Platanthera unalascensis (Spreng.) Kurtz (slender-spire orchid): Species Assessment for the Tongass National Forest, Alaska Region

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EXECUTIVE SUMMARY

Platanthera unalascensis (Spreng.) Kurtz (slender-spire orchid) is endemic to North America and the core of its distribution extends from British Columbia south through the western United States to southern California. Southeastern Alaska is the northern extent of the range of *P. unalascensis* where this plant is rare. There are 20 occurrences known from the Alaska Region, a majority on the Tongass National Forest. *Platanthera unalascensis* is listed as sensitive in USFS Alaska Region (2009) and is considered Imperiled to Vulnerable (S2S3) in Alaska. The global status of *Platanthera unalascensis* is considered secure (G5). The species is not listed designated as an Endangered Species or Candidate Species by the US Fish and Wildlife Service.

The physical parameters of habitat associated with *P. unalascensis* populations in southeastern Alaska are common. In southeastern Alaska, *P. unalascensis* grows low productivity forests with open canopy, understory openings, and forest edges generally below elevations of 300 m. The species is found in mesic to saturated organic soil and flat to gently sloped lowlands of fragmented coniferous or mixed coniferous-deciduous forests. Thus biotic factors are more likely driving the rarity of *P. unalascensis* in southeastern Alaska; specifically the presence of mycorrhizal fungi symbionts and abundance of effective pollinators. Declines in either mycorrhizal associates or pollinators are likely to have large negative consequences for the distribution and abundance of *P. unalascensis*.

The current trends in distribution and abundance are unknown at the continental scale and within Alaska. The persistence of populations and population viability are unknown. There is currently a lack of data to assess if distribution or abundance is declining on the Tongass National Forest. Though, populations of *P. unalascensis* in Alaska are typically small, making them vulnerable to extirpation by anthropogenic or natural disturbances. Small populations are also more vulnerable to a loss of genetic diversity and reductions in fitness.

Eight occurrences of *P. unalascensis* are currently located entirely or partially in development Land-Use Designations (LUDs) on the Tongass N.F. Timber harvest, mineral extraction, and road building are the most notable potential threats to this species in these locations. Physical impacts to the soil such as removal of organic matter or soil compactions may indirectly impact *P. unalascesis* as it is highly associated with mycorrhizal networks that are sensitive to soil disturbance. The potential for future competition with non-native species is unknown. Climate change is not expected to pose a major threat to *P. unalascensis* in southeastern Alaska within the next 50 years.

Preserving the habitat of *P. unalascensis* by limiting management practices that directly or indirectly alter or disturb soil and hydrology of known occurrence sites would have a positive to neutral effect on populations. *Platanthera unalascensis* looks very similar to *P. ephemerantha* and such several populations on the Tongass National Forest may be incorrectly identified. Having correctly identified populations will increase the accuracy of this assessment in relation to threats, distribution, and habitat association. Collection of voucher specimens and/or photographs, standardized and detailed survey methods, population monitoring, identification of mycorrhizal symbionts, identification of pollinators, and study of demography are the highest priority research needs in order to more vully understand the viability of this species.

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INTRODUCTION

Alaska RegionThis assessment is one of many being produced to support the Forest Planning efforts on the Tongass National Forest. *Platanthera unalascensis* is the focus of an assessment because it is a 'Sensitive Species' in Alaska Region and it is a Rare Species in Alaska. Within the National Forest System, 'Sensitive Species' are plants and animals whose population viability is identified as a concern by a Regional Forester because of significant current or predicted downward trends in abundance or significant current or predicted downward trends in habitat capability that would reduce a species distribution (FSM 2670.5). Sensitive Species require a detailed effects analysis be conducted during project planning which identifies any special management that may be needed for a particular population. Knowledge of their biology and ecology is critical for a science-based, informed analysis that is consistent amongst resource managers. Rare Species serve as a barometer for species viability at the State level.

This assessment addresses the biology of *Platanthera unalascensis* throughout its range in the Alaska Alaska Region, and more specifically within the Tongass National Forest, as the "planning area". The broad nature of the assessment leads to some constraints on the specificity of information for particular locales. Furthermore, completing the assessments promptly requires establishment of some limits concerning the geographic scope of particular aspects of the assessment and further analysis of existing (but unanalyzed) field data. This introduction outlines the scope of the assessment and describes the process used in producing the assessments.

Goal

Species assessments are designed to provide forest managers, research biologists, and the public with a thorough discussion of the biology, ecology, and conservation status of certain species based on scientific knowledge accumulated prior to initiating the assessment. The assessment goals limit the scope of the work to critical summaries of scientific knowledge, discussion of broad implications of that knowledge, and outlines of information needs. The assessment does not seek to develop specific management recommendations but provides the ecological background upon which management can be based. While the assessment does not provide management recommendations, it focuses on the consequences of changes in the environment that result from management (i.e. management implications). Furthermore, it cites management recommendations proposed elsewhere and, when management recommendations have been implemented, the assessment examines the success of the implementation.

Scope of the Assessment

The *Platanthera unalascensis* assessment examines the biology, ecology, and management of this species with specific reference to the geographic and ecological characteristics of the Tongass National Forest and the Alaska Region. Although a majority of the literature on the species originates from field investigations outside the region, this document places that literature in the ecological and social context of southeastern and, to a lesser extent, south-central Alaska. Similarly, this assessment is concerned with reproductive behavior, population dynamics, and other characteristics of *Platanthera unalascensis* in the context of the current environment rather than under historical conditions.

In producing the assessment, we reviewed refereed literature, non-refereed publications, research reports, and data accumulated by resource management agencies. Not all publications on *Platanthera unalascensis* are referenced in the assessment, nor was all published material considered equally reliable. The assessment emphasizes refereed literature because this is the accepted standard in science. Non-refereed publications or reports were regarded with less certainty. We chose to use some non-refereed literature in the assessments, however, when information was unavailable elsewhere. Unpublished data (e.g., Natural Heritage Program and USFS records) were important in estimating the geographic distribution. These data required special attention because of the diversity of persons and methods used to collect the data.

Critical sources of information for *Platanthera unalascensis* within the Tongass National Forest, Alaska, and adjacent British Columbia were the U.S. Forest Service National Resource Information System (NRIS) Threatened, Endangered, and Sensitive Plants (TESP) database and collections from multiple herbaria. These data sources provided information for global range and Alaska occurrences, habitat, and ecology. While data collected during TESP surveys are useful to discern patterns relating to the biology and ecology of the species, any analysis is limited by the disparity of data collectors, methods, and study goals. Typically these survey data are limited to areas where forst management practices take place and are therefore biased to those locations.

The motivation to produce species assessments rapidly in order to make information available for Tongass National Forest Forest Plan Amendment (2016) and other project plans, leads to tight timelines. The goal to produce assessments rapidly limited the analysis of existing, unpublished data, or attempts to conduct meta-analysis to synthesize information from published literature.

Treatment of Uncertainty

Science represents a rigorous and systematic approach to obtaining knowledge, in which ideas regarding how the world works are measured against observations. Because our descriptions of the world are incomplete and our observations limited, some level of uncertainty is implicit in the scientific approach. Science includes approaches for dealing with this uncertainty. A commonly accepted approach in science resulting in reductions of uncertainty and development of stronger inference is based on a progression of critical experiments (Platt 1964). However, conducting meaningful and critical experiments in the ecological sciences is often difficult, time consuming, and expensive. Often, a systems approach is applied to an ecological question, in which existing data and observations from multiple sources (including those derived from inventories, categories, and counting [Allen and Hoekstra 1992]) are used to construct a predictive framework in which ideas can be tested. Reduced uncertainty follows when there is high consistency among the diverse sources of information in support of the inference.

Confronting uncertainty, then, is not prescriptive. In this assessment, the strength of evidence for particular ideas is noted and alternative explanations described when appropriate. While well-executed experiments represent a strong approach to developing knowledge, alternative approaches such as modeling, critical assessment of observations, and inference are accepted as sound approaches to understanding and used in synthesis for this assessment.

The spatial accuracy of occurrence points varies widely. Data from the NRIS TESP database were received as polygons and converted to centroid points retained inside the polygons. Conversion of polygon data to points allowed comparison of NRIS data with herbarium records.

Additionally, there is some uncertainty in the identification of material. The identifications on voucher specimens were not checked for this project and occurrences from the NRIS TESP database are not always associated with a voucher. We therefore assumed that all determinations are correct for both NRIS TESP records and herbarium records. *Platanthera unalascensis* is similar to *P. ephemerantha*, which is also considered rare in the Alaska Region, and some material assigned to *P. unalascensis* has been identified as *P. ephemerantha* in recent years.

The modeled climate data used in this analysis was obtained from Scenarios Network for Alaska and Arctic Planning (SNAP) at University of Alaska Fairbanks. Climate models are downscaled from the five best performing General Circulation Models for Alaska under the A2 emissions scenario. Data modeled into the future is predictive and therefore inherently uncertain. While this represents the best knowledge available at this time, the data should be interpreted at a broad scale representing regional patterns rather than pixel by pixel.

Publication of Assessment on the World Wide Web

To facilitate use of species assessments, assessments are being published on the Tongass National Forest and the Alaska Region world wide web sites. Placing the documents on the web makes them available to agency biologists and the public more rapidly than publication as a book or report. More importantly, revision of the assessments will be facilitated by providing them in a widely accessible digital format. Revision will be accomplished based on guidelines established by the USFS, Alaska Region.

Peer Review

This Assessment has been peer reviewed prior to release on the web. This report was reviewed through a process administered by an independent scientific organization which chose two recognized experts to provide critical input on the manuscript. Peer review was designed to improve the quality of communication and increase the rigor of the assessment.

MANAGEMENT STATUS AND NATURAL HISTORY

This section describes the special management classifications assigned by government and non-government organizations in the U.S. and Canada. Existing regulatory mechanisms, management plans, and conservation strategies specific to *Platanthera unalascensis* are discussed. Management actions and recommendations are reviewed. The information provided in this section is meant to be a historic and current overview of species management. More detailed information on potential future management options tailored to the Alaska Region and the Tongass National Forest are provided in the "Conservation: Potential Management of the Species" section.

The biology and ecology of *P. unalascensis* is covered in the latter third of this section, organized thematically by a series of subheadings. An emphasis has been given to the factors that affect species management and conservation. Data gaps related to biological or ecological factors are discussed in the "Conservation: Information Needs" section.

Management Status

The species is not federally listed or candidate under the Endangered Species Act, and no Forest Service regions other than Region 10the Alaska Region maintain *P. unalascensis* on their Sensitive Species lists. *Platanthera unalascensis* was added to the USDA Forest Service Alaska Region Sensitive Species List in April of 2009 because of potential decline in habitat quality and quantity in Alaska due to anthropogenic activities and invasive plant species (Stensvold 2009).

NatureServe has assigned the global rank of G5, Secure, to *Platanthera unalascensis* (NatureServe 2017). While *Platanthera unalascensis* has no conservation rank in the majority of the western U.S. states it appears to be Secure in the core of its range in the western U.S. and British Columbia. Prior to 2012, *P. unalascensis* was listed by the Alaska Natural Heritage Program (AKNHP) as Imperiled, S2, in Alaska. In 2012, AKNHP revised the conservation status rank for *P. unalascensis* in Alaska to S3, Rare within the state, due to new occurrences on the Tongass National Forest. As part of this assessment, AKNHP assessed a new rank of Imperiled to Vulnerable, S2S3, for *P. unalascensis* based on updated occurrences and population size information. The number of *P. unalascensis* occurrences were reduced because some were verified as *P. ephemerantha*, a similar and closely related orchid that is also rare in Alaska.

Platanthera unalascensis is Secure, S5, in British Columbia and Apparently Secure, S4, in Montana, South Dakota, and Ontario (NatureServe 2017). *Platanthera unalascensis* is potentially at risk in disjunct and peripheral portions of its core range: Critically Imperiled, S1, in Quebec, Newfoundland, and New Mexico; Imperiled, S2, in Michigan and Alberta; Vulnerable, S3, in Wyoming (NatureServe 2017). The ajority of western states have no conservation status of *P. unalascensis*, indicating the species is likely not at risk.

In Canada, this species has special management status (or proposed status) in Alberta and Newfoundland and Labrador. Alberta has listed *P. unalascensis* as a Sensitive Species because of its restricted distribution and small populations and because of threats from off-road vehicles (ORVs), gas extraction, and livestock grazing (ESRD 2011). In Newfoundland and Labrador, a single widely disjunct population of *P. unalascensis* occurs on Newfoundland. The species was therefore recommended for listing by the province as Endangered in 2008 according to the Species

Status Advisory Committee (SSAC)/Committee on the Status of Endangered Wildlife in Canada (COSEWIC) criteria (SACC 2008).

Existing Regulatory Mechanisms, Management Plans, and Conservation Strategies

Platanthera unalascensis is currently listed as Sensitive by the USFS Alaska Region. Sensitive Species status provides consideration of needed protection on National Forest lands. The USFS management objectives for Sensitive Species are designed to ensure continued viability throughout their range on National Forest System lands and to ensure that they do not become threatened or endangered because of actions of the USFS (FSM 2670.22). Existing policy calls for avoiding or minimizing negative effects to species whose viability has been identified as a concern, or if effects cannot be avoided, analyzing the significance of potentially adverse effects on populations or habitat within the area of concern and on the species as a whole (FSM 2670.32). Sensitive Species are therefore targeted during TESP (Threatened, Endangered, and Sensitive Plants) surveys conducted by Forest Service personnel prior to allocating land for special uses and other management activities, such as timber sales, mineral resource extraction, or infrastructure development. The occurrence of a sensitive species in a polygon will halt the intended land application unless impacts to the species can be sufficiently mitigated. However, the Tongass National Forest Plan does not include specific measures to protect *P. unalascensis*. No comprehensive management plan for this species currently exists. The Tongass National Forest does, however, currently recommends not cutting trees, especially cedars, to ground level during projects because *P. unalascensis* often grows at the base of cedars (TNF 2011).

The National Forest System Land Management Planning Final Rule (36 CFR Part 219) was revised in 2012 andunder the new regulations discontinues the concept of “sensitive species” and adopts a revised approach to “At risk species” by evaluating potential “Species of Conservation Concern (SCC)”. Similar to the sensitive species process of listing, formal SCC lists are designated by the Regional Forester in consultation with Forest managers who prepare recommendations based on a species ability to persist over the long term in the plan area (36 CFR 219.9). The Forest Service through direction from the National Forest Management Act requires that plans provide for diversity of plant and animal communities (16 USC 1604 (g)(3)(B)). The new planning rule requires that all plans identify and assess “At risk species” (36 CFR 219.6(b)). In addition, the new direction requires plans to assess the status of the ecosystems for ecosystem integrity for the purpose of determining whether ecosystems are functioning normally and are uncompromised. The plan shall identify and assess available information relevant to the plan area for threatened, endangered, proposed and candidate species and potential species of conservation concern present in the plan area by assessing the ecological conditions for these species in the assessment.Adopting the revised National Forest System regulations provided in the 2012 Planning Rule and new directive system (FSM 1909.12.52) which defines “At risk species” is currently in transition. The departure of the “Sensitive Species” designation and subsequent adoption of “Species of Conservation Concern” will likely take the Tongass N.F. several years. In the meanwhile, it is important to note that to date, this species (and others on the Tongass) remain under the “Sensitive Species” policy (FSM 2670.22 and 2670.32). Whether designated as “Sensitive” or as “SCC”, the core concept of “At risk species” remains consistent in both definitions

Platanthera unalascensis was recently under review to be listed as a species of Conservation Concern by the Alaska Region and was recommended for listing due to the amount of occurrences located on timber harvest units, its patchy distribution, and small population numbers despite the number of occurrences.

Biology and Ecology

Classification and Description

This taxon was originally described under the name *Spiranthes unalascensis* by Sprengel in 1826, nested within Orchidaceae subtribe Orchidinae (Sprengel 1826). However, over the past century, the taxon has been known as either *Platanthera unalascensis* (Spreng.) Kurtz or *Piperia unalascensis* (Spreng.) Rydb. Hultén (1943, 1968) included the species as *Platanthera unalascensis*. Ackerman (1977) recognized *Piperia* as a genus apart from *Platanthera* or *Habenaria*, therefore the name *Piperia unalascensis* became widely accepted and has been in use to the present throughout the range of the species. Indeed, most floras published within the last 30 years prefer the name *Piperia unalascensis* over *Platanthera unalascensis* (e.g. Ackerman and Morgan 2002).

The justification for *Piperia* as a genus apart from *Platanthera* or *Habenaria* was rooted in shared morphological traits that do not appear in other *Platanthera* species. *Piperia* was distinguished from *Coeloglossum*, *Habenaria*, and *Platanthera* by its ovoid roots, leaves that are basal only and withering at anthesis, absent auricles, inconspicuous caudicles, and entire stigmas (Ackerman 1977). Based on the results of a comparison of nuclear ribosomal internal transcribed spacer (ITS) sequences obtained from 35 taxa from genera related to *Platanthera*, the *Piperia* genus should be included as a monophyletic section within *Platanthera* (Bateman et al. 2003, 2009).

The traditional morphological characteristics that have been used to support *Piperia* as a genus apart from *Platanthera*, such as inconspicuous caudicles and globose tubers, do not make a convincing argument for recognition of *Piperia* at the genus level given the clear nesting of *Piperia* within *Platanthera* based on the molecular data. Bateman et al. (2009) suggested that the globose tubers seen in section *Piperia* may be the result of a reversion to an ancestral trait that is still present in most Orchidinae, while the inconspicuous caudicles are also observed in several Orchidinae genera.

Based on these recent genetic studies, the accepted name for this taxon is *Platanthera unalascensis* (Spreng.) Kurtz (Bateman et al. 2003, 2009). The name *Piperia unalascensis* is in current use in the USDA National Resource Conservation Service (NRCS) Plants database (USDA NRCS 2017) and in the NRIS TESP database. The species is also referred to as *Piperia unalascensis* on the USDA Forest Service Alaska Region Sensitive Species List. Nomenclature should be updated to *Platanthera unalascensis* where possible and applied to future occurrences. A list of synonyms is complied in Table 1.

Table 1. Synonyms of *Platanthera unalascensis*.

List of Synonym of *Platanthera unalascensis* (Spreng.) Kurtz
Habenaria foetida (Geyer ex Hook.) S. Watson
Habenaria schischmareffiana Cham.
Habenaria unalascensis (Spreng.) S. Watson
Habenaria unalascense (Spreng.) Rchb.f.,
Monorchis unalaschcensis (Spreng.) O. Schwarz
Piperia unalascensis (Spreng.) Rydb.
Platanthera foetida Geyer ex Hook.
Platanthera schischmareffiana (Cham.) Lindl.
Spiranthes unalascensis Spreng

Species Description:
The following description of *Platanthera unalascensis* is synthesized from Hultén 1968, Douglas et al. 2001, and Ackerman and Morgan 2002 (Figure 1):

> **Perennial**: herb from two ovoid tubers, 1–4 cm long, and few fibrous roots. **Stem:** 9–70 cm tall and 0.7–6.1 mm in diameter with 1 to 8 narrow bracts. **Leaf:** basal, 2 to 5, oblanceolate, 5-16 cm long, 13-35 mm wide, withering prior to or during anthesis. **Inflorescence:** terminal spike-like racemes, 3–44 cm long, usually sparsely flowered but densely flowered in some coastal populations. **Flower:** green, odor nocturnal and musky or soapy; sepals 2.0–4.2 mm long, lanceolate to oblong, upper sepal ascending or pointed forward, lateral sepals spreading to recurved; petals 2.0–5.5 mm long, ovate to oblong; lip 2–5 mm long; spur 1.5–5.5 mm long, slender, pointed down or back. **Fruit:** capsules ellipsoid, ascending to erect, 3.5–10.5 mm long. **Seed:** tan to medium brown.

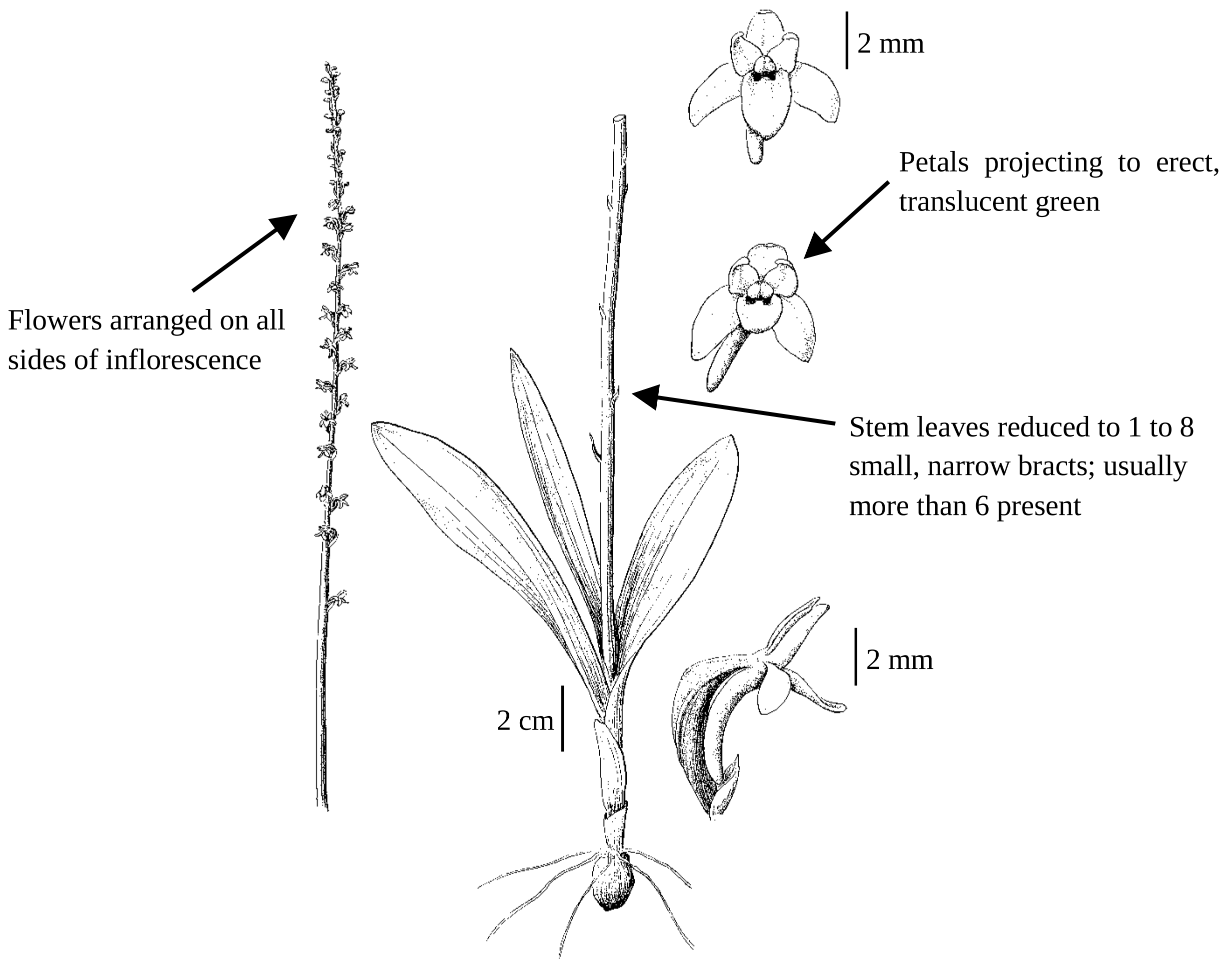
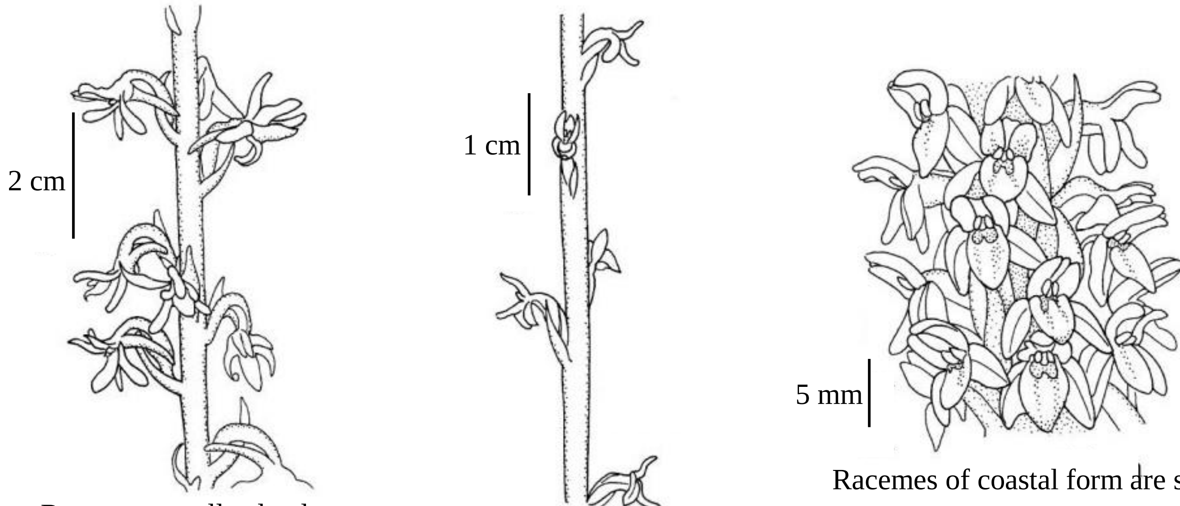


Figure 1. Illustration of *Platanthera unalascensis* annotated with important distinguishing features. Illustration by Jeane R. Janish, courtesy of University of Washington Press.



Racemes usually slender and sparsely-flowered

Racemes of montane form are more sparsely-flowered

Racemes of coastal form are short, stout, and densely-flowersed

Figure 2. Illustration of various forms of inflorescence observed in *Platanthera unalascensis*. Illustration by Barbara Alongi, courtesy of Flora of North America Association.

Multiple morphological variants of *Platanthera unalascensis* are informally recognized and differ by the compactness of the raceme (Figure 2). An uncommon coastal form, which includes the plants from Unalaska, has short, compacted, densely-flowered racemes. Most *P. unalascensis* populations consist of plants with slender and sparsely-flowered to expanded racemes. In the coast ranges and Pacific Northwest, plants are stouter and have broader sepals and petals than the inland forms found in the Rocky Mountains (Ackerman and Morgan 2002). Figure 3 shows the inflorescence and flower of a plant from Washington.

Figure 3. Raceme of *Platanthera unalascensis* courtesy of Ben Legler (A) and flower of *Platanthera unalascensis* courtesy of Paul Slichter (B).

Platanthera unalascensis is very similar to *P. ephemerantha* (synonym: *Piperia candida*) and a significant amount of material originally identified as *Platanthera unalascensis* has been subsequently assigned to *P. ephemerantha*. *Platanthera. unalascensis* can be distinguished from *P. ephemerantha* based on the morphological features listed in Table 2. Plants are difficult to identify with certainty without flowers. Some occurrences on the Tongass National Forest need to be revisited because flowers were not present during the initial survey. These occurrences are tentatively assigned to *P. unalascensis*. Other species superficially similar to *P. unalascensis* are *P stricta*, *P. dilatata*, and *Coeloglossum viride*, but these species have stem leaves whereas *P. unalascensis* and *P. ephemerantha* do not.

Table 2. Morphological characteristics that distinguish *Platanthera unalascensis* from similar species in Alaska.

Species	Bract Number	Inflorescence	Petals
Platanthera unalascensis	Usually > 6	Cylindrical	Translucent green, projecting to erect
Platanthera ephemerantha	Usually < 6	Mostly one side of flowering stem	White (with faint green midvein), straight

Distribution and Abundance

Platanthera unalascensis is known from North America. Its core range extends from southeastern Alaska through British Columbia and the Rocky Mountains to New Mexico and Baja California, but it is absent from Arizona, southern Utah, and much of Nevada (Figure 4). Disjunct occurrences also exist in Unalaska, Alaska, South Dakota, around the Great Lakes region in Ontario and Michigan, in Quebec, and in Newfoundland.

This species is common within its core range, except in some peripheral zones such as southeastern Alaska and New Mexico. Both interior montane and coastal populations are frequent from the southern half of British Columbia south through California.

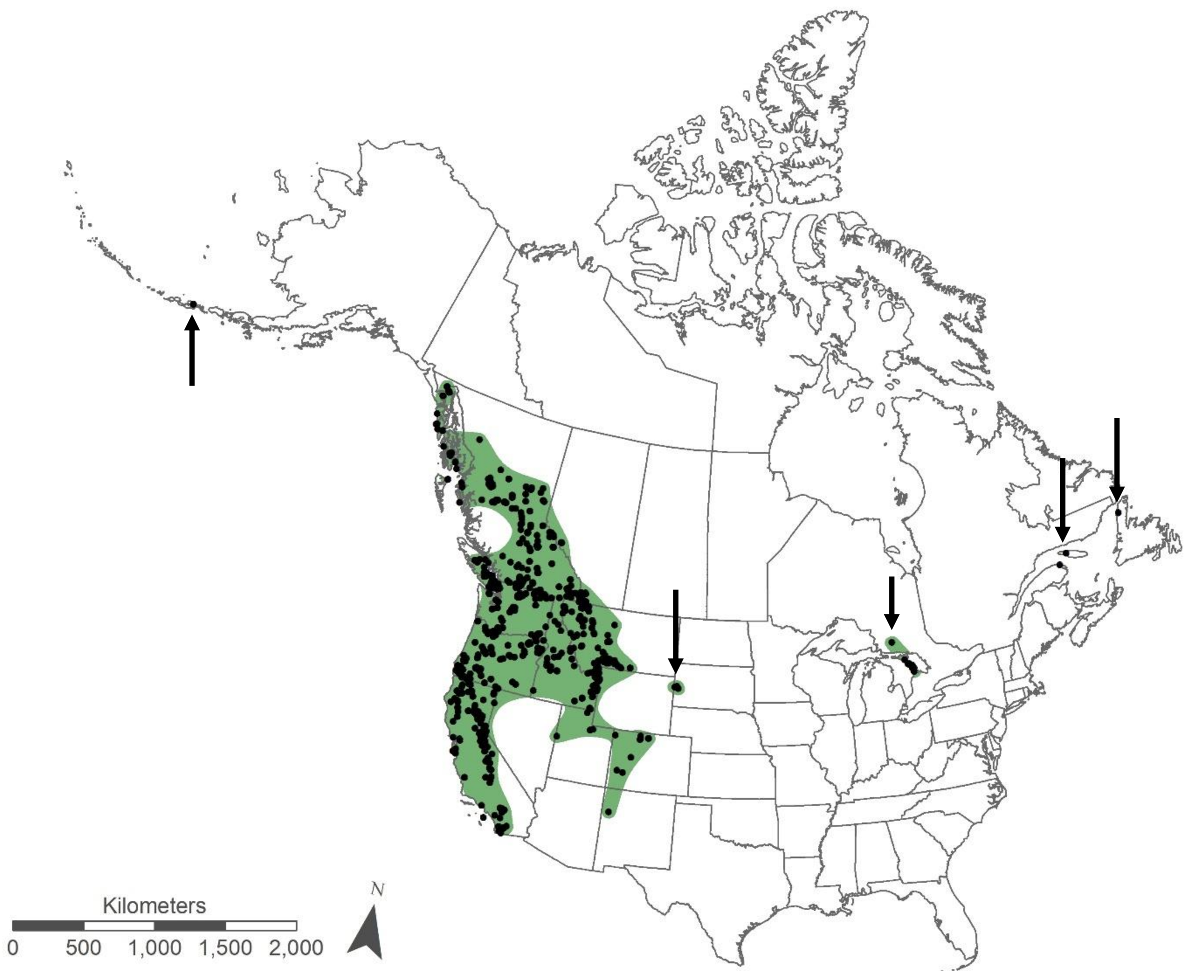


Figure 4. Global range of *Platanthera unalascensis*. Arrows indicate disjunct populations.

In Alaska, *P. unalascensis* is primarily known from southeastern Alaska where it occurs in the Alexander Archipelago, Glacier Bay, and the St. Elias Mountains (Figure 5). The species was originally described from material collected at the foot of the mountains near Unalaska in the Aleutian Islands (Sprengel 1826, Kurtz 1894). An occurrence on Amaknak Island near Unalaska, which may be the same as or close to the type location, was found in 1995 (ALA 2015). This species may also have been found at a site in Prince William Sound (Hultén 1968), but the site has not been relocated and the collection cannot be located (Lauri pers. comm).

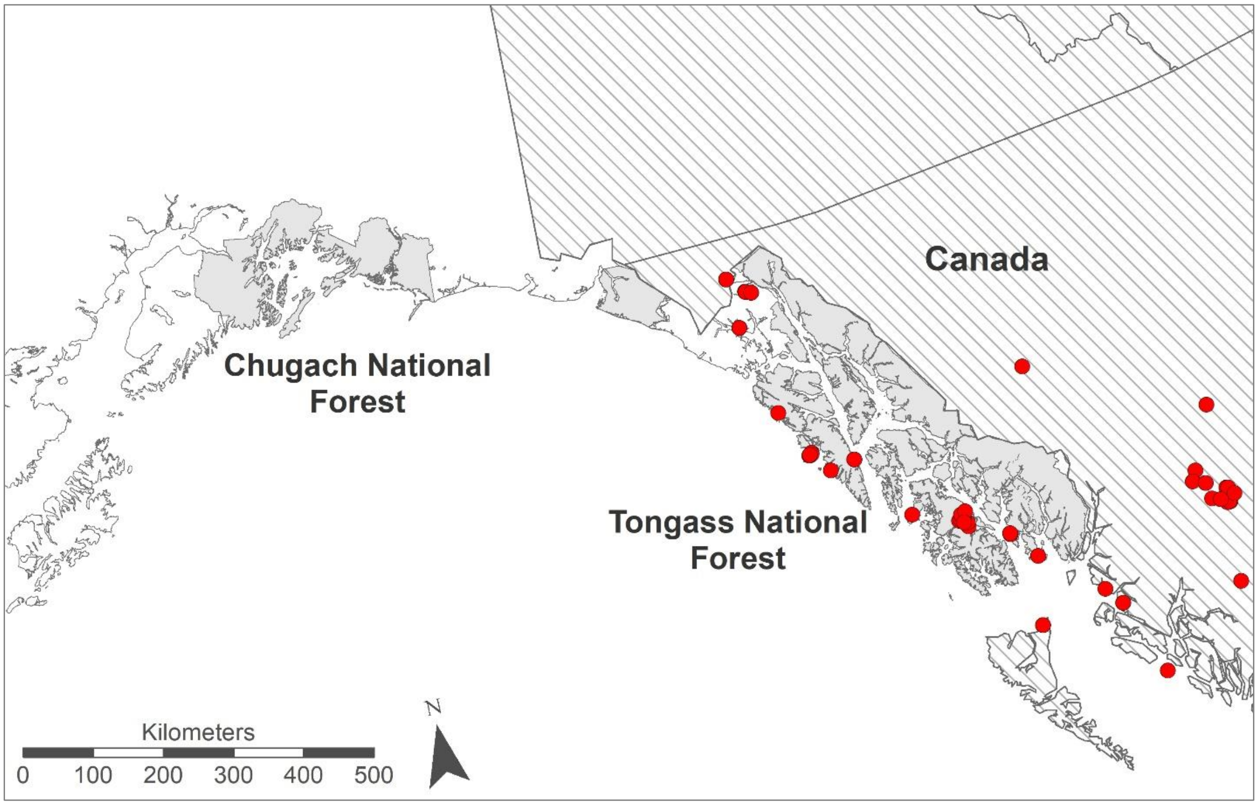


Figure 5. Known and historic occurrences of *Platanthera unalascensis* in USDA Forest Service Alaska Region and neighboring Canadian territories**.**

Within Forest Service Alaska Region, *P. unalascensis* is known only from the Tongass National Forest, though it is suspected to occur on the Chugach National Forest. On the Tongass National Forest, this species occurs from Chichagof Island south to Duke Island. Occurrences are known just north of the Tongass National Forest in Glacier Bay and the St. Elias Mountains and just south of the Tongass National Forest on Haida Gwaii (Queen Charlotte Islands) and near Prince Rupert, British Columbia (Figure 6). All occurrences on the Tongass National Forest are located on islands of the Alexander Archipelago. No occurrences have been found on the mainland within the Tongass National Forest. *Platanthera unalascensis* likely occurs on the mainland and has been found east of the Tongass National Forest in British Columbia along the Alaska Highway. Since *P. unalascensis* was added to the Sensitive Species list, many new occurrences have been documented.

A total of 20 occurrences, defined as populations found within ≤ 1 km apart (NatureServe 2002), have been documented from southeastern Alaska. Two occurrences are known from the St. Elias Mountains on state land, and one occurrence is located within Glacier Bay National Park. These three occurrences are on the mainland. The remaining 17 occurrences are located on the Tongass National Forest and are all on islands of the Alexander Archipelago. Prince of Wales Island supports the most numerous occurrences of *P. unalascensis*. Eight occurrences are located in close proximity on the central portion of Prince of Wales Island near Thorne Bay. An additional occurrence is located on nearby Kosciusko Island. Occurrences are more sporadic north throughout the rest of the Alexander Archipelago.

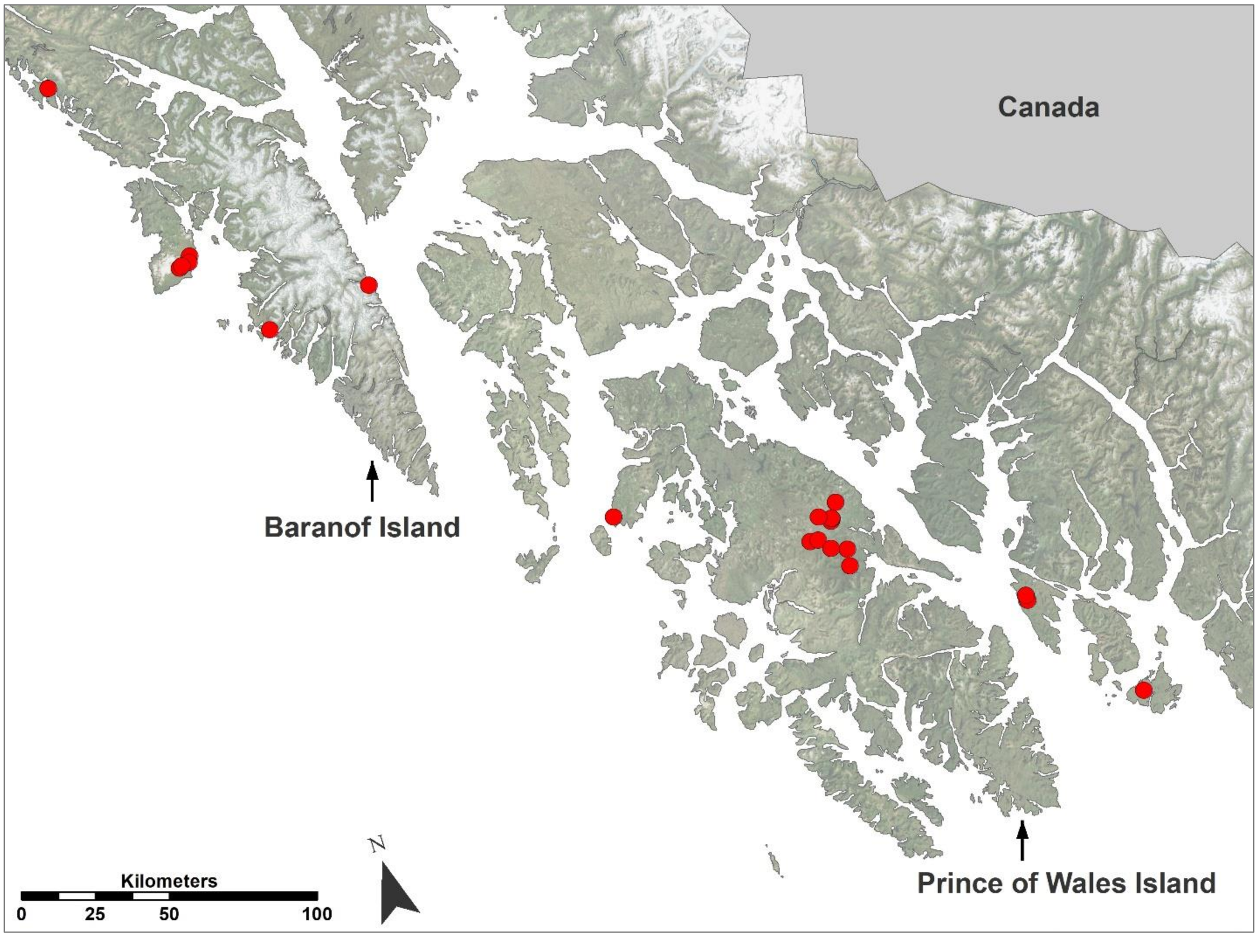


Figure 6. Known occurrences of *Platanthera unalascensis* on the Tongass National Forest and surrounding area.

Platanthera unalascensis is the most widespread of the *Platanthera* sect. *Piperia*. Other members of sect. *Piperia* occur within the range of *Platanthera unalascensis* in western North America. The largest amount of variation in sect. *Piperia* occurs in California; however, it cannot be assumed that *Platanthera unalascensis* evolved in California and subsequently dispersed. Whether the disjunct occurrences of *P. unalascensis* in the Aleutian Islands and eastern North America are the result of a recently expanding range or outliers that survived past glaciations is unknown.

No data are available to assess current trends in range throughout North America. The discovery of additional disjunct populations, such as the population in Newfoundland, does not indicate that the range is expanding. There is no evidence to suggest that the overall range of *P. unalascensis* is retracting. Discussion of the possible causes for the distribution of disjunct populations east of the Rocky Mountains is out of scope for this assessment. There are no data by which to make statements regarding the impact of European settlement on the historic range of *P. unalascensis*. It is likely, however, that settlement, infrastructure development, and resource extraction has resulted in the destruction of some populations, both within the total species range and within Alaska.

The range trend of *P. unalascensis* within Alaska cannot be assessed, especially in southeastern Alaska where nearly all occurrences have been found in the past 20 years and many of those only since the species was added to the Alaska Region Sensitive Species list in 2009. Although the occurrence shown by Hultén (1968) from the Prince William Sound has not been relocated in recent years, this is not evidence that a population in the Prince William Sound has been extirpated or that the range of the species in Alaska is retracting. The occurrence was not documented in the earlier volumes written by Hultén and the specimen that he looked at is not known. It is possible that the occurrence was based on mis-located or mis-identified material. However, assuming that the occurrence location is valid, no conclusions can be drawn until a systematic survey of potential habitat in the Prince William Sound is undertaken. The current known range of *P. unalascensis* still includes the other occurrences documented by Hultén (1968) at Unalaska and in southeastern Alaska.

Population Trend

Population trends of *P. unalascensis* in Alaska are largely unknown. The Tongass National Forest recently conducted a pilot population monitoring study on Prince of Wales Island for *P. unalascensis*, however the population was reassigned to *P. ephemerantha* after the study began (USDA Forest Service 2013). Until population monitoring is conducted within the Tongass National Forest for *P. unalascensis*, population trends can not be determined.

Assessing population trends in orchids is made difficult by their life cycle, which includes a dormancy stage of underground development for several years after germination (Currah et al. 1990, Reddoch and Reddoch 2007). Counts of above-ground plants do not necessarily reflect a consistent proportion of total population and counts of below-ground plants are difficult. For example, population counts of above ground plants in Newfoundland have varied between 4 and 40 while a total population size of 200 or more is expected (SACC 2008).

Population abundance and trends from rare plant surveys on the Tongass National Forest are anecdotal. Most occurrences consist of several above-ground plants. Three occurrences have 30 to 40 above-ground plants. The largest documented population consists of 300 plants and occurs on Prince of Wales Island near Thorne Bay; however, the identification of this population is uncertain. The occurrence at Big Thorne 128 (EO 15) has been surveyed multiple times: 2 plants were found in 2009, 32 were found in 2011, and none were found in 2012.

Habitat

In most of its North American range, *Platanthera unalascensis* grows in dry to moist coniferous or mixed coniferous-deciduous forests, subalpine meadows and thickets, and gravelly stream banks. Infrequently, it also grows on coastal bluffs (Douglas et al. 2001, Ackerman and Morgan 2002). Plants from Unalaska occur in atypical habitat: dry tundra near the beach (EO 2). The only population known from Newfoundland also occurs in atypical habitat: open *Larix laricina* swamp with *Picea mariana* and *Abies balsamea*, wet organic soil, and a thick moss layer (SACC 2008). In Eastern Canada, this species is found in dry, calcareous (dolomitic) woodlands with hardwoods and cedar (Royal Botanical Gardens 2010).

In southeastern Alaska, *P. unalascensis* grows in low productivity forests with canopy and understory openings and along forest edges (Table 3). Substrates are sometimes calcareous (limestone) or ultra-mafic (as on Duke and Baranof Islands), but this species is not restricted to these substrates.

Table 3. Occurrences of *Platanthera unalascensis* in Alaska with occurrences suspected of misidentification in red. Sources originating at ALA (University of Alaska Museum of the North) and NRIS USFS Database.

EO #	Source	ID	Date	Location	Habitat	Pop. Size
2	ALA	Accession: 12754	8/14/1984	Unalaska Island, Aleutian Islands	red bluffs, shaded saturated soil pocket	
3	ALA	Accession: 148744	8/11/1995	Glacier Bay	dry tundra along roadside near beach, infrequent	
4	ALA	Accession: 34287	7/22/1999	St. Elias Mountains	dry area surrounded by muskeg with sedge in a edge of a muskeg	2
6	ALA	Accession: 34150	7/18/2000	St. Elias Mountains	limestone outcrops and subalpine mesic meadows with scattered shrubs	
5	NRIS	100552P000081	7/22/1999	Prince of Wales Island	dry area surrounded by muskeg near edge of muskeg	2
7	ALA	Accession: 42196	7/20/2000	Baranof Island	floodplain, growing in openings in alder thicket	
8	NRIS	100531P000136	6/29/2005	West Chichagof	along abandoned mining road	
9	NRIS	100552P000226	7/28/2005	Duke Island	in muskeg gap between ultramafic boulders	3
10	NRIS	100554P000106	7/7/2009	Prince of Wales Island	edge of road right-of-ways and timber line	300
11	NRIS	100531PT00007	7/20/2009	Kruzof Island	unknown	1
12	NRIS	100531PT00010	7/22/2009	Kruzof Island	open mixed coniferous forest with dense shrub understory	2
13	NRIS	100554P000105	8/11/2009	Prince of Wales Island	edge of low volume cedar scrub and muskeg system growing beneath cedars	7
14	NRIS	100531PT00011	8/13/2009	Baranof Island	unknown	2
15	NRIS	100554P000109	8/17/2009	Prince of Wales Island: Big Thorne 128	unknown	32

EO #	Source	ID	Date	Location	Habitat	Pop. Size
16	NRIS	100554P000316	6/8/2010	Prince of Wales Island: Big Thorne units 51 and 52	mixed conifer stand bordering muskeg	1
17	NRIS	100554P000339	6/18/2010	Kosciusko Island	*Callitropsis nootkatensis* scrub	9
18	NRIS	100554P000306	6/22/2010	Prince of Wales Island: North Thorne BT Unit 124	cedar/hemlock forest	1
19	NRIS	100554P000309	7/1/2010	Prince of Wales Island: Big Thorne unit 106	base of *Callitropsis nootkatensis* in *Callitropsis nootkatensis* / *Thuja plicata* grove	8
20	NRIS	100554P000148	8/10/2010	Prince of Wales Island	Patch of *Thuja plicata* / *Tsuga mertensiana* in muskeg	6
21	NRIS	100531P00195	7/19/2011	Kruzof Island	along Mt. Edgecumbe trail, within 15 feet of trail	30
22	NRIS	100531P00196	7/19/2011	Kruzof Island	along Mt. Edgecumbe trail, within 15 feet of trail	40
23	NRIS	100554P000298	8/9/2011	Prince of Wales Island	road right-of-way under canopy of *Phalaris arundinacea*	3
24	NRIS	100554P000407	8/23/2011	Prince of Wales Island	mixed conifer muskeg edge at base of *Thuja plicata*	1
25	NRIS	100554P000440Y12	5/24/2012	Prince of Wales Island	hummock beneath *Thuja plicata*, *Callitropsis nootkatensis*, and *Tsuga mertensiana*	11

In British Columbia, *P. unalascensis* occurs from near sea level to 2,000 m (Klinkenberg 2013). Elsewhere in western North America, this species grows at up to 3,000 m (Ackerman and Morgan 2002). In Alaska, *P. unalascensis* is mostly restricted to elevations less than 325 m, likely because of a decrease in growing season length by elevation. A single occurrence known from the western end of Takhin Ridge in the St. Elias Mountains grows at a higher elevation, estimated between 520 and 1,200 m as the exact elevational range is uncertain.

Platanthera unalascensis grows in lowlands, on mountain slopes and ridges, and on coastal bluffs or beaches throughout its range including Alaska. In British Columbia, it grows predominantly on mesotrophic soils. Humus is usually mor (descrete organic layers that are separate from mineral soil), reflecting coniferous and mixed coniferous-deciduous forests as primary habitats. Some sites also have moder humus (organic material that is in transitional stage from plant residues to complete humification). The A horizon is often thin or absent. Soil pH is often moderately acidic to neutral. On the Tongass National Forest, this species grows in organic soil with duff or peat layers and litter cover appears to be high.

Platanthera unalascensis most commonly occurs in dry, mesic, or moist habitats in North America (Douglas et al. 2001, Ackerman and Morgan 2002). Occurrence sites in British Columbia range from dry to saturated (Klinkenberg 2013). In Alaska, *P. unalascensis* occurs most often in moist or saturated soils, though occurrences in mesic and dry soils have also been documented.

Slopes vary from nearly flat to 85° for occurrences in British Columbia (Klinkenberg 2013). This species does not commonly grow on cliff faces and therefore the 85° slope is likely an oitlier. Slopes from nearly flat to approximately 20° are known from Alaska. No trends in aspect are apparent in Alaska, but the aspect is recorded only for several populations. More extensive data from British Columbia strongly suggests a lack of aspect-related trends for *P. unalascensis*.

Platanthera unalascensis does not appear to grow in early seral habitats. Although it was found on a floodplain in the St. Elias Mountains, it grew within openings in alder and not on the active portions of the floodplain (EO 6). Two occurrences from the Tongass National Forest are on or near roadsides but occur either along the forest edge (EO 10) or in dense, taller vegetation downhill from the road rather than the frequently disturbed road edge (EO 23). A third occurrence has been documented from along an abandoned mining road (EO 8), but additional habitat details were not recorded.

The life cycle of orchids does not favor frequent soil disturbance nor are orchids often initial colonizers after such disturbances. Orchids require several years to develop underground after germination before photosynthetic portions of the plant emerge. Intact mycorrhizal networks are necessary to the germination and underground development of *P. unalascensis*. Therefore, areas where mycorrhizal networks have been damaged from soil disturbances are not likely to provide habitat for this species.

Reproductive Biology and Autecology

The presence of a compatible mycorrhizal fungus is an important site characteristic for the establishment of orchids and has been linked to plant rarity (Bevill and Louda 1999, van der Heijden 2002). Because seeds of orchids lack carbohydrate reserves, germination is dependent on infection by a symbiotic and often species-dependent mycorrhizal fungus, which provides the embryo with nutrients (Arditti et al. 1981). After germination, the association with mycorrhizal fungi is essential for successful development. The developing orchid receives all carbon, phosphorous, nitrogen, and other nutrients from the fungi. However, the overall relationship is mutualistic for many terrestrial photosynthetic orchids. Once the orchid matures, the carbon flow reverses, and the fungi gains carbon from the photosynthesizing plant (Dearnaley 2007, Cameron et al. 2008). *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 *P. 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 *P. unalascensis* warrants investigation as it is largely unknown.

The life cycle of *P. unalascensis* has not been specifically studied. However, useful generalizations can be drawn from common traits among the life cycles of photosynthetic terrestrial orchids. Many orchids are long-lived perennials that develop slowly. After infection by mycorrhizal fungi and subsequent germination, a protocorm is formed and may require several years to develop above-ground growth (Doherty 1997). A related species, *P. hookeri*, progresses through several stages of above-ground growth during its life cycle (Reddoch and Reddoch 2007). The juvenile stage is characterized by a small, immature leaf. The length of time required to progress from the juvenile stage to the immature stage, which is characterized by two small orbicular leaves, is unknown (Reddoch and Reddoch 2007). Mature plants produce two large leaves and can in subsequent years produce leaves only, produce leaves and an inflorescence, or become dormant (no production of above-ground plant material). Dormancy lasts one to several years and is more common in the early life stages (Reddoch and Reddoch 2007).

Platanthera unalascensis is similar to other *Platanthera* by regenerating annually, which requires considerable energy in the form of stored carbohydrates (Reddoch and Reddoch 2007). During the flowering stage, the next year's shoot bud is created at the crown and new tubers begins to elongate and form new roots. When winter dormancy begins, the tuber and roots of the previous season wither and the new tubers fully elongate with roots (Currah et al. 1990).

Platanthera unalascensis typically flowers June through August throughout its range, though in the lowlands of northern California it also flowers April and May (Ackerman and Morgan 2002). In southeastern Alaska, *P. unalascensis* flowers June through August, although on occasion it has been found to flower as early as late May. Autogamy is rare in *Platanthera* section *Piperia* and it is likely that pollinators are required for seed production. Agamospermy or vegetative reproduction have not been observed. Some pollination of flowers in the same inflorescence occurs naturally, though such pollinations result in reduced production of viable seed (Ackerman 1977, Argue 2012).

Pollen is aggregated in masses known as pollinia; the two pollinia connected by an oblong to ovoid viscidium are referred to as pollinaria. Two pollinaria are produced per flower in *P. unalascensis*. The pollinaria structure is well-suited for dispersal by insects. The viscidium of the pollinaria is sticky and attaches to the proboscis of insects as they forage for nectar. When the proboscis is removed, the viscidium and the two associated pollinia remain attached and are transported to the next flower (Ackerman 1977, Argue 2012).

Individual flowers are sequentially hermaphroditic based on age-dependent changes in floral morphology. During early anthesis, the lip is horizontal, and pollinators have access to the anthers, where the proboscis of the insect will contact the viscidium. As the flower ages, the lip lowers into a position encouraging the deposition of pollinia picked up previously. During this later stage, access to the anthers is hindered (Ackerman 1977).

Pollinators typically to visit inflorescences from the bottom to top. Because the flowers at the bottom of the inflorescences open and mature sooner than the distal flowers, those at the bottom are functionally female while those near the top are functionally male when all flowers are open (Ackerman 1977). Foraging insects deposit pollinaria in the lower flowers and then collect new pollinaria from the upper flowers before moving on to the next inflorescence (Ackerman 1977).

Flowers of *Platanthera unalascensis* are nocturnally odorous (Douglas et al. 2001, Argue 2012), suggesting that some of the pollinators are nocturnal. However, the scent also lingers during the day (Argue 2012). Pollinators of *P. unalascensis* in California appeared 1 to 3 hours after sunset. Pollinators were mainly moths of a variety of species (Ackerman 1977). In Washington, *P. unalascensis* is known to be pollinated by plum moths (Pterophoridae) or pyralid moths (Pyralidae; Washington Native Orchid Society 2010). Various types of moths have been identified as the pollinators for other species of section *Piperia* in California (Ackerman and Morgan 2002).

Specific pollinating species in Alaska have not been identified. It is likely that factors such as odor, spur length, and lip length encourage pollination by one or a few moth species (van der Pijl and Dodson 1966). In California, a mosquito and a bumblebee (*Bombus* sp.) were observed with pollinaria from *Platanthera yadonii*. A related orchid, *Platanthera orbiculata*, is known to be pollinated by nocturnal moths in the Pacific Northwest, but the pollinator guild is unknown in Alaska (*see* Fulkerson et al. 2017). Small brown stink beetles have been observed on flowers of *P. unalascensis* at one occurrence on the Tongass National Forest (EO 13 and 15), but should be considered "floral visitors" rather than pollinators as the effectiveness of these beetles in mediation pollen flow is not known. Although it is possible that mosquitos, bees, or beetles pollinate *P. unalascensis* in Alaska, sect. *Piperia* is known be to be primarily pollinated by moths. The spurs of species in sect. *Piperia* are longer than those of other *Platanthera* species and are apparently well-suited to the proboscis of moths (Ackerman 1977, Argue 2012).

Orchids produce a very large number of tiny seeds. Because seeds have very little mass, they are well-suited to short distance dispersal by wind. Most seeds likely deposit within six meters of the parent plant (Chung et al. 2004). Seeds are hypothesized to be bouyant and suited to long-distance dispersal over water, however further study is needed (Lauri 2007).

Demography

There are no specific studies on the demography of *P. unalaschensis* in Alaska or elsewhere. Except for northern Prince of Wales Island, occurrences in southeastern Alaska are separated by wide distances and geographical barriers such as mountains and ocean. Exchange of genetic material between these occurrences is highly unlikely. Transfer of seeds between occurrences or to new locations across water is unlikely but possible. Genetic diversity within these populations is likely to be low overall because exchange of genetic material or seeds is infrequent (Lauri 2007). Occurrences on northern Prince of Wales Island are in relatively close proximity and are more likely to exchange genetic material via pollinators.

Limited interspecific fertility has been observed in species of sect. *Piperia* under hand-pollinated conditions (Ackerman 1977). However, there is little evidence of hybridization in the wild (Ackerman and Morgan 2002). The existence and extent of hybridization between *P. unalascensis* and *P. ephemerantha* has not been explored in Alaska or elsewhere. No populations with intermediate characteristics have been documented; however, these two species are very similar, and intermediate characteristics may therefore be overlooked.

Community Ecology

In Alaska, *P. unalascensis* commonly grows at the base of *Callitropsis nootkatensis* or *Thuja plicata*. *Thuja plicata*, *Callitropsis nootkatensis*, and *Tsuga heterophylla* are the dominant trees at the occurrence sites. However, on Amaknak Island in the Aleutian Islands and on Takhin Ridge in the St. Elias Mountains no trees are present. The understories of occurrence sites on the Tongass National Forest are often dominated by *Menziesia ferruginea*, *Vaccinium ovalifolium*, and *V. alaskaense*. *Gaultheria shallon*, *Linnaea borealis*, and *V. vitis-idaea* are common co-occuring low shrubs. At poorly drained sites, *Lysichiton americanus* and *Nephrophyllidium crista-galli* are usually present. *Coptis aspleniifolia* and *Rubus pedatus* are present in mesic or moist soils.

In southeastern Alaska, *P. unalascensis* primarily occurs in partially shaded communities, usually coniferous forests but also alder. Sites where this species occurs have canopy openings or are located on forest edges. For example, the largest population of *P. unalascensis* on the Tongass National Forest (EO 10) occurs on a road right-of-way along the forest edge. In coniferous forest habitats, an understory shrub layer is often present, but *P. unalascensis* occurs mainly in openings and edges of these understory layers. Combined tree and shrub cover is usually greater than 50%.

Forbs often contribute 10% to 30% canopy cover. Graminoids are lacking at many sites. A notable exception is EO 23, which is located on a road right-of-way and is dominated by graminoids. At this site, the invasive *Phalaris arundinacea* partially shades the shorter *P. unalascensis*. Moss is common at most sites, and percent cover is often greater than 50%. Although soils are often moist to saturated, standing water is not common in communities in which *P. unalascensis* occurs.

Other *Platanthera* species, including *P. orbiculata* and *P. stricta*, are sometimes present in or adjacent to populations of *P. unlascensis*. This may indicate competition for habitat or for the same mycorrhizal fungi between *Platanthera* species. However, *P. stricta* often occurs in wetter microsites, such as patches of bog or fen, and may only rarely be in direct competition with *P. unalascensis*.

Browsed leaves were observed on plants at two occurrences on the Tongass National Forest (EO 17 and 23). Two other occurrences included plants trampled because of proximity to a deer bed (EO 19) and a game trail (EO 18). There is no evidence that deer or other herbivores seek or preferentially forage *P. unalascensis*. However, this species occurs in habitats frequented by deer and is at least occasionally browsed.

No evidence of disease or parasites has been recorded for occurrences in Alaska, though plants of low vigor (for reasons unknown) have been observed. One occurrence (EO 18) consisting of a single plant had a hole in the leaf, possibly indicating insect herbivory.

CONSERVATION

This section describes the threats, conservation status, and potential management of *Platanthera unalascensis* specifically within USDA Forest Service Alaska Region with focus on the Tongass National Forest. Threats include both threats to the habitat and direct threats to individuals and populations. Within the threats section, we have provided a climate sensitivity analysis including a comparison of climatic conditions in southeastern Alaska between the 2010s decade and the 2060s decade.

The Conservation Status and Potential Management sections integrate habitat, current management, and potential management into the discussion of threats. The Conservation Status section details the distribution and population trends, inherent vulnerability of the species with regards to habitats available in Alaska. and management risk in Alaska. The Potential Management section is a synthesis of management implications and potential tools and practices that may benefit species conservation in the Tongass National Forest.

The final section, Information Needs, details the current data gaps that may prevent the most effective and efficient conservation of *P. unalascensis* on the Tongass National Forest. These data gaps are discussed in terms of their direct relevance to management. Data gaps that are especially important for effective management are selected as research priorities.

Threats

Most occurrences of *Platanthera unalascensis* on the Tongass National Forest are inherently vulnerable because of their apparent small population sizes. Although, it should be noted that no estimates for total plant population sizes have been attempted at any occurrence and not all occurrences have been surveyed completely. Some of the consequences of very small populations include decreased ability to attract pollinators, loss of fitness, and increased potential for genetic assimilation (Barrett and Kohn 1991). Small populations can be extirpated by perturbations that may affect only a small part of a large population (Harper and White 1974); therefore, smaller populations are more vulnerable to extinction from human and natural causes than larger populations. Small populations are vulnerable to loss of genetic diversity through genetic drift and reductions in fitness (Given 1994, Harris et al. 1984). However, without a regional analysis of genetic structure and effective population size that would include the Alaska Region populations in a broad regional sampling or, ideally, sampling across the species' range, it is not possible to ascertain if genetic composition has changed or is liable to change.

Because of its few occurrences and small population sizes, geographic barriers to additional habitat, and potentially narrow ecological requirements, *P. unalascensis* is vulnerable to future habitat alterations and disturbances in Alaska. In addition to direct destruction of habitat or individuals, reductions in the populations or distributions of pollinators or mycorrhizal symbionts would reduce the potential for this species to successfully complete its life cycle. Because the pollinators and mycorrhizal symbionts on the Tongass National Forest are unknown, threats to these agents cannot be addressed. Generally, changes in precipitation, increased air pollution deposition, and elevated atmospheric carbon dioxide contribute to alterations in soil chemistry that impact mycorrhizal fungi (Lilleskov et al. 2002).

Eight occurrences are located entirely or partially within development Land-Use Designations (LUDs) on the Tongass National Forest where management activities are allowed. Few observations have been recorded for current or potential threats to individuals, populations, or habitats at individual occurrences. For some occurrences, potential threats are implied by the location or habitat descriptions. For most threat types and most occurrences, the potential impacts discussed below are speculative and only discussed as generalities. Outside of Alaska, few threats or disturbance impacts have been researched because this species is common throughout most of its range.

Timber Harvest

Timber harvest in coniferous forests represents a potential management concern for the long term viability of *P. unalascensis* on the Tongass National Forest. While thinning of the overstory and creation of forest edge habitat may be beneficial to *P. unalascensis*, the physical impacts of mechanical activity and the associated road building or other soil disturbances may indirectly impact *P. unalascensis*. Indeed, the microbial communities of timber harvest sites with soil compaction and organic matter removal in northern British Columbia were significantly altered, even 15 years after the timber harvest (Hartmann et al. 2015). Notably, mycorrhizal networks were the most sensitive to these types of disturbances and never fully recovered. Site characteristics are likely to be altered by mechanical activity with direct negative impacts for *P. unalascensis* from soil compaction, removal of litter and duff layers, or alteration of hydrologic regime.

Numerous occurrences on the Tongass National Forest are located in timber units and may potentially be impacted by timber harvest activities. However, no current or potential harvest-related impacts to individuals or populations have been documented for these occurrences. While the actual cutting of trees may not extirpate populations, especially if trees are not cut to ground level, associated soil disturbances as a result of yarding operations (e.g. dragging logs from the forest to log landings) are likely to cause direct destruction of plants and to expose roots or tubers. Because populations consist of both below-ground and above-ground plants, the destruction of above-ground photosynthetic plant parts will not necessarily result in the extirpation of a population, although it will certainly reduce the integrity and reproductive capacity of the population. In addition to occurrences within timber units, the area around the Cape Pole occurrence (EO 17) has been used for firewood cutting in the past. Only nine above-ground plants were observed at this location, and even small-scale timber activities such as firewood cutting could significantly reduce reproductive capacity.

Mineral Extraction

Past and present mining exploration and extraction in the habitat of *Platanthera unalascensis* are also potential threats on the Tongass National Forest. Mining impacts are likely to be restricted to river and stream corridors or alpine or subalpine areas. The two occurrences from state land in the St. Elias Mountains, one in a subalpine meadow and the other on a floodplain (EO 4 and 6), may be subject to disturbance from mining activity in the future. Occurrences on the Tongass National Forest are mostly in lowland areas with thick organic soils and low potential for mineral extraction. Potential impacts are similar to those associated with mechanical activity in timber harvest: soil compaction, removal of litter and duff layers, disturbance of mycorrhizal networks, or alteration of hydrologic regime.

No mining-related impacts have been documented for occurrences in Alaska. The Doolth Mountain occurrence is located along an abandoned mining road (EO 8), though no disturbance impacts were documented at this site. Access routes to mining claims in Alaska cross through diverse habitats and access methods usually involve high-impact mechanized vehicles such as ATVs or trucks. Proposed and existing access routes are known to traverse other sensitive species populations on National Forest lands in Alaska, and access-related impacts are possible for *P. unalascensis*.

Road Development
Access to both logging and mining sites is often accomplished by the construction of roads or ATV trails. Although logging and mining activities do not always impact habitat directly, access roads may traverse potential habitat. Access-related impacts are especially likely on northern Prince of Wales Island where habitat is concentrated in large patches. Road building results in a small total loss of habitat. However, because of the linear nature of road construction, direct loss of habitat may not be significant, especially for narrow, unpaved forest roads. Road corridors also potentially create new habitat in the form of forest edges, which may reduce the impact of the direct habitat loss caused by the road itself. Road building may cause changes in hydrologic regimes that flood potential habitat from storm run off. Additionally, this can facilitate the establishement on non-native plant species in an area.

Road construction and maintenance is a major threat for two occurrences: EO 10 is located along the forest edge bordering the right of way of a temporary road and EO 23 is located on the downhill side of a road. Road expansion or route changes could destroy these populations. Road maintenance activities have the potential to negatively affect population size, depending on the nature and extent of the maintenance. To a lesser degree, recreation is a threat where trails are constructed through the habitat. Trails can provide access to an area where orchids may be trampled or collected by the public.

Predation and Frost Damage
Insect and mammal herbivory has been observed on *P. unalascensis* in Alaska but not to an extent that is likely to significantly reduce the reproductive capacity of populations (NRIS database). Many occurrences are located in habitats used by deer and other mammals. Potential for damage by trampling is moderate. Trampled plants have been observed at only two occurrences on the Tongass National Forest where they were impacted by deer, one near a game trail (EO 18) and the other near deer beds (EO 19).

Forest damage caused by insect,disease and other factors, such as thermal insulation, may reduce suitable habitat for *Platanthera unalascensis*. This species often grows in *Callitropsis nootkatensis* coniferous forests. Die-off of *Callitropsis nootkatensis* due to frost damage of surfical roots (lack of thermal insulation during winter and spring) has been widely observed throughout southeastern Alaska (Hennon et al. 2016) and may result in degraded or destroyed habitat for *P. unalascensis*.

No insect or disease agents have been identified that are likely to reduce the vigor or reproductive capacity of individuals or populations. The effects of insect herbivory were likely observed at the Big Thorne Unit 124 occurrence (EO 18). No evidence of insect herbivory was documented from other populations.

Invasive Species
Non-native species are common both on and off the road system on Prince of Wales Island, where occurrences are in close proximity to each other and to human infrastructure. Although non-native species are common on Prince of Wales Island, only one occurrence (EO 23) is currently in competition with a non-native species, *Phalaris arundinacea*. *Phalaris arundinacea* is very common on Prince of Wales Island along roadsides and occurs the downhill side of a road corridor at EO 23. *Phalaris arundinacea* is known to establish and form monotypic stands in wetlands displacing native vegetation and altering the soil hydrology (see Carlson et al. 2008 and references therein). The effects of competition have not been assessed at this site. Habitat suitability modeling for *P. arundinacea* suggests high suitability across the range of *P. unalascensis* and little change in percentage of suitable area under future (2030) climates, although high uncertainty is associated with these modeled outputs (Jarnevich et al. 2014).

Plant and Flower Collection
Many orchids are charismantic species and are subjected to human collections for medicinal, cultural, or aesthetic purposes. *Platanthera unalascensis*, however, is not particularly charismatic or conspicuous, and therefore not likely to be collected recreationally even in areas that are easily accessible to the public. No known medicinal uses are associated with this species. The bulbs of *Platanthera unalascensis* have been documented to be eaten by the Pomo and Kayasha Native American Tribes in Southern California (Goodrich et al. 1980). However, there has been no documented use of any orchid species by Alaska Natives in the Alaska Region (Garibaldi 1999). Collection and utilization is not expected to pose a threat to this species on the Tongass National Forest. Collection of scientific voucher specimens should only occur in populations where number of reproducing individuals is high and plants appear to be healthy.

Climate Change
As changing climates are already recognized to be affecting habitats and species worldwide (e.g., Parmesan 1996) and the rate of temperature increase in Alaska is approximately double the global average (Chapin et al. 2014), concern over the future status of rare species in the Alaska Region is warranted. Climate change vulnerability of a species is recognized to be a function of the exposure to (or degree of) climate change that populations will experience, the sensitivity of the species, and the capacity to adapt to the changes (Turner et al. 2003). A number of vulnerability assessment tools have been developed that incorporate all three elements (exposure, sensitivity, and adaptive capacity) such as NatureServe Climate Change Vulnerability Index 2.1 (Young et al. 2011) and the U.S. Forest Service System for Assessing the Vulnerability of Species (Bagne et al. 2011). However, these systems require substantially more information than is available on the sensitivity and adaptive capacity of the species, are not appropriate for plants and lichens, or require environmental data not developed for Alaska. Further these methodologies often do not produce similar vulnerabilities for the same species (Lankford et al. 2014). Due to these limitations, we focus on estimations of the degree of climate change expected in the species' current range (i.e. "exposure") in the Tongass in a qualitative manner and discuss any known or suspected sensitivities and adaptive capacities of the species in a light of the degree of expected change.

"Climate" incorporates a vast array of factors, such as mean annual temperature, summer precipitation, and maximum wind speed for example, of differing importance for any one species. It is impractical to attempt to review all potential factors that compose the climate and we therefore focus on two factors: average summer temperature and average annual precipitation and compare current and predicted 2060 conditions. For most plants and lichens at higher latitudes, summer warmth (or mean July temperature) is well correlated with their distribution (Young 1971, and see Walker et al. 2005), indicating a strong association of the measure with biological limitations. Additionally plants and the habitats they are found in are well-known to be sensitive to soil/substrate and air moisture, and mean annual precipitation as a climate variable is expected to be most correlated with substrate and air moisture.

The current and predicted 2060 climates were developed for Alaska and western Canada by the Scenarios Network for Alaska & Arctic Planning (SNAP) at University of Alaska Fairbanks (UAF). Climate data generated by SNAP is downscaled using the Parameter-elevation Regressions on Independent Slopes Model (PRISM) from the five best-performing General Circulation Models (GCMs) for Alaska. The data selected for this analysis is derived from the A2 emissions scenario, which represents a realistic future emissions projection based on current trends. Data are available at a 771 m grid. While this resolution is relatively fine-scale, interpretations are restricted to broad regions. Interpretations of micro-climate at population-sized sites for sensitive species are not appropriate. To avoid generalizing trends based on stochastic annual climate events, SNAP has provided decadal averages for all data (Fresco et al. 2014). Decade 2010-2019 is selected to represent the current time frame. The 2060s decade is selected to represent the future time-frame because 50 years in the future is far enough to observe meaningful trends without being so far in the future that it cannot be meaningfully compared to current management objectives.

Southeastern Alaska has a strong Pacific Maritime climate with low variation and relatively warm temperatures and high precipitation, much of which falls as rain at low to mid elevations. Both total annual precipitation and mean annual temperature generally decrease along a south to north gradient through the Tongass National Forest. Mean July temperatures is predicted to increase in the Tongass National Forest from the 2010s to the 2060s by between 1.0 to 2.3 °C (Figure 7). The percent change is expected to remain largely constant throughout the region. Mean July temperature is predicted to increase 10 to 20% within the majority of the Tongass National Forest by the 2060s relative to the current mean July temperature Figure 7).

Annual precipitation is predicted to increase across the Tongass National Forest by the 2060s, but no regional gradients are apparent, largely because of competing patterns for summer and winter precipitation (Figure 8). Annual precipitation is predicted to increase by 9 to 12% for most of the Tongass National Forest. Precipitation is predicted to increase around the known population by approximately 260 mm; an increase in annual precipitation of approximately 10%. The greatest percent increase in precipitation is predicted to occur during winter months. Increase in total summer precipitation is most pronounced in the northern portion of the Tongass National Forest, especially the Yakutat Ranger District. Annual precipitation is predicted to increase across the Tongass National Forest by the 2060s, but no regional gradients are apparent.

Climate change sensitivity is dependent on species-specific habitat interactions. Southeastern Alaska is at the peripheral zone of many species ranges, and this is the primary factor driving species rarity in the region, as it is for *Platanthera unalascensis*. Major climate interactions are likely to be limiting the spatial extent of *P. unalascensis* distribution currently. *P. unalascensis* is common in the Coastal Rainforest cliome in southern British Columbia and Northern Washington, both of which are currently warmer than southeastern Alaska. The projected warming trend for Tongass National Forest may increase the amount of suitable habitat as southeastern Alaska. Similarly, the Chugach National Forest, especially the Prince William Sound, may become more suitable for the species. Given the trends of increased temperature and precipitation and the overall climatic stability of the region, the vulnerability of *P. unalascensis* to climate change is likely low. Climate change to the 2060s will likely result in increased habitat availability within the Alaska Region for this species.

The effects of climate change discussed above are relevant only at broad, regional scales. The projected climate data is not suitable for drawing conclusions on individual pixels or for individual populations of *P. unalascensis*. Despite a possible increase in habitat availability, negative local affects at individual population sites are possible in the future. The increase of available habitat in the future does not necessarily indicate an increase in species occurrences or abundance.

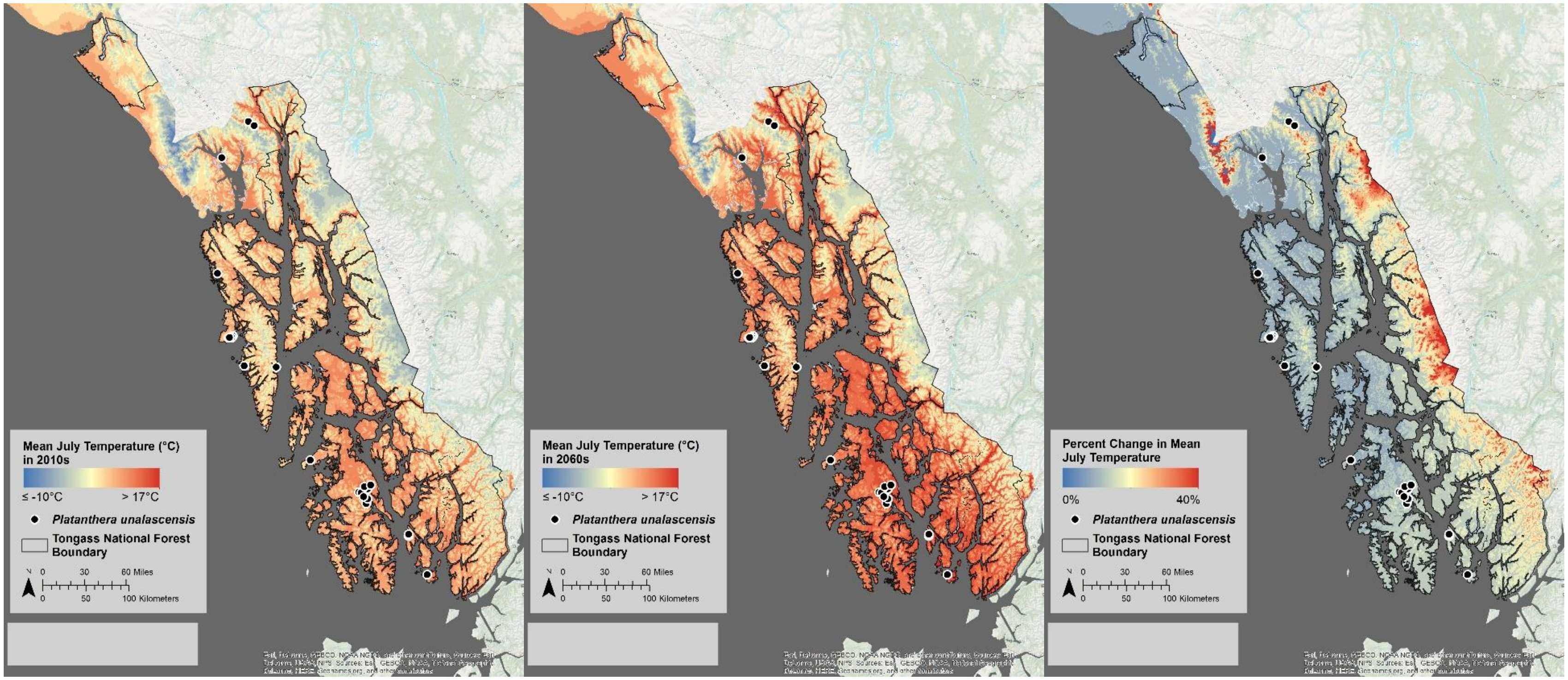


Figure 7. Current (left), predicted 2060 (center) and percent change (right) in mean July temperature (˚C) in the Tongass National Forest. Locations of *Platanthera unalschensis* populations are shown as black dots.

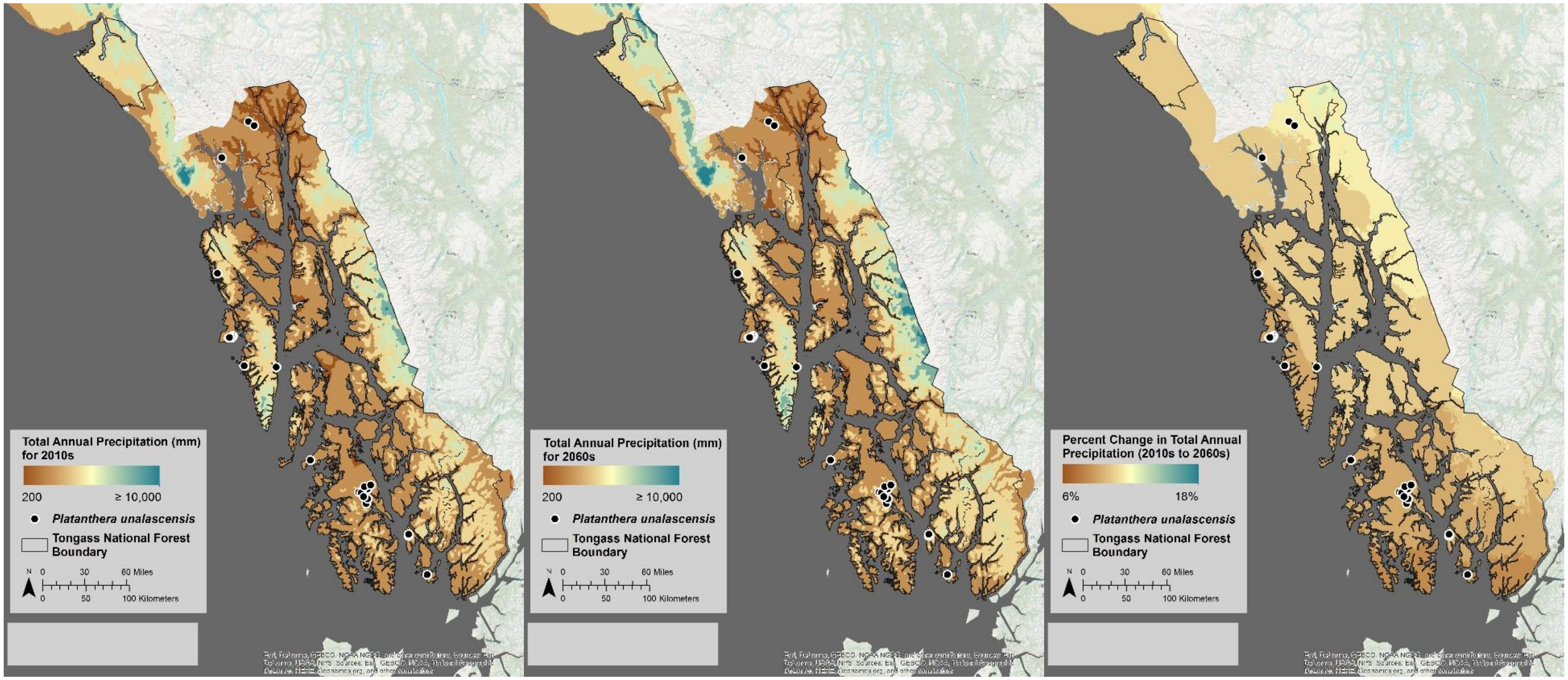


Figure 8. Current (left), predicted 2060 (center) and percent change (right) in mean annual precipitation (mm) in the Tongass National Forest. Locations of *Platanthera unalscensis* populations are shown as black dots.

Conservation Status in the Alaska Region and Tongass National Forest

There is insufficient data to assess if the distribution or abundance of *Platanthera unalascensis* is declining on the Tongass National Forest. No observations of threats or disturbance impacts create a reasonable expectation for declines in the near future. Observations of population viability are not detailed and vary considerably: some individuals in small populations are noted for their poor vigor while other individuals in different small populations have been noted for high vigor. The total number of above-ground plants observed on the Tongass National Forest is 455, but this includes the population from Rio Roberts (EO 10) that is possibly mistaken as *Pipera candida* . Assuming that the above ground portion of plants contributes 50% of the total population, a ratio which likely underestimates total population size. This population estimate is incomplete because not all occurrences documented the number of plants and not all documented plant counts were the result of exhaustive surveys.

Population size is likely correlated with the amount of available open or edge habitat at an occurrence site. In this respect, habitats vary in their potential capacity. Sites with forest edge oriented in a linear fashion are likely to provide large blocks of continuous habitat, allowing the expansion of populations.

The physical parameters of habitat apparently preferred by *P. unalascensis* in southeastern Alaska are not uncommon. Flat to gently sloped lowlands with organic, moist to saturated soils vegetated with open canopy or fragmented coniferous or mixed coniferous-deciduous forests are in fact relatively common. Instead, presence of mycorrhizal fungi symbionts and pollinator abundance, or competition and dispersal limitations are likely driving the rarity of *P. unalascensis* in southeastern Alaska.

The initial dependence of *P. unalascensis* on mycorrhizal symbionts for nutrients and the slow below-ground growth prior to emergence, photosynthesis, and reproduction make this species inherently vulnerable to habitat destruction or destruction of individuals. This species is likely slow to recover from impacts that result in population decline. Repeated impacts causing losses of individuals in short succession have the potential to extirpate populations. The existence of developing plants beneath the soil for years implies that conservation efforts need to focus on measures that protect the soil throughout the occurrence site and not just in the immediate vicinity of above-ground plants. There are no published recommendations buffer zones around sensitive plant species during timber harvest or road construction activities. However, Forest Service Botanists and Ecologists may review buffer zone policy of riparian habitat or sensitive animal species for general guidelines and recommendations that may apply to sensitive plant species.

There is no evidence currently that populations are either at risk or not at risk from human activities on the Tongass National Forest. Current and potential threats and disturbance impacts need to be documented thoroughly for all occurrences before the impacts of current land management policies can be assessed.

Potential Management of the Species in the Alaska Region and Tongass National Forest

Implications and Potential Conservation Elements

Sensitive Species management follows the Tongass National Forest Land Management Plan (USDA 2016) and FSM 2670. Standards and guidelines outlined in the Tongass National Forest Plan for Plants recommend providing protection around plant populations that meet the habitat needs of the species (USDA 2016). Forest Service Manual direction requires the agency to "maintain viable populations of all native and desired non-native wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands." Management practices must ensure that species do not become threatened or endangered because of Forest Service actions (FSM 2670.22). When possible, a buffer should be placed around each population the distance commensurate with the size and location of the population (USDA 2016).

The application of these policies on the Tongass National Forest has resulted in the identification of occurrences and the avoidance of impacts by forest management actions that might destroy habitats or individuals around those occurrences. Sensitive Species are not afforded any legal protection despite their designation for management protection. Populations on state lands, such as those in the St. Elias Mountains, are not protected by management policies. *Platanthera unalascensis* is not managed for conservation purposes in most of its range in the western North America where it is common.

Proactive surveys of areas identified as likely habitat for *P. unalascensis* by expert review is recommended in addition to the required surveys of areas identified for land uses such as timber units, roads, mining claims and other management actions. Preserving the habitat of *P. unalascensis* by limiting management practices that directly or indirectly alter or disturb soil and hydrology of known occurrence sites would have a positive to neutral effect on populations in the Tongass National Forest. Avoidance of permitted special-use and other forest management activities at all occurrence sites should continue to protect habitats and individuals.

Persistence of viable *P. unalascensis* populations on the Tongass National Forest depends on maintaining or increasing populations. The collection of more detailed information on all occurrences is necessary before managers can develop effective occurrence-specific approaches to management and conservation. In addition to protecting known occurrences, protection of likely habitat should be a management objective until surveys are conducted in those areas.

Tools and Practices

The Plants Standards and Guides in the Tongass National Forest Plan recommend plant surveys in habitats where sensitive species are known or suspected. Long-term financial commitments are necessary to protect the viability of *Platanthera unalascensis* and conduct long-term monitoring. Threats to habitat include impacts in areas where occurrences have not been documented but *P. unalascensis* is likely to occur. Future work using environmental variables to confidently identify the orchids' affinity to a particular habitat is needed so that threats to habitat can be recognized. However, environmental variables derived from Forest Service GIS information (e.g. soils, landform, slope, geology, and climate) and their associated mapping scale may be too general to accurately model the preferred habitat. Much of the Tongass National Forest has been impacted by timber harvest and road construction and to a lesser extent mineral extraction and recreation uses. The degree to which such anthropogenic disturbances have altered habitat availability is unknown, but it is likely that available habitat has been reduced on the Tongass National Forest over the past century.

Spatial and temporal differences in survey methods complicate comparisons and summaries. Inventory procedures should follow a standard, detailed TESP methodology with the same detailed data gathered at all sites. Standardization would allow a network of sample points across the region and provide more valid comparisons between occurrences. Habitat parameters of *P. unalascensis* need to be collected in a standardized way between many populations to allow analysis of trends in occupied habitat.

A comprehensive and standardized population monitoring program would help determine trends in population on the Tongass National Forest, confirm effective management practices, and identify baseline trends that can be used to predict future changes. Population monitoring of *P. unalascensis* is challenged by the dormancy phase. Above-ground photosynthetic material is not produced every year. Monitoring would be best performed during the peak flowering time of the species in early-July so that few plants are overlooked, but can be generally done in June or July and can extend to August if necessary. A monitoring program for *P. unalascensis* tracking individual plants across multiple years and employing matrix projection population viability approaches (e.g., see Gray et al. 2012) would be extremely fruitful in understanding demographic changes in this species.

Increasing awareness among USFS personnel and educating field staff in identifying the species would increase identification accuracy and survey efficiency. A rare plant field guide targeted to the Alaska Region would be beneficial to USFS staff to aid in Sensitive Species identification. A Sensitive Species guide made of small laminated cards was developed by the USFS Alaska Region in 1995 (USDA Forest Service 1995) for southeastern Alaska; however, this guide is now outdated. The Alaska Natural Heritage Program developed the Alaska Rare Plant Field Guide (Nawrocki et al. 2013); however, species were selected primarily from lands managed by the Bureau of Land Management (BLM) in Alaska. Only a few species from USFS Alaska Region species were included in the guide. The Field Guide includes information relevant to the identification of the species and the appropriate habitat including illustrations of the plants, large color photographs,, physical descriptions, and comparisons with similar species. A similar approach would likely be helpful for field personnel for all USFS Sensitive Species.

Ex-situ conservation may not be practical for *P. unalascensis*, although this technique has been applied successfully in the conservation of other sensitive plant species in other USFS regions. Seeds of terrestrial orchids are often difficult to germinate in controlled settings (Arditti et al. 1981). Mycorrhizal fungi must be present to germinate and grow orchids in a greenhouse, and the transfer of greenhouse grown orchids to occurrence sites will disrupt the mycorrhizal associations.

Information Needs

Sensitive plant surveys focus on a variety of plant species across many habitats. *Platanthera unalascensis* looks superficially similar to several common orchids, so it is possible that surveyors may have overlooked or misidentified this species in the past, particularly prior to its inclusion on the Alaska Region Sensitive Species List. Additionally, this species looks very similar to *P. ephemerantha*. Few voucher specimens have been collected in the past because most occurrences of *P. unalascensis* lack sufficient population sizes to support the removal of an individual. Most occurrences on the Tongass National Forest have not been documented with detailed photographs or voucher specimens for large populations. Some records for *P. unalascensis* may have been based on observations of *P. ephemerantha*. In the absence of voucher specimens or detailed photographs, occurrences must be relocated to establish identification with certainty. Voucher specimens or detailed photographs should be collected at occurrences to verify positive identification of the species.

Population viability and population trends of *Platanthera unalascensis* on the Tongass National Forest are unknown. Population sizes are very small in Alaska compared to occurrences elsewhere in North America (Lauri pers. comm.).Whether the small population sizes in Alaska are the result of declining population in Alaska or recent establishment from expanding range northward, if either, cannot be assessed currently.

The detail of TESP surveys on the Tongass National Forest has varied in the past. Some populations have been revisited while others have only been surveyed a single time. The intensity of searching has also varied, with extensive searching conducted during some surveys and no attempt made to delineate the spatial extent of the occurrence during other surveys. Data for all TESP fields have not been recorded during most surveys, and observations are often brief. Standardizing survey methods and intensity would aid assessment of conservation of *P. unalascensis* in the future.

Future TESP surveys should provide complete and detailed observations for all TESP fields including exhaustive associated species lists with percent covers. The spatial extent of occurrences should be delineated for all new occurrences, and comprehensive counts of above-ground plants should be conducted. The results of future TESP surveys should continue to be documented in the NRIS TESP database with all fields entered including associated species lists with percent covers. The NRIS TESP database and available geospatial layers relating to habitat characteristics, threats, and disturbances can be combined in future map products to assess spatial relationships in between distribution, habitat, and threat.

Pollinators and mycorrhizal symbionts drive the range and abundance of rare terrestrial orchids worldwide (Clements 1988, Rasmussen 2002, Roberts 2003). The specific mycorrhizal symbionts of this orchid are unknown. Rare orchids such as *P. unalascensis* may have a limited distribution because the mycorrhizal symbiont is also rare. Habitat conditions for the fungi are overlooked in the conservation and management of the orchids (Currah and Sherburne 1992, Bothe et al. 2010).

Pollinators are unknown for *P. unalascensis* in Alaska. Determining the pollinator for a plant is time consuming and challenging because some pollinators may be nocturnal. Understanding the pollination history of this orchid is important to determining effective conservation and management actions.

No information is available on rates of subpopulation colonization and extinction. Population genetic studies would likely be the most appropriate avenue for estimating rates of migration among subpopulations and assessing dispersal barriers.

Population Monitoring
A pilot study for monitoring sensitive plant populations on Prince of Wales Island initiated in 2011 was conducted for *Platanthera orbiculata*, *P. ephemerantha*, *Cypripedium parviflorum* var.

pubescens, and *Lobaria amplissima*. Population monitoring has not been conducted for *P. unalascensis* on the Tongass National Forest to determine if management activities adjacent to occurrences have impacted populations or individuals. Gathering detailed annual population data would allow future assessment of population trends. If not all populations can be visited annually, the populations on Prince of Wales Island would provide the most accessible and efficient grouping of occurrences to monitor.

Research Priorities
A list of research priorities based on the data needs discussed above are:

- Voucher specimens from all populations that can support removal of an individual for confirmation of identification. Detailed photographs of plants, focusing on diagnostic features, and habitats should be collected at all sites. Identification should be confirmed on all populations and the NRIS database should be updated to reflect the new identifications.
- Revisits of all occurrences to gather detailed and standardized data outlined in TESP methodology.
- A study of the reproductive biology and pollinators on the Tongass National Forest.
- A study of the specificity and distribution of mycorrhizal fungi symbionts on the Tongass National Forest.
- Population monitoring and viability analysis.
- Dispersal capability and germination requirements/population genetic analysis.
- Demographics, focusing on dormancy of individuals and the ratio of above-ground plants to below-ground plants in populations.
- Effects of non-native species, especially *Phalaris arundinacea*, on *Platanthera unalascensis.*

Assessing these data gaps in the future will provide a better scientific basis for effective species management on the Tongass National Forest.

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Definitions

Agamospermy: asexual reproduction by seeds, where viable seeds are produced in the absence of fertilization.

Anther: pollen-bearing portion of stamen.

Anthesis: time of flowering when flowers are fully expanded.

Ascending: angled upward.

Auricle: a small, lobed projection, usually at the base of a leaf or petal.

Autogamy: self-pollination of a flower.

Basal: related to or located at the base.

Bract: small leaves at the base of an inflorescence or flower.

Calcareous: comprised in part of calcium, referring to minerals such as limestone and dolostone which contain calcium and carbonate (CO_3) and are basic.

Caudicle: a stalk-like appendage attached to the pollinium in orchid genera that aids in attachment of the pollinium to a pollinator.

Capsule: a dry fruit of more than one carpel that opens at maturity to release seed.

Cordillera: collective term for the mountains of western North America that generally run parallel to the Pacific Coast from Alaska to Mexico.

Ellipsoid: elliptic in long section but circular in cross section.

Fruit: the seed-bearing mature ovary and associated structures of a plant.

Hypha: (*pl.* **hyphae**) multicellular, thread-like structures that comprise the primary body of a fungi.

Inflorescence: a flower cluster or arrangement of flowers on a stem.

Invasive plant: non-native plant that produces viable offspring in large numbers and has the potential to establish and spread in natural areas.

Lanceolate: lance-shaped, much longer than broad, widest below the middle and tapering to both ends.

Lip: a projection of a structure, such as the lower petal of an orchid flower.

Mycorrhiza: (*pl.* **mycorrhizae**) symbiotic association of fungal hyphae with plant roots.

Non-native: plants that are present in a given area because of their accidental or intentional introduction by human activities.

Oblanceolate: inversely lance-shaped; the structure is widest above the middle and tapers in both directions.

Ovate: egg-shaped, structure is widest below the middle.

Ovoid: three-dimensionally egg-shaped.

Perennial: multi-year life cycle, usually producing flowers and fruit each year once the individual has reached maturity.

Petal: one of the specialized inner flower leaves.

Pollinarium: (*pl.* **pollinaria**) in orchids, a pair of pollinia attached to one another by viscidia.

Pollinium: (*pl.* **pollinia**) a mass of pollen grains produced by a single anther. In orchids, the pollinium is waxy and attached to a viscidium.

Raceme: unbranched cluster of stalked flowers arising from a central stalk where the flowers at the bottom open first.

Recurved: curving backwards.

Secund: arranged on one side of an axis, such as a stem.

Sepal: one of the specialized outer flower leaves.

Spike: unbranched cluster of unstalked flowers arising from a central stalk.

Spur: hollow or sac-like projection on parts of the sepals or petals.

Stamen: the male part of the flower that bears pollen, consists of an anther and the supporting filament.

Stipe: stalk that supports another structure; in the case of orchids, the stipe is the stalk that is attached to the viscidium and supports the pollinia.

Ultramafic: comprised of minerals with low silicate content that have very high iron and magnesium content and are basic.

Viscidium: a sticky, disc-shaped structure that adheres to the proboscis of insects. This aids in the dispersal of pollen since the viscidium is attached to a pollinarium.

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Author Biography

The original *Platanthera unalascensis* Conservation Assessment was written by Karen Dillman, an ecologist with the Tongass National Forest. The current version of the *Platanthera unalascensis*Conservation Assessment was revised by the Botany Program of Alaska Natural Heritage Program (AKNHP), University of Alaska Anchorage (UAA). AKNHP collects, synthesizes, and validates information on Alaska's animal and plant species of concern and their habitats, ecosystems of concern, and invasive species. This information is provided by AKNHP to government, business, land managers, scientists, conservation groups, and the public.

The botany program conducts research on the biology of rare and invasive plant species and participates in citizen science initiatives. The program is directed under Dr. Matthew Carlson, who also teaches in the Department of Biological Sciences at UAA. Areas of research expertise for the botany program include habitat modeling, biogeography of rare and invasive plants, reproductive ecology and evolution, and ecological impacts of non-native plants. The botany program also offers a wide range of related services including field surveys, monitoring studies, mapping, and conservation planning services. The AKNHP botany program also manages the University of Alaska Anchorage Herbarium (UAAH) which holds an extensive representation of Alaska's flora, including rare Alaskan plants, non-native plants, and cryptograms. Over 14,000 specimens are in the collection and can be viewed online at: http://www.pnwherbaria.org/.

The botany program has extensive experience with rare plant conservation in Alaska and is an authority figure for assigning state level conservation ranks. Notably, the Alaska Rare Plant Field Guide has been published to aid in the identification, distribution, and ecology for plants of conservation concern in Alaska. The botany program is also the central repository of biological information on Alaska's rare and invasive plant species and tracks over 600 plant species. Lists of vascular plants and lichens of conservation concern of selected rare plants of Alaska are located on the Rare Plants page. AKNHP works closely with botanists across Alaska in an effort to ensure the most comprehensive and accurate data sets.