

*Plagiobothrys hirtus*  
(Rough popcornflower)  
Endangered

**5-Year Review: Summary and Evaluation**



*Plagiobothrys hirtus*: ODOT Wilbur Site, Douglas County, Oregon  
Photograph Sam Friedman, Roseburg Field Office

**U.S. Fish and Wildlife Service  
Roseburg Field Office  
Roseburg, Oregon**

June 9, 2010

5-YEAR REVIEW Species reviewed: *Plagiobothrys hirtus*  
(Rough popcornflower)

**TABLE OF CONTENTS**

1.0 GENERAL INFORMATION.....	1
1.1 Reviewers.....	1
1.2 Methodology used to complete the review .....	2
1.3 Background .....	2
2.0 REVIEW ANALYSIS .....	3
2.1 Application of the 1996 Distinct Population Segment (DPS) policy .....	3
2.2 Recovery Criteria .....	3
2.3 Updated Information and Current Species Status .....	12
2.4 Synthesis .....	28
3.0 RESULTS .....	29
3.1 Recommended Classification .....	29
3.2 New Recovery Priority Number .....	29
3.3 Listing and Reclassification Priority Number .....	29
4.0 RECOMMENDATIONS FOR FUTURE ACTIONS .....	29
5.0 LITERATURE CITED.....	33
Signature Page .....	36
Appendix A.....	37
Appendix B.....	38

## **5-YEAR REVIEW: Summary and Evaluation**

**Species reviewed: *Plagiobothrys hirtus* (Rough popcornflower)**

### **1.0 GENERAL INFORMATION**

#### **Purpose of 5-Year Reviews:**

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

#### **General Species Information:**

*Plagiobothrys hirtus* is an annual herb in the borage family (Boraginaceae). Individual plants are between 7 (2.75 inches) to 60 cm (23.6 inches) tall, with narrow hairy leaves along hairy stems. Flowers are five-petaled, trumpet-shaped, mostly white with yellow centers, and positioned in a hairy calyx. Flowers occur on paired coiled inflorescences. Each flower produces four tan to black-colored nutlets which will germinate readily (Amsberry and Meinke 2009). This species is endemic to northern Douglas County, Oregon in the interior Umpqua River watershed at elevations from 100 to 230 m (328 to 755 feet). The species was collected only four times between 1887 and 1961, only within Douglas County (Currin et. al 2005). The taxon was considered possibly extinct (Meinke 1982) until it was rediscovered in 1983 as a result of intensive field surveys (J. Kagan, pers. comm. 1997). At the time of final listing (64 FR 1515), *P. hirtus* was known from 17 habitat patches and two experimentally established populations. These habitat patches occurred in 8 extant Element Occurrences (EOs) at that time. In this review a "habitat patch", "patch" or "sub-population" as described in the final listing rule (USFWS 2000), will represent a patch. In this review an Element Occurrence, as described by NatureServe (NatureServe 2010) represents a grouping of patches or sub-populations that are within 1 km (0.62 miles) of each other. We use "occurrence" or "population" interchangeably. At present 36 distinct patches, within 14 extant *P. hirtus* occurrences, are distributed discontinuously from Yoncalla Creek, near Rice Hill, Oregon, south to the Sutherlin Creek, near Wilbur, in the Umpqua River watershed (Maddux and Meyers 2008; USFWS 2009). Of the 14 occurrences, five introduced populations have been established in the southern range of the

population. Two naturally occurring populations have also been augmented with additional *P. hirtus*. Suitable habitat includes open vernal wet meadows, seasonally-ponding mud-flats, or Oregon ash-swale openings dominated by native wetland-associated herbs and graminoids in valley lowlands.

## 1.1 Reviewers

**Lead Regional Office:** Sarah Hall, Region 1, Regional Office, Portland, Oregon 97232 (503) 231-6868

**Lead Field Office:** Sam Friedman, Roseburg Field Office, Roseburg Oregon 97471 (541) 957-3478

## 1.2 Methodology used to complete the review:

This review was conducted by the Roseburg Field Office (RFO) of the Oregon Fish and Wildlife Office (OFWO). The primary sources of information used in this analysis were recent survey information (RFO files) and the 2004 Recovery Plan for rough popcornflower (Recovery Plan). The findings of this review are also informed by Oregon Department of Agriculture (ODA), The Nature Conservancy (TNC), and Bureau of Land Management (BLM) research and monitoring reports that have been conducted since *Plagiobothrys hirtus* was listed in 1999 (65 FR 3866).

## 1.3 Background:

**1.3.1 FR Notice citation announcing initiation of this review:** Federal Register, Volume 73, Number 83, published April 29, 2008. We received no input from the public in response to this announcement.

### 1.3.2 Listing history

#### Original Listing

**FR notice:** Final Rule, 65 FR 3866

**Date listed:** February 24, 2000

**Entity listed:** *Plagiobothrys hirtus* (rough popcornflower)

**Classification:** Endangered

**1.3.3 Associated rulemakings:** Critical Habitat for *Plagiobothrys hirtus* was determined to be prudent at the time of listing. Designation of critical habitat has been deferred to concentrate resources on higher critical habitat listing priorities, including court-ordered designations. No other rule making has been associated with the listing of *P. hirtus*.

**1.3.4 Review History:** This document is the first 5-year review for *Plagiobothrys hirtus*

**1.3.5 Species' Recovery Priority Number at start of this 5-year review:** The recovery priority number for *Plagiobothrys hirtus* is 2C, indicating the plant occurrences face a high degree of threat, the taxa is listed at the species level, the recovery potential is high, and the species is in conflict with construction or other development projects or other forms of economic activity.

**1.3.6 Current Recovery Plan or Outline**

**Name of plan or outline:** Recovery Plan for the Rough Popcornflower (*Plagiobothrys hirtus*)

**Date issued:** July 28, 2003

**Dates of previous revisions, if applicable:** N/A

**2.0 REVIEW ANALYSIS**

**2.1 Application of the 1996 Distinct Population Segment (DPS) policy**

The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments (DPS) only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species' listing is not addressed further in this review.

**2.2 Recovery Criteria**

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes, but a set of criteria is provided for down-listing the species, not for de-listing *Plagiobothrys hirtus*.

**2.2.2 Adequacy of recovery criteria.**

**2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?** Yes.

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?** Yes.

**2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:** The following recovery criteria for downlisting *Plagiobothrys hirtus* are presented here and will be further described afterwards:

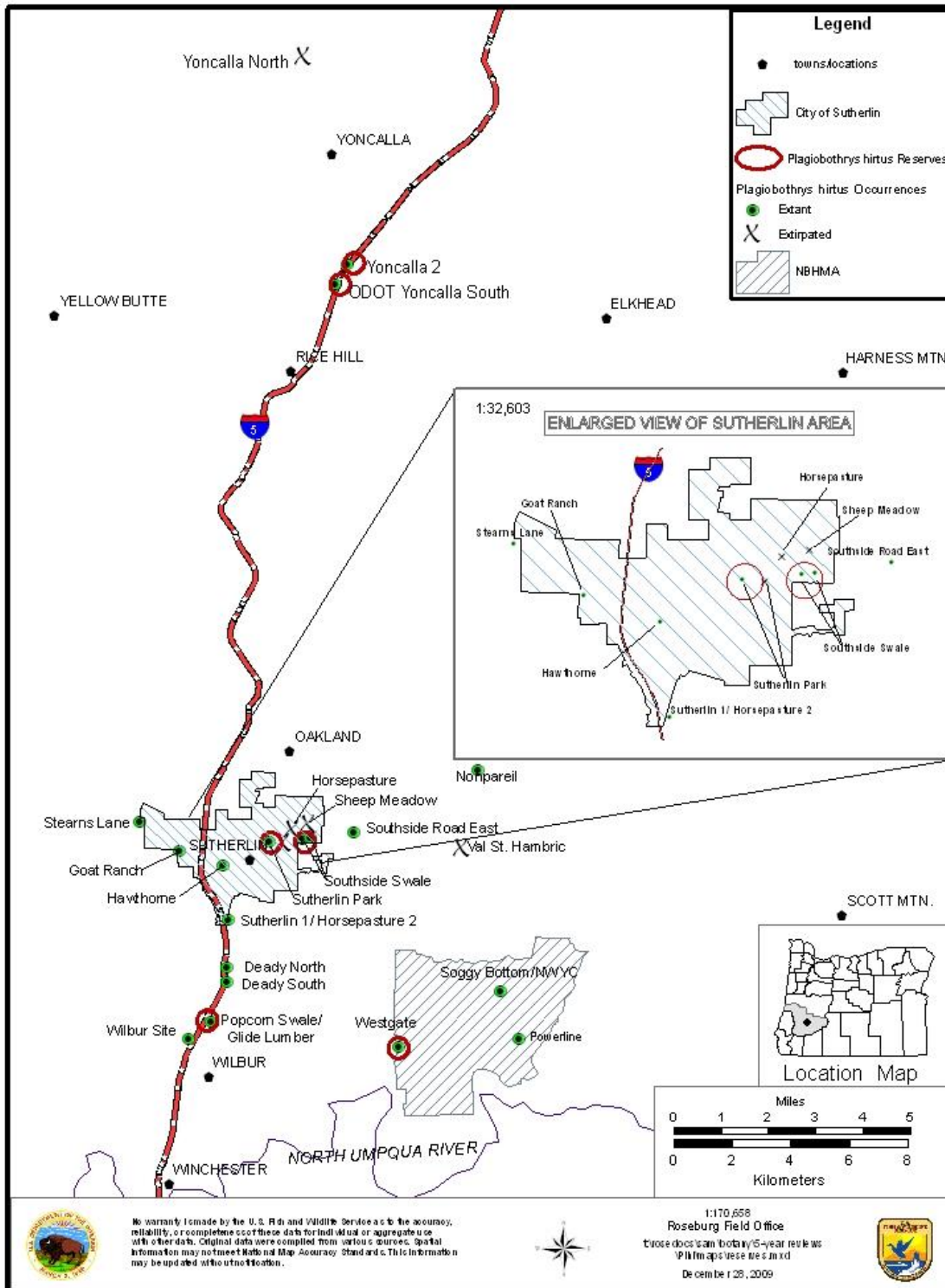
1. *At least nine reserves, containing a minimum of 5,000 plants each, are protected and managed to assure their long-term survival* (Not met);

2. *A minimum of 1,000 m<sup>2</sup> (10,764 square feet) are occupied by Plagiobothrys hirtus within each reserve, with at least 50 m<sup>2</sup> (538 square feet) having a density of 100 plants/m<sup>2</sup> (100 plants/11 square feet) or greater (Not met);*
  3. *A minimum of nine reserves are distributed among the three natural recovery units (Calapooya Creek, Sutherlin Creek, Yoncalla Creek), with at least three reserves present in each unit (Not met);*
  4. *Patches contained in each reserve are within one kilometer (0.6 mile) (Levin 1993) of each other to allow pollinator movement and gene flow among them. Patches are designed to include as much suitable habitat as possible especially if currently occupied by Plagiobothrys hirtus (Not met);*
  5. *Five years of demographic data indicate that populations in at least seven of the nine reserves within the three recovery units have average population numbers that are stable or increasing, without decreasing trends lasting more than 2 years (Unknown); and*
  6. *Seventy-five percent or more of the plants are reproductive each year, with 30 percent annual seed maturation and recruitment evident in all populations (Unknown).*
1. *At least nine reserves, containing a minimum of 5,000 plants each, are protected and managed to assure their long-term survival.*

This criterion has not been met. Of the nine extant occurrences and five introduced populations, six *Plagiobothrys hirtus* populations, which will be considered protected reserves in this species review, have a documented occupancy of at least 5,000 plants (meeting sub-criterion a) and receive the adequate long-term protection and management that qualifies for reserve status (sub-criterion b) (Figure 1). These reserves include: (1) Sutherlin Park, (2) Southside Swale, (3) TNC Oerding Popcorn Swale, (4) Westgate Site, (5) Oregon Department of Transportation (ODOT) Yoncalla South, and (6) ODOT Yoncalla 2 (Table 1). The six sites will be considered “reserves” for the purposes of this review.

Protection and management of nine secure reserves, as called for in this criterion, is expected to reduce the following threats as identified in the *Plagiobothrys hirtus* recovery plan (USFWS 2003): Factor A, habitat or population loss due to development, either through present or threatened destruction, modification or curtailment of habitat or range, Factor C, disease and predation, Factor D, Habitat or population loss through inadequacy of existing regulatory mechanisms, and Factor E, other human and natural factors affecting the plant’s continued existence, which includes vulnerability to the invasion by native and nonnative species, vulnerability to inbreeding by small population size, accidental chemical spills and herbicide spray, or encroachment of native and non-native

**Figure 1. *Plagiobothrys hirtus* Reserves**



**Table 1.** Extant and Extirpated *Plagiobothrys hirtus* occurrences

#	Site	EO	Recovery unit	Occupied Area (square meters)	Population size (latest census)	Notes	Status/ Current 5-year trend	Reserve *
1	<b>Sutherlin 1/ Horsepasture 2</b>	<b>1</b>	Sutherlin Creek	8,800	5,000 (2009)	Private; 1 patch extant, 1 extirpated	Extant/ Unknown	No
	<b>Deady Crossing North</b>	<b>5</b>	Sutherlin Creek	< 50	150 (2005)	Private; 2 patches	Extant / Declining	No
	<b>Deady Crossing South</b>	<b>12</b>	Sutherlin Creek	30	500 (2003)	Private property; 4 patches	Extant / Unknown	No
	<b>TNC Oerding reserve- Strip Patch N</b>	<b>9</b>	Sutherlin Creek	100,000	7,000 (2006)	Monitoring plan established; 3 patches	Extant/ Stable	Yes, TNC owned.
	<b>TNC Oerding reserve /Glide lumber Strip Patch S</b>			53,000	8,100 (2006)			
	<b>TNC Oerding Preserve Field Patch</b>			89,000	15,000 (2006)			
2	<b>Yoncalla North</b>	<b>2</b>	Yoncalla Creek	0	0 (2005)	No plants seen since 1939 Peck collection	Extirpated	No
3	<b>Nonpareil</b>	<b>3</b>	Calapooya Creek/ Sutherlin Creek	> 10,00	Between 2,000 and 6,000 (2009)	1932 Cole Collection; Approximately 8 patches re-discovered 6 miles east of Sutherlin	Extant/ Unknown	No
4	<b>ODOT Yoncalla South</b>	<b>4</b>	Yoncalla Creek	200	5,000 (2009)	Annually monitored; 2 patches	Extant/ Stable	Yes, ODOT owned
6	<b>Sutherlin Park/ Waite Street</b>	<b>6</b>	Sutherlin Creek	277	8,000 (2009)	Annually monitored; 2 patches extant, 1 extirpated	Extant/ Stable	Yes, City owned.
7	<b>Hawthorne</b>	<b>7</b>	Sutherlin Creek	10	200 (2006)	Heavily impacted and fragmented; 1 patch	Extant/ Declining	No
8	<b>Horsepasture</b>	<b>10</b>	Sutherlin Creek	0	0 (2005)	Developed	Extirpated	No
9	<b>Sheep Meadow</b>	<b>11</b>	Sutherlin Creek	0	0 (2005)	Developed	Extirpated	No



#	Site	EO	Recovery unit	Occupied Area (square meters)	Population size (latest census)	Notes	Status/ Current 5-year trend	Reserve *
10	Val Street	13	Sutherlin Creek	0	0 (2005)	Private property	Extirpated	No
11	Stearns Lane	14	Calapooya Creek	5	100 (2008)	Private property; 1 patch	Extant/ Stable	No
12	Southside Road East	15	Sutherlin Creek	30	1,000 (2005)	Private property; 1 patch	Extant/ Unknown	No
13	ODOT Yoncalla 2	16	Yoncalla Creek	15	5,946 (2009)	Annually monitored; 1 patch	Extant/ Stable	Yes, ODOT owned
14	Westgate	<i>None</i>	<i>none</i>	1,000	18, 210 (2009)	Introduced; Annually monitored	Extant/ Stable	Yes, BLM owned.
15	Soggy Bottoms Patch	<i>None</i>	<i>none</i>	20	15 (2009)	Introduced; Annually monitored; 1 patch	Extant/ Declining	No
	NWYC Patch		<i>none</i>	10	350 (2009)	Introduced; Annually monitored; 1 patch	Extant/ Declining	No
16	Powerline	<i>None</i>	None	1	0 (2009)	Introduced; Annually monitored	Poor/ Declining	No
17	Wilbur Site	<i>None</i>	Sutherlin Creek	500	3,982 (2009)	Introduced; Annually monitored	Extant/ Increasing	No, ODOT owned.
18	Southside Swale Patch A	<i>None</i>	Sutherlin Creek	1,500	6,300 (2009)	Only two censuses performed; 8 patches	Extant/ Stable	Yes, DSWCD owned.
	Southside Swale Patch B			2,185	> 10,000 (2006)	Private Property; 12 patches	Extant/ Unknown	No
19	Goat Ranch	<i>None</i>	Calapooya Creek	10	75 (2005)	Introduced; 1 patch	Extant/ Unknown	No

\* Identified reserves are considered to meet Criterion 1 in recovery plan: Protected from development and greater than 5,000 plants

vegetation, and fire. Listing Factor C is a less dire threat. Disease and predation has not been directly observed or determined to result in harm or loss of a plant population.

Listing Factor B, overutilization for commercial, recreational, scientific, or educational purposes, has not been documented as a threat to the species. This criterion is consistent with the best available information about the species. We do not know that the specific population size required in this criterion will actually guarantee that each *Plagiobothrys hirtus* reserve population will survive in perpetuity (Factor E), but known threats are expected to be significantly reduced or removed if this criterion can be met due to a) size requirement, b) a protection requirement, and c) a management requirement. Four additional protected populations with 5,000 or more *P. hirtus* individuals would be needed to meet this criterion.

2. *A minimum of (a) 1,000 square meters (10,764 square feet) are occupied by Plagiobothrys hirtus within each reserve, with at least (b) 50 square meters (538 square feet) having a density of 100 plants/square meter (100 plants/11 square feet) or greater.*

This criterion has been partially met. The three reserves that meet sub-criterion (a) of this criterion are Southside Swale, Popcorn Swale, and Westgate. These reserves have at least 1,000 m<sup>2</sup> occupied by *Plagiobothrys hirtus*. It is unknown if any reserves meet sub-criterion (b) and have documented at least 50 m<sup>2</sup> with a density of 100 plants/m<sup>2</sup> or greater in one year of a monitoring season. Few *Plagiobothrys hirtus* site assessments document plant density. While census and occupancy figures have been recorded, plant density information is not regularly collected at each population area.

We anticipate that a minimum of 1,000 square meters of occupied area in each reserve with at least 50 square meters having a density of 100 plants per meter will ensure that each reserve is capable of expanding and has a population density that is sufficiently robust to offset threats included in the 5 listing factors.

Meeting criterion 2 at the nine secure reserves, as described above, is expected to reduce the following threats as identified in the *Plagiobothrys hirtus* recovery plan (USFWS 2003): Factor C, threats from predation and Factor E, the threat posed by vulnerability of population decline or extirpation due to small population size. The existence of at least nine locations with 1,000 square meters occupied by *Plagiobothrys hirtus* across the species range should provide ample area and redundancy so that the species would survive a random natural event and genetics would be conserved. This criterion would ensure that sufficiently large and dense populations are viable to resist Factor C and Factor E vulnerabilities due to small population size, however, this criterion alone would not reduce threats in Factor A, habitat or population loss due to development, modification or curtailment of habitat or range.

In order to meet this criterion, six additional reserves will need to have 1,000 square meters occupied by *Plagiobothrys hirtus*. The requisite density of 50 m<sup>2</sup> with a density of 100 plants per m<sup>2</sup> needs to be recorded at reserves. Actions that could be and have been taken to meet this criterion include population introduction, augmentation, habitat

restoration, and protecting existing *P. hirtus* populations with easements or transfers of ownership to public entities or land trusts.

This criterion is consistent with the best available information about the species. However; the area and density requirements of this criterion should be reevaluated and revised by a review of monitored *Plagiobothrys hirtus* patches. This number was based on a particularly dense *P. hirtus* patch in Yoncalla, and may not represent ideal conditions at each population throughout the range of the species. The area and density requirements may represent only one scenario of optimal survival conditions and may not be representative of other *P. hirtus* locations where population stability is well documented. The area and density requirements may not take into account other stability formulas that also might be currently achievable. It is recommended that this criterion is further evaluated by examining monitoring results of several existing successful *P. hirtus* populations by a technical team.

*3. A minimum of nine reserves are distributed among the three natural recovery units (Calapooya Creek, Sutherlin Creek, Yoncalla Creek), with at least three reserves present in each unit.*

This criterion has not been met. There are four reserves that contribute to this recovery criterion. Three reserves contributing to this criterion in the Sutherlin Creek recovery unit include the Sutherlin Park, Southside Swale, and Popcorn Swale reserves. The ODOT Yoncalla South reserve that occurs in the Yoncalla Creek recovery unit, also contributes to this criterion. The Westgate reserve occurs on federally protected (BLM) land outside the current range of the species as designated in the recovery plan. This population has been successful and functioning for over ten years. No locations meeting reserve status occur in the Calapooya Creek Recovery Unit.

A distribution of nine secure reserves distributed across three recovery units, as called for in this criterion, will reduce the potential extinction of the species. Meeting this criterion alone will not ensure that development, modification or curtailment of habitat or range (Factor A), or through inadequacy of existing regulatory mechanisms (Factor D), other extant populations can be used for re-creating the lost population. Meeting the criterion will also offset threats posed Factor E, other human and natural factors affecting its continued existence, which includes vulnerability to inbreeding, accidental chemical spills and herbicide spray, habitat fragmentation, habitat degradation caused encroachment of native and non-native vegetation and severe fire. Listing Factor B, overutilization, has not been documented as a threat to the species.

This criterion is consistent with available information about the species, but it is recommended that it be revised to accommodate the following: The Sutherlin Creek Recovery Unit represents most of the known populations and includes the majority of historical suitable habitat; however, in it only three reserves are required. The Calapooya Creek and Yoncalla Creek Recovery Units have much more limited habitat, have been under less developmental stresses, but are also required to have three reserves each. The requirement of three reserves in each recovery unit is a disproportionate requirement and

should be proportioned based on existing habitat and known populations. In addition, establishment of reserves outside the three recovery units, outside the historic range of the species, should be required as this would further hedge against threats in listing factors A, C, D, and E. Reserves with self-perpetuating populations established in suitable habitat, but outside the recovery units can provide a secure seed bank to use in population re-introductions if one or more populations in the recovery units are destroyed or become subject to inbreeding/outbreeding depression and/or genetic bottlenecks.

It is recommended that this criterion is revised to reflect the natural distribution of the species: that this criterion require at least one reserve located outside the three recovery units, within the North Umpqua watershed, that a minimum of four reserves are required in the Sutherlin Creek Recovery Unit, that at least three reserves are established within the Calapooya Creek and Yoncalla Creek Recovery Units, with a minimum of one in each unit, and an additional reserve is established either outside the three recovery units or in the Calapooya Creek or Yoncalla Creek recovery units.

*4. Patches contained in each reserve are within 1 km (0.6 mile) (Levin 1993) of each other to allow pollinator movement and gene flow among them. Patches are designed to include as much suitable habitat as possible especially if currently occupied by rough popcornflower.*

This criterion has been partially met and is conditional on meeting criterion 1. This criterion requires that each reserve include all populations within a 1-km (0.6-mile) radius. As long as Criterion 1 is met, Criterion 4, by definition should be met.

Apart from Westgate Reserve, all reserves include multiple *Plagiobothrys hirtus* habitat patches that are within 1 km of each other. This criterion does not designate any minimum number of patches, populations, or a minimum amount of suitable habitat necessary to be included within a 1 kilometer diameter to be met.

Meeting this criterion will reduce the potential extinction of the species by ensuring that protected populations are within pollinator distances of each other. Successfully meeting this criterion is expected to reduce threats caused by Factor A by maintaining a corridor of habitat accessible to pollinators. This criterion is expected to also offset threats posed by Factor E, other human and natural factors affecting its continued existence, which includes vulnerability to genetic contamination by small population size, vulnerability to accidental chemical spills and herbicide spray, and vulnerability to habitat fragmentation.

This criterion is consistent with the best available information about the species; however it is more of a clarification of the reserve concept. It is necessary to retain the language in the criterion to provide how reserves are conceptualized. The language for this criterion would be better served if were incorporated into Criterion 1.

It is recommended that this criterion be merged into Criterion 1.

5. *Five years of demographic data indicate that populations in at least seven of the nine reserves within the three recovery units have average population numbers that are stable or increasing, without decreasing trends lasting more than 2 years.*

This criterion has not been met. Two reserve locations, Popcorn Swale and Westgate, have been monitored for over five years and both meet this criterion. These reserves have been monitored for almost 10 years. Populations in the reserves have never been in decline for more than two years; however at Popcorn Swale the population in one year plummeted to less than 900 plants (62 FR 61953) and other populations appear to suddenly disappear for no apparent reason. Recent census information indicates that the populations in the reserves are stable (Silvernail et al. 2007; Sullivan, pers. comm. 2008; USFWS 2009). Other reserve populations have not been monitored for over five years.

This criterion will ensure that *Plagiobothrys hirtus* populations are stable or increasing. Meeting this criterion will offset threats from Factor C, disease and predation, and Factor E, other human and natural factors affecting its continued existence, are either negligible or are not affecting populations. Meeting this criterion establishes that habitat is sufficient for populations to expand, management is successfully maintaining suitable habitat, and that populations are vigorous and apparently healthy.

In order to meet this criterion, monitoring would need to be continued at all reserves and at any new reserves for a span of five years. If population levels begin to decline within that period, management actions, such as weed management or population augmentation may need to be taken to address the reasons why the population is stressed.

6. *Seventy-five percent or more of the plants (in reserves) are reproductive each year, with 30 percent annual seed maturation and recruitment evident in all populations.*

During population monitoring for most populations, flowering percentages are nearly 100 percent at the peak of the flowering season. During monitoring, we have documented some estimates of reproductive percentage at most populations. However, there is no evidence that *Plagiobothrys hirtus* occurrences consisting of less than 75 percent reproductive individuals is an indication that these occurrences are declining or unviable. Regardless, based on surveys conducted during the appropriate flowering window, we typically find this criterion is met for all of the monitored populations at each reserve. A more in-depth survey documenting seed maturation and recruitment is rarely performed during surveys. Whether this criterion is met is unknown and may need sufficient monitoring to be performed to confirm the reproductive success in reserve populations.

This criterion will ensure that protected *Plagiobothrys hirtus* populations are healthy and capable of sexual reproduction, and that recruitment is occurring. Meeting this criterion will ensure that Factor C, disease and predation, and Factor E, other human and natural factors affecting its continued existence, are either negligible or are not affecting populations. Meeting this criterion establishes that habitat is sufficient for plants to complete their reproductive cycles, that disease and predation (grazing or herbivory) are occurring at non-threatening levels to the populations, that management actions are

successfully maintaining suitable habitat, and that populations are vigorous and apparently healthy.

It is recommended that the criterion is retained, but revised following a more in-depth study of the reproductive success at the six reserve populations.

### 2.3 Updated Information and Current Species Status

All historic and extant populations throughout the range of the species were surveyed in 2006 (Maddux and Meyers 2008). In 2009 the Nonpareil *Plagiobothrys hirtus* population (EO\*3), although not observed since 1932, was rediscovered and mapped. Currently there are 17 extant occurrences of the species, including 12 naturally occurring and five introduced populations. These correspond to approximately 36 habitat patches, including introduced populations. Biological reports for *P. hirtus* are included in Table 2. The extant populations are described below, beginning with the six reserves:

**Table 2.** Biological Reports on *Plagiobothrys hirtus*

Name	Date	Author(s)
Conservation biology of <i>Plagiobothrys hirtus</i> (Boraginaceae): Evaluation of life history and population enhancement. M.S. thesis. Oregon State University	2001	Kelly Amsberry
Conservation biology of the federally endangered species <i>Plagiobothrys hirtus</i> : additional inventory and investigations of sexual reproduction.	2001	Kelly Amsberry, Robert Meinke: ODA
Investigations of hybridization and population differentiation and their conservation and recovery implications for the endangered species <i>Plagiobothrys hirtus</i>	2002	Kelly Amsberry, Robert Meinke: ODA
Developing biogeographically based population introduction protocols for at-risk plant species of the interior valleys of southwestern Oregon: <i>Plagiobothrys hirtus</i> (rough popcorn flower)	2004	Rebecca Currin, Kelly Amsberry, Robert Meinke: ODA
Rough popcornflower Population Augmentation at Douglas Soil and Water Conservation District (Roger Johnson) Parcel	2006	Troy Maddux: ODA
Popcornflowers of the Umpqua River watershed: distinguishing rare and common species	2007	Melissa Carr, Kelly Amsberry, Robert Meinke: ODA
Evaluating allelopathic affects of pennyroyal ( <i>Mentha pulegium</i> ) on two native plant species	2007	Kelly Amsberry, Robert Meinke: ODA
2005 <i>Plagiobothrys hirtus</i> Survey, Prepared for the United States Fish and Wildlife Service	2008	Troy Maddux and Stephen Meyers: ODA
<i>Plagiobothrys hirtus</i> Reintroduction Project and Population Monitoring: 2008 Final Report	2009	K. Amsberry, R. Meinke: ODA

### ODOT Yoncalla South Reserve

The ODOT Yoncalla South Reserve is located within an ODOT Special Management Area (SMA). The SMA is maintained by ODOT to avoid direct adverse impacts to *Plagiobothrys hirtus*. This reserve area includes two *P. hirtus* patches located on the west side of a fenced area and a “triangle patch” located north of these two patches. The occurrence was discovered in 1983. A combined 55-m<sup>2</sup> area on the ODOT-owned side of the fence is occupied by *P. hirtus* at this site (ODOT 2009). The east side of the fence is privately owned and is occupied by a combined 50-m<sup>2</sup> patch of extremely dense and vigorous *P. hirtus*. The most recent population estimate at the ODOT Yoncalla South Reserve (west of the fence) is 5,053 plants from the three combined patches (ODOT 2009). The Oregon Natural Heritage Information Center (ONHIC) Element Occurrence (EO) for this reserve is EO\*4. The patches are protected under State regulations. Another large *P. hirtus* population designated as the ODOT Yoncalla 2 site (EO\*16), is located approximately 700 m north of this location.

The ODOT Yoncalla South Reserve is managed to conserve *Plagiobothrys hirtus*. A statewide Habitat Conservation Plan for all of ODOT’s SMAs, intended to protect and conserve listed plants is currently in development. Management at this site includes annual mowing and restrictions on grading and herbicide spraying. Monitoring has been conducted at the site since 2003. The potential acquisition of the *P. hirtus* habitat on the east side of the fence by ODOT would be a significant benefit to the long-term protection of the occurrence.

### ODOT Yoncalla 2 Reserve

This 26 m<sup>2</sup> (280 square feet) occurrence is within an ODOT SMA and is located 700 m (2,297 feet) north of the ODOT Yoncalla South Reserve. It was first discovered in 2004 by ODOT crews. The ONHIC EO number for this site is EO\*16. Half of the swale that the plants occupy is in a privately owned cattle pasture. Originally 150 *Plagiobothrys hirtus* plants were estimated to occur on the ODOT side of the fence. In 2009, 5,946 plants were documented at the site. Half the site occurs on State lands and has protected status. The other half is impacted by cattle each year as cattle tend to congregate around the wet areas. The site is somewhat isolated from the interstate highway, so is buffered from roadside maintenance, accidental vehicle impacts, and disturbance.

The ODOT Yoncalla 2 reserve is managed to conserve *Plagiobothrys hirtus*. A statewide Habitat Conservation Plan for all of ODOT’s SMAs, intended to protect and conserve listed plants is currently in development. Management at this site includes annual mowing and restrictions on grading and herbicide spraying. Monitoring has been conducted at the site since 2007. Primary threats to this site are direct impacts to plants caused by incompatible cattle grazing practices and non-native invasive plants. Cattle can cause soil compaction, crushing, and may eat plants. Non native plants can encroach and limit *P. hirtus* establishment. The potential acquisition of the *P. hirtus* habitat on the east side of the fence by ODOT would be a significant benefit to the long-term protection of the occurrence.

### TNC Oerding Popcorn Swale Reserve

This reserve includes three patches of *Plagiobothrys hirtus*. The ONHIC EO associated with this reserve is EO\*9. Approximately half of the reserve occurs east of Highway 99 in a 6.3-acre meadow and beyond into *Quercus garryana* (Oregon oak)-*Fraxinus latifolia* (Oregon ash) stands. The other half occurs west of the highway in a narrow 23.7-acre strip between Highway 99 and Interstate-5. The strip contains more sparse distribution of the plant than the open meadow patch. During a recent census (2006), over 30,000 *P. hirtus* plants were tallied (M. Sullivan, pers. comm. 2008).

The majority of the reserve is managed by The Nature Conservancy (TNC) and is formally known by that organization as the Oerding Preserve at Popcorn Swale. ODOT also owns portions of the reserve; although, TNC performs the majority of habitat management at this site. *P. hirtus* is not protected under a restrictive covenant on the TNC-owned portion of the reserve, but it is generally known that TNC's mission is to protect environmentally sensitive and rare habitat. The population is protected under State protective statuses on the ODOT-owned portion of the population. TNC routinely restores and enhances the habitat within the reserve area and performs periodic monitoring for both *P. hirtus* and habitat condition. Restoration activities performed at the reserve include: removal of *Centaurea nigrescens* (= *C. pratensis*) (meadow knapweed), *Dipsacus fullonum* (teasel), *Phalaris arundinacea* (reed canarygrass), and *Rubus armeriacus* (Armenian blackberry), non-native trees, oak and ash thinning, and native plant seed sowing.

The occurrence is the southern-most *Plagiobothrys hirtus* occurrence. This population blooms earlier and has an overall more diminutive habit than plant occurrences from populations north of the site, although there is a wide range in plant morphologies here. Plants range from few-flowered and diminutive to many-flowered, extremely robust and rangy specimens. It is conceivable that plants at the site are either adapting to poorer hydrological conditions, have experienced a recent hybridization event with the more common *Plagiobothrys figuratus* (fragrant popcornflower), or are manifesting genetic differences unique to the population (Amsberry and Meinke 2002). It is unknown if the occurrence is experiencing inbreeding depression.

### Southside Swale Reserve

The Southside Swale Reserve occurs on Douglas Soil and Water Conservation District (DSWCD) managed land in Sutherlin. This 2.0-acre reserve area includes a portion of a large *Plagiobothrys hirtus* patch discovered in June, 2003. Approximately 50 percent of the area is occupied by *P. hirtus* (3,700 m<sup>2</sup> is occupied). The site is moderately good habitat with abundant native graminoids. Non native plants which pose a threat to *P. hirtus* at the property are *Crategeous monogyna* (English hawthorn), *Rubus armeriacus*, *Centaurea nigrescens*, and *Schedonorus phoenix* (tall fescue). Also native *Fraxinus latifolia* could outshade the plants at this location. There is no ONHIC EO record associated with this reserve yet. In 2006, with Fish and Wildlife Partners Program



funding, ODA, DSWCD and Service staff augmented the *P. hirtus* patch, then estimated to have approximately 300 plants. At the site, 1,400 plants were planted and 5,000 seed were sown. A complete census performed in 2009 recorded 6,300 plants at the patch, some of which were progeny of the introduced plants (USFWS 2009). The patch also includes an estimated 3,000 *P. hirtus* plants across the eastern fence line on private property and an estimated 10,000 *P. hirtus* plants in a separate patch approximately 300 m east of the patch, also on private property.

DSWCD is a State agency affiliate and the *Plagiobothrys hirtus* patch falls under state regulatory protection. Although no management plan has been developed for this area, conservation actions partially funded by the Service and with DSWCD staffing have been performed at the site to enhance habitat conditions (USFWS 2007). The *P. hirtus* patches occurring on adjacent neighboring properties receive no protection. The potential acquisition of title or easements of the *P. hirtus* habitat on these properties by a public agency or land trust would be a significant benefit to the long-term protection of the occurrence.

#### Sutherlin Park Reserve

The Sutherlin Park Reserve is located within the Sutherlin Creek Recovery Unit on City of Sutherlin administered property, known at the Festival Grounds Area. This reserve area includes two *Plagiobothrys hirtus* patches within a 0.08-ha (0.20-acre) area. The ONHIC EO associated with this reserve is EO\*6. A 2009 population estimate at the Festival Grounds recorded over 8,000 plants (USFWS 2009). In 2008, 8,300 plants were counted at the site (USFWS 2009).

The Sutherlin Park Reserve is managed to conserve *Plagiobothrys hirtus*. In 2006, the east *P. hirtus* patch was inadvertently buried by a non-city affiliated recreational group. Since then, the city had the patch restored and a management plan and conservation agreement for all City of Sutherlin's *P. hirtus* populations was signed and implemented by the City, the Oregon Department of Agriculture Native Plant Conservation Program (ODA), the Service, and the Native Plant Society of Oregon (NPSO). The patches are afforded protection through the Oregon Endangered Species Act regulations (Oregon Senate Bill 533 and its corresponding Oregon Revised Statue 564). Since the finalization of the Conservation Agreement and management plan, *P. hirtus* has been annually surveyed, the invasive grass, *Phalaris arundinaceae* (reed canarygrass), has been controlled using heat solarization, native grass seed has been sown, the city stopped allowing horse traffic through the ditched area during the Sutherlin Rodeo, and temporary fencing has been placed around the *P. hirtus* patches. Plans are underway to construct more permanent fencing.

#### Westgate Reserve

The Westgate Reserve is located within the Bureau of Land Management's (BLM) North Bank Habitat Management Area (NBHMA), approximately seven miles east of the Popcorn Swale Reserve. This reserve area includes a robust *Plagiobothrys hirtus*

population that was introduced in 1998 and 1999. The source material was cultivated in greenhouses in Corvallis, Oregon from seed collected from various populations throughout the species' range. Approximately 1,000 small *P. hirtus* plants were introduced to both shaded and open sites. Since the introductions were completed, the population has been gradually increasing to inhabit most of the suitable habitat within the site and even entering a nearby roadside ditch that flows into a stream channel. Plants that were introduced to shady areas fared poorly, while plants introduced to open areas spread.

In 2006 the BLM worked with the Northwest Youth Corps (NWYC) to salvage *Plagiobothrys hirtus* plants occurring in the ditch before a road maintenance and ditch cleaning project was initiated. The BLM and NWYC salvaged nearly 2,000 plants out of the ditch area and transferred the material to a wet meadow near the Soggy Bottoms introduction site. The population overall appears to be unaffected by the salvage. The most recent population estimate at the reserve was 18,210 plants (K. Amsberry, pers. comm. 2009).

The BLM's Roseburg District Office manages this reserve through protective provisions under the Act. BLM and ODA have conducted annual population censuses and reproductive assessment evaluations since 2001. The Westgate population is included in an area-wide management plan for the NBHMA. This plan includes recommendations for invasive weed control and allows for the potential to introduce grazing to this site. BLM routinely enacts area-wide invasive plant control efforts. Threats to this introduced population are overcrowding from invasive plants.

#### Sutherlin 1/Horsepasture 2

This *Plagiobothrys hirtus* occurrence is located just south of Sutherlin in a large pasture which is east of the railroad tracks and north of a large pond. Formerly a patch west of the railroad tracks known as Sutherlin 1 was documented, but has since been extirpated (Maddox and Meyers 2008). The Sutherlin patch was first observed in 1983 and was estimated to have 60 *P. hirtus* plants. In 1997 a 3,000-plant *P. hirtus* patch located 300 m southeast of the patch was observed at a location called Horsepasture 2. In 2009 the Horsepasture 2 patch was revisited and estimated to have approximately 6,000 plants (Friedman, pers. obs. 2009). The ONHIC EO number for this site is EO\*1.

This patch occurs on privately owned land. Annual field practices currently appear to be compatible with the continued survival of this population but the risk of impact to this population is uncertain. Although there are no known developments planned for this area, there are no protections or provisions to conserve this population. Rapid development and hydrologic alternation of wetlands in the Sutherlin area puts all habitat for this species at risk.

### Deady Crossing North

This *Plagiobothrys hirtus* occurrence is located in two fields and low-lying areas on either side of a two-lane road and west of Sutherlin Creek. The occurrence was first observed in 1983 and was estimated to have a total of 150 *P. hirtus* plants within three patches. In 2005 the patches were revisited and estimated to have between 100 and 1,000 plants (Maddox and Meyers 2008). The ONHIC EO number for this site is EO\*5.

The two patches occur on privately owned land intermixed with various pasture lands and old equipment yards. Annual field practices currently appear to be compatible with the continued survival of the occurrence. The risk of development is moderate due to its distance from growing city centers. There is a possibility that establishment of non-native pear, ash, and English hawthorn trees could eventually displace this population. There are no protections or provisions to conserve or manage this occurrence so its continued status is uncertain.

### Deady Crossing South

*Plagiobothrys hirtus* is estimated to occupy approximately 500 m<sup>2</sup> (5,382 square feet) in four patches located on privately owned wetlands from Deady Road to areas just north of Wilbur, Oregon east of Highway 99, and west of Sutherlin Creek. The ONHIC EO for this site is EO\*12. When the patches were observed in 1997, 300 plants were estimated within the area. In 2005, it was estimated that there are more than 5,000 plants within this area.

The four patches occur on privately owned pasturelands and old equipment yards. Land practices appear to be compatible with the continued survival of these patches, but the risk of development or equipment storage within the populations is moderate. The patches may also be threatened by establishment of non-native pear, ash, and English hawthorn trees. Although there are no known developments planned for this area, there are no protections or provisions to conserve or manage this population so its continued status is uncertain.

### Goat Ranch

This introduced *Plagiobothrys hirtus* patch was established in 2004. The plants occur in a private field in Sutherlin, east of the Interstate 5, near the Fort McKay Road and Highway 138 junction (Case Property) (Maddox and Meyers 2008). The 400 m<sup>2</sup> (4,306 square feet) field is underlain with mapped Conser Soils and suitable hydrology for *P. hirtus*. The source of the patch was seed from three individual *P. hirtus* plants from the ODOT Yoncalla South occurrence that were temporarily stored at the site. In 2005, 35 plants were observed (Maddox and Meyers 2008). Since then the population has continued to survive and is managed by the landowners (S. Escobar, 2009 pers comm.).

This patch occurs on privately owned land. Annual field practices include goat grazing and appear to be compatible with the continued survival of this population. Although

there are no known developments planned for this area, there are no protections or provisions to conserve this population, and its genetic makeup is very limited, so its continued status is uncertain. Risks to this patch are moderate to high.

### Hawthorne

This *Plagiobothrys hirtus* occurrence was once the largest known population in the range of the species. The ONHIC EO for this site is EO\*7. This occurrence is located in an old pasture and tree orchard in central Sutherlin, near the junction of Taylor and Hastings. In 1983 approximately 1,500 plants across a 2,500 m<sup>2</sup> area were estimated to occur at the site (ONHIC 2008). In 2005, 300 to 500 plants were recorded (ONHIC 2008). In 2010 only about 300 plants were observed in an 80 m<sup>2</sup> (861 square feet) area due to building of a storage center, illegal wetland filling, and construction of a large ditch which drained the wetlands on the property (USFWS 2010). These activities permanently altered the hydrology of the area.

Threats to this site are severe. The population is now so small that any minor change in hydrology could cause extirpation and there is a long term municipal plan to extend Hastings Street through a portion of the population (D. Huff, pers. comm. 2010). The site is probably no longer suitable to support *Plagiobothrys hirtus* due to a lack of adequate hydrology. The benefits to conservation of this site are limited.

### Nonpareil

This occurrence may be the one of the largest naturally occurring populations within the range of the species. It occurs in eight non-contiguous patches, across 12 different landowners covering an approximately 5-acre area located six miles east of Sutherlin near the junction of Nonpareil and Plat K roads. There are an estimated 10,000 to 20,000 plants within the eight habitat patches. The occurrence is in both the Calapooya Creek and Sutherlin Creek Recovery Units. The ONHIC EO for this site is EO\*3.

Because the occurrence is mostly on pasturelands, and remote from residential development, threats to plants are moderate. Annual field practices currently appear to be compatible with the continued survival of this population but there is an impact risk to this occurrence, due to potential adverse agricultural practices that may occur in the field. There are no known developments planned for this area and management or conservation efforts would greatly benefit this population. If a permanent conservation easement can be developed with one of the landowners, the benefits to conservation of this site would be significant.

### Powerline

This *Plagiobothrys hirtus* patch was introduced in 2002 into marginal habitat adjacent to the powerlines in Blacktail Basin within the BLM's NBHMA. The area was planted with 667 small plants grown in greenhouses in Corvallis, Oregon from seed collected from throughout the species range. Annual monitoring conducted in 2003 and 2004 showed a

sharp decline in the number of plants and no plants were detected for three years (2005-2007). In 2008 15 large *P. hirtus* were counted after five years of no observations. In 2009 no plants were observed.

This site does not have optimal habitat for the species because it is only occasionally inundated with water. The population was introduced experimentally, and, due to lack of adequate knowledge about *Plagiobothrys hirtus* requirements, was probably inadvertently located in a site that is not suitable for this species due to a lack of adequate hydrology. It is not recommended that additional restoration or plant augmentation be performed at this site.

#### Soggy Bottoms/NWYC

Originally 500 *Plagiobothrys hirtus* plants were introduced to this site in 1998 on the BLM's NBHMA. The plants were grown from seed collected from throughout the species range in greenhouses in Corvallis, Oregon (Amsberry and Meinke 2008). The introduction appeared to be successful for several years with census numbers averaging 1,100 plants per year. After a fire swept through the area in 2003, the population increased from 1,193 to 1,869 plants. Then the following winter, extensive erosion occurred in the area, eventually changing the hydrology of the site from a wet meadow to an upland channel bank. The population plummeted to 38 plants the next year and has been declining each year since then. Only 15 plants were documented in the most recent census (K. Amsberry, pers. Comm. 2009). The BLM has recently performed extensive habitat restoration to the stream channel so that the wetland conditions can be restored in the meadow. The response of the *P. hirtus* population to the restoration will be closely monitored over the next few years and is expected to improve.

In 2006, approximately 1,000 plants were transferred from the Westgate population and the OSU greenhouse in Corvallis, Oregon as part of a salvage project and transferred to suitable wetland habitat near Soggy Bottoms by the Northwest Youth Corps (NWYC) working with BLM under an assistance agreement. Approximately 500 plants grown from seed collected previously from several sites in the Sutherlin area were planted in prepared microhabitats. Most recently (2009), 350 *Plagiobothrys hirtus* plants were recorded at the site (K. Amsberry, pers. comm. 2009).

Both the NWYC and the Soggy Bottoms patches are experiencing declines, and the site of these two experimental plantings may not ultimately be suitable for *P. hirtus*. The recently performed habitat restoration may greatly benefit this site, but the population may need additional reintroduction to achieve its former size. Any augmentation projects should wait until the site has demonstrated a stable hydrology that is suitable to *Plagiobothrys hirtus*.

#### Southside Road East

This occurrence is a single patch occurring in a large privately owned field (over 10 ha (25 acres) that was first observed in 1998 and was estimated to have 1,000 *Plagiobothrys*

*hirtus* plants. The ONHIC EO for this site is EO\*15. The location is four miles east of Sutherlin, just west of Southside Road and 1.4 miles northeast of Cooper Creek Reservoir. In 2005 the patch was revisited and estimated to consist of 100 to 1,000 plants within an estimated 25 m<sup>2</sup> (270 square feet) area (Maddox and Meyers 2008).

Although this population has appeared to be stable for the past 10 years, it has never been closely monitored. Annual field practices (i.e. grazing, mowing) have continued for several decades and the *Plagiobothrys hirtus* population is roughly the same size since 1998. It is not possible to closely monitor this population without access privileges, so any population size estimation is approximate. The population may be compatible with the continued survival of this population because the population appears to have the same approximate size and density at each periodic visit. Development is not expected to occur in this rural farming area, however; the patch is not very large, no conservation provisions exist on the land, and the patch could easily be obliterated due to agricultural development (i.e. ditching, or other water impoundment activities). The threats to this occurrence, therefore, are moderate to high.

#### Stearns Lane

The Stearns Lane site is a small *Plagiobothrys hirtus* patch in the Calapooya Creek Recovery Unit that is estimated to have from about 100 to 200 plants. It occupies less than a 2 m<sup>2</sup> (22 square feet) area (Maddox and Meyers 2008). The ONHIC EO for this site is EO\*14. The site occurs in a small open 600 m<sup>2</sup> (0.15-acre) field east of Sutherlin, Oregon near the Fords Pond and Stearns Lane junction. The field has occasionally been used for parking vehicles and equipment and is near various buried utility lines. Except for the wetland portions, the field is heavily infested with the invasive non-native plant *Centaurea nigrescens*.

This vulnerable occurrence is located on private land and is not under any conservation protection or special management provisions; however overhead utility lines cross within six feet adjacent to the patch. The presence of utility lines could provide deterrence to development in the site, but also could be a liability for utility maintenance. It is uncertain the likelihood that the population could be destroyed due to utility work as they occur adjacent, but not directly above or below utility. Utility companies do not necessarily have to comply with the Act, unless they are regulated by a federal agency.

The plants in this population are unique in that their morphological forms are similar to the Yoncalla Creek Recovery Unit plants. Their stature is more robust, they are taller, rangier, and they have characteristics of perennial plants, unlike *Plagiobothrys hirtus* plants that occur in the southern Sutherlin Creek Recovery Unit populations (Amsberry and Meinke 2002). This population is also the only naturally occurring *P. hirtus* population in the Calapooya Creek Recovery Unit and preservation of its genetic materials is crucial.

Threats to this particular site are severe. The population is so small that any minor excavation activity or roadside vehicle accident could cause extirpation. The site occurs

near various utility lines and it is conceivable that a utility company could at some point perform some minor equipment or cable repair that would necessitate digging within or around the population.

### Wilbur Site

The 8.9-ha (22-acre) Wilbur Site, located near Wilbur, Oregon, was purchased by a local business for the purpose of compensatory wetland mitigation in 1999. Various restoration activities performed at the site included removal of cattle, removal or disruption of drain tiles, blocking of ditches to increase water storage, introduction of native grass seed and native shrub and tree establishment, and excavation of swales or pools to provide additional hydrology. *Plagiobothrys hirtus*, originating from mixed sources throughout the plant's range, was introduced to three of the created swales at the site in 1999 and 2001. Prior to planting *P. hirtus*, several flats were planted with seed sourced from populations throughout the plant's range. Approximately 800 small plants were grown in greenhouses in Corvallis, Oregon and were planted at the site's created swales. In 2001 additional *P. hirtus* seed was sown at the site. In 2008 ODOT acquired the property.

No more than 400 *Plagiobothrys hirtus* plants were recorded each year between 2000 and 2007. In 2008, over 900 plants were documented and in 2009, 3,982 plants were tallied. The native grasses, *Deschampsia cespitosa* (tufted hairgrass) and *Beckmannia syzigachne* (American sloughgrass) have also been gradually increasing in area each year.

Threats at this introduction site are minimal due to the site having a protected status. The habitat for *Plagiobothrys hirtus* within the site is limited to the created swales, but there are opportunities at this site to increase the amount of area subject to seasonal inundation and provide more suitable habitat for the plant.

**2.3.1.1 New information on the species' biology and life history:** None.

**2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:**

Since the preparation of the Recovery Plan for *Plagiobothrys hirtus* (USFWS 2003), the abundance of the species at seven occurrences appear to have improved to some extent partly due to reintroduction efforts (Table 3) and due to recent census efforts (ODOT Yoncalla South, ODOT Yoncalla 2, Popcorn Swale, Sutherlin Park, Southside Swale, Wilbur Site, and Westgate).

While some habitat patches have become extirpated or experienced dramatic declines, others have remained stable or improved (Figure 1). *P. hirtus* has been introduced to one location (Goat Ranch) (Maddux and Meyers 2008), has been augmented at two patches (Southside Swale Patch A) (Maddux 2006), and has been introduced to one location (NWYC Patch) (Amsberry and Meinke 2009).

Since the Recovery Plan, the species has become extirpated from at least one known habitat patch (Val Street), it has been discovered or better described in several locations from which it was not previously known (Sutherlin Park,

**Table 3.** Augmentation, Introduction, and Reintroduction Planting Status

<b>Location</b>	<b>Planting type</b>	<b>Type or Source of Planting</b>	<b>Current Number of Plants</b>
Goat Ranch	Reintroduction	Seed from OSU nursery plant	> 50 (2006 census)
Powerline	Introduction	Greenhouse grown planting by Amsberry and Meinke in 1998	0 (2009 census)
Soggy Bottoms	Introduction	Greenhouse grown planting by Amsberry and Holmes in 1998	15 (2009 census)
NWYC	Introduction	Direct planting from Westgate site by Amsberry, Knurowski, and Carter in 2007	350 (2009 census)
Southside Swale	Augmentation	Seed and greenhouse grown planting by T. Maddux in 2006	6,300 (2009 estimate)
Westgate	Introduction	Greenhouse grown planting by Amsberry and Holmes in 1998	18, 210 (2009 census)
Wilbur Site	Reintroduction	Seed and greenhouse grown planting by J. Barnes and K. Amsberry in 2000	3,982 (2009 census)
ODOT Yoncalla South	Augmentation	Greenhouse grown planting by Amsberry in 1998	5,038 (2009 census)

Southside Swale Patch A, Southside Swale Patch B, and ODOT Yoncalla 2). It has shown to have tremendous swings in population abundance (USFWS 2000). In 1995, over 16,000 *P. hirtus* plants were documented at the TNC Oerding Popcorn Swale occurrence. However, in 1996, the population plummeted to only 394 plants, presumably due to a very wet season. The population has since been relatively stable and was documented with over 30,000 plants in 2006.

Currently, throughout the range of *Plagiobothrys hirtus* currently, there are 36 known habitat patches within 11 extant occurrences, of which, two are reintroduced, and three are introductions (Table 1). There is no current research



on demographics or demographic trends as the species is an annual or facultative perennial and reaches full maturity each season.

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):** None

Only limited genetic analysis has been conducted for *Plagiobothrys hirtus*. There is indirect evidence that at least one population may be threatened by inbreeding/outbreeding depression or genetic bottlenecks due to observation of a decreased seed production in plants that were self-crossed in a greenhouse environment. These results were thought to be partly obscured by environmental influences (Amsberry and Meinke 2001).

**2.3.1.4 Taxonomic classification or changes in nomenclature:** None

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):**

Many naturally occurring *Plagiobothrys hirtus* populations have been fragmented due to urban development. The 2000 listing rule provided many cases where populations either became fragmented or were completely lost due to development. Since the Recovery Plan was prepared in 2003, three large occurrences have since been discovered, but two occurrences have become extirpated, and two extensive populations, that were presumed extirpated, were recently observed (Table 1). In addition, three new populations were introduced. These new occurrences did not extend the range of the species, but have slightly changed the known distribution of the species within the Sutherlin Creek Recovery Unit. The newly re-discovered Nonpareil population (Cole collection) places new emphasis on the conservation importance of *P. hirtus* in eastern Sutherlin. During favorable years, known *P. hirtus* habitat patches tends to exhibit increases in spatial distribution (ODOT 2008) with decreases common in poorer years.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):**

The habitat and ecosystem conditions of *Plagiobothrys hirtus* have been well-characterized (Amsberry 2001, USFWS 2003). In the listing package, the *P. hirtus* preferred soil type was described erroneously. It was reported in the final listing document (FR 65 3867) that the species appears to be closely associated with the soil type Ruch-Medford-Takilma, and all known naturally-occurring populations occupy this soil type. This is incorrect. *P. hirtus* has only been known to occur on Bashaw, Conser, Curtin, Sibold clay, Nonpareil loam, Oakland clay loam, and Sutherlin clay loam. The great majority of *P. hirtus* occurrences are found on Conser soils.

*Plagiobothrys hirtus* occurs in habitat that is seasonally saturated and often where there is presence of native wetland plants. The native plants commonly associated with *P. hirtus* include perennials: *Deschampsia cespitosa*, *Camassia leichtlinii* (great white camas), *Carex feta* (green-sheathed sedge), *C. densa* (dense sedge), *C. unilateralis* (one-sided sedge), *Eryngium petiolatum* (rush-leaved coyote thistle), *Fraxinus latifolia* (Oregon ash), *Glyceria occidentalis* (western mannagrass), *Juncus effusus* (common rush), *J. oxymersis* (pointed rush), and *J. patens* (spreading rush). Annuals commonly associated with *P. hirtus* include *Beckmannia syzigachne*, *Veronica scutellata* (skullcap speedwell), *Downingia yina* (Willamette Downingia), and *Limnanthes douglasii* (Douglas' meadow-foam).

Non-native invasive plants that are unfortunately common in *Plagiobothrys hirtus* occurrences include *Centaurea nigrescens*, *Dipsacus follunum* (teasel), *Mentha pulugium* (pennyroyal), *Crataegus monogyna* (English hawthorn), and *Pyrus* sp (pear).

### **2.3.1.7 Other:**

#### *Plant competition*

Since completion of the *Plagiobothrys hirtus* Recovery Plan (2003), new information about the species biology, propagation, introduction techniques, compatibility with associated species, and life history, particularly the species' reproductive capabilities, have emerged. Detailed propagation and reintroduction information is provided in ODA's *P. hirtus* introduction protocol study (Currin et al. 2005).

Allelopathic interaction between the common invasive plant, pennyroyal (*Mentha pulugium*), and *P. hirtus* (Amsberry and Meinke 2008) are summarized below:

- Extracts of pennyroyal roots reduced germination and seedling vigor of *P. hirtus*.
- Allelopathic chemicals produced by pennyroyal affected growth of *P. hirtus*.
- Under the conditions used in the study, *P. hirtus* grew larger when grown with a companion planting of pennyroyal than when grown with a conspecific associate.
- Pennyroyal potentially reduces viability of created and naturally occurring populations of *P. hirtus*, although the interactions between the two species are complex.
- Addition of activated carbon to wetland field sites has potential to reduce the negative effects of pennyroyal on *P. hirtus* and improve viability of native wetland vegetation.

**Table 4.** Seed Collections stored at the Berry Botanic Garden, Portland, Oregon between 1987 and 2001

<b>Location</b>	<b>Element Occurrence</b>	<b>Number of collections</b>	<b>Number of Presumably Viable Seeds in Storage</b>
Berry Botanic Garden (seed from second generation, nursery grown-plants- origin not specified)	NA	7	460
Hawthorne	7	3	1,672
Horsepasture	10	1	626
Popcorn Swale	9	11	554
Soggy Bottoms (Introduced population)	NA	3	2,598
Southside Road East	15	1	25
Stearns Lane	14	11	232
Sutherland 1	1	2	1,153
Westgate (Introduced population)	NA	42	2,571
ODOT Yoncalla South	4	35	6,945

*Collected seed*

Seed representing the geographic range of the species is cryogenically stored at the Berry Botanic Garden in Portland, Oregon, which has been approved as a Center for Plant Conservation facility. Table 4 includes locations where *Plagiobothrys hirtus* seed has been collected.

*Propagation, Reintroduction, and Augmentation*

ODA has been actively involved in greenhouse propagation and outplanting of *Plagiobothrys hirtus* since 1997 (Gisler and Meinke 2002). ODA has produced two reports that have been valuable in the propagation and reintroduction of the species. The two reports are, Developing biogeographically based population introduction protocols for at-risk plant species of the interior valleys of southwestern Oregon (Rough popcornflower) (Currin et al. 2005) and Rough popcornflower Population Augmentation at Douglas Soil and Water Conservation District (Roger Johnson) Parcel (Maddox 2007). Other studies and research have documented the utility of *Plagiobothrys hirtus* re-introduction and augmentation (Maddux 2006; Amsberry and Meinke 2009).

*Transplanting and salvage*

Transplanting and salvage has only been partially investigated and final results are forthcoming. A single large transplantation effort was conducted in 2007 at the NWYC population on BLM land at the NBHMA, removing plants from the Westgate population. Preliminary results show that the transplantation was

minimally successful, but it may take several more years of monitoring to determine a final outcome.

**2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)** *For each of the five listing factors outlined below, provide a brief summary and citation(s) of any relevant new information, including conservation measures, regarding the magnitude (scope and severity) and imminence of previously identified threats to the species or new threats to the species. Note if any of the factors are not relevant to the species. Upon completion, go to 2.4., Synthesis.*

**2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:**

The effects of continued development in the Umpqua Valley have caused increased habitat fragmentation and the loss of native wet prairie. The *Plagiobothrys hirtus* populations located within or near Sutherlin have also experienced impacts by equipment activity associated with housing and road development since the listing of the species in 2000. This trend is anticipated to continue or increase with regional population growth. The threat has been and can be reduced through land acquisition, land protection, and compatible land use of occurrences by landowners. In additional seed collection, which has been undertaken prior to the listing of the species, can assist in the preservation of genetic materials for future use and for introduction source material. The purchase of land for conservation purposes increases the amount of potential habitat available for the species. However this threat is still not largely addressed.

**2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:**

*Plagiobothrys hirtus* still appears to not be at risk from commercial use activities, as there is no market for *P. hirtus* seed or nursery plants. Recreational use associated with flower picking and plant collection has not been observed or documented. However, a *P. hirtus* subpopulation was nearly destroyed when a recreational improvement project placed soil in a small swale to construct a recreational bike course on City of Sutherlin property. The soil was removed and plants at the population are recovering thanks to efforts by the city.

**2.3.2.3 Disease or predation:**

Herbivory of *Plagiobothrys hirtus* by deer, rabbits, and voles is unknown (USFWS 2003). A small threat is present at most locations from herbivory by caterpillar and other insects but no serious damage has been observed. Microbial interactions are largely unknown.

**2.3.2.4 Inadequacy of existing regulatory mechanisms:**

There is a need for greater protection of remnant prairie habitat and existing populations of *Plagiobothrys hirtus*, both large and small in order for the species to be considered out of harm's way. The Act does not extend protection to listed species on private land, and although Oregon State classifies the species as endangered, there is no requirement for private land owners to protect rare plants or the habitat upon which they depend.

Public ownership conveys a high likelihood that conservation of *Plagiobothrys hirtus* will be prioritized on these properties, but protection of these sites may still be subject to occasional conflicting management priorities. Habitat restoration (mowing and woody shrub removal) at some of these sites may help to improve the habitat for *P. hirtus* and contribute to an increasing population size. *P. hirtus* and its habitat are best maintained in early successional vegetation stages and ecosystem processes like mowing reduces competition from invasive non-native species.

#### *Consultations*

The Service has completed seven consultations under section 7 of the Act since *Plagiobothrys hirtus* was listed in 2000. The Service conducted one informal and two formal consultations with the U.S. Army Corps of Engineers regarding development projects. Two formal consultations were conducted within the Service regarding a recovery permit and for restoration activities under a Jobs-in-the-Woods Program project. The Service also conducted two consultations for *P. hirtus* with the Roseburg BLM. These two consultations included a formal consultation regarding a Management Plan for the NBHMA and an informal consultation regarding restoration activities at Jackson Creek for the Soggy Bottoms *P. hirtus* introduction site.

#### **2.3.2.5 Other natural or human made factors affecting its continued existence:**

It is uncertain if prescribed burns are beneficial to *Plagiobothrys hirtus*. An accidental fire occurred at the Soggy Bottoms meadow in late September, 2003 and burned across the introduced *P. hirtus* population. The fire was moderately intense and did not sterilize the soil organic layers. However, some *P. hirtus* and surrounding vegetation were burned. Following the burn individual plants were much larger and robust. The population increased from 1,193 plants in July 2003 to 1,869 plants in July 2004 following the burn. However, by 2005, the population precipitously dropped to 38 plants. By 2009 the population was down to 15 plants. The Roseburg BLM and the Service attribute the cause of the rapid population decline to changes in water flow, increased erosion due to stream channelization, and to the resulting poor condition of the habitat. The effects and perhaps role of fire in *P. hirtus* habitat restoration is still unknown. Currently the Roseburg BLM with contributions from the Service is performing restoration to

the channel and road surfaces with the intention of returning hydrology to the meadow.

### *Grazing*

The impact of grazing practices on *Plagiobothrys hirtus* plants and habitat is not well understood. The listing rule determined that grazing could harm *P. hirtus* habitat and was a threat to the species; however, several habitat patches that have persisted over the last nine years have been under both horse and cattle grazing management. The level of compatible grazing intensity is unknown at these sites.

### *Climate Change*

The likely impacts of climate change on ecological processes are closely connected to availability of water. Wet swales in southwest Oregon are particularly sensitive to slight increases in evaporation or reductions in rainfall due to their shallowness and seasonality. It is probable that winters in Oregon will become warmer and wetter, while El Nino frequency and intensity may increase. Even modest changes in warming could result in more runoff in winter with less runoff in spring and summer, more winter flooding, and drier summer soils, thereby altering the seasonality and duration of wetland hydration (Cayan *et al.* 2005, Field *et al.* 1999). Climate change is expected to lead to increased variability in precipitation, and to increase loss of soil moisture due to evaporation and transpiration of water from plants (Field *et al.* 1999), which may exacerbate effects due to drought. Drought-mediated decreases in water depth and inundation period could increase the frequency at which wetlands dry before *Plagiobothrys hirtus* has completed flowering and fruiting stages, or cause temperatures to exceed those suitable for growth of the species.

## **2.4 Synthesis**

The status of *Plagiobothrys hirtus* has improved since the species was first listed owing to the efforts of BLM, DSWCD, City of Sutherlin, ODA, ODOT, and TNC. Of the 17 documented habitat patches known at the time of listing in 2000, currently there are 36 known habitat patches and six *P. hirtus* reserves that meet only some of the recovery criteria. Indications of improvement in the status of the species are mixed. Several large and small populations have been lost and are presumed extirpated from areas around Sutherlin. One small *P. hirtus* patch in the Calapooya Creek Recovery Unit occurs on private land and is perilously small. Two large patches have been discovered in the Sutherlin area and one is in a protected status. A State agency has acquired property occupied by a recovery-level sized occurrence. A historical population in the Nonpareil area has been rediscovered that could be larger than any known occurrences. The present distribution and abundance indicate that *P. hirtus* is still endangered, and that the risk of extinction in the wild remains.

The likelihood that this species can be recovered is moderately high. Our knowledge of propagation, reintroduction, and habitat needs have increased (Amsberry and Meinke

2001; Amsberry and Meinke 2002, Amsberry and Meinke 2009). Seed production and viability is high and the species is relatively easy to propagate from seed in a nursery. Plants have been successfully established in the field with nursery-germinated plants. The current deficiency in our ability to establish viable new populations on site is finding protected land to introduce the plants. The greatest challenge to survival for the species is the continuing loss of habitat due to the conversion of suitable habitat to development (Amsberry and Meinke 2007). The cumulative impact of on-going threats challenges our capacity to provide appropriate management, even on lands that are dedicated to conservation of this species.

Woody shrub and tree removal has resulted in at least temporary increases in the amount of habitat and the number of plants (M. Sullivan, pers. comm. 2008). Tree and shrub removal at the TNC Oerding Popcorn Swale reserve and hawthorn and blackberry removal at the Southside Swale reserve, has stimulated an increase in population size and led to discovery of new habitat patches.

While acknowledging that there are challenges to *Plagiobothrys hirtus* management, it is clear that taking no action will likely result in the gradual decline of this species and, perhaps ultimately, to extinction due to vegetation encroachment and natural succession. Conserving existing populations of *Plagiobothrys hirtus*, combined with management and the establishment of new viable populations within its historical range, appear to offer this species a good chance for recovery.

### 3.0 RESULTS

#### 3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

*Extinction*

*Recovery*

*Original data for classification in error*

No change is needed

#### 3.2 New Recovery Priority Number: No change recommended

**Brief Rationale:** See synthesis

#### 3.3 Listing and Reclassification Priority Number: No change is recommended, the Listing Priority Number should remain 2C

**Reclassification (from Threatened to Endangered) Priority Number:** \_\_\_\_\_

**Reclassification (from Endangered to Threatened) Priority Number:** \_\_\_\_\_

**Delisting (regardless of current classification) Priority Number:** \_\_\_\_\_

**Brief Rationale:** Not applicable

## **4.0 RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS**

### **A. Modify Recovery Criteria**

Based on the current status of *Plagiobothrys hirtus* recovery and new information regarding restoration successes, we recommend that the following four items should be highest priority if the Service were to revise the Recovery Plan for *P. hirtus*: (1) modify recovery criteria 1 and 2 so that reserves correspond to natural plant population distribution and genotypes; (2) revise recovery Criterion 1 to include the qualification that for a population to be considered stable, the population should demonstrate a stable or positive trend in population size over the past ten years; (3) modify recovery Criterion 3 so that distribution of reserves include the introduced populations outside the known range of *P. hirtus* at the North Bank Habitat Management Area, an additional reserve in the Sutherlin Recovery Unit, and less reserves (We recommend 3 rather than 6 reserves for both recovery units) required for the Yoncalla and Calapooya Recovery Units; and (4) remove Criterion 6 until further research confirms that percentage of flowering is a strong indicator of population viability.

### **B. Prioritize Conservation of Existing Populations**

As discussed in the Synthesis section, the protection of existing occurrences will continue to be a high priority. The purchase of occupied local prairie parcels for public or land trust ownership or easement title will help to promote the protection and conservation of this ecosystem through acquisition and management. The habitat areas of highest importance are areas where there are no Recovery Unit populations under protection or where there are significant gaps in protection in the species' distribution. The Calapooya Creek Recovery Unit has no populations under protection and any occurrences or even suitable habitat protected within in this unit would be highest priority. A significant gap of about 6 km (3.7 miles) in protection occurs between Sutherlin Park and Popcorn Swale and between Southside Swale and Nonpareil.

### **C. Establishment of a Technical Team**

The establishment of a Service led technical team (Team) to guide recovery for the species is necessary to help gather and focus expertise from various public agencies and non-profit conservation groups. The team of experts and staff could better establish a strong recovery effort for the species. The team should meet at least annually and include important stakeholders from the private sector, DSWCD, TNC, BLM, ODOT, ODA, and Service staff. The Team can determine annual research needs, conservation objectives, and inform which recovery goals have been or are close to being met.

### **D. Provide for Restoration Opportunities**

Restoration of occupied habitat through conservation partnerships with local agencies and organizations and local land trusts will ensure that existing populations are healthy and that the ecosystem is conserved in an early successional status. Restoration actions are necessary across the range of the species to control competing native and non-native vegetation encroachment.



Fencing can also be useful in keeping out incompatible livestock use from *Plagiobothrys hirtus*-occupied prairie.

### **E. Prioritize Reintroduction Efforts**

Meeting recovery criteria will require establishing several new populations on protected lands or on lands where the landowner considers the conservation of *Plagiobothrys hirtus* as a high priority. Given that the species exhibits high seed production and experimental work has determined that the ability to propagate the species can be successful when seedlings are grown and outplanted, we remain confident that viable populations can be reintroduced that there is a high likelihood for recovery of the species. We use the term reintroduction broadly to include augmenting extant populations, reintroducing populations that have become extirpated, and establishing populations in areas within the species' historical range where it was not previously known to occur.

### **F. Refine and Continue the Reintroduction Site Selection Process**

The reintroduction process should be continued, assessed and revised with the assistance of a recovery technical team. In order to refine the site evaluation process, the technical team would recommend experimental planting at potential reintroduction sites to determine site suitability. This effort would also provide additional information on optimal characteristics for a reintroduction site. The identification of critical environmental factors could assist with more successful site selection. This information could be valuable when evaluating potential reintroduction sites throughout the range of *P. hirtus*. Seeding experimentation in various locations suggests that microsite preparation is key to reintroduction success.

The site evaluation process, incorporating experimental plantings, is continuing in northern Douglas County. Experimental plantings in other parts of the Umpqua Valley, such as the NBHMA also provide information for site evaluation in the southern extent of the species historic range.

The number of existing reserves falls short of the target number in the recovery criteria, and because of the scarcity of remnant wetland vegetation, under protective status, for potential reintroduction sites, this review recommends experimental *Plagiobothrys hirtus* introduction as part of wetland restoration on secured land at appropriate sites.

### **G. Potential Research Needs**

- Rangewide *Plagiobothrys hirtus* population assessments should continue every five years. Experimental studies addressing the biology of *P. hirtus* should be undertaken to increase our knowledge of the plant. The following topics should be considered in the next five years:

The use of prescribed fire should be studied as a restoration tool. Preliminary evidence shows that burning may be a useful in habitat restoration and shows promise in *Plagiobothrys hirtus* habitat maintenance.

- Non-native invasive plants have been documented as a primary inhibitor of *Plagiobothrys hirtus* establishment in the Powerline introduction site and at the Popcorn Swale site (Amsberry 2008) and degrade habitat at most *P. hirtus* occurrences. Control of these plants is a major management priority at North Bank Habitat Management area and TNC Oerding Popcorn Swale Preserve. A focused study on effective methods of non-native invasive plant control should be initiated.
- Pollination biology of *Plagiobothrys hirtus* is not yet well studied. In general, seed set appears high, indicating that pollination is highly successful, and that pollination is not a limiting factor at the present time for this species. This needs to be better documented.
- Inbreeding/outbreeding depression and genetic bottlenecks have not been documented in *Plagiobothrys hirtus*. The question whether genetic outbreeding or inbreeding depression exists in populations has not been fully answered. Results from greenhouse interspecific crosses between *P. hirtus* and *P. figuratus* can produce viable offspring, but usually have a lower viability (Amsberry and Meinke 2002). Plants at the TNC Oerding Popcorn Swale reserve and the Hawthorne sites exhibit a less-robust habit and have lower reproductive capacity; however, this does not confirm that genetic issues are present.
- Grazing studies should be conducted that evaluate whether grazing can be compatible with long-term *Plagiobothrys hirtus* survival, has merit in habitat restoration, and has the ability to maintain suitable habitat.

## Literature Cited

Compiled for the 2009 5-Year Status Review

- Amsberry, K. and R. J. Menke. 2001. Conservation biology of the federally endangered species *Plagiobothrys hirtus*: additional inventory and investigations of sexual reproduction. Final report to U.S. Fish and Wildlife Service. Portland, Oregon. 29 pp. + appendices.
- Amsberry, K., and R.J. Meinke. 2002. Investigations of hybridization and population differentiation, and their conservation and recovery implications for the endangered species *Plagiobothrys hirtus*. Report to U.S. Fish and Wildlife Service. Portland, Oregon. 44 pp.
- Amsberry, K. and R.J. Meinke. 2007. *Plagiobothrys hirtus* reintroduction project. 2006 final report to the Bureau of Land Management, Roseburg Office. Native Plant Conservation Program, Oregon Department of Agriculture. Salem, Oregon.
- Amsberry, K., and R.J. Meinke. 2008. Evaluating allelopathic affects of pennyroyal (*Mentha pulegium*) on two native plant species. Report to Bureau of Land Management, Roseburg District (Grant No. HRP070329). Roseburg, Oregon. 25 pp.
- Amsberry, K. and R.J. Meinke. 2009. *Plagiobothrys hirtus* reintroduction project and population monitoring. 2008 Final Report. Report for the Bureau of Land Management, Roseburg Office. Native Plant Conservation Program, Oregon Department of Agriculture. Salem, Oregon. 25 pp.
- Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.
- Currin, R., K. Amsberry, and R.J. Meinke. 2005. Developing biogeographically based population introduction protocols for at-risk plant species of the interior valleys of southwestern Oregon: *Plagiobothrys hirtus* (rough popcorn flower). Report to U.S. Fish and Wildlife Service. Portland, Oregon. 24 pp.
- Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.
- Maddux, T. 2006. Rough popcornflower population augmentation at Douglas Soil and Water Conservation District (Roger Johnson) parcel. Native Plant Conservation Program Oregon Department of Agriculture. Prepared for the U.S. Fish and Wildlife Service, Partners for Fish and Wildlife Program (Grant No. 13420-05-J516). Portland, Oregon. 26 pp.

- Maddux, T. and S. Meyers. 2008. *Plagiobothrys hirtus* survey. Native Plant Conservation Program, Oregon Department of Agriculture at Oregon State University. Salem, Oregon. Prepared for the U.S. Fish and Wildlife Service. Grant No. OR-EP-2, Seg. 18. 33 pp.
- NatureServe Explorer. 2010. Habitat-based Plant Element Occurrence Delimitation Guidance, 1 October 2004. Accessed on 2/4/10 at: <[http://www.natureserve.org/explorer/decision\\_tree.htm](http://www.natureserve.org/explorer/decision_tree.htm)>.
- Oregon Department of Transportation (ODOT). 2008. Special Management Area (SMA) Monitoring Survey: Yoncalla Rough Popcorn flower (*Plagiobothrys hirtus*). Oregon Department of Transportation, Roseburg, Oregon. 3 pp.
- Oregon Department of Transportation (ODOT). 2009. ODOT Rare Plant Monitoring Data Collection Form: *Plagiobothrys hirtus*, sm00033. Oregon Department of Transportation, Roseburg, Oregon. 2 pp.
- Oregon Natural Heritage Information Center. 2008. Rare, threatened and endangered species in Oregon. Oregon Natural Heritage Program, Portland, Oregon.
- Silvernail I, K. Amsberry, and R.J. Meinke. 2008. *Plagiobothrys hirtus* reintroduction project and population monitoring. 2007 Final Report. Prepared for the Bureau of Land Management, Roseburg District Office (Grant No. HRP070329). Native Plant Conservation Program, Oregon Department of Agriculture, Salem, Oregon. pp. 24.
- Sullivan, M. 2008. E-mail providing most recent census information for the TNC Popcorn Oerding Ranch Preserve at Popcorn Swale. Personal Communication.
- U.S. Fish and Wildlife Service (USFWS). 1990. Endangered and threatened wildlife and plants: review of plant taxa for listing as endangered or threatened species. Federal Register 62: 6184-6229.
- U.S. Fish and Wildlife Service (USFWS). 1997. Endangered and threatened wildlife and plants; Proposed endangered status for rough popcornflower (*Plagiobothrys hirtus*). Federal Register 59(89): 24106-24111.
- U.S. Fish and Wildlife Service (USFWS). 1999. Endangered and threatened wildlife and plants: determination of endangered status for *Plagiobothrys hirtus* (rough popcornflower). Federal Register 62(112): 31740-31748.
- U.S. Fish and Wildlife Service (USFWS). 2000. Endangered and Threatened Wildlife and Plants; Endangered Status for the Plant *Plagiobothrys hirtus* (rough popcornflower). *Federal Register* 65 FR 3866-3875, January 25, 2000.
- U.S. Fish and Wildlife Service (USFWS). 2003a. Recovery plan for the rough popcornflower (*Plagiobothrys hirtus*). U.S. Fish and Wildlife Service, Portland, OR. 51 pp.

U.S. Fish and Wildlife Service (USFWS). 2003b. Formal Consultation for Jobs-in-the-Woods Restoration Project at The Nature Conservancy's Popcorn Swale Site (ref. 1-03-F-0641). Formal Consultation. U.S. Fish and Wildlife Service, Portland, OR.

U.S. Fish and Wildlife Service (USFWS). 2007. Proposed Daffodil Estates Development along Southside Road in Sutherlin, Oregon (Army Corps Action ID: 2006-00762). Formal Consultation. U.S. Fish and Wildlife Service, Portland, OR.

U.S. Fish and Wildlife Service (USFWS). 2010. Population Monitoring at Sutherlin Park and Southside Swale 2007- 2009 by Native Plant Society of Oregon, DSWCD, and Service Staff. Memo to the Files. U.S. Fish and Wildlife Service, Roseburg Field Office, Roseburg, OR.

**Signature Page**  
**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Plagiobothrys hirtus***

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** NA

**Review Conducted By:** Sam Friedman

Neil R. Corbett Date 8/11/10  
**Lead Field Supervisor, Fish and Wildlife Service**

Concur  Do Not Concur

## Appendix A

Status of Recovery Actions from 2003 Service Recovery Plan for Rough popcornflower  
(*Plagiobothrys hirtus*)

Action	Action Number	Status
Evaluate the status of all existing populations.	1.1.1	Completed in 2005
Conduct surveys to search for new populations.	1.1.2	Completed in 2005
Select and delineate reserve sites.	1.1.3	Five sites have been delineated
Protect habitat to be included in reserves	1.1.4	On going action
Education opportunities for landowners/ managers/general public	1.1.5.1	On going action
Use of existing authorities and applicable regulations	1.1.5.2	On going action
Evaluate techniques to reduce competition	1.1.5.3.1	On going action
Evaluate techniques to reduce impacts of woody succession	1.1.5.3.2	Not initiated yet
Implement appropriate management	1.1.5.3.3	On going action
Collect seeds from extant sites for propagation	1.1.5.4.1	Expected to continue in 2010
Produce and establish transplants	1.1.5.4.2	Expected to continue in 2010
Monitor existing populations	1.1.5.5	On going action
Identify ecologically appropriate habitat	1.2.1.1	Partially completed in 2005
Protect population introduction sites	1.2.1.2	Expected to continue in 2010
Manage populations to promote viability	1.2.4	On going action
Monitor new populations to determine viability	1.2.5	On going action at some populations
Rank populations	2.1	Not a high priority action
Collect seeds for banking	2.2	Expected to continue in 2010
Evaluate population genetic diversity	3.1	Not initiated yet
Evaluate pollinator availability	3.2	Not a high priority action
Provide outreach services for owners of reserves and the general public	4	On going action

## **Appendix B**

### *Plagiobothrys hirtus* Action Plan

#### Strategic Action 1

##### **Protect and manage existing *Plagiobothrys hirtus* populations**

- Secure protection of *Plagiobothrys hirtus* habitat in Calapooya Creek watershed.
- Secure protection of *Plagiobothrys hirtus* populations in Yoncalla Creek watershed.
- Enter into Conservation Agreement with other public entities.
- Assist with habitat management at the TNC Oerding Popcorn Swale reserve.
- Assist with monitoring on DSWCD property.
- Assist with fencing to enclose DSWCD the *Plagiobothrys hirtus* population.
- Collect and store seed from representative populations in each recovery unit.

#### Strategic Action 2

##### **Re-introduce and augment *Plagiobothrys hirtus* to promote long-term viability**

- Reintroduce *Plagiobothrys hirtus* to protected suitable habitat on the Calapooya and/or Yoncalla Creek Watersheds.
- Reintroduce *Plagiobothrys hirtus* to protected suitable habitat on Sutherlin Creek Watershed.
- Introduce and augment *Plagiobothrys hirtus* in suitable habitat outside the recovery units.

#### Strategic Action 3

##### **Determine needs of population to ensure long-term viability**

- Determine compatibility of *Plagiobothrys hirtus* with livestock grazing, burning, mowing and develop recommendations.
- Evaluate and assess all introduced populations, determine needs for self-sustainability.
- Perform *Plagiobothrys hirtus* genetic studies.