US Forest Service

Conservation Assessment of Piperia unalascensis (Spreng.) Rydb.

Region 10 Sensitive Species

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Image from USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols.* Charles Scribner's Sons, New York. Vol. 1: 555.

Piperia unalascensis (Spreng.) Rydb. is designated by the Alaska Regional Forester as a sensitive species in 2009. This document is to provide current status of this orchid and identify information needs.

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Summary

Species: *Piperia unalascensis* (Spreng.) Rydb.

Management Status: USDA Forest Service, Region 10, designated by the Forest Supervisor as a Sensitive Species.

Range: Endemic to North America. United States (AK, CA, CO, ID, MI, MO, NV, NM, OR, SD, UT, WA, WY), Canada (Alberta, British Columbia, Newfoundland, Ontario, Quebec). In Alaska, it is known from south coast Alaska (Aleutians to Southeastern).

Habitat: Alaska: lower elevations and low productive forests. North America: dry woods, stream banks and open mountainous slopes.

Threats: Timber harvest, road building, recreation, mining and introduction of invasive plants.

Management Considerations: Follow Forest Plan guidance for rare and sensitive plants.

Information Needs: Inventory and Monitoring, Pollination History, Population Viability

1.0 Introduction

The National Forest Management Act (NFMA) of 1976 directs the Forest Service to manage the National Forests to "provide for diversity of plant and animal communities based on the suitability and capability of the specified land area in order to meet overall multiple-use objectives." NFMA regulations (36CFR219.20) state: "Plan decisions affecting species diversity must provide for ecological conditions that the responsible official determines provide a high likelihood that those conditions are capable of supporting over time the viability of native and desired non-native species well distributed throughout their ranges within the plan area…" Forest Service Manual (FSM 2670.12) directs the Forest Service to: "Manage "habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species."36CFR219.36 defines species at risk as Federally listed endangered, threatened, candidate, and proposed species for which loss of viability, including reduction in distribution or abundance is a concern within the plan area. Other species–at-risk may include sensitive species and state listed species."

Current Forest Service direction defines a Conservation Assessment as an analysis and documentation of the current status and distribution of a species. It also identifies what information is needed to develop a plan of action to conserve the species (such as a recovery or conservation strategy). It does not include management direction or make a management commitment.

A Sensitive Species is defined as those plant and animal species identified by a Regional Forester for which population viability is a concern as evidenced by:

1. Significant current or predicted downward trends in population numbers or density.

2. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

In 2008, *Piperia unalascensis* (PIUN3) was evaluated as a candidate for sensitive designation in the Alaska Region. The distribution of this plant was examined across its range including habitat and population trends, habitat vulnerability and life history information. After the evaluation, *Piperia unalascensis* was formally added to the USDA Forest Service Region 10 Sensitive Plant Species List in April 2009. The basic description, distribution, historical information, habitat description, and life history will be incorporated into this assessment under the Biological Information section. Since this orchid was designated as sensitive, a number of new populations have been discovered on the Tongass National Forest during project planning.

2.0 Biological Information

A.Nomenclature and Taxonomy

Scientific Name: *Piperia unalascensis* (Spreng.) Rydberg, In Bull.Torrey Bot. Club 28: 270 1901

Common Name: Alaska rein orchid

Family: Orchidaceae

Basionym: *Spiranthes unalascensis* Sprengel, 1826

Nomenclatural synonyms: *Habenaria schischmareffiana* Chamisso, 1828 , *Habenaria unalaschensis* (Spreng.) S. Wats, *Platanthera foetida* Geyer ex Hooker 1855, *Platanthera unalaschensis* (Spreng) Kurtz

B.Plant Description

The following is a simple description of *Piperia unalascensis* from Hultén 1968:

Stems scapose, with few narrow bracts, from 2 ovoid tuberoids; leaves 2-3 oblanceolate, obtuse or somewhat acute, soon withering; spike remotely flowered; flowers green, with disagreeable odor; petals and upper sepals forming hood; lip oblong; spur slender, about as long as lip. The genus *Piperia* (Orchidaceae) is taxonomically closely allied with the genus *Platanthera* (Ackerman 1977; Bateman *et al*, 2003 and 2009). It currently has nine recognized species and two subspecies primarily distributed from northern Baja California to the Aleutian Islands of Alaska, and the intermountain western states in the United States (Ackerman and Morgan, 2002). The racemes in *Piperia unalascensis* are usually slender and sparsely flowered; racemes of uncommon coastal populations (including the type) are short, stout, and densely flowered (Ackerman and Morgan, 2002). Plants of the coast ranges and the Pacific Northwest are stouter and have broader sepals and petals than do interior and montane forms (Ackerman and Morgan, 2002). (See Figures 1 and 2 for the inflorescence and flower from Washington). It typically blooms between April through August throughout its range.

Figure 1. Raceme of PIUN3. Used with permission from Ben Legler.

Figure 2. Flower of PIUN3. Used with permission from Paul Stichter.

3.0 Range and Distribution

This orchid is endemic to North America. It is known from Alaska, the western United States, except Arizona, and is also found in Michigan (USDA NRCS, 2010). In California it is widespread, mainly from the mountainous regions (University of California, 2010).

In Alaska, this orchid is restricted to the coastal region, from the Aleutian Islands to SE Alaska (Hultén, 1968). Collections in UAF herbarium are from Glacier Bay National Park, Red Bluff Bay in SE Alaska, and Unalaska Island in the Aleutian Islands (University of Alaska Museum, 2010). It is also indicated from a site in Prince William Sound (Hultén, 1968), but the site has not been relocated and the collection cannot be located (Laurey, personal comm. July 2008). The majority of the recent sightings in Alaska are from the Tongass National Forest (Figure 1).

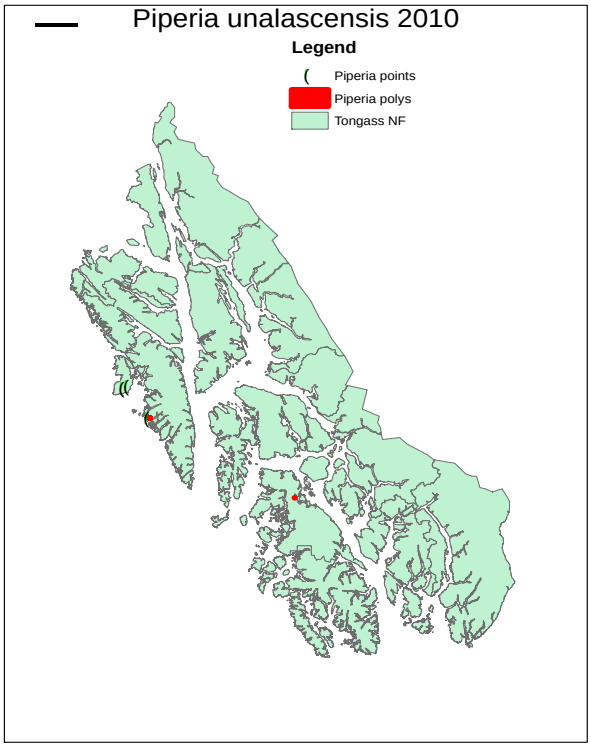


Figure 1. Known locations of *Piperia unalascensis* on the Tongass National Forest as of 2010. Red polys refer to polygons drawn around the known population, and green points are the GPS location for an individual or a population.

This plant occurs in most Canadians provinces. In British Columbia it is widespread and occurs on the mainland and on Vancouver and Queen Charlotte Islands (Calder and Taylor 1968 UCB Herbarium, 2010, Meindinger, 2001). In Alberta, it is restricted to the southern portion near the

US/Canadian border (University of Alberta, 2010). It is also reported from Newfoundland, Ontario and Quebec provinces in Eastern Canada (USDA NRCS, 2010, Royal Botanical Gardens, 2010).

4.0 Habitat and Abundance

In North America, the general habitat for this orchid is dry woods, gravelly stream banks, and open slopes in mountainous regions. In Eastern Canada, it is found in dry, dolomitic woodlands with hardwoods and cedar (Royal Botanical Gardens, 2010). This orchid is found growing as a solitary individual or in small groups of a few individuals. In SE Alaska, it grows in low productive forests at lower elevations in poorly drained soils (0 to 300 ft above sea level) (Table 1). In this region, the habitats are non-carbonate, and often contain ultra-mafic geology (Duke and Baranof Islands). Commonly associated plants include Skunk cabbage (*Lysichiton americanum*), Salal (*Galtheria shallon*), and Red and Alaska Yellow Cedar (*Thuja plicata* and *Cupressus nootkatensis*).

Table 1. Information about the sightings of *Piperia unalascensis* populations on the Tongass National Forest as of Sept 2010. Information is from Tongass GIS database.

Location	**Date**	**ID in GIS Database**	**Forest productivity from GIS**	**Soil Map Unit/Soil drainage**
Duke Island	7/28/2005	226	low	720/very poorly drained
Gravina Island	7/22/1999	081	low	25/very poorly drained
POW	7/8/2009	107	low	22/miscellaneous
POW	7/7/2009	106	high	157/very poorly drained
POW	8/11/2009	105	low	252/poorly drained
POW	8/17/2009	109	low	unidentified
Kruzof	7/22/2009	010	Low-muskeg	unidentified
Kruzof	7/20/2009	007	low	unidentified
Chichagof	6/29/2005	136	unidentified	unidentified
Baranof	8/13/2009	011	low	unidentified

5.0 Habitat Model

Habitat suitability models were recently developed for Alaska rein orchid (*Piperia unalascensis*.. Habitat suitability modeling objectively evaluates the relationship between the occurrences of a species and its habitat, consisting of a number of abiotic or biotic environmental variables. The model can be used to predict the probability of presence of the species in areas where the actual distribution is unknown. Habitat suitability maps help reduce the complexity of manually identifying suitable habitat and can guide field surveys toward areas with increased probability of finding new populations of a species (Bourg et al. 2005, Guisan et al. 2006). They also provide managers with information about rare taxa that can be used to proactively design a project so that potential impacts on habitat may be avoided, eliminating the need for surveys or mitigation in these areas.

The maximum entropy method was used to model the potential distribution of *Piperia unalascensis* (Turner 2011). Maximum entropy (Maxent) is a general purpose machine-learning algorithm that can be used to model species' geographic distributions based on the relationship between species occurrences and environmental variables (Phillips et al. 2006). Maxent produces a continuous probability distribution of species presence within the study area, represented by a spatial grid of cells. Each cell in the grid is given a value between 0 and 1, with 0 indicating no probability of occurrence and 1 indicating absolute certainty of occurrence.

Spatial data layers that represent environmental variables suspected to be important to the distribution of *Piperia unalascensis* were acquired from agency and other sources and converted to raster format with a cell resolution of 100 m. Turner (2011) provides full descriptions of the data layers and variable attributes used in the models. All known occurrences of the *Piperia unalascensis* (19 sites at the time the model was developed) within the administrative boundaries of the Tongass National Forest were included as presence data. The "presence" sites were partitioned randomly into training and test data sets, with 75 percent used as training data and 25 percent as test data. Since some locations on the Forest are missing data for one or more environmental variables, three separate models using progressively larger sets of variables were created for each species (Table 2). Each of the models may be used for assessing suitable habitat or potential species distribution, depending on the purpose and geographic extent of a particular management application. For example, Model 1 (which omits variables derived from soils and lithology information) may be used in designated wilderness areas where soil inventory information is not available.

Table 2. Environmental layers used in the three sets of habitat suitability models.

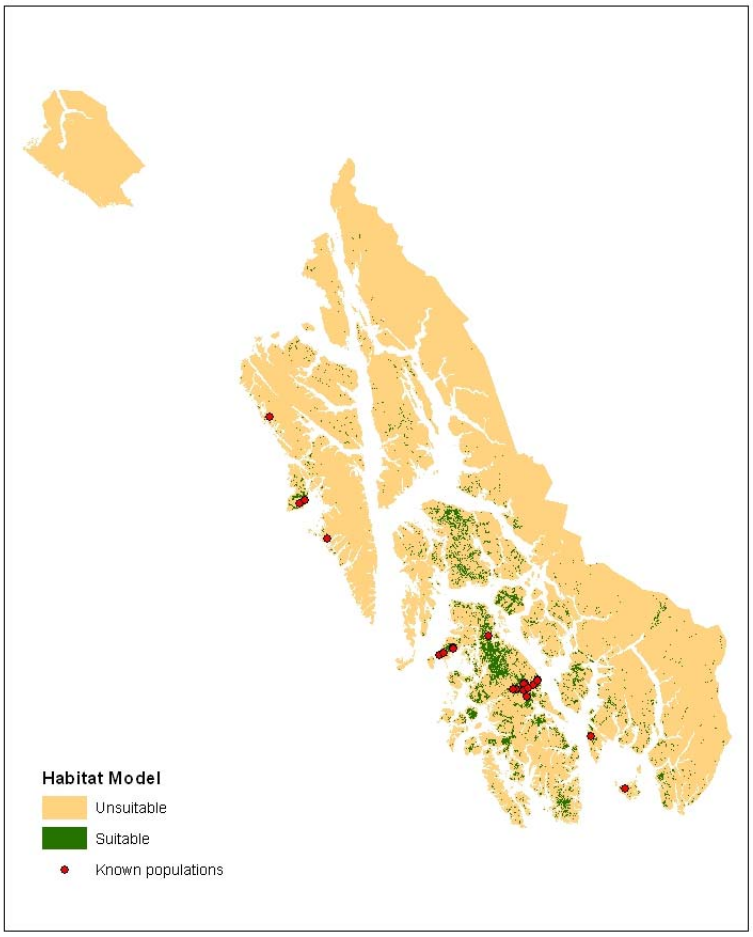
Model 1	Model 2	Model 3
Distance to nearest forest	All Model 1 layers	All Model 1 and 2 layers
Distance to nearest nonforest	Landform class	Lithology class– broad
Distance to nearest coastline	Site index	Lithology class – finest
Distance to nearest stream	Soil hydric class	
Elevation	Soil parent material	
Forest cover type	Wet-hab class	
Forest productivity class		
Mean annual precipitation		
Mean annual temperature		
Nonforest cover type		
Slope aspect		
Slope gradient		
Stand size class		
Stand volume class		

Some applications of the models, such as classifying habitat for project impact determinations, require a binary prediction. Converting a continuous prediction to a binary prediction requires selecting a threshold value, which is the probability level above which a species is predicted as present. The 'maximum sensitivity plus specificity' method was used for threshold selection. The

highest success rate for predicting suitable habitat was 60 percent for *Piperia unalascensis* Models 2 and 3, and the lowest was 50 percent for Model 1. All models were statistically significant (correctly classified test sites better than random), with p-values < 0.05.

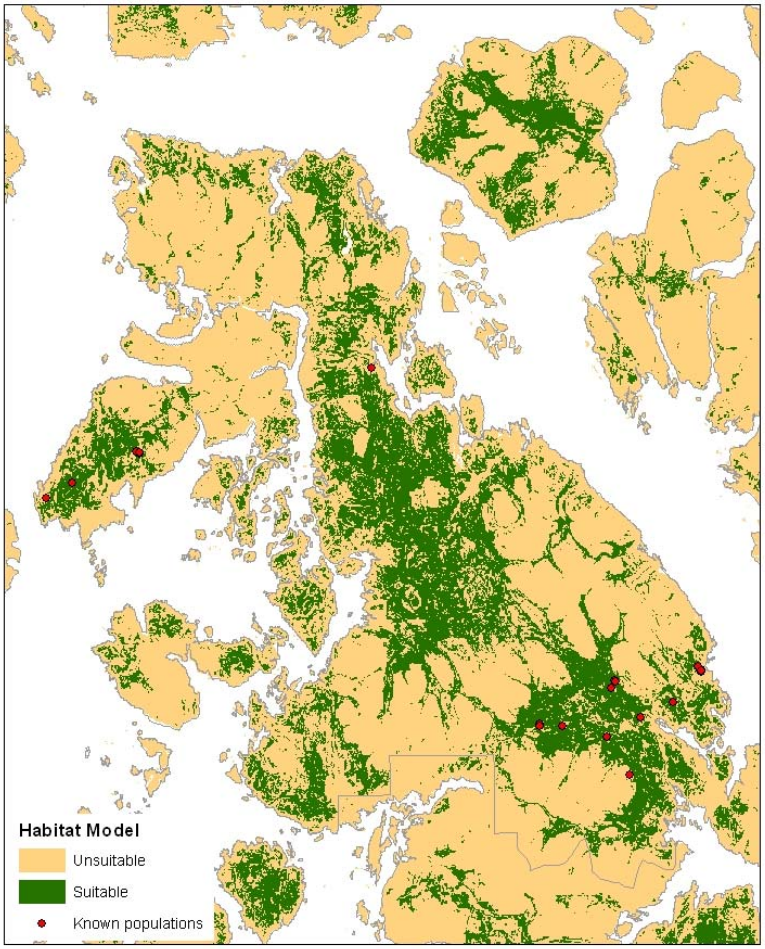
Maxent model results and threshold analysis were used to map suitable and unsuitable habitat across the entire Tongass National Forest using Model 1 and the 'maximum training sensitivity plus specificity' threshold (Figure 1). Figures 2-4 show close-up detail of Models 1 -3 using this same threshold on northern Prince of Wales Island, where *Piperia unalascensis* populations are concentrated. Areas where the species is predicted to be present (that is, the probability of presence is greater than the threshold value) are depicted in dark green. The tan areas are those areas on the Tongass deemed unsuitable according to the model.

It is important to remember that habitat suitability models represent the *potential* distribution of a species, not necessarily the areas that are actually occupied (Jimene-Valverde et al. 2008). A region identified as suitable habitat may have never been occupied due to geographic barriers to dispersal, or it may have been inhabited at one time but populations were eliminated due to a past disturbance. Additionally, incomplete information on species ecology, a lack of appropriate environmental data, or a limited number of presence records can result in an incomplete definition of a species' environmental space. Errors in environmental data and inaccurate or biased species survey data can also have negative effects on model success (Wilson et al. 2005).



Piperia unalascensis Habitat Suitability Model 1
Tongass National Forest

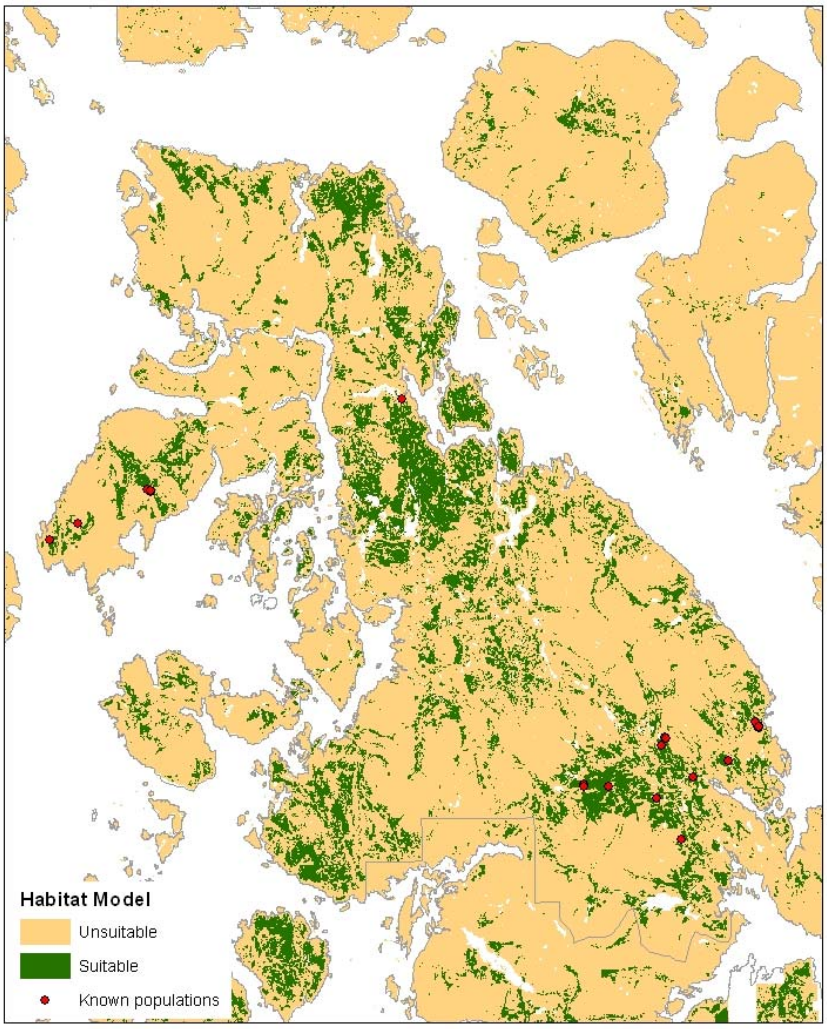
Figure 2. Habitat suitability model 1 for *Piperia unalascensis* on the Tongass National Forest.



Piperia unalascensis Habitat Suitability Model 1

Tongass National Forest - North Prince of Wales Island

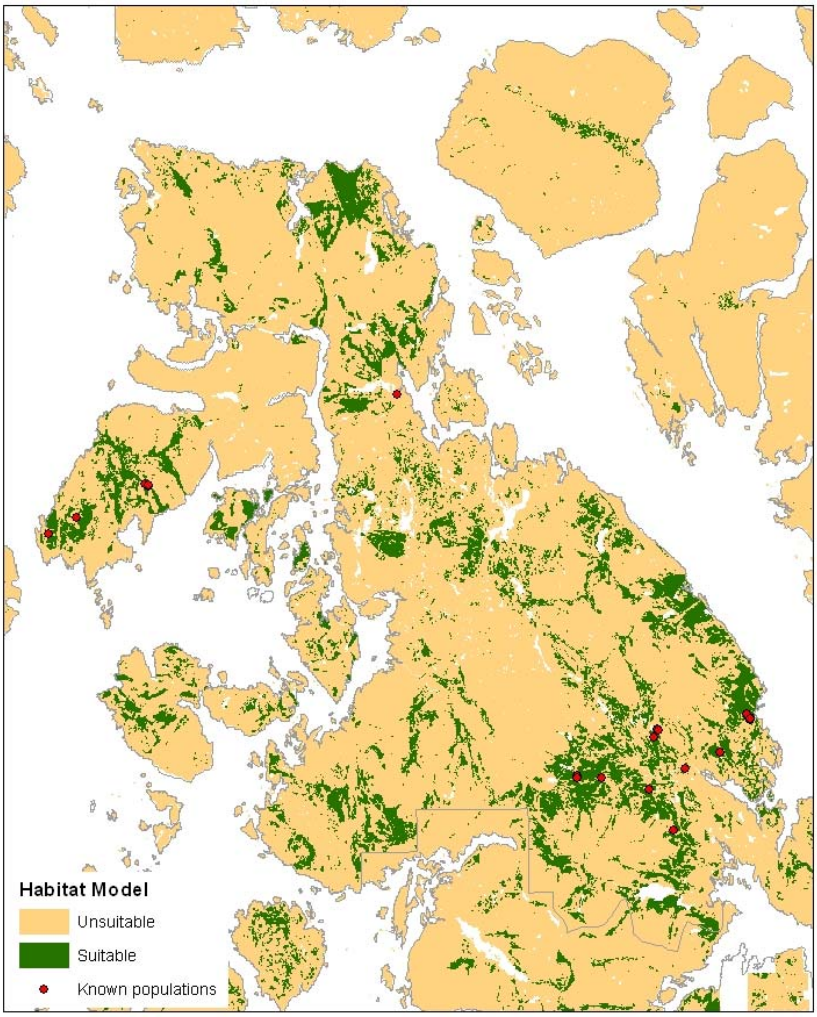
Figure 3. Habitat suitability model 1 for *Piperia unalascensis*, showing detail on northern Prince of Wales Island, Tongass National Forest.



Piperia unalascensis Habitat Suitability Model 2

Tongass National Forest - North Prince of Wales Island

Figure 4. Habitat suitability model 2 for *Piperia unalascensis*, showing detail on northern Prince of Wales Island, Tongass National Forest.



Piperia unalascensis Habitat Suitability Model 3

Tongass National Forest - North Prince of Wales Island

Figure 5. Habitat suitability model 3 for *Piperia unalascensis*, showing detail on northern Prince of Wales Island, Tongass National Forest.

6.0 Current Species Situation

A. Status History

This orchid is on the USDA Forest Service Region 10 Sensitive Plant Species List revised in April of 2008. It is considered imperiled in Alaska (S2) (Alaska Natural Heritage Program, 2010).Its global status is secure (G5) (NatureServe, 2010).

Alaska rein orchid is also considered imperiled in Michigan (S2). It is considered secure in most of the western states, except New Mexico, where it is critically imperiled (S1) (Figure 6). It is vulnerable in Wyoming (S3) and apparently secure in Montana and South Dakota (S4). In Canada, it is secure in British Columbia (S5), vulnerable in Alberta (S3), apparently secure in Ontario (S4) and critically imperiled in Quebec and Newfoundland (S1).

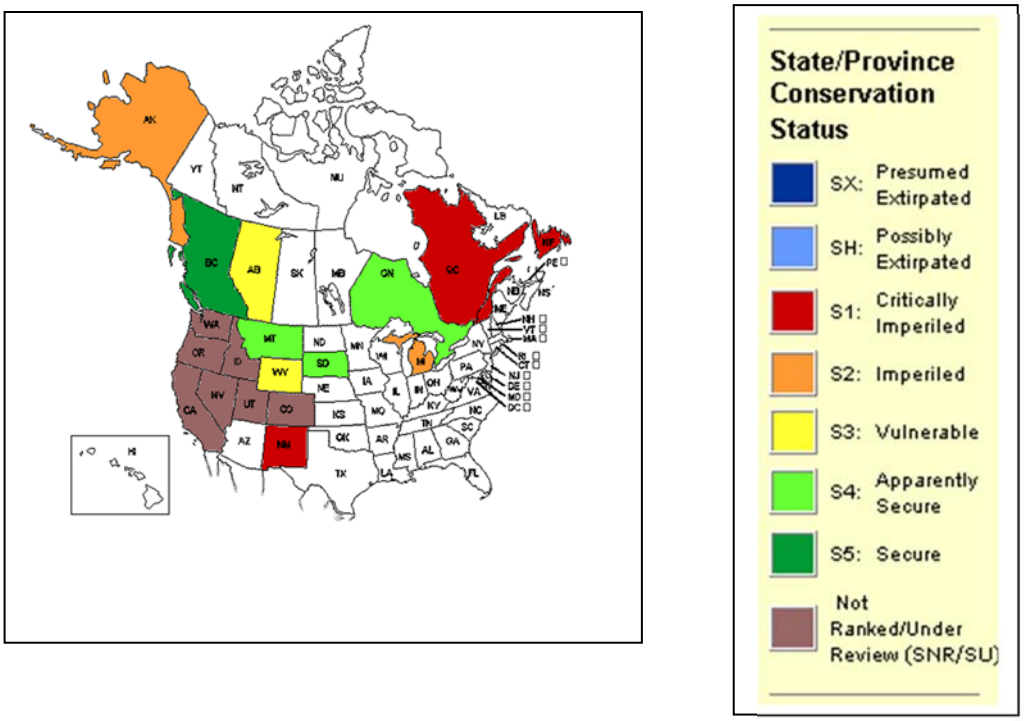


Figure 6. Map of distribution and conservation status of *Piperia unalascensis* in North America. (NatureServe 2010)

B.Viability Considerations

This orchid is intrinsically rare due to several natural factors pertaining to the above and below ground life history phases of more than one species. The underground phase of the mycorrhizal association with a fungal endophyte is unknown, as well as the species of pollinator. These two factors drive the range and abundance of rare terrestrial orchids worldwide (Clements, 1988; Rasmussen, 2002; Roberts, 2003). With so many uncertainties, it is difficult to state the viability of this species on the Tongass National Forest.

This orchid grows in forested and non-forested habitats. Some of the habitats in SE Alaska are managed for timber harvest and have associated road building disturbances nearby and throughout. 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 on or collected by the public. Past and present mining exploration and extraction in this orchid's habitat is also a potential threat.

Additionally, changes in precipitation, increased air pollution deposition such as nitrogen, and elevated CO_2 due to greenhouse gases all contribute to alterations in the belowground chemistry of the soils that also impact the mycorrhizal communities that are relied upon by orchids and other plants (Lilleskov *et al*. 2002). The predicted global climate change scenarios may be the biggest threat to this species and other rare orchids (Swarts & Dixon 2009).

7.0 Management of Sensitive Species

Sensitive species management follows the Tongass National Forest Land Management Plan (USDA, 2008) and the FSM 2670 for sensitive species. 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, 2008). Forest Service Manual direction requires the agency to "maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands". Management practices must insure that species do not become threatened or endangered because of Forest Service actions (FSM 2670.22). The Plants Standards and Guides in the Tongass National Forest Plan recommend plant surveys in habitats where sensitive species are known or suspected. When possible, a buffer should be placed around each population the distance commensurate with the size and location of the population (USDA, 2008). Known populations of sensitive plants can be avoided with proper mitigation measures. Land managers can provide permanent protection of the habitats presently occupied by *P. unalascensis* and the surrounding ecosystem upon which it depends. Long term financial commitments are necessary to protect the orchid's viability and conduct long term monitoring.

8.0 Information Needs

A. Inventory and Monitoring

Sensitive plant surveys focus on a variety of plant species across many habitats. *P. unalascensis* looks similar to several of the common orchids, so it is possible that past botanical surveys may have missed this plant, particularly the years before it was included on the sensitive list in the Alaska Region. Since this orchid has been on the sensitive list, more populations have been discovered. The known populations of *P. unalascensis* on the Tongass National Forest have not been monitored to determine if adjacent management activities have impacted their population or individuals. Additionally, this orchid also looks like white flower rein orchid (*Piperia candida* R. Morgan & Ackerman). That orchid has whiter flowers but similar growth habit. It is possible that older sightings could have been *P. candida* and without vouchers from the different known locations it is impossible to know.

B.Pollination History

The pollinator is unknown for the Alaskan populations of *P. unalascensis*. In Washington, it is known to be pollinated by the plum or pyralid moth (Washington Native Orchid Society 2010). A related orchid, *Platanthera obtusata*, is pollinated by the male mosquito in Alaska (R. Lauri pers. comm. 2011). Determining the pollinator for a plant is time consuming and challenging due to some pollinators being nocturnal. Understanding the pollination history of this orchid is important to help determine the conservation and management of the species.

C.Population Viability

The population viability of *P. unalascensis* on the Tongass National Forest is unknown. The populations are very small in Alaska compared to the rest of its range. In California, one population is over 500 individuals (R. Lauri *pers. comm*. 2011). The number of known populations in Alaska is under 20, with a total number of known individuals estimated to be less than 100 plants.

D.Mycorrhizal Fungi

Mycorrhizal infection of most wild orchid seeds is a prerequisite for the germination and growth of the plant (Bernard 1904). The specific mycorrhizal associations of this orchid with a fungus are unknown. Rare orchids such as *P. unalascensis* may have a limited distribution because the mycorrhizal symbiont is also rare and habitat conditions for the fungus are overlooked in the conservation and management of the orchids (Bothe *et al*. 2010, Currah & Sherburne 1992).

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