

Recovery Plan for *Phlox hirsuta* (Yreka Phlox)



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DEDICATION

*This recovery plan is dedicated to the memory of
Larry G. Bacon,
former Yreka City Attorney and Yreka Phlox Recovery Team member,
whose vision for conservation of Phlox hirsuta will continue to guide us all.*

ACKNOWLEDGMENTS

We gratefully acknowledge past and current members of the Yreka Phlox Recovery Team (Recovery Team) for drafting the recovery plan, their thoughtful and always constructive discussion, and their constant and steady support of the recovery planning process. Special thanks go to Pete Figura, California Department of Fish and Game, who as team leader, drafted major sections of the recovery plan and whose tireless efforts have guided the Recovery Team's clear and steady progress toward completion of the plan. We extend our sincere thanks to Frank A. Lang for original Yreka phlox illustrations and for his research in developing the nomenclatural history of the species. Special thanks also go to Robert W. Patterson for contributing photographs and developing the *Phlox* *hirsuta* species description, found herein. We are grateful to Timber Products Company for contributing the use of their Geographic Information Systems technology and the assistance of their staff in the production of soil maps. Finally, we extend our appreciation to David E. Johnson and Emily Castro of the U.S. Fish and Wildlife Service for their contributions to the preparation of this recovery plan.

YREKA PHLOX RECOVERY TEAM

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EXECUTIVE SUMMARY

Current Species Status: *Phlox hirsuta* (Yreka phlox) was listed as an endangered species on February 3, 2000 (U.S. Fish and Wildlife Service 2000), under the authority of the Endangered Species Act of 1973, as amended. The plant is a narrow endemic, known to occur at only five locations in the vicinity of Yreka, California. The number and spatial distribution of plants at these locations varies from a single occurrence containing 200 to 300 plants to a larger occurrence comprising numerous discrete suboccurrences totaling 5,000 to 10,000 plants. *Phlox hirsuta* occurs on lands owned and managed by industrial timber companies, other private landowners, the U.S. Forest Service, California Department of Transportation, and the City of Yreka.

Habitat Requirements and Limiting Factors: *Phlox hirsuta* is a serpentine endemic (a species found only on soils derived from ultramafic parent rocks). These soils have high concentrations of magnesium and iron, and often have high concentrations of chromium and nickel, as well. *Phlox hirsuta* occurs at elevations ranging from 880 to 1,340 meters (2,800 to 4,400 feet). Currently known and potential limiting factors include alteration or destruction of habitat resulting from residential development, logging, fire suppression activities, ongoing highway maintenance or construction activities, off-road vehicle use, illegal collection, and vandalism; competition with exotic plants; herbicide application; domestic animal grazing; inadequate existing regulatory mechanisms; and potential extirpation as a result of random events.

Recovery Priority: 2C, per criteria published in the Federal Register (U.S. Fish and Wildlife Service 1983). The priority is based on designation as a full species with a high degree of threat, high potential for recovery, and existing conflict between development and the species' conservation.

Recovery Strategy: Although the biology and ecology of *Phlox hirsuta* are poorly understood, field observations suggest that its populations may be stable, individual plants may be long-lived, and seedling establishment is infrequent. It is expected that *P. hirsuta* can be recovered if existing threats to the species are removed or reduced, future threats can be identified and neutralized, and techniques can be developed to augment the reestablishment of populations (in

case of unforeseen future population losses). To achieve the recovery objectives, the recovery effort will focus on securing known populations, developing a seed bank (*i.e.*, *ex situ* storage of seed) and effective propagation techniques, locating new populations, monitoring known populations, and conducting demographic and ecological research.

Recovery Objectives and Criteria: The recovery objectives are to recover *Phlox hirsuta* to the point where reclassification from endangered to threatened is warranted, and subsequently to the point where the species can be removed from the list of endangered and threatened species. To reclassify *P. hirsuta* from endangered to threatened status, the following criteria must be met: (a) four occurrences (two of which must be the China Hill and Soap Creek Ridge occurrences) have secure permanent protection (legally binding arrangements that ensure management for the benefit of *P. hirsuta* in perpetuity), and (b) a *P. hirsuta* seed bank and effective propagation techniques have been established. To delist *P. hirsuta*, the following criteria must be met: (a) the reclassification criteria (described above) have been met, and (b) two additional occurrences have been located and permanently protected, **or** 10 years of demographic research and/or quantitative monitoring at four protected occurrences has demonstrated that plant population size has not declined more than 10 percent at any occurrence (total change between year zero and year 10).

Actions Needed:

1. Protect and secure the four occurrences of *Phlox hirsuta* known as of January 1, 2002: China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences. Alternatively, the China Hill and Soap Creek Ridge occurrences are protected, and substitutes representing Jackson Street and/or Cracker Gulch are protected.
2. Develop and implement a monitoring strategy for all occurrences that will identify existing and new threats over a period of at least 10 years. Implement a management plan at each protected site to ensure the long-term persistence of *Phlox hirsuta*.
3. Create and maintain a seed bank and develop propagation techniques in case of unforeseen future population losses.
4. Survey for undiscovered occurrences in unsurveyed areas likely to support *Phlox hirsuta*.

5. Conduct biological research to guide recovery and conservation efforts.
6. Enhance public awareness, understanding, and participation in *Phlox hirsuta* recovery.

Total Estimated Cost of Recovery: Total estimated cost of recovery is \$950,220. Estimated cost is displayed below by actions needed and action priority. Costs are summarized from the Implementation Schedule on page 49.

Priority 1 actions: \$341,000

Those actions that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 actions: \$376,000

Those actions that must be taken to prevent a significant decline in the species' population or habitat quality, or some other significant negative impact short of extinction.

Priority 3 actions: \$233,220

All other actions necessary to provide for full recovery of the species.

Cost Estimate (in \$1,000 units)							
Year	Action 1	Action 2	Action 3	Action 4	Action 5	Action 6	Total
FY 1	TBD ¹	22.2+	11	7.3+	34.4	17.4	92.3+
FY 2	TBD	17.2+	5.1	5.88+	30.4	6.4	64.98+
FY 3	216+ ²	11.2+	3.1	5.88+	21.4	2.6	260.18+
FY 4	TBD	11.2+	3.1	5.88+	21.4	2.6	44.18+
FY 5	TBD	11.2+	1.1	5.88+	21.4	1.5	41.08+
FY 6	TBD	11.2+	1.1	5.88+	14.6	1.5	34.28+
FY 7	TBD	11.2+	1.1	5.88+	14.6	1.5	34.28+
FY 8	TBD	11.2+	1.1	5.88+	14.6	1.5	34.28+
FY 9	TBD	11.2+	1.1	5.88+	14.6	1.5	34.28+
FY 10	TBD	18.2+	1.1	5.88+	14.6	1.5	41.28+
Grand Total	328	181	29	172.22	202	38	950.22

¹ Estimated costs that are to be determined

² Estimated costs plus costs that are to be determined

Date of Recovery: It is anticipated that 5 years will be needed to complete the actions necessary to meet the objective of downlisting *Phlox hirsuta* to threatened. Therefore, downlisting may be accomplished as early as 2011, if the applicable recovery criteria have been met. At least 10 years will be needed to complete the actions necessary to meet the objective of delisting *P. hirsuta*. Therefore, delisting may be accomplished by 2016, if the applicable recovery criteria have been met.

TABLE OF CONTENTS

I. INTRODUCTION	1
A. Overview	1
B. Nomenclatural History	1
C. Description	2
D. Similar Species	3
E. Distribution	8
F. Habitat	12
1. Geology and Soils	12
2. Climate	12
3. Geographic Province	14
4. Site Specific Descriptions	14
G. Geographic Area Likely to Support Undiscovered Occurrences	18
H. Life History	19
1. Phenology	19
2. Reproduction	19
I. Reasons for Listing and Current Threats	21
1. The present or threatened destruction, modification, or curtailment of its habitat or range	23
2. Overutilization for commercial, recreational, scientific, or educational purposes	28
3. Disease or predation	29
4. The inadequacy of existing regulatory mechanisms	29
5. Other natural or manmade factors affecting its continued existence	31
J. Conservation Measures	31
K. Recovery Strategy	34
II. RECOVERY	37
A. Goals and Objectives	37
B. Recovery Criteria	37
C. Stepdown Narrative	38
III. IMPLEMENTATION SCHEDULE	50

IV. REFERENCES	58
A. Literature Cited	58
B. On-line Resources	62
C. Personal Communications	63
D. <i>In Litt.</i> References	63
V. APPENDICES	66
Appendix 1. A Nomenclatural History of <i>Phlox hirsuta</i>	66
Appendix 2. <i>Phlox hirsuta</i> Species Description	69
Appendix 3. Phlox Species that may be Confused with <i>Phlox hirsuta</i>	70
Appendix 4. Soil Types Associated with <i>Phlox hirsuta</i> Occurrences	72
Appendix 5. Plants Associated with <i>Phlox hirsuta</i> at China Hill and Soap Creek Ridge	80
Appendix 6. Recovery Team Activities	82
Appendix 7. Summary of Threats and Recommended Recovery Actions for Downlisting and Delisting.	87
Appendix 8. Summary of Comments on the Draft Recovery Plan for <i>Phlox hirsuta</i> (Yreka Phlox)	90

LIST OF FIGURES

Figure 1.	<i>Phlox hirsuta</i> (Yreka phlox): A) habit, B) hairs, C) flowers, D) pistil.	4
Figure 2.	<i>Phlox hirsuta</i> flowers	5
Figure 3.	Flowers of <i>Phlox hirsuta</i> and similar phlox species	6
Figure 4.	Habit, leaves (bar = 10mm), and pistils (bar = 1mm) of <i>Phlox hirsuta</i> and similar phlox species	7
Figure 5.	<i>Phlox hirsuta</i> plants at China Hill	22

LIST OF MAPS

Map 1.	Known distribution of <i>Phlox hirsuta</i> , Siskiyou County, California	9
Map 2.	Distribution of ultramafic soil types in the vicinity of the known occurrences of <i>Phlox hirsuta</i>	13
Map 3.	Areas considered most likely to support undiscovered occurrences of <i>Phlox hirsuta</i>	20

I. INTRODUCTION

A. Overview

Phlox hirsuta E.E. Nelson (Family Polemoniaceae), the Yreka phlox, is listed as an endangered species (U.S. Fish and Wildlife Service 2000) under the authority of the Endangered Species Act of 1973, as amended. Although the final rule listing the species stated that critical habitat designation for *P. hirsuta* was prudent, a proposal for designation has been deferred due to insufficient funding and higher priority listing actions. The U.S. Fish and Wildlife Service is responsible for preparing a recovery plan for the species that guides its conservation so, to the extent possible, it can be downlisted from endangered to threatened and eventually be delisted. The authors of this recovery plan are the members of the Recovery Team.

Phlox hirsuta is a perennial, low-growing, bright rose-pink to white-flowered plant that grows in soils derived from ultramafic parent materials (igneous rock containing high concentrations of iron and magnesium) in and near the City of Yreka, Siskiyou County, California. *Phlox hirsuta* is currently known to occur on China Hill in Yreka; on the north and south sides of Greenhorn Creek, west of the Yreka city limits; on the western edge of Yreka near Jackson Street; and in the vicinity of Soap Creek Ridge and Cracker Gulch, southwest of Yreka. This species has a very limited distribution and may be at particular risk from human land use activities, such as housing development and road construction, as well as catastrophic natural events, such as disease or fire.

B. Nomenclatural History

Elias Nelson described *Phlox hirsuta* based on a collection made by Edward L. Greene in 1876 “near Yreka, Siskiyou County, California” (Nelson 1899). The exact type locality is not known. It was not until 1955 that Wherry (1955) apparently assumed that Greene collected the type specimen “5 miles southwest” of Yreka, in the vicinity of the Soap Creek Ridge population.

Wherry’s assumption may be correct. E. L. Greene was the Episcopal Priest at Saint Laurence’s (now Saint Mark’s) Episcopal Church in Yreka for less than a year from 1876 to 1877. In addition to being a priest, he was a keen botanist who eventually became the University of California’s first botanist. In a letter to Asa

Gray (E. L. Greene *in litt.* 1876), Greene mentioned that he had an ample supply of sermons on hand and did not mean to compose a new one the following spring, summer, and fall, but instead to “herborize” to his heart’s content. Among his duties was preaching weekly at Fort Jones in the Scott Valley. On one of these trips he may have collected, along the road from Yreka to Fort Jones, what was eventually to be named *Phlox hirsuta* (F. Lang, Southern Oregon University, pers. comm. 2001).

Jepson (1943) treated the taxon as *Phlox stansburyi* var. *hirsuta*, and Munz (1959) followed this practice. However, most recent treatments, including Abrams (1951), Wherry (1955), and Patterson and Wilken (1993) have recognized Yreka phlox as a distinct species, *Phlox hirsuta*. The CalFlora (2000) and United States Department of Agriculture PLANTS (Natural Resources Conservation Service 2001) databases also recognize Yreka phlox as a species. A more complete nomenclatural history of the Yreka phlox is found in Appendix 1.

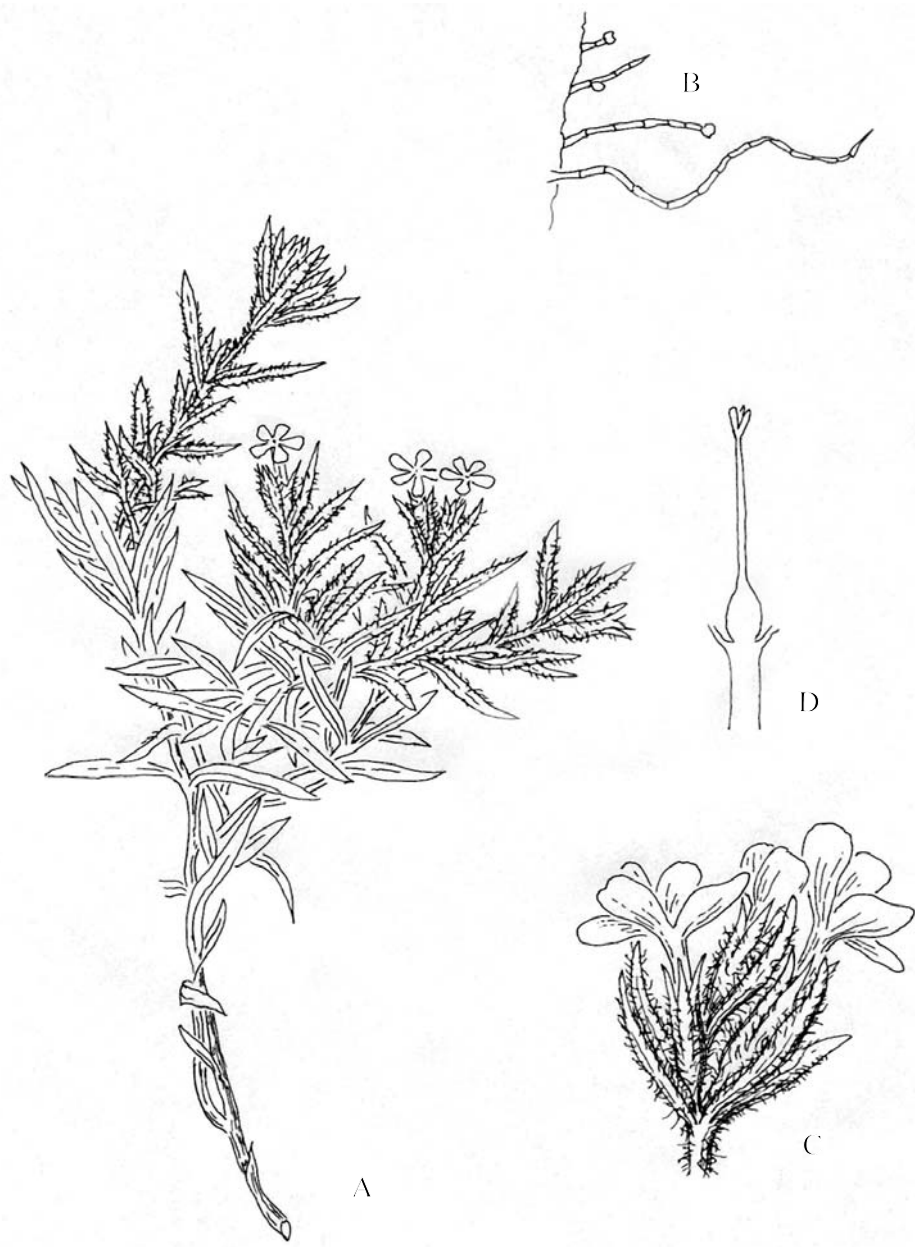
C. Description

Phlox hirsuta is a perennial (growing for more than one season) flowering plant with a woody base and herbaceous (nonwoody) stems. Mature plants are 5 to 15 centimeters (2 to 6 inches) high; however, stems growing along the ground can grow to 20 centimeters (8 inches) long. Stems are densely hirsute (i.e., bearing coarse, rough, elongate, more or less erect, fine hairs [projections of epidermal cells]). The hairs that give the species its name are 1 to 2 millimeters (0.04 to 0.08 inch) long, consisting of 5 to 10 cells arranged in a single row, with each cell flattened 90 degrees from the previous cell. Leaves are crowded in opposite pairs along the stem. The leaf blades attach directly to the stems (i.e., there is no leaf stalk/petiole), are narrowly elliptic, and have prominent midveins standing out on the lower surfaces. Leaf blades are 15 to 20 millimeters (0.6 to 0.8 inch) long and 3 to 6 millimeters (0.1 to 0.2 inch) wide. Like the stems, the leaves are densely hirsute. When in bloom, the overall plant appears covered with showy flowers. Each flower is 12 to 15 millimeters (0.5 to 0.6 inch) long and consists of a tubular hirsute calyx (collective term for sepals, the generally green outermost whorl of the flower parts that encloses the remainder of the flower when in bud), a salverform (trumpet-shaped) corolla (petals) with bright rose-pink to white corolla lobes (each 5 to 7 millimeters [0.2 to 0.3 inch] long) and rounded (not notched) tips, five stamens (male reproductive structures)

attached to the inner corolla tube at different levels, and a 5 to 6 millimeter (0.2 inch) style (stalk-like part of the pistil connecting the ovary and stigmas) that is terminated by 3 stigmas (part of the pistil [female reproductive structure] on which pollen is deposited) less than 1 millimeter (0.04 inch) long (See Figures 1 and 2). The species blooms from March to June. This information is a summary of the technical description of *P. hirsuta* that can be found in Appendix 2.

D. Similar Species

Gross similarity often makes some phlox species difficult to identify. However, *Phlox hirsuta* is readily distinguishable from any other northern California phlox (Figures 3, 4). *Phlox speciosa* (showy phlox) superficially resembles *P. hirsuta* in growth form and bright pink flowers. The two species occur immediately adjacent to each other at the China Hill and Soap Creek Ridge occurrences. However, *P. hirsuta* at these localities is restricted to serpentine soils (soils derived from ultramafic rock) while *P. speciosa* occurs on both serpentine and nonserpentine soils. *Phlox speciosa* can be distinguished from *P. hirsuta* by the former having a deep notch at the tip of each corolla lobe and a style that is shorter than the stigmas. *Phlox diffusa* (spreading phlox) is the wide-ranging montane phlox that occurs throughout California at higher elevations. It occurs near the range of *P. hirsuta*, but generally at higher elevations. *Phlox diffusa* is a cushion phlox with a lower, denser habit than *P. hirsuta*, and is never as hirsute throughout. *Phlox cespitosa* (not pictured) is very similar to *P. diffusa* but is glandular-hairy and has sharp-tipped leaves. *Phlox stansburyi* (cold-desert phlox) is a wide-ranging arid-region species that occurs east of the Sierra-Cascade crest in California. The growth form of *P. stansburyi* is not nearly as compact as that of *P. hirsuta*, and it is never as hirsute. *Phlox stansburyi* also has longer stigmas than those of *P. hirsuta*. Some treatments refer to *P. hirsuta* as a subspecies of *P. stansburyi*, but these interpretations are not substantiated by data. *Phlox adsurgens* (northern phlox) is a montane species of higher elevations in mixed evergreen and montane coniferous forests. It is glabrous (lacking hairs), has broad leaves and flowers on long stalks, and therefore is unlikely to be confused with *P. hirsuta*. A more detailed description of these similar phlox species can be found in Appendix 3, which was prepared for this recovery plan.



Frank Lang

Figure 1. *Phlox hirsuta* (Yreka phlox): A) habit, B) hairs, C) flowers, D) pistil. *Habit and hairs drawn from Elam and Fuller collection 5/14/97; flowers and pistil drawn from Patterson photographs.*



Figure 2. *Phlox hirsuta* flowers. *Photograph by R. Patterson.*



A) *Phlox adsurgens* (northern phlox)



B) *Phlox speciosa* (showy phlox)



C) *Phlox hirsuta* (Yreka phlox)



D) *Phlox diffusa* (spreading phlox)



E) *Phlox stansburyi* (cold-desert phlox)

Figure 3. Flowers of *Phlox hirsuta* and similar phlox species. Photographs by F. Lang and R. Patterson.



Figure 4. Habit, leaves (bar = 10mm), and pistils (bar = 1mm) of *Phlox hirsuta* and similar phlox species: A) *Phlox adsurgens* (northern phlox) (drawn from Ingram collection 1742), B) *Phlox speciosa* (showy phlox) (from Thiers 15859), C) *Phlox hirsuta* (Yreka phlox) (from Patterson et al. collection), D) *Phlox diffusa* (spreading phlox) (from Presicek 033), E) *Phlox stansburyi* (cold-desert phlox) (from Lambert 054).

E. Distribution

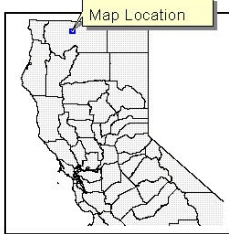
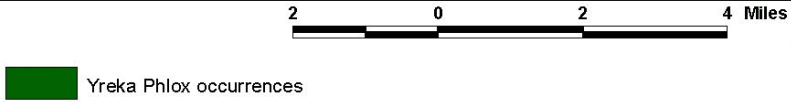
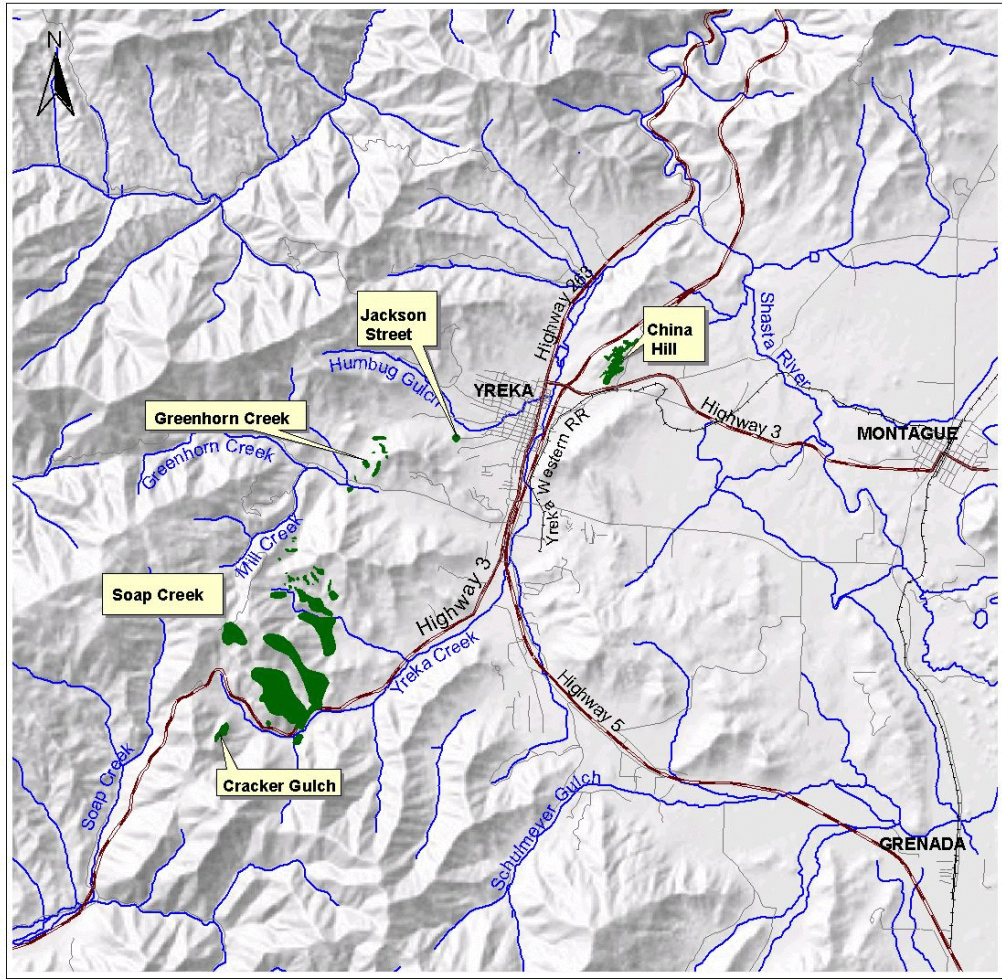
Phlox hirsuta is a narrow endemic known only from the vicinity of Yreka, California. It is currently known to occur at five locations¹, which are generally referred to as the “China Hill,” “Soap Creek Ridge,” “Cracker Gulch,” “Greenhorn Creek,” and “Jackson Street” occurrences (Map 1). In addition, the locality information from a single 1930 collection indicates a possible historical location in the vicinity of Etna or in the vicinity of Echo Mill, near Soap Creek Ridge (see Appendix 1).

Phlox hirsuta occurs on lands owned and/or managed by several government agencies and private owners. Of the land currently mapped as being occupied by *P. hirsuta*, approximately 7 percent is under the jurisdiction of the City of Yreka; 26 percent is managed by the U.S. Forest Service (Forest Service), Klamath National Forest; 5 percent is owned by industrial timber companies; and 62 percent is owned by other private landowners (Nelson 2004, California Natural Diversity Database 2005, Lenz 2005). Additionally, some *P. hirsuta* plants are found within rights-of-way managed by the California Department of Transportation (Caltrans) (Bowen 1991; K. Garrett *in litt.* 2002; R. Irvin, Caltrans, pers. comm. 2006).

The China Hill occurrence is located on an open ridge and adjacent slopes approximately 1.6 kilometers (1 mile) northeast of downtown Yreka. An estimated 1,000 to 3,000 plants are scattered over approximately 19 hectares (47 acres). These data are based on a spring 2001 survey and mapping effort by California Department of Fish and Game (Department of Fish and Game) and Timber Products Company staff, who employed very accurate Global Positioning System technology. Approximately 55 to 60 percent of this occurrence is on parcels owned by the City of Yreka, while the remainder is situated on several privately held parcels that are currently zoned for residential development.

The Soap Creek Ridge occurrence includes at least 14 discrete suboccurrences and is located adjacent to California State Highway 3, approximately 8 to 10 kilometers (5 to 6 miles) southwest of Yreka. The suboccurrences are located in

¹As used in this document, a *Phlox hirsuta* location/occurrence consists of a group of at least 200 individual plants that is separated from any other *P. hirsuta* locality by at least 0.40 kilometer (0.25 mile).



Note:
 Yreka phlox occurrence locations mapped by the California Natural Diversity Database, by Recovery Team members, and by contractors employed by the U.S. Fish and Wildlife Service.
 The areal extent of the Jackson Street occurrence and portions of the Greenhorn Creek occurrence is currently uncertain.

Map 1. Known distribution of *Phlox hirsuta*, Siskiyou County, California

Nunes Gulch in the Greenhorn Creek watershed and in Blacks, Red, and Lime Gulches in the Yreka Creek watershed. The entire occurrence was estimated to contain as many as 5,000 to 10,000 plants over a 236-hectare (584-acre) area surveyed between mid-April and mid-June 1987 (Adams 1987, California Natural Diversity Database 2005). At Soap Creek Ridge, the phlox occurs on lands owned and managed by private landowners, industrial timber companies, Caltrans, and the Forest Service.

The Cracker Gulch occurrence is located in the Yreka Creek drainage, on the south side of State Highway 3. This occurrence is located approximately 0.88 kilometer (0.55 mile) from the closest suboccurrence at Soap Creek Ridge. Land ownership at this occurrence includes a small-ranch/timberland owner and an industrial timber company. The occurrence occupies approximately 5.83 hectares (14.4 acres) (California Natural Diversity Database 2005) and is estimated to contain 500 *Phlox hirsuta* plants (J. Filipski, Southern Oregon University, pers. comm. 2005).

Plants comprising the Greenhorn Creek occurrence are found on several privately and city-owned parcels on the north and south sides of Greenhorn Creek, west of the Yreka city limits. The privately owned parcels in this area are currently zoned by Siskiyou County as “Non-Prime Agricultural District” land. Most are currently developed with single-family dwellings and accessory buildings. As is the case at Soap Creek Ridge, *Phlox hirsuta* occurs in several discrete suboccurrences at the Greenhorn location. It is estimated that the total occurrence occupies approximately 8.1 hectares (20 acres) and contains approximately 1,315 to 2,065 *P. hirsuta* plants (P. Figura *in litt.* 2005a, 2005b; L. Nelson *in litt.* 2005).

The Jackson Street occurrence is located on a privately owned parcel near the west-central edge of Yreka, in the Little Humbug Gulch drainage. A professional botanist who visited the site in 1997 or 1998 estimated the occurrence to contain at least 200 to 300 *Phlox hirsuta* plants at that time (California Natural Diversity Database 2005). No verified collections have been made from the site. Because access is restricted by the landowner, the current extent of occupied habitat and the condition of the occurrence are unknown. In 2003, several *P. hirsuta* plants

were observed directly adjacent to the public right-of-way at the end of Jackson Street (California Natural Diversity Database 2005).

A problematic *Phlox hirsuta* collection from 1930 (collected by L. Kildale, located at the California Academy of Sciences herbarium) suggests another potential occurrence. The herbarium label indicates that the collection occurred at or near “Mill Creek near Etna Mills.” Etna Mills is an older name for Etna, as well as the name of an historical settlement approximately 3.2 kilometers (2 miles) from the present town of Etna². Etna is approximately 5.6 kilometers (3.5 miles) northeast of the confluence of Mill Creek and Etna Creek. Thus, the collection may have been made somewhere in the vicinity of Mill Creek, Etna, or the historical location of Etna Mills. However, most of the habitat in these areas does not appear suitable for *P. hirsuta*, and surveys in the vicinity of Etna and Mill Creek have failed to relocate this occurrence (Adams 1987). It has been suggested that the locality information for the collection may be incorrect (California Department of Fish and Game 1986), and that the Mill Creek referred to on the collection’s herbarium label may be the Mill Creek adjacent to the extensive *P. hirsuta* occurrence on Soap Creek Ridge (Adams 1987). The upper portion of the Soap Creek drainage contains the site of an historical sawmill called “Echo Mill” (T.44N., R.08W., NW1/4 SE1/4 Sec 02). This mill site is less than 1.6 kilometers (1 mile) west of Mill Creek and less than 1.6 kilometers (1 mile) from one of the extant Soap Creek Ridge *P. hirsuta* suboccurrences. This mill was in operation in 1930, when the Kildale collection was made (R. Silva, Siskiyou County Historical Society, pers. comm. 2001). Thus, it seems possible that the specimen was erroneously labeled as being from “Mill Creek near *Etna Mills*” rather than “Mill Creek near *Echo Mills*” (J. Molter *in litt.* 2001).

² Etna is located in the Scott Valley, approximately 37 kilometers (23 miles) southwest of Yreka. A small town called Rough and Ready originated at the site in the late 1860's. Nearby was another small mill and town called Aetna Mills. In 1861 and 1862, flooding seriously damaged the town of Aetna Mills and businesses slowly moved towards Rough and Ready. In 1870, to avoid confusion with other towns in the central valley of California, the name of Rough and Ready was changed (and shortened) to Etna Mills. The "Mills" was dropped from the name in the 1930's (information from Siskiyou County Library 2001). However, this version of the naming of Etna differs from that presented by Durham (1998). According to Durham, postal authorities established the Etna Mills post office in 1861, moved it 3.2 kilometers (2 miles) north in 1863, and changed the post office name to Etna in 1924. The State legislature changed the name Etna Mills to Etna in 1874. The town of Etna was incorporated in 1878.

F. Habitat

Following is a general discussion of the geology, soils, climate, and geographic province where *Phlox hirsuta* is found. These factors are discussed in more detail for each site, including associated species.

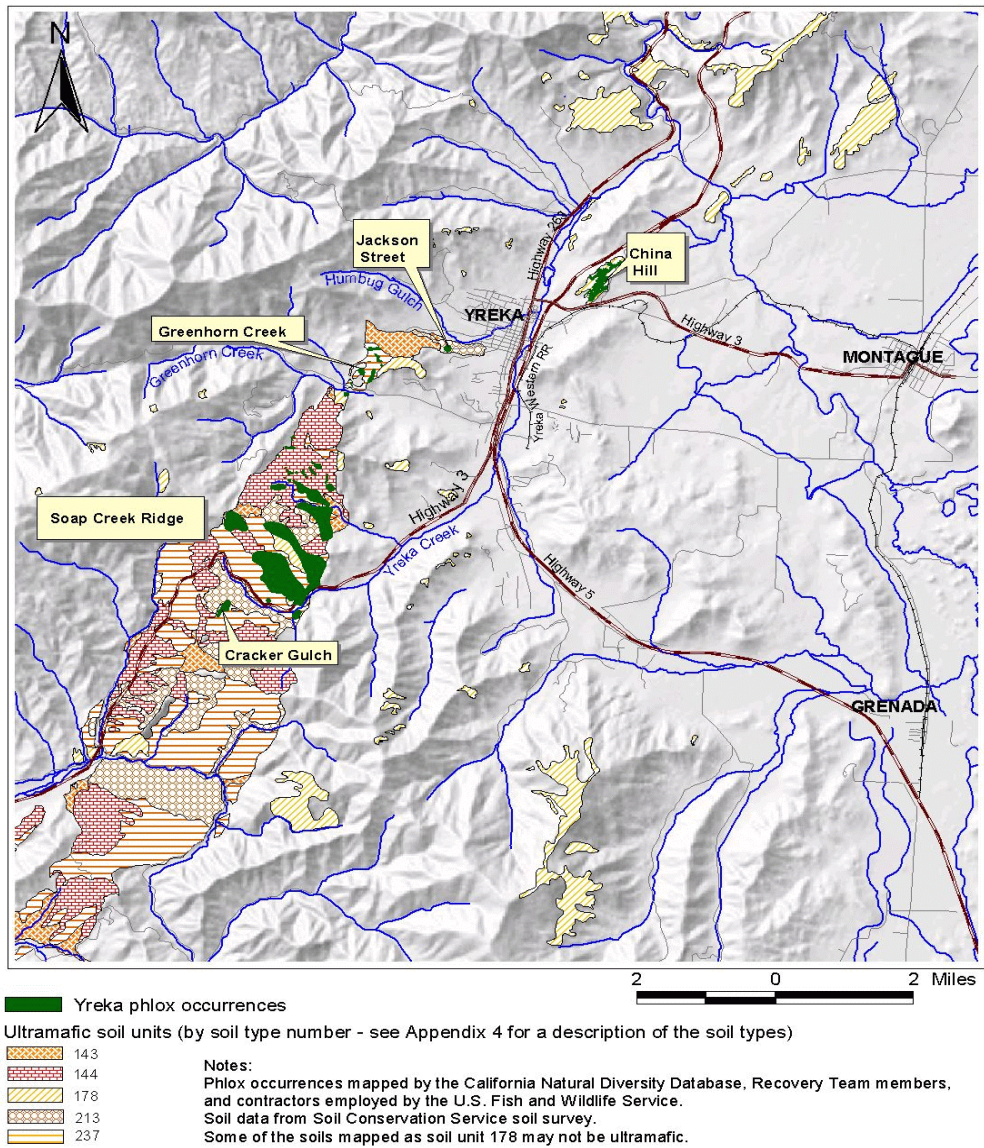
1. Geology and Soils

Phlox hirsuta is a serpentine endemic, and is found at elevations ranging from 880 to 1,340 meters (2,800 to 4,400 feet) (Map 2). A serpentine endemic is a species found only on soils derived from ultramafic parent rocks, including serpentinite and peridotite. Ultramafic rocks, and hence their derivatives, have high concentrations of magnesium and iron, and often have high concentrations of chromium and nickel, as well. Serpentine soils alter the pattern of vegetation and plant species composition nearly everywhere they occur. These soils are inhospitable for the growth of most plants because of a complex of factors that include excessive magnesium and nickel and low calcium and nutrient (nitrogen, phosphorus, and potassium) levels. Some plants, like *P. hirsuta*, adapt to these conditions and are wholly or largely restricted to them (Kruckeberg 2002).

In and near Yreka, serpentine soils supporting *Phlox hirsuta* generally are shallow to moderately deep and have moderate to high erosion hazard ratings (Soil Conservation Service 1983). Rocks associated with these soils are either reddish, due to the iron content, or greenish, due to the magnesium content. *P. hirsuta* is known to occur on five soil types, as classified and described in the Soil Survey of Siskiyou County, California, Central Part (Soil Conservation Service 1983). Soils associated with specific phlox occurrences are noted below. Soil type descriptions, taken from the Soil Survey of Siskiyou County, California, are found in Appendix 4.

2. Climate

General climatic conditions are similar among occurrences due to their close proximity, but microclimates may vary due to local differences in exposure, elevation, vegetation cover, and topography. The 30-year average annual rainfall in Yreka is 498.1 millimeters (19.61 inches) with 477.5 millimeters (18.80 inches) of snow (Western Regional Climate Center 2001). The average



Map 2. Distribution of ultramafic soil types in the vicinity of the known occurrences of *Phlox hirsuta*

maximum temperature is 19.1 degrees Celsius (66.4 degrees Fahrenheit) and average minimum temperature is 2.78 degrees Celsius (37.0 degrees Fahrenheit). Summers are hot (average July maximum 32.5 degrees Celsius [90.5 degrees Fahrenheit]) and dry (average July precipitation is 11 millimeters [0.42 inches]); winters are cool (January average high is 6.7 degrees Celsius [44 degrees Fahrenheit]) and relatively wet (average January precipitation is 89.4 millimeters [3.52 inches]).

3. *Geographic Province*

In the geographic system of The Jepson Manual (Hickman 1993), the range of *Phlox hirsuta* falls on the metamorphic fringes of the eastern boundary of the Klamath Ranges Subregion (KR) of the Northwestern California Region in the California Floristic Province. The China Hill occurrence is adjacent to an insular portion of Great Basin Province communities (sagebrush steppe and juniper savanna) that occurs in the Shasta Valley east of Yreka. This island of Great Basin Province communities lies on the border between the Klamath Ranges Subregion on the west and the volcanic Cascade Ranges Region (CaR) of the California Floristic Province to the east.

4. *Site Specific Descriptions*

This section discusses the vegetation, geology, and soils of the known *Phlox hirsuta* occurrences in more detail.

China Hill Occurrence:

China Hill is an open “serpentine barren” (Kruckeberg 2002) in the City of Yreka within a matrix of open juniper woodlands, oak woodlands, and developed areas. Elevation ranges from 850 meters to 900 meters (2,790 feet to 2,950 feet). (Personal observations by Recovery Team members 2001, California Natural Diversity Database 2005).

Vegetation. The shallow soils derived from serpentinite support scattered *Juniperus occidentalis* (western juniper) and *Ceanothus cuneatus* (buckbrush). Assemblages of shrubs, forbs, and grasses are the predominant vegetation at the site. Important components of the vegetation are *Chrysothamnus nauseosus* (rubber rabbitbrush), several species of *Eriogonum* (wild buckwheat), and several perennial grasses, including *Festuca roemerii* (Roemer’s fescue) and *Elymus*

multisetus (big squirreltail). A plant species list for the China Hill site was developed for this recovery plan and is included in Appendix 5.

Geology. The bedrock at China Hill is ultramafic rock; the site is near the northeastern edge of a prominent belt of ultramafic rocks (ranging from near Callahan in the south to near Hornbrook in the north) that is thought to be part of the Trinity ophiolite (Hotz 1977). This belt is located between the Eastern Klamath and Central Metamorphic Belts to the east and the Western Paleozoic and Triassic Belt to the west, near the boundary of the Cascade and Klamath Geologic Provinces. The belt ranges from a few tens of meters wide in the north to 4.0 kilometers (2.5 miles) wide farther south. The rocks are incompletely to completely serpentinized peridotite, dunite, and harzburgite (Hotz 1977).

Soils. This site is predominantly mapped as soil type number 178 (Lithic Xerorthents-Rock Outcrop Complex, zero to 65 percent slopes), as classified in the Siskiyou County, Central Part soil survey (Soil Conservation Service 1983). This soil unit is characterized by rock outcrops and small areas where some soil has developed to a depth of 20 to 25 centimeters (8 to 10 inches).

Soap Creek Ridge and Cracker Gulch Occurrences:

The Soap Creek Ridge area includes a complex of *Phlox hirsuta* suboccurrences separated by less than 0.40 kilometer (0.25 mile) along the main ridge and a number of minor ridges. The Cracker Gulch occurrence is located approximately 1 kilometer (0.6 mile) southwest of the Soap Creek Ridge complex. The elevation of these occurrences ranges from 1,000 to 1,360 meters (3,281 to 4,462 feet) (Personal observations by Recovery Team members 2001, California Natural Diversity Database 2005).

Vegetation. Although some areas at Soap Creek Ridge and Cracker Gulch resemble the China Hill area, these sites generally support greater vegetative cover, higher plant diversity, and more developed soils than China Hill. The predominant plant community is *Pinus jeffreyi* (Jeffrey pine) woodland, with *Calocedrus decurrens* (incense cedar), *Pseudotsuga menziesii* (Douglas-fir), and sometimes *Quercus garryana* (Oregon white oak) present in the overstory. The shrub layer is much more developed than the China Hill site, and includes *Ceanothus cuneatus*, *Cercocarpus betuloides* (birch-leaf mountain mahogany),

and *Garrya fremontii* (Fremont's silk tassel). At least 8 grass species and 35 forbs are known from this area; herbaceous species generally cover about 45 percent of the ground surface. A plant species list for Soap Creek Ridge was developed for this recovery plan and is included in Appendix 5.

Geology. The geology of the Soap Creek Ridge and Cracker Gulch sites is similar to that described for the China Hill site. Hotz (1977) describes an ultramafic outcrop in the vicinity of Soap Creek Ridge near Red Gulch (Township 44N, Range 7W, in the southeast quarter of Section 6 and the northeast quarter of Section 7) as being composed of partially serpentized dunite and exhibiting a prominent planar structure due to inclusions of differentially serpentized bands of olivine.

Soils. The Soap Creek Ridge complex of suboccurrences and Cracker Gulch are mapped in the Soil Conservation Service (1983) soil survey as follows: 178 (Lithic Xerorthents-Rock Outcrop Complex, zero to 65 percent slopes); 237 (Weitchpec Variant-Rock Outcrop Complex, 5 to 65 percent slopes); 143 (Dubakella-Ipish Complex, 5 to 30 percent slopes); 144 (Dubakella-Ipish Complex, 30 to 50 percent slopes); and 213 (Rock Outcrop-Dubakella Complex, 30 to 50 percent slopes).

Greenhorn Creek Occurrence

Phlox hirsuta plants were initially documented in the Greenhorn Creek area in 2004 (Nelson 2004, P. Figura *in litt.* 2005a). Subsequent survey and inventory work in 2005 resulted in the documentation of numerous additional *P. hirsuta* plants (P. Figura *in litt.* 2005a, L. Nelson *in litt.* 2005). Surveys have not been conducted on several private parcels in this area. Therefore, additional *P. hirsuta* plants may remain undocumented in this area.

Approximately 1,315 to 2,065 plants are currently estimated to occur at Greenhorn Creek. Based on inventory conducted to date, approximately one-half of these plants occur on each side (north and south) of the creek. Approximately one-half of the plants are located on city-owned land and one-half of the plants are on private land (P. Figura *in litt.* 2005a, 2005b; L. Nelson *in litt.* 2005).

Elevations at the Greenhorn Creek site range from 890 to 1,060 meters (approximately 2,900 to 3,475 feet)(P. Figura *in litt.* 2005a, 2005b; L. Nelson *in litt.* 2005).

Vegetation. At the Greenhorn location, *Phlox hirsuta* is found in both serpentine barrens and within open *Pinus ponderosa* (ponderosa pine) and *Pinus jeffreyi* woodlands (P. Figura, California Department of Fish and Game, personal observation 2005).

Immediately north of Greenhorn Creek near the junction of Greenhorn Road and Douglas Lane, *Phlox hirsuta* plants are found largely on an open serpentine barren. At this site soils are thin and plant cover is relatively sparse. *P. hirsuta* is generally associated with several grasses and forbs in this area, including *Achnatherum thurberianum* (Thurber's needlegrass), *Elymus multisetus*, *Vulpia microstachys* (small fescue), *Minuartia douglasii* (Douglas' sandwort), *Eriophyllum lanatum* (woolly-sunflower), *Achillea millefolium* (yarrow), *Phacelia corymbosa* (serpentine phacelia), and *Eriogonum strictum* var. *proliferum* (proliferous buckwheat). Scattered *Ceanothus cuneatus* and *Chrysothamnus nauseosus* shrubs, as well as small *Juniperus occidentalis* and *Pinus ponderosa* trees, also occur on the site (P. Figura, personal observation 2005).

North of this site, several suboccurrences are found in pine woodlands and in small, herb and grass-dominated openings within the woodlands. The understory of these woodlands is generally dominated by perennial grasses such as *Pseudoroegneria spicata* (blue-bunch wheatgrass), *Festuca roemerii*, *Elymus elymoides* (squirreltail) and *Achnatherum lemmonii* (Lemmon's needlegrass). *Ceanothus cuneatus* and *Chrysothamnus nauseosus* are the most common shrubs. Common herbs associated with *Phlox hirsuta* in the woodlands and openings include *Minuartia douglasii*, *Lomatium* sp. (lomatium), and *Erigeron bloomeri* var. *bloomeri* (Bloomer's daisy) (P. Figura, personal observation 2005).

Immediately south of Greenhorn Creek, *Phlox hirsuta* is found on a relatively steep, north-facing slope. Much of the slope is primarily occupied by numerous perennial grasses and forbs, including *Festuca roemerii*, *Pseudoroegneria spicata*, *Aspidotis densa* (Indian's dream), *Eriophyllum lanatum*, *Eriogonum umbellatum* (sulfur-flower), *Eriogonum strictum* var. *proliferum*, and *Polygonum douglasii* var.

johnstonii (Johnston's knotweed). *Chrysothamnus nauseosus* is an occasional shrub. The upper parts of the slope support open woodland dominated by scattered *Pinus ponderosa* and *Calocedrus decurrens* trees (P. Figura, personal observation 2005).

Geology. The geology of the Greenhorn Creek occurrence is similar to that described for the China Hill site (P. Figura, personal observation 2005).

Soils. As mapped by the Soil Conservation Service (1983), the plants on the north side of Greenhorn Creek are located in soil unit 237 (Weitchpec Variant-Rock Outcrop Complex, 5 to 65 percent slopes), while the plants on the south side of the creek are located on soil mapped as unit 178 (Lithic Xerorthents-Rock Outcrop Complex, zero to 65 percent slopes).

Jackson Street Occurrence:

Little is known about the Jackson Street occurrence because access has been limited by private property owners. In 2003, several *Phlox hirsuta* plants were observed adjacent to Jackson Street near its western terminus. That site was described as open woodland with scattered *Pinus ponderosa* and *Juniperus occidentalis* trees (California Natural Diversity Database 2005). The spatial extent and population size of this occurrence remains unknown. Hotz (1977) mapped the site as ultramafic rock and as part of the same ultramafic belt mentioned in the description of the China Hill site. Soils at the site are mapped in the Soil Conservation Service (1983) soil survey as either unit 143 (Dubakella-Ipish Complex, 5 to 30 percent slopes) or unit 213 (Rock Outcrop-Dubakella Complex, 30 to 50 percent slopes). Because this site has not been thoroughly investigated, the exact location of the phlox occurrence is not widely known.

G. Geographic Area Likely to Support Undiscovered Occurrences

The search for additional *Phlox hirsuta* occurrences should be concentrated on ultramafic geological formations in the Yreka and Scott Valley areas. Based on the characteristics of known and reported *P. hirsuta* occurrences (i.e., soils derived from ultramafic parent materials, elevations from roughly 750 to 1,220 meters [2,500 to 4,000 feet], from the vicinity of Yreka to the vicinity of Etna), areas of soil derived from ultramafic rock that occur within roughly 13 kilometers (8 miles) of any point along a line drawn from Paradise Craggy southwest through Yreka to

Etna are considered by the Recovery Team to have the greatest potential to support the phlox (Map 3). Based on proximity to extant occurrences, the portion of this area with the greatest likelihood of supporting additional occurrences extends from slightly northeast of Yreka through the Mineral Range on the northeastern edge of Scott Valley. Adams (1987) conducted a relatively extensive survey of Federal lands with ultramafic soils within this area. However, significant areas of potential habitat that are privately owned remain unsurveyed. In addition, there are some unsurveyed areas of potential habitat on publicly owned and managed lands.

H. Life History

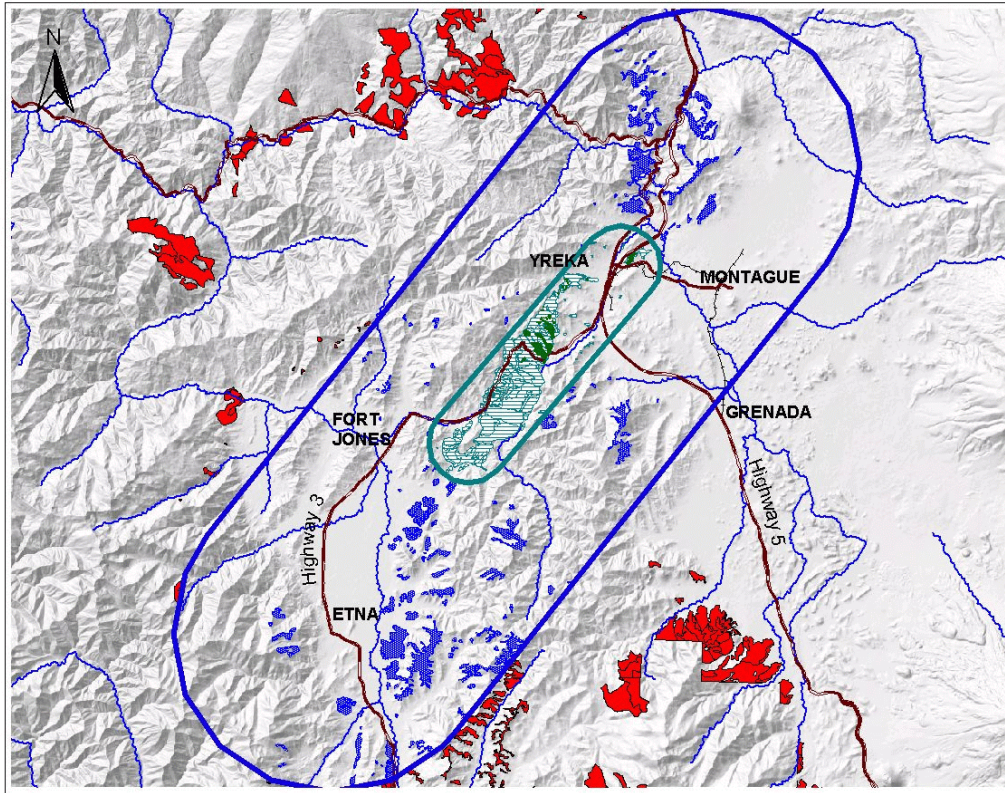
Phlox hirsuta has received little scientific study and its biology is poorly known.

1. Phenology

New vegetative growth (leaves and stems) occurs each year prior to flowering (R. Patterson *in litt.* 2001). From late February to early June, *Phlox hirsuta* plants can form hundreds of flowers in sequential bloom (Ferguson 2004, C. Ferguson *in litt.* 2005) (Figure 5). Each individual flower generally lasts two to three days. The ovary of each flower contains three locules (compartments) and has the potential to form three seeds if fertilized. However, in an ongoing pollination study, researchers have observed a single seed within the fruit capsule at the time of maturation, and this seed fills the entire ovary (Ferguson 2004). Seed set (number of seeds recovered from *P. hirsuta* capsules) and seed viability are unknown; however, in ongoing research, seed set in a subsample of *P. hirsuta* plants ranged between 78 and 92 percent and seed viability was recorded as high as 84 percent (Ferguson 2004, Ferguson and Filipski 2005). Of viable seeds that were planted in pots in the laboratory, 68.5 percent produced viable seedlings. Seedlings raised in a greenhouse took 4 to 22 days to emerge from the soil (Ferguson and Filipski 2005). By mid-summer, above-ground parts of plants become dry and nonphotosynthetic (R. Patterson *in litt.* 2001). In the next season, new growth from the tips of these dry, nonphotosynthetic shoots sometimes occurs.

2. Reproduction

Phlox hirsuta flowers are bisexual (produce both pollen and ovules) but no data exist on their mating system. Preliminary data from ongoing research



- Yreka Phlox occurrences
- Area with greatest likelihood of supporting undiscovered occurrences
- Ultramafic soil units within "greatest potential" area
- Area with reasonable potential to support undiscovered occurrences
- Ultramafic soil units within "reasonable potential" area
- Other ultramafic soil units

Notes:
 Yreka phlox occurrences mapped by the California Natural Diversity Database, by Recovery Team members, and by contractors employed by the U.S. Fish and Wildlife Service.
 Soils data from Soil Conservation Service and Klamath National Forest soil surveys.
 Soils data is incomplete for some areas shown on map.

Map 3. Areas considered most likely to support undiscovered occurrences of *Phlox hirsuta*.

indicates that *P. hirsuta* does not self-pollinate and relies on insects to vector pollen to set fruit and produce seed (Ferguson 2004). To date, insect representatives from four orders (Lepidoptera, Hymenoptera, Diptera, and Coleoptera [butterflies, bees, flies, and beetles, respectively]) have been observed visiting phlox flowers. However, different lepidopterans were most commonly observed probing the corolla tube of *P. hirsuta*. *P. hirsuta* pollen has been identified on the proboscis of three lepidopteran species, the white-lined sphinx moth (*Hyles lineata*), Clark's day sphinx moth (*Proserpinus clarkiae*), and painted lady butterflies (*Vanessa cardui*) (J. Filipski, pers. comm. 2005). In addition, thrips (Order Thysanoptera), which are commonly found associated with *P. hirsuta* flowers (on petals and inside the corolla tube), have been observed carrying phlox pollen grains and may represent another means of vectoring *P. hirsuta* pollen. Other phlox species are pollinated by butterflies (Scott 1997), moths (Wisconsin Department of Natural Resources 2000), and hummingbirds (Oregon State University 1999). The five known *P. hirsuta* occurrences are spatially separated by a minimum of 0.88 kilometer (0.55 mile) (Soap Creek Ridge suboccurrences to Cracker Gulch occurrence) and a maximum of about 3.4 kilometers (2.1 miles) (China Hill to Jackson Street occurrence). Thus, regular gene flow between occurrences seems unlikely (R. Patterson *in litt.* 2001, Recovery Team member observations 2001) because of the distances involved.

Little or no information exists on seed dispersal, seed germination, or seedling establishment in the wild, or even how long *Phlox hirsuta* plants typically live (R. Patterson *in litt.* 2001). Adams (1987) reported values for number of fertile fruits in *P. hirsuta*, but did not correlate these values with actual seed set or seed viability. As a result of ongoing research, biologists recently have been successful in raising *P. hirsuta* plants in the greenhouse (M. Knight, Klamath National Forest, pers. comm. 2005).

I. Reasons for Listing and Current Threats

Section 4 of the Endangered Species Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) state that a species may be determined to be endangered or threatened because of one or more of five factors described in section 4(a)(1). These factors are (A) the present or threatened destruction, modification, or curtailment of a species' habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes;



Figure 5. *Phlox hirsuta* plants at China Hill. Photograph by R. Patterson.

(C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting a species' continued existence. The final rule (U.S. Fish and Wildlife Service 2000) listing *Phlox hirsuta* as an endangered species identified the primary threats to the species as the present or threatened destruction, modification, or curtailment of its habitat or range; urbanization; inadequate State regulatory mechanisms; and potential extirpation as a result of random events. Following is a description of these threats organized according to listing factor. As used below, the term threats includes currently known and potential threats. Currently known threats are those that have been previously identified as having a negative effect on *P. hirsuta*. Potential threats are those whose effects are currently unknown, but would likely have a negative effect on *P. hirsuta* habitat.

1. The present or threatened destruction, modification, or curtailment of its habitat or range

China Hill:

Threats to *Phlox hirsuta* at the China Hill site are destruction of plants and habitat due to residential development, competition with exotic plants, off-road vehicle use, garbage dumping, vandalism, and illegal collection. City of Yreka and Siskiyou County records and aerial photographs indicate that until 1974, there was virtually no disturbance of *P. hirsuta* habitat at this site (L. Bacon, City of Yreka, pers. comm. 2001). However, remnants of a mining ditch, constructed in 1879, are clearly visible on aerial photographs (L. Bacon, pers. comm. 2001). The ditch skirts the southwest edge of the present distribution of *P. hirsuta* plants on China Hill (P. Figura, California Department of Fish and Game, pers. comm. 2005). Therefore, construction of the ditch may have removed plants and permanently altered *P. hirsuta* habitat.

In 1974, the northern portion of the China Hill site was subdivided into eight parcels ranging in size from 4 to 7.3 hectares (10 to 18 acres). This subdivision resulted in a total of nine properties on China Hill, eight of which support *Phlox hirsuta*. Three of the eight are privately owned and five are now owned by the City of Yreka (L. Bacon, pers. comm. 2002; California Department of Fish and Game 2003; M. F. McHugh, pers. comm. 2006; R. Nelson *in litt.* 2006). One privately owned property that was created by the 1974 parcel map division is not known to support *P. hirsuta* plants. Although no residences or buildings have

been constructed on any of the private parcels, several owners have attempted to sell the lots as home sites in recent years. Future home building and associated residential landscaping on these sites could permanently destroy *P. hirsuta* habitat. In 1992, *P. hirsuta* plants were destroyed on one lot when a property owner graded an area for a house pad and installed underground electrical and water lines (L. Bacon, City of Yreka, pers. comm. 2001).

At the time of subdivision, an access road bisecting this *Phlox hirsuta* occurrence was constructed (L. Bacon, City of Yreka, pers. comm. 2001). This unmaintained private roadway is not gated or locked and, as long as it continues to be used for access to this site, likely represents permanent destruction of some *P. hirsuta* habitat. However, Recovery Team members (2002) and others (Knorr 1995, C. Brown, Fruit Growers Supply Company, pers. comm. 2001; Knight 2001; P. Figura *in litt.* 2005c) have observed that *P. hirsuta* is able to recolonize areas that are not continually disturbed (e.g., the center portion of rarely used dirt roads, road cuts).

Adverse impacts from competition with noxious weeds are not currently apparent at the China Hill site. However, scattered populations of two noxious weeds, *Isatis tinctoria* (dyer's woad) and *Centaurea solstitialis* (star thistle) have been observed in areas of occupied habitat on the road that bisects the China Hill site (personal observations by Recovery Team members 2002, 2003). In 2005, during a cursory inventory of China Hill, Patrick Griffin, Siskiyou County Agricultural Commissioner, located four distinct areas where noxious weeds were becoming established in close proximity to *Phlox hirsuta* plants. He removed 47 *I. tinctoria* plants from within occupied *P. hirsuta* habitat in one location and 80 *I. tinctoria* plants from the road and roadsides in two other locations on China Hill. The *C. solstitialis* plants are located on the roadside and are not near any *P. hirsuta* plants, but remain a threat to this occurrence (P. Griffin *in litt.* 2005, M. Knight *in litt.* 2005).

The China Hill site is a popular location for local use because it affords easy access to interesting plant diversity and views of the surrounding area, and is relatively isolated. General public use of the access road has resulted in the creation of several off-road tracks that may have destroyed plants because these tracks run through areas of occupied habitat. Garbage litters portions of the site.

Although currently the extent and volume of the garbage is limited, its presence combined with ease of access to the site, may have the effect of encouraging larger-scale trash dumping in areas of occupied habitat (personal observations by Recovery Team members 2001).

On an April 26, 2001, field trip, Recovery Team members noted that within occupied phlox habitat on a private parcel, several trenches had been dug, filled with potting soil, and planted with ornamental bulbs. It is not known whether individual *Phlox hirsuta* plants were destroyed or removed during this action.

Soap Creek Ridge:

Soap Creek Ridge *Phlox hirsuta* habitat has been disturbed in the past by logging, a small chromium mine, fire suppression activities, domestic animal grazing, and road construction and maintenance (Bowen 1991; J. Davidson, pers. comm. 2001; Knight 2001; K. Garrett *in litt.* 2004, 2005). Newly identified threats include herbicide application along road rights-of-way and competition with exotic and introduced plants.

The primary threats related to logging are road and landing construction as well as the use of heavy equipment within occupied habitat during logging or skidding operations. Although the low density of merchantable trees limits logging opportunities in areas where *Phlox hirsuta* occurs at Soap Creek Ridge, *P. hirsuta* has been observed in areas that have been selectively logged (Knight 2001, P. Figura *in litt.* 2005c). Therefore, it is likely that some plants were destroyed during past logging efforts. However, if properly planned and implemented (i.e., on-the-ground determination of occurrence boundaries, appropriate constraints on the construction and reconstruction of new roads and log landings, appropriate constraints on other equipment use or timber operations within or immediately adjacent to the occurrence), future timber operations are not anticipated to be a substantial threat to *P. hirsuta*.

Although the effects of fire on *Phlox hirsuta* are not known at this time, fire suppression activities may directly affect this species. One year after a fire had burned through *P. hirsuta* habitat, Forest Service staff noted that fire suppression activities may have destroyed plants and removed habitat when fire lines were constructed by tractor blading. However, plants had not been destroyed in places

where the tractor had merely driven over them. Because plants had not been marked before the fire, effects of the fire itself on *P. hirsuta* were impossible to measure (Knorr 1995).

Thirty years ago, the realignment of Highway 3 affected part of the Soap Creek Ridge occurrence (S. Stacey, Caltrans, pers. comm. 1996). Currently, Caltrans requires the acknowledgment of sensitive and listed species occurrences during the project planning and implementation process. However, despite the fact that road maintenance crews are to be made aware that no new ground is to be disturbed along this stretch of highway (R. Sheffield, Caltrans, pers. comm. 1997), the portion of the occurrence within the Caltrans right-of-way could be disturbed by road maintenance or construction activities (Bowen 1991; K. Garrett *in litt.* 2004, 2005). Caltrans has erected markers along the highway shoulder so that crews are aware of occupied *Phlox hirsuta* habitat and can avoid disturbance to these areas during routine road maintenance (R. Irvin, Caltrans, pers. comm. 2006).

Until recently, the area within the highway right-of-way was thought to consist of a total of approximately 100 plants among 5 small subpopulations that occupy less than 0.8 hectare (2 acres) along 4 kilometers (2.5 miles) of California State Highway 3. A sixth subpopulation, which consists of at least 100 plants, was discovered within this same right-of-way area during the spring of 2002 (K. Garrett *in litt.* 2002). This subpopulation is flanked by a cut slope and highway on one side and a stretch of abandoned highway (asphalt has been removed) on the other. Two small *Phlox hirsuta* plants were found growing on the abandoned highway section. Although road construction has resulted in the permanent destruction of some phlox habitat in the Soap Creek Ridge area, *P. hirsuta* plants have been observed on other road cuts and in the median strip of little-used dirt roads (Knorr 1995; C. Brown, pers. comm. 2001; Knight 2001; P. Figura *in litt.* 2005a). In some cases, plants that have recolonized these disturbed areas appear to be vigorous.

Domestic animals may affect *Phlox hirsuta* by grazing and trampling, although the serpentined rock and poor soils on which this species occurs generally support limited forage values. Nonetheless, much of the land in the vicinity of Soap Creek Ridge is utilized to some extent for grazing. Forest Service inventory notes mention that many plants appeared to have been heavily grazed and cropped

back (Barker 1982). However, a 1987 Forest Service inventory found no observable damage from livestock, although it was clear that cattle had used the area in the past (Knight 2001). The effects of domestic animal grazing on *P. hirsuta* are not well understood and should be monitored and researched.

Other threats identified in the process of developing this recovery plan include herbicide application and competition with exotic and introduced plants. Adverse impacts from herbicide application are most likely to occur along State Highway 3 in the Soap Creek Ridge area, where Siskiyou County or other local agencies could potentially spray plants during weed control activities. Siskiyou County occasionally spot sprays for *Centaurea diffusa* (diffuse knapweed), *Centaurea maculosa* (spotted knapweed), *Isatis tinctoria*, and *Tribulus terrestris* (puncture vine) along the shoulder of Highway 3 in the vicinity of *Phlox hirsuta*; however, spraying crews are aware of *P. hirsuta* and do not spray phlox plants (J. DePree *in litt.* 2002). Caltrans does not spray herbicide in this area (K. Garrett *in litt.* 2002). Herbicides may also be applied on private lands following timber harvest or stand-replacing fires to aid in reforestation.

Isatis tinctoria has been observed in areas of occupied habitat at Soap Creek Ridge (personal observations by Recovery Team members 2002). While no adverse effects to *Phlox hirsuta* are currently apparent, substantial infestation by *I. tinctoria* would represent a significant threat.

Cracker Gulch:

The Cracker Gulch occurrence is bisected by a logging road. Although it is unknown whether the construction of the road directly affected any *Phlox hirsuta* plants, plants do occur on both sides of the road. The road is privately owned and is gated, so little public use or off-road vehicle use occurs in the vicinity of the *P. hirsuta* occurrence. The primary threat to this occurrence is ground disturbance associated with timber harvesting. Although there is little merchantable timber within the occurrence boundary, larger trees do occur slightly downhill from the phlox plants (California Natural Diversity Database 2005). However, if properly planned and implemented, timber operations should not adversely affect the plants.

Greenhorn Creek:

The land supporting the Greenhorn Creek occurrence has been subdivided into numerous parcels, many of which are as small as 4 hectares (10 acres). Greenhorn Creek and Greenhorn Road run through the largest parcel (30 hectares [73 acres]) (Nelson 2004), which is owned by the City of Yreka. Threats to *Phlox hirsuta* in this occurrence include grading of suitable habitat for new homes, road construction and landscaping associated with the building of new homes, domestic animal grazing and trampling within fenced enclosures, off-road vehicle use, and invasion by competitive nonnative plants, including *Isatis tinctoria*, *Centaurea solstitialis*, *Taeniatherum caput-medusae* (medusahead), *Cardaria draba* (heart-podded hoary cress), and *Hypericum perforatum* (Klamathweed) (J. Silveira *in litt.* 2005a). In 2004, vehicles were driven across City of Yreka property to access a parcel listed for sale. Once these tracks were created, they were used for off-road vehicle recreation. In the process, the original tracks were lengthened, so that they extend beyond city land and into occupied *P. hirsuta* habitat (J. Silveira *in litt.* 2005b). In response to this newly created threat to *P. hirsuta* plants, City of Yreka employees erected a high earthen berm to discourage the off-road vehicle activity. In addition, earthen berms have been constructed in two other areas adjacent to Greenhorn Road to protect *P. hirsuta* on City of Yreka property from off-road vehicle and other types of recreational access (J. Silveira *in litt.* 2005b, J. Silveira, U.S. Fish and Wildlife Service, pers. comm. 2005).

Jackson Street:

Little information is known about the threats to the Jackson Street occurrence, except that it occurs within a rural residential area. Future home and driveway construction and residential landscaping would threaten this occurrence, as would invasion by competitive nonnative plants. Because little is known about the current extent and condition of the Jackson Street occurrence, other threats cannot be identified at this time.

2. Overutilization for commercial, recreational, scientific, or educational purposes

Phlox hirsuta may be of interest to rock garden enthusiasts (California Native Plant Society 1977). The North American Rock Garden Society (2004) lists wild-collected *P. hirsuta* seeds on their 1999 seed exchange web page. The China Hill occurrence is popular with local gardening groups because of its easy access (M.

Knight, pers. comm. 2005). However, the number and frequency with which seeds or plants may be illegally collected is unknown. Therefore, the impact of this threat on the species is not known.

3. Disease or predation

Threats to the species as a result of disease or predation are poorly understood. Researchers have noted herbivory of flowers within the China Hill and Cracker Gulch occurrences, although the degree to which reproduction is affected has not been determined (C. Ferguson, Southern Oregon University, pers. comm. 2005).

4. The inadequacy of existing regulatory mechanisms

The final Federal rule listing *Phlox hirsuta* as an endangered species indicated that inadequate existing regulatory mechanisms posed a threat to the species (U.S. Fish and Wildlife Service 2000). The inadequacies described were primarily based on uncertainties related to protection measures and/or mitigation requirements pursuant to the species' listing status as endangered under the California Endangered Species Act (CESA) and its protection under the California Environmental Quality Act (CEQA).

CESA prohibits the import, export, take, purchase, sale or possession of any threatened or endangered species or any part or product thereof (section 2080, California Fish and Game Code). It is generally not legal to "take" (destroy or kill) State-listed plants on private lands. However, some activities are specifically exempted from the general take prohibitions in CESA (sections 2080 to 2087 and section 1913, California Fish and Game Code). These activities include certain timber operations, certain mining assessment work and surface mining operations, the removal of listed plants from certain areas (such as ditches, roads, and rights-of-way), and accidental taking that occurs as the result of routine and ongoing agricultural activities that occur on a farm or ranch.

Additionally, it is possible for individuals and/or agencies to obtain specific permits from the Department of Fish and Game allowing endangered plants to be taken. Permits may be issued to individuals, agencies, universities, and other scientific or educational institutions for scientific, educational, and management purposes. Permits may also be issued by the Department of Fish and Game for the take of listed species where the taking is incidental to otherwise lawful activities,

such as for permitted development projects. In these cases, the impacts of such taking must be “minimized and fully mitigated” and must not jeopardize the continued existence of the species (section 2081, California Fish and Game Code).

The Federal rule listing *Phlox hirsuta* as endangered (U.S. Fish and Wildlife Service 2000) noted that this permit and mitigation process was newly amended into CESA, and had not yet been “tested” with regard to its effectiveness in protecting State-listed plants. Impacts to listed plants are often prevented by working with project proponents to avoid activities in occupied habitats. However, where impacts cannot be avoided and incidental take permits are issued by the Department of Fish and Game, “full mitigation” generally involves some combination of 1) minimizing those on-site impacts by limiting or restricting activities in occupied habitats, 2) purchasing or otherwise setting aside off-site land to protect other extant populations in perpetuity, and/or 3) restoring suitable habitat in an effort to establish additional occurrences or increase population size (S. Flint, California Department of Fish and Game, pers. comm. 2005).

In California, activities that meet the definition of a project under CEQA and require discretionary approval by public agencies are subject to CEQA³. The final Federal rule listing *Phlox hirsuta* indicated that mitigation and protection requirements for CEQA projects are dependent on the discretion of the particular lead agency approving a given project. Both the City of Yreka and Siskiyou County Planning Departments prepare an “initial study” to determine whether discretionary project proposals (e.g., new subdivision or parcel map approval, use permits, zone changes, and for the City of Yreka, some grading projects) should be reviewed for effects to State- and federally listed species (M. F. McHugh, City of Yreka, pers. comm. 2006; R. LaTourelle, Siskiyou County Planning Department, pers. comm. 2006). A project review is sent to regulatory agencies seeking information regarding the potential impacts on resources under that agency’s jurisdiction. If the initial study determines that there may be some concern for

³The definition of “project” can be found at section 21065, division 13, of the California Public Resources Code. Certain classes of projects have been statutorily or categorically exempted from CEQA (sections 15260 and 15300 et seq., title 14, California Code of Regulations). CEQA does not apply to projects where the State governmental agency is required by law to act in a set way without being allowed to use its own judgement (“ministerial” projects) (section 21080, division 13, California Public Resources Code and section 15002 (i), title 14, California Code of Regulations). Examples of such “ministerial” projects include issuance of building permits and approval of final subdivision maps (section 15268, article 18, State CEQA Guidelines).

effects to listed species, biological or botanical surveys may be required. CEQA requires analysis of a project's environmental impacts, disclosure of those impacts, and, where feasible, mitigation of those adverse impacts that are determined to be significant. As adverse impacts to species listed pursuant to CESA are generally considered to be significant under CEQA (section 15065, title 14, California Code of Regulations), projects usually contain protection and/or mitigation measures to avoid or minimize impacts to listed plants (even in those cases where project activities may be exempt from the take prohibitions of CESA, as described above).

Pursuant to CEQA (section 21080.3, California Public Resources Code), the Department of Fish and Game is often consulted by lead agencies conducting project reviews, and has the opportunity to provide comments and recommendations regarding biological resource issues related to those projects. Lead agencies approving CEQA projects generally implement the recommendations made by the Department of Fish and Game to avoid and/or mitigate impacts to State-listed plants (R. Williams, California Department of Fish and Game, pers. comm. 2005; R. LaTourelle, pers. comm. 2006).

5. *Other natural or manmade factors affecting its continued existence*

Phlox hirsuta is known from only five sites. These sites occupy approximately 269 hectares (665 acres) in a restricted habitat type (serpentine soils) and occur over a very small range (approximately 65 square kilometers [25 square miles]). As stated in the Final Rule determining the endangered status for this species, "The combination of only two [*now five*] populations, small range, and restricted habitat makes the species highly susceptible to extinction or extirpation from a significant portion of its range due to random events such as fire, drought, disease, or other occurrences (Shaffer 1981, 1987; Meffe and Carroll 1994)."

J. Conservation Measures

The limited distribution and vulnerability of *Phlox hirsuta* has been recognized for many years (U.S. Fish and Wildlife Service 2000). Federal action was initiated by Section 12 of the Act, which directed the Secretary of the Smithsonian Institution to prepare a report on those plants considered to be endangered, threatened, or extinct in the United States. In a January 9, 1975, report to Congress (House Document No. 94-51), the Secretary of the Smithsonian Institution included *P. hirsuta* in the list of endangered species. On June 16, 1976,

the Fish and Wildlife Service published a proposal in the Federal Register to determine endangered status for approximately 1,700 vascular plant taxa, including *P. hirsuta* (U.S. Fish and Wildlife Service 1976). From 1980 until 1993, the Fish and Wildlife Service classified *P. hirsuta* as either a Category 1 or 2 candidate for listing. Category 1 candidates were those for which the Fish and Wildlife Service had on file substantial information on biological vulnerability and threats to support preparation of listing proposals. Category 2 candidates were those for which data indicated that listing was possibly appropriate, but for which substantial data on biological vulnerability and threats were not currently known or on file to support listing proposals. In the February 28, 1996, Federal Register Notice of Review (U.S. Fish and Wildlife Service 1996), *P. hirsuta* was listed simply as a candidate species because that notice discontinued the use of category designations. Candidate species are those taxa for which the Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to support proposals to list a species as threatened or endangered. On April 1, 1998, the Fish and Wildlife Service published a proposed rule in the Federal Register to list *P. hirsuta* as endangered (U.S. Fish and Wildlife Service 1998). On February 3, 2000, the final rule determining endangered status for this species was published (U.S. Fish and Wildlife Service 2000).

Phlox hirsuta was listed as endangered by the State of California in 1986, and has been recognized as being rare and endangered by the California Native Plant Society since 1980. Region 5 of the Forest Service and the Bureau of Land Management, Redding Field Office, have recognized *P. hirsuta* as a Sensitive Species since at least 1979 (Recovery Team members 2002).

By 1984, The Nature Conservancy had prepared an Element Preservation Plan that concluded that both the China Hill and Soap Creek Ridge occurrences warranted protection (Hesseldenz 1984). The plan indicated the China Hill occurrence was of higher conservation priority due to its more substantial and immediate threats. In 1986, the City of Yreka entered into a nonbinding agreement with The Nature Conservancy to protect the China Hill area and its unique natural elements to the best of its ability. Though The Nature Conservancy's "landowner contact" program is no longer active, the City of Yreka has maintained its intent and effort to protect the China Hill site. Three properties supporting *Phlox hirsuta* were donated to the City (two in 1996 and one in 1998).

The City of Yreka has since managed these and its other property on China Hill for the conservation of *P. hirsuta*.

In 2001, the City of Yreka and staff from the Department of Fish and Game submitted a proposal to the California Wildlife Conservation Board (Wildlife Conservation Board) to acquire, on a willing-seller basis, most of the remaining privately held properties on China Hill that supported *Phlox hirsuta*. The goal of this proposal was to acquire a total of 26.02 hectares (64.25 acres) of land, approximately 8 to 12 hectares (20 to 30 acres) of which were occupied by *P. hirsuta*. The Department of Fish and Game's Lands Committee evaluated the proposal and recommended that the Wildlife Conservation Board pursue acquiring the properties. The Wildlife Conservation Board and the City of Yreka initiated the acquisition process, and as a result, the City acquired two additional properties totaling 11.2 hectares (27.6 acres) (L. Bacon, pers. comm. 2002; California Department of Fish and Game 2003; M. F. McHugh, pers. comm. 2006; R. Nelson *in litt.* 2006). The City of Yreka now owns approximately 60 percent of the China Hill occurrence and intends to maintain its commitment to protect *P. hirsuta* at this site.

In recent years, Timber Harvesting Plans for timber operations conducted on private land in the Soap Creek Ridge and Cracker Gulch area have included pre-project *Phlox hirsuta* surveys. When appropriate, site-specific mitigation measures that have been developed in conjunction with the Department of Fish and Game have been designed and implemented by private landowners and timber companies to avoid project-related impacts to *P. hirsuta* plants (P. Figura, pers. comm. 2002).

Several conservation measures have been initiated for *Phlox hirsuta* during the recovery planning process. On July 14, 2003, the Department of Fish and Game was awarded a grant, through section 6 of the Act, to fund willing-seller acquisition of three of the four remaining privately owned parcels on China Hill. The Wildlife Conservation Board has initiated the process of evaluating and appraising these 14 hectares (35 acres). If the land is ultimately acquired, the Wildlife Conservation Board intends to transfer ownership to the City of Yreka.

On August 4, 2003, the Department of Fish and Game was awarded another section 6 grant to fund research on *Phlox hirsuta* pollination. Dr. Carol Ferguson, Southern Oregon University, and her students conducted field work in the spring of 2004 and 2005 (Ferguson 2004, Ferguson and Filipski 2005, Ferguson *in litt.* 2005).

In the fall of 2003, the Fish and Wildlife Service awarded two contracts for *Phlox hirsuta* surveys on private and public lands with serpentine soils within the area considered most likely to support undiscovered occurrences (Map 3). Over the last two field seasons, 11 private landowners have granted permission to survey their lands (Lenz 2004, 2005; Nelson 2004; L. Nelson *in litt.* 2005). To date, 560.1 hectares (1,383 acres) have been surveyed for *P. hirsuta* on private lands and public lands managed by the City of Yreka, Forest Service, and Bureau of Land Management (M. Lenz *in litt.* 2005, L. Nelson *in litt.* 2005). As a result of these surveys, new suboccurrences have been found in the Greenhorn Creek and Soap Creek Ridge occurrences.

In 2005, two conservation actions were implemented in response to immediate and localized threats to *Phlox hirsuta*. The City of Yreka erected earthen berms in three locations of the Greenhorn Creek occurrence to prevent further off-road vehicle and other types of recreational damage to *P. hirsuta* plants and habitat (J. Silveira *in litt.* 2005a, 2005b; J. Silveira, pers. comm. 2005). In May, Siskiyou County staff mapped noxious weed locations and removed 127 *Isatis tinctoria* plants from China Hill to prevent them from going to seed. Control of *I. tinctoria* will require a dedicated and continuing effort (P. Griffin *in litt.* 2005).

As they have in years past, the Forest Service and California Native Plant Society continue to sponsor the *Phlox hirsuta* display at the annual Siskiyou County Wildflower Show and offer information on ongoing recovery efforts.

K. Recovery Strategy

The primary threats to *Phlox hirsuta* involve the destruction of plants and/or modification of habitat from activities such as residential development, road construction, timber management, competition with exotic invasive weeds, and off-road vehicle use. Additionally, due to its limited distribution, *P. hirsuta* is susceptible to extinction or extirpation from a significant portion of its range as a

result of random events such as fire, drought, and disease. Because of these threats, the long-term viability of *P. hirsuta* is currently uncertain.

Although *Phlox hirsuta* biology and ecology are poorly understood, field observations by Recovery Team members between 2000 and 2005 suggest that *P. hirsuta* populations may be relatively stable, individual plants may be long-lived, and seedling establishment may be infrequent. Very few *P. hirsuta* seedlings have been observed by Recovery Team members during this time period, while specific mature plants have been observed to persist over several years. Additionally, mature flowering plants have been observed in a wide range of size classes, suggesting that some plants are fairly old (assuming that, in general, plant size is positively correlated with age). Therefore, if the threats described above (and any other threats that are identified in the future) can be removed or minimized, and if techniques can be developed to augment the reestablishment of *P. hirsuta* populations in case of unforeseen future population losses, it is expected that *P. hirsuta* can be recovered. The significant protection measures and the long-term management approach proposed in this recovery plan provide a conservation strategy that should permit downlisting, and hopefully the eventual delisting, of *P. hirsuta*.

Because the primary threat is direct modification of habitat, it is critical to protect and secure occupied sites through acquisition and/or binding conservation agreements. Unsurveyed land in the vicinity should be surveyed so that undiscovered populations can be identified and protected, which will facilitate eventual delisting of the species. Both land protection and surveys will be facilitated by improved public awareness and appreciation of the species, so public outreach and information programs should be developed and maintained. Establishment of a seed bank (*i.e.*, *ex situ* storage of seed) and controlled propagation programs will also improve options for reestablishment of the species in the event of catastrophic population loss or destruction of existing habitat. Over a longer time frame, appropriate management of populations at protected sites will be necessary for the species to persist. Thus, the sites should be monitored to assess population trends, habitat condition, and the status of new or ongoing threats. Because basic biology of the species is poorly known, effective management for conservation of the species will require additional information on life history, breeding system, pollinators, and effects of soil disturbance and fire

management. Monitoring and research information should be adaptively incorporated into site management plans.

Thus, in order to accomplish the recovery plan objectives of downlisting and delisting *Phlox hirsuta*, the Recovery Team has developed a six-step strategy. This strategy consists of 1) protecting and securing the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences⁴ of *P. hirsuta* (i.e., all occurrences known as of January 1, 2002, when the recovery criteria were being developed), or alternatively, the China Hill and Soap Creek Ridge occurrences are protected, and substitutes representing the Jackson Street and/or Cracker Gulch occurrences are protected⁵; 2) developing and implementing a monitoring strategy that will identify existing and new threats to *P. hirsuta*, and implementing a management strategy at each protected site to ensure long-term persistence; 3) creating and maintaining a seed bank and developing propagation techniques in case of future population losses; 4) surveying for undiscovered occurrences of *P. hirsuta*; 5) conducting research on the biology and ecology of *P. hirsuta*; and 6) enhancing public awareness, understanding, and participation in *P. hirsuta* recovery. How these steps specifically may lead to downlisting or delisting is discussed in the Recovery Criteria section below.

⁴As used in this document, a *Phlox hirsuta* occurrence consists of a group of at least 200 individual plants that is separated from any other occurrence by at least 0.40 kilometer (0.25 mile).

⁵A substitute for the Jackson Street occurrence would be a newly discovered occurrence that would consist of an equal or greater number of plants than the Jackson Street occurrence and be located between China Hill and Soap Creek Ridge (e.g., Greenhorn Creek). Therefore, the resulting geographic distribution of occurrences would approximate the current distribution and would facilitate potential genetic exchange. A substitute for the Cracker Gulch occurrence would be a newly discovered occurrence that would consist of an equal or greater number of plants than the Cracker Gulch occurrence without restriction on location. Substitute occurrences consist of a group of at least 200 individual plants that is separated from any other *Phlox hirsuta* occurrence by at least 0.40 kilometer (0.25 mile).

II. RECOVERY

A. Goals and Objectives

This recovery plan includes specific recovery criteria that, when met, will accomplish the following two objectives: 1) permit consideration of reclassifying *Phlox hirsuta* from endangered to threatened and 2) permit consideration of removing *P. hirsuta* from the list of endangered and threatened species.

B. Recovery Criteria

The actual downlisting or delisting of a listed entity (*i.e.*, species, subspecies, or distinct population segment) is achieved through a formal rulemaking process. The recovery criteria set forth in a recovery plan are intended to serve as objective, measurable guidelines to assist us in determining when a listed entity has recovered to the point that the protections afforded by the Endangered Species Act are no longer necessary. However, the actual downlisting or delisting process is not solely dependent upon achieving the recovery criteria; it is achieved through the formal rulemaking process based upon a five factor analysis (per section 4(a)(1) of the Endangered Species Act), in conjunction with an analysis of the recovery criteria, that results in a determination that the threats to the listed entity have been sufficiently controlled or eliminated such that downlisting or delisting is warranted.

To reclassify *Phlox hirsuta* from endangered to threatened status (*i.e.*, to downlist), the following criteria must have been met: (a) the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences have secure permanent protection, or alternatively, the China Hill and Soap Creek Ridge occurrences are protected and substitutes representing the Jackson Street and/or Cracker Gulch occurrences are protected (see footnote 4 in the Recovery Strategy section above), and (b) a *P. hirsuta* seed bank and effective propagation techniques have been established. To delist *P. hirsuta*, the following criteria must have been met: (a) the reclassification criteria (described above) have been met and (b) two additional occurrences have been located and permanently protected, or 10 years of demographic research and/or quantitative monitoring at four protected

occurrences has demonstrated that plant population size has not declined more than 10 percent at any occurrence (total change between year 0 and year 10)⁶.

C. Stepdown Narrative

Recovery actions needed to implement the recovery strategy for *Phlox hirsuta* are outlined below in stepdown format. Recovery actions are linked with threats and recovery criteria in Appendix 7.

- 1 Protect and secure the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch *Phlox hirsuta* occurrences. Alternatively, protect the China Hill and Soap Creek Ridge occurrences and protect substitutes representing the Jackson Street and/or Cracker Gulch occurrences.

The Recovery Team determined that protecting and securing the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences is essential to the conservation and recovery of the species. The Recovery Team also anticipated that if additional surveys were conducted, additional *Phlox hirsuta* occurrences might be discovered. The recovery strategy is to protect the two occurrences recognized at the date of Federal listing (China Hill and Soap Creek Ridge), as well as protecting two additional occurrences that have been recognized and/or discovered since that listing. There is no substantial evidence suggesting that any historical *P. hirsuta* occurrences have been extirpated (although see the discussion of the possible “Mill Creek near Etna Mills” occurrence in the Introduction). Therefore, the recovery strategy is to secure and protect all known occurrences and does not anticipate the need to establish any new occurrences or reestablish known existing occurrences, except in the case of future catastrophic population loss or destruction of existing habitat.

⁶ The percent change in plant population size will be estimated using data collected from annual monitoring. Prior to the initiation of detailed monitoring surveys and/or demographic study, a pilot study should be undertaken to determine if 10 years represents an appropriate time scale to measure population changes for *Phlox hirsuta* and to guide the development of a sampling design with the statistical rigor to detect such changes.

“Protecting and securing” occurrences will involve the development of legally binding arrangements that ensure the land supporting the occurrence will be perpetually managed for the benefit of *Phlox hirsuta*⁷. Practical methods for ensuring this protection include acquisition of land supporting phlox (from willing sellers) by public agencies or private organizations with formal commitments to phlox conservation, development of Conservation Agreements between the Fish and Wildlife Service and landowners, or similar arrangements with other public or private conservation organizations.

In addition to protecting land supporting each occurrence, a 45-meter (150-foot) buffer⁸ around each occurrence or suboccurrence should also be protected, where feasible, to reduce external influences and allow expansion of populations. Depending on the nature of particular occurrences or suboccurrences, larger buffers may be warranted. In some cases, as in the China Hill occurrence, the land ownership pattern will naturally provide for such a buffer. Buffers will be managed in the same manner as their associated protected occurrences.

1.1 Protect and secure the China Hill occurrence.

Collaboration between the City of Yreka, Department of Fish and Game, and the Wildlife Conservation Board led to the purchase, in 2002, of two privately held properties from willing sellers at China Hill. Fee title has been transferred to the City of Yreka, which has indicated that it is willing to

⁷Specific management strategies should be developed for each occurrence. Such strategies will include permitted management activities at or adjacent to each occurrence that will minimize known threats (identified in this document or in the listing notice published in the Federal Register [U.S. Fish and Wildlife Service 2000]) and identify new threats to *Phlox hirsuta* survival and recovery. Activities that do not threaten the survival and recovery of *P. hirsuta* should be identified and permitted within occurrence and/or buffer boundaries.

⁸The buffer distance was chosen by the Recovery Team, based on the professional opinion of its members. The Recovery Team believes that, in most cases, the maintenance of a 45-meter buffer around occurrences and/or suboccurrences (within which certain potentially threatening activities are limited) will be sufficient to preclude adverse impacts to *Phlox hirsuta* plants from the potential threats specifically identified in the Recovery Plan. Managing these buffers to limit threats to the phlox would also maintain conditions suitable to permit seedling recruitment and phlox establishment beyond the limits of the existing occurrence boundaries (where present).

manage the China Hill area indefinitely for the benefit of *Phlox hirsuta* (and potentially for other compatible uses). If three additional properties are acquired, the City will own the land that supports approximately 95 percent of the China Hill phlox occurrence. Should the Wildlife Conservation Board be unable to purchase these three properties, these unprotected portions of this occurrence will need to be protected and secured by developing conservation agreements or easements with willing landowners.

- 1.2 Protect and secure the Soap Creek Ridge, Cracker Gulch, and Jackson Street occurrences. Alternatively, protect the Soap Creek Ridge occurrence and substitutes representing the Jackson Street and Cracker Gulch occurrences.

Protect these occurrences (on both private and publicly managed land) through willing-seller acquisition, conservation agreements, easements, and other economic incentives. Some of these occurrences (and potential substitutes) are comprised of several discrete suboccurrences scattered over an area of mixed ownership. Thus, the land supporting these occurrences may be owned and managed by various parties, including the Forest Service, Caltrans, City of Yreka, industrial timber companies, nonindustrial timber and ranch owners (i.e., from tens to hundreds of hectares or tens to thousands of acres), and relatively small-property residential owners (approximately 2 to 8 hectares, or 5 to 20 acres). Protection agreements and strategies will likely vary depending on the particular owner or manager and the specific location and size of the phlox occurrence or suboccurrence.

- 2 Develop and implement a monitoring strategy for all occurrences that will identify existing and new threats over a period of at least 10 years. Implement a management plan at each protected site to ensure the long-term persistence of *Phlox hirsuta*.

2.1 Prepare a monitoring plan that will identify threats and adverse impacts to *Phlox hirsuta* occurrences.

The monitoring plan should be developed by biologists, landowners, and land managers and should include a specific monitoring protocol that will be applied consistently throughout the monitoring period. The monitoring period must extend for at least five years after *Phlox hirsuta* has been delisted, to comply with the monitoring provisions in section 4(g)(1) of the Act. Monitoring should focus on determining habitat condition, anthropogenic threats⁹, and gross population response to these factors. Monitoring may, but need not, include detailed assessments of population size and demography (but see also Task 5.1). If assessments of population size will be included, a pilot study should be conducted to guide the development of a final sampling design that will permit efficient detection of long-term population changes. The monitoring plan should also specify qualifications for monitoring personnel. Familiarity with *P. hirsuta*, the ecology of ultramafic habitats, and threats to *P. hirsuta* should be minimum qualifications for those leading monitoring efforts. The plan should also prescribe periodic reporting procedures to ensure monitoring results are regularly forwarded to relevant stakeholders and agencies (i.e., private landowners, Forest Service, Fish and Wildlife Service, Department of Fish and Game, Caltrans, etc.).

Because the majority of the occurrences and suboccurrences are located on private land, monitoring protocols will need to be developed in consultation with willing landowners. For this reason, any conservation agreements or easements developed per Actions 1.1 and 1.2, should include provisions for regularly scheduled monitoring.

⁹ Anthropogenic (i.e, human-mediated) threats are residential development, off-road vehicle use, introduction or expansion of competitive nonnative plants, removal of plants by collectors, illegal dumping, grazing and other impacts from domestic animals, fire suppression activities, pesticide and/or herbicide application, timber operations, and road construction and maintenance operations. Not all threats apply to all occurrences.

2.2 Implement threat monitoring.

Monitoring and periodic reporting procedures should be implemented according to the monitoring plan. Activities and other events which appear to be adversely affecting *Phlox hirsuta* plants or phlox habitat should be immediately reported to relevant parties (Fish and Wildlife Service, Department of Fish and Game, the landowner or land manager of any occurrence, as well as any other agency or organization involved in a conservation agreement related to those occurrences) so that steps can be taken to immediately ameliorate these adverse impacts.

2.3 Prepare a monitoring report at the end of 10 years that summarizes the findings of the threat-monitoring program.

The monitoring program report should identify any activities found to have adversely affected *Phlox hirsuta* and describe any changes in habitat condition that occurred during the monitoring period. The report should identify any ongoing threats to *P. hirsuta* occurrences and should include strategies to neutralize those threats. Based on the findings of the monitoring effort, the report should also determine whether all anthropogenic threats to *P. hirsuta* have been effectively neutralized by existing conservation measures developed in Action 2.2.

2.4 Develop and implement a management plan for each protected site.

Based on information gained during the threat-monitoring program and as a result of biological and ecological research conducted in Actions 5.1, 5.2, 5.3, and 5.4, develop and implement a management plan for each protected site. Such management plans will include any actions needed to eliminate or minimize all threats to each occurrence and enhance *Phlox hirsuta* habitat.

3 Create and maintain a seed bank and develop propagation techniques in case of unforeseen future population losses.

The seed bank will serve as a repository of plant material that can potentially be used to 1) repopulate existing occurrences if they suffer catastrophic population losses due to disease, habitat modification, etc., or 2) create new populations in currently unoccupied areas if the habitat supporting current occurrences is ever destroyed. If future evidence indicates that collection for horticultural purposes occurs frequently and is not controlled by outreach, development of propagation techniques and guidelines to permit legal propagation and sale in nurseries could be considered to decrease this threat. Propagation techniques may also be used to create additional individuals for reintroduction or establishment of wild populations if existing occurrences are inadvertently damaged in the future.

3.1 Write and implement a plan for seed storage.

A seed storage plan should be prepared by personnel with botanical training working in consultation with individuals and institutions experienced in long-term seed storage (such as the Center for Plant Conservation in St. Louis, Missouri, and the Berry Botanic Garden in Portland, Oregon). Included in the plan should be a determination of an appropriate number of seeds to be collected from each known occurrence and the length of collection intervals needed to maintain seed viability with adequate genetic diversity in perpetuity. Specific collecting protocols that promote seed collection that is scientifically sound and in accordance with Federal and State laws and policies should also be included. The plan should be a dynamic document that can be easily modified as new information about *Phlox hirsuta* seed characteristics and ecology is developed.

3.2 Write and implement a plan to develop propagation techniques. If future evidence indicates that collection for horticultural purposes occurs frequently and is not controlled by outreach about *Phlox hirsuta*, then consider developing guidelines which would allow legal nursery acquisition and sale of *P. hirsuta* plants without threatening native populations.

Development of propagation techniques, as well as any collection, acquisition, and sale of *Phlox hirsuta* will need to be conducted in accordance with Federal and State laws and policies. Research on propagation should be conducted by horticulturists and nursery professionals experienced in native plant propagation techniques.

- 3.3 Prepare a reintroduction plan that 1) specifies the conditions warranting and 2) guides the potential reintroduction of “off-site” *Phlox hirsuta* plant material (seeds or plants) into areas currently supporting phlox or for establishing new wild-land occurrences.

In case there is an unforeseen catastrophic loss of an existing *Phlox hirsuta* occurrence, it could be necessary to use stored seeds or propagated plant material to reestablish a wild-land occurrence(s). Conditions warranting such an action should be specified in the plan (e.g., is total loss of an occurrence necessary prior to reintroduction efforts, or is documentation of severe population decline sufficient?). The reintroduction plan should aim to maintain the genetic integrity of existing occurrences. Therefore, restrictions on the origin and age of the material used in the introduction should also be developed.

- 4 Survey for undiscovered occurrences in unsurveyed areas likely to support *Phlox hirsuta*. For the purposes of this document, the geographic area most likely to support undiscovered occurrences of *P. hirsuta* is defined as soils derived from ultramafic rock occurring within 13 kilometers (8 miles) from any point along a line drawn from Paradise Craggy southwest through Yreka to Etna, California (Map 3).

Areas of potential habitat for *Phlox hirsuta* remain unsurveyed, particularly on private land, but also to a lesser extent on public lands (e.g., Caltrans, City of Yreka, Forest Service, and Bureau of Land Management). Recently identified occurrences (Cracker Gulch, Jackson Street, and Greenhorn Creek) and suboccurrences (Soap Creek Ridge) on private and public lands indicate the potential for discovering additional occurrences remains substantial.

4.1 Create a map that shows where surveys have been completed.

At the present time, negative and positive survey results are not compiled in one database. A map showing where *Phlox hirsuta* surveys have been completed will be an important tool to aid in efficient gathering and display of occurrence information. Annual updates to the map are essential.

4.2 Create incentives for private- and public-land surveys.

Private landowners may be wary of permitting agency biologists or contractors to examine their property due to fear that use restrictions may be placed on their land if a listed species is identified. Agency outreach efforts can show landowners that, with careful planning and implementation, ongoing land uses (e.g., timber operations and ranching) can be compatible with *Phlox hirsuta* conservation.

Incentives for landowners to allow enhanced access to private land might include direct financial assistance and/or an understanding of potential regulatory relief resulting from identification of additional *Phlox hirsuta* occurrences. For example, if a landowner is likely to have to eventually pay for a survey in order to conduct a permitted activity (e.g., timber operations pursuant to a timber harvesting plan), the owner may be willing to allow surveyors access to their land if the survey cost is borne by an outside party. Funding for these surveys may be sought from public agencies and private conservation organizations. Likewise, such funding could also be directed toward surveying the relatively few areas on public lands where surveys have not been completed because of funding shortfalls or because priority for botanical surveys is low compared to other agency functions.

Additionally, access to private lands may be permitted if a landowner understands that an occurrence of phlox on their property may be a financial opportunity due to the potential for payment or tax relief resulting from a conservation easement or other agreement.

Also, since one of the delisting pathways is contingent upon locating at least two additional occurrences of *Phlox hirsuta*, landowners may be willing to allow access to their land if they are made aware that land use restrictions related to phlox potentially could be removed as a result of delisting, if additional occurrences are located.

- 4.3 Protect and secure at least two additional *Phlox hirsuta* occurrences (in addition to the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences) if needed for delisting (see Recovery Criteria section above).

Protection will need to involve a legally binding agreement, as described in Stepdown Action 1 above.

- 5 Conduct biological research and use the results to guide recovery and conservation efforts.

Better understanding of *Phlox hirsuta* biology and ecology will permit more effective management of existing phlox occurrences. As this knowledge increases, management strategies can be modified to better encourage the survival, reproduction, and recruitment of individual phlox plants.

Applying these strategies will allow managers, and others responsible for phlox protection, to appropriately develop and/or modify the conditions of conservation agreements and easements developed to protect *P. hirsuta*.

- 5.1 Determine whether *Phlox hirsuta* populations are stable, increasing, or declining over time.

Population trends within *Phlox hirsuta* occurrences are unknown. Anecdotal field observations seem to suggest that populations at the China Hill and Soap Creek Ridge occurrences are relatively stable, that individual plants may be long-lived, and that seedling establishment is infrequent. Quantitative monitoring and/or demographic studies should be conducted to determine both typical short-term population changes (i.e., 1 to 3 years) as well as longer-term population trends (10 years or more). One of the two delisting

pathways is contingent upon long-term (10 or more years) monitoring of population trends at known occurrences. Prior to initiating long-term quantitative monitoring, a pilot study should be conducted to guide the development of a final sampling design that will permit efficient and statistically robust detection of long-term population changes.

- 5.2 Determine breeding system, degree of seed production and seed viability, seed dormancy characteristics, and germination requirements.

Very little information about the reproductive ecology of *Phlox hirsuta* is available. Preliminary observations by Klamath National Forest staff (Adams 1987) indicated that on plants producing flowers, an average of 32 percent of the flowers develop into mature fruits (presumably containing fully developed seeds). Research conducted at Southern Oregon University has yielded valuable information about the breeding system, seed production and viability, dormancy characteristics, and germination requirements. However, additional information about the breeding system and reproductive ecology of *P. hirsuta* is necessary.

- 5.3 Determine pollinators and pollination success.

Recent research indicates that *Phlox hirsuta* is insect-pollinated and has documented some of the insect visitors to phlox flowers. Depending on the characteristics of its pollinators (i.e., whether it is pollinated by one or a few specific animals or by numerous taxa, whether these animals are common or uncommon in areas occupied by the phlox, etc.), adequate phlox management may require the creation and/or maintenance of habitat for those taxa.

- 5.4 Determine whether specific disturbances (e.g., fire or soil disturbance) or other management actions are needed for successful or enhanced recruitment.

Field observations indicate that *Phlox hirsuta* is sometimes able to successfully establish on previously disturbed areas (little-used roadbeds and other areas that have been historically graded). However, the frequency of successful establishment in both disturbed and undisturbed habitats is unknown. The morphology of *P. hirsuta* seedlings is not well understood. It is not known whether fire stimulates seed germination. Thus, observers are currently unable to discern the extent to which seedling establishment occurs, characterize the microsites where establishment occurs, or determine the conditions needed for seedling establishment.

- 6 Enhance public awareness, understanding, and participation in *Phlox hirsuta* recovery.

Public appreciation of *Phlox hirsuta* and participation in recovery efforts will likely be vital to successful long-term phlox conservation. Information about *P. hirsuta* and its conservation needs could be displayed in the Yreka City Hall lobby, Siskiyou County libraries, and Siskiyou County Museum. Local school students could be encouraged to participate in *P. hirsuta* conservation projects. Public awareness of the rarity and beauty of *P. hirsuta* may also foster an enhanced appreciation of the unique character of the regional flora and natural history.

- 6.1 Participate in the Siskiyou County Wildflower Show.

Phlox hirsuta displays at the annual Siskiyou County Wildflower Show in Yreka on Mother's Day should be continued. The Siskiyou County Wildflower Show is sponsored by the Klamath National Forest in partnership with the California Native Plant Society. When feasible, staff from various regulatory and management agencies (Fish and Wildlife Service, Department of Fish and Game, Forest Service, etc.) should be available to discuss *P. hirsuta* with interested attendees of the show. In addition to the general information contained in the display, updated information on conservation activity should also be included as recovery efforts continue.

- 6.2 Develop China Hill interpretive display and encourage public participation.

Interpretive signs and brochures (and perhaps foot trails) that explain *Phlox hirsuta* ecology and management should be installed on City of Yreka property at China Hill. Public participation in management and ongoing maintenance activities at China Hill should be invited and encouraged by the City of Yreka and other agencies.

- 6.3 Encourage public participation in long-term monitoring.

To the extent feasible, interested members of the public should be invited to participate in long-term monitoring of *Phlox hirsuta* populations. Training of volunteers will foster public awareness of *P. hirsuta* and local environmental changes (e.g., exotic species introduction, new creation of off-road vehicle tracks, evidence of illegal collection, garbage dumping, and residential development), as well as provide a relatively low-cost labor pool to contribute to monitoring efforts.

III. IMPLEMENTATION SCHEDULE

The following implementation schedule outlines actions and estimated costs for the *Phlox hirsuta* recovery program. The schedule is a guide for meeting the objectives and criteria discussed in Part II of this recovery plan. The implementation schedule describes and prioritizes actions, provides an estimated time-table for performance of actions, indicates responsible agencies, and estimates costs of performing actions. Cost figures provided here are intended as gross estimates for general planning purposes. In this document, cost figures developed in 2002 and published in the draft Recovery Plan, have been converted to 2006 dollar-amount equivalents using a Consumer Price Index calculator (Federal Reserve Bank of Minneapolis 2006). Annual costs were estimated as being proportional to the original cost break-down structure and because of this, rounding errors have been introduced in some instances. More detailed budget analyses will have to be undertaken by the responsible agencies. These actions, when accomplished, are expected to bring about the recovery of *P. hirsuta*.

1. Priority. The priority for each action is given in the first column of the implementation schedule. Priorities are assigned as follows:

Definition of action priorities:

Priority 1 - An action that must be taken to prevent extinction or prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in the species' population or habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

2. Action Number and Description. The action number and description are extracted from the Stepdown Narrative found in Part II of the recovery plan. Please refer back to this narrative for a more detailed description of each action.

3. Action Duration. The action duration column indicates the number of years estimated to complete the action if it is a discrete action, or whether it is a continual or ongoing action.

Definition of action durations and costs:

Continual - An action that will be implemented on a routine basis once begun.

Ongoing - An action that is currently being implemented and will continue until the action is no longer necessary for recovery.

TBD - To be determined.

Unknown - Action duration, responsible party, or associated costs are not known.

4. Responsible Parties. In the implementation schedule, we have identified agencies and other parties that are primary stakeholders in the recovery process. The list of potential stakeholders is not limited to the list below; other stakeholders are invited to participate. The most logical lead agency or agencies from the list of responsible parties (based on authorities, mandates, and capabilities) has been identified with an asterisk (*). The following abbreviations are used to indicate the responsible party for each recovery action:

Key to Responsible Party Acronyms used in the Implementation Schedule

ACAD	Academic Institutions
BLM	Bureau of Land Management
CDFG	California Department of Fish and Game
CALTRN	California Department of Transportation
CNPS	California Native Plant Society
CPC	Center for Plant Conservation
FWS	U.S. Fish and Wildlife Service
FS	U.S. Forest Service
PVT	Private Companies and/or Private Landowners
SC	Siskiyou County

WCB State of California Wildlife Conservation Board
Yreka City of Yreka

5. Cost Estimates. Estimated total and annual cost for each recovery action for the first 5 years after release of the recovery plan are shown. Total costs for continual and ongoing actions are based on the estimated time to recovery. The costs include estimated salaries for individuals who will carry out identified actions. However, these costs are approximate and based primarily on estimates agreed on by members of the Recovery Team during recovery plan meetings. In most cases these costs were estimated without the benefit of a scope-of-work or any other type of bid process. Typically, the responsible party (or lead agency) bears the largest share of the cost, with other stakeholders as contributors. The inclusion of estimated costs in this recovery plan does not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these actions is subject to the availability of funds as well as other constraints affecting the stakeholders involved.

Implementation Schedule for the <i>Phlox hirsuta</i> Recovery Plan										
Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					
					Total Costs	FY 1	FY 2	FY 3	FY 4	FY 5
1	1.1	Protect and secure China Hill occurrence	3	*CDFG, FWS, PVT, WCB, Yreka	216	0	0	216	0	0
1	1.2	Protect and secure Soap Creek Ridge, Cracker Gulch, and Jackson Street occurrences. Alternatively, protect the Soap Creek Ridge occurrence and substitutes for Cracker Gulch and Jackson Street occurrences	5	CALTRN, FS, *FWS, PVT	112	TBD	TBD	TBD	TBD	TBD
1	3.1	Write and implement a plan for seed storage	4	*ACAD, CDFG, CPC, FWS	6	2	2	1	1	0

Implementation Schedule for the <i>Phlox hirsuta</i> Recovery Plan										
Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					
					Total Costs	FY 1	FY 2	FY 3	FY 4	FY 5
1	3.2	Write and implement a plan to develop propagation techniques. If future evidence indicates that collection for horticultural purposes occurs frequently and is not controlled by outreach about <i>Phlox hirsuta</i> , then consider developing guidelines which would allow legal nursery acquisition and sale of <i>P. hirsuta</i> plants without threatening native populations	4	*CDFG, FS, *FWS, SC, *NURSERIES	7	3	2	1	1	0
Priority 1 actions subtotal					341					
2	2.1	Prepare a monitoring plan that will identify threats and adverse impacts to <i>Phlox hirsuta</i> occurrences	2	ACAD, CDFG, FS, *FWS, PVT	17	11	6	0	0	0
2	2.2	Implement threat monitoring	10	FS, *FWS, PVT, Yreka	112	11.2	11.2	11.2	11.2	11.2

Implementation Schedule for the <i>Phlox hirsuta</i> Recovery Plan										
Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					
					Total Costs	FY 1	FY 2	FY 3	FY 4	FY 5
2	2.4	Develop and implement a management plan for each protected site	Continual	*CDFG, CALTRN, FS, *FWS, PVT, Yreka	45	TBD	TBD	TBD	TBD	TBD
2	5.1	Determine whether <i>Phlox hirsuta</i> populations are stable, increasing, or declining over time	10	*ACAD, CDFG, FWS	56	11	9	4.5	4.5	4.5
2	5.2	Determine breeding system, degree of seed production and seed viability, seed dormancy characteristics, and germination requirements	10	*ACAD, CDFG, FWS	56	11	9	4.5	4.5	4.5
2	5.3	Determine pollinators and pollination success	5	*ACAD	34	6.8	6.8	6.8	6.8	6.8
2	5.4	Determine whether specific disturbances (e.g., fire or soil disturbance) or other management actions are needed for successful or enhanced recruitment	10	*ACAD	56	5.6	5.6	5.6	5.6	5.6
Priority 2 actions subtotal					376					

Implementation Schedule for the <i>Phlox hirsuta</i> Recovery Plan										
Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					
					Total Costs	FY 1	FY 2	FY 3	FY 4	FY 5
3	2.3	Prepare a monitoring report at the end of 10 years that summarizes the findings of the threat-monitoring program	1	CALTRN, CDFG, FS, *FWS, PVT, Yreka	7	0	0	0	0	0
3	3.3	Prepare a reintroduction plan that 1) specifies the conditions warranting and 2) guides the potential reintroduction of “off-site” <i>Phlox hirsuta</i> plant materials (seeds or plants) into areas currently supporting phlox or for establishing new wild-land occurrences	10	*ACAD, CDFG, CPC, FS, FWS, PVT	16	6	1.1	1.1	1.1	1.1
3	4.1	Create a map that shows where surveys have been completed	10	*CDFG	4.22	1.7	0.28	0.28	0.28	0.28
3	4.2	Create incentives for private- and public-land surveys	10	CDFG, *FWS, SC, Yreka	56	5.6	5.6	5.6	5.6	5.6

Implementation Schedule for the <i>Phlox hirsuta</i> Recovery Plan										
Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					
					Total Costs	FY 1	FY 2	FY 3	FY 4	FY 5
3	4.3	Protect and secure at least two additional <i>Phlox hirsuta</i> occurrences (in addition to the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences)	Continual	FS, *FWS, PVT, Yreka	112	TBD	TBD	TBD	TBD	TBD
3	6.1	Participate in the Siskiyou County Wildflower Show	Ongoing	CDFG, CNPS, *FS, FWS, Yreka	2	0.2	0.2	0.2	0.2	0.2
3	6.2	Develop China Hill interpretive display and encourage public participation	10	CNPS, *Yreka	34	17	6	2.2	2.2	1.1
3	6.3	Encourage public participation in long-term monitoring	Continual	CDFG, CNPS, FS, FWS, *Yreka	2	0.2	0.2	0.2	0.2	0.2
Priority 3 actions subtotal					233.22					
Total Estimated Cost of Recovery					950.22					

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V. APPENDICES

Appendix 1. A Nomenclatural History of *Phlox hirsuta*

(Prepared by Dr. Frank A. Lang)

- 1899 Nelson, E. 1899. Revision of the Western North American Phloxes. Contr. Dept. Bot. and Rocky Mtn. Herb. 27:1-35.

Phlox hirsuta was described by Elias Nelson based on a single specimen collected by Edward Lee Greene (No. 719, "Rocky hilltops near Yreka, Siskiyou County, California", April 26, 1876). No other specimens were cited. The type specimen is at Missouri Botanical Garden. Elias Nelson was a student of Aven Nelson at the University of Wyoming, and the publication resulted from E. Nelson's Master Degree research. Both Nelsons (apparently not related) corresponded with Greene. Materials are part of the E. L. Greene archives at the University of Notre Dame.

- 1907 Brand, A. 1907. Polemoniaceae. In: Engler, A., Das Pflanzenreich. IV. 250:72.

Phlox hirsuta is mentioned in Latin under the heading "Species incertae sedis" (species of uncertain position). The only specimen cited was Greene No. 719, and the publication states "Nicht gesehen" (not seen). Brand suggested that the species may have formed from hybridization between *P. stansburyi* and *P. speciosa* (see Wherry 1955).

- 1909 George Butler, collection 739.

Collected May 3, 1909. Yreka is the only location mentioned. The specimen is located in the Jepson Herbarium (accession #700013), Berkeley, California.

- 1910 George Butler, collection 1165.

Collected April 10, 1910, and apparently labeled *Phlox douglasii*. Described as collected in "dry hills, Yreka." The specimen is located in

the University Herbarium (accession #164097), Berkeley, California.
Annotated *P. hirsuta* by Wherry 1940.

- 1925 Jepson, W. L. 1925. A manual of the flowering plants of California.

P. hirsuta is treated as a species in this flora. Jepson cites the *Greene 719* collection.

- 1930 Kildale, L. Possible collection from near Etna.

Phlox hirsuta was collected by L. Kildale in 1930. Kildale described the collection as occurring in the “vicinity of Mill Creek near Etna Mills”. The specimen is located in the California Academy of Sciences herbarium (#9830), San Francisco, California.

- 1934 Eastwood A., and J. T. Howell collection.

Phlox hirsuta collected near Yreka on Ft. Jones Road. April 20, 1934. Annotated *P. hirsuta* by Wherry 1940. The specimen is located at the Herbarium of Rancho Santa Ana Botanic Garden and Pomona College (#202878), Claremont, California.

- 1943 Jepson, W. L. 1943. A flora of California (volume 3, part 2). Jepson Herbarium and Library, University of California, Berkeley, California.

In this publication, Jepson reduced *Phlox hirsuta* to a variety of *P. stansburyi* (var. *hirsuta* (E. Nelson) Jepson comb. nov.). Although Jepson stated “this plant is but slightly known and satisfactory evaluation waits on fuller collections” he ultimately concluded that “the probable invalidity of var. *hirsuta* as a species is emphasized by its highly localized occurrence at Yreka, whence only two or three collections, one being *Butler 739*.”

- 1951 Abrams, L. 1951. An illustrated flora of the Pacific States. Volume III. Stanford University Press, Stanford, California.

Abrams treated *P. hirsuta* as a distinct species, and noted that it was “known only from dry hillsides near Yreka, and Mill Creek near Etna Mills, Siskiyou County, California.”

- 1955 Wherry, E. 1955. The genus Phlox. Morris Arboretum Monographs 3:1-174. Philadelphia, Pennsylvania.

Wherry treated *P. hirsuta* as a species based on “examination of 10 specimens.” He gave the location of Greene’s collection as “Type: Yreka, 5 miles southwest (40° 40½' 122° 42½'), California. [Type Specimen] Greene 719, May 26, 1876, in Mo Bot Gard.” This reference is the first mention of the type locality being southwest of Yreka. Wherry may have concluded this from reviewing the Nelsons’ correspondence with Greene, or he may have guessed. Wherry stated that the phlox is “an endemic known only on two serpentine outcrops 20 miles apart in the Pacific Border Province, the type locality and Etna Mills (40°26' 122°54).” Wherry also mentioned Brand’s theory of the phlox’s hybrid origin: “the serpentine phlox was ‘suspected’ by Brand to be a hybrid between *P. stansburyi* and *P. speciosa*, but resembles neither.”

- 1959 Munz, P. 1959. A California flora. University of California Press, Berkeley, California. 1,681 pp.

Munz treated Yreka phlox as *P. stansburyi* var. *hirsuta*. Munz also included the habitat description “dry slopes, ca. 3000-4000 ft; N. Oak Wd; near Yreka and Etna Mills, Siskiyou Co.”

- 1993 Patterson, R., and D. Wilken. 1993. Phlox. In: Hickman J. (ed.), The Jepson manual: higher plants of California. University of California Press, Berkeley, California. 1,400 pp.

In their treatment prepared for the Jepson Manual, Patterson and Wilken treated Yreka phlox as *P. hirsuta*, and provided the following habitat description: “dry serpentine talus, open Jeffrey pine/incense-cedar forest. 1000-1500 m. n CaRH (Siskiyou Co.)”.

Appendix 2. *Phlox hirsuta* Species Description

(Prepared by Dr. Robert W. Patterson)

Perennial: From woody caudex, 5-15 centimeters. Stems decumbent, open (Soap Creek Ridge) to more compact (China Hill) 15-20 centimeters, current year's growth ~ 7-8 centimeters; trichomes 5-10 cells long, each cell flattened 90° from previous, clear, 1-2 millimeters, proximal cells longer than distal cells; internodes 10-20 millimeters.

Leaves: Narrow elliptic, 15-20 millimeters, 3-6 millimeters wide, apex attenuate, sessile, midvein standing out on abaxial surface, margins slightly thickened and/or revolute, densely-hirsute (cells like those on stem), ascending ± rigid, giving leaves a crowded appearance.

Inflorescence: In bloom the overall plant appearing covered in flowers. Few-flowered open cymes, pedicels 1-5 millimeters, moderately densely hirsute.

Flowers: Calyx tubular, 10-15 millimeters, 2-3 millimeters wide at widest point, membrane obvious but narrower than calyx lobes, fused portion ca. 2X the free lobes, ribs densely hirsute (trichomes like those on leaves).

Corolla salverform, tube yellow to cream, slightly exerted from calyx, 12-15 millimeters, ca. 1 millimeter wide when flattened, lobes light to (more commonly) bright rose-pink, 5-7 millimeters, ca. 3-4 millimeters wide at widest point, ± truncate.

Stamens included, inserted on corolla tube, filaments ca. 1 millimeter, attached at different levels and evenly-spaced, the upper most attached in the distal 1/3 of the tube, the lowermost attached in the proximal 1/3 of the tube; anthers oval, each anther sac lobed at base, filaments attached at sinus between anther lobes; pollen yellow.

Pistil syncarpous, stigmas < 1 millimeter, stigmatic along entire adaxial surface; style included (w/stigma), 5-6 millimeters; ovary 1-1.5 millimeters, ovules 1 per carpel.

While some species of phlox are often confused with other species, *P. hirsuta* is readily distinguishable from any other northern California phlox.

Appendix 3. Phlox Species that may be Confused with *Phlox hirsuta*

(Prepared by Robert W. Patterson)

P. speciosa. *Phlox speciosa* is wide-ranging, occurring throughout much of the Klamath and Cascade Ranges, the Sierra Nevada, and north to British Columbia and Montana. Its range includes that of *P. hirsuta*, and it would not be unexpected for the two species to occur together in the range of the latter. Both species share a similar habit and showy, often bright pink flowers; however, *P. speciosa* generally has a notch at the tip of each corolla lobe (petal), while *P. hirsuta* has more rounded, unnotched corolla lobes. Secondly, *P. speciosa* has long style branches, while *P. hirsuta* has short style branches. *Phlox speciosa* occurs sympatrically with/immediately adjacent to *P. hirsuta* at the China Hill site, but occurs on both, ultramafic and nonultramafic soils, while *P. hirsuta* occurs only on ultramafic soils.

P. adsurgens. *Phlox adsurgens* occurs in Northern California and into Oregon, but while the large scale ranges of these two species seem to overlap, *P. adsurgens* apparently does not occur near Yreka. The two species are readily distinguished: *P. adsurgens* is glabrous, has broad leaves, and flowers on long pedicels, as opposed to *P. hirsuta* being hirsute throughout, with narrow leaves and short to absent pedicels. *Phlox adsurgens* is a montane species of higher elevations, in open areas of *Abies*- and *Picea*-dominated forests. It is unlikely that anyone remotely familiar with these two species would ever confuse them with each other.

P. diffusa. *Phlox diffusa* is the wide-ranging montane *Phlox* that occurs throughout California at higher elevations. It occurs near the range of *P. hirsuta*, probably at higher elevations. It is a cushion phlox with a lower, denser habit than *P. hirsuta*, and with crowded yet solitary inflorescences. Corollas of *P. diffusa* are most commonly white, although can range to deep pink or blue; thus, the corolla color range of *P. hirsuta* probably can overlap with that of *P. diffusa*. It never gets as hairy (hirsute) as *P. hirsuta*.

P. stansburyi. This plant is a wide-ranging arid region species most common east of the Sierra-Cascade crest in California. Its range may be fairly disjunct from that of *P. hirsuta*. Nelson's (1899) key to phloxes in the original

publication distinguishes *P. stansburyi* (style exceeding calyx) from *P. hirsuta* (style not exceeding the calyx). Of interest is that Jepson (1943) demoted *P. hirsuta* to a variety of *P. stansburyi* (although this new combination was made with the remark that "this plant is but slightly known and satisfactory evaluation waits"). Jepson provided no significant basis for this demotion, and it had the unfortunate result of taking *P. hirsuta* off the "radar screen" of many botanists. Despite Jepson's claim that *P. hirsuta* "belongs to the same phytogeographic area in California" as the east-of-Sierra *P. stansburyi*, other biogeographers would not likely equate these regions.

Appendix 4. Soil Types Associated with *Phlox hirsuta* Occurrences

The following description of soil types associated with *P. hirsuta* occurrences is taken directly from the Soil Survey of Siskiyou County, California, Central Part (Soil Conservation Service 1983).

CHINA HILL SITE

178 - Lithic Xerorthents-Rock outcrop complex, 0 to 65 percent slopes.

This map unit is on mountains. The vegetation is mainly brush, shrubs, annual grasses, and forbs. Elevation is 2,000 to 6,000 feet. The average annual precipitation is 20 to 50 inches, the average annual air temperature is 48 to 52 degrees Fahrenheit, and the average frost-free season is 50 to 125 days.

This unit is about 40 percent Lithic Xerorthents and 30 percent Rock outcrop. Included in this unit are small areas of soils that are similar to Lithic Xerorthents but are 10 to 40 inches deep to bedrock, Rubble land, Riverwash, and areas where slopes are more than 65 percent. These included areas make up about 30 percent of the mapped acreage.

Lithic Xerorthents are very shallow and excessively drained. They formed in residual material derived from intrusive igneous, sedimentary, or metamorphic rock. These soils have a surface layer that varies in texture and is underlain by bedrock at a depth of 8 to 10 inches.

Rock outcrop consists of exposures of intrusive igneous, sedimentary, or metamorphic rock.

This unit is used for wildlife habitat and watershed.

This map unit is in capability subclass VIIIs(5), nonirrigated.

SOAP CREEK RIDGE/CRACKER GULCH

143 - Dubakella-Ipish complex, 5 to 30 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees Fahrenheit, and the average frost-free period is about 125 days.

This unit is 40 percent Dubakella stony loam and 30 percent Ipish gravelly clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to Dubakella soil but are underlain by serpentine rock at a depth of 10 to 20 inches, soils that formed in residuum derived from basic igneous rock, and soils that are gravelly throughout. Also included are small areas of Weitchpec Variant gravelly loam and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay loam about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Ipish soil is very deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown gravelly loam about 2 inches thick. The upper part of the subsoil is dark brown

gravelly clay loam about 42 inches thick. The lower part is dark brown very gravelly clay loam about 21 inches thick. Bedrock is at a depth of 65 inches.

Permeability of the Ipish soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 to 80 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to use as woodland. It can produce about 1,180 cubic feet, or 5,250 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion and low fertility. Trees on the Dubakella soil are subject to windthrow. Soil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion.

Jeffrey pine is a suitable tree to plant on this unit. Reforestation is limited mainly by low fertility.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes manzanita, bottlebrush squirreltail, beardless wheatgrass, bluebunch wheatgrass, and Idaho fescue.

This map unit is in capability subclass VII(5), nonirrigated.

144 - Dubakella-Ipish complex, 30 to 50 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, perennial grasses, and forbs. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees Fahrenheit, and the average frost-free period is about 125 days.

This unit is 40 percent Dubakella stony loam and 30 percent Ipish gravelly clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to this Dubakella soil but are underlain by serpentine at a depth of 10 to 20 inches, soils that formed in residuum of basic igneous rock, and a soil that is gravelly throughout. Also included are small areas of Weitchpec Variant gravelly loam and Rock outcrop. Included areas make up about 30 percent of the total acreage.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine rock. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay loam about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

The Ipish soil is very deep and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 1/4 inch thick. The surface layer is dark brown gravelly loam about 2 inches thick. The upper part of the subsoil is dark brown gravelly clay loam about 42 inches thick. The lower part is dark brown very gravelly clay loam about 21 inches thick. Bedrock is at a depth of 65 inches.

Permeability of the Ipish soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 to 80 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as woodland and for livestock grazing.

This unit is poorly suited to use as woodland. It can produce about 1,180 cubic feet, or 5,250 board feet (Scribner rule), of timber per acre from a fully stocked stand of even-aged Jeffrey pine trees 80 years old.

The main concerns in producing and harvesting timber are the hazard of erosion, slope, and low fertility. Trees on the Dubakella soil are subject to windthrow. Spoil from excavations is subject to rill and gully erosion and to sloughing. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Conventional methods of harvesting trees are difficult to use because of the steepness of slope.

Jeffrey pine is a suitable tree to plant on this unit. Reforestation is limited mainly by low fertility.

When the density of the forest canopy is less than about 40 percent, this unit produces grazable understory. The understory includes manzanita, bottlebrush squirreltail, beardless wheatgrass, bluebunch wheatgrass, and Idaho fescue. Livestock grazing should be managed to protect the soil in this unit from excessive erosion.

This map unit is in capability subclass VII(5), nonirrigated.

178 - Lithic Xerorthents-Rock outcrop complex, 0 to 65 percent slopes.

(See description above).

213 - Rock outcrop-Dubakella complex, 30 to 50 percent slopes.

This map unit is on mountains. The native vegetation is mainly mixed conifers, shrubs, forbs, and perennial grasses. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees Fahrenheit, and the average frost-free period is about 125 days.

This unit is 50 percent Rock outcrop and 30 percent Dubakella stony loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ipish soils that have a very gravelly loam surface layer, Weitchpec Variant gravelly loam, a soil that is similar to the Dubakella soil but is gravelly clay throughout, and soils that have slopes of more than 50 percent. Included areas make up about 20 percent of the total acreage.

Rock outcrop consists of exposures of bedrock. It does not support vegetation.

The Dubakella soil is moderately deep and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface is covered with a mat of undecomposed and partially decomposed needles, leaves, twigs, bark, and other organic debris about 2 inches thick. The surface layer is pale brown stony loam about 11 inches thick. The subsoil is brown very gravelly clay loam about 25 inches thick. Bedrock is at a depth of 36 inches. A few stones are on the surface in most places.

Permeability of the Dubakella soil is slow. Available water capacity is very low to low. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used for wildlife habitat and watershed.

This map unit is in capability subclass VIIIs(5), nonirrigated.

237 - Weitchpec Variant-Rock outcrop complex, 5 to 65 percent slopes.

This map unit is on mountains. The native vegetation is mainly brush and juniper. Elevation is 2,500 to 5,000 feet. The average annual precipitation is about 35 inches, the average annual air temperature is about 48 degrees Fahrenheit, and the average frost-free period is about 125 days.

This unit is 40 percent Weitchpec gravelly loam and 30 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of a Dubakella stony loam that has slopes of 30 to 50 percent and a soil that is similar to this Weitchpec Variant soil but is underlain by bedrock at a depth of 20 to 40 inches. Included areas make up about 30 percent of the total acreage.

The Weitchpec Variant soil is shallow and well drained. It formed in residuum derived dominantly from serpentine. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The upper 4 inches of the subsoil is grayish brown gravelly clay loam. The lower 8 inches is grayish brown very gravelly clay loam. Bedrock is at a depth of 16 inches.

Permeability of this Weitchpec Variant soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to very rapid, and the hazard of water erosion is moderate to very high.

Rock outcrop consists of exposed areas of bedrock. It supports no vegetation.

This unit is used as rangeland.

This unit is poorly suited to use as rangeland. The production of vegetation suitable for livestock grazing is limited by slope, the areas of Rock outcrop, and shallow soil depth. Use of mechanical treatment practices is not practical because of the many areas of Rock outcrop and steepness of slope. Steepness of slope and the areas of Rock outcrop also limit access by livestock and promote overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil in

the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The potential plant community on this unit includes manzanita, western juniper, and buckbrush.

This map unit is in capability subclass VII(5), nonirrigated.

JACKSON STREET

143 - Dubakella-Ipish complex, 5 to 30 percent slopes. (See description above).

213 - Rock outcrop-Dubakella complex, 30 to 50 percent slopes. (See description above).

Appendix 5. Plants Associated with *Phlox hirsuta* at China Hill and Soap Creek Ridge (Compiled by Marla A. Knight)

CHINA HILL SITE

Trees

Juniperus occidentalis

Shrubs

Ceanothus cuneatus

Chrysothamnus nauseosus

Eriogonum sphaerocephalum var.
halimoides

Herbs

Achillea millefolium

Allium sp.

Arabis puberula

Artemisia sp.

Astragalus purshii var. *tinctus*

Blepharipappus scaber

Castilleja sp.

Claytonia lanceolata

Crocidium multicaule

Crepis occidentalis

Dichelostemma capitatum

Epilobium sp.

Erigeron bloomeri var. *bloomeri*

Eriogonum strictum var. *proliferum*

Eriophyllum lanatum var.
achillaeoides

Eschscholzia californica

Frasera albicaulis

Fritillaria pudica

Gilia capitata

Horkelia sp. (*daucifolia*?)

Lasthenia sp.

Lewisia rediviva

Lupinus sp.

Minuartia douglasii

Orobanche sp. (*uniflora*?)

Phacelia corymbosa

Phlox speciosa

Plagiobothrys sp.

Sisyrinchium douglasii

Thysanocarpus curvipes

Viola beckwithii

Grasses

Achnatherum thurberianum

Elymus multisetus

Elymus sp.

Festuca roemerii

Poa sandbergii (?)

Vulpia microstachys

Nonnative Plants

Amsinckia intermedia

Bromus madritensis ssp. *rubens*

Bromus tectorum

Centaurea solstitialis

Isatis tinctoria

Poa bulbosa

SOAP CREEK RIDGE SITE

Trees

Calocedrus decurrens
Juniperus occidentalis
Pinus jeffreyi
Pseudotsuga menziesii
Quercus garryana

Shrubs

Ceanothus cuneatus
Cercocarpus betuloides
Chrysothamnus nauseosus
Eriodictyon californicum
Garrya fremontii
Lonicera hispidula
Lonicera involucrata
Rhamnus ilicifolia

Herbs

Achillea millefolium
Allium falcifolium
Antennaria dimorpha
Aspidotis densa
Astragalus sp.
Balsamorhiza sp.
Blepharipappus scaber
Cirsium sp.
Claytonia rubra
Collinsia rattanii
Crepis pleurocarpa
Crocidium multicaule
Dodecatheon sp.
Epilobium sp.
Eriophyllum lanatum
Erysimum sp.

Fritillaria recurva
Galium serpenicum ssp. *scotticum*
Gilia capitata
Horkelia daucifolia
Ipomopsis aggregata
Lithophragma parviflorum
Lomatium macrocarpum
Madia elegans
Microsteris gracilis
Minuartia nuttallii ssp. *gregaria*
Penstemon sp.
Phacelia corymbosa
Phacelia greenei
Phacelia hastata
Plagiobothrys sp.
Plectritis macrocera
Silene sp.
Triteleia sp.
Viola purpurea

Grasses

Achnatherum occidentale ssp.
californicum
Pseudoroegneria spicata
Elymus elymoides
Elymus glaucus
Festuca roemerii
Poa sp.
Vulpia microstachys var. *pauciflora*

Nonnative Plants

Bromus tectorum

Appendix 6. Recovery Team Activities

Activities of Recovery Team Members in Support of <i>Phlox hirsuta</i> Recovery			
Date	Activity	Location	Team Participants
01/03/01	Recovery Team meeting (entire team)	Yreka	L. Bacon, C. Brown, T. Burton, J. Davidson, J. De Pree, P. Figura, K. Garrett, S. Harrison, N. Kanim, M. Knight, F. Lang, J. Molter, R. Patterson, A. Wagner
02/20/01	Meeting/field trip related to land acquisition evaluation for China Hill properties with <i>Phlox hirsuta</i>	Yreka, China Hill	L. Bacon, P. Figura
03/06/01	Submission of land acquisition evaluation to CDFG/WCB Lands Committee	NA	L. Bacon, T. Burton, P. Figura
04/18/01	Survey/mapping of phlox occurrence	China Hill	P. Figura, A. Wagner
04/24/01	Survey/mapping of phlox occurrence	China Hill	P. Figura, A. Wagner
04/26/01	Recovery Team meeting and field trip (entire team)	Yreka, China Hill, Soap Creek Ridge	L. Bacon, C. Brown, T. Burton, J. Davidson, J. De Pree, J. Favero, P. Figura, K. Garrett, N. Kanim, M. Knight, F. Lang, J. Molter, R. Patterson, A. Wagner
04/27/01	Recovery Team meeting (technical team)	Yreka	P. Figura, N. Kanim, M. Knight, J. Molter, R. Patterson

Activities of Recovery Team Members in Support of <i>Phlox hirsuta</i> Recovery			
Date	Activity	Location	Team Participants
04/27/01	Survey for <i>Phlox hirsuta</i> in Caltrans right-of-way	Soap Creek Ridge	N. Kanim, J. Molter
05/11/01	Survey/mapping of phlox occurrences	Soap Creek Ridge, Cracker Gulch	P. Figura
05/13/01	<i>Phlox hirsuta</i> display at annual Siskiyou County flower show. Information on listing and recovery provided.	Yreka	M. Knight
06/12/01	Recovery Team meeting (technical team)	Davis	P. Figura, S. Harrison, N. Kanim, M. Knight, F. Lang, J. Molter
07/26/01	Recovery Team meeting (entire team)	Yreka	L. Bacon, C. Brown, J. De Pree, P. Figura, S. Harrison, K. Garrett, N. Kanim, M. Knight, F. Lang, J. Molter, R. Patterson, A. Wagner
08/14/01	Recovery Team meeting (technical team)	Yreka	P. Figura, S. Harrison, N. Kanim, M. Knight, F. Lang,
09/21/01	Field trip with WCB-contracted property assessor	China Hill	P. Figura

Activities of Recovery Team Members in Support of <i>Phlox hirsuta</i> Recovery			
Date	Activity	Location	Team Participants
04/23/02	Field trip to look for <i>Phlox hirsuta</i> pollinators	China Hill	N. Kanim
04/24/02	Field trip to assess/delineate <i>Phlox hirsuta</i> occurrence	Cracker Gulch	P. Figura, C. Quirnbach
04/25/02	Field trip to collect <i>Phlox hirsuta</i> and <i>P. speciosa</i> for genetic analysis	China Hill	N. Kanim
04/25/02	Survey for <i>Phlox hirsuta</i> in Caltrans right-of-way	Soap Creek Ridge	K. Garrett, N. Kanim
04/26/02	Survey for <i>Phlox hirsuta</i> in Caltrans right-of-way	Soap Creek Ridge	K. Garrett
05/20/02	Recovery Plan planning meeting	Yreka	P. Figura, N. Kanim
06/03/02 to 06/20/02	Review of WCB appraisals for China Hill parcels with five private property owners	Yreka	L. Bacon
06/25/02	Creation of GIS map detailing <i>Phlox hirsuta</i> occurrences in relation to soil types	NA	C. Quirnbach
06/27/02	Recovery Team meeting (entire team)	Yreka	L. Bacon, C. Brown, T. Burton, J. Davidson, J. De Pree, P. Figura, K. Garrett, S. Harrison, N. Kanim, M. Knight, C. Quirnbach

Activities of Recovery Team Members in Support of *Phlox hirsuta* Recovery

Date	Activity	Location	Team Participants
09/12/02	Recovery Team meeting (entire team)	Yreka	J. Davidson, J. De Pree, P. Figura, S. Harrison, F. Lang, N. Kanim, M. Knight, J. Molter, C. Quirnbach
09/30/02	Submission of ESA section 6 grant proposal to CDFG/FWS for funding a study of <i>Phlox hirsuta</i> pollination biology	NA	P. Figura
11/20/02 12/17/02	Acquisition of a total of 28 acres of phlox habitat at China Hill by City of Yreka (with WCB funds)	China Hill	L. Bacon
02/14/03	Meeting with representatives of Siskiyou County, City of Yreka, FWS, and CDFG to address County and City planning needs	Yreka	L. Bacon, J. De Pree, P. Figura, N. Kanim

Activities of Recovery Team Members in Support of <i>Phlox hirsuta</i> Recovery			
Date	Activity	Location	Team Participants
01/17/03	Submission of ESA section 6 grant proposal to CDFG/FWS for funding additional property acquisition at China Hill	NA	P. Figura, N. Kanim
04/17/03	Field trip with Southern Oregon University entomology class to investigate insects visiting phlox flowers	China Hill	P. Figura, N. Kanim
05/11/03 05/09/04 05/08/05	<i>Phlox hirsuta</i> display at annual Siskiyou County flower show. Information on listing and recovery provided	Yreka	M. Knight
07/19/04	Notice of availability of draft Recovery Plan for <i>Phlox hirsuta</i> (Yreka Phlox) published in the Federal Register	NA	Recovery Team
06/09/05	Noxious weed treatment and inventory	China Hill, Soap Creek Ridge	M. Knight

Appendix 7. Summary of Threats and Recommended Recovery Actions for Downlisting and Delisting.

LISTING FACTOR	THREAT	RECOVERY CRITERIA	ACTION NUMBERS
A	Urban development	1,3,4	Land acquisition from willing sellers; development of conservation agreements, easements, and other economic incentives; monitor occurrences; survey for new occurrences; conduct research; increase public awareness (see Actions 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.3, 5.4, 6.1, 6.2, 6.3)
A	Human disturbances including off-road vehicle use, road construction and maintenance operations, garbage dumping, and vandalism	1,3,4	Land acquisition from willing sellers; development of conservation agreements, easements, and other economic incentives; monitor occurrences; survey for new occurrences; conduct research; increase public awareness (see Actions 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.3, 5.4, 6.1, 6.2, 6.3)
A	Timber harvesting and fire suppression activities	1,3,4	Monitor occurrences, survey for new occurrences, conduct research (see Actions 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.2, 5.3)
A	Herbicide application	1,3,4	Monitor occurrences, survey for new occurrences, conduct research (see Actions 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.2, 5.3)

87

LISTING FACTOR	THREAT	RECOVERY CRITERIA	ACTION NUMBERS
A	Competition with exotic and introduced plants	1,3,4	Land acquisition from willing sellers, monitor occurrences, survey for new occurrences, conduct research, increase public awareness (see Actions 1.1, 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.2, 5.3, 6.1, 6.2, 6.3)
A	Livestock grazing	1,3,4	Land acquisition from willing sellers, development of conservation agreements and easements, monitor occurrences, survey for new occurrences, increase public awareness (see Actions 1.1, 1.2, 2.1, 2.2, 2.3, 2.4, 4.1, 4.2, 5.3, 6.1, 6.2, 6.3)
B	Illegal horticultural collection	1,3,4	Develop propagation techniques and guidance for legal nursery acquisition of <i>Phlox hirsuta</i> plants without threatening native populations, increase public awareness (see Actions 3.2, 6.1, 6.2, 6.3)
D	Uncertainties related to protection measures and/or mitigation requirements pursuant to the California Endangered Species Act and the California Environmental Quality Act	1,2,3,4	Land acquisition from willing sellers, development of conservation agreements, easements, and other economic incentives; monitor occurrences; create and maintain a seed bank and develop propagation techniques; survey for new occurrences; conduct research (see Actions 1.1, 1.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 5.3, 5.4)

LISTING FACTOR	THREAT	RECOVERY CRITERIA	ACTION NUMBERS
E	Random events (e.g., fire, drought, disease)	1,2,3,4	Monitor occurrences, create and maintain a seed bank and develop propagation techniques, survey for new occurrences, conduct research (see Actions 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 5.1, 5.2, 5.3, 5.4)

Listing Factors:

- A. The Present or Threatened Destruction, Modification, or Curtailment of Yreka Phlox Habitat or Range
- B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes
- C. Disease or Predation
- D. The Inadequacy of Existing Regulatory Mechanisms
- E. Other Natural or Manmade Factors Affecting Its Continued Existence

69

Recovery Criteria for Downlisting:

1. The China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences have secure permanent protection, or alternatively, the China Hill and Soap Creek Ridge occurrences are protected, and substitutes representing the Jackson Street and/or Cracker Gulch occurrences are protected.
2. A *Phlox hirsuta* seed bank and effective propagation techniques have been established.

Recovery Criteria for Delisting:

3. The reclassification criteria described above have been met.
4. Two additional occurrences have been located and permanently protected, or ten years of demographic research and/or quantitative monitoring at four protected occurrences has demonstrated that plant population size has not declined more than 10 percent at any occurrence (total change between year 0 and year 10).

Appendix 8. Summary of Comments on the Draft Recovery Plan for *Phlox hirsuta* (Yreka Phlox)

On July 19, 2004, the Fish and Wildlife Service released the Draft Recovery Plan for *Phlox hirsuta* (Yreka Phlox) for a 90-day comment period that ended on October 18, 2004. The Fish and Wildlife Service also requested peer review from seven independent scientists and agency biologists with expertise in biology, ecology, and conservation of rare plants and serpentine ecology. During the comment period, letters were received from one Recovery Team member, two members of the public, and one independent expert who provided peer review. Comments included additional information on the nature of ongoing threats, requests for clarification of specific elements of the draft Recovery Plan, suggestions for expansion of recovery actions, suggestions to ensure implementation of recovery actions, and a suggestion that there is no need for a Yreka phlox recovery plan. All comment letters are on file in the Yreka Fish and Wildlife Office.

Summary of Significant Comments and Responses

Comment: We received a comment from a Recovery Team member requesting that we add ongoing highway maintenance or construction activities to the list of threats to *Phlox hirsuta*. The comment also included a specific recommendation for clarification of the environmental review that takes place for these types of highway maintenance projects.

Response: We have incorporated the suggested revisions into the final version of the recovery plan.

Comment: We received a comment that surveys for undiscovered occurrences of *Phlox hirsuta* should be encouraged on public lands as well as on private lands.

Response: We have incorporated this recommendation into the final version of the recovery plan.

Comment: We received a request for clarification of the definition of “occurrence” and how management of a 45-meter buffer would be applied in the

specific instance of a small property owner whose property is completely or nearly completely included within a potential buffer area. The commenter recommended that an occurrence be defined by a minimum density in addition to the minimum distance criterion used in the draft recovery plan and that buffer size be proportional to occurrence size. Finally, the commenter recommended that management be implemented on a parcel-by-parcel basis, rather than an occurrence-by-occurrence basis.

Response:

Definition of Occurrence and Management within Buffers

The definition of “occurrence” used in the recovery plan is “a group of at least 200 individual plants that is separated from any other occurrence by at least 0.40 kilometer (0.25 mile).” As the commenter points out, there is no specific definition for “group.” The maximum distance between plants that are part of the same group is 0.25 mile. This definition was chosen primarily to ensure that any occurrences protected and secured in order to meet the recovery criteria would be of a certain minimum size and be spatially separate from other managed occurrences.

Regardless of the specific definitions used in the recovery plan, it is not a regulatory document. The recovery plan does not specify protection or mitigation measures that are required for implementation of future projects or activities within or adjacent to *Phlox hirsuta* occurrences. Recovery plans merely prescribe the recovery criteria that must be met in order for downlisting or delisting to occur under the Act, and propose actions that should be taken in order for those criteria to be met. If the recovery criteria are not met, *P. hirsuta* cannot be downlisted or delisted under the current recovery plan. As the recovery plan states, meeting these recovery goals will require *cooperation with willing landowners*.

Additionally, the recovery plan does not specifically state that every plant in every occurrence must be protected in order to recover *Phlox hirsuta*¹⁰. The

¹⁰ It is important to note, however, that any activities that may involve take of State-listed or federally listed plants are subject to California State laws described under Factor 4 in the Reasons for Listing and Current Threats section of the recovery plan. Section 9(a)(2)(B) of the Federal Act states that it is unlawful to remove and reduce to possession any endangered plant from areas under Federal jurisdiction; maliciously damage or destroy any endangered plant on areas under

recovery plan does indicate that, in order for recovery to occur, specific occurrences must be “protected and secured.” Such protections involve the development of legally binding arrangements that ensure the land supporting the occurrence will be perpetually managed for the benefit of *P. hirsuta*. The recovery plan recommends that site-specific management strategies should be developed for each occurrence. We have revised the final recovery plan to recognize the fact that many landowner management activities within occurrences and buffers will not threaten *P. hirsuta* recovery. Flexibility is built into the recovery strategy in that it permits different occurrences to be managed in different fashions, yet still be considered to be “protected and secured” as long as the land supporting the occurrence is managed to benefit *P. hirsuta*. To emphasize this flexibility, additional revisions have been incorporated into the Stepdown Narrative of the final recovery plan.

Buffer Size

The commenter recommends that the size of buffers should be proportional to the size of the occurrences they surround. As the commenter suggests, an occurrence consisting of more individuals may be more likely to produce more viable seeds and thus be more likely to colonize an adjacent area than an otherwise equivalent occurrence with fewer individuals.

However, in addition to providing an area for potential population expansion, the 45-meter buffer distance was chosen to protect the plants near the edge of larger occurrences, and most or all of the plants in smaller occurrences. Because of its limited distribution, all *Phlox hirsuta* occurrences or suboccurrences are currently considered important to the long-term survival of the species. In addition, a smaller occurrence may actually be more susceptible to many threats than a larger occurrence facing the same threats in the same habitat. Because of its small size, a smaller occurrence is more likely to be entirely destroyed or seriously damaged by a given stressor. In theory, the survival and reproductive success of each individual in a smaller occurrence may be more important to the longevity and potential future expansion of the occurrence than

Federal jurisdiction; or remove, cut, dig up, or damage or destroy endangered plants on any other area in knowing violation of State law or regulation or in the course of any violation of State criminal trespass law.

that of each individual plant in a larger occurrence. Therefore, it is prudent to provide a buffer sufficiently large to protect occurrences, be they large or small.

Management on a Parcel-by-Parcel Basis Rather than on an Occurrence-by-Occurrence Basis

It is possible that portions of a parcel, or even a whole parcel, may become part of a buffer area for a given occurrence, even if there are no *Phlox hirsuta* plants on the property. In such an instance, for that occurrence to be considered protected and secured under the recovery plan, the portion of the parcel occurring within the buffer area would need to be managed so as not to contribute threats to *P. hirsuta* (to the extent feasible). That particular management strategy would need to be developed with the landowner of the buffering parcel.

Although the focus and goal of the recovery plan is to manage on an occurrence-by-occurrence basis rather than a parcel-by-parcel basis, the recovery plan assumes that individual owners will be responsible for managing the plants and habitat on their property. The final recovery plan has been slightly modified to clarify this intention. As stated in Section 1.2 of the Stepdown Narrative (page 40), “the land supporting these occurrences may be owned and managed by various parties, including the Forest Service, Caltrans, City of Yreka, industrial timber companies, nonindustrial timber and ranch owners...and relatively small-property residential owners... Protection agreements and strategies will likely vary depending on the particular owner or manager and the specific location and size of the phlox occurrence or suboccurrence.”

Comment: We received a comment that there was no need for a recovery plan for the Yreka phlox because this species has been flourishing on its own without governmental intervention for a long time.

Response: The Yreka phlox has been listed as endangered by the State of California for nearly twenty years. Since the time of State listing, the phlox has had some degree of government protection, which has played a role in numerous conservation activities that have helped to protect it (e.g., acquiring property from willing sellers on China Hill and transferring it to public ownership to preclude development in phlox habitat).

Based on current scientific knowledge, it remains unclear whether *Phlox hirsuta* is flourishing or not. The Yreka phlox was listed as endangered by the Federal government in 2000, because of concerns for the continued viability of this species, which is threatened by the present and threatened destruction and modification of its habitat, urbanization, inadequate State regulatory mechanisms, and potential extirpation as a result of random events because of its limited distribution. The recovery plan summarizes the current state of scientific knowledge about this species, and provides a set of recovery criteria and a strategy to meet those criteria. If and when those criteria are completely met, a rule-making process can be initiated to remove *P. hirsuta* from the list of endangered species, based on an analysis of threats associated with the five listing factors as described in section II.B above.

Comment: One commenter recommended that private landowners, who are willing to set aside land for Yreka phlox protection, should be compensated at the fair market value plus an inflation factor for the acreage involved.

Response: When government agencies use public funds to acquire lands, they are required by Federal and State law to pay fair market value for those lands. Agencies are generally not able to pay over and above the appraised value for “inflation factors” or other reasons. The Fifth Amendment of the Constitution of the United States, requires that the Federal government provide “just compensation” for acquisition of property. In most cases, “just compensation” means the fair market value of the property on the date it is appropriated (Uniform Appraisal Standards for Federal Land Acquisitions, Interagency Land Acquisition Conference, Washington, D.C. 2000). Land acquisitions on China Hill that have recently occurred to benefit Yreka phlox have been funded by the Wildlife Conservation Board on behalf of the Department of Fish and Game. The price paid for such property acquired from willing sellers may not exceed fair market value as determined by an appraisal prepared by a licensed appraiser (section 1348.2, California Fish and Game Code).

Comment: Based on experience with other recovery efforts, the independent reviewer found that the draft recovery plan lacks a clear time table for specific tasks and clearly defined measures of success (i.e., a goal, by a specific date, of a certain number of populations, each consisting of a certain number of

reproductive individuals, by a month and date). Such a clear time table and clearly defined measures of success would enable responsible staff to develop time budgets and evaluate progress toward the proposed goal of *Phlox hirsuta* recovery.

Response: The specific recovery criteria are the recovery plan's measures of success. The criteria are clearly defined (e.g., "the China Hill, Soap Creek Ridge, Jackson Street, and Cracker Gulch occurrences have secure permanent protection..."), although they do not include specific time deadlines. The criteria are meant to be valid in any year, so long as the management and ecological conditions that they specify have been met. Additionally, the tasks outlined in both the Stepdown Narrative (Part II Recovery) and detailed in the Implementation Schedule (Part III, Implementation) will help responsible staff develop time budgets and evaluate progress toward recovery. A more detailed time table for implementation and recovery activities may be desirable from a management standpoint, in that it would permit managers and the public to gauge the timeliness of progress toward recovery goals at any given time. However, such a time table is not currently practical because achievement of recovery plan objectives and acquisition of necessary funding are subject to budgetary and other constraints affecting all the parties involved, as well as their need to address other priorities.

Comment: The independent reviewer found the draft recovery plan to be thorough, complete, and a good model for future plans, if the recovery strategy outlined in the plan is adopted and implemented. The reviewer thought that the draft recovery plan reflects considerable care given to the scientific merits of a successful recovery effort as well as a good commentary on engaging the public and the local community in the protection and recovery effort.

Response: We agree. This recovery plan reflects the hard work, thoughtful discussion, and collaborative effort of the entire Recovery Team. We also agree that the success of the plan is only as good as our ability to implement it. The Implementation Schedule identifies Federal, State, County, and City agencies and other parties that are the primary stakeholders in the recovery process. However, the successful implementation of this recovery plan also depends upon the participation of interested members of the public.