

BALDWIN LAKE ECOLOGICAL RESERVE  
SLENDER-PETALED THELYPODIUM MONITORING PLAN  
WITH  
2015-2017 RESULTS & DISCUSSION



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PREPARED BY THE  
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE  
NATIVE PLANT PROGRAM

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#F15AP00059 AND THE RARE AND ENDANGERED SPECIES PRESERVATION FUND



EXECUTIVE SUMMARY..... iii

Part 1 .....BALDWIN LAKE ECOLOGICAL RESERVE SLENDER-PETALED  
THELYPODIUM MONITORING PLAN

Part 2 .....BALDWIN LAKE ECOLOGICAL RESERVE SLENDER-PETALED  
THELYPODIUM MONITORING RESULTS AND DISCUSSION 2015-2017





## EXECUTIVE SUMMARY

Slender-petaled thelypodium (*Thelypodium stenopetalum*) is an herbaceous biennial plant that is designated as endangered under the California Endangered Species Act and federal Endangered Species Act. Slender-petaled thelypodium is found in the Big Bear Valley of the San Bernardino Mountains and a population of this species is located at the California Department of Fish and Wildlife (CDFW) Baldwin Lake Ecological Reserve (Reserve) in San Bernardino County.

The monitoring plan presented in this report was implemented from 2015 to 2017, and implementation is expected to continue into 2021 or later. No slender-petaled thelypodium plants were found at the Reserve in 2015, 15 plants were found in 2016, and 51 plants were found in 2017. Ten slender-petaled thelypodium photo monitoring positions were established at the Reserve from 2015 to 2017 to document habitat conditions and to capture a visual location of where the plants were observed.

With only three years of monitoring data, it is difficult to make strong conclusions. The biennial nature of slender-petaled thelypodium and population fluctuations related to changes in precipitation make it difficult to obtain an accurate estimate of density or population size at the Reserve. Fluctuations in the number of flowering plants do not necessarily equate to population growth or decline, making it difficult to discern reliable population trends. However, since so few plants were observed we are concerned about the persistence of this population.

This protocol should be implemented by CDFW staff at the Reserve. The purpose of this monitoring protocol is to facilitate the adaptive management of the population of slender-petaled thelypodium at the Reserve. The monitoring consists of three parts: 1) monitoring population size of the target species, slender-petaled thelypodium; 2) taking photographs; and 3) documenting any visible threats to the population on the Reserve.



# BALDWIN LAKE ECOLOGICAL RESERVE SLENDER-PETALED THELYPODIUM MONITORING PLAN

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

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# 1. INTRODUCTION

Slender-petaled thelypodium (*Thelypodium stenopetalum*) is an herbaceous biennial plant that is designated as endangered under the California Endangered Species Act and federal Endangered Species Act. Slender-petaled thelypodium is found in the Big Bear Valley of the San Bernardino Mountains and a population of this species is located at the California Department of Fish and Wildlife (CDFW) Baldwin Lake Ecological Reserve (Reserve) in San Bernardino County (Figures 1 and 2). No management is occurring at the Reserve.

This protocol should be implemented by CDFW staff at the Reserve (Figure 2). The purpose of this monitoring protocol is to facilitate the adaptive management of the population of slender-petaled thelypodium at the Reserve. The monitoring consists of three parts:

1. Monitoring population size of the target species, slender-petaled thelypodium;
2. Taking photographs; and
3. Documenting any visible threats to the population on the Reserve.

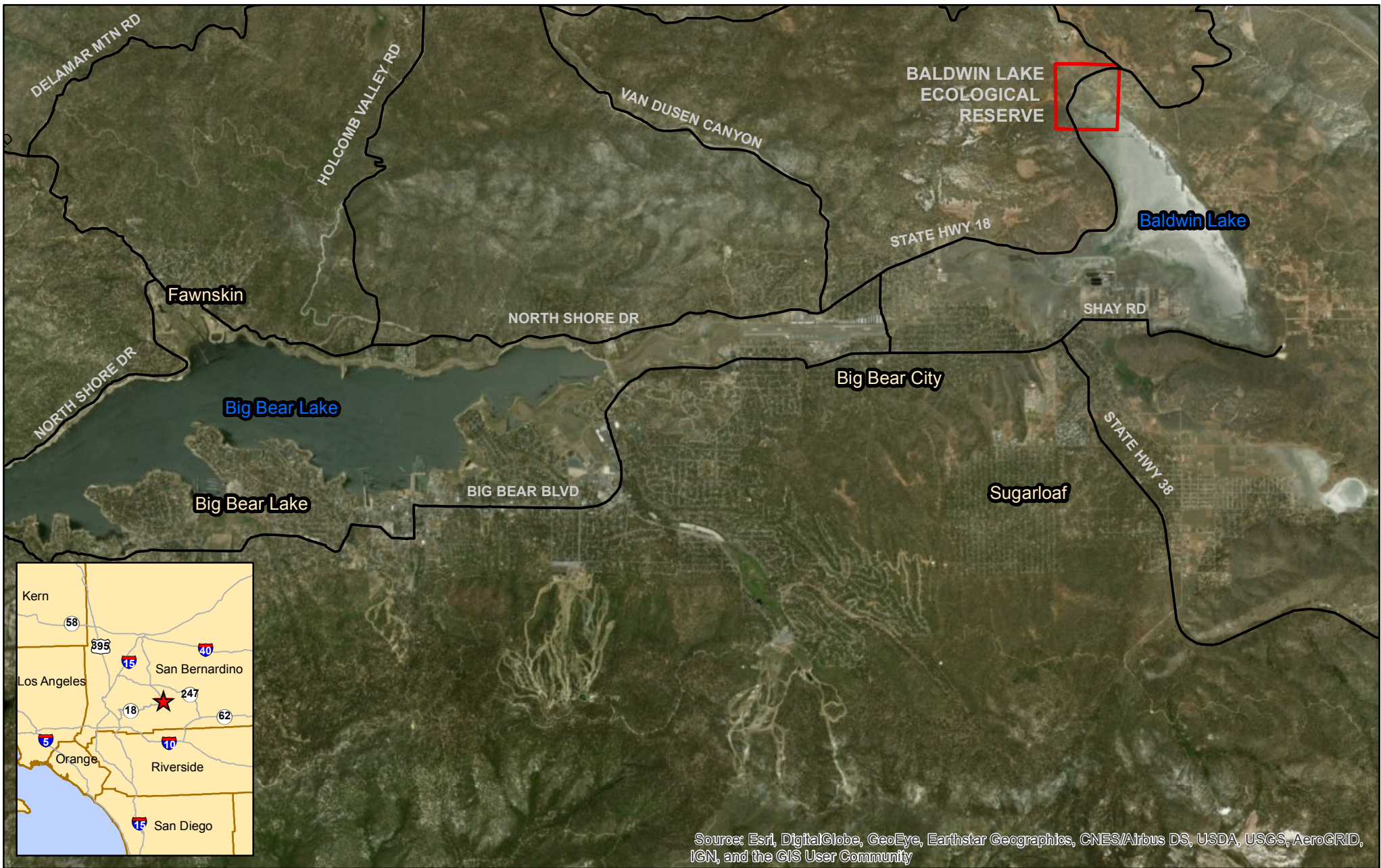
## 2. ECOLOGICAL MODEL

See Figure 3 for an ecological model of slender-petaled thelypodium.

### 2.1. LIFE HISTORY

Slender-petaled thelypodium is typically considered a biennial species, with individual plants completing their life cycle in two years. During the first year, individual plants generally produce only leaf rosettes and rarely flower that year. The species has also been observed acting as an annual during drier years, producing smaller flowers that fall off the plant earlier than during wet years (USFWS 2011). Slender-petaled thelypodium generally grows from 30 to 80 centimeters (12 to 31 inches) tall, with one to many branches per plant. Plants generally flower from May to June, and flowers may be present on the inconspicuous flower stalk through July. Focused pollination studies have not been conducted on this species, but various insects have been observed visiting the flowers including bumblebees (*Bombus* spp.), bee flies (Bombyliidae), and butterflies (Henderson 2003). The larvae of the Andrew's marble butterfly (*Euchloe hyantis andrewsii*) has been observed feeding on native mustard species including slender-petaled thelypodium, but the extent to which this insect utilizes this species is unknown. No information is available on seed dispersal, though it seems the seeds do not disperse far from the parent plant (USFS 2000). No information on seed germination requirements is available, but successful germination is likely related to moisture and temperature, with drier conditions and higher temperatures potentially resulting in a lower percentage of germinating seeds (USFWS 2011).

Slender-petaled thelypodium is primarily found on vernal moist alkaline meadows at elevations from 1,600 to 2,500 meters (5,250 to 8,200 feet) and is only found in the Big Bear Valley of the San Bernardino Mountains (USFWS 2011). Lakeshores and alkaline flats are also suitable habitat for this species (USFS 2000). All populations of slender-petaled thelypodium are found on alkaline clays crossed by annually moist seeps and streams, which indicates that soil hydrology is an important factor in its distribution. Slender-petaled thelypodium plants are often found towards the drier edges of moist meadows or in drier sparsely vegetated meadows dominated by rothrock sagebrush (*Artemisia rothrockii*) (USFS 2000). Plants are often found growing up through Great Basin sagebrush (*Artemisia tridentata*) shrubs (USFWS 2011.) Although soil hydrology plays an important role in the distribution of slender-petaled thelypodium, plants grow across a mosaic of moisture gradients (USFWS 1998), indicating that





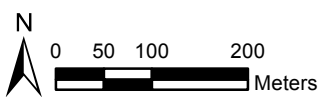
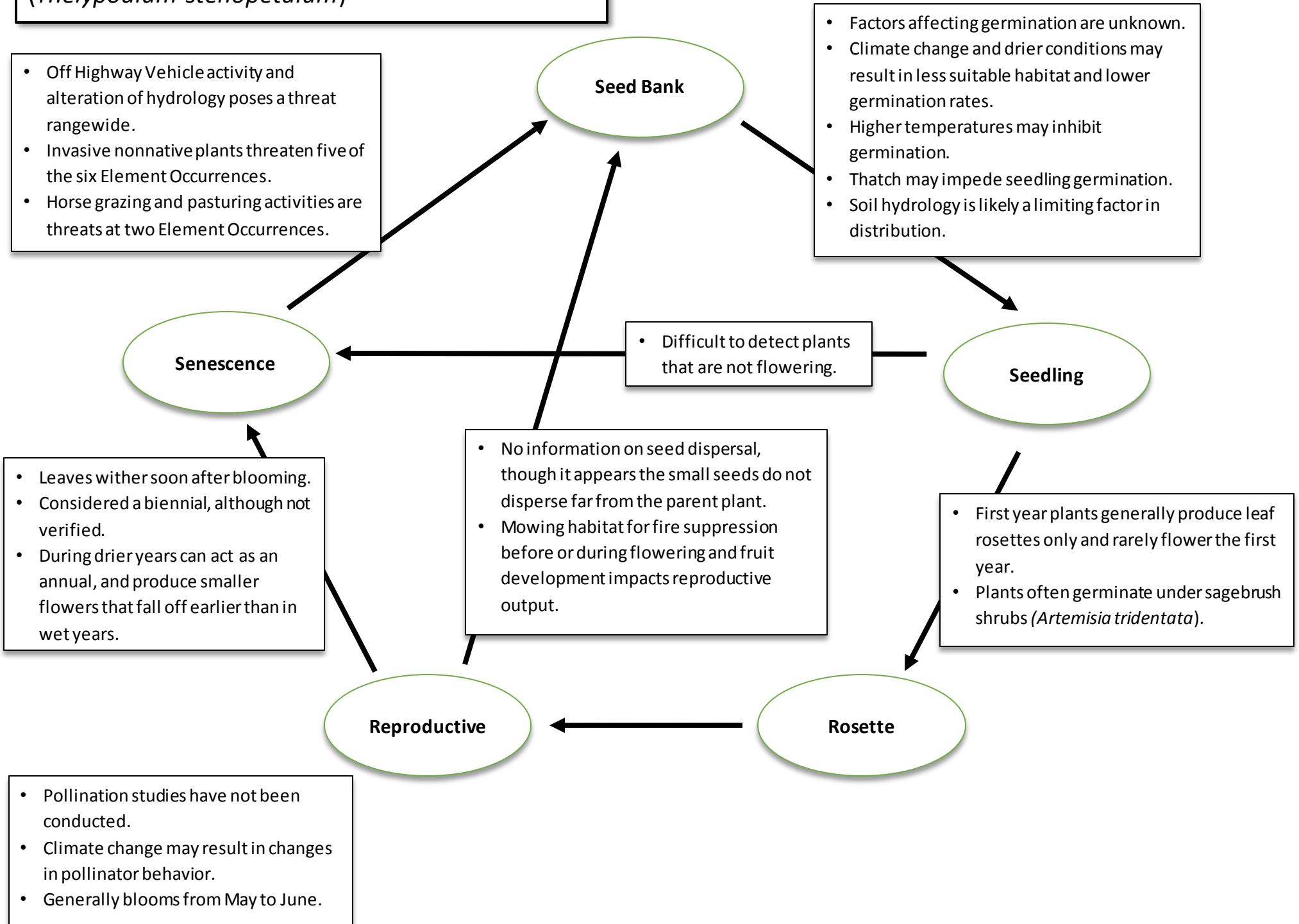


Figure 2

Vicinity of Baldwin Lake Ecological Reserve

**Figure 3. Ecology of Slender-petaled Thelypodium (*Thelypodium stenopetalum*)**





soil hydrology alone is not the only limiting factor in determining suitable habitat (USFWS 2011). Only six populations of slender-petaled thelypodium are presumed to exist (CNDDDB 2018, USFWS 2011).

Vernally moist meadows dry out in the summer and leave evaporates such as salt and minerals on the soil surface, creating salt scalds. These areas are free of vegetation and may provide a niche for plants that can tolerate harsh conditions such as slender-petaled thelypodium (Krantz 2008).

The moist meadows where slender-petaled thelypodium grows are sometimes interspersed with pebble plains, which is another rare habitat in the Big Bear Valley area. Pebble plains are areas of clay soils that are covered with a layer of orange and white quartzite pebbles that are pushed to the surface of the clay by “frost-heaving” (Krantz 1990). During the winter months, the frozen soil surface thaws and contracts during the day, and refreezes at night. The ice expands and pushes the cobbles to the surface. The pebble plains support a specialized plant community comprised of miniature plants adapted to these soil conditions, including several rare plant species (USFWS 2011), and slender-petaled thelypodium is often observed growing in close association with fluffy, frost-heaved soils (Eliason pers. comm. 2016). The pebble plains is a fragile community that is susceptible to high-impact recreational activities such as off highway vehicles (OHV).

Much of the moist meadow habitat that provided suitable habitat for slender-petaled thelypodium has been eliminated, with only an estimated 400 hectares (1,000 acres) remaining in the Big Bear and Holcomb Valleys (USFWS 2011).

### 3. MANAGEMENT OBJECTIVES

Slender-petaled thelypodium can be hard to detect during its first year since the rosettes are small and often germinate under shrubs such as sagebrush. Slender-petaled thelypodium was monitored at the Reserve from 1989 to 1994, with the population varying from approximately 60 individuals in 1990 to almost 3,500 individuals in 1994 (Greene 1994). Results of a study investigating the population response of the species to precipitation supported a significant relationship between the total number of adult plants and 2-year precipitation, 2-year winter precipitation, 3-year precipitation, and 3-year winter precipitation (Henderson 2003), which could partially explain such large fluctuations in population size.

Populations of slender-petaled thelypodium are vulnerable to impacts associated with OHV use, and unauthorized OHV use may threaten slender-petaled thelypodium at the Reserve. The fence along State Route 18 that could prevent unauthorized OHVs from entering the Reserve requires periodic maintenance and repair, and it has been knocked down or has fallen down due to heavy snow drifts.

Photomonitoring is used to qualitatively evaluate the general condition of slender-petaled thelypodium habitat and document the impacts of potential OHV use and other disturbances. In addition, qualitative observations recorded during field visits should document any disturbances or threats to the species and other rare species on the Reserve.

The management objectives are:

- Management Objective #1: Maintain a population of slender-petaled thelypodium containing individuals in both stage classes (rosette, flowering) at Baldwin Lake Ecological Reserve for at least three of the five years from 2018 - 2022.

- Management Objective #2: Prevent disturbances from impacting the ability of slender-petaled thelypodium and other rare plants to maintain healthy self-sustaining populations at Baldwin Lake Ecological Reserve.
- Management Objective #3: Prevent non-native plant species invasions from impacting the ability of slender-petaled thelypodium and other rare plants to maintain healthy self-sustaining populations at Baldwin Lake Ecological Reserve.

## 4. MONITORING DESIGN

### 4.1. SPRING POPULATION MONITORING

The following sections provide instruction on how to implement this monitoring protocol. As part of the protocol, you will conduct a census of slender-petaled thelypodium at Baldwin Lake Ecological Reserve. Conduct the spring census when slender-petaled thelypodium plants are evident and easily identifiable, likely in mid to late May or early June.

#### 4.1.1. SAMPLING OBJECTIVE

All slender-petaled thelypodium plants in the population at the Reserve will be counted, unless there are too many to count. If there are too many to count, a sampling methodology will be developed in the field.

#### 4.1.2. BEFORE GOING INTO THE FIELD

Before going into the field read this protocol, recruit field helpers (a total of 2-3 workers is ideal), and organize your field equipment. Contact the reserve manager prior to your visit (Eddy Konno in 2018).

#### Organize field equipment

(Figure 4):

- (2+) 100 meter tapes
- (2+) 50 meter tapes
- Screwdrivers or other tools for pinning meter tapes to the ground
- (many) Pin Flags
- (2+) Lengths of PVC (0.25 meter)
- (2+) Lengths of PVC (1 meter)
- (3+) Hand tally counters
- Data sheets, clipboards, pencils
- Replacement field markers (aluminum conduit and/or rebar with caps and lengths of PVC)
- PVC cutter
- Tape measure
- Small sledgehammer

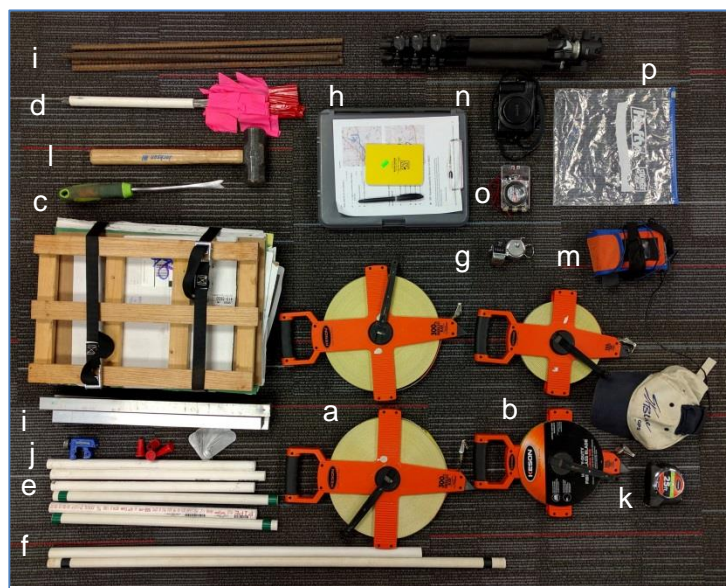


Figure 4 - Spring Field Equipment

- m) GPS for relocating field markers and documenting plant locations
- n) Tripod and camera
- o) Compass
- p) Zip-lock bags and/or plant press
- q) Metal detector for relocating missing field monument locations (not pictured)

#### 4.1.3. IN THE FIELD

##### **Survey the Reserve for slender-petaled thelypodium**

Drive to the Reserve and park in the Reserve's parking lot on the west side of Highway 18.

- Lat/Long: 34°17'26.35"N, 116°49'11.94"W
- Google Maps: <https://www.google.com/maps/@34.290653,-116.8199844,370m/data=!3m1!1e3>
- See Figure 2

All parts of the Reserve can be reached on foot from the parking lot. Slender-petaled thelypodium has only been documented in the portion of the Reserve east of Highway 18 (see Figure 5). Carefully cross the road on foot and climb over or go through the fence on the east side of the road.

Plants identified on the Reserve in 2016 and 2017 were growing in small patches, which are shown on Figure 5. Return to each of these areas and carefully search for plants, including areas under sagebrush in your search. Place a pin flag next to any slender-petaled thelypodium plants you identify, using caution to not damage the plants. Walk carefully through the area to avoid trampling any plants; plants in the rosette stage are difficult to see.

Following the initial focused search, systematically search suitable habitat in the Reserve by walking north/south transects in the "search area" using the road as a baseline and a compass bearing to orient the transects (see Figure 6). Transects should be spaced approximately 3 – 4.5 meters (10 – 15 feet) apart. Place a pin flag next to any individual slender-petaled thelypodium plants identified.

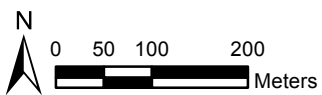
##### **Collect data**

After surveying the Reserve, return to the areas marked with pin flags. Carefully survey the area for additional plants that may have been missed during the initial search. Often slender-petaled thelypodium plants germinate under shrubs, so be sure to check carefully around and under larger plants. Place pin flags in the ground near individuals as you find them, using caution to not damage any plants.

Once you are confident that you have identified and flagged all slender-petaled thelypodium plants, begin your census.

The plants identified to date were found in groupings or patches. It is easier to count individuals if you conduct a census of each area or grouping and tally the numbers when you are finished. Count rosettes and flowering individuals for each grouping and record these numbers on the appropriate datasheet. Make sure to fill out all fields on the datasheet and take any other necessary field notes.





Source: DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



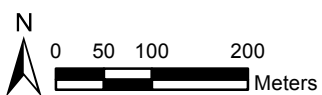
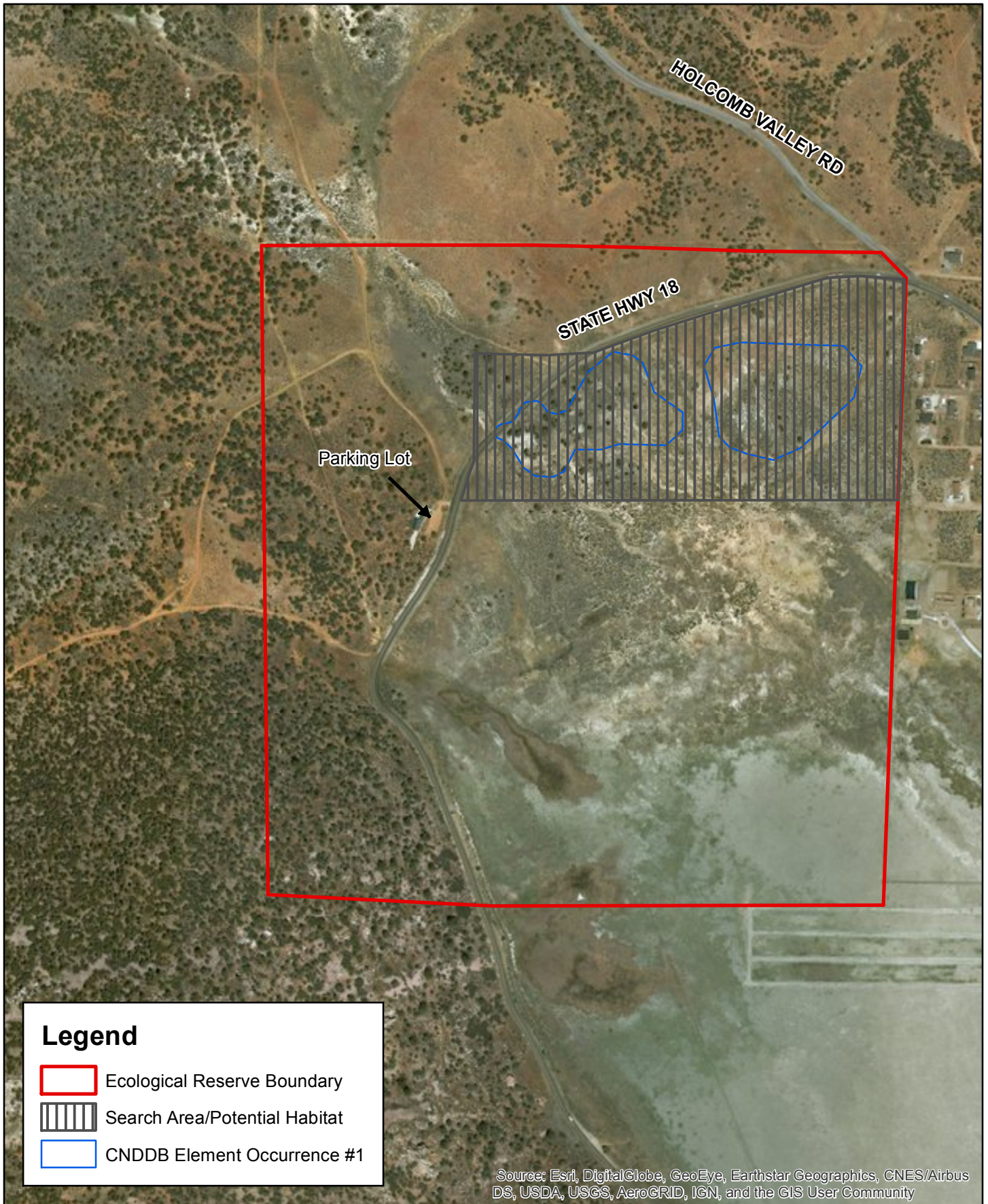


Figure 6  
Survey Area for Slender-petaled Thelypodium at  
Baldwin Lake Ecological Reserve

If additional groupings of plants that are not shown on Figure 5 are identified while surveying, identify the grouping with the next subsequent letter (i.e., group E, F, etc.), count rosettes and flowering individuals for the grouping, and record the data on the appropriate datasheet.

#### 4.1.4. BACK IN THE OFFICE

- Scan, save, and re-name all field data sheets. The current project folder is: U:\groups\HCPB\Shared Folders\NPP\Section 6\2014\Project Files\Baldwin Lake. The Project folder may change in the future.
- Compare the results with previous years and make graphs of the data. Make conclusions and talk to the reserve manager about adaptive management of the site.  
**This is the most important part of adaptive management!**

## 4.2. ANNUAL PHOTOMONITORING FOR ADAPTIVE MANAGEMENT

Photomonitoring should be conducted annually when the population is censused. Photos should be taken after pin flags are placed next to each plant as described above in Section 4.1.3 to visually document locations and numbers of individual plants.

### 4.2.1. BEFORE GOING INTO THE FIELD

The monitor conducting the photomonitoring should be trained and familiar with the proper use of a field compass and the digital camera and tripod that will be used. The following equipment is required:

- Clipboard with photomonitoring log sheets (Section 9)
- Pencil
- Digital camera with fully-charged batteries and available memory
- Tripod
- Tape measure or meter tape
- Compass set to the correct declination for the site (11 degrees east)

To duplicate approximately the same field of view from year to year, the camera should be set to a focal length that is equivalent to a focal length of approximately 27mm on a “full frame” camera such as a 35mm film camera or a Nikon “FX” camera and lens. Monitoring photographs for the 2015 – 2017 photomonitoring were taken using a Nikon “DX” camera and lens, set to a focal length of 18mm, which is equivalent to 27mm on a “full frame” camera and lens. Before visiting the site, check the specifications for digital cameras that may be used for the monitoring to see if photographs can be taken with the correct field of view. If the camera equipment to be used cannot duplicate this field of view, the closest field of view possible should be used.

### 4.2.2. IN THE FIELD

#### **Locate Photopoint Monuments**

The photopoints were placed to document general habitat conditions, to capture a visual location of where the individual plants were observed during this monitoring effort, and to capture habitat conditions in areas where these plants had been identified during previous monitoring efforts in the early 1990s. Photopoints use landmarks and transect markers from the previous monitoring effort as a reference. One photopoint is marked with an aluminum rod with a red cap and tag denoting its photopoint identifier. The locations of photopoints are described



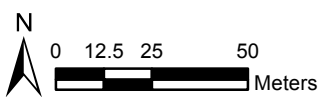
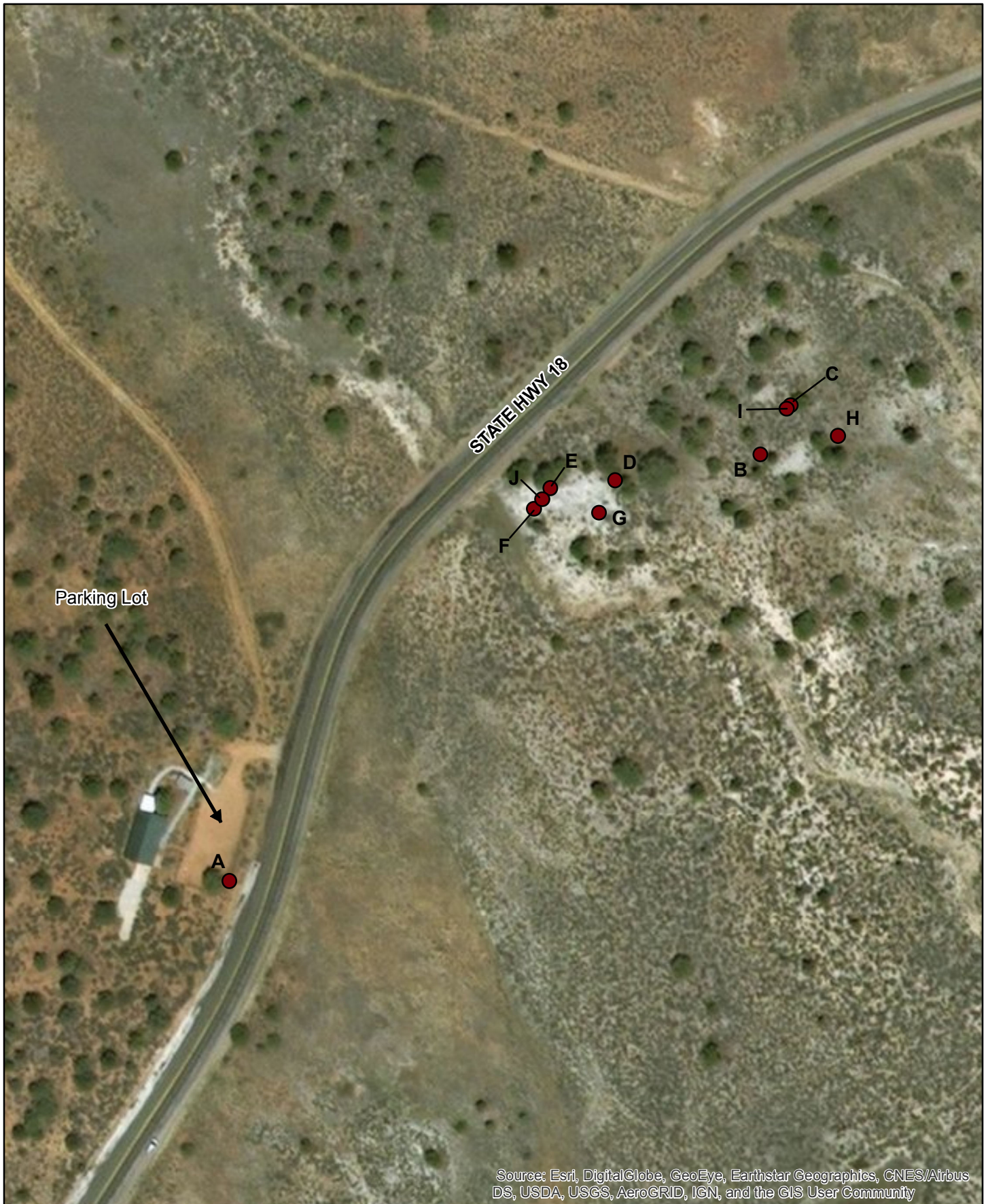
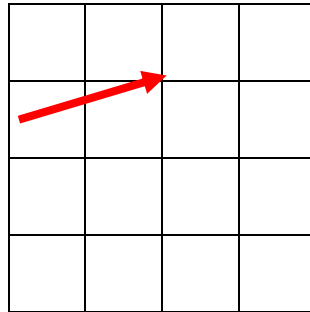


Figure 7  
 Photopoint Locations at Baldwin Lake Ecological Reserve  
 Baldwin Lake Ecological Reserve Slender-petaled Thelypodium Monitoring Protocol

Photographs should be taken from the established photopoints listed in Table 1 below and shown on Figure 7. Directions for locating photopoints are included in Table 1.

- **Set up the tripod and camera** so that the center of the camera lens is 5 feet (152cm) from the ground (the maximum height for many tripods).
- **Populate Each Page of the Photomonitoring Log** with the date, photographer name, focal length, camera, lens and camera settings.
- **Take a “Slate” Photo** of the first page of the Photomonitoring Log sheet itself before taking all of the monitoring photos on that page. Take a photo of the next page of the Photomonitoring Log before taking all of the photos that are listed on that page, and so on, until all monitoring photos have been taken.
- **Take monitoring photos** in the order that they are listed on the Photomonitoring Log and move between the photomonitoring locations. Follow these rules:
  - Use the field compass to ensure that all photos are taken in the direction indicated in the Photomonitoring Log.
  - Make sure that the camera focuses properly before taking each picture, and use the preview function of the camera to make sure that the photos are being taken correctly.
  - Take each of the photographs so that the subject of the photo or the horizon is approximately 1/4 of the way down from the top of the frame, so that more of the ground is incorporated into the photo.



Center the photo subject or horizon in the camera viewfinder here



**Table 1 - Photomonitoring Points**

Photopoint ID	Reference Marker for Photopoint	Lat, Lon of Reference marker	Actual Photopoint location	Notes
A	Southeast corner of fence at Reserve Parking lot	34.290853, -116.820207	At corner of fence	Tripod placed on inside corner of fence
B	SW corner marker of "transect #4"	34.29205, -116.818389	2 meters southwest of marker	
C	NE corner marker of "transect #4"	34.292167, -116.818314	2 meters northeast of marker	
D	SE corner marker of "transect #1"	34.291964, -116.818933	3 meters east of marker	
E	SW corner marker of "transect #1"	34.291942, -116.819103	2 meters west of marker	
F	SW corner marker of "transect #2"	34.291883, -116.81915	3 meters west of marker	
G	SE corner marker of "transect #2"	34.291872, -116.818989	3 meters east of marker	
H	"Photopoint H" marker installed	34.292095, -116.818130	At marker	
I	NE corner marker of "transect #1"	34.291989, -116.818942	At marker	
J	NW corner marker of "transect #2"	34.2919, -116.818333	2 meters NW of marker	

#### 4.2.3. BACK IN THE OFFICE

Save all monitoring photos in the in the project folder on the shared drive in the folder for that field visit, for example: "U:\groups\HCPB\Shared Folders\NPP\Section 6\2014\Priority Plant Surveys\Project Files\Baldwin Lake Thelypodium\Monitoring\2016 Visit\May 2016 Photomonitoring\Photos unedited."

Carefully change the file names for the monitoring photos using the following convention: [uppercase letter of photopoint][lowercase letter identifying photo][four digit year][two digit month][two digit day of the month]. For example, for photo b of Photopoint A taken on May 19, 2015, the file should be named "Ab20150519".

All properly named monitoring photos should be saved in the following folder on the shared drive: "U:\groups\HCPB\Shared Folders\NPP\Section 6\2014\Priority Plant Surveys\Project Files\Baldwin Lake Thelypodium\Monitoring\All photomonitoring photos for comparison". The location of this folder may change in the future.

With the monitoring photos saved, use the Windows Photo Viewer or a similar program and the left and right arrow keys on the keyboard to compare monitoring photos with those taken during previous site visits and look for signs of excessive impacts from trampling or other threats and other differences. Make conclusions and talk to the reserve manager about adaptive management of the site. **This is the most important part of adaptive management!**

### 4.3. DOCUMENTATION OF THREATS

During each site visit, any visible threats to the population should be recorded and saved to the file. Such threats include but are not limited to non-native invasive plant infestations, evidence of trampling, or evidence of OHV use.

## 5. RESPONSIBLE PARTIES

CDFW staff in the Native Plant Program or Inland Deserts Region (Region 6) should implement this monitoring protocol and report results and recommended actions annually to the Reserve manager. The Reserve manager should make decisions on how to adaptively manage the Reserve.

## 6. FUNDING

CDFW staff in the Native Plant Program used grant funding from the U.S. Fish and Wildlife Service Cooperative Endangered Species Conservation Fund (Federal Grant Identifier F15AP00059) to prepare this protocol and collect monitoring data from 2015 to 2017. CDFW staff in the Native Plant Program expect to continue implementation of this Monitoring Plan from 2018 to 2021, funded by another grant from the U.S. Fish and Wildlife Service Cooperative Endangered Species Conservation Fund (Federal Grant Identifier F18AP00042). Continuation of this Monitoring Plan after 2021 is likely dependent on the ability of staff in the Native Plant Program to use staff time funded by the endangered species tax check off fund, general fund, and other programs to complete the work. Field helpers can often be borrowed from other CDFW programs if the appropriate program managers approve the work as cross training for their staff. Implementation of this monitoring protocol could also be implemented by staff in CDFW's Inland Deserts Region or by CDFW volunteers. It is estimated that annual implementation of this protocol will require the following:

In-office preparations: 16 hours by one environmental scientist or senior environmental scientist (specialist) = **16 hours**

Field visits to collect data: 32 hours by one environmental scientist or senior environmental scientist (specialist) and one other field helper = **64 hours**

In-office data analysis and reporting: 16 hours by one environmental scientist or senior environmental scientist (specialist) = **32 hours**

**TOTAL STAFF TIME NEEDED: Approximately 112 hours per year**

## 7. MANAGEMENT IMPLICATIONS OF POTENTIAL RESULTS

Management Implication #1: If a population that includes both stages of slender-petaled thelypodium is not found on the Reserve in three of the five years, research will be initiated to investigate the cause of failure, which could include drought and climate change. CDFW will request that Rancho Santa Ana Botanic Garden conduct seed viability testing on seed that has been collected from the Reserve and is in their long-term conservation storage facility. If seeds in storage are viable, reintroduction efforts at the Reserve will be initiated.

Management Implication #2: If OHV evidence is found, fences will be inspected for damage and will be repaired. If other disturbances or threats are identified to slender-petaled thelypodium

and other rare plants or their habitat on the Reserve, alternative management such as non-native species removal will be considered.

## 8. REFERENCES

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### **Personal Communications and Observations**

Eliason, Scott. 2016. U.S. Forest Service. Personal communication with Cherilyn Burton, CDFW Senior Environmental Scientist (Specialist), Sacramento, California during field visit between S. Eliason and CDFW staff at Baldwin Lake Ecological Reserve.

## 9. DATA SHEET EXAMPLES

The following pages are examples of field data sheets that may be used or modified for monitoring.



**California Department of Fish and Wildlife Baldwin Lake Ecological Reserve Qualitative Monitoring**

Date: \_\_\_\_\_

Field personnel: \_\_\_\_\_

Location(s) visited:

Describe the phenological condition of vegetation:

Describe any particularly abundant or notable plants or wildlife observed:

Describe visible threats and disturbances:

Describe weed infestations:

Photographs taken:

Recommendations:

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint A: Southeast corner of Parking lot**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Tripod is placed at inside corner of parking lot fence. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	Northeast, level	Baldwin Lake sign in the middle of the photo frame. Top of mountains just above middle of the frame.		
b	East, level	Top of mountains just above the middle of the photo.		
c	Southeast, level	Top of mountains just above the middle of the frame.		
d	South, level	Top of the mountain in the background is in the middle of the photo (vertically).		

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint B: "Transect #4" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 2 meters southwest of southwest corner of the transect – no marker installed. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	Northeast, camera angled slightly downward to include the start of the transect	Horizon almost at the top of the frame		
b	North			

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint C: "Transect #4" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 2 meters northeast of the northeast marker of the transect. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	Southwest	Mountain top at the very top of the frame.		
b	South			



**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint D: "Transect #1" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 3 meters due east of the southeast marker of the transect. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	283°	Photo facing 283° to include all 4 markers		
b	West	Does not capture all 4 markers		

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint E: "Transect #1" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 2 meters due west of the southwest marker of the transect. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	East			

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint F: "Transect #2" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 3 meters west of the southwest marker of the transect. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	East	Includes all 4 markers of transect.		

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**

**Photopoint G: "Transect #2" – relocated from previous monitoring project in the 1990's**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photopoint is 3 meters east of the southeast marker of the transect. Use a tape measure and compass to locate photopoint. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	West	Includes all 4 markers of transect. Top of mountains near top of frame.		

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**  
**Photopoint H**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photo point is located near the closest juniper near the grouping of *Thelypodium stenopetalum* individuals found around the following coordinates: 34°17'31.77", -116°49'05.15". Monument installed with a tag that reads "Photopoint H, CDFW ThSt". Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

<b>Photo</b>	<b>Direction and angle</b>	<b>Description</b>	<b>Original photo file name in camera</b>	<b>Notes</b>
a	North, level			
b	Northeast, level			
c	East, level			

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**  
**Photopoint I**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photo point taken at the marker for transect 4 northeast corner. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ **Observer(s)** \_\_\_\_\_

**Camera:** \_\_\_\_\_ **Lens:** \_\_\_\_\_

**Focal Length:** \_\_\_\_\_ **Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	Northeast, level			

**Baldwin Lake Ecological Reserve, Photomonitoring Data Sheet**  
**Photopoint J**

Shoot photos with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). Take all photos on a tripod, set with camera approximately 5 feet above the ground. Legs of tripod fully extended; middle piece of tripod not extended. Photo point is 2 meters northwest of the northwest corner marker of transect #2. There is no monument or marker for the photopoint. Use a measuring tape and compass to set up photo point. Take a photo of this monitoring sheet before you begin the monitoring photos.

**Date:** \_\_\_\_\_ **Observer(s):** \_\_\_\_\_

**Camera used:** \_\_\_\_\_ **Lens:** \_\_\_\_\_ **Focal Length:** \_\_\_\_\_

**Camera Setting:** \_\_\_\_\_

**Notes/General Observations:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Photo	Direction and angle	Description	Original photo file name in camera	Notes
a	Northwest, level			
b	North, level			

# BALDWIN LAKE ECOLOGICAL RESERVE SLENDER-PETALED THELYPODIUM MONITORING RESULTS AND DISCUSSION 2015 - 2017

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

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# 1. INTRODUCTION

This document summarizes the 2015-2017 monitoring results from implementation of the 2017 Baldwin Lake Ecological Reserve Slender-Petaled Thelypodium Monitoring Plan (Monitoring Plan). The Monitoring Plan is included as Part 1 of this report and includes detailed instructions on how to implement a monitoring protocol for slender-petaled thelypodium (*Thelypodium stenopetalum*) at the California Department of Fish and Wildlife (CDFW) Baldwin Lake Ecological Reserve (Reserve). The purpose of the Monitoring Plan is to facilitate the adaptive management of the population of slender-petaled thelypodium at the Reserve. Implementation of the Monitoring Plan is expected to continue into 2021 or later. This document includes an interpretation of results, an assessment of the monitoring project, and management recommendations. The results and recommendations in this document are a critical step in the adaptive management process.

## 2. SUMMARY OF RESULTS

This document reports on the result of the following monitoring components:

1. A census of slender-petaled thelypodium plants on the Reserve;
2. Photomonitoring; and
3. Documentation of potential threats.

In addition, precipitation information generated using a PRISM climate model is presented, and general observations of other rare plants on the Reserve are reported.

### 2.1. SPRING DENSITY MONITORING

The location of the population of slender-petaled thelypodium on the Reserve is shown on Figure 1. All individuals of slender-petaled thelypodium were counted on the Reserve in 2016 and 2017. The Reserve was surveyed extensively in 2015, but no individuals were found.

In 2016, we counted 3 basal rosettes and 12 flowering adult plants of slender-petaled thelypodium, for a total of 15 individual plants (see Figure 2). Two additional rosettes were located that were potentially slender-petaled thelypodium, but they were too small to positively identify and are not included in the total for 2016. In 2017, we identified 38 basal rosettes and 13 flowering adult plants, for a total of 51 slender-petaled thelypodium individuals (see Figure 2).

### 2.2. ANNUAL PHOTOMONITORING FOR ADAPTIVE MANAGEMENT

Ten slender-petaled thelypodium photo monitoring positions were established at the Reserve from 2015 to 2017. Since the population is small and restricted, many of the photopoints were established to capture the habitat conditions rather than document individual plants. Monitoring photos were taken in May or June after plant surveys and population counts were completed. Monitoring photos from 2015 to 2017 at selected photo positions are presented in Figures 3 through 7.

The photopoints were established to document habitat conditions and to capture a visual location of where the plants were observed during 2016 and 2017. During 2015, no plants were found and only one photopoint was established to document overall condition of the habitat. In

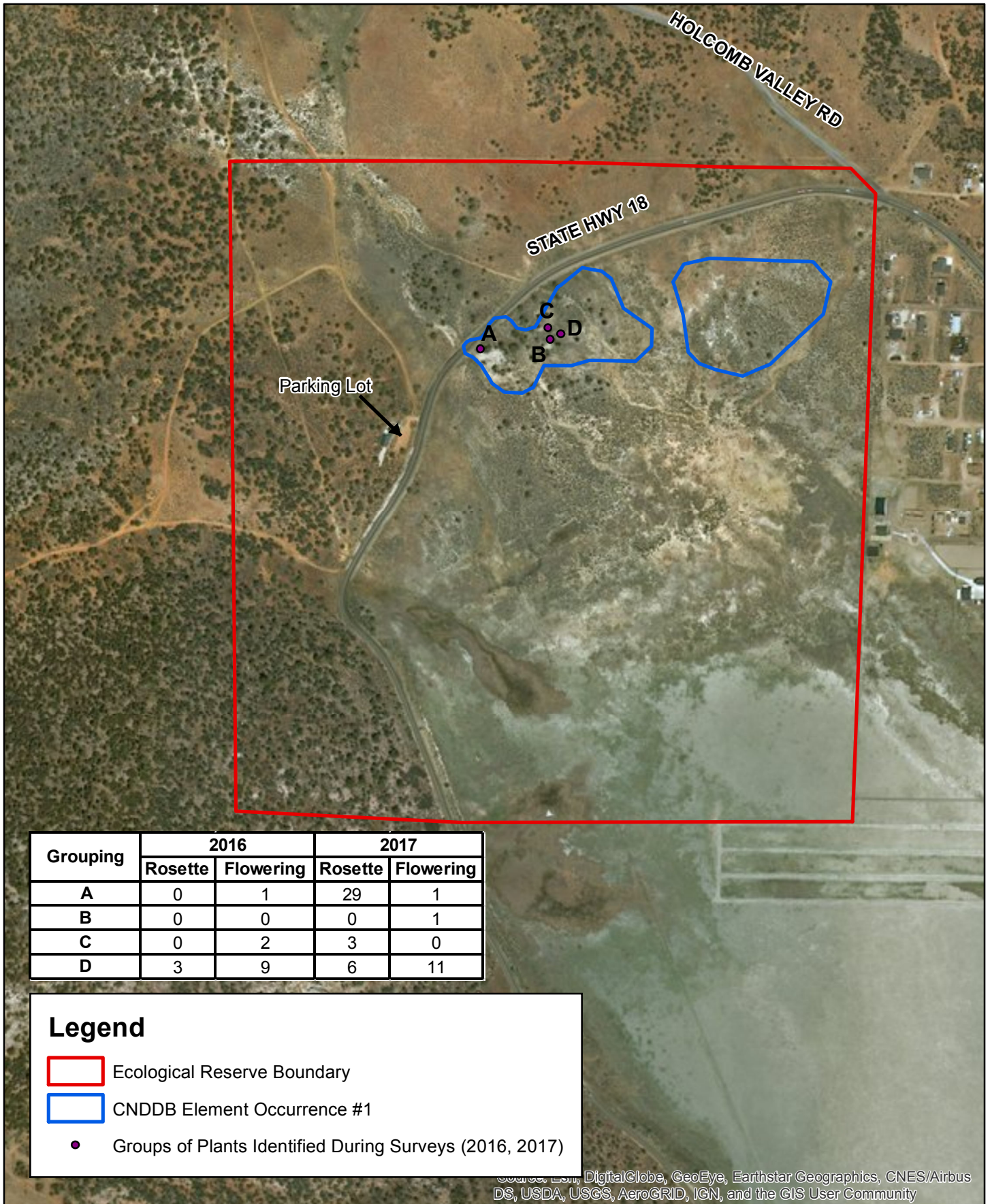
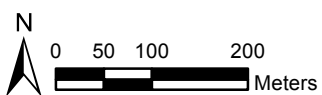
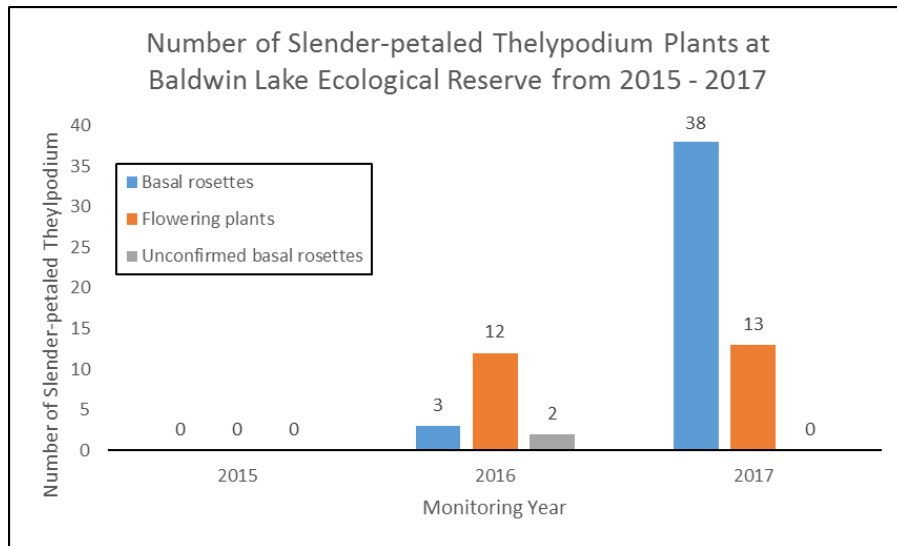


Figure 1

Slender-petaled Thelypodium Observed in 2016 and 2017 at Baldwin Lake Ecological Reserve

Baldwin Lake Ecological Reserve Slender-petaled Thelypodium Monitoring Protocol





**Figure 2 - Number of Slender-Petaled Thelypodium Plants at Baldwin Lake Ecological Reserve 2015 – 2017**

2016 and 2017, additional photopoints were added using transect markers that were installed during a population monitoring project in the early 1990’s as reference points. These photopoints were established to capture general conditions of the habitat where these plants had been identified in the past even though only one plant was found in one of the transects in 2016, and no plants were found in any of the transects in 2015 and 2017, as well as to document the location and habitat where individuals were found outside of the historic transects in 2016 and 2017. The locations of photopoints are described in Table 1 and shown on Figure 8 included in Part 1 of this report.

### 2.3. DOCUMENTATION OF THREATS

Potential threats to slender-petaled thelypodium that were identified during the 2015 – 2017 monitoring visits included competition from non-native plants and vulnerability to trespass from off-highway vehicles (OHVs). Cheat grass (*Bromus tectorum*), a non-native, invasive annual grass was identified growing throughout the Reserve. This species has Cal-IPC Rating of High, which means it has severe ecological impacts on physical process, plant and animal communities, and vegetation structure, and it disperses and establishes rapidly. Cheat grass is known to displace native vegetation by outcompeting seedlings for soil moisture, and it is also known to change the frequency, extent and timing of wildfires (Young 2000). Two other non-native, potentially invasive plants, tuberclad crowfoot (*Ranunculus testiculatus*) and clasping pepperweed (*Lepidium perfoliatum*), are also growing at the Reserve. The specific impacts to slender-petaled thelypodium from cheat grass and other invasive species are unknown, but it is expected that slender-petaled thelypodium could be negatively affected by invasion of these species on the Reserve. The extent of cheat grass invasion and invasion of other non-native plant species should be further studied and monitored.

At the time of listing, OHV activity was identified as one of the main threats to habitat occupied by slender-petaled thelypodium, and continues to threaten and impact its habitat. The fence along the edge of the road to prevent trespass by OHVs into habitat occupied by slender-petaled thelypodium has been knocked down in part, likely due to heavy snowfall or other factors. While no evidence of OHV activity was observed within the slender-petaled thelypodium



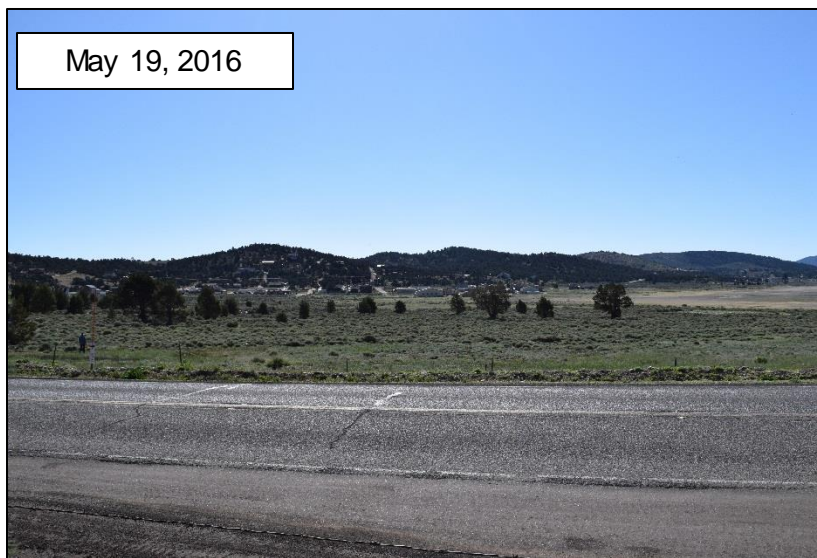
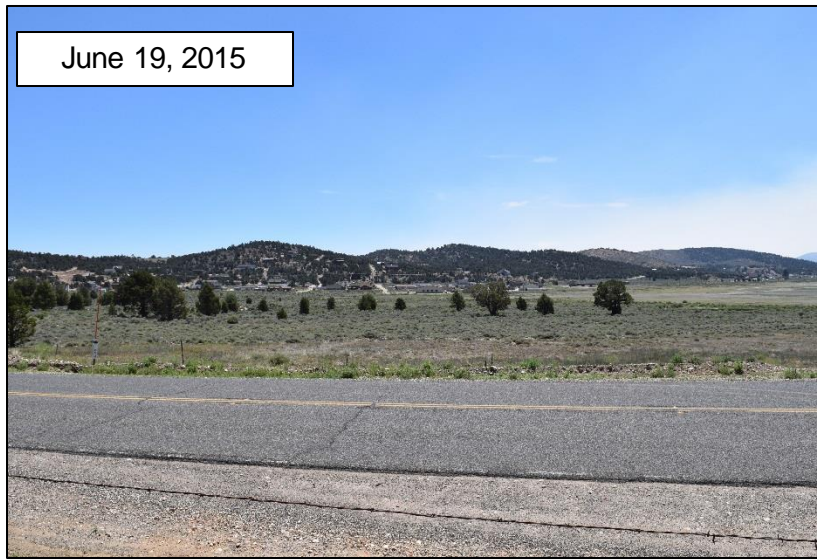


Figure 2  
Photopoint Ab 2015 – 2017  
Baldwin Lake Ecological Reserve





Figure 4  
Photopoint Ba 2016 – 2017  
Slender-petaled Thelypodium Habitat  
The Flags Mark the Corners of a Historic Monitoring Transect



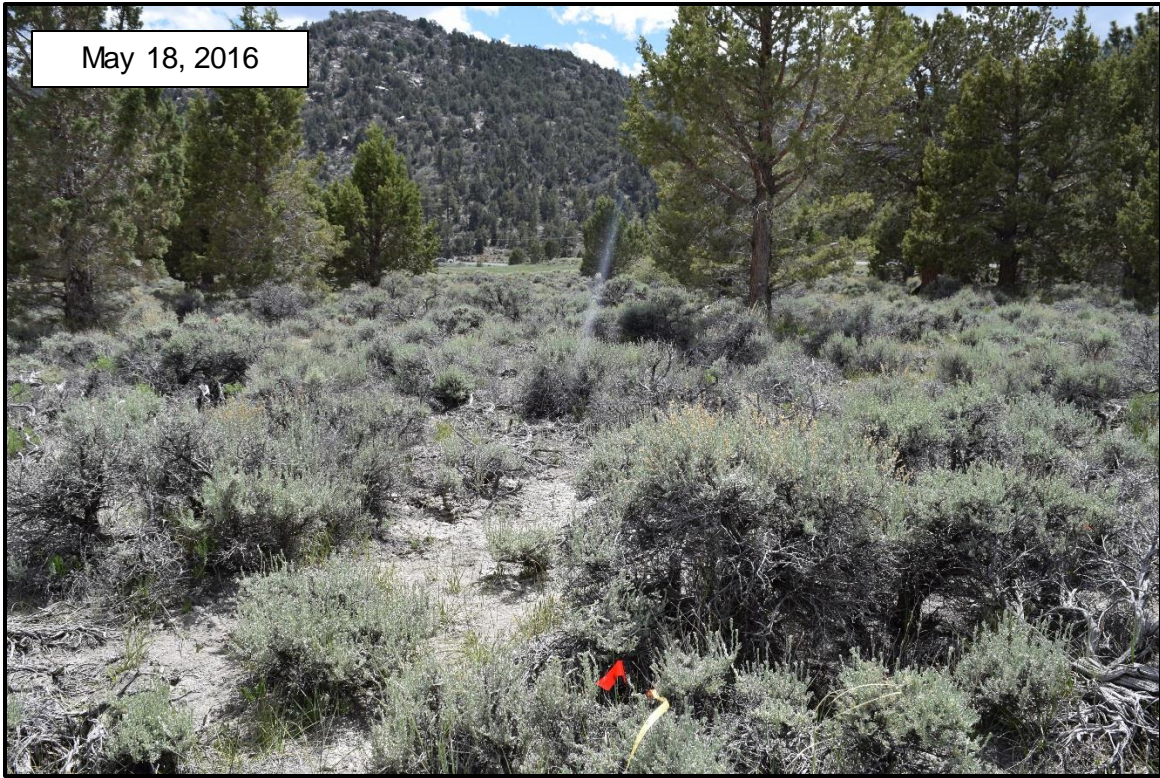
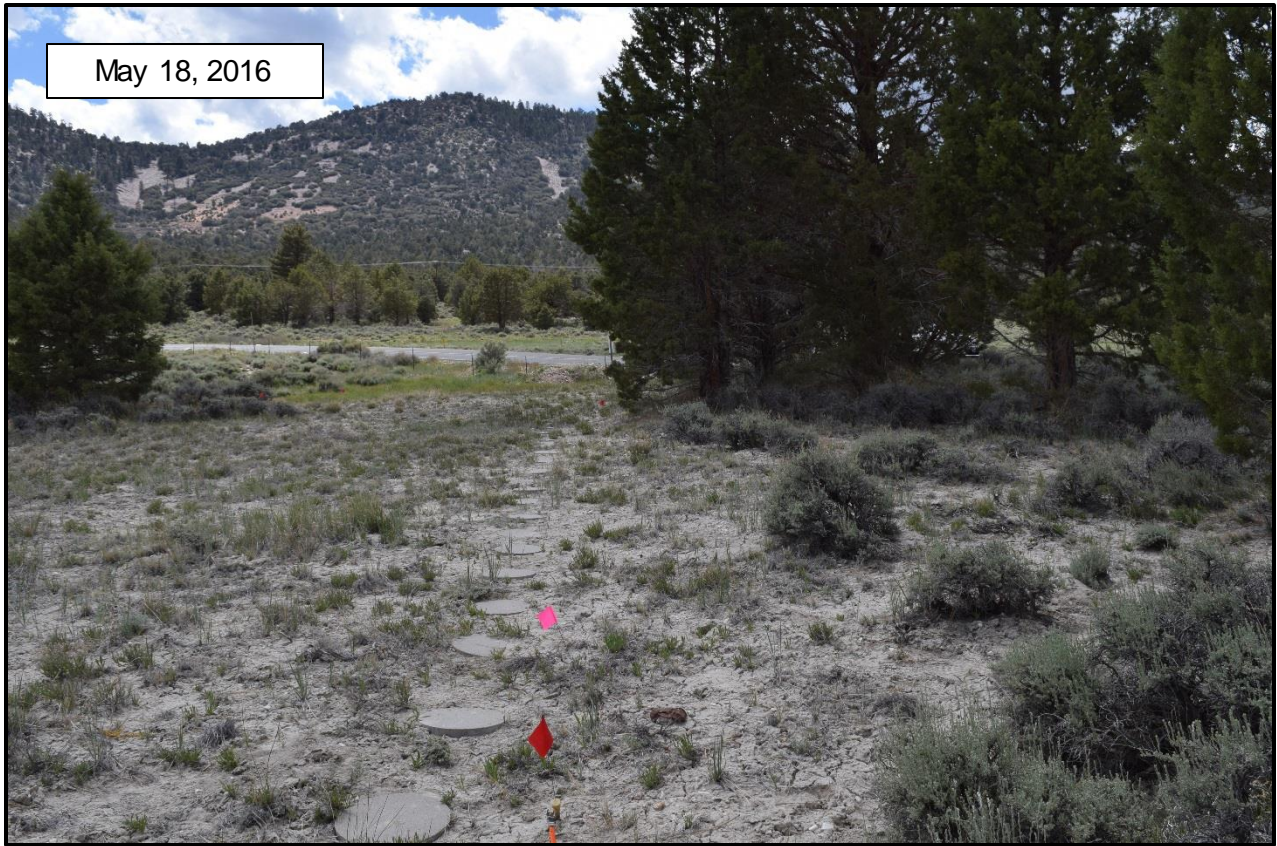


Figure 5  
Photopoint Ca 2016 – 2017  
The Flag Marks the Corner of a Historic Monitoring Transect





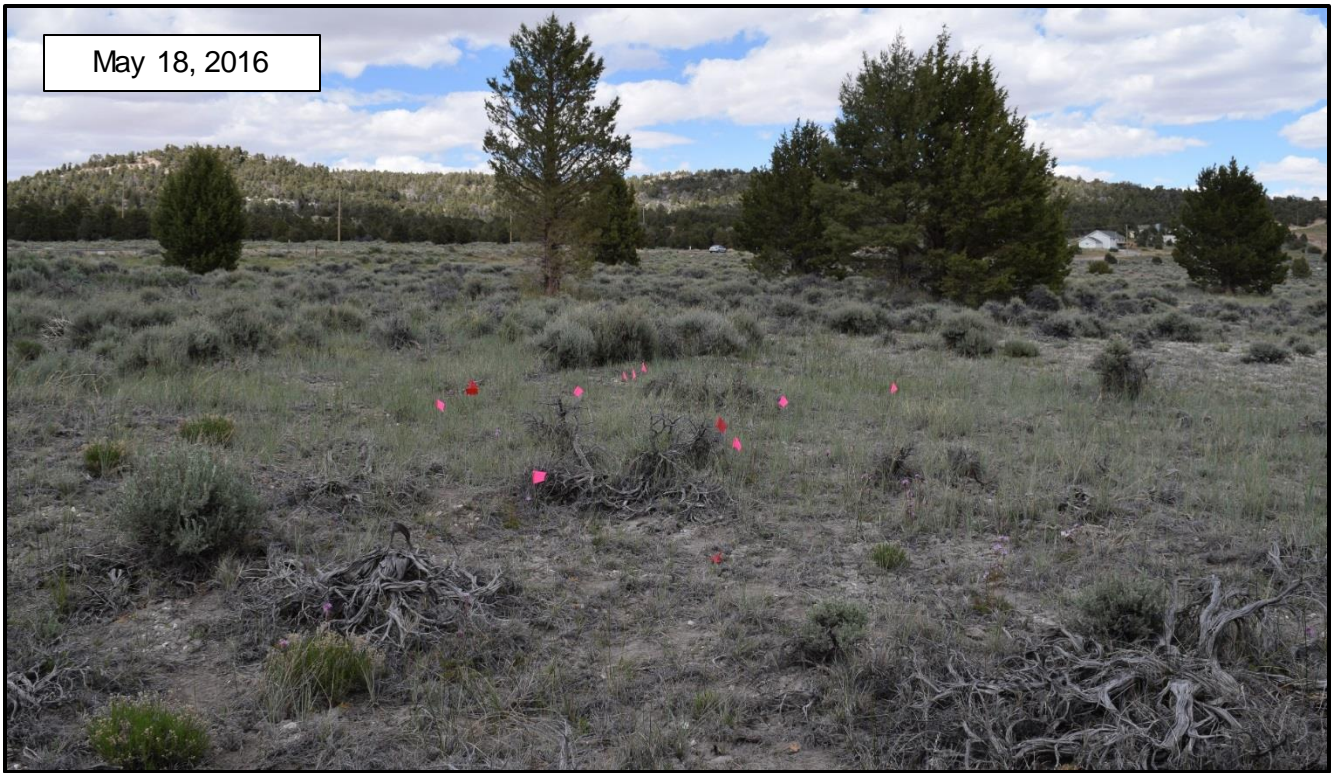
The red flag marks the corner of a historic monitoring transect. The pink flag marks the location of a slender-petaled thelypodium plant.



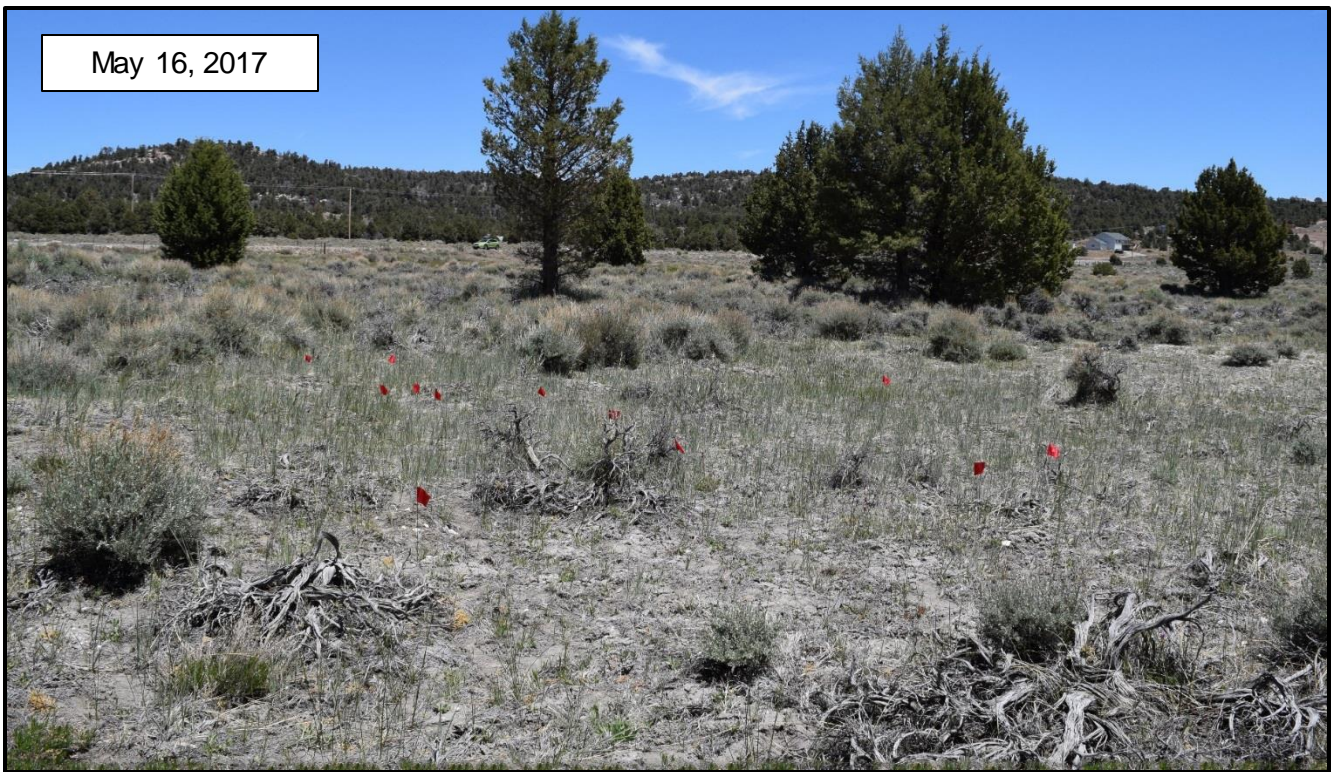
The flag marks the corner of a historic monitoring transect.

Figure 6  
Photopoint Db 2016 – 2017  
Slender-petaled Thelypodium Habitat





The flags mark locations of slender-petaled thelypodium plants



The flags mark locations of slender-petaled thelypodium plants

Figure 7  
Photopoint Hb 2016 – 2017

habitat during the 2015 - 2017 monitoring visits, OHVs could access the Reserve through gaps in the fence.

## 2.4. PRECIPITATION

A study conducted by Henderson (2003) showed a significant relationship between precipitation and the number of adult slender-petaled thelypodium plants at a population located in Belleville Meadow, approximately 4.5 miles northwest of the Reserve. In the study, Henderson organized precipitation by “growing year” for slender-petaled thelypodium, which was assumed to begin on September 1 (after fruiting is typically complete) and extend through August 31<sup>st</sup> of the following year (Henderson 2003). The “growing year” rather than a calendar year was used in the statistical analysis for the study. The results of the study indicated that the total number of adult plants was directly correlated with the total precipitation from the current and previous year (two-year total) and with the total precipitation of the current and previous two years (three-year total). The results also identified a correlation between the number of adult plants and the total two-year and three-year winter (December through February) precipitation. The study did not find a statistically significant relationship between the number of adult plants and total precipitation in one year.

Precipitation information generated using a PRISM climate model is presented in Figures 8 and 9 (PRISM 2018). During the monitoring period, the two-year and three-year cumulative precipitation totals were lowest during the 2015 surveys, and no plants were observed during the monitoring visit in 2015. The two- and three-year cumulative totals in 2015 and 2016 were lower than the 30-year average of two-year and three-year precipitation totals (1987 – 2017). The two-year and three-year cumulative totals were higher than the 30-year average in 2017. The two-year and three-year winter precipitation totals were lowest in 2015, and were lower than the 30-year average in 2015 and 2016. The two-year and three-year winter precipitation totals were highest in 2017 and were higher than the 30-year average.

Since the number of adult plants has been shown to be correlated with two-year and three-year winter and cumulative precipitation, seed production for the population is likely to be higher in those years. Seed should be collected in years when the two-year and three-year cumulative levels are higher than normal, assumed to be the 30-year average.

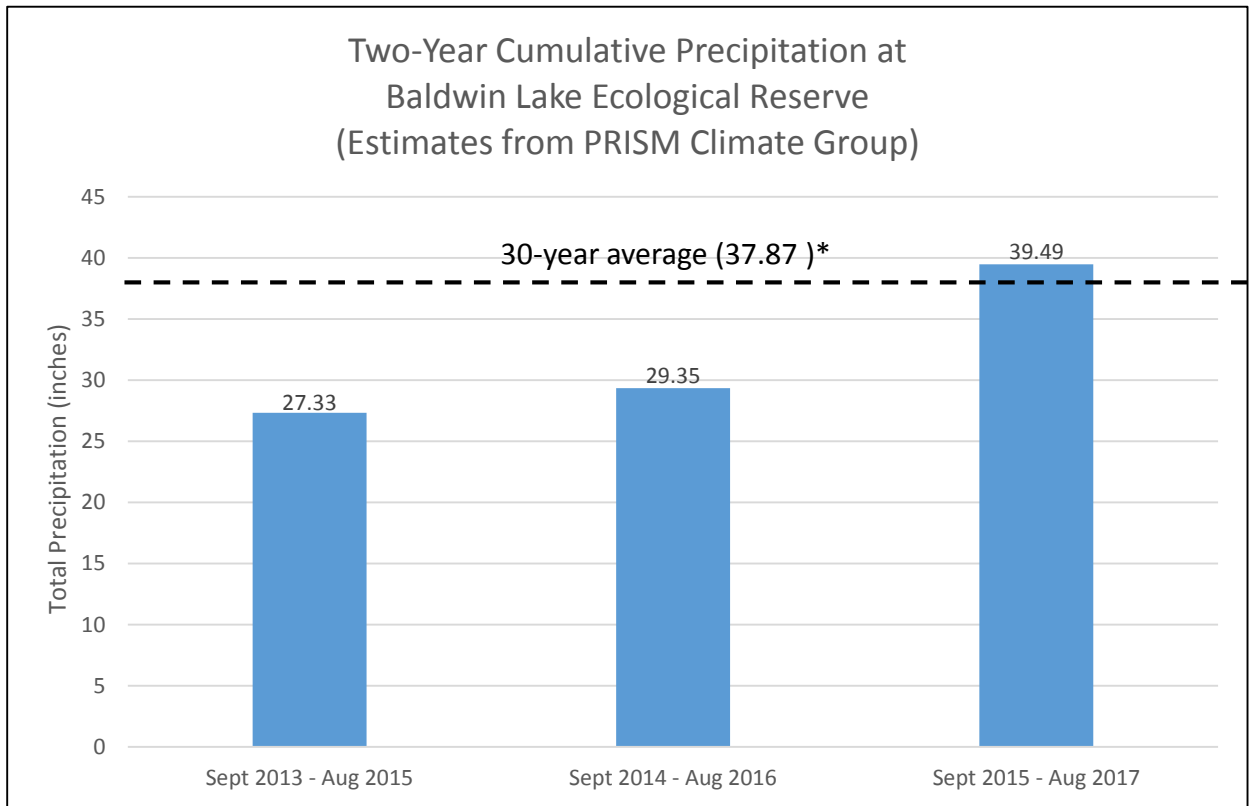
## 2.5. OTHER OBSERVATIONS

In addition to slender-petaled thelypodium, several other rare plant species were also observed during the course of surveys for slender-petaled thelypodium.

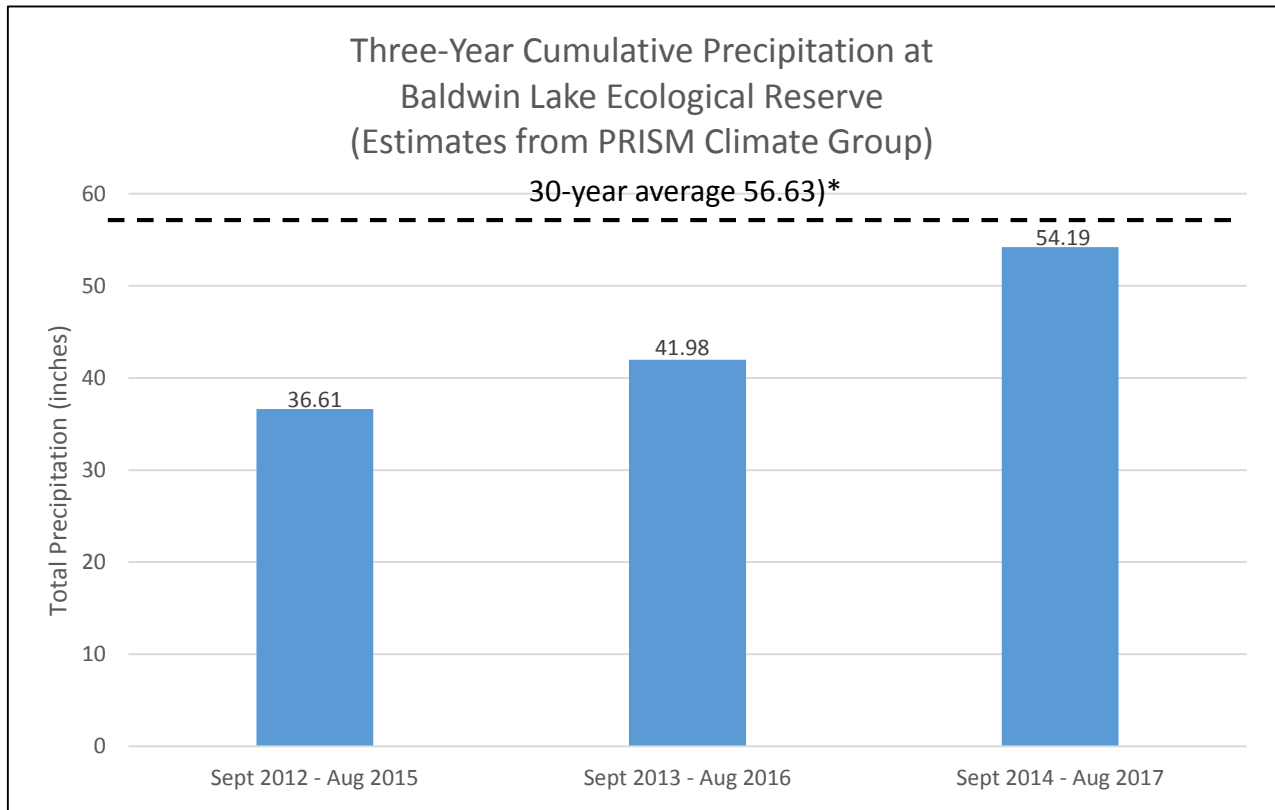
Bird-foot checkerbloom (*Sidalcea pedata*) is state and federally listed as endangered, and has a California Rare Plant Rank of 1B.1. California Natural Diversity Database (CNDDDB) element occurrence (EO) number 1 occurs on the Reserve. This species was observed by CDFW staff during surveys in 2015, 2016, and 2017, but no quantitative estimates of population size were made.

Big Bear Valley milk-vetch (*Astragalus lentiginosus* var. *sierrae*) has a California Rare Plant Rank of 1B.2, and CNDDDB EO 2 occurs on the Reserve. This species was observed by CDFW staff during surveys in 2016 and 2017 but no quantitative estimates of population size were made.

Ash-gray paintbrush (*Castilleja cinerea*) is federally listed as threatened and has a California Rare Plant Rank of 1B.2. CNDDDB EO 1 occurs on the Reserve and CDFW staff observed this



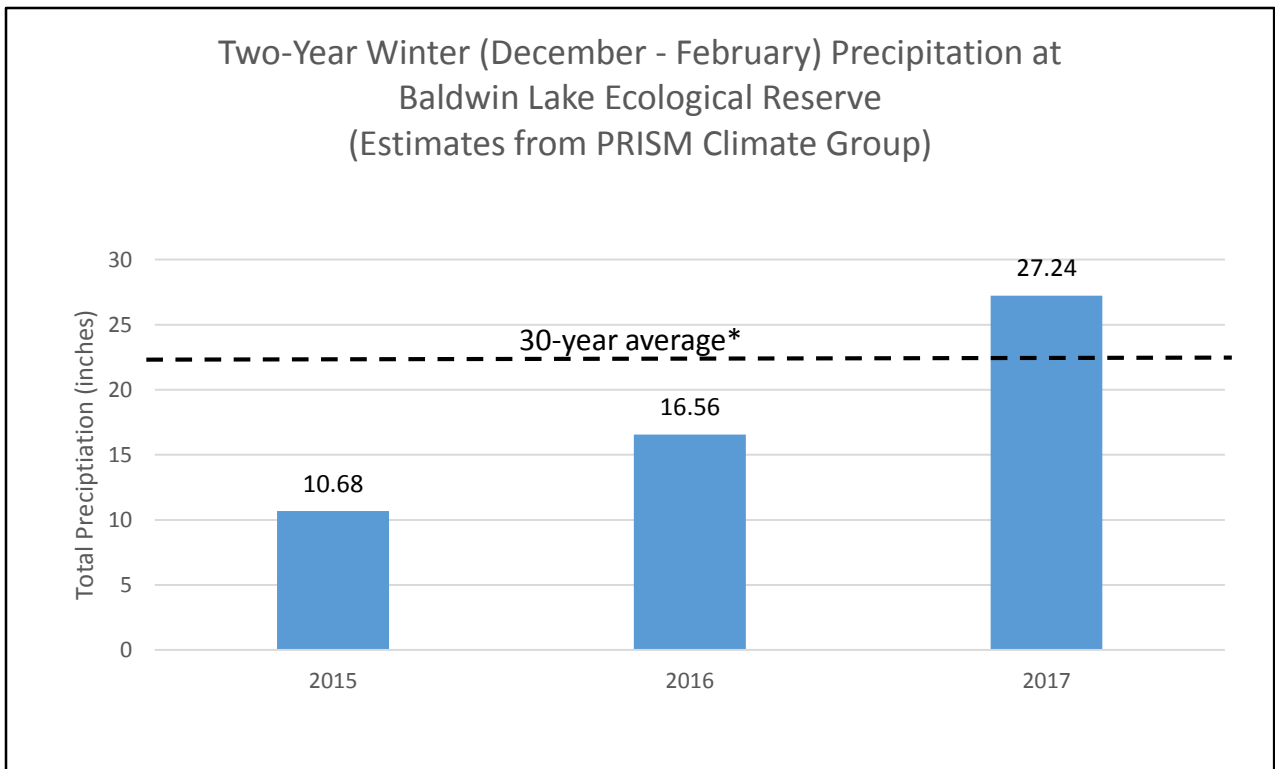
\*Average of the two-year totals from August 1986 – September 2017



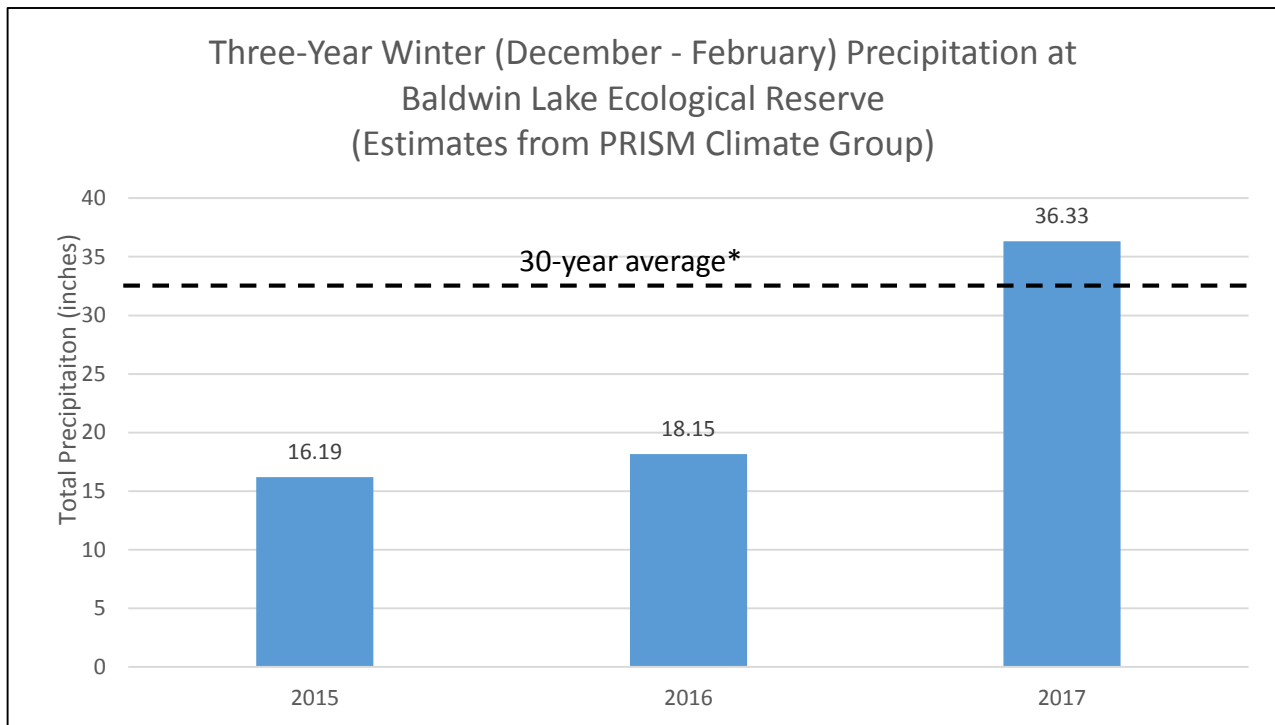
\*Average of the three-year totals from August 1985 – September 2017

**Figure 8**  
**Two- and Three-Year Cumulative Precipitation at  
Baldwin Lake Ecological Reserve 2015 – 2017**





\*Average of the two-year winter month (December – February) totals recorded from February 1987 – February 2017



\*Average of the three-year winter month (December – February) totals recorded from February 1987 – February 2017

**Figure 9**  
**Two- and Three-Year Cumulative Winter Precipitation at  
Baldwin Lake Ecological Reserve 2015 – 2017**

species growing at the Reserve in 2015, 2016, and 2017, but no quantitative estimates of population size were made. Baldwin Lake linanthus (*Linanthus killipii*) has a California Rare Plant Rank of 1B.2 and CNDDDB EO 1 occurs on the Reserve. This species was observed by CDFW staff during surveys in 2016 and 2017 but no quantitative estimates of population size were made.

Southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanum*) is federally listed as threatened and has a California Rare Plant Rank of 1B.2. CNDDDB EO 1 occurs on the Reserve. CDFW staff observed this species growing at the Reserve in 2015, 2016, and 2017, but no quantitative estimates of population size were made.

### 3. INTERPRETATION OF RESULTS

With only three years of monitoring data, it is difficult to make strong conclusions. Slender-petaled thelypodium was not observed during the first year of monitoring in 2015 and was observed in small numbers during the second and third years. Low population numbers are likely related to low cumulative precipitation levels.

The biennial nature and population response to changes in precipitation of slender-petaled thelypodium makes it difficult to obtain an accurate estimate of density or population size. Monitoring at a nearby population (Belleville Meadow, EO 10) over ten years recorded the population fluctuating between 500 and 75,000 individuals in correlation with soil moisture and precipitation (USFWS 2011). Population estimates of this species conducted over six years at the Reserve fluctuated from 11 plants in 1988 to 2,473 plants in 1994 (CNDDDB 2018). Fluctuations in the number of flowering plants do not necessarily equate to population growth or decline, making it difficult to discern reliable population trends (USFWS 2011). However, the number of individuals of slender-petaled thelypodium is very low, and CDFW is concerned about the survival and persistence of this species. Recommended actions outlined below in Section 5.3 need to be started as soon as possible to prevent extinction of slender-petaled thelypodium.

Many of the life history aspects and ecological requirements of slender-petaled thelypodium are unknown. Research on seed production and reproductive output of the species is critical to informing recovery and conservation decisions. In addition, germination requirements and seed longevity need to be determined for this species. Seeds of slender-petaled thelypodium are in conservation storage at Rancho Santa Ana Botanic Garden. In 1994, 17,216 seeds were collected from the Reserve and placed into long-term storage; in 2010, 283 seeds were collected from EO 2 for long-term storage; and in 2012, 1972 additional seeds were collected and placed into storage from EO 2. Most of these seeds are still in storage, with the exception of a few seeds that have been tested for viability. CDFW will request viability testing of these collections by Rancho Santa Ana Botanic Garden and will request that seed germination requirements are investigated. A research study needs to determine specific seed germination requirements, and opportunities to examine seed germination requirements should be explored. Successful seed germination is critical to the survival of this species and will inform efforts to introduce seed into suitable habitat in the species' range.

### 4. ASSESSMENT OF THE MONITORING PROJECT

The monitoring project has been largely successful and our methods have resulted in important initial data. The monitoring data for slender-petaled thelypodium is not subject to sampling error because a complete count or census of the population was conducted; all plants found on the

Reserve were counted. Any uncertainty in the data is, therefore, is not due to statistical or sampling error, but is a result of counting errors due to the possibility of missing plants during surveys. Basal rosettes can be difficult to detect because they often growing under shrubs.

Additionally, attempts to precisely align monitoring photos has been difficult. Precise alignment of monitoring photos is important because it allows direct comparison of specific areas of the ground in the photograph, and it may be difficult to determine which areas of the ground are the same if two monitoring photos are even slightly misaligned. Differences in perspective resulting from photographs taken with different cameras, from slightly different positions and in slightly different directions can be very distracting, and may require careful correction with photo editing software such as Photoshop before insightful comparisons become easily possible. In addition, different lighting conditions due to cloud cover or time of day can result in differences in perspective, making comparisons challenging. Because correcting the differences in perspective requires photo editing expertise and a significant time commitment, every effort should be made to carefully align monitoring photos in the field.

## 5. MANAGEMENT RECOMMENDATIONS

The management objectives and management implications identified in the Monitoring Plan are repeated below, with a discussion of whether the management implications should be triggered based on the monitoring results. Additional management recommendations for the project are also included.

### 5.1. MANAGEMENT OBJECTIVE #1

Maintain a population of slender-petaled thelypodium containing individuals in both stage classes (rosette, flowering) at Baldwin Lake Ecological Reserve for at least three of the five years from 2018 – 2022.

**Management Implication Identified in the Monitoring Plan:** Failure to meet the objective to maintain a population that includes both stages of slender-petaled thelypodium on the Reserve for three of the five years will result in initiation of seed bulking and reintroduction efforts into suitable occupied habitat and nearby suitable habitat.

**Recommendation:** The management objective does not begin until 2018; however, there has been a population of slender-petaled thelypodium containing individuals in both stage classes for two of the three years since 2015. Research on seed germination requirements should be initiated as soon as possible to inform potential reintroduction efforts.

### 5.2. MANAGEMENT OBJECTIVE #2

Document and identify disturbances that may be impacting the ability of slender-petaled thelypodium and other rare plants to maintain healthy self-sustaining populations at Baldwin Lake Ecological Reserve

**Management Implication Identified in the Monitoring Plan:** Any OHV evidence will be documented. Fences will be inspected for damage and will be repaired where damaged. If other disturbances or threats are identified to slender-petaled thelypodium and other rare plants or their habitat on the Reserve, alternative management will be considered.

**Recommendation:** No OHV evidence was found during the three years of surveys conducted so far, but the fence on both sides of Highway 18 is damaged. Large sections of the fence are completely open and should be repaired.

### 5.3. MANAGEMENT OBJECTIVE #3

Document non-native plant species invasions that may be impacting the ability of slender-petaled thelypodium and other rare plants to maintain healthy self-sustaining populations at Baldwin Lake Ecological Reserve.

**Management Implication Identified in the Monitoring Plan:** Non-native plant species invasions will be documented. If non-native plant invasions are identified as threatening the survival of slender-petaled thelypodium and/or other rare plants, non-native species removal will be considered.

**Recommendation:** Invasive cheat grass was identified growing throughout the Reserve, but the specific impacts to slender-petaled thelypodium and other rare plants on the Reserve from cheat grass are unknown. Two other non-native, potentially invasive plants, tubercled crowfoot (*Ranunculus testiculatus*) and clasping pepperweed (*Lepidium perfoliatum*), were also observed at the Reserve. The extent of non-native plant species should be further studied and monitored. Once the extent of non-native plant species invasions is determined, a weed removal effort should be implemented to eliminate or reduce the population of cheat grass and other problematic invasive plants in the Reserve. Weed removal efforts could include hand pulling of invasive plant species such as cheat grass near known patches of slender-petaled thelypodium prior to seed set.

### 5.4. OTHER RECOMMENDATIONS

- Remove trash and litter from the Reserve.
- Secure permission to survey element occurrence 3, located on private property approximately 4 miles south of the Reserve, and element occurrence 6, located on private property and Wildhaven Ranch-owned property approximately 2 miles south of the Reserve.

## 6. REFERENCES

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## 7. REVIEWERS

This document was prepared by Cherilyn Burton, a senior environmental scientist (specialist) in the CDFW's Native Plant Program. The following individuals reviewed this document:

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