

Hanford Site Rare Plant Monitoring Report for Calendar Year 2015



Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728



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Date Published
February 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management



P.O. Box 550
Richland, Washington 99352

APPROVED

By Sarah Harrison at 1:04 pm, Mar 02, 2020

Release Approval

Date

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1.0 INTRODUCTION

In 2015, two separate rare plant monitoring efforts occurred on the portion of the Hanford Site managed by the U.S. Department of Energy (DOE) (referred to herein as Central Hanford).

1. Upland plants of conservation concern were inventoried concurrently with efforts to map plant communities on Central Hanford. Plants were selected based on 2015 status with the Washington State Department of Natural Resources Natural Heritage Program (WNHP) listings, which are summarized in the bullets below. This effort was led by Mission Support Alliance (MSA) and subcontracted personnel from SEE Botanical Consulting. Species canvassed as a part of this study include the following:
 - *Aliciella leptomeria*, **Great Basin gilia**. Washington (WA) State Threatened
 - *Astragalus columbianus*, **Columbia milkvetch**. WA State Sensitive; Federal Species of Concern
 - *Calyptidium roseum*, **rosy pussypaws**. WA State Threatened¹
 - *Cryptantha leucophaea*, **gray cryptantha**. WA State Sensitive²; Federal Species of Concern
 - *Eremogone franklinii* var. *thompsonii*, **Thompson's sandwort**. WA State Sensitive
 - *Eremothera minor*, **small-flowered evening-primrose**. WA State Sensitive
 - *Eremothera pygmaea*, **dwarf evening-primrose**. WA State Sensitive³
 - *Erigeron piperianus*, **Piper's daisy**. WA State Sensitive⁴
 - *Erythranthe suksdorfii*, **Suksdorf's monkeyflower**. WA State Sensitive⁵
 - *Leymus flavescens*, **yellow wildrye**. WA State Review Group 1⁶
 - *Loeflingia squarrosa* var. *squarrosa*, **spreading pygmyleaf**. WA State Threatened
 - *Oenothera cespitosa* ssp. *cespitosa*, **cespitose evening-primrose**. WA State Sensitive.⁷
2. Gray cryptantha (*Cryptantha leucophaea*) was surveyed in a separate, focused effort to survey the populations occurring on Central Hanford. This effort was led by Washington Rare Care and Conservation (Rare Care) with participation by botanists/ecologists representing Rare Care, WNHP, the U.S. Bureau of Land Management (BLM), and MSA.

This report summarizes the methodology, results, and conclusions of these two monitoring efforts carried out during calendar year (CY) 2015.

1.1 Purpose and Need for Rare Plant Monitoring at Hanford

The U.S. Department of Energy, Richland Operations Office (DOE-RL) conducts ecological monitoring on the Hanford Site to collect and track data needed to ensure compliance with an array of environmental laws, regulations, and policies governing DOE activities. Ecological monitoring data provide baseline

¹ Listed as Federal Species of Concern in 2019 WNHP listings.

² Listed as WA State Threatened in 2019 WNHP listings.

³ Listed as Federal Species of Concern in 2019 WNHP listings.

⁴ Removed from WNHP listings, no longer considered WA State Sensitive.

⁵ Listed as Federal Species of Concern in 2019 WNHP listings.

⁶ Listed as WA State Sensitive and a Federal Species of Concern in 2019 WNHP listings.

⁷ Listed as Federal Species of Concern in 2019 WNHP listings.

information about the plants, animals, and habitat under DOE-RL stewardship at the Hanford Site required for decision making under the *National Environmental Policy Act (NEPA)* and *Comprehensive Environmental Response, Compensation, and Liability Act*. The *Hanford Site Comprehensive Land Use Plan (CLUP, DOE/EIS-022-F)*, which is the Environmental Impact Statement for Hanford Site activities, helps ensure that DOE-RL, its contractors, and other entities conducting activities on the Hanford Site are in compliance with NEPA.

The *Hanford Site Biological Resources Management Plan (BRMP, DOE/RL-96-32)* is identified by the CLUP as the primary implementation control for managing and protecting natural resources on the Hanford Site. According to the CLUP, the BRMP

provides a mechanism for ensuring compliance with laws protecting biological resources; provides a framework for ensuring that appropriate biological resource goals, objectives, and tools are in place to make DOE an effective steward of the Hanford biological resources; and implements an ecosystem management approach for biological resources on the site. The BRMP provides a comprehensive direction that specifies DOE biological resource policies, goals, and objectives.

DOE-RL places priority on monitoring those plant and animal species and habitats with specific regulatory protections or requirements; that are rare and/or declining (federal- or state-listed endangered, threatened, or sensitive species); or are of significant interest to federal, state, or Tribal governments or the public.

The BRMP ranks wildlife species and habitats (Level 0-5), providing a graded approach to monitoring biological resources based on the level of concern for each resource. Washington State Endangered and Threatened species are categorized as Level 4 resources and are considered Essential Resources by the BRMP, requiring a high level of status monitoring. Washington State Sensitive Species and Federal Species of Concern are categorized as Level 3 resources and are considered Important Resources by the BRMP, requiring a moderate level of status monitoring.

1.2 Plant Species of Conservation Concern on the Hanford Site

This section provides a brief overview of the rare plant species found on the Hanford Site and their status as of 2015.

1.2.1 Washington State Listed Rare Plant Species

State status of plant species within Washington State is determined by the WNHP. Factors considered in determining plant status include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness. Values include:

- **Endangered.** In danger of becoming extinct or extirpated from Washington State.
- **Threatened.** Likely to become endangered within the near future in Washington State if the factors contributing to population decline or habitat loss continue.

- **Sensitive.** Vulnerable or declining and could become endangered or threatened in the state without active management or removal of threats.
- **Review Group 1.** Of potential concern but needs more research to assign another rank.

As of 2015, 12 plant species that occur or potentially occur on the Hanford Site are listed as either endangered or threatened by Washington State; an additional 18 plant species are listed as sensitive. A list of these species can be found in DOE-RL-2014-52, *Hanford Site Environmental Report for CY 2014*, Section 11.2, Endangered and Threatened Species.

1.2.2 Federally-Listed Rare Plant Species

Federally-listed rare plants are protected under the *Endangered Species Act* (ESA). The purpose of the ESA is to protect and recover imperiled species and the habitats upon which they depend. The federal list of endangered and threatened plant species is maintained by the U.S. Fish and Wildlife Service (USFWS) in 50 CFR 17.12, "Endangered and Threatened Plants." Federal classifications for rare plants include the following:

- **Listed Endangered.** The plant is in danger of extinction throughout all or a significant portion of its range.
- **Listed Threatened.** The plant is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
- **Proposed Endangered.** A plant that is proposed to be listed as endangered and is undergoing a review process.
- **Proposed Threatened.** A plant that is proposed to be listed as threatened and is undergoing a review process.
- **Candidate Species.** A plant for which the USFWS or the National Oceanic and Atmospheric Administration Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened.
- **Species of Concern.** An informal term referring to a species that might be in need of conservation action. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing.

Two plant species found on the Hanford Site, Umtanum desert buckwheat (*Eriogonum codium*) and White Bluffs bladderpod (*Physaria douglasii* ssp. *tuplashensis*), were listed as threatened species under the ESA in April 2013; the rule was reaffirmed late in 2013 and was effective as of December 20, 2013 (78 FR 23984, "Endangered and Threatened Wildlife and Plants"). No other plants found on the Hanford Site are currently on the federal list of endangered and threatened species; however, as of 2015 there are four plant "Species of Concern" on the Hanford Site. A current list of these species can be found in DOE-RL-2014-52.

1.3 Report Scope

The remainder of the report is organized as follows:

- **Section 2.0** discusses the methods, results, and conclusions reached during the monitoring of upland plants on Central Hanford.
- **Section 3.0** discusses the methods, results, and conclusions reached during the focused survey of the gray cryptantha population in the dunes of Central Hanford.
- **Section 4.0** lists the literature cited in this report.

2.0 MONITORING UPLAND PLANTS OF CONSERVATION CONCERN

2.1 Background

The goal of the 2015 monitoring effort was to build on fieldwork done in the mid-1990s (The Nature Conservancy 1999) in order to facilitate a broader understanding of the distribution, abundance, and inter-year variability of plants of conservation concern on the DOE-managed portion of the Hanford Site (Figure 1).

2.2 Methods

A major portion of this rare plant survey was done concurrently with fieldwork supporting the update of the Hanford Site vegetation map (HNF-61417). Known sites that have not been heavily surveyed for the past several years were emphasized; other known sites were assessed as time allowed. Survey methodology focused on sites where suitable habitat for the targeted plant species was present. Large occurrences were sampled with transects through appropriate habitat that were walked by surveyors.

Surveys were performed between April 1 and May 14, 2015. Locations were recorded with Garmin Global Positioning System models 64S and 60CSx. Occurrences located during the survey effort that were not previously known (*Oenothera cespitosa* ssp. *cespitosa*, *Eremothera minor*, and *Aliciella leptomeria*) were documented with WNHP sighting forms.

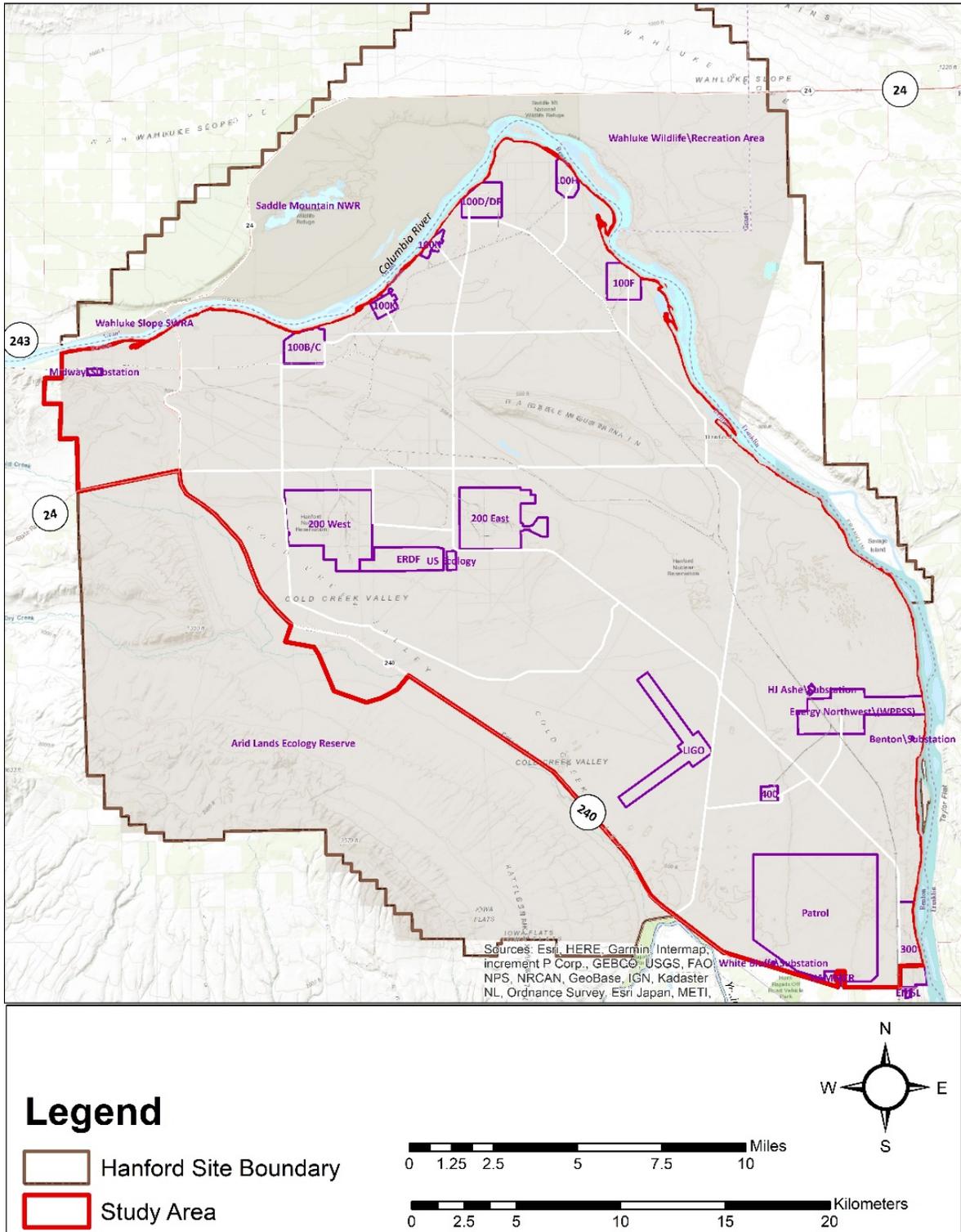


Figure 1. Central Hanford Study Area (in Red) for the 2015 Rare Plant Survey.

2.3 Results

Survey results are summarized in the species-specific sections below. Specific locations in the form of coordinate data have been sent to WNHP. To obtain coordinate data for conservation purposes, contact WNHP.

2.3.1 *Aliciella leptomeria*

Known as sand gilia or Great Basin gilia, *Aliciella leptomeria* is listed as a Threatened Species in Washington State. This annual has one to several thin spreading branches and is generally 7 to 23 cm (3 to 9 in.) in height. The stems are covered with glands and tiny hairs, and a rosette of strap-shaped leaves with lobes rounded with sharp points are found at the base of the plant. Tube-shaped purple flowers with yellow throats extending beyond the calyx generally appear in May. Figure 2 shows an *Aliciella leptomeria* individual in bloom.

Occurrences of *Aliciella leptomeria* during the 2015 survey are summarized in Table 1. A few *Aliciella leptomeria* plants were found at the known site at Federal Way, although the species was not as abundant as reported in the original sightings from the mid-1990s. The boundaries of the Federal Way population were expanded. Two new occurrences were recorded for this species, with a population of 15 plants found near Army Loop Road and a new population recorded north of Gable Mountain. The population north of Gable Mountain was identified with a plant specimen and population size was not recorded.

Plants with characteristics intermediate with *Aliciella lottiae* were found east of the known site at Federal Way. Intermediates between the two species are known to occur in some areas (Porter 1998).



Figure 2. *Aliciella leptomeria* (Great Basin Gilia) in Bloom. (Photo by Sheri Hagwood, hosted by the USDA-NRCS PLANTS Database).

Table 1. Results of CY 2015 Survey for *Aliciella leptomeria*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Aliciella leptomeria</i>	Army Loop Road	Yes ⁸	Yes	15 plants.
	North of Gable	Yes	Yes	3 plants. ⁹
	Federal Way	No (expanded area)	Yes	A few plants observed in part of original reported site. In addition, larger occurrence to the east, with <i>Aliciella lottiae</i> , and many plants showing intermediate characteristics between the two species. Although the surveyors and others (Sackschewsky, personal communication) have examined the known sites for these species numerous times during the correct season over a period of more than 15 years, this was the first time any plants of the species have been observed on the Hanford Site since they were originally reported. Occurrences are likely extant, but only occur after certain patterns of favorable precipitation.

2.3.2 *Astragalus columbianus*

Astragalus columbianus, commonly called Columbia milkvetch, is considered Sensitive in the state of Washington and is a Federal Species of Concern. A local endemic that was once believed to be extinct, its range is restricted to Yakima, Kittitas, and Benton Counties.

Astragalus columbianus is a short-lived (2 to 4 years) perennial with white to cream colored flowers that normally appear in April (Figure 3). It is found on gravelly and rocky silt loams, silts, and lithosols. The seed pods are distinctive, turning red when exposed to direct sun, and allow the plant to be recognized for several months after flowering.

Occurrences of *Astragalus columbianus* detected during the 2015 survey are summarized in Table 2. No new occurrences were found in 2015; however, the top and south slope of Umtanum Ridge occurrence was expanded as plants were found further south on the slope than previously reported. The other two occurrences of *Astragalus columbianus* have been impacted by development but appeared to be intact at the time of monitoring.

Prior to this monitoring effort in 2015, portions of the *Astragalus columbianus* population that were in the vicinity of the Midway-Benton No. 1 Transmission Line Rebuild Project were surveyed and over 100 individuals were counted (DOE/EA-1912).

⁸ May be site of collection made by Baird in 1984 (Porter 1998).

⁹ Occurrence details of this site were not gathered, as plant was identified from collected sample; point location only.



Figure 3. *Astragalus columbianus* (Columbia Milkvetch) in Flower.

Table 2. Results of CY 2015 Survey for *Astragalus columbianus*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Astragalus columbianus</i>	Top and south slope Umtanaum Ridge	No (area expanded)	Yes	Vigorous occurrence. Plants found further south on slope than previously reported (point locations/abundance recorded). Apparently stable.
	North of Umtanum Ridge	No	Yes	Two subpopulations. Near the river, the plants are still present but the site conditions are poor with high cover of cheatgrass and bulbous bluegrass. A few plants in the roadway at the base of Umtanum Ridge had been impacted by the BPA pole replacement project but the site was intact (HNF-54686).
	East of Highway 24 at Vernita Grade	No	Yes	Flagged and under protection. Mostly in area maintained as firebreak.

2.3.3 *Calyptidium roseum*

Calyptidium roseum, also known as rosy pussypaws, is a Washington State Threatened species¹⁰. In Washington State, this species is known only from two occurrences on Central Hanford and one occurrence across the river on the Hanford Reach National Monument. *Calyptidium roseum* is a tap-rooted annual forb with two or more spreading stems. The fleshy leaves of this plant form a basal rosette. The small flowers, which are borne on a coiled inflorescence, consist of two almost circular

¹⁰ *Calyptidium roseum* is also listed as a Federal Species of Concern in 2019 WNHP listings.

sepals, two white petals, two stigmas, and one stamen. The entire plant is generally only a few inches in width. Figure 4 shows a *Calyptridium roseum* plant in bloom.

Calyptridium roseum have not been detected on Central Hanford since their original sightings in the mid-1990s, despite visits to known sites in 2006, 2011, and in this monitoring effort. It is possible these plants only appear after favorable weather conditions that have not occurred during the previous survey years. Table 3 describes the results of 2015 *Calyptridium roseum* monitoring efforts.



Figure 4. *Calyptridium roseum* (Rosy Pussy-paws).

Table 3. Results of CY 2015 Survey for *Calyptridium roseum*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Calyptridium</i> (= <i>Cistanthe</i>) <i>roseum</i>	All known occurrences on site	No	No	Although the surveyors and others (Sackschewsky, personal communication) have examined the known sites for these species numerous times during correct season over a period of more than 15 years, they have not been observed on the Hanford Site since they were originally reported. Occurrences are likely extant, but only occur after certain patterns of favorable precipitation.

2.3.4 *Cryptantha leucophaea*

Cryptantha leucophaea, or gray cryptantha, is a Washington State Sensitive Species¹¹ and a Federal Species of Concern. A regional endemic from the western Columbia Basin, *Cryptantha leucophaea* is found in sandy area, especially dunes that have not completely stabilized. This species is believed to have been extirpated in the state of Oregon. As shown in Figure 5, *Cryptantha leucophaea* is a large, showy perennial forb with distinctive white flowers and herbage covered with stiff appressed hairs.

Cryptantha leucophaea was slated for inventory by participants of the Rare Care Program in May 2015 (see Section 3.0). Thus, this effort did not specifically target *Cryptantha leucophaea* for assessment, except in conjunction with updating the vegetation map by documenting patterns of vegetation within that area. The upland plant monitoring effort documented unmapped locations of *Cryptantha leucophaea* plants that appear to be outliers from the main populations in the Hanford Dunes. The location information of these outliers were provided to Rare Care to be included in their reporting.

Occurrences of *Cryptantha leucophaea* seen during the 2015 upland plant survey are summarized in Table 4. Plants were observed at both known occurrence areas and the Hanford Dune occurrence area was expanded. As discussed in Section 1, a separate survey that focused solely on *Cryptantha leucophaea* is the subject of Section 3 of this report.



Figure 5. *Cryptantha leucophaea* (Gray Cryptantha).

¹¹ *Cryptantha leucophaea* is listed as a WA State Threatened Species in 2019 WNHP listings.

Table 4. Results of CY 2015 Survey for *Cryptantha leucophaea*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Cryptantha leucophaea</i>	Hanford Dunes	No (area expanded)	Yes	Relatively abundant and vigorous within limited habitat in active dunes.
	South-East of 100-D	No	Yes	One patch with two plants, reduced from two patches of two plants reported in 2012.

2.3.5 *Eremogone franklinii* var. *thompsonii*

Eremogone franklinii var. *thompsonii* (formerly *Arenaria franklinii* var. *thompsonii*), also known as Thompson's sandwort, is a Washington State Sensitive Species. *Eremogone franklinii* var. *thompsonii* is a tufted perennial with white flowers that grows from a taproot (Figure 6).

Occurrences of *Eremogone franklinii* var. *thompsonii* during the 2015 survey are summarized in Table 5. No new occurrences of this plant were recorded but the known occurrence area was expanded and the Hanford Dune population appears to be stable and relatively abundant.



Figure 6. *Eremogone franklinii* var. *thompsonii* (Thompson's Sandwort).

Table 5. Results of CY 2015 Survey for *Eremogone franklinii* var. *thompsonii*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Eremogone</i> (=Areneria) <i>franklinii</i> var. <i>thompsonii</i>	Hanford Dunes (and associated sites)	No (area expanded)	Yes	Sporadic distribution and relatively abundant in open sand habitats. Appears stable.

2.3.6 *Eremothera minor*

Eremothera minor, also known as small-flower evening-primrose, is a Washington State Sensitive Species that is generally found on gravelly basalt slopes; sandy and alkaline soils; and dry, rocky hillsides. As shown in Figure 7, this annual is hairy with small white to pink sessile flowers and is fairly short, ranging from 3 to 30 cm (1.2 to 12 in.) tall.

A new occurrence of *Eremothera minor* was found on the Hanford Site near Army Loop Road and consists of around 2,000 individuals. This occurrence is described in Table 6.



Figure 7. *Eremothera minor* (Small-Flowered Evening-Primrose). (Photo by Sheri Hagwood, hosted by the USDA-NRCS PLANTS Database).

Table 6. Results of CY 2015 Survey for *Eremothera minor*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Eremothera</i> (= <i>Camissonia</i>) <i>minor</i>	Army Loop Road	Yes	Yes	A couple thousand small plants.

2.3.7 *Eremothera pygmaea*

Eremothera pygmaea, or dwarf evening-primrose, is a Washington State Sensitive Species¹² that is a regional endemic in eastern Washington and Oregon. This diminutive annual species is generally found on unstable soil or gravel within sagebrush steppe communities. As seen in Figure 8, *Eremothera pygmaea* is most recognizable between June and August; the plants often have small white to light pink flowers and fruits (capsules) on the plant at the same time.

No populations of *Eremothera pygmaea* were detected during 2015 monitoring (Table 7). This plant was last detected in 2012 at the Pit 9 site. It is possible that the 2015 field visit may have been too early to detect the plants.



Figure 8. *Eremothera pygmaea* (Dwarf Evening-Primrose).

¹² *Eremothera pygmaea* is listed as a Federal Species of Concern in 2019 WNHP listings.

Table 7. Results of CY 2015 Survey for *Eremothera pygmaea*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Eremothera</i> (= <i>Camissonia</i>) <i>pygmaea</i>	Gable Mountain	No	No	No plants present this year.
	Gravel pit 9	No	No	No plants seen this year (field visit was a bit early). Species was abundant and vigorous at the site in 2012.

2.3.8 *Erigeron piperianus*

Endemic to the Columbia Basin of Washington State, *Erigeron piperianus* (Piper's daisy) is found in dry, open places where the soil is somewhat alkaline. A Washington State Sensitive Species¹³, *Erigeron piperianus* is a small yellow-flowered perennial in the sunflower family that generally blooms from May through June (Figure 9). Hybrids between this species and *Erigeron poliospermus* (cushion fleabane), which has purple-tinted, white ray flowers, are found where the species co-occur on the Hanford Site.

Erigeron piperianus occurs in the Central Plateau of the Hanford Site, which is an area heavily impacted by human activities. These populations (200 Area Plateau site in Table 8) have been tracked periodically as part of ecological compliance activities and were last heavily surveyed in 2011 (HNF-52260). This population appears to be stable. The other known occurrences are located on and near Umtanum Ridge. The southernmost occurrence on Umtanum Ridge appears stable, while the northern occurrence (though made up of only one plant in a roadway) has been extirpated. Table 8 summarizes the occurrence of *Erigeron piperianus* on Central Hanford.



Figure 9. *Erigeron piperianus* (Piper's Daisy).

¹³ WNHP has since changed this designation and Piper's daisy is no longer a listed species in Washington State (2020).

Table 8. Results of CY 2015 Survey for *Erigeron piperianus*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Erigeron piperianus</i>	Umtanum Ridge, top and south slope	No (area expanded)	Yes	Vigorous occurrence over large area. Abundant number of seedlings present. Occurrence documented further downslope (south) than previously reported.
	200 Area Plateau	No	Yes	Some of the sites had plants present and in bloom; others had dead plants and abundant seedlings. Likely stable unless converted or heavily impacted.
	North of Umtanum Ridge	No	No	One plant in road previously reported (HNF-52260); presumably extirpated.

2.3.9 *Erythranthe suksdorfii*

Erythranthe suksdorfii (formerly *Mimulus suksdorfii*), or Suksdorf's monkeyflower, is a Washington State Sensitive Species¹⁴. Shown in Figure 10, this annual occurs seasonally in moist swales, drainages, or vernal pools within sagebrush steppe vegetation. *Erythranthe suksdorfii* is a slender plant with small yellow, faintly spotted flowers that are slightly two-lipped and have a hairy throat.

As described in Table 9, *Erythranthe suksdorfii* was not seen at any known sites on Central Hanford during the 2015 survey. Since the plants on Central Hanford were originally recorded, they have only been detected once (HNF-54686). It is hypothesized that the plants require patterns of high precipitation to germinate that did not occur prior to the 2015 surveys.

¹⁴ *Erythranthe suksdorfii* is listed as a Federal Species of Concern in 2019 WNHP listings.



Figure 10. *Erythranthe suksdorfii* (Suksdorf's Monkeyflower).

Table 9. Results of CY 2015 Survey for *Erythranthe suksdorfii*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Erythranthe</i> (=Mimulus) <i>suksdorfii</i>	All known occurrences on site	No	No	Although the surveyors and others (Sackschewsky, personal communication) have examined the known sites for these species numerous times during correct season over a period of more than 15 years, they have not been observed on the site since they were originally reported. ¹⁵ Occurrences are likely extant but only occur after certain patterns of high precipitation.

2.3.10 *Leymus flavescens*

Leymus flavescens, known as sand wildrye, is on the Washington State Review Group 1¹⁶ list as of 2015. This perennial grass species requires early successional sandy habitats and is at risk from dune succession and stabilization. Figure 11 depicts *Leymus flavescens*, which can reach up to 1 m (3.3 ft) in height and usually fruits in July and August.

Leymus flavescens was observed in its known occurrence area in 2015; this area was expanded to account for new individuals. See Table 10 for a summary of *Leymus flavescens* occurrences during the 2015 survey.

¹⁵ Except two very small, burned-out *Ereanthre suksdorfii* plants in 2012 at a site that had been originally reported to have thousands of plants.

¹⁶ *Leymus flavescens* is listed as a WA State Sensitive Species and a Federal Species of Concern in 2019 WHNP listings.



Figure 11. *Leymus flavescens* (Sand Wildrye).

Table 10. Results of CY 2015 Survey for *Leymus flavescens*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Leymus flavescens</i>	Hanford Dunes	No (area expanded)	Yes	Occurs in limited habitat within the Hanford Dunes.

2.3.11 *Loeflingia squarrosa* var. *squarrosa*

Loeflingia squarrosa var. *squarrosa*, or spreading pygmyleaf, is classified as a Threatened Species in the state of Washington. A tap-rooted annual that is only 1 to 12 cm (0.4 to 4.7 in.) in height, this small plant can be easily overlooked (Figure 12). Found in low swales and shallow vernal pools, the few known occurrences of this species in Washington State are found on the Hanford Site and were originally found in an unusually wet year. The population was restricted to a very small geographic area and is at risk of being extirpated in the state.

As described in Table 11, *Loeflingia squarrosa* var. *squarrosa* was not observed at any known sites in 2015. It is hypothesized that this population only occurs after certain patterns of high precipitation.



Figure 12. *Loefflingia squarrosa* (Spreading Pygmyleaf).

Table 11. Results of CY 2015 Survey for *Loefflingia squarrosa*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Loefflingia squarrosa</i> var. <i>squarrosa</i>	All known occurrences on site	No	No	Although the surveyors and others (Sackschewsky, personal communication) have examined the known sites for these species numerous times during correct season over a period of more than 15 years, they have not been observed on the Hanford Site since they were originally reported. Occurrences are likely extant but only occur after certain patterns of high precipitation.

2.3.12 *Oenothera cespitosa* ssp. *cespitosa*

Commonly known as cespitose or tufted evening-primrose, *Oenothera cespitosa* ssp. *cespitosa* is a Washington State Sensitive Species¹⁷. This perennial species is easily recognized by its tufted habit and large white flowers that open at sunset and become pinkish with age (Figure 13). *Oenothera cespitosa* ssp. *cespitosa* is found in open sagebrush areas on sandy or gravelly slopes, the flat terrace of the Columbia River, road cuts, and other exposed sites.

¹⁷ *Oenothera cespitosa* ssp. *cespitosa* is listed as a Federal Species of Concern in 2019 WNHP listings.

One new occurrence of *Oenothera cespitosa* ssp. *cespitosa* was detected within an old channel of the Columbia River. The previously known occurrence consisted of one individual and had not been located during the 2011 monitoring effort (HNF-52260) and was not detected in 2015 (Table 12).



Figure 13. *Oenothera cespitosa* (Tufted Evening-Primrose).

Table 12. Results of CY 2015 Survey for *Oenothera cespitosa* var. *cespitosa*.

Species	Site name	New occurrence	Observed in 2015	Notes
<i>Oenothera cespitosa</i> var. <i>cespitosa</i>	Riverland	Yes	Yes	18 plants within 2 acres located in an old channel of the Columbia River. Vigorous.
	Federal Way	No	No	One plant reported just north of the paved road during mid-1990s. Looked for numerous times; apparently extirpated (possibly from herbicide).

2.4 Discussion

As mentioned previously, several of the rare annuals that were originally reported from the site during the mid-1990s have not been seen since that time (Salstrom and Easterly personal observations; Sackschewsky, personal communication; The Nature Conservancy 1999). This abundant occurrence of rare annual plants may be attributed to unusual weather patterns during 1995 and 1996, which included high precipitation for 2 years in a row that changed the water profile (182% and 180% of normal). These conditions have not been experienced on the Hanford Site since then (Hanford Meteorological Station 2015). The next highest precipitation year since 1996 was 2010 (150% of normal), a year in which rare annuals were not surveyed on the Hanford Site. See Table 13 for a comparison of the rainfall totals from 1994 to 1997 and 2014 to 2015.

Table 13. Monthly Rainfall Totals for Rare Plant Survey Years at Hanford.

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1994	0.44	0.11	0.03	0.61	1.27	0.38	0.15	0.08	0.08	0.93	0.68	1.36	6.12
1995	2.14	0.69	0.95	1.54	0.79	0.77	0.34	0.07	0.79	0.87	1.04	2.32	12.31
1996	1.42	1.22	0.83	0.43	0.62	0.05	0.14	0.02	0.22	0.88	2.67	3.69	12.19
1997	1.51	0.25	0.7	0.33	0.33	0.46	0.19	0.06	0.32	0.92	1.01	0.31	6.39
2014	0.37	1.12	1	0.38	0.24	0.26	0.04	0.88	0.16	0.77	0.38	0.93	6.53
2015	0.67	0.42	0.65	0.09	1.49	0.13	0.05	T	0.06	0.28	0.6	2.04	6.48
<i>Average*</i>	<i>0.94</i>	<i>0.63</i>	<i>0.52</i>	<i>0.47</i>	<i>0.55</i>	<i>0.54</i>	<i>0.19</i>	<i>0.23</i>	<i>0.3</i>	<i>0.57</i>	<i>0.85</i>	<i>1.01</i>	<i>6.81</i>

* Averages from 1946 – 2018 data

T = Trace Rainfall

Three of the rare annual species observed in the mid-1990s (*Calyptridium roseum*, *Loeflingia squarrosa* var. *squarrosa*, and *Erythranthe suksdorfii*) were observed in 2007 on Priest Rapids Bar located within the nearby Hanford Reach National Monument, 2 years after a fire burned the area (Salstrom and Easterly personal observation). The plants have not been observed at that site since 2007.

During 2015, the weather patterns were again unusual, although dry. Some species of unlisted annuals were abundant and many species were in flower a month or more before the date typically observed. The window for identification of rare species was relatively short. An early February rainfall event coupled with warm night-time temperatures likely contributed to the early bloom periods.

Despite dry conditions, some species of annuals were abundant during the survey period. These species included annuals in the Polemoniaceae family, including the few plants of *Aliciella leptomeria*, which was observed in 2015 on Central Hanford for the first time since the mid-1990s. Other members of the Polemoniaceae family that were abundant included the more common *A. lottiae* and *Gilia sinuata*.

Other annuals present in abundance included *Microsteris gracilis*, *Layia gladiosa*, *Vulpia* spp., *Cryptantha circumscissa*, *Phacelia linearis*, *Mentzelia albicaulis*, *Descurainia richardsonii*, *Holosteum umbellatum*, and *Draba verna*. All but the last two species are native species. These taxa have indeterminate growth, growing larger and producing more flowers as long as conditions are amenable. Many were quite large and vigorous. Some normally abundant species were quite sparse, most notably *Sisymbrium altissimum*. In addition, relatively large numbers of seedlings of perennials were observed, including *Artemisia tridentata*, *Erigeron piperianus*, *Lomatium macrocarpum*, *Phacelia hastata*, *Balsamorhiza careyana*, and *Triteleia grandiflora*.

In summary, new occurrences of *Aliciella leptomeria*, *Eremothera minor*, and *Oenothera cespitosa* var. *cespitosa* were documented during 2015 rare plant monitoring. Existing occurrences of *Aliciella leptomeria*, *Astragalus columbianus*, *Cryptantha leucophaea*, *Eremogone franklinii* var. *thompsonii*, *Erigeron piperianus*, and *Leymus flavescens* were expanded to account for growing or moving populations.

Existing occurrences were not found in 2015 for *Calyptridium roseum*, *Erythranthe suksdorfii*, *Eremothera pygmaea*, *Erigeron piperianus*, *Loeflingia squarrosa* var. *squarrosa*, and *Oenothera cespitosa* var. *cespitosa*. A number of these species (*Calyptridium*, *Erythranthe*, *Loeflingia*) are hypothesized to occur only during favorable rainfall years, while 2014 and 2015 had below average rainfall. Two of the occurrences not found in 2015 occurred on or near roads and are believed to be extirpated due to road

usage and maintenance (*Erigeron*, *Oenothera*). Occurrences of *Eremothera pygmaea* may have been missed due to the early timing of the field visit, though the southern-most site hosted a few thousand plants.

An unusually dry season leading up to the upland rare plant monitoring event in 2015 may have led to certain populations of plants not occurring. Repeated rare plant monitoring efforts, especially in years with relatively high precipitation, are needed to assess the occurrence of the rare plant species detected on the Hanford Site in the mid-1990s.

3.0 CRYPTANTHA LEUCOPHAEA MONITORING

As discussed in Section 2.3.4, *Cryptantha leucophaea* or gray cryptantha is a Washington State Sensitive Species and a Federal Species of Concern. In CY 2015, Rare Care collaborated with the BLM to monitor the remaining occurrences of *Cryptantha leucophaea* that had not been visited in the past 5 years. This monitoring effort included the survey of *Cryptantha leucophaea* populations at the Hanford Site and subsequent seed collection described in this section.

Rare Care found that about 26% of the known occurrences of *Cryptantha leucophaea* in Washington State could not be relocated. At 30% of the known occurrences that were relocated, populations had declined by 75% or more. Additionally, 26% of the known occurrences that were relocated had populations of fewer than 50 individuals (Rare Care 2015a).

A total of 6,200 individuals were documented at the Hanford Site during *Cryptantha leucophaea* monitoring in May 2015. The remainder of this section describes the monitoring effort and the results obtained.

3.1 Description

Cryptantha leucophaea is a large, showy perennial forb in the borage family (Boraginaceae). Plants generally have a group of clustered stems and are between 15 to 40 cm (6 to 16 in.) tall. Stems are covered with hairs. The flowers are whitish with yellow centers, and the corolla tube is longer than the calyx. Figure 14 shows *Cryptantha leucophaea*.



Figure 14. *Cryptantha leucophaea* (Gray Cryptantha) in Bloom.

3.2 Monitoring Methodology

This monitoring effort occurred from May 11 to May 14, 2015, and was led by Wendy Gibble of Rare Care. Field support was provided by Lauren Clark and Lisa Hirtz of Rare Care, Molly Boyter and Reed Benkendorf from the BLM, Joe Arnett from the WNHP, and Judy Pottmeyer and Erin McElroy from MSA.

Surveys focused on pedestrian visits to previously recorded populations of *Cryptantha leucophaea* and several transects through the area known as Hanford Dunes north of the Energy Northwest facility. Global Positioning System data were collected with multiple handheld units. Population occurrences were mapped by taking at least four Universal Transverse Mercator readings along the perimeter of the population; if no plants were found the Universal Transverse Mercator was taken for the area searched.

3.3 Habitat on the Hanford Site

At the Hanford Site, *Cryptantha leucophaea* occurs sporadically on stable areas with soil crust, moss, and occasionally cheatgrass (*Bromus tectorum*); however, larger clusters of plants tend to occur in open sand, along ridges, or in sand dune bowls that are less stable and have actively moving sand. Figure 15 depicts the typical habitat for this species on the side of a dune.



Figure 15. Typical Habitat for *Cryptantha leucophaea*.

The following species were commonly found associated with *Cryptantha leucophaea* during the 2015 survey:

- Antelope bitterbrush (*Purshia tridentata*)
- Gray rabbitbrush (*Ericameria nauseosa*)
- Green rabbitbrush (*Chrysothamnus viscidiflorus*)
- Needle-and-thread grass (*Hesperostipa comata*)
- Bastard toadflax (*Comandra umbellata*)
- Blazing star (*Mentzelia laevicaulis*)
- Pale evening-primrose (*Oenothera pallida*)
- Indian ricegrass (*Achnatherum hymenoides*)
- Whiteleaf scorpionweed (*Phacelia hastata*)
- Dune scurfpea (*Psoraleidum lanceolatum*)
- Winged dock (*Rumex venosus*)
- Prairie junegrass (*Koeleria cristata*)
- Yellow salsify (*Tragopogon dubius*)
- Sand beardtongue (*Penstemon acuminatus*)
- Blue Mountain prairie clover (*Dalea ornata*)
- Slender hawksbeard (*Crepis atribarba*)
- Cheatgrass
- Annual fescue (*Vulpia* sp.)
- Snow buckwheat (*Eriogonum niveum*)
- Turpentine spring parsley (*Cymopterus terebinthinus*)
- Clustered broomrape (*Orobanche fasciculata*)
- Sandwort (*Arenaria* sp.)
- Threadleaf scorpionweed (*Phacelia linearis*).

3.4 CY 2015 Monitoring Results

Overall, roughly 6,200 individual plants of *Cryptantha leucophaea* were observed at the Hanford Site over the monitoring period. Of those plants, approximately 98% were in bloom and 2% were vegetative. Skeletons of senescing plants were not included in the tally and were only occasionally seen. Because of the extent of the Hanford Dune fields (roughly 1,141 ha [2,820 ac]) and the scattered nature of the *Cryptantha leucophaea* patches, it is likely that not all occurrences within the dune fields were found. The borders of the known *Cryptantha leucophaea* occurrence are believed to be fairly well defined. Figure 16 shows the general area surveyed for *Cryptantha leucophaea* in 2015.

3.5 CY 2015 Seed Collection

Rare Care banks seeds of Washington State's rarest native plants in the Miller Seed Vault at the University of Washington in Seattle. The banked seed may be used for reintroducing populations to ecologically appropriate sites during recovery efforts and are available to scientists conducting research related to the conservation of native plants (Rare Care 2015b).

Each year seed collections are made from populations of rare native plants across Washington State to add to the seed bank. On June 18, 2015, approximately 1 month after the initial survey was completed, Wendy Gibble and Lauren Clark from Rare Care and Reed Benkendorf of the BLM returned to the Hanford Site to collect *Cryptantha leucophaea* seed. These seeds were collected following Rare Care protocols and were surveyed prior to being removed from the Hanford Site by MSA Radiological Control Technicians.

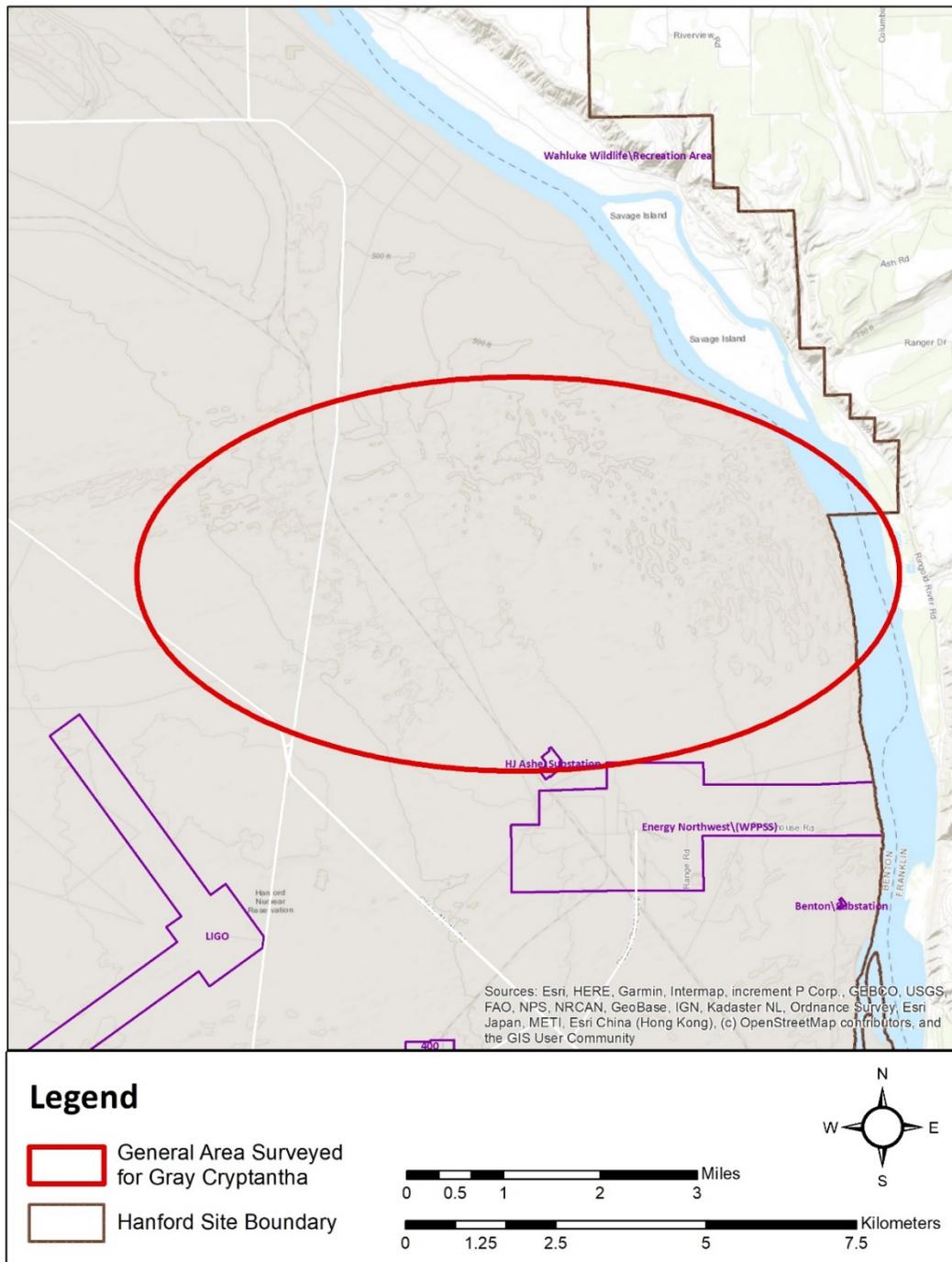


Figure 16. General Area Surveyed for *Cryptantha leucophaea* in 2015.

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