.<br><br>As with all species of *Ambrosia* it tends toward self-pollination and regular inbreeding especially in isolated populations or when branches are unable to intersperse with neighboring individuals. This appears to contribute to genetic drift within more isolated populations (Payne et al. 1973). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

*Ambrosia chamissonis* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats:** Threats to populations and habitat include off highway vehicle (OHV) use in some areas, as well as invasive species, changing sea levels, and habitat erosion due to frequent and more intense storm surges.
- **Declining trends:** Some locations are impacted by human recreation. All are likely to be impacted by changing sea level, increased erosion, and invasive species. Revisits have found that some populations have disappeared, and no new populations have been found.
- **Restricted ranges:** Populations of this species are known to the south of the Tongass on Haida Gwaii and the BC coast, but known occurrences within the Tongass are widely spaced, with over one hundred miles between some occurrences. The Tongass is the northern edge of the range for this species.
- **Low population numbers or restricted ecological conditions:** Sandy beach habitat is rare in Southeastern Alaska. There are nine estimated occurrences on the Tongass, two of which are likely extirpated. Population counts are incomplete but several of the occurrences mention that the plant was "rare" or that the occurrence consisted of a single individual.
- **Other factors:** Unsuitable habitat may inhibit dispersal of the species. Suitable habitat patches on the Tongass are isolated by miles of rocky shoreline, interior forested habitats, and/or open ocean between neighboring islands.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| 1 | ACCS_Mar25 (EO3)[7/30/2003] | Tongass National Forest, Misty Fjords | | NA | NA |
| 1 | TESP_Mar25 (100552P000145)[7/30/2003] | | | | |
| 1 | ACCS_Mar25 (EO3)[7/19/2005] | Alexander Archipelago, Kagunut I. | upper beach area, prostrate on sand | rare in area, one small population found on this and local islands | |
| 2 | TESP_Mar25 (100551P000154)[8/26/2010] | | Single small ambrosia stem found just above the beach logs, in fairly large gravel. | Plant Count: 1 | |
| 2 | ACCS_Mar25 (EO11)[8/26/2010] | Tongass National Forest | Aspect= SSE; Substrate= Gravel; | | |
| 3 | TESP_Mar25 (100554P000129)[6/28/2009] | | Parent Material: Sand | 1 Genet | |
| 3 | TESP_Mar25 (100554P000129)[6/11/2020] | | | Nothing found | Possible eriosion of site, gravelly substrate |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | up to forested/ sphagnum substrate, sandy habitat seems to be gone |
| 3 | ACCS_Mar25 (EO10)[6/29/2009] | Tongass National Forest | Slope = 10; Aspect= E;Parent Material= Sand; | | |
| 4 | TESP_Mar25 (100522P000018)[7/24/2006] | | | | |
| 4 | ACCS_Mar25 (EO8)[7/24/2006] | Tongass National Forest, Etolin Isl, McHenry | on beach near rec. site. | | |
| 5 | ACCS_Mar25 (EO4)[8/13/2003] | Alexander Archipelago, Shoals Point, SE tip Kruzof I., Kruzof Island, near Shoals Point, about 20 km W of Sitka | Growing below storm tide log deck. | Five small patches of 1-2 square meters in area. | |
| 5 | ACCS_Mar25 (EO4)[7/17/2008] | Tongass National Forest | | | |
| 5 | TESP_Mar25 (100531PG00193)[7/17/2008] | | Upper beach, growing in coarse sand, fine gravels and broken shells | 25 ramets (estimate). Five patches ranging in size from 10 square feet to 4 square feet. | |
| 5 | ACCS_Mar25 (EO4)[8/13/2003] | Tongass National Forest, Kruzof Island, Shoals Point area | | | |
| 5 | TESP_Mar25 (100531P000051)[8/13/2003] | | | | |
| 5 | ACCS_Mar25 (EO4)[7/17/2008] | Tongass National Forest | | | |
| 5 | TESP_Mar25 (100531PG000192)[7/17/2008] | | | 2 ramets (estimate). Small patch of about 2 sq. feet | |
| 5 | ACCS_Mar25 (EO4)[8/13/2003] | Tongass National Forest, Kruzof Island, Shoals Point area | | | |
| 5 | TESP_Mar25 (100531P000052)[8/13/2003] | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 5 | CPNWH_Mar25 (WTU383694)[8/13/2003] | Kruzof Island, near Shoals Point, about 20 kilometer west of Sitka. | Growing below storm tide log deck. With Carex macrocephala, Elymus mollis, Heracleum latum. | | |
| 6 | ACCS_Mar25 (EO2)[7/08/1994] | Tongass National Forest, RULL TNFS 5336 | | | |
| 6 | TESP_Mar25 (100531P000027)[7/08/1994] | | | | |
| 7 | ACCS_Mar25 (EO5)[8/14/2003] | Tongass National Forest, Kruzof Island, Shelikof Bay area | | | |
| 7 | TESP_Mar25 (100531P000053)[8/13/2003] | | | | |
| 7 | ACCS_Mar25 (EO5)[7/02/2008] | Tongass National Forest | | | |
| 7 | TESP_Mar25 (100531P000053)[7/02/2008] | | | 5 genets (not estimated). Five patches ranging in size from 2 sq. meters to a square foot. | |
| 8 | ACCS_Mar25 (EO7)[8/22/2005] | Tongass National Forest, Kruzof Is., Shelikof Bay, Cuvacan Cove, scattered along upper beach meadow | upper beach, beach sand | | |
| 8 | TESP_Mar25 (100531P000147)[8/22/2005] | | | | |
| 8 | TESP_Mar25 (100531P000147)[6/08/2016] | | | | |
| 8 | ACCS_Mar25 (EO7)[6/22/2011] | Tongass National Forest | | | |
| 9 | ACCS_Mar25 (EO1)[8/10/1993] | Tongass National Forest, CANNON BEACH FAGAN TNFS 4177 LOCATION U | | | |
| 9 | ACCS_Mar25 (EO1)[8/10/1993] | Yakutat Foreland, Cannon Beach vic., T28S, R34E, S18, NE1/4, SW1/4 | in Leymus mollis type above supratidal beach | | |
| 9 | TESP_Mar25 (100535P000027)[6/22/2016] | | | | Coordinates for EO are now inundated by saltwater in the surf zone. Possible beach erosion |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | since last visit several years ago |
| 9 | TESP_Mar25 (100535P000027)[6/16/2016] | | | | |
| | Occurrences not on TNF but in SE | | | | |
| | ACCS_Mar25 (EO9)[8/07/2008] | | | | |

# *Arctophila fulva*

Photo: Serguei Ponomarenko CC-BY-NC (iNaturalist 2025)



*Arctophila fulva* [(Trin.) Andersson]

**Pendantgrass**

Global Rank: **G5**
Alaska State Rank: **SNR**

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce or isolated<br><br>*Arctophila fulva* is known from two estimated occurrences on the Tongass NF (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 0.62 mile (1 km). The two occurrences are in the very northwestern part of the Forest in the Yakutat Forelands in wetlands (Arctos 2025, CPNWH 2025, USFS 2025a). |
| 2<br><br>Distribution in surrounding geographic | C | C = Widely distributed outside of the Tongass NF<br><br>Global Rank: G5 (Secure), Alaska State Rank: Not ranked (NatureServe 2025)<br><br>Canadian provinces and territories: S2 (Imperiled): Manitoba, Ontario; S3 (Vulnerable): British Columbia; all others are S4 (Apparently Secure), S5 (Secure), SNR (not ranked), or not present. United States: SNR (not ranked) in Alaska (NatureServe 2025). |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| area | | *Arctophila fulva* has a circumpolar distribution (Cayouette and Darbyshire 2007). It occurs in all the northern Canadian provinces and territories, but is absent from Alberta, Saskatchewan, New Brunswick, and Nova Scotia (Cayouette and Darbyshire 2007). Within the United States, it only occurs in Alaska (Cayouette and Darbyshire 2007, NRCS 2025). Outside of southeast Alaska, the species is widely distributed in the rest of the state (Arctos 2025, CPNWH 2025). The Tongass NF records are separated from the next nearest Alaskan records by approximately 140 miles (CPNWH 2025).<br><br>To the east of the Tongass NF, *Arctophila fulva* is rare in British Columbia where it only occurs near the northern border with Yukon (Klinkenberg 2020, CPNWH 2025). The nearest records to the Tongass NF records are approximately 70 miles to the northeast in Yukon on the other side of the coast range mountains.<br><br>It is unclear if the Tongass NF occurrences are disjunct from the rest of the species' range. The coast range mountains may be a disperal barrier between the Tongass NF and the Yukon populations, while the approximately 140 miles of coastline between the Tongass NF occurrences and the next nearest Alaskan occurrences likely holds suitable habitat for the species (though also includes large bays and tidewater glaciers that could inhibit dispersal). Whether the Tongass NF occurrences are disjunct or not, they do represent the southern edge of the species' known range.<br><br>Across its range, *Arctophila fulva* is found in marshes, wet meadows, streamsides, lakes, ponds, and other habitats with saturated soils from the sub-arctic to arctic at elevations ranging from sea level to approximately 4600 feet (1400 m) (Cayouette and Darbyshire 2007, Klinkenberg 2020, CPNWH 2025).<br><br>In the northern part of the species' range in Alaska, studies show substantial decreases in *Arctophila fulva* wetlands (30% decrease in area between 1948 and 2013) and appear highly susceptible to further declines with climate warming (Miller et al 2023). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>*Arctophila fulva* is an aquatic emergent perennial grass that propagates clonally from perennial underground rhizomes, and likely also by seed, though some populations appear to not produce viable seeds (Rautiainen et al. 2004, Kreivi et al. 2005, Andreson 2015). In studies in Finland, the dispersal distance of rhizome fragments is small (Rautianen et al. 2004). The plant prefers to establish in areas with limited competition from other species, and once established, strong |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | rhizomatous growth often produces a pure stand (Kreivi 2009, Andreson 2015). Dispersal mechanisms of the species specific to Alaska were not found in a literature search. |
| 4<br><br>Abundance on Tongass NF | A | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Arctophila fulva* is known from two occurrences in the northwest part of the Tongass NF (Appendix 1). Neither occurrence has a population estimate, with the only comments being "in bands around 'islands' and patches of other aquatics" and "uncommon, scattered in patches" (Appendix 1). Given that this species is at the southern edge of its range on the Tongass NF, only has two occurrences, and has been described as uncommon, *Arctophila fulva* is likely rare on the Tongass NF. |
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>Population trends for known occurrences of *Arctophila fulva* on the Tongass NF are unknown due to lack of repeat visits to the occurrences (CPNWH 2025, USFS 2025a). |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>The habitat for the two Tongass NF occurrences of *Arctophila fulva* is a shallow lake and a wet meadow with ponds and streams on the Yakutat Ranger District. While forested and non-forested wetlands (or palustrine wetlands), and lakes are common on the Tongass NF (Turner and Mallott 2025), the two occurrences of *Arctophila fulva* on the far northern edge of the Tongass NF are at the southern edge of the known range for this species.<br><br>When undisturbed, freshwater wetlands on the Tongass NF have historically been stable ecosystems, with some persisting for thousands of years (Turner and Mallott 2025). However, landscape position, soil drainage, and hydrology are important drivers for non-forested wetlands with the level of soil saturation a factor in the species composition of a particular wetland (Turner and Mallott 2025). This would indicate that activities in the immediate vicinity that change hydrology could cause a negative habitat trend. Activities in the immediate vicinity of the two occurrences that could alter hydrology include timber harvest and roads. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Occurrence 1 is within a third of a mile of a timber project that runs along the western edge of the wetland. Several other timber projects both on and off FS land are within a few miles and upstream in the watershed that feeds the wetland where the species occurs (aerial imagery, USFS 2024d). A highway also runs through the wetland that is habitat for *Arctophila fulva* at Occurrence 1. Occurrence 2 has a road within 250 feet. Roads are vectors for invasive species including reed canarygrass, which is known to invade similar habitats to *Arctophila fulva* and is present on the Yakutat road system. |
| 7<br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Climate change is predicted to lead to increased air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress for wetland species with high soil moisture requirements such as *Arctophila fulva* (Halofsky et al 2025). Some freshwater bodies have already shrunk (Halofsky et al 2025). Declining water table depth in wetlands may allow for tree encroachment, which would alter species composition (Berg et al 2009, Halofsky et al 2025). In addition, the two occurrences on the Tongass, which are in the northern part of the Tongass NF, are at the southern edge of this species' range in western North America, which indicates that it may be disproportionately affected by warming temperatures.<br><br>Invasive plants are known to be present near both occurrences of *Arctophila fulva* on the Tongass (USFS 2025b). The habitats most vulnerable to invasion by non-native species on the Tongass NF include meadows and riparian corridors (Chestnut and Tucker 2025, Wiles and Warren 2025). Thus, the habitat for this species is vulnerable to the further spread of the invasive plants already present and others that may be introduced. The risk of introduction of additional invasive plants is higher due to nearby roads. |
| 8<br>Life history and demographics | B | **B = Life history characteristics that suggest populations have an intermediate ability to recover from disturbance events and no other demographic risk factors are known.** |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | *Arctophila fulva* is an aquatic emergent perennial grass. It has special stem tissues that allow for air conduction from the atmosphere to underwater parts (Andreson 2015). The erect, emergent stems (culms) arise from long horizontal rhizomes, and can grow up to 39.4 in (100 cm) tall (Cayouette and Darbyshire 2007, Klinkeberg 2020). The erect stems generally do not live more than two years (Kreivi 2009). It is one of the few grasses that can develop underwater aquatic leaves (Cayouette and Darbyshire 2007). As with all grasses, the flowers lack petals and sepals and instead are borne within bracts in a cluster at the ends of the stems; pollen is usually moved between plants by wind (Cayouette and Darbyshire 2007). It prefers to establish in areas with limited competition from other species, and once established, its strong rhizomatous growth often produces a pure stand (Kreivi 2009, Andreson 2015). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Arctophila fulva* within the plan area based upon the following:

- **Significant threats:** Predicted changes in water table may cause changes in species composition in wetlands. *Arctophila fulva* is an aquatic emergent so may not persist with lower water table. Studies show substantial decreases in *Arctophila fulva* wetlands in northern Alaska and appear highly susceptible to further declines with climate warming. In addition, invasive plants near both occurrences may expand further, and new invasive species could be introduced by the nearby roads.
- **Declining trends in population or habitat:** Population trends on the Tongass NF are unknown. Nearby timber harvest and road building may have impacted populations. Invasive plants are known from both of the occurrences. In the northern part of the species' range in Alaska, studies show substantial decreases in *Arctophila fulva* wetlands.
- **Restricted range:** Occurrences within the plan area represent the southernmost populations. It is unknown whether the Tongass NF occurrences are disjunct from the main range of the species.

- **Low population numbers or restricted ecological conditions:** Two occurrences are known on the plan area. They are both on the far northern edge of the Forest on the Yakutat Ranger District.
- **Other factors:** Some populations of the species appear to not produce seeds, which would greatly limit dispersal. However, dispersal mechanisms of the species specific to Alaska were not found in a literature search and it is unknown whether the Tongass NF populations produce seeds.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 0.62 mi (1 km) are grouped into estimated occurrences, which represent populations separated by more than 0.62 mi (1 km). Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **Arctos 2025, CPNWH_April2025(ALA-UAM:Herb:249846)[8/20/2013]** | **Yakutat vic., 9 Mile meadow on highway, Yakutat Quad, Tongass National Forest.** | **In large meadow with small ponds and meandering channels, patches of sedges, small shrubs and herbaceous cover.** | **Uncommon, in scattered patches.** | |
| **2*** | **USFS-TESP_Mar25 (100535P000127Y13)[6/12/2013]** | **Yakutat; Summit Lake** | **shallow lake, 1.5 + feet,with muddy/silty bottom and occassional patches of small gravel.** | **in bands around 'islands' and patches of other aquatics** | |
| 2 | CPNWH_April2025(ALA-UAM:Herb:249841)[6/12/2013] | Yakutat area, Summit Lake, Yakutat Quad, Tongass National Forest. | Emergent in shallow lake. [Also collected at same place and date Lysimachia thyrsiflora] | Uncommon in scattered patches. | |

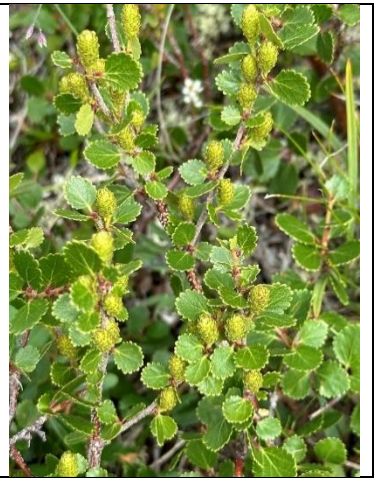
# *Betula glandulosa*

*Betula glandulosa* [Michx.]

**Tundra dwarf birch**

Global Rank: **G5**
Alaska State Rank: **SNR**

Photo: Kallum McDonald (CC0 ) (iNaturalist 2025)



**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>*Betula glandulosa* is known from one estimated occurrence on the Tongass National Forest (Tongass NF). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). This occurrence is in a calcareous fen on Chichagof Island (Appendix 1, Arctos 2025, CPNWH 2025). Calcareous fens are rare within southeastern Alaska and may be the rarest of all North American wetland types (Johnson 2006, McClellan et al 2003, Dillman 2020). |
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass National Forest.<br><br>Global Rank: G5 (Secure), Alaska State Rank: Not mapped or ranked (NatureServe 2025)<br><br>State Ranks:<br>Canadian provinces and territories: S1 (Critically Imperiled ): New Brunswick, Nova Scotia; S3 (Vulnerable): Newfoundland; all others are S4 (Apparently Secure) or S5 (Secure); United States: S1 (Critically Imperiled): Maine, New |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | York; S2 (Imperiled): California, New Hampshire; S3 (Vulnerable ): Montana; all others are S4 (Apparently Secure), SNR (not ranked), or not present in that state (NatureServe 2025).<br><br>*Betula glandulosa* is a deciduous shrubby birch that is widespread in North America and northeastern Asia. In North American it occurs in all Canadian states and territories, and in the United States it occurs in Alaska, California, Colorado, Idaho, Montana, New Mexico, Oregon, South Dakota, Utah, Washington and Wyoming (Furlow 1997, NatureServe 2025, NRCS 2025).<br><br>The *Betula glandulosa* record from the Tongass NF on Chichagof Island is the only record from the Alexander Archipelago (Arctos 2025, CPNWH 2025, Johnson 2025 pers. comm.). The nearest Alaskan records are approximately 90 miles to the north near Mt. Kashagnak and Mosquito Lake on the border with British Columbia (Arctos 2025, CPNWH 2025). To the northwest, the species occurs across most of mainland Alaska (Arctos 2025, CPNWH 2025). To the east, *Betula glandulosa* is common in British Columbia east of the Coast Range (Klinkenberg 2020). Due to the distance, intervening mountains and water bodies, and limited dispersal ability, the population is likely disjunct.<br><br>Across its range in North America, *Betula glandulosa* can be found in arctic and alpine tundra, muskegs, peat bogs, wet meadows, seeps, swamps, and riparian areas from sea level to 3400 m (Furlow 1997, Sawyer 2012, Dean 2022, Oregon Flora 2025). Yet on the Tongass NF, the one occurrence is found in a karst fen near a limestone ridge. This is one of several examples in southeast Alaska of species occurring in atypical habitats at the edge of their range or as disjunct populations associated with limestone (Johnson 2006, Johnson 2025 pers. comm.). The phenomenon of species on the edge of their ranges switching to a different habitat or soil type has been documented previously, and authors have hypothesized that the atypical habitat may provide an environment with less interspecific competition (Griggs 1914, Stanton-Geddes et al. 2012). |
| **3**<br><br>Dispersal capability | **A** | A = Very limited dispersal ability on the Tongass NF<br><br>*Betula glandulosa* produces small, winged fruits called samaras through sexual reproduction; these fruits are wind-, bird-, and water-dispersed in the fall, winter, and early spring (de Groot et al. 1997, Tollefson 2007). The large seed size (3-4 mm) is not well adapted for long-distance dispersal (Johnson 2006), and on Chichagof Island, the seeds would likely only disperse well by wind in March and April, typically the driest months of the year in southeast Alaska (Johnson 2006). |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Betula glandulosa* is known from one occurrence on the Tongass NF. Botanists have searched for additional occurrences on Chichagof Island (and elsewhere in the Tongass NF), and to date, none have been located (Johnson 2025 pers. comm.). In 2004 the occurrence covered roughly 0.05 acre; no stem count was made, because the mean canopy cover of the fen was very dense (80%) (Johnson 2025 pers. comm.). Given that there is just one occurrence, and that one occurrence covers a small area, this species is rare on the Tongass NF. |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Betula glandulosa* was observed at the one Tongass NF occurrence in 1994 and again in 2003 and 2004, but population counts were not documented (Appendix 1) (USFS 2025a). |
| **6**<br><br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>The one occurrence on the Tongass is in a limestone-influenced, rich fen (Appendix 1; Johnson 2006, Arctos 2025, CPNWH 2025, Johnson 2025 pers. comm.). This habitat type is rare on the Tongass and is also an Alaska ecosystem of conservation concern (Boggs et al. 2019, ACCS 2025).<br><br>There is a road approximately 0.2 miles from the occurrence. This road runs between the population and the limestone ridge that is the source of the limestone-enriched water that feeds the fen. Calcareous fens rely on very specific source waters with underlying carbonate geology, so any change to the source or the flow of these waters can alter the species composition (Turner and Mallott 2024).<br><br>There are several timber projects near the population, including a single-tree selection cut in 2013 within 400 feet of the population, and a stand clearcut in 1992 approximately 0.2 miles away. Karst fens frequently occur in watersheds that have been heavily managed for timber harvest and may be adversely impacted by the increased runoff after timber harvest on upgradient karst (Boggs et al. 2019). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | The invasive plant reed canarygrass (*Phalaris arundinacea*), a highly invasive grass with the potential to thrive in the calcareous fen habitat, occurs in a rock pit approximately half a mile from the *Betula glandulosa* population (USFS 2025b) and may also grow along the road closer to the population |
| **7**<br><br>Habitat vulnerability or modification; other threats | **B** | B = Habitat modification is likely to result in ecological patterns similar to the range of historical conditions but is being impacted by modern stressors.<br><br>Limestone-influenced fens are frequently found in watersheds that are heavily managed for timber harvest. These fens may be adversely impacted by increased runoff after upslope timber harvest. Additional threats include any activities that alter the balance between surface and ground water inflow and discharge such as road construction road maintenance, ditching, and gravel or rock pit excavation (Boggs 2019, Johnson 2006, McClellan et al 2003). Trampling, impacts from off-road vehicles, herbivory, and threats from invasive plants are also possible (Fulkerson et al. 2017).<br><br>The occurrence is approximately 0.2 miles from a road. This makes the population vulnerable to rapid run-off from heavy rainstorms or flooding streams when storms coincide with melting snow. The predicted increase in annual precipitation across the Tongass NF is likely to increase runoff and flooding. In addition, the proximity of this occurrence to a road renders it vulnerable to disturbance from off-road vehicles.<br><br>Additionally, southeast Alaska is expected to experience increased air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress for wetland species (Turner and Mallott 2024, Halofsky et al 2024). Although it is expected that these ecosystems will persist, there is uncertainty regarding changes in species composition (Turner and Mallott 2024). Some freshwater bodies have already shrunk (Halofsky et al 2025). Additionally, declining water table depth in wetlands may allow for tree encroachment, which would alter species composition (Berg et al 2009, Halofsky et al 2025).<br><br>The invasive plant reed canarygrass (*Phalaris arundinacea*), a highly invasive grass with the potential to thrive in the calcareous fen habitat, occurs in a rock pit approximately half a mile from the *Betula glandulosa* population. *Phalaris arundinacea* is known to establish and form monotypic stands in wetlands displacing native vegetation and altering the soil hydrology (Carlson et al. 2008) and has expanded into wetlands elsewhere in southeastern Alaska. Herbicides used to treat reed canarygrass also have the potential to be a threat to *Betula glandulosa*. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | The area where *Betula glandulosa* is located has been proposed as a special botanical and geological interest area (Dillman 2020). If approved, this status could help protect this occurrence. |
| **8**<br><br>Life history and demographics | **B** | B = Low reproductive rate<br><br>*Betula glandulosa* is a deciduous shrub to 3 m tall (Furlow 1997). It produces wind pollinated flowers in the late spring, with the staminate and pistillate flowers appearing with the leaves after snowmelt in separate inflorescences on the same shrub (de Groot et al. 1997, Furlow 1997). Plants in this species are thought to be self-incompatible, which means that the pollen produced by a plant will not produce seed on that same plant (Tollefson 2007). In more northern areas, production of viable seed is limited by the shorter growing season, lower temperatures, and distance between genetically distinct individuals (Tollefson 2007). *Betula glandulosa* can also reproduce vegetatively by underground rhizomes and branch layering. Reproduction by seed is more common in southern populations, and vegetative reproduction is more common in northern populations (Tollefson 2007).<br><br>The root system of *Betula glandulosa* can be long-lived, dating to well over 100 years old (de Groot et al. 1997). Roots are ectomycorrhizal, and this is regarded as an adaptation to arctic and alpine soils that are generally low in inorganic nitrogen and phosphorus (Tollefson 2007).<br><br>Some studies indicate that sexual reproduction in this species, including seed set and recruitment from seeds, is low (Hermanutz et al. 1989, Johnson 2006). The seed bank of *Betula glandulosa* can be extensive but short-lived, and seedling survival is often low, with young plants growing slowly (Tollefson 2007). In 2003, the germination rate of seeds from *Betula glandulosa* plants on the Tongass NF was 0.1% (Johnson 2006). |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☐ | ☐ | ☒ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

*Betula glandulosa* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats:** A highly invasive grass with the potential to thrive in the calcareous fen habitat occurs along the nearby road within half a mile of the population. The nearby road also increases the risk of other invasive species being introduced. Predicted changes in water table could cause changes in species composition in wetlands.
- **Declining trends in population or habitat:** The one known occurrence has seen upslope timber harvest and road construction; these actions may have past and ongoing impacts on the hydrology of the wetland.
- **Restricted range:**The one *Betula glandulosa* occurrence on Chichagof Island is the only record from the Alexander Archipelago. The next nearest records are approximately 90 miles to the north. Combined with low dispersal ability, it is possible that the Tongass NF occurrence is genetically isolated.
- **Low population numbers or restricted ecological conditions:**
- On the Tongass, there is one occurrence approximately .05 acres in size. The occurrence is in a limestone-influenced fen, a rare habitat type both on the Tongass and in North America.
- **Other factors:** Dispersal ability and reproduction rates are likely low.

Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |

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| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Personal Communication

Johnson, Joni. 2025. Botanist, Tongass National Forest. Email correspondence about occurrence of *Betula glandulosa* on the Tongass NF. Personal Communication 31 July 2025.

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **Johnson 2006; Johnson 2025 pers. comm. [2003 and 2004]** | **Chichagof Island. Game Creek Watershed. Adjacent to Kennel Creek Limestone Formation. [Degree, Minutes, Seconds coordinates provided by J. Johnson for this fen are in the SE1/4 of the SE1/4 of Sec18 along the N edge of Game Creek on the west side of Game Creek FS Rd.]** | **Calcareous (ave. pH 6.1-7.1), shrub fen on 3% slope, dominated by Betula glandulosa, Calamagrostis canadensis, Swertia obtusa, Viola, Dodecatheon jeffreyi, Lysichiton americanus, Symphyotrichum subspicatum, and Parnassia fimbriata. Other species present: Salix barclayi, Viburnum edule, Cornus canadensis, Rhododendron groenlandicum, Rubus arcticus, Angelica genuflexa, Achillea millefolium, Caltha leptosepala, Botrypus virginianus, Heracleum lanatum, Lysimachia europaea, Platanthera dilatata var. dilatata, Sanguisorba officinalis, Carex spp.** | **The Betula glandulosa occurrence covers roughly 0.05 acre. The observer searched for additional locations in the area (and elsewhere) and did not find any. The density is such that a stem count wasn't practicable. The mean canopy cover of the shrub fen is roughly 80% (very dense in much of the area and then more sparse on the fringes).** | |
| 1 | CPNWH_April2025(ALA-UAM:Herb:18936); Arctos 2025 [6/15/1994] | Chichagof Island, Game Creek watershed, 24 km S of Hoonah off USFS Road 8502, along the side of Kennel Cr. Limestone ridge bordering the NE side of the Game Cr. watershed, T45S, R61E, S13, NE1/4, NE1/4, Sitka Quad, Tongass National Forest. | Rich fen on 8-10 percent slope below a colluvium slope along the side of a limestone ridge. | | |

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# *Botrychium yaaxudakeit*

*Botrychium yaaxudakeit* [Stensvold and Farrar]

**Yakutat moonwort**

Global Rank: **G3G4**
Alaska State Rank: **S2**



photo: Google images

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **B** | B = Patchy OR gaps.<br><br>*Botrychium yaaxudakeit* is known from nine estimated occurrences on the Tongass National Forest (Tongass NF).. We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). Eight of these occurrences are in beach meadows on the Yakutat Forelands, and one was documented from Inian Island on the Hoonah Ranger District (USDA FS 2023, CPNWH 2023). The habitat for all these occurrences is sandy beach meadows.<br><br>*Botrychium yaaxudakeit* was described and differentiated from *B. lunaria* in 2002 (Stensvold et al 2002). |
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside of the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass National Forest.<br><br>Global Rank G3G4, Alaska State Rank S2<br><br>British Columbia Province Rank S4, Yellow List; Ontario S1, Yukon Territory S4, California S1, Montana S1, Oregon SNR, Wyoming S1 |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | *Botrychium yaaxudakeit* has been reported from Glacier Bay, near Haines and from the Wrangell-St. Elias mountains of Alaska, southwestern Yukon territory and northwestern British Columbia. It has also been found in central British Columbia, Alberta, Ontario, northwestern Montana, northeastern Oregon and east-central California (Farrar 2011, NatureServe 2023). Known locations are widely separated, and more occurrences are likely to be found in between as surveys for *Botrychium yaaxudakeit* continue (NatureServe 2025).<br><br>In coastal habitat *Botrychium* yaaxudakeit grows in beach sand deposits that are sparsely to densely vegetated. In inland locations *Botrychium yaaxudakeit* grows in grassy riverine meadows and mountain talus slopes and roadsides (IAState). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat<br><br>*Botrychiums* are homosporous so a single spore may be the founder of a new population (Peck et al. 1990, Stensvold 2007, Dauphin et al. 2014).<br><br>Plants may be trampled by human, animal or vehicular traffic, which prevents spore production for a year.<br><br>Long distance dispersal happens occasionally as evidenced by widely disjunct mountain populations. There is also evidence that moonworts are dispersed by birds, such as the arctic tern, which nests in moonwort habitat in Yakutat (Mary Stensvold, personal communication, 2014). |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare – current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>Nine beach meadow occurrences have been mapped on the Yakutat Ranger District. Two of these occurrences from the early 2000s note that the species is locally common or abundant, although the count at one site during a remeasure in 2017 was 3 plants. An additional location has been inventoried in the Inian Islands north of Chichagof Island (USDA FS 2023). Although less than half of the available beach meadow habitat on the Yakutat Ranger District has been surveyed, this species would still be considered rare if detection rates approximated those in surveyed habitat. |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>In some areas of the forelands, population numbers may be declining due to natural vegetative succession. A monitoring study was established from 1998 to 2002 and was not revisited for 15 years. *Botrychium yaaxudakeit* occurred in three monitoring plots established from 1998 to 2002. In one monitoring plot *Botrychium yaaxudakeit* was "locally common" in 1998 and 2000 but only three plants were found in 2017. In the second plot, Botrychium |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | yaaxudakeit was not detected, likely due to natural succession. In the third plot, there were twelve plants in 2017 and no record of earlier population counts (USDA 2017). It is unclear if declining populations can be assessed by this study because of the natural dynamism of suitable beach meadow or dune habitat. While the occurrences monitored declined, Botrychium species should be able to colonize new beach habitat as suitability of old habitat decreases (USDA 2017).<br><br>The known use of off-road vehicles near at least one of the populations, and increased beach recreation in general suggest a possible downward population trend due to recreation pressures (Goldstein 2009, USDA FS 2017). Plants or populations along the Yakutat beaches could be obliterated by trampling related to the increased amount of tourism and recreational use taking place in the area (Goldstein et al. 2009). |
| **6**<br><br>Habitat trend on Tongass NF | **A** | A = Decline of beach habitat quality<br><br>Within the Tongass National Forest, this species has only been found on beaches (USDA FS 2023). The Yakutat Forelands are described as Pacific Uplifted Tidal Marsh, a habitat of conservation concern described as declining due to human activity (Boggs et al. 2019).<br><br>Beach habitats are subject to modern stressors such as off-road vehicular traffic, invasive species and other recreation activities, such as outfitting and guiding. In Yakutat, the vegetated portion of the beaches is mostly protected from OHV riding by the recent Yakutat Access and Travel Management Plan. For example, three riding trails are permitted in the Blacksand spit area, where two of the ten known *Botrychium yaaxudakeit* populations are documented. Otherwise, the vegetated portions of the beaches are closed to OHV riding (Nate Catterson, personal communication, 2014). Yakutat has approximately fifty miles (80 kilometers) of beaches and much of the beach meadow habitat is not disturbed by humans.<br><br>Vegetative succession also represents a decline of beach habitat quality, as this species occurs in sparsely vegetated habitat. Beaches in Yakutat shift and change dramatically, resulting in dynamic and heterogenous patterns of vegetative succession. The monitoring study noted evidence of succession from bare dunes to herbaceous meadow to closed canopy forest within suitable beach habitat on the Yakutat (USDA FS 2017). Succession processes may have been accelerated by isostatic rebound, which has resulted in the rising of coastline, altering hydrology and disconnecting habitats from coastal influence (Boggs et al. 2019). It is unknown whether plants can respond to these changes and disperse into suitable habitat created through isostatic rebound. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **7**<br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification has occurred or is anticipated with conditions departing from expectations based on NRV; habitat impacted by modern stressors.<br><br>The Yakutat Forelands are classified as Pacific Uplifted Tidal Marsh, which is considered a vulnerable habitat (S3) within the state of Alaska (Boggs et al. 2019). Primary threats include development and human activity.<br><br>Additionally, isostatic rebound and sea level rise will alter coastlines in Southeast Alaska. In Yakutat, sea level drop is predicted to drop 1.8 meters by 2108 after accounting for both sea level rise and the high rates of isostatic rebound seen in the Yakutat Peninsula (Johnson et al. 2019). It is unknown whether plants can respond to these changes and disperse into suitable habitat created through isostatic rebound.<br><br>Upper beach meadow habitat is vulnerable to modification by OHV traffic and other recreation, including outfitting and guiding. While these impacts can be regulated, current management practices have allowed significant damage to the beach meadows in the Yakutat forelands. Invasive species pose a long-term threat to habitat; at present their impact appears to be minimal in most areas and through active weed prevention and treatment programs on the Yakutat district, the impacts to the beach habitat is expected to remain low.<br><br>Beach habitat in general is dynamic, and vulnerable to severe erosion caused by winter storms or natural geomorphic processes. One suspected deleterious consequence of climate change is the indirect effect of an increase in storm intensity and/or frequency, resulting in higher wind speeds and larger storm swells accelerating coastal erosion (Halofsky et al. in draft). Such conditions, and associated erosion events, pose a continued threat to Yakutat beach meadow habitats. Stochastic events such as tsunami or storms could imperil the plant's existence along shorelines (Goldstein et al. 2009). |
| **8**<br>Life history and demographics | **B** | B = Low reproductive rate<br><br>Moonworts typically have a low reproductive rate, especially where suitable habitat is patchy. Some beach meadow habitats may create ideal conditions for a relatively high reproductive rate, but these areas are also more vulnerable to disturbance (Goldstein et al. 2009). |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☐ | ☐ | ☒ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Botrychium yaaxudakeit* within the plan area based upon the following:

- **Significant threats**: Beach habitat for this species is subject to modern stressors, the largest of which is off-road vehicle traffic in the Yakutat area. Other stressors include invasive species and other recreation activities, such as outfitting and guiding.
- **Declining trends**: Beach meadow habitat is susceptible to changes from isostatic rebound, tectonic uplift, and tectonic down-warping, which may result in habitat alteration occurring at a pace that is too rapid for plants to colonize new potential habitat. In addition, vegetative succession has caused declines in some beach habitat quality, as this species occurs in sparsely vegetated habitat.
- **Restricted range**: On the Tongass National Forest, *Botrychium yaaxudakeit* is only known to beach meadows in the Yakutat area. The species range continues North to Glacier Bay and Wrangell St Elias National Park and south to British Columbia.
- **Low population numbers or restricted ecological conditions**: Although it is speculated that additional occurrences will be found in subalpine and alpine habitats, the species is known from nine occurrences in the Yakutat Forelands and one in the Inian islands. The Yakutat Forelands are described as Pacific Uplifted Tidal Marsh, a habitat of high conservation concern.
- **Other factors**: It is unknown whether other factors exist that could impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |

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| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| 1 | TESP_Sept25 (100532PT00001) [6/3/2008] | Inian I Mosquito Cove | | | |
| 1 | ACCS_Mar25 (EO2)[6/03/2008] | Tongass National Forest | | NA | NA |
| 2 | TESP_Mar25 (100535P000010)[7/25/1999] | Yakutat, Dry Bay, NW mouth, on spit | | | |
| 2 | ACCS_Mar25 (EO4)[7/25/1999] | Tongass National Forest, DRY BAY STENSVOLD 7646 | | | |
| 3 | ACCS_Mar25 (EO6)[7/24/1999] | Tongass National Forest, AKWE BACKDUNE MEADOW STENSVOLD 7630 REV | | | |
| 3 | TESP_Mar25 (100535P000014)[7/4/1999] | | | | |
| 3 | TESP_Mar25 (100535P000014)[7/26/2017] | Yakutat, Akwe River Spit, near landing strip | | | |
| 4 | TESP_Mar25 (100535P000060)[7/25/2017] | Yakutat, Blacksand Spit North, near ATV trail | | 12 plants | |
| 4 | TESP_Mar25 (100535P000060)[7/20/2002] | Yakutat, Blacksand Spit North, near ATV trail | | | |
| 4 | ACCS_Mar25 (EO6)[7/24/2004] | Yakutat forelands, Blacksand Spit, ca. 7 km SE of Situk Land, just SE of the trail running from the inside of the spit to the ocean | open sand with little vegetation | | |
| 4 | ACCS_Mar25 (EO5)[7/20/2002] | Tongass National Forest, NEAR BLK N PLOT STENSVOLD 8057 | | | |
| 4 | TESP_Mar25 (100535P000123)[8/16/2011] | Yakutat, Blacksand Spit North, near ATV trail | Sandy upper beach meadow behind beach berm dune. Veg fairly sparce | 1 plant | Plant is 2 ft from atv trail |
| 4 | ACCS_Mar25 (EO6)[8/16/2011] | Tongass National Forest | | | |
| 4 | CPNWH_April2025(ALA)[7/24/2004] | Yakutat forelands, Blacksand Spit, ca. 7 km SE of Situk Land, just SE of the trail running from the inside of the spit to the ocean, Yakutat Quad. | Open sand with little vegetation. Growing with Leymus mollis, Fragaria chiloensis, Festuca rubra, Moehringia lateriflora, Castilleja ulaschcensis, Anemone multifida, | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | Achillea sp, and Oxytropis campestris | | |
| 5 | ACCS_Mar25 (EO8)[7/20/2002] | Tongass National Forest, BLACSAND 1.5 MI NW STENSVOLD 8064 | | | |
| 5 | TESP_Mar25 (100535P000054)[7/20/2002] | Yakutat, Blacksand Spit N, 1 mi N of ATV trail | | | |
| 6 | ACCS_Mar25 (EO7)[no date] (Biotics Database) | 2 miles south of the Yakutat airport on the end of Broken Bridge Road. | | | |
| 7 | ACCS_Mar25 (EO9)[1/01/1996] | CANNON BEACH | | | |
| 8 | ACCS_Mar25 (EO14)[no date] | 50 m east of upper beach meadow, Coast Guard Beach, Yakutat | | | |
| 8 | ACCS_Mar25 (EO12)[no date] | On a 300' spur road branching from the WWII road through the forest paralleling the beach between Cannon Beach and the Coast Guard Beach | | | |
| 9 | ACCS_Mar25 (EO13)[7/14/1998] | Yakutat Foreland, Ankau R. mouth and saltchucks, about 5 km W of downtown Yakutat, just E of Ankau Cemetary, Phipps Peninsula about 1.5 km SE of Pt. Carrew, just N of the mouth of Ankau R. and saltchucks | on sandy substrate near sandy beach/shrubby zone ecotone | Locally common | |
| 9 | ACCS_Mar25 (EO13)[8/01/2000] | Yakutat Foreland, Ankau R. mouth and saltchucks, about 5 km W of downtown Yakutat, just E of Ankau Cemetary, on Phipps Peninsula about 1.5 km SE of Pt. Carrew, just N of the mouth of Ankau R. and saltchucks | on sandy substrate near sandy beach/shrubby zone ecotone | Locally common | |
| 9 | ACCS_Mar25 (EO11)[no date] | ANKAU CEMETARY BEACH | | | |
| 9 | ACCS_Mar25 (EO15)[7/25/2001] | Yakutat Foreland, Ankau R. mouth and saltchucks, about 5 km W of downtown Yakutat, just E of Ankau Cemetary, on Phipps Peninsula about 1.5 km SE of Pt. Carrew, just N of the mouth of Ankau R. and saltchucks | On sandy substrate near sandy beach/shrubby zone ecotone. With scattered Fragaria chiloensis, Lupinus nootkatensis, Festuca rubra, Achillea millefolium, Leymus mollis, Oxytropis campestris, and Rhinanthus crista-galli, and other Botrychium species. | | |
| 9 | ACCS_Mar25 (EO15)[7/17/1980] | Yakutat, about 3 miles west of town on eastern Phipps Peninsula just north of Ankau River, near Ankau Cemetary | growing in disturbed area along the road, sandy beach ecotone | | |
| 9 | ACCS_Mar25 (EO15)[no date] | about 5 km W of downtown Yakutat just E of Ankau Cemetary on Phipps Peninsula about 1.5 km SE of Pt. Carrew just N of the mouth of Ankau R. and saltchucks | | | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | ACCS_Mar25 (EO15)[no date] | about 5 km W of downtown Yakutat just E of Ankau Cemetary on Phipps Peninsula about 1.5 km SE of Pt. Carrew just N of the mouth of Ankau R. and saltchucks | | | |
| 9 | ACCS_Mar25 (EO15)[no date] | about 5 km W of downtown Yakutat just E of Ankau Cemetary Phipps Peninsula about 1.5 km SE of Pt. Carrew just N of the mouth of Ankau R. and salt chucks | | | |
| 9 | ACCS_Mar25 (EO15)[7/14/1998] | Tongass National Forest, ANKAU FIRST FARRAR VISIT STENS7272 | | | |
| 9 | TESP_Mar25 (100535P000022)[7/14/1998] | | | | |
| 9 | TESP_Mar25 (100535P000036)[7/28/2017] | Ankau Beach New | | 3 | |
| 9 | TESP_Mar25 (100535P000036)[ 7/21/2002] | Yakutat, Ankau Beach | | Notes say abundant | |
| 9 | ACCS_Mar25 (EO15)[7/21/2002] | Tongass National Forest, ANKAU PLOT 2 | | | |
| | Not on Tongass NF | | | | |
| 1 | ACCS_Mar25 (EO3)[6/03/1997] | On mainland, north of west end of Pleasant Island. Icy Strait. Gustavus, near tanks and docks. | Gentle south aspect, low sand dunes, outwash plain | | |

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# *Crassula aquatica*

*Crassula aquatica* [(L.) Schoenl.]

**Water pygmy weed**

Global Rank: **G5**

Alaska State Rank: **S1S2**



photo: Keir Morse

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>*Crassula aquatica* is known from two estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The two occurrences are both near Chief Shakes Hot Springs on the Stikine River (USDA FS 2023, ANHP ACCS 2023, CPNWH 2023). One is described as growing in hot springs, the other in a wet meadow associated with a warm stream. |
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass National Forest.<br><br>British Columbia Province Rank S4, Yellow List; Yukon Territory S1, not ranked in Washington, Montana, Idaho, Oregon, or California.<br><br>*Crassula aquatica* is a circumpolar species. In Alaska, outside of the Tongass NF occurrences, *Crassula aquatica* is also known to occur infrequently on the Kenai and Alaska Peninsulas (CPNWH 2023, Carlson et al. 2004). While *Crassula aquatica* is infrequent and widely scattered in both Canada and Alaska (FNA 2020, Klinkenberg 2023), it is more common across portions of its circumpolar range that extends across Iceland and Eurasia, and south to California and Mexico (NatureServe 2023, Klinkenberg 2023). There were 57 known occurrences of *Crassula aquatica* in British |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Columbia when assessed in 2021, 37 of which were considered extant (BCCDC 2021). The Tongass NF locations are approximately 201 kilometers (125 miles) from the nearest herbarium record in British Columbia.<br><br>Although the Tongass NF records are associated with hot springs, this habitat trait is not shared for other known occurrences of this species across its range (CPNWH 2023). Other occurrences in south-central Alaska are associated with tidal marshes and brackish water (Carlson et al. 2004). Outside of Alaska, its habitat is described as wet vernal pools and mudflats in the lowland zone (Flora of British Columbia) and coastal marshes and brackish mudflats, vernal pools, and muddy margins of ponds and streams (Flora of North America).<br><br>Although threats are not widely documented, and data are insufficient to understand scope and severity, *Crassula aquatica* is likely threatened across its range by development, water diversion, alteration of hydrology, erosion, recreational activities, invasive species, flooding, and other threats (NatureServe 2023). |
| **3**<br><br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Crassula aquatica* is a small annual species. The fruit is a small follicle or a dry pod that opens along one slit and contains 6-12 seeds.<br><br>Dispersal mechanisms specific to *Crassula aquatica* could not be found in the scientific literature, but some species of *Crassula* have disjunct distributions that may be due to long-distance dispersal by birds (Bywater and Wickens 1984). |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>The two known locations of *Crassula aquatica* on the Tongass NF are both known to Chief Shakes Hot Springs. Population numbers for these locations are unknown (USDA FS 2023). |
| **5**<br><br>Population trend on | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Population trends for the two documented occurrences are unknown (USDA FS 2023). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| Tongass NF | | |
| **6**<br>Habitat trend on Tongass NF | **B** | B = Stable amounts of suitable or potential habitat, relatively unchanged habitat quality.<br><br>The two known locations on the Tongass NF at Chief Shakes Hot Springs are associated with hot springs and a wet meadow along a warm stream (CPNWH 2023, ANHP ACCS 2023). These springs are part of the Geothermal Springs Biophysical Setting, which is restricted to 150 locations across the state (Boggs et al. 2019). However, the ecosystem type was determined to be relatively secure (Boggs et al. 2019).<br><br>There is no evidence of an overall declining trend in geothermal spring habitat in Alaska. The Geothermal Spring Biophysical setting was assigned an S4 rank, indicating that it is relatively secure (Boggs et al. 2019). Threats to geothermal springs include development for recreation, energy, or agriculture (Boggs et al. 2009). Unlike more remote geothermal springs, the Chief Shakes Hot Spring complex has been developed for recreational use and is popular among local public users. Development consists of several elevated structures, decks, and boardwalks that largely leave the meadow beneath intact. There are also trails associated with the site, which is accessed by boat from the Stikine River (Houser, personal communication, 2023).<br><br>Hydrology at the Chief Shakes hot springs complex varies widely by year, with meadows sometimes dry and grassy, and in other years flooded. Beaver are also part of this system, with water ponding behind dams and sometimes spilling over (Houser 2023).<br><br>Habitat for other occurrences of *Crassula aquatica* in Alaska is described as tidal marsh or brackish water habitat (Carlson et al. 2004); these habitats are broadly distributed across the Tongass National Forest. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Primary threats to known locations at Chief Shakes Hot Springs include recreation and maintenance activities, changes to hydrology, and invasive species. One known location is twenty feet from a developed geothermal pool, suggesting it may be vulnerable to recreational impacts. While there are no plans for future development at the Chief Shakes Hot Springs complex, maintenance activities are proposed to reconstruct decking around the pools. While these construction actions would not change the resulting footprint of development, there may be ground-disturbing activities in the vicinity of pools (Houser 2023). Habitat at the location that is 20 feet from pools would be vulnerable to ground-disturbing activities.<br><br>Changes to hydrology could alter the competitive dynamics where *Crassula aquatica* currently occurs. It is unknown whether potential climate change effects to meadow habitat for *Crassula aquatica* would be outside of the historic range of variability for this species, which is adapted to dynamic hydrologic conditions but may not fare well if habitat is subsequently re-flooded (Mork et al. 2018 in MDNR DEWR 2022). This species has also been noted in Minnesota to compete poorly with perennial vegetation that may establish under stable water levels that do not fluctuate (MDNR DEWR 2022). Wetland and riparian vegetation on the Tongass NF may be vulnerable to drying or successional changes with predicted temperature increases (Halofsky et al 2025). In addition, the timing and volume of river flows is predicted to change along with changes to the proportion of precipitation falling as rain, which may impact site hydrology (EcoAdapt 2014) due to the site's proximity to the Stikine River.<br><br>Wetland and riparian potential habitat is also vulnerable to invasion by non-native species like reed canarygrass (*Phalaris arundinacea*) (Huette et al. 2003). The invasive plant reed canarygrass and herbicide treatments are recorded near Chief Shakes Hot Springs. Both the invasive grass and herbicide treatments are potential threats to *Crassula aquatica* (USDA FS 2023).<br><br>General threats to other potential habitat within the Geothermal Spring Biophysical setting include recreation, agriculture, and energy development (Boggs et al. 2019). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **8**<br><br>Life history and demographics | **B** | B = Low reproductive rate or high mortality (e.g., susceptible to disease, predation, or competition), but not both; OR life history characteristics that suggest populations have an intermediate ability to recover from disturbance events and no other demographic risk factors are known.<br><br>*Crassula aquatica*, an annual plant and wetland obligate, roots in the bottom sediments of shallow water. Flowers are pollinated by small flying insects. As an annual species, each year's population is dependent upon successful seed production in preceding years, a well-stocked seed bank, and suitable environmental conditions (MDNR DEWR 2022). Seeds can survive in the soil seed bank for many years, though precise data on longevity are lacking. One study in Sweden estimated seed density of 51,000 per square meter (Milberg and Stridh 1994 in MDNR DEWR 2022). Germination is rapid when moisture conditions become ideal, usually within 2-3 days (Bliss and Zedler 1998 in MDNR DEWR 2022).<br><br>In Minnesota, *Crassula aquatica* has been found to survive with no loss of vigor when the water level decreases and exposes plants above water level, but does not fare well if habitat is subsequently re-flooded (Mork et al. 2018 in MDNR DEWR 2022). This species has also been noted in Minnesota to compete poorly with perennial vegetation that may establish under stable water levels that do not fluctuate (MDNR DEWR 2022).<br><br>Some degree of disturbance tolerance is indicated by one herbarium specimen from the Kenai Peninsula that states plants are growing in disturbed soils (CPNWH 2023), and Flora of the Pacific Northwest describes habitat to include reservoir margins. |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

This species is recommended as a Species of Conservation Concern based upon the following rationale:

- **Significant threats** – The two occurrences on the Tongass NF are in a developed geothermal location at Chief Shakes Hot Springs. One of these locations is located twenty feet from a developed pool, which increases the potential for adverse impacts from recreational use or maintenance of buildings, decks and boardwalks. The invasive plant reed canarygrass (*Phalaris arundinacea*) and herbicide treatments are recorded near Chief Shakes Hot Springs. Both the invasive grass and herbicide treatments are potential threats to *Crassula aquatica*.
- **Declining populations or habitat trends** – Population trends for the two documented locations of *Crassula aquatica* on the Tongass NF are unknown. The two known locations on the Tongass NF at Chief Shakes Hot Springs are associated with hot springs and a wet meadow along a warm stream. There is no evidence of an overall declining trend in geothermal spring habitat in Alaska.
- **Restricted range** – The two known locations on the Tongass NF are described from a single locale at Chief Shakes Hot Springs along the Stikine River. These locations are disjunct from the closest occurrence in British Columbia by over 201 kilometers (125 miles).
- **Low populations or restricted ecological conditions** – The two known records on the Tongass are limited to Chief Shakes Hot Springs. Additional potential habitat occurs also in Pacific tidal marshes, although no occurrences have been documented in those habitats on the Tongass NF.

Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1** | **ACCS_Mar25 (EO1)[7/30/1993]** | **Coast Mts, Chief Shakes Hot Springs** | **growing in hot springs** | **NA** | **NA** |
| 1 | ACCS_Mar25 (EO0)[7/30/1993] | Coast Mts, Chief Shakes Hot Springs, Petersburg Quad, Tongass tiol Forest.Â | Growing in hot springs. | | |
| 1 | CPNWH_April2025(ALA)[7/30/1993] | Coast Mts, Chief Shakes Hot Springs, Petersburg Quad, Tongass tiol Forest. | Growing in hot springs. | | |
| **2** | **ACCS_Mar25 (EO1)[no date]** | **Warm stream, 20 meters east of open air tub, . Chief Shakes Hot Springs on the Stikine River. Survey site #R93-22.** | **in wet meadow** | | |

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# *Cypripedium montanum*

*Cypripedium montanum* [Douglas ex Lindl.]

**Mountain lady's slipper**

Global Rank: **G4**
Alaska State Rank: **S1**



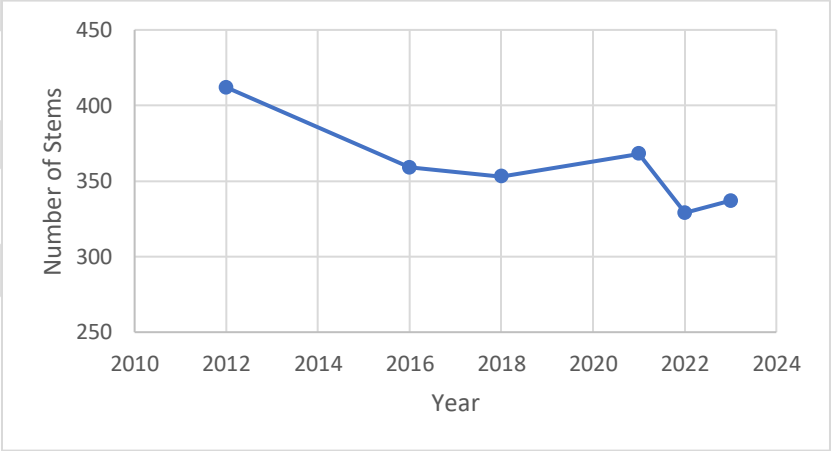
photo: Susan McDougal

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Population is naturally distributed as isolated patches, with limited opportunity for dispersal among patches.<br><br>*Cypripedium montanum* is known from one estimated occurrence on the Tongass National Forest (Tongass NF). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The occurrence is in a calcareous fen on Etolin Island (Appendix 1, USDA FS 2023, CPNWH 2023, Fulkerson et al. 2017). Calcareous fens are rare within southeastern Alaska and may be the rarest of all North American wetland types (Johnson 2006, McClellan et al 2003).<br><br>One historic occurrence from the Stikine River, mistakenly thought to be on the Tongass, was searched for in 2014 near the Alaska/Canada border but the population was not located (Fulkerson et al. 2017). |
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF.<br><br>Global Rank G4, Alaska State Rank S1<br>British Columbia Province Rank S4S5, Yellow List; California S4, Idaho SNR, Montana S4, Oregon S3S4, Washington SNR, Wyoming S2, Alberta S2, British Columbia S4S5, Saskatchewan S1<br><br>*Cypripedium montanum* is known from California north through British Columbia and Southeast Alaska, and east to Saskatchewan, Wyoming, Idaho, and Montana. The Tongass population is near the northern edge of the species' range |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | and is approximately 130 miles from the next closest occurrence (in British Columbia near Telegraph Creek) (CPNWH 2023).<br><br>Most occurrences in Alaska are in or near Glacier Bay National Park, over 200 miles from the Etolin Island population. Nearly all the Glacier Bay collections are from areas influenced by limestone (Fulkerson et al. 2017).<br><br>Habitat across its range is a variety of montane forest and transitional habitats, including dry to moist open coniferous forest and sometimes deciduous forest (Luer 1975, Cribb 1997, Sheviak 2002 in Fulkerson et al. 2017).<br><br>Across its range, *Cypripedium montanum* populations are thought to be declining (50% to 75% decrease) (Vrilakas 2002). Unspecified anecdotal reports and herbarium records indicate that there were more occurrences in western Oregon than there are today (Siddall et al. 1979, Meinke 1982). Some populations in California cannot be relocated, and this is attributed to habitat loss (Coleman 1995). The decline outside of Alaska is thought to be gradual over the last century due to factors that include fire suppression, grazing and trampling by livestock, land use practices (e.g., logging, agriculture, urbanization), and collecting (Fulkerson et al. 2017). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>*Cypripedium montanum* is a rhizomatous perennial that can reproduce clonally and sexually. For sexual reproduction, it relies on pollinators such as small, solitary bees (Fulkerson et al. 2017, Bernhardt et al. 2014). Flies have been observed as potential pollinators exiting *Cypripedium montanum* flowers in Alaska (Fulkerson et al. 2017). It is thought that out-crossing with other individuals is the primary mating system of *Cypripedium montanum* (Edens-Meier et al. 2010).<br><br>While there is little information on the seeds of *Cypripedium montanum*, similar *Cypripedium* species have dust-like seeds, that are very light and disperse easily by wind or water (Arditti 1967). However, seeds lack an endosperm and require a specific mycorrhizal fungus to germinate and grow (Arditti 1967, Wells 1981, Doherty 1997 in Fulkerson et al. 2017). The presence of the appropriate mycorrhizal fungi on the landscape is likely a limiting factor in the establishment of this plant, as many orchids have distinct mycorrhizal communities (McCormick and Jacquemyn 2014). *Cypripedium* species are completely mycotrophic for several years after germination, existing in a subterranean condition. Immature plants rely on the fungus for water and nutrition until sufficient growth occurs and enough stored energy accumulates to allow leaf production (Rasmussen 1995 in Fulkerson et al. 2017). |
| **4** | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment. |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| Abundance on Tongass NF | | There is one occurrence on the Tongass NF. This site has been revisited several times and counts over the last decade have estimated the population at approximately 300-400 stems (USDA FS 2023).<br><br>Because this species is restricted to one location on the Tongass National Forest, the risk of extirpation or population viability loss from natural disturbances or human activities is high (Fulkerson et al. 2017). |
| **5**<br><br>Population trend on Tongass NF | **A** | A = Significant downward or suspected downward population trend.<br><br>The population was estimated at 75-100 plants when it was first discovered in 2006. In June of 2011 an initial count of 188 stems was made, but a visit later that same year discovered more plants and estimated the population to be closer to 300 stems. Counts in later years have been in the 300-400 range (412, 359, 353, 368, 329, and 337 in 2012, 2016, 2018, 2021, 2022, and 2023 respectively – see figure below). Based on these numbers, the population appears to have a downward trend. However, there have been challenges with the monitoring protocol. These challenges include dormancy periods, inconsistent protocol, and potential for not detecting vegetative plants during surveys (USDA FS 2023, Fulkerson et al. 2017, USDA FS 2018).<br><br>  |
| **6**<br><br>Habitat trend | **A** | A = Decline in habitat quality or quantity.<br><br>The one occurrence of *Cypripedium montanum* on the Tongass has a road that runs approximately 100 feet from the edge of the population. This road runs between the population and the limestone ridge that is the source of the |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| on Tongass NF | | limestone-enriched water that feeds the fen. Calcareous fens rely on very specific source waters with underlying carbonate geology, so any change to the source or the flow of these waters can alter the species composition (Turner and Mallott 2024). The road was built in the early 1980s, while the orchid population wasn't discovered by a botanist until 2006, and a comprehensive population count wasn't made until 2012. Therefore, it is unclear to what extent the construction of the road impacted the habitat and population before monitoring began.<br><br>A stand clearcut occurred in 1986 approximately 80 feet from the occurrence. Karst fens frequently occur in watersheds that have been heavily managed for timber harvest and may be adversely impacted by the increased runoff after timber harvest on upgradient karst (Boggs et al. 2019).<br><br>The invasive plant reed canarygrass (*Phalaris arundinacea*), a highly invasive grass with the potential to thrive in the calcareous fen habitat, occurs along the nearby road within half a mile of the *Cypripedium montanum* population. Reed canarygrass on the Etolin island road system has been treated extensively with herbicide, which, if not used carefully, also has the potential to impact the orchid population.<br><br>Signs of insect and ungulate herbivory and minor trampling (likely from deer) have been noted in most years that the population has been visited (USDA FS 2023). |
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Limestone-influenced fens are frequently found in watersheds that are heavily managed for timber harvest. These fens may be adversely impacted by increased runoff after upslope timber harvest. Additional threats include any activities that alter the balance between surface and ground water inflow and discharge such as road construction road maintenance, ditching, and gravel or rock pit excavation (Boggs 2019, Johnson 2006, McClellan et al 2003). Plant collection, trampling, impacts from off-road vehicles, herbivory, and threats from invasive plants are also possible (Fulkerson et al. 2017, Goldstein et al. 2009).<br><br>The Etolin Island occurrence is located less than fifty meters off Forest Service Route 6545 and 15 meters downstream of a culvert. This makes the population vulnerable to rapid run-off from heavy rainstorms or flooding streams when storms coincide with melting snow (Fulkerson et al. 2017). The predicted increase in annual precipitation across the Tongass NF is likely to increase runoff and flooding. In addition, the proximity of this occurrence to a road renders it vulnerable to |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | collection by orchid collectors, as well as disturbance from off-road vehicles (Fulkerson et al. 2017). *Cypripedium* species historically have experienced extensive collection, causing critical declines in some populations (Cribb and Sandison 1998 in Fulkerson et al. 2017).<br><br>Additionally, southeast Alaska is expected to experience increased air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress for wetland species (Turner and Mallott 2024, Halofsky et al 2024). Although it is expected that these ecosystems will persist, there is uncertainty regarding changes in species composition (Turner and Mallott 2024).<br><br>Eight non-native species occur within three kilometers of the *Cypripedium montanum* population with *Phalaris arundinacea* (reed canarygrass) having the greatest Invasiveness Rank. *Phalaris arundinacea* is known to establish and form monotypic stands in wetlands displacing native vegetation and altering the soil hydrology (Carlson et al. 2008) and has expanded into wetlands elsewhere in southeastern Alaska. *Phalaris arundinacea* poses a threat to sensitive wetland species and has the potential to establish at the Etolin Island population due to the wet meadow habitat that *Phalaris arundinacea* is associated with and the proximity of the road. The proximity of the Forest Service Road to the *Cypripedium montanum* Etolin Island population increases the chance of invasion of any non-native species because roads commonly serve as vectors for their spread (Fulkerson et al. 2017). |
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>Average floral life span is three weeks, and average fruit set of nectarless orchids like *Cypripedium montanum* is 20% (Lipow 2002),<br><br>Growth rate is slow. A total of 8-16 years may elapse between seed germination and flowering (Curtis 1939).<br><br>Little is known about the demography of this species, due to dormancy in some years and difficulty in distinguishing between genetically distinct and genetically identical stems (Fulkerson et al. 2017, Kaye 1999). Although there are few demographic monitoring data, potential causes for failure to recruit seedlings include pollination limitation, seed inviability, seedling predation, and long maturation period before emergence (Curtis 1943). The spatial disjunction of the |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Tongass National Forest occurrence likely restricts gene flow and the distribution of genetic variation over time, although this has not been studied (Fulkerson et al. 2017). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Cypripedium montanum* within the plan area based upon the following:

- **Significant threats:** Significant threats to habitat on the Tongass include road construction and maintenance as well as other activities that alter hydrology including upslope timber harvest. Other threats include increased stormwater run off, invasive plants, herbicide treatments, plant collecting, and disturbance from off-road vehicles. Outside of Alaska threats to the species include fire suppression, grazing and trampling by livestock, land use practices (e.g., logging, agriculture, urbanization), and collecting.
- **Declining trends in population or habitat:** The one known location has seen upslope timber harvest and road construction; these actions may have past and ongoing impacts on the hydrology of the wetland. In addition, the existence of the road increases the risk of invasive species encroachment, as well as off-road motorized and non-motorized use. A highly invasive grass with the potential to thrive in the calcareous fen habitat occurs along the nearby road within half a mile of the population. While the monitoring protocol has had challenges, the Tongass occurrence may be experiencing a downward trend. Across its range, *Cypripedium montanum* populations are thought to be declining.
- **Restricted range:** The one occurrence on the Tongass is approximately 130 miles from the nearest population in British Columbia and over 190 miles from the nearest population in Alaska. This occurrence is also near the northern edge of the range for the species.
- **Low population numbers or restricted ecological conditions:** On the Tongass, there is one occurrence with approximately 300-400 individuals. The occurrence is in a limestone-influenced fen, a rare habitat type both on the Tongass and in North America.

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**Other factors:** *Cypripedium montanum* seeds are thought to be easily dispersed, however the species requires infection with specific mycorrhizal fungi for germination success, and the presence of the appropriate mycorrhizal fungi on the landscape is likely a limiting factor in the establishment of this species. Under favorable conditions, seeds will germinate within a year, but above-ground shoots may not appear for several years. In addition, the growth rate is slow, with 8 to 16 years between germination and flowering.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| 1 | ACCS_Mar25 (EO1)[8/24/2006] | Tongass National Forest, VY EIS, Etolin Isl, Kindergarden L outside | in limestone influenced wet cmplx | | |
| 1 | ACCS_Mar25 (EO1)[8/24/2006] | Alexander Archipelago, Etolin I., E of Kindergarden Lake | Sphagnum wetland with limestone-influenced water | | |
| 1 | TESP_Mar25 (100522P000036)[5/30/2023] | | | | |
| 1 | ACCS_Mar25 (EO1)[8/30/2011] | Tongass National Forest | | | |
| 1 | ACCS_Mar25 (EO1)[6/01/2011] | Tongass National Forest | Slope = 1; Aspect= 64 ; Substrate= ; Parent Material= Lacustrine Sediments; Soil Moisture= Moist; Light Exposure= Full Shade; | | |
| 1 | TESP_Mar25 (100522P000036)[no date] | | Habitat is a CAAQD poor fen surrounded by string muskegs and low-productivity mixed-conifer forest. pH of the soil within the population ~7.5. There is no visible upwelling. It appears the fen is fed from the draige. Forest Plant Ass PICOC/CASI. | | |
| 1 | CPNWH_April2025(ALA)[8/24/2006] | Alexander Archipelago, Etolin I., E of Kindergarden Lake, Petersburg Quad, Alexander Archipelago. | Sphagnum wetland with limestone-influenced water, abundant. | | |
| 2 | ACCS_Mar25 (EO2)[7/01/1929] | on the Stikine River, near the mouth of the Clearwater, a short distance east of the Alaska boundary. | Not on Tongass NF | | |

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# *Cypripedium parviflorum* var. *pubescens*

*Cypripedium parviflorum* var. *pubescens*
[(Willd.) O.W. Knight]

**Yellow lady's slipper**

Global Rank: **G5T5**
Alaska State Rank: **S1**



photo: Thomas Barnes

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Scarce or isolated.<br><br>*Cypripedium parviflorum var. pubescens* is known from four estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). All of the occurrences are on the northern end of Prince of Wales Island.<br><br>Habitat for these occurrences is karst fen roadside or exposed calcareous slope on northwestern Prince of Wales Island (USDA FS 2023). All occurrences are in or adjacent to (<800 ft) mapped karst. Three locations are adjacent to the mainline road to the north end of the island (USDA FS 2023).<br><br>The Karst Fen Biophysical Setting is described as imperiled in the state (S2) and is considered to be the rarest wetland type in North America (Boggs et al. 2019). On the Tongass NF, this uncommon wetland type is found in low- to mid-elevation hydrologic discharge zones below limestone outcrops and ridges and likely other settings where the groundwater sources are in contact with carbonate terrain (Boggs et al. 2019). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **2**<br><br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF.<br><br>Global Rank G5T5, Alaska State Rank S1<br>British Columbia Province Rank S5?, Yellow List; Ranked in 10 additional Canadian territories and 25 additional states.<br><br>Although *Cypripedium parviflorum* is widely distributed across the United States and Canada (NatureServe 2023), other known populations of the variety *pubescens* are quite disjunct from Southeast Alaska (Klinkenberg 2014). There are a handful of known locations in interior British Columbia, west of Fort Nelson (approximately 560 kilometers, (350 miles) from the known sites on the Tongass) and southeast of Kamloops (approximately 1,200 kilometers (750 miles) from the known sites on the Tongass) (Klinkenberg 2014).<br><br>*Cypripedium parviflorum* var. *pubescens* is found across a broad range, but range-wide there are very few reports of large, demonstrably secure populations. All reported populations contain less than 400 individuals, and most contain less than 30 plants (NatureServe 2023).<br><br>Preliminary analysis of DNA from populations across western North America found that Alaska populations of *Cypripedium parviflorum* had the greatest genetic variation and the greatest genetic distance from other populations in western North America. This suggests that there may have been a coastal refugium from glaciation that gave rise to the Alaska populations, but which contributed little to recolonization of other regions. This underscores the importance of the Tongass National Forest populations to the conservation of genetic diversity (McCormick 2018). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>*Cypripedium parviflorum* var. *pubescens* is a rhizomatous perennial forb that reproduces clonally and sexually. Seeds of *Cypripedium parviflorum* are very small, with 7,000 seeds per fruit (Light and MacConaill 1998). Similar *Cypripedium* species also have dust-like seeds. The seed size and morphology are consistent with wind-dispersal (Mergen 2006 in Carlson and Fulkerson 2017).<br><br>While the seeds of *Cypripedium* species may disperse easily by wind and water, they lack an endosperm and thus require symbiotic mycorrhizal relationships for germination and growth. Suitable habitats with the mycorrhizal fungi |

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<table>
<tr><th>Criteria</th><th>Rank</th><th>Rationale</th></tr>
<tr><td></td><td></td><td>present may be rare. For Cypripedium parviflorum var. pubescens, a narrow mycorrhizal association occurs with a symbiont in the Tulasnellaceae, a fungal family well known for many orchid symbionts (Shefferson 2005, Pecoraro et al. 2013). The presence of the appropriate mycorrhizal fungi on the landscape is likely a limiting factor in the establishment of this plant, as many orchids have distinct mycorrhizal communities (McCormick and Jacquemyn 2014 in Carlson and Fulkerson 2017).</td></tr>
<tr><td>4<br>Abundance on Tongass NF</td><td>A</td><td>A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>Three of four the occurrences are small, with stem counts in different years ranging from 8-78 (Occurrence 1), 5-42 (Occurrence 3), and 10-15 (Occurrence 4) (Table 1). The fourth occurrence is the largest and numbered 385 stems in 2023 (USDA FS 2023). Notes indicate many of the plants counted in years with larger numbers were small.<br><br>Stem count variability year to year may be due in part to dormancy of plants and inconsistent timing of counts.</td></tr>
<tr><td>5<br>Population trend on Tongass NF</td><td>D</td><td>D = Insufficient information to draw inferences about criterion.<br><br>There is no definitive information available about population trends of this species on the Tongass NF. The stem counts that are available do not indicate a downward trend, but confidence in this assessment is low due to inconsistent monitoring protocols and dormancy periods.<br><br>Table 1. Stem counts at Cypripedium parviflorum sites from 2006 to 2023. The Neck Lake occurrence has two locations that are just under 1 km apart that have separate counts.
<table>
<tr><th>Occurrence</th><th>Site</th><th>2006</th><th>2012</th><th>2014</th><th>2016</th><th>2018</th><th>2020</th><th>2022</th><th>2023</th><th>Notes</th></tr>
<tr><td>1</td><td>Neck Lake ("Roadside CYPA3")</td><td></td><td></td><td>7</td><td>10</td><td>15</td><td>35</td><td>55</td><td>70</td><td></td></tr>
<tr><td>1</td><td>Neck Lake ("Rock Pit")</td><td></td><td></td><td>1</td><td>1</td><td>1</td><td>0</td><td>3</td><td>8</td><td>Growing in dense patch of RCG</td></tr>
<tr><td>2</td><td>Perue Peak</td><td>20*</td><td></td><td></td><td></td><td></td><td></td><td></td><td>385</td><td>*partial estimate</td></tr>
<tr><td>3</td><td>Red Bay</td><td>15</td><td></td><td></td><td></td><td>5</td><td>10</td><td>34</td><td>42</td><td></td></tr>
</table>
</td></tr>
</table>

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | 4 \| Memorial Beach \| \| 15 \| \| \| 15 \| 10 \| \| \| |
| **6**<br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>Habitat for this species on the Tongass NF is karst fen roadside or exposed calcareous slope on northern Prince of Wales Island (USDA FS 2023, Carlson and Fulkerson 2017). All occurrences are in or adjacent to (<800 ft) mapped karst. Three of the four occurrences are adjacent to the mainline road to the north end of the island (USDA FS 2023).<br><br>Road construction and other management activities are likely to have contributed to a declining trend in the quality and quantity of occupied roadside habitat and potential karst habitat on Prince of Wales Island and throughout the Tongass National Forest. The three roadside occurrences where this species is found are located in a heavily managed area of the Tongass National Forest, with historically heavy logging activity. (Carlson and Fulkerson 2017). Fens may have been adversely impacted by the increased runoff after timber harvest on upgradient karst (Boggs et al. 2019).<br><br>Reed canarygrass and other invasives are also widespread along the Prince of Wales road system and may outcompete *Cypripedium parviflorum*. In 2014 one location was hand-brushed by district personnel to eliminate competition, and avoid the need for mechanical brushing, which may have improved local habitat quality by maintaining the open to partially shaded conditions that this taxon prefers (Carlson and Fulkerson 2017).<br><br>The magnitude of impacts from herbivory does not appear to be great, but could negatively affect seed production, recruitment, and survivorship rates of reproductive and vegetative individuals (Carlson and Fulkerson 2017). |
| **7**<br>Habitat vulnerability or modification; | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>At three of the four known occurrences, there is high habitat vulnerability due to the site proximity to roads. Roadside habitat is very vulnerable to modification by road construction or maintenance activities (widening, paving), roadside brushing, vehicular traffic, or introduction of invasive species. Activities such as road widening could extirpate |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| other threats | | occurrences. Because these occurrences are all within easy sight-distance from the road, they may be targeted by enthusiastic gardeners and flower pickers. Single events of road construction or a bout of plant collecting could cause occurrence extirpation (Carlson and Fulkerson 2017).<br><br>Additional threats include competition with invasive species, or tree and shrub encroachment that would adversely modify the open to partially shaded conditions that this species prefers. Roadside brushing might be necessary to maintain sufficient light conditions for the two occurrences in forested roadside habitat. Competition for light and other resources is likely very important for this species, and at least one occurrence is found growing with very abundant *Phalaris arundinacea*, which is one of the most competitive and ecologically destructive species in Alaska (Carlson and Fulkerson 2017).<br><br>Karst fen habitats frequently occur in watersheds that are heavily managed for timber harvest, thus fens may be adversely impacted by the increased runoff after timber harvest on upgradient karst. Additional threats include any activities that influence the balance between surface and ground water inflow and discharge (Boggs et al. 2019). The association of this plant to marble substrates could make it subject to adverse impacts due to future marble quarrying (Carlson and Fulkerson 2017).<br><br>Southeast Alaska is expected to experience increased air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress (Turner and Mallott 2024, Halofsky et al 2024). |
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>*Cypripedium parviflorum* is presumed to have a demography characterized by high adult survivorship, a lengthy period to achieve reproductive maturity, and low seedling establishment rates (Mergen 2006). The species can reproduce clonally to increase the size and density of existing populations but depends on sexual reproduction for long-distance dispersal. Pollination may be an infrequent event, with low rates of fruit production. The average fruit set of North American nectarless orchids is around 20% (Lipow et al. 2002, Carlson and Fulkerson 2017). In a Missouri population of this variety, the insects most likely to carry pollen were small- to medium-sized bees (Edens-Meier et al. 2018), however no information is available regarding the pollinator fauna of populations on Prince of Wales Island or the degree of |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | pollen limitation on fruit and seed production (Carlson and Fulkerson 2017). Because population sizes and habitat patches are small, seed production may be limited by the scarcity of suitable pollinators (Carlson and Fulkerson 2017). The reproductive success rate in non-rewarding orchids such as *Cypripedium parviflorum* var. *pubescens* is typically lower than in orchids that provide a benefit to the pollinator (Tremblay et al. 2005).<br><br>Elsewhere in its range *Cypripedium parviflorum* is characterized as a very weak competitor and competition for light may be one of the more important limiting ecological conditions for the plant (Mergen 2006 in Carlson and Fulkerson 2017). On the Tongass National Forest, this species is susceptible to competition, either from tree or shrub encroachment that changes the growing environment for individuals, or from competition with invasive species such as *Phalaris arundinacea*.<br><br>Individuals of *C. parviflorum* var. *pubescens* may have extended periods of dormancy, where aboveground growth may not occur for up to four years (Shefferson et al. 2001). The environmental causes of dormancy are not known, and it is unknown how extensive this behavior may be for populations in the Tongass National Forest. Studies need years of observation to characterize the demography of this species (Carlson and Fulkerson 2017).<br><br>Population viability analysis of a European *Cypripedium* species indicated that probability of survival was greater when populations were larger (between 50 and 200 plants) than when populations were between 5 and 20 plants, and that removal of a few mature plants increased the risk of population extirpation regardless of population size (Terschuren 1999). |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

### Conclusion Rationale

There is substantial concern for the long-term persistence of *Cypripedium parviflorum* var. *pubescens* within the plan area based upon the following:

- **Significant threats** - Three of four occurrence are roadside and may be impacted by road maintenance, traffic and competition from invasive species or trees and shrubs. Additionally, climate change may alter hydrology in karst fens and open forest.
- **Declining populations or habitat trends** - Population trends are difficult to discern due to limited monitoring, dormancy periods, and clonal habit. There is insufficient evidence to suggest that populations are declining. There may have been some impacts to habitat with management activities, especially given the proximity of three occurrences to roads.
- **Restricted range** - Tongass NF occurrences are disjunct both geographically (350 miles/560 km) and genetically from other occurrences of this taxon across its range.
- **Low populations or restricted ecological conditions** – Four occurrences are known on the Tongass NF. Three of the four occurrences are small, and all are restricted to limestone habitat on the northern end of Prince of Wales Island. Occurrences are vulnerable to extirpation by stochastic events due to small sizes.
- **Other factors** - *Cypripedium* species are known to have low reproductive rates, to need a specific mycorrhizal fungus to germinate, and to be weak competitors.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1** | **ACCS_Mar25 (EO12)[6/15/2014]** | **Tongass National Forest. Neck Lake, Roadside** | | **NA** | **NA** |
| 1 | TESP_Mar25 (100554P000545Y14)[no date] | | | | |
| 1 | TESP_Mar25 (100554P000545Y14)[no date] | | | | |
| 1 | TESP_Mar25 (100554P000545Y14)[no date] | | | | |
| 1 | TESP_Mar25 (100554P000545Y14)[7/13/2022] | | | | |
| 1 | TESP_Mar25 (100554P000546Y14)[no date] | | | | |
| 1 | TESP_Mar25 (100554P000546Y14)[6/23/2020] | | limestone quarry, plant was growing on small pile of cobble sized rock, full sun exposure | | |
| 1 | ACCS_Mar25 (EO14)[8/18/2014] | Tongass National Forest. POW | | | |
| **2** | **ACCS_Mar25 (EO11)[7/08/2006]** | **Tongass National Forest: POW CYPA hike site. Prince of Wales Island.** | | | |
| 2 | TESP_Mar25 (100554P000638Y23)[6/14/2023] | Perue Peak North Prince of Wales | Large area of exposed limestone. The plant occurs in soil pockets in cracks and holes within the rock. | | |
| **3** | **ACCS_Mar25 (EO10)[6/10/2006]** | **Tongass National Forest: POW Red Bay roadside. Northern Prince of Wales Island.** | **Muskeg, though soil saturation was low at the time of sighting due to several hot, dry days. In opening with no apparent shading nearby.** | | |
| 3 | ACCS_Mar25 (EO10)[8/31/2006] (100554P000056) | Tongass National Forest, Red Bay woodland bog | POW Isl, .5 mi N of 20-rd and 2079 jct; 1 indiv. in "muskeg" | | |
| **4** | **ACCS_Mar25 (EO13)[6/19/2012]** | | **Roadside shoulder. partial shade** | | |

DRAFT

# *Diapensia lapponica*

*Diapensia lapponica* [L., 1753]

**Lapland Diapensia**

Global Rank: **G5**

Alaska State Rank: **SNR**



photo: (CC BY 4.0) JSReiff

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce OR isolated.<br><br>*Diapensia lapponica* is known from one estimated occurrence on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). This occurrence is on the northern end of the Forest near Skagway (Appendix 1; CPNWH 2025, USFS 2025a).<br><br>The one occurrence is on an alpine ridge in low, windswept tundra (Appendix 1). This habitat is typical for this species (FNA 2025).<br><br>There are no occurrences of this species in southeastern Alaska outside of the Tongass NF, though there are a few occurrences in adjacent British Columbia (CPNWH 2025). |
| **2**<br>Distribution in surrounding geographic | **C** | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G5, Alaska State Rank SNR<br>*Diapensia lapponica* is broadly distributed throughout circumboreal North America, Eurasia, and Atlantic Islands (FNA 2025). In North America, it is present in Canadian provinces and territories as well as northeastern states and Alaska (FNA 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| area | | Across its range, *Diapensia lapponica* occurs on slopes, alpine summits, fellfields and cliff faces at elevations of 200 m to 1,900 m (FNA 2025). It is typically found in open areas with gravelly and bare soils and shows some tolerance to serpentine soils (Day and Scott 1981, FNA 2025, GBIF 2025).<br><br>In southeastern Alaska this species is only known from the one occurrence on the Tongass NF; in the rest of Alaska there are 14 occurrences scattered throughout the state (CPNWH 2025). The nearest occurrences to the Tongas NF occurrence are in British Columbia, approximately 70 miles away (CPNWH 2025). It is unclear if the remote mountain ranges between the Tongass NF occurrence and the BC occurrence have been surveyed, so there is insufficient information to determine if the Tongass NF occurrence is disjunct. The occurrence on the Tongass NF is on the southern edge of the range in western North America (CPNWH 2025). |
| **3**<br><br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Diapensia lapponica* is a perennial herb with a cespitose growth habit (FNA 2025). Its main dispersal mechanism is by seeds, which are dispersed by wind and gravity (Densmore 1997). A study in Sweden found seedling recruitment was highest in years with cool summers and low in years with higher mean annual temperatures (Molau 1997). Thus, increasing temperatures may negatively impact dispersal and recruitment of this species. |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Diapensia lapponica* is known from one occurrence on the Tongass NF (Appendix 1). The single occurrence does not have a population estimate (Appendix 1; CPNWH 2025, USFS 2025). |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of follow-up surveys, population trends of known occurrences of *Diapensia lapponica* on the Tongass NF are unknown (USFS 2025a, CPNWH 2025). |
| **6** | **A** | A = Decline in habitat quality or quantity. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| Habitat trend on Tongass NF | | The habitat for the one occurrence of *Diapensia lapponica* on the Tongass NF is an alpine ridge in low, windswept tundra (Appendix 1). This habitat can be grouped under Alpine Vegetation which occurs above the tree line and consists mainly of herbaceous and dwarf shrub species (Turner and Mallott 2024).<br><br>While follow-up visits to the occurrence have not occurred, alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025).<br><br>In addition, the one occurrence on the Tongass, which is in the northern part of the Tongass NF, is at the southern edge of this species' range in western North America, which indicates that it may be disproportionately affected by warming temperatures. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Alpine ecosystems, where *Diapensia lapponica* is found, are highly vulnerable to stressors, including reduced snowpack, woody vegetation encroachment, altered interactions with pollinators, and rising temperatures (Turner and Mallot 2025, Halofsky et al. DRAFT). Reduced snowpack has a negative impact on the survival of this species because early snowmelt and thin snow cover exposes the plant to frost damage (Molau 1996). Additionally, increased frequency of heavy rainfall events during anthesis may contribute to reduced fecundity of *Diapensia lapponica* (Elberling 2001). Some of these impacts may be buffered by site topography and heterogeneity that allows plants to persist in microsites with cooler temperatures and/or higher snow accumulation (Halofsky et al. 2024, Seastedt and Oldfather 2021).<br><br>Additionally, alpine habitat may be impacted by mining, communication sites and recreation. |
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>*Diapensia lapponica* is a perennial cushion forming dwarf shrub with a taproot and cespitose growth habit (FNA 2025). It produces bisexual, solitary flowers and capsule fruits (FNA 2025). It flowers from May to June (FNA 2025). Flower pollination syndrome is unknown, but likely primarily pollinated by insects (CPC 2025, Elberling 2001). Plants are self- |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | compatible, but reliant on outcrossing for increased fecundity (Elberling 2001). Mature fruits are produced from August to October (Densmore 1997, GBIF 2025). Seed storage behavior is unknown but suggested to be recalcitrant or intermediate (SID 2025). Seeds likely have physiological dormancy and require 2 months of cold stratification for germination (Baskin and Baskin 2014, Densmore 1997).<br><br>*Diapensia lapponica* is slow growing with radial growth rates averaging 0.6 mm per year (Molau 1997). The species takes an average of 18 years to reach sexual maturity and may live for hundreds of years (Molau 1997).<br><br>Capsules are susceptible to damage from fungal infection by *Apiothyrium arctium* leading to significant seed mortality (Day and Scott 1981). |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

**Conclusion Rationale**

*Diapensia lapponica* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats**: Decreased snow duration and extent may increase frost damage to individual plants and woody

vegetation encroachment is likely to impact habitat. Seedling recruitment declines during warm summers.

- **Declining trends**: Population trends are not known. Alpine habitat is moderately stable and highly vulnerable to stressors.
- **Restricted ranges**: The occurrence is on the northern edge of the Tongass NF and is at the southern edge of the species range in western North America.
- **Low population numbers or restricted ecological conditions**: There is one occurrence known on the Tongass NF.
- **Other factors**: The species is slow growing, taking an average of 18 years to reach sexual maturity and is therefore unlikely to be resilient to disturbance.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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# *Glehnia littoralis leiocarpa*

*Glehnia littoralis leiocarpa* [(Mathias) Hultén]

**American silvertop**

Global Rank: **G5T5**
Alaska State Rank: **S3**

Photo: Mason Brock (CC0: iNaturalist 2025)



**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Scarce OR isolated<br><br>*Glehnia littoralis* subsp. *leiocarpa* is known from four estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1; ANHP ACCS 2025, Arctos 2025, CPNWH 2025, USFS 2025a). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The four occurrences are located near sea level in the Yakutat Foreland (two occurrences) and Kruzof Island (two occurrences) (Appendix 1). In addition, there are four other occurrences of *Glehnia littoralis* that are located in southeast Alaska outside of the boundaries of the Tongass NF; three are in the Yakutat Foreland and one is on Prince of Wales Island (Appendix 1; ANHP ACCS 2025, Arctos 2025, CPNWH 2025, Fulkerson 2025 pers. comm.).<br><br>Occurrence 4 on Kruzof Island (based on a specimen made by Luella Smith in 1935) has a large georeferencing error; the actual label locality "Kruz off Jn. near Sitka" is georeferenced in an estuary at Inner Point on Kruzof Island with 75% certainty (CPNWH 2025). However, all other collections made by Smith (and available online) are from Baranof Island near Sitka, which means that it is difficult to know where she actually collected her specimen of *Glehnia littoralis* subsp. *leiocarpa*. (Arctos 2025, CPNWH 2025, SEINet 2025).<br><br>The habitats recorded for this species on the Tongass NF are upper beach, coastal sand dunes, sandy beach strand vegetation, and open sedge dune area (Arctos 2025, CPNWH 2025, SEINet 2025, USFS 2025a). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | It should be noted that some works recognize this subspecies at the species level, resulting in North American plants being called *Glehnia leiocarpa* and Asian plants *Glehnia littoralis* (Mathias 1928, Pan et al. 2018). North American botanical works recognize Alaskan plants at the subspecific level (Ickert-Bond 2019, Klinkenberg 2020, NRCS 2025). |
| **2**<br><br>Distribution in surrounding geographic area | **C** | C = Widely distributed outside of the Tongass NF<br><br>Global Rank: G5T5 (Secure), Alaska State Rank: S3 (Vulnerable) (NatureServe 2025)<br><br>State Ranks:<br>Canadian provinces and territories: S3 (Vulnerable): British Columbia; not present in any other provinces or territories.<br>United States: S2 (Imperiled): California; SNR (Not Ranked); Oregon, Washington; not present in any other states (NatureServe 2025).<br><br>*Glehnia littoralis* subsp. *leiocarpa* occurs in coastal areas in northwestern North America where it ranges discontinuously along the immediate coast from southern Alaska south to northern California (Klinkenberg 2020, Levin 2024, Arctos 2025, CPNWH 2025).<br><br>Outside of southeast Alaska, *Glehnia littoralis* subsp. *leiocarpa* is known from fewer than ten collections along the immediate coast of Alaska and Kodiak Island; the nearest Alaskan records are approximately 130 miles west-northwest near the Tsiu River (Arctos 2025, CPNWH 2025, SEINet 2025). It is thought to be infrequent in British Columbia on Haida Gwaii and Vancouver Island (Hultén 1968, Klinkenberg 2020, Arctos 2025, CPNWH 2025).<br><br>Throughout its range, *Glehnia littoralis* subsp. *leiocarpa* grows along the immediate coast on mesic loose sands of beaches or dunes at elevations ranging from sea level to approximately 65 feet (20m) (Constance and Wetherwax 2012, Klinkenberg 2020, Levin 2024, CNPS 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat<br><br>*Glehnia littoralis* subsp. *leiocarpa* is found on sand dunes and upper beach habitat on the Tongass NF and elsewhere in North America. The single seeds of this plant are each encased in a dry fruit segment called a mericarp, and the seed is dispersed within the mericarp but later separates (Levin 2024). In Asia, *Glehnia littoralis* fruits are thought to be dispersed by wind and seawater (Wang et al. 2016, Yang et al. 2017, Pan et al. 2018). Once the fruit is dispersed, *Glehnia littoralis* subsp. *leiocarpa* seedlings would only be successful in appropriate sandy beach and dune habitat. |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>One of the four occurrences states that the species was "uncommon" (Appendix 1). Considering that there are only four occurrences total and that the species is restricted to a rare habitat type, the overall abundance is likely low. |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Population trends for known occurrences of *Glehnia littoralis* subsp. *leiocarpa* on the Tongass NF are unknown due to lack of population counts for the Forest occurrences (Arctos 2025, CPNWH 2025, USFS 2025a). Occurrence 3 at Shelikof Bay on Kruzof Island was first documented in 2005 and then revisited in 2015, indicating that the population persisted for ten years, although population trends were not noted (USFS 2025a). |
| **6**<br><br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>Occurrence 1 (near Yakutat at Cannon beach) sees recreational use, including OHVs (off-highway vehicles). In addition, upper beach habitat at occurrence 1 is within 300 ft of the mapped non-native weeds *Lupinus polyphyllus*, *Poa annua*, and *Taraxacum officinale*; the *Lupinus polyphyllus* infestation is mapped at the edge of the upper beach habitat (USFS 2025b). Similarly, occurrence 2 is within one mile of mapped *Lupinus polyphyllus*, and occurrence 3 is 0.5 mile from mapped *Poa annua* (USFS 2025b). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | *Lupinus polyphyllus* is known to invade open meadow habitat at the edge of where *Glehnia littoralis* subsp. *leiocarpa* has been observed (APMC 2014). The proximity of this invasive plant to occurrences 1 and 2 indicates a decrease in habitat quality. |
| **7**<br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>The coastal habitat of southeastern Alaska is vulnerable to modification and/or loss due to future predictions of sea level change, as well as changes in temperature and precipitation. Along the northern coast of the Tongass NF, sea levels are projected to fall as much as 5.9 feet as a result of rapid isostatic rebound. However, the southern coast may see sea levels rise as much as 0.7 feet (Halofsky et al 2025). Additionally, projections suggest an increase in average temperatures and precipitation over southeast Alaska (USDA FS 2023, Boggs et al. 2019). As a result, the coast may see more frequent and intense storm surges which could lead to a higher chance of modification as sand is moved further upland, or loss occurs by means of erosion (Carter 1991). It is unknown whether plants can respond to these changes and disperse into newly created suitable habitat.<br><br>Beach habitat in some locations may also be threatened by human development and recreational use, including off-road vehicles (Boggs et al. 2019, USDA FS 2014). Upper beach meadows are vulnerable to infestation by invasive species. Invasive plants can establish and spread in these meadows, and several species are readily dispersed by air or carried by tidewater to other beaches (Turner and Mallott 2024). The natural disturbance regime, sandy soil, and high light environment contribute to the invasibility of this habitat (Spellman and Swenson 2012). |
| **8**<br>Life history and demographics | **D** | **D = Insufficient information to draw inferences about the criterion**<br><br>*Glehnia littoralis* subsp. *leiocarpa* is a perennial herb in the Apiaceae that grows from a taproot and has a very short stem that may be entirely buried in the sand (Levin 2024). It has prostrate leaves with bases often hidden below the surface of the sand and flowers that may be produced from May to July (Levin 2024). In Asia, the flowers of *Glehnia littoralis* are thought to be pollinated by insects or wind; in Japan insect pollinators include wasps and bees (Wang et al. 2016, Nakao et al. 2018). *Glehnia littoralis* subsp. *leiocarpa* produces fused fruits (schizocarps) that break into smaller |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | parts (mericarps) each bearing a seed which later becomes free from the mericarp (Levin 2024). No information was found on seed survival or germination rates of *Glehnia littoralis* subsp. *leiocarpa* inside or outside of the planning area. |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☐ | ☐ | ☒ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

*Glehnia littoralis ssp. leiocarpa* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats:** Threats to populations and habitat include off highway vehicle (OHV) use in some areas, as well as invasive species, changing sea levels, and frequent and more intense storm surges.
- **Declining trends:** While population trends are unknown, habitat in at least one of the four locations is impacted by recreational use, and three of the four locations have known invasive species.
- **Restricted ranges:** The four occurrences on the Tongass are widely separated from other known locations by over 250 miles to the south and 130 miles to the north.
- **Low population numbers or restricted ecological conditions:** Sandy beach habitat is rare on the Tongass NF. While population counts are unknown, considering that there are only four occurrences total and that the species is restricted to a rare habitat type, the overall abundance is likely low.
- **Other factors:** *Glehnia littoralis* fruits are thought to be dispersed by wind and seawater. Suitable habitat patches on the Tongass are isolated by miles of rocky shoreline, interior forested habitats, and/or open ocean between neighboring islands.

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## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **ANHP-ACCS_Mar25 (EO11)[6/25/1991]** | **Yakutat Foreland, Cannon Beach vic.** | **Sandy beach, strand vegetation.** | **Uncommon.** | |
| 1 | Arctos 2025 (ALA-UAM:Herb:3726) [6/25/1991] | Yakutat Foreland, Cannon Beach vic. | Sandy beach, strand vegetation. [Collected on same date in same place: Lathyrus maritimus, Achillea borealis, Castilleja chrymactis, Honckenya peploides.] | Uncommon. | |
| **2*** | **ANHP-ACCS_Mar25 (EO6)[6/25/1977]** | **Yakutat Foreland, Situk R. mouth, ADF&G fish and wildlife protection cabin** | **coastal sand dunes** | **Prostrate in moist sand.** | |
| 2 | Arctos 2025, CPNWH_April2025(ALA-UAM:Herb:50867)[6/25/1977] | Yakutat Foreland, Situk R. mouth, ADF&G fish and wildlife protection cabin, Yakutat Quad. | Coastal sand dunes. [Collected on same date at same place in sand dunes: Salix stolonifera, Castilleja unalashcensis, Carex bicolor, Hedysarum alpinum, Festuca rubra ssp. aucta] | Prostrate in moist sand. | |
| **3*** | **ANHP-ACCS_Mar25 (EO5)[8/23/2005]** | **Tongass National Forest, Kruzof Is., Shelikof Bay, Cuvacan Cove,** | **upper beach** | | |
| 3 | USFS-TESP_Mar25 (100531P000148)[8/23/2005] | Kruzof Is., Shelikof Bay, Cuvacan Cove, upper beach | | | |
| 3 | USFS-TESP_Mar25 (100531P000148)[6/08/2016] | [maps to Kruzof Island, Shelikof Bay, Cuvacan Cove]. Revisit. | Individual plants usually found within open sedge dune area. | | |
| **4*** | **ANHP-ACCS_Mar25 (EO3)[9/01/1935]** | **secondary ocean-beach, Kruz off Jn. near Sitka.** | | | |

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| | | | | | |
|---|---|---|---|---|---|
| | | NOT ON TONGASS NF | | | |
| **5*** | **Fulkerson 2025 pers. comm., ANHP-ACCS_Mar25 (EO1)[June, 1966]** | **Hollis, Prince of Wales Island.** | | | |
| **6*** | **ANHP-ACCS_Mar25 (EO7)[no date]** | **along the Ankow River; near ocean cape. [Should be Ankau River]** | | | |
| 6 | ANHP-ACCS_Mar25 (EO7)[8/31/1904] | Ankow River. [Should be Ankau River] | | | |
| 6 | Fulkerson 2025 pers. comm., ANHP-ACCS_Mar25 (EO12)[no date] | Along Ankoro River, near Ocean Cape, Yakutat Bay vicinity. [should be Ankau River] | | | |
| **7*** | **ANHP-ACCS_Mar25 (EO10)[7/18/1953]** | **Yakutat Foreland, Yakutat** | | | |
| **8*** | **ANHP-ACCS_Mar25 (EO8)[7/17/1980]** | **Yakutat. About 2 miles south of the airport on the end of Broken Bridge Road at the ocean beach.** | **Growing in sand on upper beach dunes.** | | |
| 8 | ANHP-ACCS_Mar25 (EO8)[no date] | Yakutat, about 2 miles south of airport on end of Broken Bridge Road at the ocean beach. | | | |
| 8 | CPNWH_Mar25 (WTU362119)[7/17/1980] | Yakutat. About 2 miles south of the airport on the end of Broken Bridge Road at the ocean beach. | Growing in sand on upper beach dunes. | | |
| 8 | Arctos 2025 (ALA-UAM:Herb:51015) [7/17/1980] | Yakutat. About 2 miles south of the airport on the end of Broken Bridge Road at the ocean beach. | Growing in sand on upper beach dunes. | | |
| 8 | ANHP-ACCS_Mar25 (EO11)[7/17/1980] | Yakutat Foreland, Yakutat Airport, 3 km S of airport [Herbarium specimen label actually says "About 2 miles S of the Airport on the end of Broken Bridge Road at the ocean beach." Data entry changed this to "3 km S of the airport"] | Growing in sand on upper beach dunes. | | |
| 8 | Arctos 2025 (ALA-UAM:Herb:3726) [6/25/1991] | Yakutat Foreland, Yakutat Airport, 3 km S of airport [Herbarium specimen label actually says "About 2 miles S of the Airport on the end of Broken Bridge Road at the ocean beach." Data entry changed this to "3 km S of the airport"] | Growing in sand on upper beach dunes. | | |

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# *Neoalbatrellus subcaeruleoporus*

*Neoalbatrellus subcaeruleoporus* [Audet & B.S. Luther, 2016]

**Little blue polypore**

Global Rank: G3
Alaska State Rank: SNR



photo:(CCBY) Alan Rockeffeller

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Isolated.<br>*Neoalbatrellus subcaeruleoporus* is known from one estimated occurrence on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of populations that are separated by less than 1 km (0.62 mile). This occurrence is located on the southern coast of Mitkof Island in beach fringe forest with Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*). (Appendix 1; MyCoPortal 2025, USFS 2025a).<br>This species may be confused for *Albatrellopsis flettii* which is also present nearby but is much larger in stature with white pores (iNaturalist 2025, Siegel and Schwarz 2024). There are no subspecies of *Neoalbatrellus subcaeruleoporus* on the Tongass NF (Audet and Luther 2016). |
| **2**<br>Distribution in surrounding geographic | **B** | B = Limited distribution outside the Tongass National Forest.<br>Global Rank G3, Alaska State Rank SNR, British Columbia S3, IUCN Near Threatened (Vellinga 2019)<br>*Neoalbatrellus subcaeruleoporus* is narrowly distributed in western North America (MyCoPortal 2025), ranging from SE Alaska to the central coast of California (MyCoPortal 2025). In North America, *Neoalbatrellus subcaeruleoporus* is |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| area | | present in one Canadian province, British Columbia, as well as several US states: Alaska, Washington, Oregon, and California.<br><br>Across its range, *Neoalbatrellus subcaeruleoporus* occurs in old growth temperate rainforest at elevations of 0 m to 2120 m (Siegel and Schwarz, 2024, MyCoPortal 2025). The habitats are described as having deep shade and thick moss (Mushroom Observer 2025).<br><br>The IUCN report indicates that the geographic range of *Neoalbatrellus subcaeruleoporus* is restricted to the range of *Tsuga heterophylla* (Vellinga 2019). However, even where *Tsuga heterophylla* is abundant, *Neoalbatrellus subcaeruleoporus* is still rare, suggesting there are additional habitat requirements or limiting biological characteristics.<br><br>The occurrence on the Tongass NF is the northernmost known occurrence of *Neoalbatrellus subcaeruleoporus.* The next nearest record is approximately 400 miles to the southeast in British Columbia (MyCoPortal 2025). Populations continue south from there and are concentrated on the islands of the Puget Sound, WA and in the Cascade mountains of WA and OR (MyCoPortal 2025). Given the distance from the next nearest records and island geography, the Tongass NF occurrence may be disjunct. |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat.<br><br>*Neoalbatrellus subcaeruleoporus* is a mycorrhizal mushroom-forming species (Siegel and Schwarz 2024). Its main dispersal mechanism is by sexual spores (Audet and Luther 2016). Spores are dispersed by wind. Fungal spore dispersal success is species-specific, dependent on spore size and ornamentation, volume of spores produced, environmental factors like wind and other dispersal agents like animals, and availability of suitable habitat and host plants (Golan and Pringle 2017, Peay and Bruns 2014). |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>The one known occurrence does not have a population estimate. *Neoalbatrellus subcaeruleoporus* is a conspicuous blue mushroom-forming fungus that is difficult to overlook. Considering the number of observations of mushroom producing fungi across Southeast in general, coupled with the rarity of this species across its range, it is likely very rare on the Tongass. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of follow-up surveys, population trends of the only known occurrence of *Neoalbatrellus subcaeruleoporus* on the Tongass NF are unknown (USFS 2025a, MyCoPortal 2025). |
| **6**<br><br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>The one occurrence of *Neoalbatrellus subcaeruleoporus* on the Tongass NF is in old growth *Tsuga heterophylla* and *Picea sitchensis* coastal forest (Audubon Alaska 2025, MyCoPortal 2025). Expected habitat for the species on the Tongass is old growth forest that includes *Tsuga heterophylla*. However, due to the species being rare across its range, there are likely as yet unknown additional habitat requirements or biological characteristics that limit potential habitat. Timber harvest has occurred in the recent past 985 m west from Occurrence 1 and is widespread on Mitkof Island (USFS 2025d). *Timber* harvest has impacted old growth forest across the Tongass NF, but a suitable amount of old growth forest likely remains.<br><br>Impacts to *Neoalbatrellus subcaeruleoporus* can also be expected where Hemlock sawfly outbreaks have resulted in host tree stress or mortality. Large hemlock defoliation events occurred in Alaska in 2020 and 2021 (impacting 644,000 acres, with 101,00 acres of mortality) but defoliation has been limited to 1,000-3,100 acres in more recent years (FS-R10-FHP 2024).<br><br>The one record occurs in a narrow (less than 200 feet wide) strip of forest between the beach and a road. The construction of the road and impacts associated with it (road maintenance, invasive species, as well as potential non-target herbicide application) may have impacted the fungus. |
| **7**<br><br>Habitat vulnerability or | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors<br><br>Removal of host trees from timber activities and climate change may impact the habitat of *Neoalbatrellus subcaeruleoporus*. Old growth timber harvest is likely to continue on the Tongass NF and will impact potential habitat for this species. Additionally, projected increased air temperature, decreased soil moisture (due to increased |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| modification; other threats | | evapotranspiration), and growing season water deficit may lead to drought stress for *Neoalbatrellus subcaeruleoporus* (Halofsky et al. 2025, Turner and Mallott 2024, Vellinga 2019, Wiles and Warren 2024).<br><br>Hemlock sawfly and blackheaded budworm outbreaks in Southeast Alaska from 2016-2019 were correlated with warm and dry summers, so defoliation events that impact habitat for *Neoalbatrellus subcaeruleoporus* are likely to continue under projected climate trends (Howe et al 2024).<br><br>A recreation cabin is planned for construction in 2027 less than 0.5 mile from the occurrence. Increased traffic on the road that runs past the occurrence, road improvements (also planned), as well as potential increased foot traffic along the beach fringe from visitors to the cabin may have an impact on the fungus.<br><br>Threats to *Neoalbatrellus subcaeruleoporus* across its range include wild-fire, pervasive drought periods, and bark beetle outbreaks (Vellinga 2019). |
| **8**<br><br>Life history and demographics | **A** | A = Life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>*Neoalbatrellus subcaeruleoporus* is an annual mushroom with a charismatic poroid basidiomata with blue cap and light blue pores (Audet and Luther 2016, Vellinga 2019, Zhou et al. 2025). *Neoalbatrellus subcaeruleoporus* is a putative mycorrhizal species which produces sporocarps in strong association with *Tsuga heterophylla* from mid-September to mid-December annually (Audet and Luther 2016, Vellinga 2019). The obligate mutualist association with hemlocks limits the viability of this species (Vellinga 2019).<br><br>The life span of *Neoalbatrellus* fungi has not been measured, though anecdotal evidence that this species produces mushrooms repeatedly in the same location implies the mycelia may be long-lived (Vellinga 2019). |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Neoalbatrellus subcaeruleoporus* within the plan area based on the following reasons:

- **Significant threats:** This species is likely an obligate mycorrhizal associate of western hemlock. Ongoing old growth timber harvest and insect outbreaks will likely impact potential habitat. This species is sensitive to drought and projected soil moisture deficits could also impact the future persistence of this species on the Tongass. Additionally, a new Forest Service cabin is planned less than 0.5 miles away, so the area is likely to be impacted by increased recreation use.
- **Declining trends:** While suitable habitat (western hemlock forests) appears to be widespread and stable throughout the planning area, across its range *Neoalbatrellus subcaeruleoporus* is rare where it is found, which suggests there may be additional habitat requirements or biology that limits reproductive success. The one occurrence on the Tongass has a road less than 100 feet away.
- **Restricted ranges:** *Neoalbatrellus subcaeruleoporus* is endemic to western edge of North America. The only known occurrence on the Tongass National Forest is 400 miles from the closest known populations in British Columbia and is a major northern extension of its known range.
- **Low population numbers or restricted ecological conditions:** Given its single occurrence, this species is vulnerable to extirpation by stochastic events. While suitable habitat (western hemlock forests) appears to be widespread and stable throughout the planning area, the rarity of this species across its known range indicates that ecological conditions required for this species' establishment and reproduction are much more restricted.
- **Other factors: No other factors are known to affect the species.**

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **MyCoPortal 2025 (WTU) [08/28/2016]** | **Mitkof Island, Beach of Sumner Straights W. of S. Blind Slough + Woodpecker Cove.** | **Substrate: terricolous. Beach forest, *Picea-sitchensis, Tsuga heterophylla*. Thick duff of needles.** | | |

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# *Nephroma occultum*

*Nephroma occultum* [Wetmore, 1980]

**Cryptic paw lichen**

Global Rank: G3

Alaska State Rank: S1



photo: (CC0) Julia Carr

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Isolated or rare.<br><br>*Nephroma occultum* is known from four estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). These occurrences are located on Kuiu Island south of Tebenkof Bay on the west side of Petrof Bay, on Mainland on the west side of Shakes Slough of the Stikine River, on Prince of Wales Island between Shaheen and Shinaku creeks, and on Etolin Island near the southern tip of the west-most peninsula (CLH 2025, USFS 2025a).<br><br>Habitat for Occurrence 1 is old-growth beach fringe forest. Habitat for Occurrence 2 is old-growth riparian forest. Habitat for Occurrences 3 and 4 is unknown due to location data being obscured (Appendix 1).<br><br>There are approximately two more occurrences of this species in southeastern Alaska outside of the Tongass NF, both near Haines (CLH 2025).<br><br>This species could be confused for *Lobaria oregana* which often co-occurs (McCune and Geiser 2023). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest<br><br>Global Rank G3, Alaska State Rank S1, Washington S3, Oregon S3, British Columbia S3<br><br>*Nephroma occultum* ranges from Southcentral Alaska to southern Oregon (CLH 2025, COSEWIC 2019), but with few occurrences across this range (NatureServe 2023). In Oregon and Washington it only occurs west of the Cascades (McCune and Geiser 2023).<br><br>*Nephroma occultum* is mostly restricted to very humid old-growth forests at lower elevations but has been found occasionally in younger forests (McCune and Geiser 2023, NatureServe 2025).<br><br>The species is threatened across its range by timber harvest, climate change, and related increases in the frequency and severity of fires and insect outbreaks, leading to the death of host trees (COSEWIC 2019). |
| **3**<br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>*Nephroma occultum* is a lichen species which grows as an epiphyte at different canopy levels (USDA & BLM 2008). It disperses via soredia and fragmentation; there is no evidence for sexual spore dispersal for *Nephroma occultum* (USDA & BLM 2008). Soredia are thought to be dispersed by wind, rain, and animals (COSEWIC 2019).<br><br>Dispersal distances for clonal propagules like soredia are limited, often falling between 15 to 30 meters from the lichen, and depend on wind direction, wind speed, forest density, and moisture levels (Armstrong 1994, Pasiche-Lisboa et al. 2019, Ronnås et al. 2017). Generally, asexual propagules are distributed with more abundance during periods of increased wind velocity and decreased humidity (Pasiche-Lisboa et al. 2019).<br><br>For *Nephroma occultum* specifically, the soredia are described as larger than those of most lichens, which likely limits propagule dispersal (COSEWIC 2019). |
| **4**<br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>All four of the known occurrences on the Tongass NF were collected with an abundance rank of 1, which indicates that the species was rare (three or fewer individuals observed on the sampling plot) (Appendix 1; CLH 2025, USFS 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of follow-up surveys, population trends of known occurrences of *Nephroma occultum* on the Tongass NF are unknown (USFS 2025a, CLH 2025). |
| **6**<br><br>Habitat trend on Tongass NF | **A/B** | A = Decline in habitat quality or quantity<br>B = Stable amounts of suitable or potential habitat, relatively unchanged habitat quality<br><br>The known habitat for *Nephroma occultum* on the Tongass NF is old-growth beach fringe or riparian forest. Range-wide habitat is mostly very humid old-growth forests at lower elevations (NatureServe 2025, COSEWIC 2019).<br><br>Timber harvest in low elevation old-growth forest has been widespread on the Tongass. While timber harvest has occurred in the past in beach fringe and riparian forest, those habitats are now protected by harvest buffers.<br><br>Impacts to *Nephroma occultum* can also be expected where Hemlock sawfly outbreaks have resulted in host tree stress or mortality. Large hemlock defoliation events occurred in Alaska in 2020 and 2021 (impacting 644,000 acres, with 101,00 acres of mortality) but defoliation has been limited to 1,000-3,100 acres in more recent years (FS-R10-FHP 2024).<br><br>Occurrences 1 and 2 are in Wilderness Areas. The exact coordinates for Occurrences 3 and 4 are unknown, but Occurrence 3 likely falls within a Timber Production LUD (Land Use Designation) and Occurrence 4 in an area currently designated as Old-Growth Habitat or Semi-Remote recreation. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **B** | B = Habitat modification is likely to result in ecological patterns similar to the range of historical conditions but is being impacted by modern stressors.<br><br>Timber harvest, insect outbreaks, and climate change may impact the habitat of *Nephroma occultum*.<br><br>Recent timber harvest activities have occurred in the vicinity of the old-growth ecosystems at Occurrence 3 (USFS 2025d). This activity will continue on Prince of Wales Island and across the Tongass NF in the future. Loss of host trees will cause direct mortality to *Nephroma occultum*, but changing moisture and light conditions along timber harvest edges can also impact this species (COSEWIC 2019). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Insect outbreaks like hemlock sawfly that defoliate and kill host trees would also impact *Nephroma occultum.* Hemlock sawfly and blackheaded budworm outbreaks in Southeast Alaska from 2016-2019 were correlated with warm and dry summers, so defoliation events that impact habitat for *Neoalbatrellus subcaeruleoporus* are likely to continue under projected climate trends (Howe et al 2024). |
| **8**<br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (susceptible to competition).<br><br>*Nephroma occultum* is a foliose cyanolichen that grows as an epiphyte in upper, middle, or lower canopies (USDA & BLM 2008). *Nephroma occultum* is not known to sexually reproduce with apothecia. Asexual reproduction is through soredia and fragmentation (USDA & BLM 2008).<br><br>The generation time of *Nephroma* lichens has not been measured, but was estimated to be 24 years for a similar species *Lobaria pulmonaria* (COSEWIC 2019). The growth rate of an individual lichen is dependent on access to moisture in the environment and other climatic factors like light and temperature; most lichens grow very slowly and, if given the resources, can have a lifespan of up to hundreds of years (Beschel 1973).<br><br>No information about reproductive success and survival or mortality of *Nephroma occultum* from the Tongass NF is available.<br><br>*Nephroma occultum* is described as a "poor competitor" against mosses or liverworts which is easily displaced (COSEWIC 2019). This, coupled with the poor dispersal efficiency described in criterion 3, indicate that survival is difficult for this species even in suitable habitats. |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☐ |

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| | | | |
|---|---|---|---|
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Nephroma occultum* in the plan area based on the following:

- **Significant threats**: Timber harvest would impact occurrences that are not within riparian or beach buffers. Insect outbreaks like hemlock sawfly that defoliate and kill host trees will also kill *Nephroma occultum*. The species is threatened range-wide by timber harvest, climate change, and related increases in the frequency and severity of fires and insect outbreaks.
- **Declining trends**: Population trends are unknown. Timber harvest across the Tongass NF (including in beach and riparian areas in the past) means that there has been a decline in habitat quantity, but a large amount of potential habitat remains.
- **Restricted ranges**: The species is a Pacific Northwest endemic and has few occurrences across its range (Global Rank G3, Alaska State Rank S1, Washington S3, Oregon S3, British Columbia S3).
- **Low population numbers or restricted ecological conditions**: Four occurrences are known on the Tongass NF, with few individuals at each occurrence. Range-wide the species is restricted mostly to low elevation, very humid old-growth forest, but this is not a restricted habitat type on the Tongass NF.
- **Other factors**: Dispersal is limited due to reliance on asexual reproduction.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **CLH 2025 (ALA) [07/04/2003]** | **Alexander Archipelago, Kuiu Island, south of Tebenkof Bay, west side of Petrof Bay., Tongass National Forest** | **Growing on base of dead Ribes stalk. Beach fringe forest of *Tsuga heterophylla, Alnus sitchensis*. Uplifted beach with *Vaccinium* sp., *Dryopteris*.** | | |
| **2*** | **CLH 2025 (OSC) [07/11/2012]** | **Mainland. Stikine River. West side Shakes Slough upstream from Shakes cabin., River or Glacial Valley.** | ***Tsuga mertensiana, Picea sitchensis, Vaccinium* spp. Substrate: fallen branch.** | | |
| **3*** | **CLH 2025 (OSC) [06/19/2006]** | **Tongass National Forest. FIA Site # 1031** | | **Spot Tests: Cortex KC-, Medulla K-.** | |
| **4*** | **CLH 2025 (OSC) [06/23/2006]** | **Tongass National Forest. FIA Site # 14304** | | **Spot Tests: Medulla K+ red.** | |

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# *Papaver mcconnellii*

*Papaver mcconnellii* [Hultén]

**McConnell's poppy**

Global Rank: G4
Alaska State Rank: SNR

Photo: J. Straka (CC-BY: iNaturalist 2025)



**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>*Papaver mcconnellii* is known from two estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1, Arctos 2025, CPNWH 2025, Krieckhaus 2025 pers. comm., SEINet 2025, USFS 2025a). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile) (NatureServe 2025). The two occurrences are located within an area approximately 1 mile wide and 6 miles long on Chichagof Island in the West Chichagof-Yakobi Wilderness.<br><br>Occurrence 1 was on gravel bars along an inlet stream to Rust Lake around 950 ft (290 m) and Occurrence 2 was on gravel substrate along a snow melt fed inlet stream to Whitestripe Lake around 1800 ft (550 m) (Appendix 1; Arctos 2025, CPNWH 2025, Krieckhaus 2025 pers. comm., USFS 2025). Habitat data for Occurrences 1 and 2 specify that the plants were observed near or on limestone substrate (Arctos 2025, SEINet 2025, USFS 2025a), and one of the observers confirmed that all the *Papaver mcconnellii* occurrences were seen on karst or karst-influenced floodplains (Krieckhaus 2025 pers. comm.). This species is known to occur on calcareous substrates elsewhere in its distribution (Kiger and Murray 1997). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Associated species collected with Occurrence 1 include *Gentianella propinqua, Bistorta vivipara*, and *Torreyochloa pallida* var. *pauciflora* (Appendix 1; Ickert-Bond et al. 2019, Arctos 2025, SEINet 2025).<br><br>In the USFS-TESP database, the observations of *Papaver mcconnellii* in the vicinity of Rust and Whitestripe lakes are only identified to the genus *Papaver* (USFSa). However, herbarium specimens collected at the same time (in July, 2004) were later identified to *Papaver mcconnellii* by experts who visited the ALA herbarium (Arctos 2025). Before grouping the USFS-TESP observations with the herbarium specimens, we confirmed with one of the collectors/observers that there was only one kind of *Papaver* seen at Rust and Whitestripe lakes in July, 2004, and the specimens collected were thought to be the same species as the plants documented in the USFS-TESP database (Krieckhaus 2025 pers. comm.). Another unidentified *Papaver* was documented at Bear Mountain on Baranof Island in July 2004 (Arctos 2025, USFS 2025a). However, in this case, the specimen collected was not determined to species by the experts who visited the ALA herbarium (Arctos 2025). Therefore, the Bear Mountain observation and specimen are not included in the locations for *Papaver mcconnellii* (Appendix 1).<br><br>It should be noted that this species is sometimes treated under the name *Oreomecon mcconnellii* (Elvebakk and Bjerke 2024). However, *Papaver mcconnellii* is the name currently used in the *Flora of Alaska* project (Ickert-Bond et al. 2019). |
| **2**<br><br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside of the Tongass NF<br><br>Global Rank: G4 (Apparently Secure), Alaska State Rank: SNR (ACCS 2025, NatureServe 2025)<br><br>State Ranks:<br>Canadian provinces and territories: S4 (Apparently Secure): Yukon; SNR (Not Ranked): Northwest Territories; not present in any other provinces or territories. United States: S4 (Apparently Secure): Alaska; not present in any other states (NatureServe 2025).<br><br>*Papaver mcconnellii* is restricted to northwestern North America where it occurs in Alaska, the Northwest Territories, and Yukon (Kiger and Murray 1997, NRCS 2025).<br><br>There are two occurrences of *Papaver mcconnellii* from the Tongass NF (Arctos 2025, CPNWH 2025, Krieckhaus 2025 pers. comm., SEINet 2025, USFS 2025a). The nearest Alaskan records are approximately 450 miles to the northwest along |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | the Robertson River in the Eastern Alaska Range (SEINet 2025). The species is not known to occur in British Columbia (Kiger and Murray 1997, Klinkenberg 2020, Björk 2019, Arctos 2025, CPNWH 2025). The Tongass NF occurrences may be disjunct from other occurrences because they are on an island and separated from other occurrences by several mountain ranges. However, the species is known from widely separated mountain ranges across its range and mountains in Alaska are remote, rugged and difficult to survey, so there may be unknown occurrences between the Tongass NF occurrences and the nearest occurrence document in the Eastern Alaska Range. The occurrences on the Tongass NF are the southern edge of the species' range.<br><br>*Papaver mcconnellii* is found on mountain summits, ridges, shaly slopes, and screes, on substrates that are often calcareous (Porsild and Cody 1980, Kiger and Murray 1997). It occurs at elevations ranging from near sea level to approximately 4920 feet (1500 m) (Kiger and Murray 1997, Arctos 2025). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat<br><br>There is no published information on seed dispersal of *Papaver mcconnellii*, either inside or outside of the planning unit. In other *Papaver* species, one to several seeds fall through the capsule pores when the fruit is shaken by the wind; in some species, the seeds land just a few yards from the parent plant (McNaughton and Harper 1964). One study in the Northwest Territories (Canada) found that dispersal of *Papaver radicatum* seeds was effected by wind and birds (especially the rock ptarmigan, *Lagopus muta*) and took place not only during the snow-free months but also from capsules projecting above the snow and during the spring snowmelt when stems and capsules become wet and soft, collapse to the ground and deposit seeds directly on the soil (Grulke and Bliss 1983). Migratory birds and storms were suggested to be the primary means of long-distance dispersal of *Papaver radicatum* seeds in northeastern Greenland (Bennike et al. 2002). Given that known occurrences of *Papaver mcconnellii* are found in gravelly habitat along streams or drainages, it is likely that some of its seeds are dispersed by water movement, and that flooding events could disperse the seeds to a non-optimal habitat.<br><br>Given the specialized gravel-bar, high elevation habitat of *Papaver mcconnellii* on the Tongass NF, it is likely that this species would only disperse through suitable habitat. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare – current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Papaver mcconnellii* is known from two occurrences on the Tongass NF, all from one high elevation region of Chichagof Island that is approximately 1 mile wide and 6 miles long (Appendix 1). These are the only known occurrences of this species in southeast Alaska (Arctos 2025, CPNWH2025, SEINet 2025). Both occurrences have population counts, with occurrence 1 having a total of 57 plants, and occurrence 2 having a total of 89 plants (Appendix 1; USFS 2025a).<br><br>Based on the number of occurrences (2), the restricted geographic area where this species occurs on the Forest, and the low number of plants counted at the two locations (146 plants in total), *Papaver mcconnellii* is rare on the Tongass NF. |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of follow up surveys, population trends for known occurrences of *Papaver mcconnellii* on the Tongass NF are unknown (USFS 2025a). |
| **6**<br><br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>As explained in Criterion 1, on the Tongass NF *Papaver mcconnellii* is found on calcareous substrate in gravelly drainages, streams, and floodplains at elevations of 950 to 1800 ft in elevation (Arctos 2025, CPNWH 2025, Krieckhaus 2025 pers. comm., SEINet 2025, USFS 2025a). These map to alpine and subalpine vegetation types (Tongass Vegetation Map), which have moderate and high ecosystem integrity on the Tongass NF (Turner and Mallot 2025). However, in both occurrences, habitat may be dependent on late persisting snow keeping base stream flows stable and water temperatures low (Chestnut and Tucker 2025). There is evidence of rising temperatures and the loss in extent and duration of alpine snow on the Tongass NF (Turner and Mallot 2025, Halofsky et al DRAFT), which may alter habitat for this species by changing microhabitat characteristics and plant community composition.<br><br>Additionally, the coordinates for four of the records that make up Occurrence 1 overlap with a large infestation of the non-native *Taraxacum officinale* (dandelion) (USFS 2025b). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on natural range of variation, and/or habitat is impacted by modern stressors<br><br>Warming trends may accelerate the loss of precipitation as ice and snow and limit late persisting alpine snowpack (Turner and Mallot 2025). Changes in air temperature, moisture availability and growing season length is likely to alter plant competition relationships and may allow for encroachment of woody species (Halofsky et al DRAFT). Additionally, predicted increases in air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress for *Papaver mcconnellii* (Turner and Mallott 2025, Wiles and Warren 2025). Given that the occurrences on the Tongass NF are the southern edge of the range of *Papaver mcconnellii*, it may be particularly sensitive to warming. Calcareous alpine and subalpine habitat is rare on the Tongass NF, occurring only in patches, so *Papaver mcconnellii* may struggle to disperse to suitable habitat as its current habitat changes.<br><br>As mentioned above, Occurrence 1 is vulnerable to competition with non-native dandelion (USFS 2025b). |
| **8**<br><br>Life history and demographics | **D** | D = Insufficient information to draw inferences about the criterion<br><br>*Papaver mcconnellii* is a loosely tufted perennial herb from a taproot that grows to 15 cm high (Kiger and Murray 1997). It has large flowers (to 6 cm across), yellow or white in color; the flowers appear throughout the growing season, i.e., June to August (Kiger and Murray 1997). There is evidently no published information on its reproductive success or demography, either inside or outside of the planning unit. Reproductive success in some arctic species, including *Papaver*, is dependent on the flowers tracking the diurnal movement of the sun (heliotropism), with the petals functioning as solar reflectors and increasing the temperature of the ovary (Kevan 1975, Mølgaard 1989, Corbett et al. 1992). *Papaver mcconnellii* is thought to be self-incompatible, requiring pollen from a different individual for successful fertilization of the ovules (Paape et al. 2011). The pollinators are not known, although other arctic species, including those of *Papaver*, are visited by hoverflies (Syrphidae) (Robinson 2014). The fruits of *Papaver* are dry capsules with apical pores through which the seeds exit (Kiger and Murray 1997). Given its habitat on gravel bars of streams (Arctos 2025, USFS 2025a), *Papaver mcconnellii* may be a pioneer species. |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

*Papaver mcconnellii* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats**: Non-native dandelion is known to overlap with one of the known occurrences. Additionally, loss of perennial and late persisting snow may alter water availability and cause drought stress.
- **Declining trends**: Population trends are unknown. Habitat is vulnerable to rising temperatures and loss of snowpack, which may alter species composition in alpine and subalpine habitat.
- **Restricted ranges**: The occurrences on the Tongass NF are the southern edge of the species' range. Therefore, the *Papaver mcconnellii* occurrences on the Tongass NF may be vulnerable to warming temperatures and resulting ecological impacts.
- **Low population numbers or restricted ecological conditions**: There are two known occurrences, totaling 146 plants, of Papaver mcconnellii on the Tongass NF, within approximately six miles of each other on Chichagof Island. Given that calcareous alpine and subalpine habitat is rare on the Tongass NF, it may be difficult for this species to disperse to new habitat if current habitat becomes too degraded.
- **Other factors**: It is unknown whether other factors may exist that could impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |

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| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **Krieckhaus 2025 pers. comm; USFS-TESP_Mar25 (100531P000103)[7/20/2004]** | **[West Chichagof-Yakobi Wilderness] Chichagof Island, Rust Lake, on gravel bar ~200 m above lake, limestone influence.** | **on gravel bar ~200 m above lake, limestone influence.** | **4 poppies** | **Coordinates within mapped polygon of Taraxacum officinale.** |
| 1 | Krieckhaus 2025 pers. comm; USFS-TESP_Mar25 (100531P000105)[7/20/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Rust Lake | on gravel bar, sandy gravel, limestone influence | 40 poppies | Coordinates within mapped polygon of Taraxacum officinale. |
| 1 | Arctos 2025, CPNWH_April2025, SEINet 2025 (ALA-UAM:Herb:134516)[7/20/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Rust Lake area, inlet stream, Sitka Quad, Tongass National Forest. | Gravel bars of floodplain. [collected on same date in same place: Glyceria pauciflora] | | |
| 1 | Krieckhaus 2025 pers. comm; USFS-TESP_Mar25 (100531P000124)[7/22/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Rust Lake area, ~ 1 mi. up main valley, | gravel bar, limestone influence | 7 plants | Coordinates within mapped polygon of Taraxacum officinale. |
| 1 | Krieckhaus 2025 pers. comm; USFS-TESP_Mar25 (100531P000125)[7/23/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Rust L. area, ~ 2 mi. up main valley, | gravel bar, limestone influence | 6 plants, | Coordinates within mapped polygon of Taraxacum officinale. |
| 1 | CPNWH_April2025, SEINet 2025 (ALA-UAM:Herb:134515)[7/23/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Rust Lake, inlet stream N of lake, Sitka Quad, Tongass National Forest. | Gravel bar, coarse gravel and sand, growing in small scattered patches along floodplain. [Collected on same date and place: Gentianella propinqua, Bistorta vivipara] | growing in small scattered patches along floodplain. | |
| **2*** | **Krieckhaus 2025 pers. comm; USFS-TESP_Mar25** | **[West Chichagof-Yakobi Wilderness] Chichagof Island, Whitestripe Lake area.** | **gravel floodplain along main inlet stream,** | **9 plants** | |

| | | | | | |
|---|---|---|---|---|---|
| | **(100531P000102)[7/16/2004]** | | | | |
| 2 | Arctos 2025, CPNWH_April2025, SEINet 2025 (ALA-UAM:Herb:140788)[7/16/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Whitestripe Lake and Whitestripe Mt., Sitka Quad, Tongass National Forest. | Inlet stream floodplain gravel bars, limestone substrate dominating region. | | |
| 2 | Arctos 2025, CPNWH_April2025(ALA-UAM:Herb:140789)[7/16/2004] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Whitestripe Lake and Whitestripe Mt., Sitka Quad, Tongass National Forest. | Inlet stream floodplain gravel bars, limestone substrate dominate in area. | | |
| 2 | Krieckhaus 2025 pers. comm; USFS-TESP_Mar25 (100531P000146)[8/12/2005] | [West Chichagof-Yakobi Wilderness] Chichagof Island, Whitestripe Mountain | Main population and smaller one found in snowbed/runoff stream and bank on cobbles and gravel substrate. A few poppy plants were found along the inlet stream to Whitestripe Lake in 2004. | 80 plants. | |

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# *Peltigera gowardii*

*Peltigera gowardii* [Lendemer & O'Brien]

**Waterfan**

Global Rank: **G3G4**
Alaska State Rank: **S1**



photo: COSEWIC 2013

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>There are two known locations of *Peltigera gowardii* on the Tongass National Forest (Tongass NF) (Appendix 1). One is near Thunder Mountain, on the mainland, in the Stikine-Leconte Wilderness (Wrangell Ranger District), and the other is in the Todahl Creek area on Kupreanof Island (Petersburg Ranger District) (USFS 2025, Dillman et al 2012).<br><br>The Kupreanof population was discovered during a rare plant survey, and the Thunder Mountain site is near a lichen air quality biomonitoring site. In general, this species is not cryptic but may be difficult to detect at times due to water reflectance, and its reduction to basal crust in the winter months (Bjork 2014).<br><br>The habitat for *Peltigera gowardii* is described as "at or below water level in clear, permanent, unshaded alpine or subalpine streams" (NatureServe 2025) and "on rock immersed in stable-flow streams" (Spribille 2023).<br><br>There is an additional occurrence off Forest Service land at the top of the Eaglecrest Ski Resort on Douglas Island (iNat 2025). |
| **2**<br>Distribution in surrounding | **B** | B = Limited distribution outside the Tongass NF, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF.<br><br>Global Rank G3G4, Alaska State Rank S1<br>British Columbia Province Rank S2, Red List; California S3, Idaho SNR, Montana S1, Oregon SNR, Washington SNR |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| geographic area | | This lichen is known from British Columbia in six locations (BCCDC 2023), two of which were not detected in subsequent surveys (Miadilikowska et al. 2014, Bjork 2014) for an estimated total of 727 individuals (COSEWIC 2013). A location in Washington and a location in Montana with unknown numbers of individuals were confirmed with molecular techniques (Miadilikowska et al. 2014). It is also known from one location in a stream in Denali National Park (ARCTOS 2023, Spribille et al. 2023). This taxon is considered critically imperiled in Alaska (ANHP ACCS 2023).<br><br>Three waterfan species are now documented to occur in North America: two in the Pacific Northwest (*Peltigera gowardii*, *Peltigera aquatica*), and one in the eastern United States (*Peltigera hydrothyria*). *Peltigera gowardii* is closely related to *Peltigera hydrothyria*. The latter was originally placed in a genus of its own, *Hydrothyria,* by Russell (1853). *Hydrothyria* was transferred to and included within the genus *Peltigera* by Miadlikowska & Lutzoni (2000). Recently, Lendemer & O'Brien (2011) separated *Peltigera gowardii* from *Peltigera hydrothyria*. A specimen of what is now known as *Peltigera gowardii* was collected as early as 1866. The photosynthetic partner of *Peltigera gowardii*, a cyanobacterium, is reported to be *Nostoc* cyanobacterium, but may be *Capsosira*, which recently has been identified in the closely related *Peltigera hydrothyria* (Lendemer and H. O'Brian 2011, Casamatta et al. 2006). Molecular work by Miadlikowska et al 2014 has now placed *Peltigera gowardii* as separate from its southern Pacific Northwest congeners, a new species called *Peltigera aquatica* which occurs from Washington to California in similar habitats. More recently, McCune and Stone (2022) have suggested that while *P. aquatica* and *Peltigera gowardii* are genetically distinct, they can occur together and are indistinguishable morphologically, chemically, or ecologically, which has stalled data collection and conservation efforts. Instead McCune and Stone (2022) argue both species should be considered varieties of *Peltigera hydrothia* (*Peltigera Hydrothia var. gowardii and Peltigera hydrothia var aquatica*). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat<br><br>This aquatic lichen needs water to reproduce. It is assumed that dispersal may occur as propagules travel downstream in water. Little is known as to its dispersal potential between watersheds or riparian areas. Presumably spores and asexual propagules could be carried by animals crossing the stream and depositing them to another stream where the photobiont is present, but this has not been documented.<br><br>*Peltigera gowardii* reproduces sexually via spores. These spores may provide a means of dispersal over longer distances or upstream. It is suspected that when the lichen is at or above water level, the spores can be dispersed into the air. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | When these spores land in a stream with appropriate water quality, they need to find and grow together with compatible cyanobacteria in order to become the visible lichen (Peterson 2010 in COSEWIC 2013). |
| **4**<br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br>The two occurrences on the Tongass NF total approximately 100 individual thalli (K. Dillman, personal communication, 2014). |
| **5**<br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br>One population is within a timber unit in conifer forest on Kupreanof Island and has not been monitored since timber harvest activities occurred. The population on the mainland in the Stikine-Le Comte Wilderness was monitored in 2013 and contained fewer individuals and decreased cover within the stream relative to 2005. The summer of 2013 was very dry, indicating a potential correlation between interannual variability in water levels and the number of thalli (Dillman, personal communication, 2014). Long-term population trends, however, are not known. |
| **6**<br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br>*Peltigera gowardii* grows at or below water level in clear, permanent, unshaded alpine or subalpine streams that are usually one meter or less across, and lower and upper montane conifer and riparian forests (COSEWIC 2013, NatureServe 2025). Habitat for all aquatic *Peltigera* species is characterized by specific levels of year-round humidity, stream-water flow, low water temperature, neutral pH values, and a lack of silt (Miadlikowska et al. 2014). Glavich (2009) found that the similar species *Peltigera aquatica* is associated with mid- to high elevation streams that are typically spring-fed with relatively stable flows, and with little scouring or siltation. It is often associated with large elevation drops and waterfalls where the mixing of air and water increase the level of dissolved gases in the water (Davis et al. 2000). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Alpine habitat has moderate ecosystem integrity and is trending lower, largely due to climate change (Turner and Mallot 2025). Unshaded subalpine habitat for *Peltigera gowardii* is likely susceptible to the same effects of climate change (tree encroachment and loss of snow melt), as alpine habitat.<br><br>One of the occurrences on the Tongass NF is in forested, low elevation habitat, which is incongruous with typical habitat for this species. In California, study of *Peltigera hydrothia (*prior to the species split in 2014) found the species occurred in mid elevation montane forests in shaded streams (Glavich 2009). However, the study also noted that further north in Washington and British Columbia, the species was observed in colder, subalpine sites in exposed streams (Glavich 2009).<br><br>The Tongass NF occurrence was documented in July 1997 and habitat was described as "snow melt fed stream". The GPS coordinates for this occurrence have some error, but it was found during a survey for timber harvest and may have been affected by timber harvest that occurred in the area in 2000. Additionally, increased temperatures and summer drought are likely to have altered habitat conditions in this low elevation stream. Since low elevation habitat appears to already be marginal for this species, changes to stream temperatures and flows may have adversely impacted this occurrence. It has not been revisited. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Climate change is the main threat to this species in alpine and subalpine habitat, where it has been most frequently observed in British Columbia and Northern Washington. Two occurrences in Southeast Alaska are in alpine or subalpine streams. This habitat is highly susceptible to changes as the tree line expands upwards and alpine plant communities change (Turner and Mallot 2025). Furthermore, as temperatures warm and less precipitation falls as snow, the duration and extent of snow in the alpine will decline. This is likely to contribute to increased stream temperatures and summer drought conditions in alpine and subalpine streams that are likely to be detrimental to *Peltigera gowardii*. These altered growth conditions along streamside habitat are likely to result in a shift in species composition, potentially leading to increased shading and decreased habitat suitability for this species.<br><br>One of the occurrences on the Tongass NF is also in a low elevation forested stream. This habitat has been modified by timber harvest and roads, and it may continue to be impacted because the small streams where *P. gowardii is* found may not to support fish and thus do not require protections. Timber harvest activities and associated road building may |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | additionally produce silt inputs to streams, or alter site hydrology. As the hydrologic requirements (temperature, silt levels, streamflow) appear to be highly specific for *Peltigera gowardii* (COSEWIC 2013), such activities present a threat to this species. |
| **8**<br>Life history and demographics | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Peltigera gowardii* is a perennial lichen whose fungal partner reproduces by spores. Its photobiont is *Nostoc* cyanobacteria (Lendemer and H. O'Brian 2011).<br><br>Sexual reproductive structures (apothecia) are common in *Peltigera gowardii*. It is suspected that when thalli are at or above water level, their asci eject ascospores into the air. Some thalli can be found as much as one meter below the water level (Davis et al. 2003). From what is known about other foliose lichens, it seems unlikely that the asci in the apothecia of *Peltigera gowardii* are able to discharge their spores when the thalli are under water. Ascospores of thalli growing at water level can be discharged into the air and when they land on a rock in a stream with appropriate water quality, it is presumed that they germinate and grow toward nearby cyanobacteria. If the latter are compatible, the cyanobacteria become enveloped by the fungal strands and together they grow to become a visible thallus (Honneger 2008). Under favorable conditions, thalli can develop into large colonies, 10 cm or more in diameter.<br><br>Demographics in Alaska: both populations contained thalli with apothecia so the fungal partner is reproducing. Generation time is uncertain but estimated at seventeen years (COSEWIC 2013).<br><br>Generation time for Peltigera gowardii has not been measured but is presumed to be relatively long, approximately 10-30 years (COSEWIC 2013). |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |

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| | | | |
|---|---|---|---|
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

### Conclusion Rationale

There is substantial concern for the long-term persistence of *Peltigera gowardii* within the plan area based upon the following:

- **Significant threats**: Projections for warmer wetter winters, which decrease the amount of snowpack and increase stream temperatures (cold water is a necessary habitat feature of this lichen), pose a significant threat. Additionally, an increase in sediment or change in hydrology in suitable small streams that lack riparian protections near activities such as road building or timber harvest could negatively affect this species. Altered hydrology, increased temperatures, and changes to sediment deposition can all result in growth conditions that influence a shift in the streambank plant community composition, potentially decreasing light availability and thus the suitability of this species' aquatic habitat.
- **Declining trends**: Population monitoring is limited. One occurrence within wilderness showed a reduction in individuals and cover in 2013 possibly due to drought. Alpine and subalpine habitat is declining due to climate change, particularly as snow cover extent and duration is lost, stream temperatures will rise, and summer alpine/subalpine stream flows will fall.
- **Restricted range**: There are two known occurrences of this species on the Tongass National Forest. These occurrences are the furthest north known for the species and over 375 kilometers (230 miles) from the next closest occurrences in British Columbia. *Peltigera gowardii* is considered critically imperiled in the state of Alaska. Additionally, *Peltigera gowardii* is endemic to the western U.S. and may be vulnerable globally (G3G4).
- **Low populations or restricted ecological conditions**: Fewer than 100 thalli are known to the Tongass NF, which renders occurrences vulnerable to extirpation by stochastic events. Low numbers and abundances, coupled with long generation time and specific microhabitat requirements, suggest that this species would not tolerate disturbance well.
- **Other factors**: This species is thought to disperse primarily through fragmentation but likely faces barriers to dispersal upstream or between watersheds. If fungal spores disperse, they must encounter a suitable photobiont for the lichen to establish.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |

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|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **USFS Lichen Biomonitoring Database [7/17/1997]** | **Kupreanof Is., north of Portage Bay. Stream bank of Missionary Range.** | **Stream in forested hillside with Saxifrage spp., Galium sp., grasses, mosses, and liverworts. 160 m. Snowmelt fed stream** | **3 = (>10 individuals, but on <50% of available substrate)** | |
| **2*** | **USFS Lichen Biomonitoring Database [7/19/2005]** | **Mainland, Thunder Mtn, East of Petersburg** | **2580 feet; Alpine area** | **3 = (>10 individuals, but on <50% of available substrate)** | |
| 2 | USFS Lichen Biomonitoring Database [8/1/2013] | Mainland. W slopes Thunder Mtn, w of Bussy L, on W boundary near stream outlet. | In streams; general area (associated lichen biomonitoring plot) is: transition from Pico/emni to Mixed con, Tsuga heterophylla, Picea sitchensis, Pinus contorta forest with heath understory and some Lyam, carex, and Rubus. | 3 = (>10 individuals, but on <50% of available substrate) | |
| | Occurrences not on the Tongass NF | | | | |
| 3 | INaturalist; Paul Norwood [8/2/2025] | Douglas Island, at top of access road at Eaglecrest Ski Resort | Rocky stream bed at approximately 2600 feet | | Recreation |

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# *Phyllodoce empetriformis*

*Phyllodoce empetriformis* [(Sm.) D. Don]

**Pink mountainheath**

Global Rank: **G5**
Alaska State Rank: **S1S2**



photo: Walter Siegmund

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce OR isolated.<br><br>*Phyllodoce empetriformis* is known from three estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The occurrences are located in the alpine on Etolin Island and the Juneau Icefield, and on the mainland at the terminal moraine of the Oasis Glacier.<br><br>There are additional occurrences in Southeast Alaska on non-NFS lands around Skagway and in Glacier Bay National Park, as well as just over the border into Canada.<br><br>This plant is distinguished from the more common *Phyllodoce glanduliflora* by having pink rather than yellow flowers. Hybrids between *Phyllodoce empetriformis* and *P. glanduliflora* are encountered occasionally where the two species occur together (FNA 2025). |
| **2**<br>Distribution in surrounding | **C** | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G5, Alaska State Rank S1S2<br>Alberta: S5, British Columbia: S5, Northwest Territories: S4, Yukon Territory: S4, Arizona: S1, California: SNR, Idaho: SNR, Montana: S5, Oregon: SNR, Washington: SNR, Wyoming: S3 |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| geographic area | | *Phyllodoce empetriformis* is widespread throughout the Pacific Northwest outside of Alaska with many documented occurrences in mountainous areas of British Columbia, Washington, Oregon, Idaho, and Northern California (CPNWH 2023, Calflora 2023). Herbarium records indicate the closest populations to the Tongass NF occurrences are approximately 100 miles away in British Columbia (CPNWH 2023). It is unclear if the Tongass NF occurrences are disjunct from the rest of the species range. Additional occurrences within Alaska are located on Kodiak Island, and within the Yukon Delta National Wildlife Refuge (CPNWH 2023).<br><br>Range-wide habitat is described as moist subalpine and alpine slopes (FNA 2025). |
| **3**<br><br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br><br>There is no information regarding seed dispersal methods in *Phyllodoce empetriformis* however, seeds of related *Phyllodoce caerulea* are thought to be dispersed by wind or over short distances in ground water (Coker and Coker 1973) |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>The Oasis Glacier occurrence estimated the population at 30 individuals but noted that many plants had dropped their flowers so it was difficult to tell *Phyllodoce empetriformis* from *Phyllodoce glanduliflora.* The population overall was described as "sparse distribution, scattered across moraine". The Etolin Island population described abundance as simply "rare", and the Juneau Icefield occurrence does not give any indication of abundance (Appendix 1, TESP 2025). |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Monitoring of *Phyllodoce empetriformis* on the Tongass NF has not occurred, so population trends are unknown. |
| **6**<br><br>Habitat trend on Tongass | **A** | A = Decline in habitat quality or quantity.<br><br>Habitat for this species on the Tongass NF and range-wide is alpine/subalpine as well as terminal moraine. Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). Climate change may lead to |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| NF | | upslope shift in elevation of tree line, increased proportion of woody vegetation relative to herbaceous, fragmentation and loss of alpine plant communities (Halofsky et al DRAFT).<br><br>*Phyllodoce empetriformis* communities may be especially vulnerable to climate-induced tree and shrub encroachment, as shown by research in the Cascade Range of Oregon and Washington (Franklin et al 1971). The snow-free period in certain subalpine meadow communities is probably the most critical factor affecting tree establishment (Franklin et al 1971). Research from 1971 found an intense period of climate-induced tree establishment in *Phyllodoce empetriformis* meadows in the Cascade Range of Oregon and Washington from 1928-1937, indicating community shifts impacting this species have already occurred.<br><br>Other comparatively minor, localized, or short duration stressors include mining, communication sites, and recreation. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Climate change may result in changes to the distribution of glacial moraine habitat. It is anticipated that glaciers will recede and snowpack decrease (Bennetsen et al. 2023), which has the potential to expose additional glacial moraine habitat. However, a study at Mt. Ranier documented heather meadows that included *Phyllodoce empetriformis* were limited to areas with reliable winter snow cover and moisture throughout the summer (Edwards 1980). Changes to precipitation patterns and snow cover or duration may impact this species, resulting in declines if mortality outpaces establishment into new habitats. |
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>*Phyllodoce empetriformis* is a perennial shrub in the Ericaceae family that reproduces sexually by seeds.<br><br>Little information is available on the population dynamics or reproductive biology of the species (Rochefort and Peterson 2001). Heather populations establish by seed on moist, well drained sites (Rochefort and Peterson 2001). *Phyllodoce empetriformis* seed production is thought to be high, but seedling recruitment is infrequent even under |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | favorable environmental conditions (Edwards 1980, Ingersoll 1991). A lifespan of up to 70 years has been documented from growth ring counts but mortality rates and recruitment rates are unknown (Edwards 1980, Olmsted 1975).<br><br>Generally, alpine heather species are not resilient to disturbance from recreation (Edwards 1980).<br><br>Alpine shrubs such as *Phyllodoce empetriformis* are inherently slow growing (Atkin et al 1996). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☐ | ☐ | ☒ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

- **Significant threats**: Alpine habitat has high vulnerability to climatic changes, and *Phyllodoce empetriformis* communities may be especially vulnerable to tree encroachment. Climate change may increase the amount of available glacial moraine habitat however, changes in snowpack and precipitation may result in population declines if mortality outpaces establishment into new habitats.
- **Declining trends**: No monitoring of this species on the Tongass NF has occurred, so population trends are unknown. *Phyllodoce empetriformis* communities in the Cascade Range have been found to be especially vulnerable to climate-induced tree encroachment, with snow-free period thought to be the most critical factor affecting tree establishment. Changes in snow and ice cover in the alpine in southeast Alaska are already evident.
- **Restricted ranges**: Herbarium records indicate the closest populations to the Tongass NF occurrences are approximately 100 miles away in British Columbia. It is unclear if the Tongass NF occurrences are disjunct from the rest of the species range.
- **Low population numbers or restricted ecological conditions**: Of the three known occurrences, populations were estimated to be less than 30 individuals at one and "rare" at another. Because there are a limited number of locations, and census numbers are low, some populations may be vulnerable to demographic stochasticity. Alpine, subalpine, and moraine habitat in general are not

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rare habitat types on the Tongass NF, but given the few occurrences, it is possible there are specific microhabitat requirements or other factors (e.g. dispersal limitation, competitive exclusion) that contribute to the rarity of this species.

- **Other factors**: *Phyllodoce empetriformis* is slow-growing, long-lived, and not resilient to disturbance.

## Conclusion

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|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1** | **ACCS_Mar25 (EO9)[7/19/2011]** | **Etolin Island, W of Menefee Inlet, Petersburg Quad, Tongass tiol Forest** | **alpine heath** | **NA** | **NA** |
| 1 | ACCS_Mar25 (EO9)[7/21/2011] | Etolin Island, W of Menefee Inlet, Petersburg Quad, Tongass tiol Forest | | | |
| 1 | CPNWH_April2025(ALA)[7/19/2011] | Etolin Island, W of Menefee Inlet, Petersburg Quad, Tongass tiol Forest. | Alpine heath, rare. | | |
| 1 | CPNWH_April2025(ALA)[7/21/2011] | Etolin Island, W of Menefee Inlet, Petersburg Quad, Tongass tiol Forest. | Rare. | | |

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| | | | | | |
|---|---|---|---|---|---|
| **2** | **TESP_Mar25 (100521P0000129Y17)[7/05/2022]** | | **moraine boulder field with nonvascular plants** | **30 genets (estimated)** | |
| 2 | ACCS_Mar25 (EO7)[7/13/2017] | Tongass National Forest, Petersburg Ranger District, mainland, Oasis Glacier. | Terminal moraine. | | |
| 2 | CPNWH_Mar25 (UAAH12568)[7/13/2017] | Tongass National Forest, Petersburg Ranger District, mainland, Oasis Glacier | Terminal moraine. | | |
| **3** | **ACCS_Mar25 (EO1)[no date]** | **N end, Taku A nunatak, Juneau Icefield, Alaska.** | | | |
| | Occurrences not on Tongass NF | | | | |
| 7 | ACCS_Mar25 (EO6)[7/07/2003] | Coast Mtns., White Pass Unit, near NE border, eastern fork of White Pass R., site 227 | alpine willow-herbaceous meadow, bordered by ericaceous heath, stream bank, rare in moist thin soil layer with moss and lichen over dioritic boulders on S-facing slope | | |
| 8 | ACCS_Mar25 (EO3)[no date] | White Pass is located on the Alaska - Cada (BC) border, approximately 13 mi NE of Skagway. Not clear if location was in Alaska or Cada. | | | |
| 4 | ACCS_Mar25 (EO4)[8/19/2000] | St. Elias Mts., Flower Mt., upper Porcupine Cr., ridge trending NE from summit | rocky, low heath alpine tundra and meadows | | |
| 4 | ACCS_Mar25 (EO4)[7/19/2011] | Haines area, Flower Mountain, Skagway Quad, Tongass tiol Forest | dwarf ericaceous tundra | | |
| 6 | ACCS_Mar25 (EO5)[8/22/2000] | St. Elias Mts., Four Winds Mt., ridge trending SE from summit | rocky alpine heath and mesic meadows, limestone substrate | | |
| 5 | ACCS_Mar25 (EO2)[no date] | Tlehini (Klehini R.). Not clear if this was in AK or Canada. | | | |

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# *Platanthera unalascensis*

*Platanthera unalascensis* [Spreng. (Rydb.)]

**Alaska rein orchid**

Global Rank: **G5**
Alaska State Rank: **S2S3**



photo: USDA PLANTS

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Habitat is scarce or isolated<br><br>*Platanthera unalascensis* is known from four estimated occurrences on the Tongass National Forest (Tongass NF), two of which may be incorrectly identified. We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). One confirmed occurrence is located at Red Bluff Bay on the eastern coast of Baranof Island, known from a specimen collected in 1984, where the species was recorded as occurring on red bluffs in a shaded, saturated soil pocket (ARCTOS 2023). The second confirmed location on the Tongass National Forest is near Doolth Mountain on west Chichagof Island collected in 2005, where the species was noted along an abandoned mining road in a roadside muskeg (ARCTOS 2023).<br><br>There has been confusion about the number of occurrences of *Platanthera unalascensis* on the Tongass NF in the past. Many occurrences previously identified as *Platanthera unalascensis* have since been determined to be *Platanthera ephemerantha* (Johnson 2023). For example, all occurrences on Prince of Wales Island that have been revisited or have herbarium vouchers have been confirmed to be *Platanthera ephemerantha*. *P. ephemerantha* has a similar growth habit but whiter flowers and fewer bracts (Nawrocki et al. 2017).<br><br>The two occurrences on the Tongass NF that are still unverified are on Duke Island and at Sevenfathom Bay on Baranof Island. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Due to the confusion about the identification of *Platanthera unalascensis*, habitat requirements have also been uncertain. Originally, the species was thought to be ultramafic associated on the Tongass NF. Incorrect records expanded probable habitat requirements. However, the two confirmed occurrences are on ultramafics, and the unverified Duke Island occurrence also is on ultramafic geology, so it is possible that the species has ultramafic substrate affinities in Southeast Alaska.<br><br>There are three additional herbarium specimens in Southeast Alaska on non-NFS lands. One is in Glacier Bay National Park in open mixed shrubland. Two occur in the Takhin River valley area west of Haines in a subalpine meadow and in the floodplain of the river in alder shrub. All three occurrences describe limestone geology, although there may be mafic components in all three locations (USGS 2025).<br><br>There is at least one known *Platanthera* species with an affinity for ultramafic substrates – *Platanthera bifolia*, which grows on ultramafic areas in the Central Balkans (Djordjević et al 2025).<br><br>Globally, ultramafic rock outcrops are known for hosting floras with high levels of endemism (Galey 2017). |
| **2**<br><br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass NF, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF.<br><br>Global Rank G5, Alaska State Rank S2S3<br>British Columbia Province Rank: S5, Yellow List; Alberta S2, Newfoundland S1, Ontario S4, Quebec S1, California SNR, Colorado SNR, Idaho SNR, Michigan S2S3, Montana S4, Nevada SNR, New Mexico S1, Oregon SNR, South Dakota S4, Utah SNR, Washington SNR, Wyoming S3.<br><br>Herbarium records elsewhere in Alaska include locations in areas north of the Tongass National Forest populations (Glacier Bay National Park, Takhin River, Haines Highway), as well as at least one record on Unalaska Island in the Aleutians (ARCTOS 2023). A few records south of the Tongass are located in areas near Prince Rupert, Queen Charlotte Islands, and Smithers, British Columbia. One record is located at the Iskut River approximately 150 km northeast of Wrangell (Klinkenberg 2023). The main distribution in the surrounding geographic area is disjunct by a significant |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | distance from the Tongass NF and is located from the southern half of British Columbia south to Washington, Idaho, Oregon, and California (Klinkenberg 2023, Douglas et al. 1999, Nawrocki et al. 2017).<br><br>Southeastern Alaska is the northern extent of the species' range (Nawrocki et al. 2017).<br><br>Range wide habitat is described generally as meadows and woods (NatureServe 2025), but the Tongass NF is the northern end of the range and species have been documented shifting habitat requirements at range edges to avoid competition (Griggs 1914, Stanton-Geddes et al. 2012). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>Orchids produce a very large number of tiny seeds. Because the seeds have very little mass, they are well-suited to dispersal by wind. Most seeds likely deposit within six meters of the parent plant (Chung et al. 2004). Seeds are hypothesized to be buoyant and suited to long-distance dispersal over water, however further study is needed (Lauri 2007, Nawrocki et al. 2017).<br><br>The seeds require an association with a mycorrhizal fungus for germination and plant establishment (Clements 1988). *Sistotrema*, a genus of saprophytic fungus, has been shown to form mycorrhizal associations with *Platanthera unalascensis* in Alberta (Currah et al. 1990). Although no research has been done to identify the mycorrhizal relationships for *Platanther unalascensis* in Alaska, it is possible that similar interactions with *Sistotrema* occur. A closely related species, *Platanthera yadonii*, has been shown to form mycorrhizal associations with a broad range of fungi across three families (Pandey et al. 2013). The specificity and abundance of fungal associates in *Platanther unalascensis* warrants investigation as it is largely unknown (Nawrocki et al. 2017).<br><br>The limited distribution of orchids may be due at least in part from the rarity of their mycorrhizal symbiont (Bothe et al. 2010). Thus, the ability of this species to disperse to other areas could be limited by the absence of its specific mycorrhizal fungus. |
| **4**<br><br>Abundance on Tongass | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>Eight plants were counted at the Doolth Mountain occurrence in 2016. No other counts have been made at either of the verified occurrences. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| NF | | |
| **5**<br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br>Population trends of *Platanthera unalascensis* in Alaska are unknown. |
| **6**<br>Habitat trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br>Occurrences on the Tongass NF are in open areas including meadows and bluffs that are associated with ultramafic geology.<br>The occurrence near the old mining road may have been impacted by road construction and mining activities. It is difficult to make inferences about general habitat trends when habitat requirements are uncertain. |
| **7**<br>Habitat vulnerability or modification; other threats | **D** | D = Insufficient information to draw inferences about criterion.<br>Mining or roadbuilding activities to access mineral deposits could impact habitat or occurrences of this species. There is an old mine at one of two confirmed occurrences and mining claims at the Duke Island occurrence, but no mining is currently proposed at either location.<br>Orchardgrass is known along the old mining road at the Chichagof Island occurrence but is not likely to invade the muskeg habitat where *Platanthera unalascensis* occurs.<br>Global climate change may be the most pervasive threat to future long-term persistence of rare orchids (Swarts and Dixon 2009). Climate change will likely alter temperature and precipitation patterns, which will affect the water table, especially in summer (Turner and Mallot 2025). This may create drought stress for *Platanthera unalascensis* and declining water table depth in wetlands may allow for tree encroachment. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>*Platanthera unalascensis* is a long-lived perennial that develops slowly. After infection by mycorrhizal fungi mediates germination, several years may pass before the plant develops above-ground growth (Nawrocki et al. 2017). Intact mycorrhizal networks are necessary to the germination and underground development of P*latanther* unalascensis. Therefore, areas where mycorrhizal networks have been damaged from soil disturbances are not likely to provide habitat for this species (Nawrocki et al. 2017).<br><br>The pollinator of this species on the Tongass is currently not known. A related orchid, *Platanthera obtusata*, is pollinated by the male mosquito in Alaska (Nawrocki et al. 2017). In Washington state it is known to be pollinated by the plum or pyralid moth (Washington Native Orchid Society 2014).<br><br>Terrestrial orchids require an association with a mycorrhizal fungus for germination and plant establishment, and it is essential for successful development and competition of orchids in their natural environments (Clements 1988). The specific mycorrhizal association of this orchid is unknown (Nawrocki et al. 2017). The limited distribution of orchids may be due at least in part from the rarity of their mycorrhizal symbiont.<br><br>The life cycle of orchids does not favor frequent soil disturbance nor are orchids often initial colonizers after such disturbances (Nawrocki et al 2017). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☐ | ☐ | ☒ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

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## Conclusion Rationale

*Platanthera unalascensis* is recommended as a Species of Conservation Concern. Although overall habitat and population trends are unknown, *Platanthera unalascensis* has a restricted range and low population numbers on the Tongass National Forest. The balance of this evidence was considered in the recommendation to consider *Platanthera unalascensis* a Species of Conservation Concern. The following elements were considered in this recommendation:

- **Significant threats** – Past and present mining exploration and extraction in this orchid's habitat is a potential threat. Occupied and potential habitat in ultramafic rock outcrops are vulnerable to minerals exploration and telecommunications sites. Several commercial minerals could potentially occur, including nickel, gold, silver, or zinc.
- **Declining populations or habitat trends** – Population trends on the Tongass NF are unknown. One occurrence may have been impacted by road construction and mining activities.
- **Restricted range** – Tongass NF occurrences of this species are at the northern extent of the species' range. Only two locations have been positively verified as this species; there may be two additional occurrences. The species may have more strict habitat requirements at this northern range edge and thus may contribute genetic diversity to the global population.
- **Low populations or restricted ecological conditions** – There are just two confirmed occurrences of this species on the Tongass NF, with an additional two occurrences unverified. The single occurrence for which there is count data numbered eight plants in 2016. Due to low population numbers, these occurrences may be vulnerable to extirpation from stochastic events. This species requires specific mycorrhizal fungi for germination, and presence of the fungi may limit dispersal. While general habitat conditions are not certain, it may be restricted to ultramafic and mafic substrates.
- **Other factors** – *Platanthera unalascensis* seeds are thought to be easily dispersed, however the species requires infection with specific mycorrhizal fungi for germination success, and the presence of the appropriate mycorrhizal fungi on the landscape is likely a limiting factor in the establishment of this species. *Platanthera unalascensis* is a long-lived perennial that develops slowly.

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# Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data |
|---|---|---|---|---|
| | Confirmed with herbarium vouchers | | | |
| **1*** | **ACCS_Mar25 (EO35)[8/14/1984]** | **Alexander Archipelago, Red Bluff Bay, E coast Baranof I.** | **red bluffs, shaded saturated soil pocket** | |
| **2*** | **ACCS_Mar25 (EO40)[6/29/2005]** | | **Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= Chichagof Is., 1 mi. NW of Doolth Mtn. Abandoned mining rd.** | |
| 2 | TESP_Mar25 (100531P000136)[7/21/2016] | | | 8 plants |
| 2 | TESP_Mar25 (100531P000136)[no date] | | | |
| 2 | CPNWH_April2025(ALA)[6/29/2005] | Sitka C-7 Quad, Chichagof Island. Approximately 1 mile NW of Doolth Mountain, Sitka Quad, Alexander Archipelago, Chichagof Island. | Along an abandoned mining road; disturbed roadside meadow. | |
| | | | | |
| | Unverified records possible | | | |
| **3** | **ACCS_Mar25 (EO2)[7/28/2005]** | | **Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= DUKE ISLAND, 3 IND. IN MUSKEGY GAP BETWEEN ULTRAMAFIC BOULDERS** | **3** |
| 3 | TESP_Mar25 (100552P000226)[7/28/2005] | DUKE ISLAND, 3 IND. IN MUSKEGY GAP BETWEEN ULTRAMAFIC BOULDERS | | 3 |
| **4** | **ACCS_Mar25 (EO34)[8/13/2009]** | **Baranof Is., Sevenfathom Bay** | | **2** |
| | | | | |
| | Occurrences not on TNF | | | |

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| | | | | |
|---|---|---|---|---|
| 5 | ACCS_Mar25 (EO42)[8/12/2001] | Glacier Bay, N of Vivid Lake, E side of a small ridge, Vivid 2, UTM 413821.17N, 6525070.2W, T 35 S, R 53 E, S 12 | limestone, open mixed shrubland and spruce | |
| 6 | ACCS_Mar25 (EO43)[7/20/2000] | St. Elias Mts., Takhin R. valley, vic. upstream of abandoned airstrip | floodplain, growing in openings in alder thicket | |
| 7 | ACCS_Mar25 (EO44)[7/18/2000] | St. Elias Mts., Takhin Ridge, W end, upper Takhin R. valley | limestone outcrops and subalpine mesic meadows with scattered shrubs | |
| 7 | ACCS_Mar25 (EO44)[7/18/2000] | Haines Alaska, Takhin Ridge . | Rich steep subalpine meadow on calcareous substrate. | |
| | | | | |
| | Erroneous or unlikely | | | |
| 8 | ACCS_Mar25 (EO37)[7/22/2008] | Edgecumbe Trail | growing at trail edge | |
| 8 | ACCS_Mar25 (EO37)[7/19/2011] | | | |
| 8 | TESP_Mar25 (100531P00196)[7/19/2011] | | | 30 |
| 9 | ACCS_Mar25 (EO21)[8/17/2009] | | | |
| 9 | ACCS_Mar25 (EO21)[8/11/2009] | | Vegetation= ; Slope = 5; Aspect= E; Substrate= Moss; Parent Material= ; Soil Moisture= Moist; Soil Texture= ; Light Exposure= Partial Shade; Comments= | |
| 10 | TESP_Mar25 (100554P000339)[6/18/2010] | Kosciusko Island, muskeg south of Cape Pole | yellow cedar scrub with fairly heavy Vaccinium understory throughout the area, but limited where PIUN3 was found | |
| 11 | ACCS_Mar25 (EO41)[8/11/2001] | Glacier Bay, W side of Willoughby I., E of VABM Else , UTM 433679.31N, 6495238.1W, T 38 S, R 56 E, S 10 | NW-facing limestone cliffs, dryas dwarf shrub | |
| **12** | **ACCS_Mar25 (EO5)[7/22/1999]** | **Unit 7 Gravina Sale, north of Bostwick Bay south of Vallener. South end of muskeg located on photo #198-69.** | | |
| 12 | TESP_Mar25 (100552P000081)[7/22/1999] | Gravina Island southeast of Grant Cove | dry area surrounded by muskeg with sege in a edge of a muskeg/470 (mixed conifer salal) habitat<br><br>Revisited: "rareplant coverage comments: GravinaTS,U7,NoBostwick, So | 2 |

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| | | | | |
|---|---|---|---|---|
| | | | Vallenar, 2 plants, took photo" **A Lund 2026: No photo in TESP | |
| 13 | ACCS_Mar25 (EO3)[7/01/1967] | Annette Island; Moss Point Road. | In muskeg amidst salal, myrica and salix. | |
| 14 | TESP_Mar25 (100554P000407)[8/23/2011] | | Muskeg edge at base of THPL in patchy TSHE-THPL-CANO. | |
| 15 | TESP_Mar25 (100554P00571)[7/26/2017] | | | |
| 16 | TESP_Mar25 (100554P00575)[8/21/2017] | | | |
| 17 | TESP_Mar25 (100554P000298)[8/09/2011] | | Growing on downhill side of road prism about 5' from the road, under a canopy of PHAR. Impossible to see basal leaves so only flowering individuals are represented. | |
| 18 | TESP_Mar25 (100554P00574)[8/29/2017] | | | |
| 19 | TESP_Mar25 (100554P00576)[7/19/2017] | | lakeshore, little to no overstoy | |
| 20 | TESP_Mar25 (100554P00573)[7/10/2017] | | lakeshore, little to no overstory, variable understory, boggy, third sub population located in former beaver pond now riparian wet meadow | |
| 21 | TESP_Mar25 (100554P000440Y12)[5/24/2012] | | Located on a hummock beneath THPL, CUNO, and TSME, above a seepage filled with CABI2, LYAM3, and PLSA6. | |
| 22 | TESP_Mar25 (100554P000148)[8/10/2010] | | Small THPL/TSME surrounded by a muskeg. | |
| 23 | TESP_Mar25 (100554P00572)[7/26/2017] | | | |
| **24** | **ACCS_Mar25 (EO36)[7/22/2009]** | **South Kruzof I** | **Aerial looks like muskeg, volcanic geology** | |
| **25** | **TESP_Mar25 (100531P00195)[7/19/2011]** | South Kruzof, | Volcanics, | **40** |
| 25 | ACCS_Mar25 (EO38)[7/19/2011] | South Kruzof | volcanics | |
| **26** | **ACCS_Mar25 (EO39)[7/20/2009]** | **South Kruzof** | | |

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# *Polystichum kruckebergii*

*Polystichum kruckebergii* [W. Wagner]

**Kruckeberg's holly fern**

Global Rank: **G4**
Alaska State Rank: **S1**

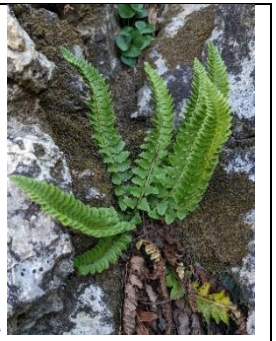


photo: Tyson Hobbs

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Habitat is naturally distributed as isolated patches, with limited opportunity for dispersal among patches. Some local populations may be extirpated, and rates of recolonization will likely be slow.<br><br>*Polystichum kruckebergii* is known from three estimated occurrences on the Tongass National Forest (Tongass NF). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). One occurrence is from the Cleveland Peninsula north of Ketchikan and the other two are from Red Bluff Bay on the eastern side of Baranof Island (Appendix 1).<br><br>There is one other occurrence in the region not on the Tongass just south of Metlakatla. The habitat for all occurrences is ultramafic rock outcrops. These outcrops exist as rare, isolated patches in Southeast Alaska (Gehrels and Berg 1992). Approximately 0.2% of Tongass NF geology is mapped as ultramafic (Wilson et al. 2015), and areas where these rocks exist on the surface as outcrops (and thus suitable habitat for *Polystichum kruckebergii*) are even more rare. |
| **2**<br>Distribution in surrounding geographic | **B** | B = Limited distribution outside the Tongass NF, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF.<br><br>Global Rank G4, Alaska State Rank S1<br>British Columbia Province Rank: S3S4, Yellow List; California S4, Idaho S2, Montana S2S3, Nevada SNR, Oregon S4, Utah S1, Washington SNR |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| area | | *Polystichum kruckebergii* is widely but sporadically distributed in small numbers in both the Sierra-Cascade and Rocky Mountains. Populations sometimes consist of only two or three dwarfed plants (FNA 2020). Occurrences in southeast Alaska are disjunct from the nearest population in British Columbia by approximately 450 kilometers (280 miles) (Douglas et al. 1998, Klinkenberg 2023). In British Columbia the habitat for this species is also ultramafic rock outcrops and talus in the montane and subalpine zones (Klinkenberg 2020).<br><br>The Tongass NF is close to the northern edge of this species range.<br><br>Globally, ultramafic rock outcrops are known for hosting floras with high levels of endemism (Galey 2017). |
| **3**<br><br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>This species disperses via spores, through wind and water. It is unknown how far these spores normally disperse. |
| **4**<br><br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>The population numbers recorded at the three occurrences are small: Occurrence 1 is made up of five small locations, one of which had two plants (numbers for the other four locations were not recorded). Fifteen plants were recorded at Occurrence 2 and 11 plants at Occurrence 3 (Appendix 1). |
| **5**<br><br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Population trend information for *Polystichum kruckebergii* on the Tongass NF is not available. |
| **6**<br><br>Habitat trend on Tongass | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Habitat for *Polystichum kruckebergii* on the Tongass is ultramafic rock outcrops both in the alpine (Redtop Mt) and montane (Red Bluff Bay). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| NF | | Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). It is unclear to what extent these environmental changes may have already affected the habitat for *Polystichum kruckebergii*. Because the occurrence in SE Alaska not on the Tongass NF is at lower elevation, and because the range of this species continues farther south (though still in montane to alpine habitat) it is possible that it will be resilient to climatic changes. |
| **7**<br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Some habitat modification has occurred from minerals exploration and telecommunication sites. *Polystichum kruckenbergii* records and habitat on South Baranof Island are within the South Baranof Wilderness area. According to Tongass Geology and Mineral specialists (Loofbourrow 2023) no minerals activities are currently being planned in the areas where this species is known to occur. Several commercial minerals could potentially occur, including nickel, gold, silver, zinc, etc. The method of extraction would likely depend on how far below the surface the minerals are located.<br><br>Alpine ecosystem integrity is highly vulnerable due to climate change (Turner and Mallot 2025). Climate change may lead to upslope shift in elevation of tree line, increased proportion of woody vegetation relative to herbaceous, fragmentation and loss of alpine plant communities (Halofsky et al DRAFT). |
| **8**<br>Life history and demographics | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Polystichum kruckebergii* is an evergreen perennial fern arising from a short, stout rhizome (Klinkenberg 2020). It is a tetraploid presumed to be of hybrid origin, with *Polystichum lonchitis* and *Polystichum lemmonii* as its diploid progenitors, although this hypothesis has not been confirmed (FNA 2020). |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Polystichum kruckebergii* within the plan area based upon the following:

- **Significant threats**: Occupied and potential habitat in ultramafic rock outcrops are vulnerable to minerals exploration and telecommunications sites. Several commercial minerals could potentially occur, including nickel, gold, silver, or zinc. One of the two known locations on the Tongass is alpine, a habitat highly vulnerable to climate change.
- **Declining trends**: Population trends are unknown. Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors, but it is unclear to what degree changes in alpine habitat may have impacted habitat suitability for this species.
- **Restricted ranges**: Southeast Alaska occurrences are disjunct from the rest of the species' range and near the northern edge of the species' range. Additionally, *Polystichum kruckebergii* is rare across its range.
- **Low population numbers or restricted ecological conditions**: Population counts are low, and the species is restricted to an extremely rare habitat type (ultramafic rock outcrops).
- **Other factors**: It is unknown whether other factors may exist that could impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |

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| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1** | **ACCS_Mar25 (EO2)[7/09/1998]** | **Alexander archipelago. Cleveland Peninsula. Gold mountain.** | **Alpine; serpentine dunite** | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | CPNWH_Mar25 (UAAH10006)[7/09/1998] | Alexander archipelago. Cleveland Peninsula. Gold mountain. | Collected on serpentine dunite in alpine. | | |
| 1 | ACCS_Mar25 (EO3)[8/11/1997] | Southeast Alaska Mainland, Cleveland Penin., just E of summit of Redtop Mtn., 4 km S of head of Vixen Inlet, 55Â¿ 45' 46" N, 132Â¿ 03' 05" W | on an isolated ultramafic outcrop, 2 plants growing on organic material accumulated in cracks of bare ultramafic rock, with few alpine vascular plants growing in cracks in otherwise bare ultramafics | 2 plants | |
| 1 | ACCS_Mar25 (EO3)[8/12/1997] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= ClevelandPenn,GoldMtnslopes,5pops?dup? | | |
| 1 | TESP_Mar25 (100552P000024)[8/12/1997] | | | | |
| 1 | ACCS_Mar25 (EO3)[8/12/1997] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= ClevelandPenn,GoldMtnslopes,4pops?dup? | | |
| 1 | TESP_Mar25 (100552P000023)[8/12/1997] | | | | |
| 1 | ACCS_Mar25 (EO3)[8/11/1997] | Mainland, about 55 km northwest of Ketchikan on the Cleveland Peninsula. Just east of the summit of Redtop Mountain, an islodated ultramafic outrcop which is about 4 km south of the head of Vixen Inlet. | Bare ultramafic rock. With few alpine vascular plants grwoing in cracks in otherwise bare ultramafics. | | |
| 1 | CPNWH_Mar25 (WTU358332)[8/11/1997] | Mainland, about 55 km northwest of Ketchikan on the Cleveland Peninsula. Just east of the summit of Redtop Mountain, an islodated ultramafic outrcop which is about 4 km south of the head of Vixen Inlet. | Bare ultramafic rock. With few alpine vascular plants grwoing in cracks in otherwise bare ultramafics. | | |
| 1 | TESP_Mar25 (100552P000022)[8/12/1997] | | | | |
| 1 | ACCS_Mar25 (EO3)[8/12/1997] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= ClevelandPenn,GoldMtnslopes,5pops | | |
| 1 | ACCS_Mar25 (EO3)[7/09/1998] | Mainland about 55 miles North West of Ketchikan. East of the summit of Redtop Mountain, 4 Km South of hehead of Vixen inlet. | | | |

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| | | | | | |
|---|---|---|---|---|---|
| 1 | CPNWH_Mar25 (WTU340591)[7/09/1998] | Mainland about 55 miles North West of Ketchikan. East of the summit of Redtop Mountain, 4 Km South of hehead of Vixen inlet. | | | |
| 1 | TESP_Mar25 (100552P000021)[1/01/1997] | | | | |
| 1 | ACCS_Mar25 (EO3)[1/01/1997] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= ClevelandPenn,GoldMtnslopes,5 pops? | | |
| 1 | ACCS_Mar25 (EO3)[7/09/1997] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= ClevelandPenn,GoldMt.slopes,5pops? | | |
| 1 | TESP_Mar25 (100552P000019)[7/09/1997] | | | | |
| 1 | ACCS_Mar25 (EO3)[no date] | The Cleveland Peninsula, about 55 km northwest of Ketchikan, just east of the summit of Redtop Mountain, 4 km south of the head of Vixen Inlet. | | | |
| **2** | **ACCS_Mar25 (EO4)[7/18/2003]** | **Alexander Archipelago, Red Bluff Bay, E coast Baranof I., about 40 km SE of Sitka near Red Bluff Bay.** | **growing in fissures of ultramafic rock on small bedrock walls 2-3 meters high** | | |
| 2 | TESP_Mar25 (100531P00199Y12)[7/19/2012] | | | 15 genets (estimate) | |
| 2 | ACCS_Mar25 (EO5)[7/18/2003] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= 3rd collection in Alaska, ultramafic roc | | |
| 2 | TESP_Mar25 (100531P000045)[7/18/2003] | | Ultramafic rock | | |
| **3** | **ACCS_Mar25 (EO6)[6/18/2004]** | **Port Alexxander Quad.: Alexander Archipelago, Baranof Island, Red Bluff Bay.** | **Ultramafic rock outcrop, bluff with overhang.** | | |
| 3 | ACCS_Mar25 (EO7)[6/18/2004] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= Baranof Is., Red Bluff ultramafics, rock wall overhang, plants growing in broken rock, 10 ferns | | |

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| | | | | | |
|---|---|---|---|---|---|
| 3 | TESP_Mar25 (100531P000082)[6/18/2004] | | Baranof Is., Red Bluff ultramafics, rock wall overhang, plants growing in broken rock | 10 ferns | |
| 3 | TESP_Mar25 (100531P000081)[6/18/2004] | | Baranof Is., Red Bluff ultramafics, ravine at base of steep slope, 1 plant sheltered under boulder | 1 plant | |
| 3 | ACCS_Mar25 (EO7)[6/18/2004] | | Vegetation= ; Slope = ; Aspect= ; Substrate= ; Parent Material= ; Soil Moisture= ; Soil Texture= ; Light Exposure= ; Comments= Baranof Is., Red Bluff ultramafics, ravine at base of steep slope, 1 plant sheltered under boulder | | |
| 3 | CPNWH_April2025(ALA)[6/18/2004] | Alexander Archipelago, Baranof I., Red Bluff Bay, Port Alexander Quad, Tongass tiol Forest. | Rare on 10Â¿ slope on NE aspect, ultramafic rock outcrop, bluff with overhang. | | |
| | | In SE but not on Tongass NF | | | |
| 1 | ACCS_Mar25 (EO1)[8/15/2001] | Yellow Hill, E side of hill, at trail head | growing in cracks of bare ultramafic rock, ca. 10 plants in population | Ca. 10 plants in population | |

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# *Primula pumila*

*Primula pumila* [(Ledebour) Pax, 1847]

**Arctic primrose**

Global Rank: **G5**

Alaska State Rank: **S4**



photo: (CC0) Igor Zagrebin

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce OR isolated.<br><br>*Primula pumila* is known from seven estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of populations that are separated by less than 1 km (0.62 mile). These occurrences are located on Baranof Island near Cold Storage Lake north-northeast of Sitka (Occurrence 1) and in an alpine area approximately six miles north of Sitka (Occurrence 7), and on Chichagof Island near Whitestripe and Rust Lakes (Occurrence 2, 3, 4, 5, and 6) (Appendices 1 and 2; CPNWH 2025, USFS 2025a).<br><br>Within the Tongass NF boundary, this species occurs in alpine habitat described as limestone ridges, alpine saddles, snow pockets, and north aspects on rock soils such as talus and gravel (Appendix 1).<br><br>There are no other documented occurrences of this species in southeastern Alaska outside of the Tongass NF (CPNWH 2025). |
| **2**<br>Distribution in surrounding | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass N.F.<br><br>Global Rank G5, Alaska State Rank S4 |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| geographic area | | *Primula pumila* is distributed from northern southeast Alaska and far northwestern Canada to Far East Russia (FNA 2025). In North America, *Primula pumila* is present in Northwest Territories (possibly extirpated) and Yukon (S2) Canadian provinces and territories as well as Alaska (FNA 2025, NatureServe 2025).<br><br>Across its range, *Primula pumila* occurs on tundra slopes, solifluction terraces, and late snowbeds (FNA 2025). NatureServe describes habitat as moist meadows and heathlands (NatureServe 2025). Additionally, in nutrient rich sites the plant tends to be robust, while in nutrient poor and exposed alpine sites it may be diminutive and reduced (FNA 2025).<br><br>In southeastern Alaska this species is only known from the Tongass NF; its range continues scattered throughout much of Alaska (CPNWH 2025). The next nearest record to the Tongass NF occurrences is approximately 300 miles north in Yukon (CPNWH 2025), and the occurrences on the Tongass NF are the southern range edge for the species. Given the large gap in records and island geography, the Tongass occurrences may be disjunct from the main range of the species. |
| **3**<br><br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Primula pumila* is a perennial herb with short and thick rhizomes with rosettes that are sometimes clumped (FNA 2025). Dispersal is likely by seed but is not well documented.<br><br>Primula pumila is self-fertile, which may allow for greater reproductive efficiency (Kelso 1992). It is a self-fertile derivative of P tschuktshorum that probably originated through selection for reproductive assurance (an evolutionary mechanism that allows for seed production when pollinators are scarce) when Pleistocene climatic perturbation disrupted insect pollinators (Kelso, 1992). |
| **4**<br><br>Abundance on Tongass NF | **B** | B = Uncommon - current abundance is large enough that demographic stochasticity is not likely to lead to rapid local extinction, but, in combination with highly variable environmental factors, could pose a threat.<br><br>*Primula pumila* is known from seven occurrences on the Tongass NF, and population counts are incomplete. Occurrence 2 had approximately 75 plants, Occurrence 3 had four plants, and Occurrence 4 had more than 100 plants (Appendix 1; CPNWH 2025, USFS 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **5**<br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of follow-up surveys, population trends of occurrences of *Primula pumila* on the Tongass NF are unknown (USFS 2025a, CPNWH 2025). |
| **6**<br>Habitat trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>The habitat for the six occurrences of *Primula pumila* on the Tongass NF is alpine habitat including limestone ridges, alpine saddle, and snow pockets (Appendix 1). Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). It is unclear to what degree these widespread changes have impacted the habitat of *Primula pumila* specifically.<br><br>Occurrence 7 has thousands of observations within 0.5 mile of the occurrence on a citizen science data-sharing platform (iNaturalist) indicating the area may receive significant visitation.<br><br>Occurrence 3 has an extensive mapped infestation and treatments of the non-native dandelion (*Taraxacum officinale*) within 0.5 miles. |
| **7**<br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on natural range of variation, and/or habitat is impacted by modern stressors.<br><br>Primula pumila may rely on late persisting snow beds to provide cool moist habitat on the Tongass NF (FNA 2015). Loss of alpine snow and ice have already been documented on the Tongass NF and may alter suitable habitat for this species (Turner and Mallot 2015). Snowbed specialist species have been shown to suffer as a consequence of earlier snowmelt dates and be replaced by species that do not specialize in snowbeds (Schob et al 2008).<br><br>Climate change may degrade habitat for *Primula pumila* as it leads to an upslope shift in elevation of tree line and an increased proportion of woody vegetation relative to herbaceous (Halofsky et al. In draft). It is possible that melting glaciers may expose habitat for this species, although it is not currently known from areas where glaciers are present, and it is unknown how effective this species would be at dispersing to new habitat. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Within all occupied and potential habitat types for this species, increased temperatures predicted with climate change may lengthen growing seasons and increase the demand for water by vegetation, while expected changes to precipitation types, timing, and volume can result in lower soil moisture coincident with this increased demand (Halofsky et al. 2025). Temperature increases and altered hydrology may also disrupt plant-animal interactions (pollinators, seed dispersers) as phenological cues of interacting species respond differently to warming conditions and seasonal changes in water availability (Parmesan 2006, Fricke et al. 2022).<br><br>Expansion of the large population of non-native dandelion near the Rust Lake occurrences may threaten the *Primula pumila* population in that area. Potential non-target herbicide application is also a risk when rare plants share habitat with target invasive plants. |
| **8**<br><br>Life history and demographics | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Primula pumila* is a perennial herb with short rhizomes (FNA 2025). It produces flowers and fruits with seeds, and flowers during the summer (FNA 2025). The genus Primula is known to be a poor competitor and tends to be restricted to low competition habitats (Bullard et al. 1987, Kéry et al. 2000, Carlson 2006).<br><br>Information on longevity of *Primula pumila* in particular was not found in the literature, but alpine plants are usually long-lived, with some forbs calculated to be older than 300 years (Grabherr et al 2010).<br><br>Trailing range edge (in this case, the southern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes that may be necessary to species' persistence under future climates (Rehm et al 2015). |

**Substantial Concern Determination Table**

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |

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| | | | |
|---|---|---|---|
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

- **Significant threats**: Climate change will likely degrade habitat due to loss of seasonal snowbeds. Invasive plants are present near one occurrence. Expansion of this infestation as well as non-target herbicide application are risks.
- **Declining trends**: Population trends are unknown. Alpine habitat is trending down due to loss of snow. This species relies on seasonal snowbeds for moisture in the summer and loss of late persisting snow may have already degraded habitat.
- Restricted ranges: *Primula pumila* occurrences on the Tongass NF are at the southern edge of the species' range. The Tongass NF occurrences may be disjunct from the main range further north. The next nearest record to the Tongass NF occurrences is approximately 300 miles north.
- **Low population numbers or restricted ecological conditions:** Occurrences are in three general areas near Rust Lake and Whitestripe Lake (Chichagof I) and Cold Storage Lake (Baranof I), which are a relatively small area of the forest.
- **Other factors:** Species in the genus Primula are known to be poor competitors and tend to be restricted to habitats with low competition. Trailing range edge (in this case, the southern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

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| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **CPNWH_Mar25 (WTU274191) [8/09/1975]** | **Baranof Island, just above Cold Storage Lake, about 10 air miles north-northeast of Sitka.** | **Growing in low wet area near a small pool in alpine saddle.** | **Flowers.** | |
| 1 | TESP_Mar25 (100531P000029) [8/09/1975] | | | MULLER 719 WTU 274191 XEROX AT TNFS P. | |
| **2*** | **CPNWH_April2025(ALA) [7/21/2004]** | **Alexander Archipelago, Chichagof I., Rust Lake, karst mountain E of lake, Sitka Quad, Tongass National Forest.** | **Rare on 20 degree slope on N aspect, ridgeline limestone snow pocket.** | | |

| | | | | | |
|---|---|---|---|---|---|
| 2 | TESP_Mar25 (100531P000114) [7/21/2004] | Chichagof Is., Rust L. area; | limestone ridge; above snowbed in broken rock | ~ 75 seen | |
| **3*** | **TESP_Mar25 (100531P000120) [7/22/2004]** | **Chichagof Is., Rust L. area;** | **limestone ridge** | **4 plants in trough between 2 limestone outcrops** | |
| **4*** | **CPNWH_April2025(ALA) [7/15/2004]** | **Alexander Archipelago, Chichagof I., Whitestripe Lake and[X]Whitestripe Mt., Sitka Quad, Tongass National Forest.** | **Common on 2 degree slope on NW aspect, shallow, gravelly soil over fractured limestone.** | | |
| 4 | CPNWH_April2025(ALA) [7/15/2004] | Alexander Archipelago, Chichagof I., Whitestripe Lake and[X]Whitestripe Mt., belowWhitestripe mountain ridge, Sitka Quad, Tongass National Forest. | Common on NE aspect, limestone talus. | | |
| 4 | TESP_Mar25 (100531P000098) [7/15/2004] | Chichagof Is., Whitestripe L. area | limestone ridge, shallow gravelly/rocky soil | 100+ plants | |
| 4 | TESP_Mar25 (100531P000100) [7/15/2004] | Chichagof Is., Whitestripe L. area | talus field below limestone bluff | 100+ plants | |
| 4 | TESP_Mar25 (100531P000097) [7/15/2004] | Chichagof Is., Whitestripe L. area | karst sinkhole basin on ridge | 16 plants | |
| **5*** | **TESP_Mar25 (100531P000144) [8/11/2005]** | **Chichagof Is., Whitestripe L. area, "marble" mountain N of lake** | | | |
| **6*** | **TESP_Mar25 (100531P000028) [7/08/1973]** | **WHEELER TNFS 3435 LOC APPROX PRIMULA EX [In Whitestripe area, on lower peak of adjacent Mount Lydonia]** | | | |
| **7*** | **iNaturalist**<br><br>**[multiple observations, spanning 2000-2025]** | **Alpine area approximately 6 miles north of Sitka** | | | |

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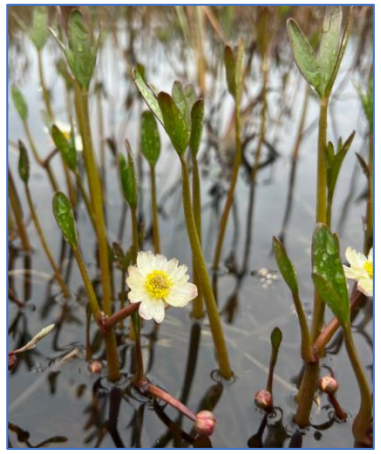
# *Ranunculus pallasii*

*Ranunculus pallasii* [Schltdl.]

**Pallas' buttercup**

Global Rank: **G4**
Alaska State Rank: **SNR**

Photo: Colin Jones (CC-BY-NC; iNaturalist 2025)



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**Species Assessment**

| Criteria | Rank | Rationale |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>*Ranunculus pallasii* is known from two estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1; Arctos 2025, CPNWH 2025, USFS 2025a). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The occurrences are found in the northwestern part of the Tongass NF in the Yakutat Foreland (Appendix 1), and they represent the southeastern edge of this species range in Alaska (SEINet 2025).<br><br>Occurrence 1 is made of two records, including an herbarium specimen by Carolyn Parker on 28 June 1991 in the Situk River Estuary (Appendix 1). Parker recorded the habitat as moist to wet meadow with sedges; other plants collected by her at that location on the same date included *Salix hookeriana*, *Tiarella trifoliata*, *Bistorta vivipara*, *Castilleja chrymactis*, *Castilleja unalaschcensis*, *Circaea alpina*, *Ligusticum scoticum*, and *Polemonium acutiflorum* (Arctos 2025, CPNWH 2025). |

| Criteria | Rank | Rationale |
|---|---|---|
| | | Occurrence 2, which is based solely on an observation made by Michael Shephard, maps to a location south of Italio Lake at 1890 ft (576 m) in elevation with no habitat information provided. The location for this record is noted as being approximate. The approximate location, lack of habitat information, as well as the record date (12/31/1991), make this record questionable (USFS 2025a).<br><br>A 1957 specimen at herbarium ALA with the location Alaska, POW I. was interpreted by the herbarium as originating on Prince of Wales Island, and without explanation, the herbarium added the more specific location "Hassler Harbor" and georeferenced the specimen at Hassler Harbor (Arctos 2025). This specimen is actually from POW 1, the Lonely Point Short Range Radar Site at Pitt Point, Alaska (Jeffrey 2025) on Alaska's north coast. The collector Edward Clebsch did his master's thesis research near Point Barrow (Clebsch 1957). Therefore, this incorrect Prince of Wales Island location was not included in the number of occurrences on the Tongass NF (Appendix 1).<br><br>*Ranunculus pallasii* is treated under the name *Coptidium pallasii* in the Flora of Alaska project and elsewhere (Emadzade et al. 2010, Hoffmann et al. 2010, Ickert-Bond et al. 2019). |

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| Criteria | Rank | Rationale |
|---|---|---|
| **2**<br>Distribution in surrounding geographic area | **C** | C = Wide distribution outside the TNF<br><br>Global Rank: G4 (Apparently Secure), Alaska State Rank: S2 (Imperiled) (NatureServe 2025)<br><br>Canadian provinces and territories: S1 (Critically Imperiled): Manitoba; S2 (Imperiled): Ontario; S3 (Vulnerable): Northwest Territories, Nunavut, Quebec; all others are S4 (Apparently Secure), SNR (not ranked), or not present. United States: S2 (Imperiled): Alaska; not present in any other states (NatureServe 2025).<br><br>*Ranunculus pallasii* occurs in northern North America and northern Eurasia (Whittemore 1997, POWO 2025). In north America its distribution ranges from Alaska east through the northernmost provinces and territories of Canada and southeast into northern Manitoba, Ontario, Quebec, and Labrador (Whittemore 1997, NRCS 2025).<br><br>There are two occurrences of *Ranunculus pallasii* from the Tongass NF (Arctos 2025, CPNWH 2025, USFS 2025a). The nearest other Alaskan records are approximately 250 miles northwest of Yakutat near Cordova (Arctos 2025, CPNWH 2025, SEINet 2025). Within Alaska, *Ranunculus pallasii* is mainly distributed along the west coast, including islands, and along the northern coast where it also occurs in inland areas (Hultén 1968, Welsh 1974, Porsild and Cody 1980, Arctos 2025, CPNWH 2025, SEINet 2025).<br><br>It is unclear if the Tongass NF occurrences are disjunct from the rest of the species' range. The approximately 250 miles of coastline between the Tongass NF occurrences and the next nearest Alaskan occurrences likely holds suitable habitat for the species (though also includes large bays and tidewater glaciers that could inhibit dispersal). Whether the Tongass NF occurrences are disjunct or not, they do represent the southern edge of the species' range on the western North America coast. |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | Throughout its range, *Ranunculus pallasii* occurs in fresh to brackish shallow water in pools, bogs, or swamps in muskeg or tundra at elevations ranging from sea level to approximately 2300 feet (700 m) (Hultén 1968, Welsh 1974, Whittemore 1997, Arctos 2025, CPNWH 2025). |
| **3**<br>Dispersal capability | **B** | B = Disperses only through suitable habitat (dispersal areas may or may not be corridors).<br><br>*Ranunculus pallasii* is a perennial herb with a creeping habit and elongated rhizomes that root at the nodes (Benson 1948, Whittemore 1997). Therefore, *Ranunculus pallasii* appears well adapted for vegetative (clonal) reproduction and may disperse rhizomes locally via water movement. The pollination system in *Ranunculus* is not specialized, and the flowers are visited by many kinds of insects (Steinbach and Gottsberger 1994, Kipling and Warren 2014). However, efficiency of sexual reproduction is generally low in *Ranunculus* species having a means of reproducing clonally (Sarukhán 1974, Lovett-Doust 1981, Kocot et al. 2022). The fruits of *Ranunculus* are one seeded achene, with many achenes produced per flower, and the achene is dispersed with the seed inside (Whittemore 1997). *Ranunculus pallasii* is strongly adapted to wetlands, and the achenes have spongy tissue that appears to be an adaptation to flotation and water dispersal (Hoffmann et al. 2010). |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | Given that the populations of this species on the Tongass NF are at their southeastern limit in Alaska and that they may have limited success in producing fruits through sexual reproduction, it is likely that this species will have difficulty dispersing long distances and expanding its range on the Tongass NF. |
| **4**<br>Abundance on Tongass NF | **A** | A = Rare – current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Ranunculus pallasii* is known from two estimated occurrences in the Yakutat Foreland, one of which is questionable (Appendix 1; Arctos 2025, CPNWH 2025, USFS 2025a). Only Occurrence 1 has a qualitative assessment of abundance ("scarce") (Appendix 1). Given the number of occurrences and the comment that it was scarce at Occurrence 1, it is likely that this species is rare on the Tongass NF. |
| **5**<br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Due to lack of monitoring, population trends for known occurrences of *Ranunculus pallasii* on the Tongass NF are unknown (Arctos 2025, CPNWH 2025, USFS 2025a). |
| **6**<br>Habitat trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Habitat for *Ranunculus pallasii* on the Tongass NF is moist to wet meadows on the Yakutat Ranger District (Arctos 2025, CPNWH 2025). Occurrence 1 is located in the Situk River Estuary near sea level (Arctos 2025, CPNWH 2025, USFS 2025a).<br><br>Non-native plants are mapped in the Situk River Estuary (most recently recorded in 2014), including *Phalaris arundinacea, Lupinus polyphyllus, Poa pratensis, and Agrostis stolonifera* (USFS 2025b). However, the lack of a recent invasive inventory combined with the high degree of uncertainty associated with the coordinates of Occurrence 1 make it difficult to infer to what degree invasive plants are impacting this occurrence of *Ranunculus pallasii.* |

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| Criteria | Rank | Rationale |
|---|---|---|
| | | Freshwater habitats on the Tongass NF are grouped under the vegetation category forested and non-forested wetlands (or palustrine wetlands), which is a freshwater, non-tidal influenced vegetation type with saturated soil that is very common on the Forest (Turner and Mallott 2025). In contrast wetlands influenced by tides and the presence of brackish and saltwater are grouped under the category tidal wetlands (Turner and Mallott 2025). When undisturbed, freshwater wetlands on the Tongass NF have historically been very stable ecosystems, exhibiting high ecological integrity (Turner and Mallott 2025). The ecological integrity of tidal wetlands on the Tongass NF is currently only moderate due to the current impacts of climate change (Turner and Mallott 2025). |
| **7**<br>Habitat vulnerability or modification; other threats | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Climate change may impact the habitat of *Ranunculus pallasii*, as it is considered to be the main future stressor of palustrine and tidal wetlands on the Tongass NF (Turner and Mallott 2025).<br><br>There is a road approximately 0.5 miles from the (estimated) location of Occurrence 1. Roads are vectors for the introduction and spread of invasive plants. Potential non-target herbicide application is also a risk.<br><br>Climate change is predicted to lead to increased air temperature, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit which may lead to drought stress for palustrine wetland species (Turner and Mallott 2025, Wiles and Warren 2025). Some freshwater bodies have already shrunk (Halofsky et al 2025). Although it is expected that these ecosystems will persist, there is uncertainty regarding changes in species composition (Turner and Mallott 2025). Declining water table depth in wetlands may allow for tree encroachment (Berg et al 2009, Halofsky et al 2025). Similarly, the main future stressor for tidal wetlands is climate change, which is predicted to increase air and ocean temperatures, increase or intensify storm frequency, and cause sea level rise (Turner and Mallot 2025). |

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| Criteria | Rank | Rationale |
|---|---|---|
| **8**<br>Life history and demographics | **D** | D = Insufficient information to draw inferences about criterion.<br><br>*Ranunculus pallasii* is a perennial herb that grows up to 15 cm high (Benson 1948, Whittemore 1997). Given its creeping habit with rhizomes elongated and rooting at the nodes (Benson 1948, Whittemore 1997), *Ranunculus pallasii* appears well adapted for vegetative (clonal) reproduction. The flowers are white or pink and appear in the summer (July and August; Benson 1948, Whittemore 1997). The pollination system in *Ranunculus* is not specialized, and the flowers are visited by many kinds of insects (Steinbach and Gottsberger 1994, Kipling and Warren 2014). Efficiency of sexual reproduction is generally low in *Ranunculus* species having a means of reproducing clonally (Sarukhán 1974, Lovett-Doust 1981, Kocot et al. 2022). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☒ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Ranunculus pallasii* within the plan area based upon the following:

- **Significant threats:** Predicted changes in water table may cause changes in species composition in wetlands, including lowered water table that may allow for tree encroachment. *Ranunculus pallasii* is an aquatic emergent so would not persist with lower water table. Additionally, the occurrence on the Yakutat Ranger District is the southern range edge for this species, so may be disproportionately affected by climatic shifts. An invasive plant of wetland environments, reed canarygrass, is mapped upstream of *Ranunculus pallasii*. Due to lack of recent invasive inventory, the current extent of this highly invasive grass is unknown. Both the invasive grass and non-target herbicide application are potential threats to *Ranunculus pallasii*. New invasive species could be introduced by nearby and upstream roads.
- **Declining trends in population or habitat:** Due to lack of monitoring, population trends are unknown. Habitat is likely to be impacted by

climate change, and some freshwater bodies have already shrunk. Invasive species may be impacting habitat for this species.

- **Restricted range:** Occurrences within the plan area represent the southernmost populations for the species. The next nearest populations are over 250 miles away. Tongass NF occurrences may be disjunct from the main range of the species.
- **Low population numbers or restricted ecological conditions:** Two occurrences are known on the plan area, and both are on the far northern edge of the Forest on the Yakutat Ranger District. Wetlands further south on the Tongass NF may not be suitable habitat for *Ranunculus pallasii*.
- **Other factors:** Efficiency of sexual reproduction (and thus long-distance dispersal) may be low in this species.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Personal Communications

Fulkerson, Justin. 2025. Lead Botanist and Collections Manager, Alaska Center for Conservation Science. Email correspondence about Tongass NF location of *Ranunculus pallasii*. Personal Communication 6 October 2025.

## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **Arctos 2025, CPNWH_April2025(ALA-UAM:Herb:3870)[6/28/1991]** | **Yakutat Foreland, Situk R. estuary, Yakutat Quad.** | **Herbaceous moist to wet meadow. Scarce; growing under sedges. [Collected on same date in same location and habitat: Salix hookeriana, Tiarella trifoliata, Bistorta vivipara, Castilleja chrymactis, Castilleja unalaschcensis, Circaea alpina, Ligusticum scoticum, Polemonium acutiflorum]** | **Scarce** | |
| 1 | USFS-TESP_Mar25 (100535P000075); Fulkerson 2025 | TNFS STIUK [sic] LOC APPROX | | | |

| | | | | | |
|---|---|---|---|---|---|
| | pers. comm. [6/28/1991] | | | | |
| **2*** | **USFS-TESP_Mar25 (100535P000079)[ 12/31/1991]** | **LOC APPROX NO SPEC [maps on mountain peak just south of Italio Lake at 1890 ft]** | | | |
| **3*** | **Arctos, 2025 (UAM:Herb:41251 ) [8/14/1957]** | **Prince of Wales Island, Hassler Harbor [Specimen label just says Alaska, POW I., lake edge. This location is acutally POW-1 at Pitt Point, Alaska, and herbarium coordinates are incorrect.]** | **Lake edge. Not on Tongass NF** | | |

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# *Romanzoffia unalaschcensis*

*Romanzoffia unalaschcensis* [Cham.]

**Unalaska mist-maid**

Global Rank: **G3G4**

Alaska State Rank: **S3S4**



photo: USDA 2002

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Habitat or population connectivity is limited due to factors such as environmental gradients, introduced species, disease, habitat loss, or habitat degradation. Dispersal among patches is limited or not possible.<br><br>*Romanzoffia unalaschcensis* is known from three estimated occurrences on the Tongass National Forest (Tongass NF). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). Two occurrences are located on Heceta Island in "alpine talus meadow" habitat and "steep patches of soil within rock sinkholes and crevices, on limestone rock, partially shaded" (USDA FS 2023, CPNWH 2023, ACCS 2023). Both Heceta Island occurrences are on mapped karst.<br><br>The third occurrence is along Starrigavan Creek near Sitka, in cobbles on the stream bank (iNaturalist 2025). The bedrock geology is the Khaz Complex of the Kelp Bay Group which contains "chaotically deformed rocks composed of blocks of greenstone, greenschist, tuff, graywacke, argillite, chert, limestone, and phyllite" (Wilson et al 2015). Thus, there may be minerals present (Ca, Mg) that raise the pH at this site.<br><br>One other occurrence, documented in 1982 on Baranof Island near Sitka, was reported extirpated by road construction (Goldstein et al. 2009). The land this occurrence was on is now state land. The habitat was described as "open area, old spruce/hemlock forest" (Appendix 1).<br><br>Across its range, the habitat for this species is described as "moist banks and crevices of rock outcrops" (Welsh) and "moist places" (Hulten). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | This species could be confused with *Romanzoffia sitchensis* which also occurs in southeast Alaska. The key break given by Hulten is: Leaves glabrous on both sides; pedicels slender, longer than calyx (*R. sitchensis*) vs. Leaves viscid-pubescent beneath; pedicels about as long as calyx (*R. unalaschcensis*)<br><br>Volume 15 of the Flora of North America, which this species would be included in, has not been published yet, therefore a recent treatment of the species and genus is unavailable. |
| **2**<br><br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass N.F.<br><br>Global Rank G3G4, Alaska State Rank S3S4<br><br>*Romanzoffia unalaschcensis* is endemic to Alaska, and the occurrences on the Tongass National Forest are the southeastern range edge (NatureServe 2023). There is one occurrence known outside of Alaska to the south in Haida Gwaii in limestone rock outcrops (iNaturalist 2025). Trailing range edge (in this case, the southern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes that may be necessary to species' persistence under future climates (Rehm et al 2015).<br><br>It is unclear if Romanzoffia unalaschcensis is confined to limestone influenced habitat on the Tongass NF. The two Heceta occurrences are on limestone substrate, the Haida Gwaii occurrence is on limestone, and the Baranof occurrence is on bedrock with limestone components that may influence soil pH at the occurrence. The phenomenon of species on the edge of their ranges switching to a different habitat or soil type has been documented previously, and authors have hypothesized that the atypical habitat may provide an environment with less interspecific competition (Griggs 1914, Stanton-Geddes et al. 2012).<br><br>Thirty-one occurrences are scattered from the eastern Aleutians across the south coast to southeastern Alaska. Twenty-six occurrences are located from Kodiak Island west to the Aleutians. The five occurrences on the Chugach National Forest are located at Cape St. Elias on Kayak Island, Hawkins Creek on Hawkins Island, Hinchinbrook Island, and Columbia Bay. The occurrence nearest the Sitka occurrence is located approximately 350 miles (560 km) away in the Grindle Hills near Bering Glacier in Wrangell-St. Elias National Park.<br><br>NatureServe reports a total of 34 documented occurrences across the species' range; some locations are noted as requiring further confirmation (NatureServe 2023). The range of *Romanzoffia unalaschcensis* is spread over a large and |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | poorly explored area (NatureServe 2023). Across its range this species occurs on moist to wet river and stream banks, beach terraces, rock crevices and faces, and at forest edges (NatureServe 2025). |
| **3**<br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br>Little is known about the dispersal capability of this species (Goldstein et al. 2009). |
| **4**<br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br>The Heceta Island occurrences were counted at 65 individuals in 2010, occupying relatively small areas on Bald Mountain (USDA FS 2023). There is no information on abundance for the occurrence near Sitka. The low number of individuals and restricted distribution of occurrences increases the risk of imperilment due to stochastic or environmental factors. |
| **5**<br>Population trend on Tongass NF | **A** | A = Significant downward or suspected downward population trend.<br>None of the extant known occurrences in Southeast Alaska have been revisited (USDA FS 2023). An occurrence documented in 1982 on Baranof Island near Sitka was reported destroyed by road construction (Goldstein et al. 2009). |
| **6**<br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br>Two known occurrences of *Romanzoffia unalaschcensis* occur in alpine/subalpine habitat on steep patches of soil within limestone rock sinkholes and crevices. Occurrences are in partial shade, mesic conditions, co-occurring with sedges, *Mitella* and *Polystichum* (Johnson 2023). Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska; this habitat exhibits high vulnerability to ecosystem stressors (Turner and Mallot 2025).<br>The third known occurrence near Sitka occurs in riparian habitat in a population recreation area. There are ATV trails through this area that likely impact habitat. Additionally, the area surrounding this occurrence was logged in 1974 and |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | activities likely impacted habitat directly through road building and machinery use and indirectly through altered runoff and harvest to stream edge. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **B** | B = Habitat modification is likely to result in ecological patterns similar to the range of historical conditions but is being impacted by modern stressors.<br><br>The alpine/subalpine occurrences of *Romanzoffia unalaschcensis* in the plan area are most vulnerable to increasing temperature trends and shifts in winter precipitation type from snow to rain, as well as decreases in snow accumulation. The loss of high elevation snow and ice in southeast Alaska is already evident, and species occupying these exposed habitats are known to rely on sustained winter snowpack as insulation from freezing temperatures and high winds (Halofsky et al. 2025). Trends of increasing temperature and altered precipitation patterns can also result in the encroachment of woody shrub species into sparsely vegetated alpine and subalpine habitats (Turner and Mallot 2025).<br><br>Riparian habitat is likely to be impacted by changes in timing and frequency of large rain events, rain on snow events, and resulting flooding (Halofsky et al 2024). Peak flows and floods can scour riparian areas, erode stream channels, undercut riparian trees and alter plant community composition (Halofsky et al 2024).<br><br>Surveys for this species conducted on the Chugach NF revealed a preference for habitats undergoing intermediate disturbance like wet, open and well-drained gravel substrate on stream banks and shorelines. In a report summarizing these surveys it was determined that the most severe threat to the persistence of *Romanzoffia unalaschcensis* on the Chugach NF is the encroachment of shrubs into open habitat (Mohatt 2019).<br><br>Modification of occupied habitat by road construction is believed to have resulted in extirpation of a known occurrence of this species on Baranof Island.<br><br>Within all occupied and potential habitat types for this species, increased temperatures predicted with climate change may lengthen growing seasons and increase the demand for water by vegetation, while expected changes to precipitation types, timing, and volume can result in lower soil moisture coincident with this increased demand (Halofsky et al. 2025). Temperature increases and altered hydrology may also disrupt plant-animal interactions (pollinators, seed dispersers) as phenological cues of interacting species respond differently to warming conditions and seasonal changes in water availability (Parmesan 2006, Fricke et al. 2022). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **8**<br><br>Life history and demographics | **D** | D = Insufficient information to draw inferences about criterion.<br><br>Little is known about the life history and demographics of this species (Goldstein et al. 2009).<br><br>Trailing range edge (in this case, the southern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes that may be necessary to species' persistence under future climates (Rehm et al 2015). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Romanzoffia unalaschcensis* in the plan area based upon the following:

- **Significant threats:** Observable decreases in high elevation ice and snowpack are likely to threaten the overwintering capability of the known occurrences in the plan area. Changes in climatic conditions including increased temperatures and a shift in precipitation types, timing, and volume may further negatively impact riparian habitat. Increased water demands from warmer summer temperatures, in combination with changes to the timing of stream flows, can result in water stress across all potential habitat types. Encroachment of woody shrubs, shading out, and increased competition as a result of changing growth conditions also pose a threat to the few recorded occurrences in the planning area. Recreation at the occurrence near Sitka is likely to impact Romanzoffia unalaschcensis.
- **Declining populations or habitat trends:** An occurrence documented in 1982 on Baranof Island near Sitka was reported destroyed by road construction. Additionally, the area around the extant Sitka occurrence was heavily logged in the 1970s when there were few protections for riparian habitat. Alpine habitat is trending down due to loss of snow and growing season water deficits, while riparian habitat may be trending down due to increasing frequency and intensity of flooding events.

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- **Restricted range:** *Romanzoffia unalaschensis* is endemic to Alaska. The occurrences on the Tongass NF are on the southeastern range edge of the species and thus may contribute genetic diversity that would contribute to the species resiliency to warming climates. The closest of the remaining 27 occurrences known to Alaska is approximately 350 miles (560 km) from the Sitka site in Wrangell-St. Elias National Park.
- **Low populations or restricted ecological conditions:** Sixty-five individuals were recorded within occurrences in 2010. The low number of individuals and small number of occurrences increases the risk of imperilment due to stochastic or environmental factors. Ecological conditions are not known to be restricted but unknown limitations to dispersal capability or more specific habitat preference at the southern range edge may contribute to rarity. This species may be associated with limestone influenced soils on the Tongass NF, which would limit potential habitat.
- **Other factors:** It is unknown whether other factors may exist that could impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **ACCS_Mar25 (EO21)[7/23/1993]** | **Heceta Island, Bald Mountain, westernmost peak** | **Alpine talus meadow.** | **NA** | **NA** |
| 1 | CPNWH_April2025(ALA)[7/23/1993] | Heceta Island, Bald Mountain, westernmost peak, Craig Quad, Tongass National Forest, Alexander Archipelago. | Alpine talus meadow. | | |
| 1 | ACCS_Mar25 (EO6)[no date] | Heceta Island, Bald Mountain, westernmost peak at northside base of cliffs. Survey site #R93-11. | 3 | ACCS_Mar25 (EO6)[no date] | Heceta Island, Bald Mountain, westernmost peak at northside base of cliffs. Survey site #R93-11. |

| **2*** | **ACCS_Mar25 (EO10)[7/18/2010]** | | **Vegetation= ; Slope = 30; Aspect= 220 ; Substrate= Soil; Parent Material= ; Soil Moisture= Moist; Soil Texture= ; Light Exposure= Partial Shade; Comments=** | | |
|---|---|---|---|---|---|
| 2 | ACCS_Mar25 (EO10)[7/18/2010] | Bald Mountain | steep patches of soil within rock sinkholes and crevices, on limestone rock, partially shaded | | |
| 2 | ACCS_Mar25 (EO10)[7/18/2010] | | Vegetation= ; Slope = 75; Aspect= 348 ; Substrate= Soil; Parent Material= ; Soil Moisture= Moist; Soil Texture= ; Light Exposure= Full Shade; Comments= | | |
| 2 | CPNWH_April2025(ALA )[7/18/2010] | Bald Mountain, Craig Quad, Alexander Archipelago, Heceta Island. | Steep patches of soil within rock sinkholes and crevices, on limestone rock, partially shaded. Growing with *Carex nigricans*, *Cystopteris fragilis*, *Mitellla pentandra*, mosses, *Phleum alpinum*, *Polystichum lonchitis*, *Saxifraga lyallii*, *Sedum rosea*. | | |
| 2 | TESP [7/17/10] | Site 35: NE of Bald Mtn. | | 40 genets | |
| 2 | TESP [7/17/10] | Bald Mountain West Site #34 | | 25 genets | |
| | | In SE Alaska but not on Tongass NF | | | |
| 3 | ACCS_Mar25 (EO3)[no date] | Baranof Island, ca. 6 miles E of Sitka, SE side of Herring Cove in Silver Bay, about 500 ft. down Green Lake Road, 20 feet above road. | | | |
| 3 | ACCS_Mar25 (EO3)[6/27/1982] | | | | |
| 3 | TESP_Mar25 (100531P000001)[no date] | | | | |
| 3 | ACCS_Mar25 (EO33)[6/27/1982] | Alexander Archipelago, Baranof I., Sitka, 10 km E of town | Open area, old spruce/hemlock forest. | | |

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# *Saxifraga eschscholtzii*

*Saxifraga eschscholtzii* [Sternb.]

**Cushion saxifrage**

Global Rank: **G4**
Alaska State Rank: **SNR**

Photo: Jason Grant (CC-BY; iNaturalist 2025)



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**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br><br>Distribution on Tongass NF | **A** | A = Scarce or isolated<br><br>*Saxifraga eschscholtzii* is known from five estimated occurrences on the Tongass National Forest (Tongass NF), all on Baranof Island within approximately three to seven miles of the town of Sitka (Appendix 1; iNaturalist 2025). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The five occurrences are on or near the summits of Arrowhead Peak, Bear Mountain, Mount Verstovia, Three Sisters Peak, and an unnamed mountain several kilometers east of Starrivagan Bay (Appendix 1). The records are at or above timberline and range in elevation from approximately 2,625 to 4,265 feet (800–1,300 m) above sea level (Appendix 1). All the records are encompassed within an area of approximately 16 square miles. The Tongass NF occurrences are the southeasternmost in the species' range, and there are no known occurrences outside of the Tongass NF in southeastern Alaska (Arctos 2025, CPNWH 2025, SEINet 2025). None of the Tongass NF occurrences are in Wilderness Areas.<br><br>Photographs on iNaturalist (2025) provide the only documentation for the Tongass NF occurrences. No digitized specimen records from southeastern Alaska were found (Arctos 2025, CPNWH 2025, SEINet 2025). The *Saxifraga eschscholtzii* map in Hultén (1968) shows a record near the town of Gustavus, which is approximately 95 miles (155 km) from the occurrences near Sitka and within a few miles of the boundary of Tongass NF. Welsh (1974) states "rarely in southeastern Alaska". Neither of these floras cite any specimens. Photographic records of the species on the Tongass NF |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | often show it growing on steep and mostly bare rock with mosses, lichens, and other tufted rock-loving plants (iNaturalist 2025). No specific substrate information was reported, but the occurrences are on rock mapped as the Khaz Complex, which is a mix of many rock types including volcanic, plutonic, metamorphic, and sedimentary rocks, and some local deposits of limestone (Karl et al. 2015).<br><br>Many of the tops of high mountains of the Alexander Archipelago may have been nunataks protruding above the ice during the Last Glacial Maximum (Carrara et al. 2007); this may have contributed to the current distribution of species such as *Saxifraga eschscholtzii*. |
| **2**<br><br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass N.F., or widely disjunct taxa for which the main distribution is a significant distance from the Tongass N.F.<br><br>Global Rank: G4 (Apparently Secure), Alaska State Rank: S3 (Vulnerable) (NatureServe 2025)<br><br>State Ranks:<br>Canadian provinces and territories: SH (Possibly Extirpated): Northwest Territories, Nunavut; S3 (Vulnerable): Yukon; not present in any other provinces or territories. United States: SNR: Alaska; not present in any other states (ACCS, NatureServe 2025).<br><br>*Saxifraga eschscholtzii* occurs in northwestern North America and in Siberia (Brouillet and Elvander 2009). In North America, it occurs in Alaska and Yukon and is considered possibly extirpated from the Northwest Territories and Nunavut (Brouillet and Elvander 2009, NatureServe 2025, NRCS 2025).<br><br>The nearest records to the Tongass NF occurrences are approximately 425 miles north-northwest along the Chisana River and approximately 480 miles to the northwest on Copper Mountain, just north of Landlocked Bay (Arctos 2025, CPNWH 2025, SEINet 2025). *Saxifraga eschscholtzii* records are widely distributed elsewhere in Alaska, ranging from the Seward Peninsula east through the Brooks Range, and from Kodiak and the Alaska Peninsula east through the Alaska Range (Hultén 1968, Welsh 1974, Arctos 2025, CPNWH 2025). The species is not known to occur in British Columbia (Klinkenberg 2020, Arctos 2025, CPNWH 2025, SEINet 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Throughout its North American range, *Saxifraga eschscholtzii* occurs on tundra and alpine cliffs, rock ledges, rocky outcrops and slopes, or gravelly substrates that are often calcareous (Hultén 1968, Welsh 1974, Porsild and Cody 1980, Brouillet and Elvander 2009). Records range in elevation from approximately 250 to 6,500 feet (75–2,000 m) (Brouillet and Elvander 2009, SEINet 2025). |
| **3**<br>Dispersal capability | **D** | D = Insufficient information to draw inferences about criterion.<br>No information was found on mode of reproduction or dispersal of *Saxifraga eschscholtzii*. Some *Saxifraga* taxa reproduce sexually by seed and vegetatively (Lindgaard-Hansen and Molau 1994); no records of vegetative reproduction by *Saxifraga eschscholtzii* were found. *Saxifraga* seeds are very small and are probably wind dispersed (Margreiter et al. 2022). No information was found on the dispersal distances of *Saxifraga* seeds. Potential *Saxifraga eschscholtzii* habitat is patchy, and distance between appropriate habitat patches presents a likely barrier to dispersal. |
| **4**<br>Abundance on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br>While there is no information on abundance or population extent for any of the Tongass NF occurrences, the species is known from a limited distribution on the Tongass NF, with the five estimated occurrences on one island within an area of approximately 16 square miles (Appendix 1). |
| **5**<br>Population trend on Tongass NF | **D** | D = Insufficient information to draw inferences about criterion.<br>There is no information on population sizes or trends for any of the Tongass NF occurrences. |
| **6**<br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br>*Saxifraga eschscholtzii* grows on rocky substrates above timberline at elevations ranging from approximately 2,625 to 4,265 ft (800–1300 m). The occurrences are all in the alpine zone on ridges or mountain tops above forested areas. Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc<br><br>Climate change is the main stressor of alpine ecosystems on the Tongass NF (Turner and Mallott 2025). The ecological integrity of this ecosystem is considered moderate and trending towards lower ecological integrity (Turner and Mallott 2025). Climate change is predicted to cause increased air temperature, higher precipitation, a shift in winter precipitation from snow to rain, and lower total snowpack (Wiles and Warren 2024, Turner and Mallott 2025). A lower snowpack level and warmer temperatures will lead to earlier snowmelt and decreased soil moisture later in the season (Wiles and Warren 2024, Turner and Mallot 2025). Increasing temperature will result in longer growing seasons and higher evapotranspiration rates which will raise vegetation water demands (Wiles and Warren 2024, Turner and Mallot 2025). Precipitation is predicted to increase but not enough to fulfill increased summer water demand (Turner and Mallot 2025).<br><br>There is uncertainty regarding potential changes to species composition in alpine zones on the Tongass NF (Turner and Mallott 2025). While there are no models specifically assessing alpine vegetation in southeastern Alaska, models from other alpine or tundra ecosystems predict increases in shrubby and woody vegetation as temperatures increase, snowpack declines, and timberline elevation rises (Turner and Mallot 2025). Upslope encroachment by woody species will decrease alpine habitat, while deglaciation and loss of permanent snow and ice fields will lead to some increases in areas open to potential colonization by alpine vegetation (Turner and Mallot 2025). However, colonization rates of new alpine habitat are unknown and may not equal rates of habitat loss at lower elevations (Turner and Mallot 2025).<br><br>While open rocky habitat may be abundant and may increase on the Tongass NF in the future (due to a decrease in glacial cover and snowpack caused by climate change), the Tongass NF occurrences are already at the extreme southeastern edge of the species' range and further changes in temperature or precipitation could cause declines in suitable habitat for the species.<br><br>Of the five Tongass NF occurrences, one (#5) is within one mile of a mapped historical or recent timber project (USFS 2025d), but the unforested rocky alpine habitat is unlikely to be impacted by downslope activities such as timber projects or road building. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | One of the occurrences (#3) is located within 0.6–0.9 mile of 14 taxa of mapped non-native plants (Appendix 1; USFS 2025b). Non-native plants mapped in the vicinity of the occurrence include *Agrostis stolonifera*, *Cerastium fontanum* ssp. *vulgare*, *Lolium arundinaceum*, *Matricaria discoidea*, *Phalaris arundinacea*, *Phleum pratense*, *Plantago major*, *Poa annua*, *P. palustris*, *P. pratensis*, *Ranunculus repens*, *Rumex obtusifolius*, *Taraxacum officinale*, and *Trifolium repens*. The rocky habitat of *Saxifraga eschscholtzii* may provide a buffer from non-native plant impacts, since many species do not thrive on steep rock faces.<br><br>Other potential stressors in alpine habitat include mining, communication sites, and recreation (Turner and Mallott 2025). |
| **8**<br><br>Life history and demographics | **D** | **D = Insufficient information to draw inferences about the criterion**<br><br>*Saxifraga eschscholtzii* is a rhizomatous, cushion- or mat-forming perennial herb in the Saxifrage family (Saxifragaceae) (Brouillet and Elvander 2009). No published information on reproductive success or demography of *Saxifraga eschscholtzii* was found from inside or outside of the planning unit. In the early summer, *Saxifraga eschscholtzii* rosettes produce solitary flowers on short peduncles (Brouillet and Elvander 2009). *Saxifraga eschscholtzii* is dioecious so requires cross pollination (Brouillet and Elvander 2009). No species-specific pollinator information was found. Confirmed pollinators of other *Saxifraga* species include flies, bees, and butterflies (Stenström and Molau 1992, Lindgaard-Hansen and Molau 1994, CPC 2025).<br><br>Cushion plants typically grow very slowly but have high adult survival rates and very long lifespans, which is sufficient for the stability and maintenance of populations (Chen et al 2017). However, alpine cushion plants facilitate other species because the dense dome of vegetation helps to moderate temperature, store moisture, retain soil and nutrients and protect from wind (Reid et al 2011). Temperature warming is likely to shift competitive balance toward the species cushion plants facilitate, to their own detriment (Dolezal et al 2019). Studies have also shown that loss of alpine snow has led to increased freeze damage for dwarf shrub species (Wipf et al 2009). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Saxifraga eschscholtzii* in the plan area based on the following:

- **Significant threats:** Predicted changes in temperature, precipitation type, and decreases in snowpack may alter species composition in alpine habitats. Changes to species composition may include the encroachment of woody species and result in decreased suitable habitat for *Saxifraga eschscholtzii*. Significant threats to habitat on the Tongass include changes to community composition and water availability due to changing growth conditions and the encroachment of woody species. Individuals of this species on the Tongass exist at the southern edge of their range, and as a result are particularly vulnerable to changes in growing conditions.

- **Declining trends in population or habitat:** Monitoring for this species has not been conducted on the Tongass NF, and population trends remain unknown. However, alpine and subalpine habitat on the Tongass NF is vulnerable to climatic changes, and changes in seasonal snowpack and reduced alpine/subalpine snow and ice are already evident.
- **Restricted range:** Occurrences on Tongass NF are at the southernmost edge of this species' range. The nearest occurrence outside the Tongass NF is 425 miles north, and there are significant gaps in habitat and geographic boundaries to dispersal and gene transfer between these populations.
- **Low population numbers or restricted ecological conditions:** Population numbers are unknown but only five occurrences of this species are recorded on the Tongass NF all on Baranof Island. This species likely grows very slowly and increasing temperatures are likely to facilitate increased competition from faster growing species.
- **Other factors:** It is unknown whether other factors may exist that impact the persistence of this species in the planning area.

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Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **iNaturalist [9/23/2025]** | **Bear Mountain (~ 600m south of summit)** | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain (~ 600m south of summit) | | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | iNaturalist [9/23/2025] | Bear Mountain (~ 600m south of summit) | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| 1 | iNaturalist [9/23/2025] | Bear Mountain summit | | | |
| **2*** | **iNaturalist [9/23/2025]** | **Mount Verstovia** | | | |
| **3*** | **iNaturalist [9/23/2025]** | **Arrowhead Peak** | | | |
| 3 | iNaturalist [9/23/2025] | Arrowhead Peak | | | |
| **4*** | **iNaturalist [9/23/2025]** | **Ridge just south of Three Sisters Peak** | | | |
| 4 | iNaturalist [9/23/2025] | Three Sisters Peak | | | |
| 4 | iNaturalist [9/23/2025] | Three Sisters Peak | | | |
| **5*** | **iNaturalist [9/23/2025]** | **unnamed peak 3 km east of Starrigavan Bay** | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |
| 5 | iNaturalist [9/23/2025] | unnamed peak 3 km east of Starrigavan Bay | | | |

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# *Tanacetum camphoratum*

*Tanacetum camphoratum* [Less.]

**Dune tansy**

Global Rank: **G5T4T5**
Alaska State Rank: **S1**



photo: Wikipedia

**Species Assessment**

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| **1**<br>Distribution on Tongass NF | **A** | A = Scarce OR isolated.<br><br>*Tanacetum camphoratum* is known from one estimated occurrence on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). The one occurrence on the Tongass National Forest is on a beach on Kruzof Island.<br><br>Suitable upper beach meadow or open sand dune habitat is rare in Southeastern Alaska. Beaches are separated and isolated by miles of rocky shoreline, interior forested habitats, or open ocean between neighboring islands (Carlson and Fulkerson 2017, USDA FS 2023). |
| **2**<br>Distribution in surrounding geographic area | **B** | B = Limited distribution outside the Tongass National Forest, or widely disjunct taxa for which the main distribution is a significant distance from the Tongass NF<br><br>Global Rank G5T4T5, Alaska State Rank S1<br>British Columbia Province Rank S4S5, Yellow List<br><br>*Tanacetum camphoratum* is distributed from Monterey Bay north through Oregon, Washington, Vancouver Island and then disjunct to northern Haida Gwaii and the Kruzof Island population (Carlson and Fulkerson 2017). The Tongass National Forest population is approximately 250 miles (400 km) disjunct from the closest population at Haida Gwaii. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | This species was previously described as *Tanacetum bipinnatum*, sensu lato, along with *T. huronense* and *Tanacetum bipinnatum* sensu strictu (Watson 2006). *Tanacetum bipinnatum* records in interior California, Washington and Oregon will require review to determine whether they represent *Tanacetum camphoratum* or *Tanacetum huronense*. *Tanacetum huronense* has a broader distribution, occurring from Newfoundland, through the Great Lakes region, Canadian prairies, and west to interior Alaska (Carlson and Fulkerson 2017). |
| **3**<br>Dispersal capability | **A** | A = Very limited dispersal ability (restricted dispersal capability coupled with ephemeral habitats).<br><br>Although this species is capable of reproduction through either seeds or rhizomes, no viable seed production has been observed in the single occurrence on the Tongass NF (Carlson and Fulkerson 2017). The highly clonal nature coupled with self-incompatibility may be compromising seed production in this population, although manipulative studies would be necessary to determine this. Seed viability of *Tanacetum camphoratum* is low with less than 10% germination success (Went and Munz 1949). Seed germination appears to increase with burial and associated sandy beach or dune expansion (Marshall 2014, in Carlson and Fulkerson 2017).<br><br>In southeastern Alaska, viable habitat for this species includes sandy upper beach meadows and dunes (Carlson and Fulkerson 2017). These habitats are limited in extent and separated by rocky shoreline or the distances between islands. Dispersal capability (to new beach habitat) is limited to the low probability of a viable rhizome being transported by ocean current to suitable habitat on a new beach. The beach meadow habitat that is occupied at North Beach is believed to have formed recently and it is suggested that *Tanacetum camphoratum* has only recently colonized the ephemeral habitat (Carlson and Fulkerson 2017). *Tanacetum camphoratum* is recognized as an early colonizer of beach fringe habitats on the Oregon coast (Wiedemann 1998). |
| **4**<br>Abundance on Tongass NF | **A** | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>Only one small population has been found on the Tongass NF, with stem counts ranging from an estimate of 1000 stems in 2013 to 172 stems in 2017 (Carlson and Fulkerson 2017). Stems that would have otherwise been lost to erosion have been transplanted to one of six sites with similar habitats.<br><br>*Tanacetum camphoratum* is unlikely to be overlooked during botanical surveys. Directed botanical surveys have occurred in beach meadows where habitat was thought suitable including Cuvacan Cove in 2008 and 2011, Shoal's Point in 2003 and 2008, Shelikof Bay in 2008, and Sea Lion Cove in 2008. While *Tanacetum camphoratum* was not |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | encountered, other regionally rare beach species were found (Krieckhaus 2014, Carlson and Fulkerson 2017). Survey results suggest that this species is extremely restricted within the Tongass NF. |
| **5**<br>Population trend on Tongass NF | **A** | A = Significant downward or suspected downward population trend.<br><br>There is evidence that the single Tongass NF occurrence is in rapid decline due to habitat loss, specifically coastal erosion, in recent years. This occurrence has been monitored in multiple years since it was first inventoried at 700 stems in 2003. In 2013, the population was estimated at between 100-700 stems. By 2017, however, the population was reduced to 172 stems due to beach erosion (Carlson and Fulkerson 2017).<br><br>A relocation effort was launched in 2013. Where beach erosion was undercutting eight stems, they were relocated to one of six sites in similar habitat. Additional plants were translocated in 2014 (eight stems), 2016 (150 stems) and 2018 (50 stems). Overall, the salvage and translocating work appears to have been successful, as many of the plants have survived over multiple years. However, it remains to be seen if these sites will become self-sustaining through either seed or vegetative reproduction over the long-term (USDA FS 2019). |
| **6**<br>Habitat trend on Tongass NF | **A** | A = Decline in habitat quality or quantity.<br><br>On the Tongass NF, *Tanacetum camphoratum* occurs in sandy substrates in the upper beach zone. The population on the Tongass NF is found below the storm tide log deck. Throughout its range, this species occurs on coastal foredunes associated with river outlets, parallel ridges, and prograding shorelines (Carlson and Fulkerson 2017).<br><br>Habitat quantity at the known Tongass NF occurrence is being lost by wave-cut erosion processes and natural succession. Occupied habitat increased from 900 $ft^2$ in 2003 to 1600 $ft^2$ in 2012, however decreased to 1250 $ft^2$ in 2013 due to erosion, a process that was observed to continue through 2017. In that year, stems were actively eroding into a stream whose channel had changed, undercutting occupied habitat (Carlson and Fulkerson 2017). While the stream had changed course in 2017, halting the erosional process, by 2018 it changed course again, and erosion resumed. This trend threatens the persistence of the occurrence.<br><br>Natural ecological succession is also contributing to a decline in habitat quality. The herbaceous upper beach meadow in North Beach, Kruzof Island is converting to a closed Sitka spruce forest (Carlson and Fulkerson 2017). Currently |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | *Tanacetum camphoratum* plants are only found in small open areas of moss and forbs between young spruce trees (Carlson and Fulkerson 2017). As the beach continues to erode, remaining plants are restricted to the spruce treeline, where closing canopy will degrade habitat quality for this species (USDA FS 2019).<br><br>One hundred years from now sea level on the north end of the forest is expected to be 1.8 m lower due to isostatic rebound as glaciers melt, while on the south end of the forest, sea levels may be 0.2 m higher (Halofsky et al 2025). This will likely alter current beach meadow habitat and it is unknown whether plants can respond to these changes and disperse into newly created suitable habitat. Additionally, there are projected to be more high intensity storm events (Halofsky et al 2025), which could increase coastal erosion, further impacting beach meadow habitat. |
| **7**<br><br>Habitat vulnerability or modification; other threats | **A** | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Beach erosion has resulted in substantial modification of habitat. A migrating stream triggered erosion of the upper beach where *Tanacetum camphoratum* occurs and resulted in 50% loss of occupied habitat between 2006 and 2017 where the stream undercut the population (Carlson and Fulkerson 2017, USDA FS 2019). By 2017, the stream channel changed course, and erosion ceased, however by 2018 the stream channel again changed course, and erosional processes resumed (Carlson and Fulkerson 2017, USDA FS 2019).<br><br>Off-highway vehicle traffic has also degraded beach habitat associated with the dune tansy. Although off-trail areas were officially closed to motorized vehicle use in 2007 through an Access and Travel Management Plan, site visits documented that motorized vehicular traffic continued within a portion of the occurrence (Kriekhaus 2014). A user-created off-road trail had been established through the center of the population by 2012 (USDA FS 2019). Exclosures were established in 2013 to restrict off-road vehicular access. Beach erosion has reduced habitat accessibility to off-road vehicles, which are not currently able to access the occurrence.<br><br>Non-native species present an additional threat to habitat for *Tanacetum camphoratum*. *Senecio jacobaea,* considered moderately invasive, was recorded near the occurrence (ACCS 2017, Carlson and Fulkerson 2017). These four plants were hand-pulled and may have been eliminated. Other non-native species recorded from Shelikov Bay include: *Cerastium fontanum*, *Phalaris arundinacea*, *Plantago major*, *Poa annua*, *Poa pratensis*, *Trifolium hybridum, Trifolium repens*, and *Phleum pretense*. These species are currently restricted to roadsides of logging roads (e.g., Forest Road 7591) and either |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | tend to be weak competitors or are unlikely to occur in well-drained sandy habitats (Carlson and Fulkerson 2017). Native species may also present a risk. Beach wild-rye can form dense, monotypic stands in beach meadow habitat, and may out-compete *Tanacetum camphoratum* in this area (USDA FS 2019).<br><br>An additional factor that could affect the population (or previously unknown populations) is dune tansy's similar appearance to the invasive common tansy (*Tanacetum vulgare*); enthusiastic weed pullers might accidentally obliterate a population (Goldstein et al. 2009).<br><br>Beach habitat in general is dynamic, and vulnerable to severe erosion caused by winter storms or natural geomorphic processes. One suspected deleterious consequence of climate change is the indirect effect of an increase in storm intensity and/or frequency, resulting in higher wind speeds and larger storm swells accelerating coastal erosion. Specifically, wind speed is projected to increase 2–4% by 2050 (Abatzoglou and Brown 2011). Such conditions, and associated erosion events, pose a continued threat to the original *Tanacetum camphoratum* and transplant populations along the Shelikof Bay beaches. Additionally, increased precipitation may continue flooding and shifting of the neighboring stream, continuing the habitat loss of the *Tanacetum camphoratum* population (Carlson and Fulkerson 2017). |
| **8**<br><br>Life history and demographics | **A** | A = Low reproductive rate and high mortality (such as: susceptible to disease, predation, or competition); OR life history characteristics that suggest populations may not recover rapidly from disturbance events or other demographic risk factors are of concern.<br><br>Dune tansy is a perennial species which typically reproduces by seed and by vegetative growth. The disjunct population found on Kruzof Island appears to be clonal and does not produce viable seeds. This single mode of reproduction limits the potential for this population to spread and occupy available habitat.<br><br>There is no available information about the demography of *Tanacetum camphoratum* on the Tongass NF or elsewhere in its range. It is widely regarded as a pioneer species of foredunes and dynamic upper beach meadows, and such species typically are characterized by reaching reproductive maturity rather quickly, producing numerous seeds with low maternal investment, having high mortality rates, and are often poor competitors. This species is likely capable of expansion within a site through vegetative spread, once established (Carlson and Fulkerson 2017). |

## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☒ | ☐ | ☐ |

## Conclusion Rationale

*Tanacetum camphoratum* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats:** Substantial modification of habitat has occurred and continues to occur as a dynamic stream course has shifted channel location over the past two decades, undercutting and resulting in a significant decrease in occupied habitat. In addition, off-road highway vehicle trampling has occurred through the known occurrence. Although the current stream location prevents off-highway vehicle access, the dynamism of the beach habitat environment may result in future off-highway vehicle impacts if that beach again becomes accessible. Additional threats include natural successional processes as Sitka spruce trees mature and result in closed-canopy conditions, competition with native and invasive species, and in increase in erosion due to increased storm intensity and/or frequency. Increased precipitation predicted by 2060 may continue flooding and shifting of the neighboring stream, continuing the habitat loss of the *Tanacetum camphoratum* population.
- **Declining trends:** The single population has declined by approximately 75% since its initial discovery in 2003, and at last count numbered 172 stems. This decline is primarily attributed to the stream and coastal erosion of occupied habitat. Viable seeds have not been observed and it is likely that the population at North Beach is a single clone (genetically a single individual). This indicates that it has limited opportunities for establishment of new populations and if in fact it is a single genotype, limited genetic diversity to promote longer term ecological resilience. The clonal habit may, however, increase the probability of transplant success, as well as allow for expansion into adjacent habitat where available.
- **Restricted ranges:** The nearest population of this species is approximately 250 miles (400 km) away on Haida Gwaii.
- **Low population numbers or restricted ecological conditions:** Sandy beach habitat is rare on the Tongass NF. The known population is restricted to narrow upper beach meadow margin at a single location. Similar habitats occur elsewhere in southeastern Alaska, but additional populations have not been detected. Individuals that would have been lost to erosion have been transplanted. These small subpopulations are persisting from the last census, but not increasing. It remains to be seen whether transplanted stems will become self-sustaining through either seed or vegetative reproduction over the long-term.

- **Other factors:** The Tongass population is likely dispersal limited because it is not known to produce viable seeds and may only reproduce via rhizomes. This single mode of reproduction limits the potential for this population to spread and occupy available

habitat.

Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| 1 | ACCS_Mar25 (EO2)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, Cuvacan Beach 2 | | | |
| 1 | ACCS_Mar25 (EO2)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, Cuvacan Beach 1 | | | |
| 1 | ACCS_Mar25 (EO1)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, North Beach 3 | | | |
| 1 | ACCS_Mar25 (EO1)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, North Beach 2 | | | |
| 1 | ACCS_Mar25 (EO1)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, North Beach 1 | | | |
| 1 | ACCS_Mar25 (EO1)[no date] | Tongass National Forest in Shelikof Bay, Kruzof Island, North Beach 4 | | | |
| 1 | CPNWH_Mar25 (WTU385055)[7/16/2005] | Sitka A-6 Quad. Kruzof Island, Shelikof Bay on "north beach". | | | |
| 1 | CPNWH_Mar25 (WTU383695)[8/12/2003] | Kruzof Island, Shelikof Bay, about 25 kilometers northwest of Sitka. | | | |

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| | | | | | |
|---|---|---|---|---|---|
| 1 | TESP_Mar25 [5/17/2017] | | | 2. Early growing season | |
| 1 | TESP_Mar25 [5/17/2017] | | | 5. Early growing season | |
| 1 | TESP_Mar25 [5/17/2017] | | | 13. Transplanted 7/19/16 | |
| 1 | TESP_Mar25 [6/21/2011] | | | 350 ramets (estimated). Population has expanded somewhat, but is also constrained by competition from other species, including young spruce on this mostly stabilized portion of the upper beach | |
| 1 | TESP_Mar25 [5/17/2017] | | | 6. Individuals transplanted 7/19/16 | |
| 1 | TESP_Mar25 [5/17/2017] | | | 84. Population augmented with individuals salvaged from original population in 2016. | |

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# *Therorhodion camtschaticum*

*Therorhodion camtschaticum* [(Pallas) Small, 1914]

**Kamchatka rhododendron**

Global Rank: **G5**

Alaska State Rank: **SNR**



photo: (CC0) Светлана Царахов

## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce OR isolated.<br><br>*Therorhodion camtschaticum* is known from four estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of individuals that are separated by less than 1 km (0.62 mile). These occurrences are located on the northern, outer coast of the forest including on Yakobi Island (Occurrence 1), Yakutat near Mountain Lake (Occurrence 2), Mt. Edgecumbe on Kruzof Island (Occurrence 3), and Mountain Lake Repeater ridge in the Yakutat area (Occurrence 4) (Appendix 1; CPNWH 2025, iNaturalist 2025, USFS 2025a).<br><br>Within the Tongass NF boundary, this species occurs in ridgelines, volcanic pumice, and rock outcrops (Appendix 1). Occurrence 2 is near a ridgeline on a SE aspect on broken bedrock and gravel, Occurrence 3 is on a volcanic slope, and Occurrence 4 was found sprawling over low rock outcrop on a south-facing slope. The habitat for Occurrence 1 is recorded in the USFS database as "muskeg", but the specimen associated with this record does not include habitat information, the herbarium collection was made in 1979 (i.e. location information has a high degree of uncertainty), so it is unclear if that habitat information is correct. The population was not found in a subsequent visit.<br><br>There are no occurrences of this species in southeastern Alaska outside of the Tongass NF (CPNWH 2025). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 2<br><br>Distribution in surrounding geographic area | C | C = Wide distribution outside the Tongass National Forest.<br><br>Global Rank G5, Alaska State Rank SNR<br><br>*Therorhodion camtschaticum* is narrowly distributed from northern southeast Alaska to far eastern Russia and Japan (FNA 2025), restricted primarily to the coastline and insular regions of the North Pacific and Bering Sea (FNA 2025, NatureServe 2025, Polezhaeva et al. 2025). Across its range, it occurs in Arctic and alpine tundra and heathlands, meadows, and subalpine woods at elevations of 0 m to 1,500 m (FNA 2025).<br><br>In southeastern Alaska this species is known only from the Tongass NF; its range continues east in Alaska with an occurrence approximately 250 km (150 mi) to the east near Wrangell-St. Elias National Park & Preserve (CPNWH 2025). It is unclear if the Tongass occurrences are disjunct, but they do represent the southeastern edge of the species' known range. |
| 3<br><br>Dispersal capability | D | D = Insufficient information to draw inferences about criterion.<br><br>Its main dispersal mechanism is by seeds (FNA 2025). Seeds are likely dispersed by wind due to the light weight of the seeds (SID 2025). |
| 4<br><br>Abundance on Tongass NF | A | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Therorhodion camtschaticum* is known from four occurrences on the Tongass NF (Appendix 1). Occurrence 1 is noted as "disjunct plants" that were not relocated in surveys after the initial observation in 1979; Occurrence 2 notes there were 50 or more plants in 2004; Occurrence 3 notes about 80-120 flowering plants in 180 square meters in 2025; Occurrence 4 only notes the species was present in 2010 (Appendix 1). |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>The plants on Yakobi Island (Occurrence 1) were not relocated in subsequent surveys (Appendix 1; USFS 2025a, CPNWH 2025). The other occurrences do not have revisit information. |
| 6<br><br>Habitat trend on Tongass NF | A | A = Decline in habitat quality or quantity.<br><br>Habitat for *Therorhodion camtschaticum* on the Tongass NF appears to be ridgelines, volcanic pumice, and rock outcrops in the alpine and subalpine on the northern outer coast. Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice in southeast Alaska and has high vulnerability to stressors (Turner and Mallott 2025). Alpine dwarf shrub communities are phenologically linked with snowmelt timing, so early spring exposure may increase risk of freezing damage during early development, and consequently reduce seasonal growth (Wheeler et al 2014). The few studies available examining alpine shrub response to accelerated snowmelt suggest growth is typically not enhanced under early snowmelt in temperate alpine habitats (Wheeler et al 2014).<br><br>Occurrence 3, the most southern occurrence and the largest known on the Tongass, is along a trail. Records of this occurrence are only known through a citizen science data-sharing platform (iNaturalist). Comments on this platform indicate that unauthorized collections may have been made. *Therorhodion camtschaticum* has showy pink flowers so this occurrence near a trail may be vulnerable to attention from hikers. |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on NRV, and/or habitat is impacted by modern stressors such as herbicides, nonnative invasive species, water diversions, recreation, etc.<br><br>Alpine ecosystem integrity on the Tongass NF is highly vulnerable due to climate change (Turner and Mallot 2025). In addition to the potential effects of reduced snowmelt in section 6, *Therorhodion camtschaticum* may be affected by temperature increases and altered hydrology that may disrupt plant-animal interactions (pollinators, seed dispersers) as |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | phenological cues of interacting species respond differently to warming conditions and seasonal changes in water availability (Parmesan 2006, Fricke et al. 2022).<br><br>While there are no records of non-native plants on the trail near Occurrence 3, surveys are not up-to-date, and trails are vectors for the introduction of non-native species. The occurrence is also vulnerable to other recreation impacts such as trampling and flower picking.<br><br>Other comparatively minor, localized, or short duration stressors to alpine habitat in general include mining, communication sites, and recreation. |
| 8<br><br>Life history and demographics | D | D = Insufficient information to draw inferences about criterion.<br><br>*Therorhodion camtschaticum* is a perennial shrub (FNA 2025). It produces rotate-campanulate flowers and capsule fruits with seeds (FNA 2025). It flowers from June to August (FNA 2025, NatureServe 2025). The flower pollination syndrome of this species is unknown (CPC 2025). Mature fruits are produced in late summer (FNA 2025). Seeds are potentially orthodox (DeBolt and Spurrier 2004, SID 2025). Seed germination requirements for this species are unknown (Baskin and Baskin 2014). Other species within the *Rhododendron* genus found in arctic tundra habitats tend to require cold and moist conditions to germinate and may suggest shared traits with *Therorhodion camtschaticum* regarding dormancy despite the tentative phylogenetic placement of this species (Baskin and Baskin 2014, FNA 2025).<br><br>The life span of *Therorhodion* species is not well documented, but alpine plants are usually long-lived (Grabherr et al 2010).<br><br>Trailing range edge (in this case, the southeastern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes that may be necessary to species' persistence under future climates (Rehm et al 2015). |

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# Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☒ | ☐ | ☐ |
| Restricted range | ☒ | ☐ | ☐ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

There is substantial concern for the long-term persistence of *Therorhodion camtschaticum* within the plan area based upon the following:

- **Significant threats:** Alpine habitat on the Tongass NF is currently considered only moderately stable due to the already evident loss of snow and ice and has high vulnerability to stressors. Early snowmelt may increase risk of freezing damage and reduce seasonal growth in alpine dwarf shrubs including *Therorhodion camtschaticum.* Recreation at the most southerly and largest known occurrence may impact *Therorhodion camtschaticum*.
- **Declining trends:** Due to lack of monitoring, population trends are unknown, though one occurrence was not relocated in a subsequent visit, and a different occurrence may have been impacted by unauthorized plant collecting. Loss of snow and ice in alpine and subalpine habitats in southeast Alaska is already evident.
- **Restricted ranges:** The Tongass NF occurrences are at the far southeastern edge of this species' range. The next nearest occurrence is approximately 150 miles away. It is unclear if the Tongass occurrences are disjunct, but they do represent the southeastern edge of the species' known range.
- **Low population numbers or restricted ecological conditions:** There are four occurrences on the Tongass NF, and habitat for this species on the Forest appears to be restricted to the alpine and subalpine on the northern outer coast. Population counts for the occurrences are incomplete, with the largest estimated at 80-120 plants.
- **Other factors:** Trailing range edge (in this case, the southeastern edge) populations often exhibit high degrees of local adaptation and contain unique genotypes that may be necessary to species' persistence under future climates

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Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **TESP_Mar25 (100532P000009) [6/24/1979]** | **Yakobi I Hocktaheen** | **Muskeg** | **Plant not relocated in subsequent surveys. Disjunct plants, disjunct from the west.** | |
| 1 | CPNWH_April2025(ALA) [6/24/1979] | Alexander Archipelago, Hoktaheen Lake, Yakobi I., Mt. Fairweather Quad, Tongass National Forest. | | | |
| **2*** | **TESP_Mar25 (100535P000104) [7/08/2004]** | **Yakutat area; Mtn. Lake Repeater ridge** | **just below ridgeline** | **50 or more plants** | |
| 2 | CPNWH_April2025 (ALA) [7/08/2004] | Yakutat Forelands, Mountain Lake, ridge W of lake, Yakutat Quad, Tongass National Forest. | Rare on 15 deg. slope on SE aspect, rocky ridgeline. | | |

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|---|---|---|---|---|---|
| 2 | TESP_Mar25 (100535P000105) [7/08/2004] | Yakutat area; Mtn. Lake Repeater ridge | on ridgeline in broken bedrock and gravels | | |
| 2 | TESP_Mar25 (100535P000106) [7/08/2004] | Yakutat area; Mtn. Lake Repeater ridge | shoulder of ridge, | 2 patches ~ 1 sq. meter | |
| **3*** | **iNaturalist 2025 (308624277) [7/28/2025]** | **Mt. Edgecumbe, Kruzof Island** | **Located on east facing volcanic pumice covered slope.** | **About 80 - 120 flowering plants found. Covering an 180 square meter area at approximately 2250' elevation** | |
| **4*** | **TESP_Mar25 (100535P000114) [7/14/2010]** | | **sprawling over low rock outcrop on south-facing slope** | **Species found.** | |

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# *Woodsia glabella*

*Woodsia glabella* [R. Br.]

**Smooth Woodsia**

Global Rank: **G5**
Alaska State Rank: **SNR**

Photo: iNaturalist user "Randal" (CC0: iNaturalist 2025)



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## Species Assessment

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| 1<br><br>Distribution on Tongass NF | A | A = Scarce or isolated<br><br>*Woodsia glabella* is known from two estimated occurrences on the Tongass National Forest (Tongass NF) (Appendix 1). We define an estimated occurrence as a grouping of populations that are separated by less than 1 km (0.62 mile). Occurrence 1 is located on Admiralty Island, on the ridge north of Greens Creek Mine, and Occurrence 2 is on the mainland in the southeast part of the Forest near Quartz Hill (Arctos 2025, CPNWH 2025). Neither Forest occurrence is within a Wilderness Area, but Occurrence 2 is 0.5 mile west of the Misty Fjords National Monument Wilderness. There are two other occurrences in southeast Alaska outside the Tongass NF boundary, one near Juneau and one on Willoughby Island in Glacier Bay National Park (Appendix 1).<br><br>On the Tongass NF, *Woodsia glabella* is found on wet exposed rock outcrops and rocky ridges from 2850 to 3100 ft (870 to 945 m) (Appendix 1; DeLapp 1994, Arctos 2025, CPNWH 2025). *Woodsia glabella* is generally found on calcareous rocks. Observational data for Occurrence 1 indicates the substrate is carbonate (Arctos 2025, CPNWH 2025). |

| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Observational information on substrate for Occurrence 2 is lacking, but geological data indicates the substrate is derived from roof pendants of the Coast plutonic complex with marble (derived from calcium carbonate) interspersed (CPNWH 2025, USGS 2025).<br><br>Plant associates observed or collected with *Woodsia glabella* on the Tongass NF include *Draba glabella*, *Micranthes nivalis*, *Carex circinata*, *Luzula arcuata* ssp. *unalaschkensis*, *Arcteranthis cooleyae*, *Cassiope lycopodioides*, *Luetkea pectinata*, *Fauria crista-gallii*, and *Lycopodium* spp. (DeLapp 1994, Arctos 2025). These species are typical of alpine heath habitat (Turner and Mallott 2025). |
| 2<br><br>Distribution in surrounding geographic area | C | *C* = Widely distributed outside of the Tongass NF<br><br>Global Rank: G5 (Secure), Alaska State Rank: SNR (NatureServe 2025, ACCS)<br><br>State Ranks:<br>Canadian provinces and territories: S2 (Imperiled): Alberta, Manitoba, Nova Scotia; S3 (Vulnerable): Labrador, Newfoundland, New Brunswick, Saskatchewan; all others are S4 (Apparently Secure) or S5 (Secure).<br><br>United States: SH (Possibly Extirpated): Massachusetts; S1 (Critically Imperiled): Maine, New Hampshire, New York; S2 (Imperiled): Minnesota, Vermont (NatureServe 2025).<br><br>*Woodsia glabella* has a broad distribution in northern North America and Eurasia (Windham 1993, POWO 2025). It has been reported from all the provinces and territories of Canada (Windham 1993, NatureServe 2025, NRCS 2025). In the United States it is known from Alaska, Maine, Minnesota, New Hampshire, New York, and Vermont, and is presumed extirpated from Massachusetts (Windham 1993, NatureServe 2025, NRCS 2025).<br><br>There are widely scattered records throughout much of the Alaskan mainland (Arctos 2025, CPNWH 2025). To the east, the species is infrequent in eastern and northern British Columbia (Klinkenberg 2020, Arctos 2025). The species is capable of self-fertilization, so a single spore can establish a new occurrence, which increases the chances of long-distance dispersal (see Criteria #3). However, long distance dispersal events are likely uncommon, so it is difficult to determine if Tongass NF occurrences are disjunct. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| | | Throughout its range, *Woodsia glabella* occurs on shaded, moist cracks and ledges on cliffs, mostly on calcareous rocks, especially limestone, in the montane and subalpine zones at elevations ranging from near sea level to approximately 4925 feet (1500 m) (Porsild and Cody 1980, Windham 1993, Klinkenberg 2020). |
| 3<br><br>Dispersal capability | B | B = Disperses only through suitable habitat<br><br>*Woodsia glabella* has a typical fern life-cycle with a conspicuous sporophyte (spore-bearing) generation alternating with a free-living but tiny gametophyte (sexual) generation (USFS 2010). Spores are thought to mainly be dispersed via wind and animals (Brock 2025), although they might also be dispersed via water movement. In northern Europe, the gametophytes of *Woodsia glabella* are homosporous, producing both sperm and eggs (Derzhavina 2022); thus, they are capable of self-fertilization which increases the potential for new populations to become established through long-distance spore dispersal (Peck et al. 1990). This species is not thought to have effective clonal reproduction via its short rhizome, nor does it travel far via rhizomatous growth (Derzhavina 2022). |
| 4<br><br>Abundance on Tongass NF | A | A = Rare - current abundance is low enough that stochastic and other factors could lead to potential imperilment.<br><br>*Woodsia glabella* is known from two occurrences on the Tongass NF. Neither Forest occurrence has a population count, although Occurrence 1 on Admiralty Island describes the occurrence as "rare" (CPNWH 2025). |
| 5<br><br>Population trend on Tongass NF | D | D = Insufficient information to draw inferences about criterion.<br><br>Population trends for known occurrences of *Woodsia glabella* on the Tongass NF are unknown due to lack of repeat visits to the occurrences (Arctos 2025, CPNWH 2025). |
| 6 | A | A = decline in habitat quality or quantity |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| Habitat trend on Tongass NF | | On the Tongass NF, the two occurrences of *Woodsia glabella* are found in alpine habitat on exposed rock outcrops and rocky ridges (Appendix 1). Occurrence 1 is on carbonate substrate and occurrence 2 may be influenced by carbonate substrate (marble). The occurrence on Admiralty Island is on the ridge north of Greens Creek mine and was discovered during surveys prior to exploratory drilling. The occurrence on the southeast end of the forest is on a ridge above the Quartz Hill mine. This area was excluded from the Misty Fjords National Monument to allow mineral extraction. It is unclear if either occurrence has been impacted by mining activities.<br><br>The current ecological integrity of alpine habitat on the Tongass NF is considered moderate but trending lower due to observed impacts from warming temperatures, including decreased snowpack duration and extent (Turner and Mallott 2025). |
| 7<br><br>Habitat vulnerability or modification; other threats | A | A = Substantial modification of habitat has occurred or is anticipated with conditions departing from expectations based on natural range of variation, and/or habitat is impacted by modern stressors<br><br>Increasing temperatures may impact the alpine habitat of *Woodsia glabella*. Slow-melting snowpack, along with rain, provides continuous moisture throughout the alpine growing season (Turner and Mallott 2025). Fern gametophyte growth and sexual reproduction requires water. Projected increased air temperatures, decreased soil moisture (due to increased evapotranspiration), and growing season water deficit, may lead to drought stress (Turner and Mallott 2025, Wiles and Warren 2025) and perhaps sexual reproductive failure for species with moisture requirements such as *Woodsia glabella*. In addition, loss of snowpack in the alpine habitat may expose vegetation to more wind damage (Turner and Mallott 2025). Increasing temperatures and loss of snow may impact the species' ability to persist.<br><br>Calcareous alpine habitat is a restricted habitat type on the Tongass NF so Woodsia glabella will likely struggle to colonize new areas if current habitat becomes unsuitable.<br><br>Continued mining exploration may also negatively impact *Woodsia glabella* or alpine habitat. |
| 8<br><br>Life history and | B | B = Low reproductive rate or high mortality (e.g., susceptible to disease, predation, or competition), but not both; OR life history characteristics that suggest populations have an intermediate ability to recover from disturbance events and no other demographic risk factors are known. |

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| *Criteria* | *Rank* | *Rationale* |
|---|---|---|
| demographics | | The fern *Woodsia glabella* is a perennial herb that grows from an erect to ascending short rhizome with a mass of long roots that anchor the plant to rock crevices (Derzhavina 2022). The leaves grow from the rhizome and reach a length of 3.5–15 cm (Windham 1993). This species has a typical fern life-cycle with a conspicuous, leafy sporophyte (spore-bearing generation) alternating with a free-living but tiny gametophyte (sexual generation) (USFS 2010). As in other *Woodsia* species, the sori (clusters of sporangia) are found on the undersurface of the leaf-segments; each sorus has a protective flap (indusium) that is divided into narrow, hairlike segments (Windham 1993, Derzhavina 2022).<br><br>*Woodsia glabella* sporophytes are green only in the summer, and typically the spores are released from the sporangia in late summer or early fall (Windham 1993). In studies in northern Europe, spores were also produced by immature sporophytes; this early production of spores would allow plants to reproduce early in drought years (Derzhavina 2022). The plants survive harsh conditions by dropping their leaf blades, leaving clusters of petioles attached to the rhizome (Windham 1993, Derzhavina 2022). The plants overwinter as rhizomes under snow, in crevices, between stones, and on scree, and the thick bunches of petioles protect the buds of new leaves from the drying effects of cold winds, high temperatures, excessive insolation, and transpiration (Derzhavina 2022). The bunches of petioles also allow the plants to accumulate humus and moss growth which contribute to the retention of moisture (Derzhavina 2022). In laboratory studies, spores of *Woodsia glabella* germinated within two weeks with complete formation of the gametophyte, eggs, and sperm taking 10 to 12 weeks (Derzhavina 2022).<br><br>Spores of *Woodsia* species in northern Japan germinate in the fall, and the young gametophytes are adapted to surviving periods of severe winter frost; not until the following summer are the gametophytes mature and the young sporophytes produced (Sato 1982). In a related species, *Woodsia scopulina*, the sporophyte and gametophyte generations were found to have different microhabitat preferences; the gametophytes were only observed in sheltered places (i.e., talus hollows and rock crevices) without direct sunlight, and they only grew on patches of fresh, bare soil (Watson and Vazquez 1981). Survivorship of individual gametophytes and juvenile sporophytes of *Woodsia scopulina* was estimated to be very low (Watson and Vazquez 1981). Microhabitat differences between sporophyte and gametophyte have also been observed in *Woodsia obtusa*; the rarity of this fern species in Canada was explained by a low likelihood of any given site meeting the habitat requirements of both generations (Wild 2010). Complex reproductive processes may also contribute to rarity of *Woodsia glabella* in Southeast Alaska. |

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## Substantial Concern Determination Table

| Basis of substantial concern | Yes | No | Insufficient information |
|---|---|---|---|
| Significant threats | ☒ | ☐ | ☐ |
| Declining populations or habitat trends | ☐ | ☐ | ☐ |
| Restricted range | ☐ | ☐ | ☒ |
| Low populations or restricted ecological conditions | ☒ | ☐ | ☐ |
| Other factors (see conclusion rationale) | ☐ | ☐ | ☒ |

## Conclusion Rationale

*Woodsia glabella* is recommended as a Species of Conservation Concern for the following reasons:

- **Significant threats**: Both occurrences on the forest are near active mines (Green's Creek and Quartz Hill). Mineral exploration could directly impact these occurrences. In addition, loss of snowpack and drought stress may directly impact survival and reproduction of this species.
- **Declining trends**: Population trends for this species are not known. Alpine habitat has moderate ecosystem integrity and is highly vulnerable to stressors due to loss of snowpack and increasing temperatures.
- **Restricted Range**: This species is circumboreal. Due to potential for long distance dispersal, it is unclear if occurrences on the Tongass NF are disjunct from other occurrences in Alaska and British Columbia.
- **Low population numbers or restricted ecological conditions**: There are two known occurrences on the Tongass NF and the species was described as rare at one occurrence. Woodsia species have complex reproductive processes that may contribute to the rarity of *Woodsia glabella* in Southeast Alaska. Calcareous alpine habitat is a restricted habitat type on the Tongass NF so Woodsia glabella will likely struggle to colonize new areas if current habitat becomes unsuitable.
- **Other factors**: It is unknown whether other factors may exist that could impact the persistence of this species in the planning area.

## Conclusion

| | |
|---|---|
| ☐ | The species is secure and its continued long-term persistence in the plan area is not at risk based on knowledge of its abundance, distribution, lack of threats to populations and/or habitats, and stable or increasing habitat and/or population trends. Not recommended as a potential Species of Conservation Concern. |
| ☐ | There is a lack of scientific information to determine that there is substantial concern for long-term persistence of the species in the plan area. Not recommended as a potential Species of Conservation Concern. |

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| | |
|---|---|
| ☒ | The scientific information supports a conclusion that there is substantial concern for long-term persistence of the species in the plan area. Recommended as a potential Species of Conservation Concern. |

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## Appendix 1. Abbreviated Location Table

Individual occurrences within 1 km are grouped into estimated occurrences, which represent populations separated by more than 1 km. Parent occurrence rows are in bold font with the occurrence number having an asterisk and additional data belonging to that occurrence in regular font below the parent occurrence with the same number. Cited data sources are provided in the Literature Cited section.

| Occ. Num. | Data Source [Date] | Locality | Habitat | Population Data | Threats |
|---|---|---|---|---|---|
| **1*** | **Arctos 2025, CPNWH_April2025(ALA-UAM:Herb:242432)[7/19/2010]** | **Greens Creek, north ridge, Juneau Quad, Alexander Archipelago, Admiralty Island.** | **SE-facing, carbonate rock outcrop, 20 degree slope, rare. [Collected on same date at same place and habitat: Draba glabella, Micranthes nivalis].** | **Rare** | |
| **2*** | **DeLapp 1994; Arctos 2025, CPNWH_Mar25 (WTU408402)[6/29/1993]** | **Ketchikan Quad.: Quartz Hill area, alpine cirque in valley east of Boca de Quadr.** | **In rocks of [wet] exposed slope of alpine ridge with Cassiope [lspp.], Luetkea [pectinata], Fauria [crista-gallii], and Lycopodium spp. [Collected on same date at same place and habitat: Carex circinata, Luzula arcuata ssp. unalaschkensis, Arcteranthis cooleyae, Cassiope lycopodioides]** | | |
| **3*** | **Arctos 2025 (UAM:Herb:195673) [8/3/1966]** | **Gold Creek Basin, east of Juneau [not on Tongass NF]** | **Gravelly soil, in mixed Spruce, Hemlock, Alder, and Willow woods.** | | |

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|---|---|---|---|---|---|
| **4*** | **Arctos 2025 (UAM:Herb:195681) [8/13/1874]** | **Willoughby Island, Mt. Fairweather Quad** | | | |

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