

# Population monitoring of grimy mousetail (*Ivesia rhypara* var. *rhypara*) and Crosby's buckwheat (*Eriogonum crosbyae*)



2016

Report to the Bureau of Land Management,  
Lakeview District

Report prepared by Meaghan I. Petix and  
Matt A. Bahm  
*Institute for Applied Ecology*



## PREFACE

This report is the result of an agreement between the Institute for Applied Ecology (IAE) and the Bureau of Land Management (BLM). IAE is a non-profit organization dedicated to natural resource conservation, research, and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships. Our current activities are concentrated on rare and endangered plants and invasive species.



Questions regarding this report or IAE should be directed to:

Matt Bahm

Conservation Research Program Director

Institute for Applied Ecology

563 SW Jefferson Avenue

Corvallis, Oregon 97333

phone: 541-753-3099

fax: 541-753-3098

email: [mattab@appliedeco.org](mailto:mattab@appliedeco.org)

## ACKNOWLEDGMENTS

The authors thank the BLM Lakeview District for providing funding for this project. The following IAE staff and interns contributed their time and energy during the 2016 field season: Michelle Allen, Tom Kaye, Erin Gray, Liza Holtz and Ari Freitag.

**Cover photograph:** View from ERCR10\_C, one of the survey sites for *Eriogonum crosbyae* in Guano Valley, Lake County, Oregon.

### **Suggested Citation**

Petix, M.I. and M.A. Bahm. 2016. Population monitoring of grimy mousetail (*Ivesia rhypara* var. *rhypara*) and Crosby's buckwheat (*Eriogonum crosbyae*). Institute for Applied Ecology, Corvallis, Oregon and USDI Bureau of Land Management, Lakeview District. vi + 21 pp.

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## EXECUTIVE SUMMARY

This document summarizes monitoring of *Ivesia rhypara* var. *rhypara* (grimy mousetail) and *Eriogonum crosbyae* (Crosby's buckwheat) on land managed by the BLM Lakeview District. In 2016 we revisited 5 special status plant sites in Guano Valley, Lake County, OR: 1 site for *I. rhypara* var. *rhypara* and 5 for *E. crosbyae*. In addition, we revisited 1 *E. crosbyae* site in Fish Fin Rim, Harney County, OR.

- A total of 37 *I. rhypara* var. *rhypara* plants were counted at the site in Guano Valley, Lake County, OR.
  - There were 17 vegetative individuals, 20 reproductive individuals, and no seedlings observed.
  - There were 18 fewer plants observed than when the *I. rhypara* var. *rhypara* monitoring study was initiated in 1990.
- A total of 3524 *E. crosbyae* plants were counted across 5 sites in Guano Valley, Lake County, OR and 1 site in Fish Fin Rim, Harney County, OR.
  - Of the 3524 plants counted, 177 were seedlings, 616 were vegetative, and 2731 were reproductive.
  - Populations ranged in size from 28 to 1589.

# Population monitoring of grimy mousetail (*Ivesia rhypara* var. *rhypara*) and Crosby's buckwheat (*Eriogonum crosbyae*)

## REPORT TO THE BUREAU OF LAND MANAGEMENT, LAKEVIEW DISTRICT

### INTRODUCTION

#### *Ivesia rhypara* var. *rhypara*

*Ivesia rhypara* var. *rhypara* (grimy mousetail) (Figure 1) is a Bureau of Land Management (BLM) sensitive species. In addition, it is listed as endangered by the Oregon Department of Agriculture (ODA), and it is considered a Species of Concern by the U.S. Fish and Wildlife Service (USFWS). The Oregon Biodiversity Information Center (ORBIC) considers *I. rhypara* var. *rhypara* to be threatened or endangered throughout its range (ORBIC 2016). The heritage rank for *I. rhypara* var. *rhypara* is G2T2S1. Its state rank of “critically imperiled” is defined as “at high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors” (ORBIC 2016).



**FIGURE 1. IVESIA RHYPARA VAR. RHYPARA (GRIMY MOUSETAIL) IN FLOWER.**

*I. rhypara* var. *rhypara* has only six occurrences throughout its range: three in Malheur County, Oregon, one in Lake County, Oregon, one in Washoe County, Nevada, and one in Elko County, Nevada (Kaye et al. 1991).

*I. rhypara* var. *rhypara* is a low, spreading, perennial species of the rose family (Rosaceae) (ODA 2007). It is restricted to volcanic tuff slopes from 3,900 to 5,500 feet (Kaye et al. 1991). Habitat is very dry and relatively barren with low vegetation cover (ODA 2007). All populations of the species fall within the Basin and Range physiographic province in the shrub-steppe major vegetation type (Franklin and Dyrness 1973).

*I. rhypara* var. *rhypara* flowers primarily from May to June (Kaye et al. 1991). The flowers (Figure 2) are potentially cross-pollinated by a variety of insects, including several Hymenoptera (bees and wasps), Diptera (flies), and Lepidoptera (butterflies) (Kaye et al. 1991; Amsberry et al. 2002).



**FIGURE 2. CLOSE UP OF FLOWER ON IVESIA RHYPARA VAR. RHYPARA.**

## *Eriogonum crosbyae*

*Eriogonum crosbyae*, or Crosby's buckwheat (Figure 3), is a BLM sensitive species. In addition, it is listed as threatened by ODA, and it is considered a Species of Concern by USFWS (ORBIC 2016). ORBIC considers *E. crosbyae* to be threatened or endangered throughout its range (ORBIC 2016). *E. crosbyae* is limited to southwestern Harney County and southeastern Lake County, Oregon, and Washoe County in northwestern Nevada (Housley 2004). Within Oregon, this wildflower has only been reported from twelve small populations (Kaye et al. 1990).

*E. crosbyae* is a low, matted, perennial species of the knotweed family (Polygonaceae) (ODA 2011). This species occurs in sagebrush areas in white tuffaceous parent material with little soil development, usually on rounded, gentle slopes where the rock has not crumbled into fragments, from 5,250 to 5,460 feet (ODA 2011). All populations of the species fall within the Basin and Range physiographic province in the shrub-steppe major vegetation type (Franklin and Dyrness 1973).

*E. crosbyae* flowers from late May through July (Kaye et al. 1990). The flowers of *E. crosbyae* (Figure 4) are potentially pollinated by a variety of visitors, including several Hymenoptera (bees and wasps), Diptera (flies), and Coleoptera (beetles) (Kaye et al. 1990).



FIGURE 3. *ERIOGONUM CROSBYAE* (CROSBY'S BUCKWHEAT) IN FLOWER.



FIGURE 4. FLOWERS OF *ERIOGONUM CROSBYAE* [PHOTO BY GERALD D. CARR, OREGON FLORA IMAGE PROJECT]

## Project Objectives

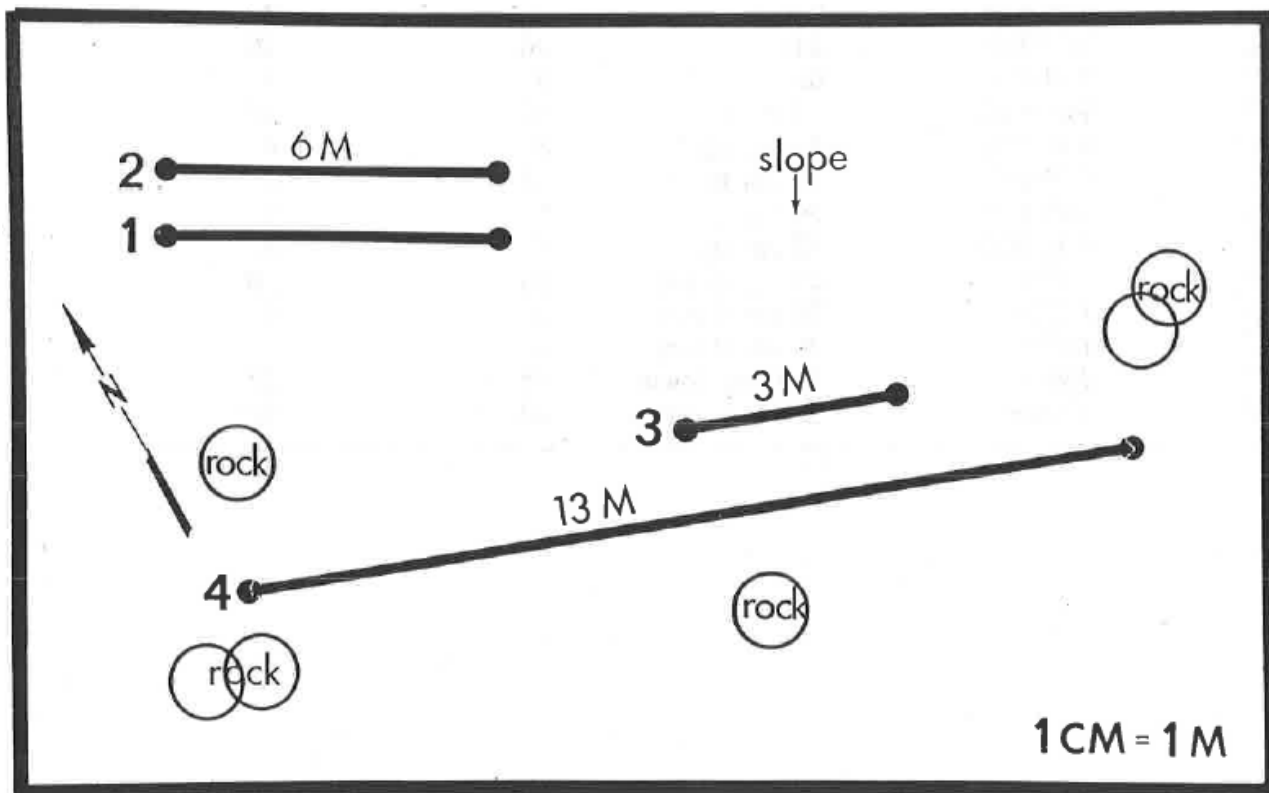
- 1) To revisit 5 special status plant sites at the Guano Creek Research Natural Area on Lakeview BLM-managed land: 1 site for grimy mousetail (IVRHR\_A) and 4 for Crosby's buckwheat (ERCR10\_B, C, D, F).
- 2) Update previous monitoring efforts by revisiting existing transects at the *Ivesia rhypara* var. *rhypara* site and census the *Eriogonum crosbyae* sites. At each site we will assess and document abundance, reproduction, population trends, soil characteristics and potential threats.
- 3) Compare current populations to the previous monitoring data to estimate population trend for *Ivesia rhypara* var. *rhypara*, census *Eriogonum crosbyae* sites to assess current status and allow future comparison of population trends, and develop recommendations for management actions needed to ensure the long-term viability of these populations.



## METHODS

### *Ivesia rhypara* var. *rhypara*

In 1990, four permanent belt transects were established at the *I. rhypara* var. *rhypara* population in Guano Valley, Lake County, OR to serve as fixed locations for monitoring population trends (Figure 5; Kaye et al. 1991). On July 12, 2016 we revisited these existing transects. We relocated the original transect markers, which were 10-inch spikes at each end of the transects. Following the methodology from Kaye et al. (1991), for each plant observed, we recorded its position along the transect (m) along with its lateral distance from the transect line (cm). We also recorded the size of each plant (i.e. the diameter along transect axis) and the number of inflorescences. For purposes of monitoring and data analysis, plants were considered individuals if there was no visible, above-ground connection to another clump (Kaye et al. 1991).



**FIGURE 5. SITE MAP SHOWING THE RELATIVE POSITIONS OF THE FOUR PERMANENT MONITORING TRANSECTS IN THE *IVESIA RHYPARA* VAR. *RHYPARA* POPULATION AT GUANO VALLEY, LAKE COUNTY, OREGON, T38S R27E S22 [FROM KAYE ET AL. 1991].**

Kaye et al. (1991) had marked each *I. rhypara* var. *rhypara* plant along the transects with a numbered aluminum tag on a nail driven into the adjacent rock (Figure 6). We were able to relocate many of the original plant markers but there were also plants found with no marker. For plants that were found with no marker, we attempted to identify the plant using data from previous years on plant tag number and corresponding position along transect and lateral distance from transect line. Once we identified the plant, we replaced the marker (nail and/or tag), assigning it the same tag number that it had been assigned before. For plants that had no marker beside them and could not be matched with a previously observed plant based on its position, we deemed these as “new” plants. In 2016, five “new” plants were tagged that had not been observed in previous years (Appendix C).



**FIGURE 6. *IVESIA RHYPARA* VAR. *RHYPARA* PLANT WITH MARKER (ALUMINUM TAG + NAIL) ALONG PERMANENT MONITORING TRANSECT.**

## ***Eriogonum crosbyae***

Field surveys for *E. crosbyae* were conducted July 12-14, 2016. The four sites in Guano Valley, Lake County, OR (ERCR10\_B, C, D, F) that were part of our project objectives were revisited, as well as an additional site in Guano Valley (ERCR10\_E) and another site (ERCR10\_A) in Fish Fin Rim, Harney County, OR. A complete census of *E. crosbyae* reproductive, vegetative, and seedling plants was conducted within these sites. Sighting report forms were completed for each site noting potential causes of disturbance, geology, plant community composition, presence of exotic plant species, and physical characteristics of the site. Site specific information for each *E. crosbyae* survey site is available in Appendix A.

## RESULTS

### *Ivesia rhypara* var. *rhypara*

A total of 37 *I. rhypara* var. *rhypara* plants were counted at the Guano Valley, Lake County, OR site on July 12<sup>th</sup>, 2016 (Table 1); 100% of the population was sampled within the transects. Transect #1 sampled 6 plants over its 6-m length, transect #2 contained 5 plants in 6-m, transect #3 sampled 7 plants in 3-m, and 19 plants were sampled along the 13-m of transect #4 (Appendix C). Of these plants, 17 were vegetative and 20 were reproductive; there were no seedlings observed (Table 1). The average plant was 11.7 ( $\pm$  1.1) cm in diameter (range: 0.5–28 cm), and produced 2.08 ( $\pm$  0.44) inflorescences (range: 0-9) (Table 2; Figure 7). There was a weak correlation between plant size and fecundity ( $r^2 = 0.258$ ), although the two largest individuals (28cm in diameter) were both non-reproductive.

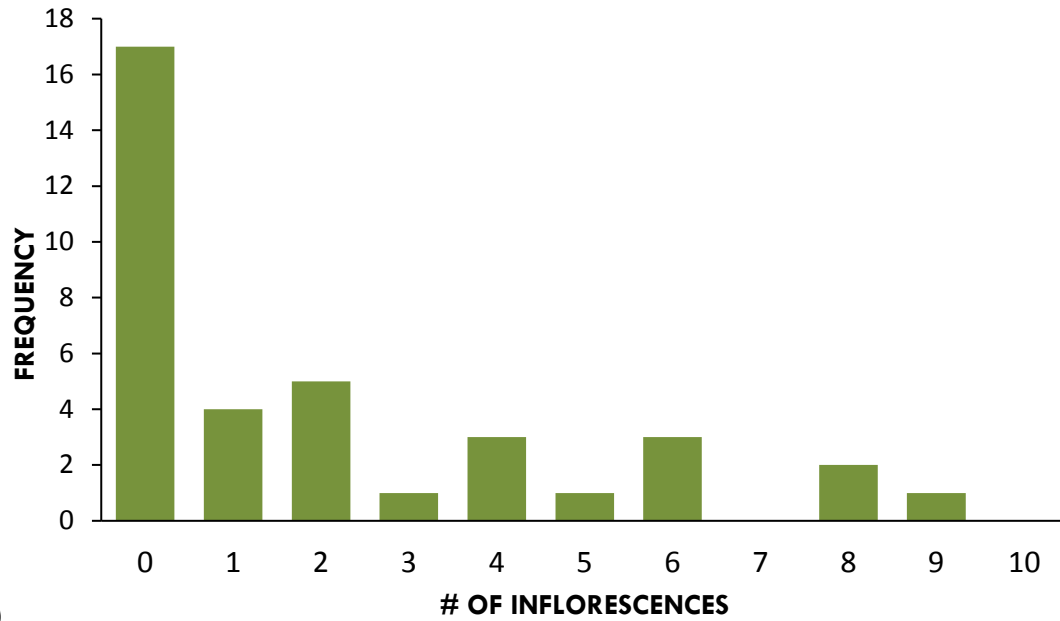
**TABLE 1. CHARACTERISTICS OF THE *IVESIA RHYPARA* VAR. *RHYPARA* POPULATION SURVEYED IN 2016.**

| <i>Site</i> | <i>Seedling</i> | <i>Vegetative</i> | <i>Reproductive</i> | <i>Total</i> |
|-------------|-----------------|-------------------|---------------------|--------------|
| IVRHR_A     | 0               | 17                | 20                  | 37           |

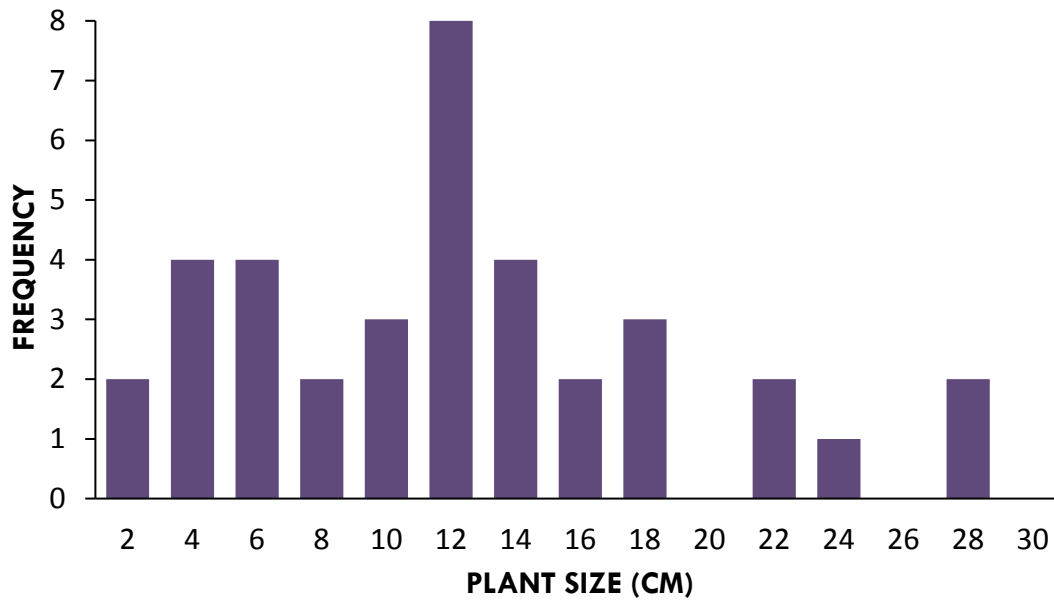
The 37 *I. rhypara* var. *rhypara* plants located on permanent monitoring transects in 2016 constituted the total number of plants located at the site (Table 1). This was 18 fewer plants observed than when the monitoring study was initiated in 1990, representing a 33% decrease in the total population size (Table 2). In 2016, five “new” plants were tagged that had not been observed in previous years, indicating that this population has had successful seedling recruitment, albeit at low rates. 2016 had the lowest mean number of inflorescences per plant (2.1 inflorescences per plant) of all years in which monitoring occurred (Table 2).

Of the 37 plants observed in 2016, 25 were identified as plants that were observed and marked when monitoring was initiated in 1990 (Appendix C). This highlights the long-lived nature of *I. rhypara* var. *rhypara* since these plants have been alive for at least twenty-six years.

A)



B)



**FIGURE 7. FREQUENCY DISTRIBUTION OF A) # OF INFLORESCENCES PER PLANT, AND B) PLANT SIZE OF *IVESIA RHYPARA* VAR. *RHYPARA* ALONG PERMANENT TRANSECTS AT GUANO VALLEY, LAKE COUNTY, OREGON. N = 37**

**TABLE 2. NUMBER OF *IVESIA RHYPARA* VAR. *RHYPARA* PLANTS ON TRANSECTS, NUMBER OF PLANTS OFF TRANSECTS, TOTAL NUMBER OF PLANTS AT SITE, MEAN PLANT SIZE (CM) [ $\pm$  SE], AND MEAN NUMBER OF INFLORESCENCES PER PLANT [ $\pm$  SE] FOR YEARS IN WHICH POPULATION MONITORING OCCURRED FROM 1990 TO 2016.**

| <b>year</b>                     | <b>1990</b>       | <b>1991</b>       | <b>1992</b>       | <b>1994</b>      | <b>1996</b>       | <b>1997</b>       | <b>1999</b>       | <b>2005</b>       | <b>2016</b>       |
|---------------------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b># of plants on transects</b> | 49                | 51                | 52                | 25               | 26                | 30                | 30                | 34                | 37                |
| <b># plants off transects</b>   | 6                 | 8                 | 10                | 2                | unknown           | unknown           | unknown           | unknown           | 0                 |
| <b>total # plants at site</b>   | 55                | 59                | 62                | 27               | unknown           | unknown           | unknown           | unknown           | 37                |
| <b>mean plant size (cm)</b>     | 11.9 ( $\pm$ 1.0) | 12.6 ( $\pm$ 1.0) | 12.6 ( $\pm$ 1.1) | 9.7 ( $\pm$ 0.8) | 19.2 ( $\pm$ 2.7) | 11.7 ( $\pm$ 1.2) | 15.1 ( $\pm$ 1.2) | 12.1 ( $\pm$ 1.3) | 11.7 ( $\pm$ 1.1) |
| <b>mean # inflo/plant</b>       | 5.5 ( $\pm$ 1.2)  | 10.8 ( $\pm$ 2.2) | 9.6 ( $\pm$ 2.1)  | 5.5 ( $\pm$ 1.0) | 30.4 ( $\pm$ 8.1) | 12.3 ( $\pm$ 2.4) | 11.2 ( $\pm$ 1.8) | 4.8 ( $\pm$ 1.2)  | 2.1 ( $\pm$ 0.4)  |

Data compiled from Kaye et al. 1991 and data collected by Lakeview BLM staff (including Lucile Housley, BLM Lakeview Botanist) in 1990-1992, 1994, 1996-1997, 1999, and 2005.

## *Eriogonum crosbyae*

A total of 3524 *E. crosbyae* plants were counted across five sites in Guano Valley, Lake County, OR and one site in Fish Fin Rim, Harney County, OR (Table 3).

Populations ranged in size from 28 to 1589 (Table 3). The site with the highest number of *E. crosbyae* plants observed, ERCR10\_A, was the one site in Fish Fin Rim, Harney County, OR, geographically located away from the other sites that were surveyed (approximately 23 miles northeast). ERCR10\_A had the highest number of reproductive plants observed (1210), constituting 76% of the total population at that site (Table 3). Across the survey sites, very few seedlings were observed, with ERCR10\_A having the greatest number of seedlings (Table 3).

**TABLE 3. CHARACTERISTICS OF POPULATIONS OF *ERIOGONUM CROSBYAE* SURVEYED IN 2016.**

| Site         | Seedling   | Vegetative | Reproductive | Total       |
|--------------|------------|------------|--------------|-------------|
| ERCR10_A     | 122        | 257        | 1210         | 1589        |
| ERCR10_B     | 2          | 29         | 84           | 115         |
| ERCR10_C     | 50         | 115        | 696          | 861         |
| ERCR10_D     | 3          | 208        | 668          | 879         |
| ERCR10_E     | 0          | 4          | 48           | 52          |
| ERCR10_F     | 0          | 3          | 25           | 28          |
| <b>Total</b> | <b>177</b> | <b>616</b> | <b>2731</b>  | <b>3524</b> |

In the spring/summer of 1989, Kaye et al. (1990) observed 452 *E. crosbyae* plants across five sites in Guano Valley, Lake County, OR. The individual sites are not directly comparable to the five sites surveyed in 2016 because sites have been combined or divided differently since the previous surveys. However, the total number of *E. crosbyae* plants observed in Guano Valley in 2016 (1935 plants) is over 3x the number of plants observed in 1989 (452). In addition, Kaye et al. (1990) observed “at least 1000 individuals” at the subpopulation in Fish Fin Rim, Harney County, OR. In 2016, we observed 1589 *E. crosbyae* at this site, but we cannot directly compare with the survey from 1989 since a complete census was not conducted.

## DISCUSSION

Monitoring of the *I. rhypara* var. *rhypara* population in Guano Valley, Lake County, OR has shown the population fluctuating from 55 individuals in 1990 when monitoring was initiated to half that number only a few years later (27 individuals in 1994), and then back up to 37 individuals in 2016 (Table 2). The severe reduction of the population in 1994 was mainly due to livestock trampling, which occurred before the area was excluded from grazing that same year (Housley 2004). Since grazing has been excluded, the *I. rhypara* var. *rhypara* population has remained relatively stable, likely because the species is a long-lived perennial. With the designation of the Guano Creek Research Natural Area (RNA), the *I. rhypara* var. *rhypara* population is no longer threatened from livestock grazing/trampling or mining development, which has threatened other *I. rhypara* var. *rhypara* populations in Nevada. However, threats that could

slowly decimate the population are the possibility of climate warming and diminished variability due to a small gene pool (Housley 2004). With low seedling recruitment and low seed production, population viability is one of the greatest threats facing this population. Amsberry et al. (2002) observed few seedlings at *I. rhypara* var. *rhypara* sites surveyed in Oregon and Nevada (including the Guano Creek population). Since *I. rhypara* var. *rhypara* individuals appear to be long-lived, they posited that seedling “recruitment in the harsh sites where this species occurs may be episodic and/or infrequent” (Amsberry et al. 2002). It is recommended that the health of the Guano Valley *I. rhypara* var. *rhypara* population continue to be monitored.

The censuses of the *E. crosbyae* populations in Guano Valley, Lake County, OR and Fish Fin Rim, Harney County, OR revealed populations ranging in size from 28 to 1589 plants with a high percentage of reproductive individuals (Table 3). However, across the survey sites, there were very few seedlings observed. A high proportion of older plants in a population may be indicative of chronically low seedling recruitment (Harper 1977), making the population vulnerable to disturbance and short term decline (Kaye et al. 1990). While years with large numbers of seedlings may be infrequent, they may be sufficient to maintain these populations, given the long-lived nature of *E. crosbyae* (Kaye et al. 1990). With the designation of the Guano Creek RNA, the *E. crosbyae* populations in Guano Valley, Lake County, OR are no longer threatened from livestock grazing/trampling or mining development, which has threatened other *E. crosbyae* populations in Nevada. However, the *E. crosbyae* population in Fish Fin Rim, Harney County, OR does not have the same protections. Since it is the largest *E. crosbyae* population that we surveyed, it is recommended that this population be prioritized for preservation. Kaye et al. (1990) found that genetic variation was greater within populations of *E. crosbyae* than between them, and thus, it would be more effective to preserve large populations of *E. crosbyae* than several small ones.

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## APPENDIX A. SUMMARIES FOR *IVESIA RHYPARA* VAR. *RHYPARA* AND *ERIOGONUM CROSBYAE* SURVEYS

### IVRHR\_A

**Survey Date:** July 12, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S22 NW1/16 SW1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 290531 E, 4681663 N, NAD83.

**Occurrence information:** We found a total of 37 live *I. rhypara* var. *rhypara* plants (17 vegetative and 20 reproductive).

**Habitat Information:** *I. rhypara* var. *rhypara* plants were found in an area with exposed light-colored tuffaceous soil and very low vegetation cover, giving it a barren appearance. Species found among *I. rhypara* var. *rhypara* include *Ericameria nauseosa*, *Stephanomeria exigua*, *Ipomopsis congesta*, *Phacelia hastata*, *Chaenactis douglasii*, *Bromus tectorum*, *Eriogonum* spp., *Lupinus* sp., and *Scutellaria nana*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *I. rhypara* var. *rhypara* exists are highly erodible.



**FIGURE 8. OVERVIEW OF IVRHR\_A SITE; *IVESIA RHYPARA* VAR. *RHYPARA* HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

## ERCR10\_A

**Survey Date:** July 14, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Fish Fin Rim, Harney County, OR. T 37S R 30E S7 NW1/16 NW1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 25.25 miles on paved Hwy 140 E. Turn left onto 6176-00 (gravel); continue driving on 6176-00 all the way to site (~41 miles). UTM's: 11T 315372 E, 4695005 N, NAD83.

**Occurrence information:** We found a total of 1,589 live *E. crosbyae* plants (122 seedlings, 257 vegetative, and 1, 210 reproductive).

**Habitat Information:** *E. crosbyae* plants were found throughout the site on exposed light-colored tuffaceous slopes and flat areas near the base of the slopes with low shrub cover. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Chrysothamnus viscidiflorus*, *Linanthus pungens*, *Crepis acuminata*, *Chaenactis douglasii*, *Poa secunda*, *Bromus tectorum*, *Elymus elymoides*, *Ericameria nauseosa*, *Eriogonum* spp., *Astragalus* sp., *Lomatium* sp., and *Penstemon speciosus*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. At the site, we observed evidence of wild horse activity (hoof prints) but not on the tuffaceous soils where *E. crosbyae* was observed. ERCR10\_A was the one site surveyed which was not within the Guano Creek RNA and thus, has the potential for livestock grazing to occur.



**FIGURE 9. OVERVIEW OF ERCR10\_A SITE; ERIOGONUM CROSBYAE HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

## ERCR10\_B

**Survey Date:** July 13, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S22 SW1/16 SE1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 291421 E, 4681024 N, NAD83.

**Occurrence information:** We found a total of 115 live *E. crosbyae* plants (2 seedlings, 29 vegetative, and 84 reproductive). Many *E. crosbyae* plants at this site were dried out; there were some plants that appeared to be dead but these were not included in the census since we could not confirm they were definitely *E. crosbyae*.

**Habitat Information:** Most *E. crosbyae* plants were observed in the southwestern section of the site on bare tuffaceous slopes. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Chrysothamnus viscidiflorus*, *Linanthus pungens*, *Hesperostipa comata*, *Bromus tectorum*, *Elymus elymoides*, *Eriogonum* spp., and *Lupinus* sp.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. Invasive plant species, including *Bromus tectorum*, were observed at the site.



**FIGURE 10. OVERVIEW OF ERCR10\_B SITE; ERIOGONUM CROSBYAE HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

## ERCR10\_C

**Survey Date:** July 12, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S22 SW1/16 NW1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 290562 E, 4682215 N, NAD83.

**Occurrence information:** We found a total of 861 live *E. crosbyae* plants (50 seedlings, 115 vegetative, and 696 reproductive).

**Habitat Information:** *E. crosbyae* plants were found throughout the site on exposed light-colored tuffaceous slopes and flat areas near the base of the slopes with low shrub cover. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Ericameria nauseosa*, *Phacelia hastata*, *Astragalus purshii*, *Achnatherum hymenoides*, *Bromus tectorum*, *Eriogonum* spp., *Erigeron linearis*, *Crypthanta watsonii*, and *Juniperus occidentalis*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. Invasive plant species, including *Bromus tectorum*, were observed at the site.



**FIGURE 11. OVERVIEW OF ERCR10\_C SITE; ERIOGONUM CROSBYAE HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

## ERCR10\_D

**Survey Date:** July 13, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S27 NW1/16 NE1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 291562 E, 4680803 N, NAD83.

**Occurrence information:** We found a total of 879 live *E. crosbyae* plants (3 seedlings, 208 vegetative, and 668 reproductive).

**Habitat Information:** *E. crosbyae* plants were found throughout the site on exposed light-colored tuffaceous slopes and flat areas near the base of the slopes with low shrub cover. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Hesperostipa comata*, *Crepis acuminata*, *Bromus tectorum*, *Eriogonum* spp., *Erigeron linearis*, *Stephanomeria exigua*, *Astragalus* sp., and *Penstemon speciosus*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. Invasive plant species, including *Bromus tectorum*, were observed at the site.



**FIGURE 12. IAE INTERN, LIZA HOLTZ, SURVEYING FOR *ERIOGONUM CROSBYAE* AT ERCR10\_D SITE.**

## ERCR10\_E

**Survey Date:** July 13, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S22 NW1/16 NW1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 290714 E, 4682243 N, NAD83.

**Occurrence information:** We found a total of 52 live *E. crosbyae* plants (4 vegetative and 48 reproductive).

**Habitat Information:** A large amount of this site seemed to be unsuitable habitat for *E. crosbyae* (i.e. high shrub cover). Most *E. crosbyae* plants were found in the southern section of the site in an area with low shrub cover that was bare and rocky. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Ericameria nauseosa*, *Linanthus pungens*, *Phlox hoodii*, *Balsamorhiza sagittata*, *Bromus tectorum*, *Elymus elymoides*, *Eriogonum* spp., *Erigeron linearis*, *Astragalus* sp., and *Penstemon speciosus*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. Invasive plant species, including *Bromus tectorum*, were observed at the site.



**FIGURE 13. OVERVIEW OF ERCR10\_E SITE; ERIOGONUM CROSBYAE HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

## ERCR10\_F

**Survey Date:** July 12, 2016

**Observers:** Meaghan Petix, Liza Holtz, and Ari Freitag

**Location information:** Guano Valley, Lake County, OR. T 38S R 27E S22 SW1/16 NW1/4 WM. From Adel, OR [reset odometer at Fuel Commander in Adel, OR] drive 22.6 miles east on paved Hwy 140 E to an intersection (0.6 miles east of milepost 49); turn north onto a dirt two-track road and drive about 13 miles to where Guano Creek crosses Road 6106A. UTM: 11T 290623 E, 4681897 N, NAD83.

**Occurrence information:** We found a total of 28 live *E. crosbyae* plants (3 vegetative and 25 reproductive).

**Habitat Information:** *E. crosbyae* plants were found at this site on an exposed west-facing light-colored tuffaceous slope. Species found among *E. crosbyae* include *Artemisia tridentata* ssp. *wyomingensis*, *Achnatherum hymenoides*, *Bromus tectorum*, *Phacelia hastata*, *Ipomopsis congesta*, *Erigeron linearis*, *Eriogonum ovalifolium*, *Eriogonum* spp., *Lupinus* sp., *Castilleja angustifolia*, *Astragalus* spp., and *Penstemon speciosus*.

**Disturbance and threat information:** Erosion is a threat given the tuffaceous soils on which *E. crosbyae* exists are highly erodible. Invasive plant species, including *Bromus tectorum*, were observed at the site.



**FIGURE 14. OVERVIEW OF ERCR10\_F SITE; ERIOGONUM CROSBYAE HABITAT WAS LOCATED ON EXPOSED TUFFACEOUS SOILS.**

APPENDIX B. COORDINATES (LATITUDE + LONGITUDE AND UTMS)  
FOR THE FOUR PERMANENT BELT TRANSECTS ESTABLISHED TO  
MONITOR *IVESIA RHYPARA* VAR. *RHYPARA*

| <i>Ivesia rhypara</i> var. <i>rhypara</i> |       |            |            |              |               |           |
|---|-------|------------|------------|--------------|---------------|-----------|
| "IVRHR_A"                                 |       | WAYPOINT   | LATITUDE   | LONGITUDE    | UTM, Zone 11T |           |
| TRANSECT #1                               | START | IVRHR-A 1B | 42.2590524 | -119.5392605 | 290552 E      | 4681661 N |
| TRANSECT #2                               | START | IVRHR-A 2B | 42.2590484 | -119.539211  | 290556 E      | 4681660 N |
| TRANSECT #3                               | START | IVRHR-A 3B | 42.2589758 | -119.5392956 | 290549 E      | 4681652 N |
| TRANSECT #4                               | START | IVRHR-A 4B | 42.2590131 | -119.5393243 | 290547 E      | 4681657 N |

APPENDIX C. PLANT POSITION, SIZE, AND NUMBER OF INFLORESCENCES ALONG FOUR *IVESIA RHYPARA* VAR. *RHYPARA* MONITORING TRANSECTS AT GUANO VALLEY, LAKE COUNTY, OREGON. LATERAL DISTANCES ARE EITHER 0 (ON THE TRANSECT), UP (UPHILL), OR DOWN (DOWNHILL).

| plant tag#                        | position along transect (m) | lateral distance from transect line | plant size [along transect axis] (cm) | number of inflorescences |
|-----------------------------------|-----------------------------|-------------------------------------|---------------------------------------|--------------------------|
| <b>TRANSECT #1 (LENGTH = 6 M)</b> |                             |                                     |                                       |                          |
| 1                                 | 1.00 - 1.17                 | 0.0                                 | 17                                    | 4                        |
| 70                                | 1.37 - 1.40                 | 25.0 cm down                        | 2                                     | 0                        |
| 71                                | 1.05 - 1.09                 | 3.5 cm up                           | 4                                     | 0                        |
| 4                                 | 3.75 - 3.98                 | 0.0                                 | 23                                    | 5                        |
| 8                                 | 4.55 - 4.66                 | 0.0                                 | 12                                    | 4                        |
| 53                                | 4.20 - 4.42                 | 2.0 m down                          | 22                                    | 1                        |
| <b>TRANSECT #2 (LENGTH = 6 M)</b> |                             |                                     |                                       |                          |
| 11                                | 0.87 - 1.08                 | 0.0                                 | 21                                    | 8                        |
| 16                                | 2.30 - 2.35                 | 0.0                                 | 5                                     | 4                        |
| 17                                | 2.35 - 2.44                 | 0.0                                 | 9                                     | 2                        |
| 18                                | 3.36 - 3.46                 | 0.0                                 | 10                                    | 0                        |
| 22                                | 4.88 - 4.94                 | 0.0                                 | 6                                     | 0                        |



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**TRANSECT #3 (LENGTH = 3 M)**

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|    |             |              |     |   |
|----|-------------|--------------|-----|---|
| 24 | 1.18 - 1.34 | 0.0          | 16  | 6 |
| 72 | 1.37        | 24.0 cm down | 0.5 | 0 |
| 25 | 1.44 - 1.58 | 0.0          | 14  | 2 |
| 54 | 1.42 - 1.46 | 9.0 cm down  | 4   | 1 |
| 26 | 1.78 - 1.90 | 0.0          | 12  | 2 |
| 27 | 2.13 - 2.41 | 0.0          | 28  | 0 |
| 73 | 2.08 - 2.13 | 7.0 cm down  | 5   | 0 |

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**TRANSECT #4 (LENGTH = 13 M)**

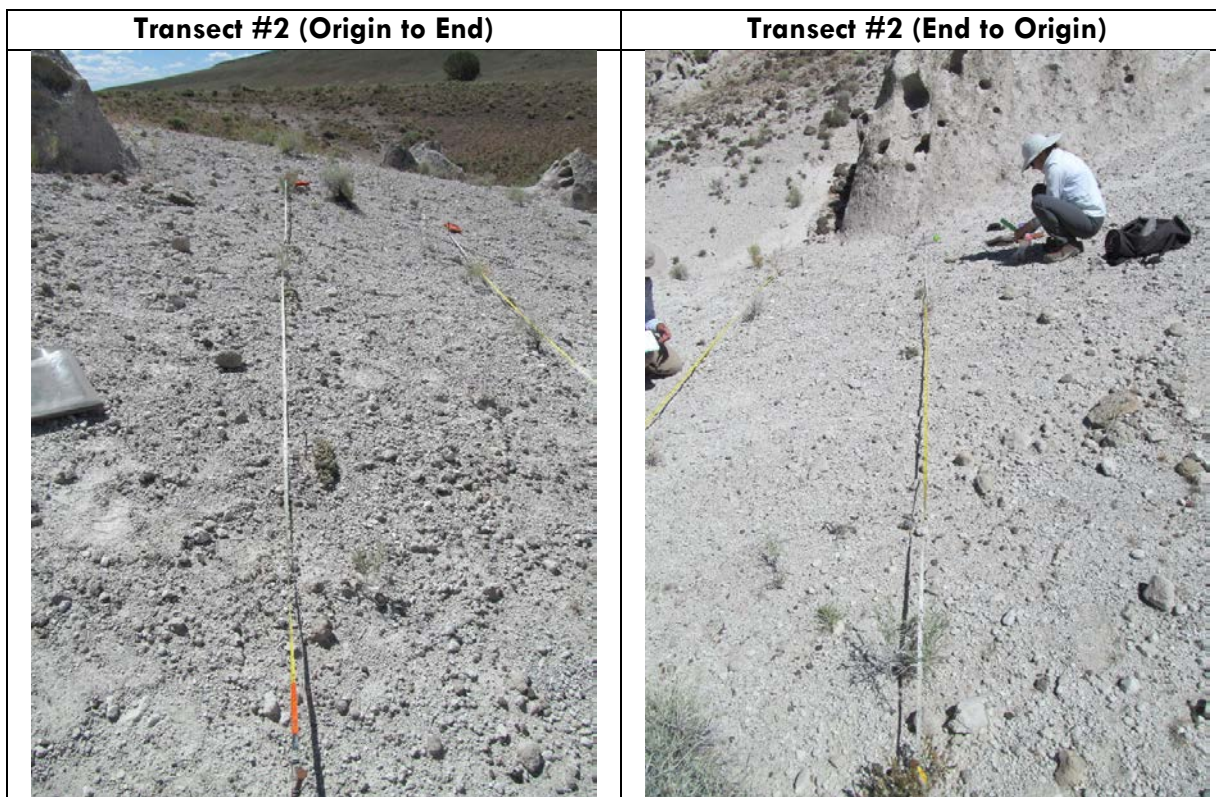
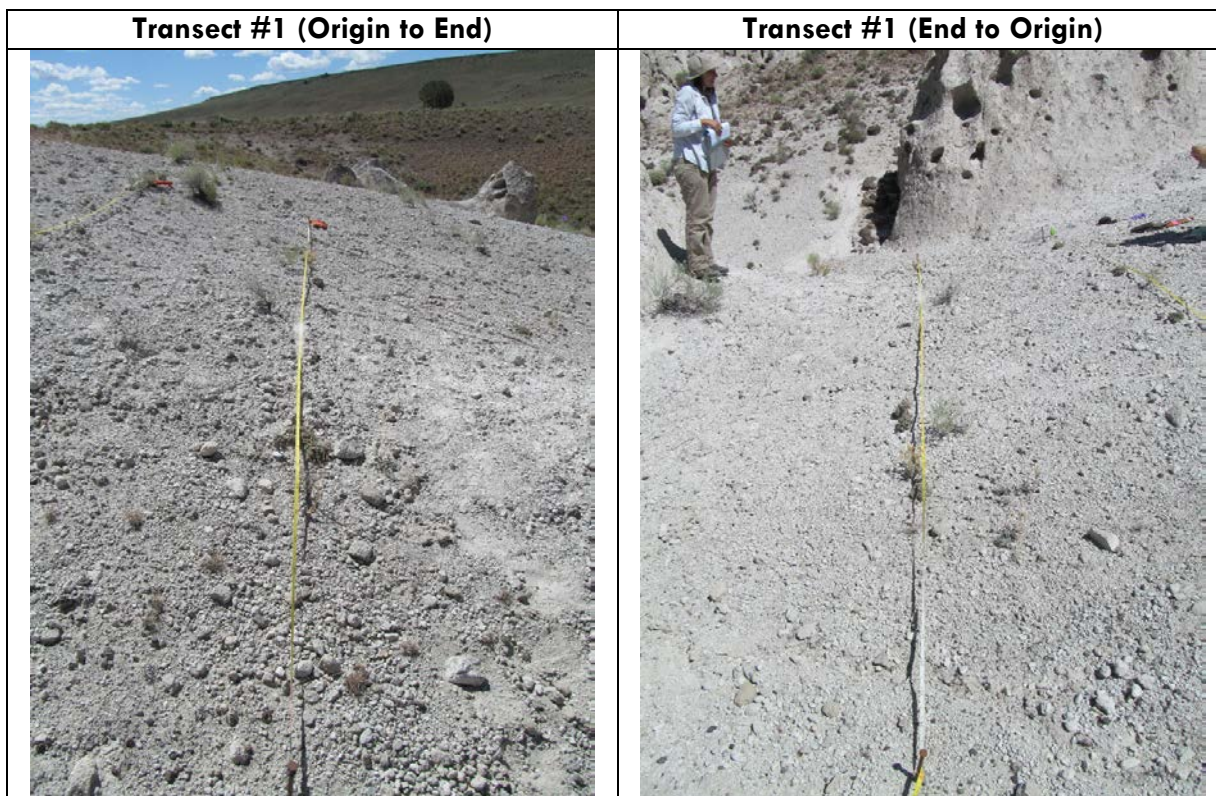
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|     |               |             |    |   |
|-----|---------------|-------------|----|---|
| 28  | 0.48 - 0.61   | 0.0         | 13 | 2 |
| 41* | 0.64 - 0.67   | 1.0 cm up   | 3  | 0 |
| 29  | 0.78 - 0.86   | 0.0         | 8  | 8 |
| 67  | 1.46 - 1.49   | 4.0 cm down | 3  | 0 |
| 30  | 2.29 - 2.41   | 0.0         | 12 | 3 |
| 31  | 2.47 - 2.63   | 0.0         | 16 | 0 |
| 32  | 3.46 - 3.59   | 0.0         | 13 | 0 |
| 33  | 3.69 - 3.81   | 0.0         | 12 | 0 |
| 35  | 4.27 - 4.55   | 0.0         | 28 | 0 |
| 36  | 6.50 - 6.61   | 4.0 cm down | 11 | 0 |
| 38  | 6.97 - 7.08   | 0.0         | 11 | 0 |
| 39  | 7.11 - 7.16   | 1.0 cm down | 5  | 1 |
| 40  | 8.95 - 9.02   | 0.0         | 7  | 0 |
| 74  | 8.92 - 9.01   | 8.0 cm down | 9  | 0 |
| 86* | 9.61 - 9.73   | 0.0         | 12 | 6 |
| 47  | 10.05         | 1.1 m down  | 13 | 9 |
| 66  | 10.00 - 10.12 | 1.9 m down  | 12 | 2 |
| 29* | 10.30         | 2.73 m down | 17 | 6 |
| 64  | 9.13          | 2.67 m down | 18 | 1 |

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**\*NOTE:** Plants #41 and #29 located on T4 were not the plants originally marked with those numbers in 1990 (locations along transect did not match up); it is likely they were assigned with these numbers at some later point since the nail/tag looked relatively new. Plant #86 was determined to be the original plant #43 marked in 1990 based on its location along T4; it is likely the tag was missing when monitoring occurred in a later year and it was re-tagged with this new number.

# APPENDIX D. PHOTOPOINTS FOR *IVESIA RHYPARA* VAR. *RHYPARA* TRANSECTS



**Transect #3 (Origin to End)**



**Transect #3 (End to Origin)**



**Transect #4 (Origin to End)**



**Transect #4 (End to Origin)**

