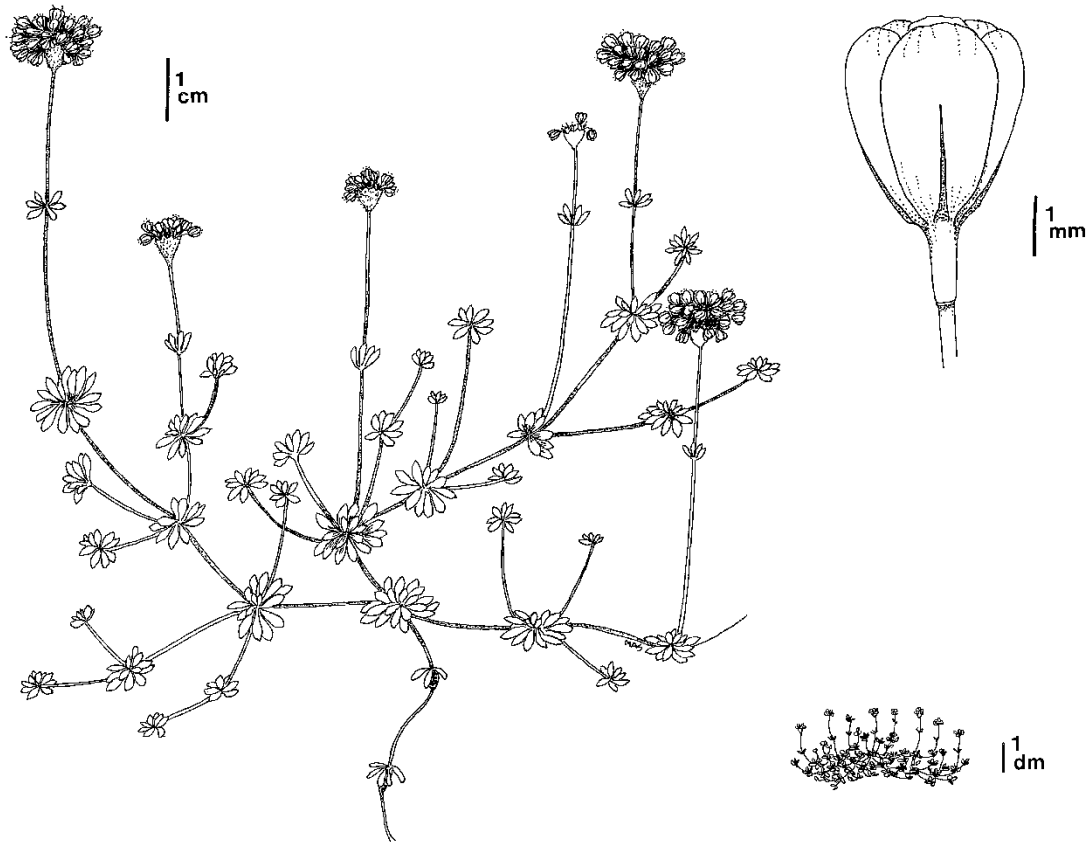


LITTLE RED MOUNTAIN ECOLOGICAL RESERVE
KELLOGG'S BUCKWHEAT MONITORING PLAN
WITH
2015-2017 RESULTS & DISCUSSION



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

OCTOBER 2018

FUNDING PROVIDED BY COOPERATIVE ENDANGERED SPECIES CONSERVATION FUND GRANT
#F15AP00059 AND THE RARE AND ENDANGERED SPECIES PRESERVATION FUND

EXECUTIVE SUMMARY..... iii

Part 1 LITTLE RED MOUNTAIN ECOLOGICAL RESERVE KELLOGG’S
BUCKWHEAT MONITORING PLAN

Part 2 LITTLE RED MOUNTAIN ECOLOGICAL RESERVE KELLOGG’S
BUCKWHEAT MONITORING RESULTS AND DISCUSSION 2015-2017

EXECUTIVE SUMMARY

Kellogg's buckwheat (*Eriogonum kelloggii*) is a perennial plant that is designated as endangered under the California Endangered Species Act. Kellogg's buckwheat is endemic to serpentine habitat of lower montane forest in the northern Coast Range in Mendocino County, California. The species is found on dry ridges in rocky barren openings associated with serpentine habitat between 1,900 and 4,100 ft (580 and 1,250 m) in elevation. Kellogg's buckwheat is almost entirely restricted to private and Bureau of Land Management (BLM) land at Red Mountain; however, one small population of Kellogg's buckwheat occurs at the California Department of Fish and Wildlife (CDFW) Little Red Mountain Ecological Reserve (Reserve).

CDFW staff visited the Reserve in 2003, and again in 2015 and 2017 to document the condition of the Kellogg's buckwheat population, search for additional populations Kellogg's buckwheat and make other observations. Considering field notes from 2003 and information generated from monitoring visits in 2015 and 2017, it is clear that the population of Kellogg's buckwheat suffered a significant decline between 2003 and 2017. The Kellogg's buckwheat population occurred on both sides of a fire road in 2003, but now only occurs on the west side of the fire road. Monitoring visits in 2015 and 2017 also show a significant decline in the population, primarily due to the deaths of several plants in an approximately two by three meter area of the population. There is no obvious reason for the deaths of these Kellogg's buckwheat plants between 2015 and 2017. Losses could have occurred due to a small land slide localized in this area or as a result of some other factor such as canopy shading or excessive rainfall in the winter and spring of 2017.

The monitoring plan presented in this document should be implemented by CDFW staff to facilitate the adaptive management of Kellogg's buckwheat at the Reserve. Due to the remoteness of the Reserve and lack of ongoing funding to conduct monitoring, it is recommended that another CDFW visit to the Reserve be scheduled in 2022. If a population of at least ten Kellogg's buckwheat plants with a diameter of 10 centimeters or greater is not present at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, CDFW should implement a management response in 2023. Recommended management responses include collecting seeds from remaining plants in 2023, preserving seeds in long-term conservation storage, and initiating a seed germination study. Additional management responses could also be considered in 2023, if necessary.

Several other rare plants are known to occur on the Reserve and should continue to be documented during monitoring visits in the future.

LITTLE RED MOUNTAIN ECOLOGICAL RESERVE KELLOGG’S BUCKWHEAT MONITORING PLAN

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

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1. INTRODUCTION

Kellogg's buckwheat (*Eriogonum kelloggii*) is a perennial plant designated as endangered under the California Endangered Species Act. The species was a candidate for listing under the federal Endangered Species Act, but on September 18, 2014, the U.S. Fish and Wildlife Service found that listing Kellogg's buckwheat was not warranted. Kellogg's buckwheat is endemic to serpentine habitat of lower montane forest in the northern Coast Range in Mendocino County, California. The species is found on dry ridges in rocky barren openings associated with serpentine habitat between 1,900 and 4,100 ft (580 and 1,250 m) in elevation.

Kellogg's buckwheat is almost entirely restricted to private and Bureau of Land Management (BLM) land at Red Mountain; however, one small population occurs at the California Department of Fish and Wildlife (CDFW) Little Red Mountain Ecological Reserve (Reserve) (Figures 1 and 2). CDFW purchased the approximately 2,400-acre Reserve from the Coastal Mining Company in 1988. This Monitoring Plan focuses on the approximately 850-acre western area of the Reserve that is associated with serpentine habitat (Study Area). The Study Area also supports populations of the state endangered Red Mountain catchfly (*Silene campanulata* subsp. *campanulata*), white-flowered rein-orchid (*Piperia candida*, California Rare Plant Rank 1B.2), Sonoma canescent manzanita (*Arctostaphylos canescens* ssp. *sonomensis*, California Rare Plant Rank 1B.2), and redwood lily (*Lilium rubescens*, California Rare Plant Rank 4.2). An individual Raiche's manzanita plant (*Arctostaphylos stanfordiana* subsp. *raichei*, California Rare Plant Rank 1B.1) was also observed in the Study Area on June 13, 2003.

The Study Area is surrounded by BLM land and private property and is very difficult to access. The Study Area is not open to the public and appears to be visited very infrequently. Ecological reserve signs have been posted in the Study Area, but the Reserve is otherwise unmanaged.

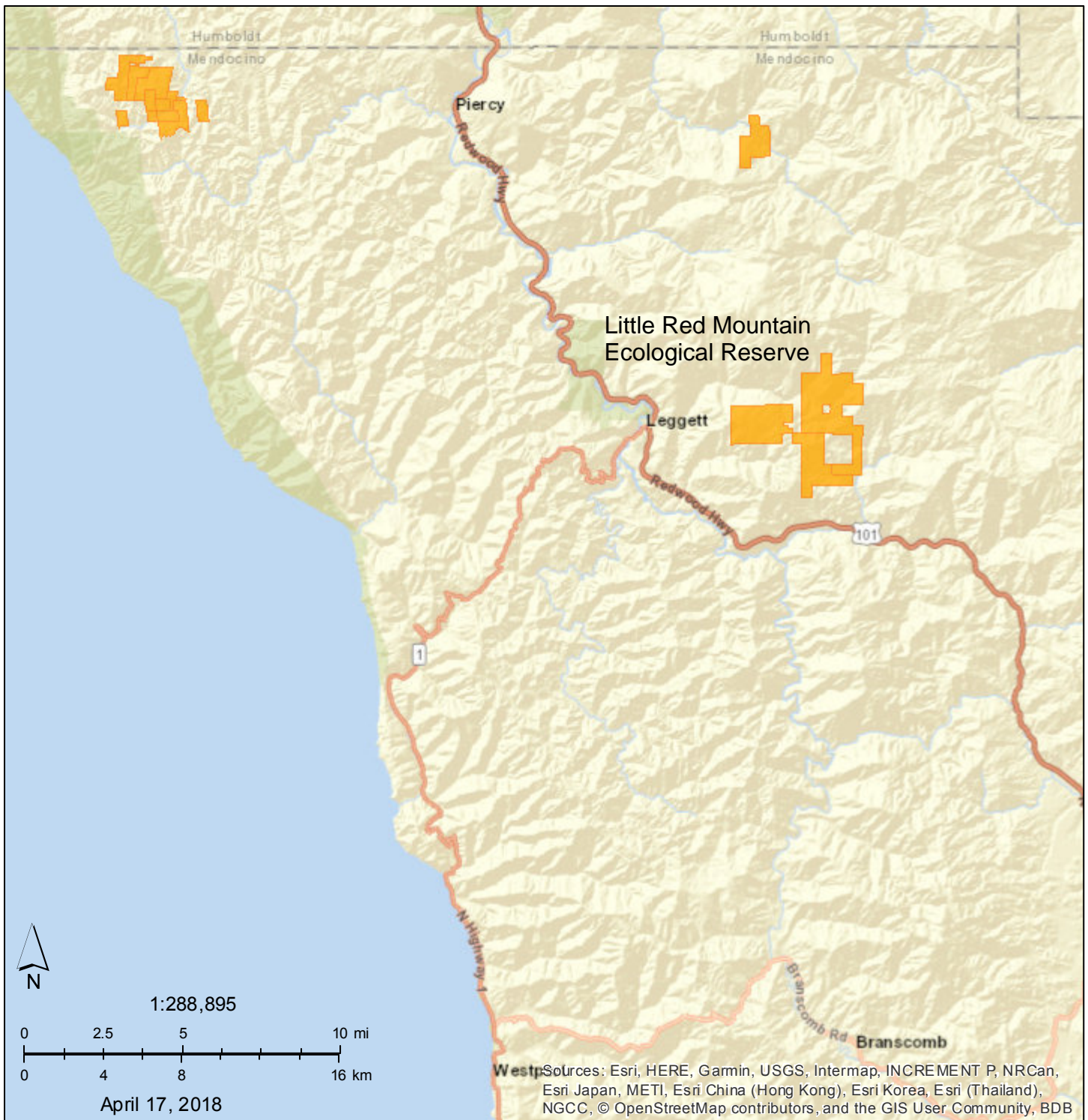
This Little Red Mountain Ecological Reserve Kellogg's Buckwheat Monitoring Plan (Monitoring Plan) should be implemented by CDFW staff in the Study Area. The purpose of the Monitoring Plan is to monitor the status of the Kellogg's buckwheat population and other rare plants in the Study Area, expand CDFW's knowledge of the Study Area, and identify and alleviate threats to the Study Area before they become prohibitively expensive to address. Due to the remoteness and relatively low threats to the Study Area, this Monitoring Plan only involves visiting the Study Area every five years. CDFW staff should visit the Study Area again in **June of 2022** to document the status of Kellogg's buckwheat.

This Monitoring Plan provides background information on the monitoring approach used, detailed instructions on how to collect both qualitative and quantitative data on the population of Kellogg's buckwheat in the Study Area, and suggested management responses. This Monitoring Plan is intended to provide a powerful foundation for adaptive management of Kellogg's buckwheat in the Study Area, but it is not intended to be so rigid as to preclude adaptation and flexibility in the future. The monitoring consists of three parts:

1. A census documenting the size and location of all Kellogg's buckwheat plants in the Study Area relative to a baseline,
2. Photomonitoring of the Kellogg's buckwheat population, and
3. Opportunistic surveys of the Study Area for Kellogg's buckwheat and other plants.

1.1. SITE DESCRIPTION

The Study Area consists of a mosaic of mixed coniferous forest/Jeffrey pine woodland/chaparral vegetation types on serpentine substrates. The most common shrub species in the vicinity of



CDFW Lands [ds665]

Ecological Reserve

Figure 1: Vicinity of Little Red Mountain Ecological Reserve

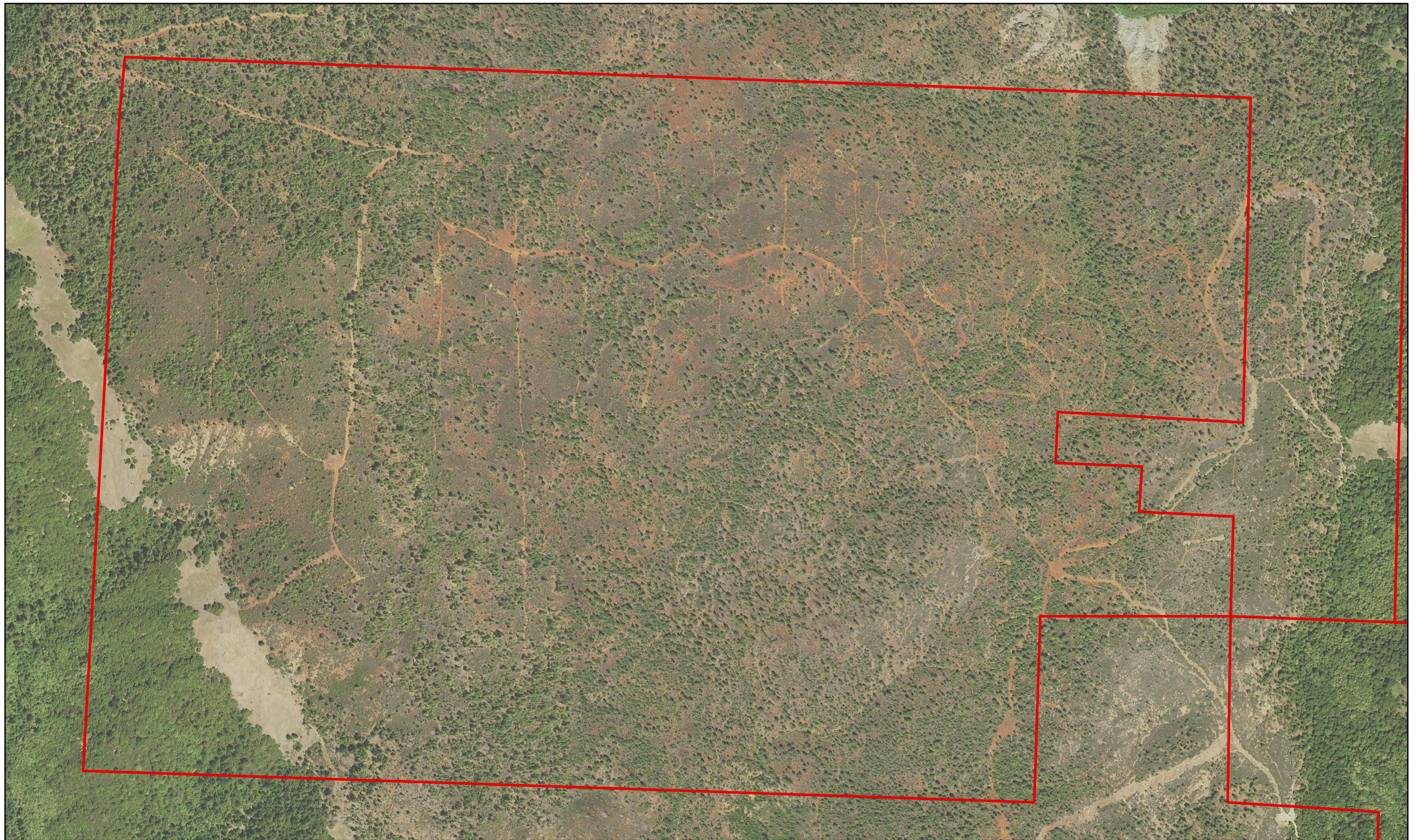


Image source: NAIP 2014

0 0.05 0.1 0.2 Miles



Figure 2: Little Red Mountain Ecological Reserve Study Area

the Kellogg's buckwheat population is *Sonoma canescent manzanita*. The highest point in the Study Area is the forested peak of Little Red Mountain on the west side of the Study Area. The east half of the Study Area is generally lower in elevation than the west half of the Study Area.

There is evidence of past mining activity in the form of roads and exploratory soil excavations throughout the Study Area. Vegetation and roads on the Reserve were also cleared in the Study Area in 2008 for firefighting purposes. The Kellogg's buckwheat population may have been impacted by the fire control efforts, but no survey of the area was completed. Regardless, in an attempt to restore the impacts of the fire suppression activities, CDFW staff worked extensively with California Department of Forestry and Fire Protection (CalFire) to redistribute earth material back over the disturbed areas that had been created for safety zones during the 2008 fires.

2. ECOLOGICAL MODEL

An ecological model for Kellogg's buckwheat is not provided because so little is known about the life history of the species.

2.1. LIFE HISTORY OF KELLOGG'S BUCKWHEAT

Little is known about the life history of Kellogg's buckwheat. Known information about the species is presented in the U.S. Fish and Wildlife Service Species Report for the Two Red Mountain Plants: Red Mountain Buckwheat (*Eriogonum kelloggii*) and Red Mountain Stonecrop (*Sedum eastwoodiae*), dated September 2014.

Kellogg's buckwheat is a perennial herb that blooms between May and August. The exact lifespan of Kellogg's buckwheat is not known. *Eriogonum* species occupying restricted habitats similar to those occupied by Kellogg's buckwheat, and which are adapted to similar environmental and ecological conditions (e.g., xeric conditions, limited resources, tolerance of unique soils) have long lifespans and tend to grow slowly and favor individual persistence (Anderson 2006). Based on the persistence of Kellogg's buckwheat populations that have been monitored on Red Mountain, the lifespan of Kellogg's buckwheat is also expected to be long.

Annual monitoring of 13 permanent plots at three study sites on Red Mountain by Baad (2002) between 1987 and 1998, and again in 2002 showed considerable annual variation in plant density and reproductive success, but no discernible long-term trends at two of the three study sites. One study site exhibited a decline in plant density by 65 percent over the past 11 years, and a second area exhibited a pronounced reduction in reproductive success since 1998. The latter study area is located adjacent to and within a stand of knobcone pine (*Pinus attenuata*) that burned approximately 45 years ago. The decline in reproductive success may be a result of progressive growth of trees and shrubs leading to canopy closure as part of the recovery from fire (Baad 2002).

3. MANAGEMENT OBJECTIVES

The initial management objective is:

- Maintain a population of at least ten Kellogg's buckwheat (*Eriogonum kelloggii*) plants with a diameter of ten centimeters or greater at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022. (This is a target/threshold type of management objective.)

4. MONITORING DESIGN

4.1. CENSUS OF POPULATION

As part of the Monitoring Plan, all Kellogg's buckwheat plants in the known population in the Study Area should be mapped relative to the monitoring baseline, measured, and the phenological condition should be recorded. The 15 meter-long monitoring baseline was established near the population to facilitate monitoring.

This protocol is designed to be completed by two to three monitors over two or three field days every five years. At least one of the monitors should be an experienced botanist. The monitoring should be conducted when Kellogg's buckwheat is most likely to be in bloom, likely in June. Because Kellogg's buckwheat is a perennial plant, monitoring could likely be conducted at any time of year that the site is accessible.

4.1.1. BEFORE GOING INTO THE FIELD

Print out all of the necessary data sheets, this monitoring plan, and trip reports from previous monitoring years. Necessary data sheets include:

- Combined Vegetation Rapid Assessment and Releve Field Form with Instructions;
- Photomonitoring Log: Little Red Mountain Ecological Reserve Plot 1;
- Graph paper to record sizes and locations of Kellogg's buckwheat relative to the baseline;
- California Native Species Field Survey Form;
- Qualitative Monitoring Datasheet.

Reserve a date to conduct the monitoring, recruit field helpers and contact the Reserve manager about your plans (Scott Koller in 2018). Secure a high clearance 4-wheel drive vehicle to access the Reserve because the access roads are very rugged. Contact the adjacent landowner (contact information on file) to inquire about the condition of the access road, and to provide information on your plans.

All monitors should familiarize themselves with the species being monitored, the Reserve, this Monitoring Plan and the data that has been previously collected. Request field assistance from Northern Region staff.

The Study Area is very remote, so it is important to bring everything that will be needed for the duration of the trip. Gather the equipment and materials listed below:

- Ten essentials for camping (with some examples);
 - navigation (maps, compass, PGS receiver),
 - sun protection (hat, sunscreen),
 - insulation (warm clothes and sleeping bag),
 - illumination (flashlights),
 - first-aid supplies,
 - fire supplies (lighter, matches),
 - repair kits and tools (knife),
 - food,
 - water (there is no water available in the Study Area),
 - shelter (tent),

- Monitoring Plan, datasheets, previous site visit summaries, plant list and other references;
- Clipboards, pencils;
- Combination to access gates;
- Tow chain;
- Chainsaw, tree saw, loppers;
- (2+) 100-meter tapes;
- (2+) 50-meter tapes;
- Screwdrivers or other tools for pinning meter tapes to the ground;
- (many) Pin Flags;
- Permanent marker;
- (3+) Hand tally counters;
- Replacement field markers (aluminum conduit and/or rebar with caps and lengths of pvc);
- PVC cutter;
- Tape measure;
- Small sledgehammer;
- GPS for relocating field markers and documenting plant locations;
- Tripod, camera, charged batteries and memory card;
- Compass;
- Zip-lock bags and/or plant press;
- Metal detector for relocating missing field monument locations.

4.1.2. IN THE FIELD

From Highway 101, exit 609 and go to the north side of Highway 101. Proceed through the first gate to the Reserve using the appropriate combination. Access to the Reserve requires crossing through private property. Make efforts to contact the landowner prior to visiting the site, and inquire about road conditions. The landowner has volunteered to check and clear the road of obstructions prior to previous site visits. The road to the Reserve was very rutted and worn in 2017, and passage required a high clearance vehicle. A second locked gate is also on the route. Use the appropriate combination to open it. The access route from Highway 101 is available online (at <https://binged.it/2sYmy7o>) and in Figure 3. There is a third gate near the Reserve boundary. The driving route to the west side of the Study Area requires driving over 4-5 foot tall regenerating shrubs and may involve clearing downed trees and woody debris. There is a place to park and camp at 39.874344°, -123.667687°. The Kellogg's buckwheat population and monitoring baseline is accessible on foot by turning left at the road junction (39.874455°, -123.668826°).

The two monuments that mark the ends of the monitoring baseline were hammered into the west side of the road, 15 meters apart. The monuments consist of rebar hammered into the ground, with a PVC pipe around it, with a red plastic cap, all surrounded by square aluminum conduit, with an aluminum marker tab (Figure 4). The monuments were named CDFW Plot 1 South (39.870438°, -123.669810°) and CDFW Plot 1 North (39.870573°, -123.669812°). A third monument named "Plot 1 photo point" is on the east side of the road (39.870511°, -123.669765°).

The monitoring baseline was deliberately placed alongside all Kellogg's buckwheat plants found on the Reserve in 2015. Surveys in 2017 did not lead to the discovery of any additional Kellogg's buckwheat outside of the areas alongside the monitoring baseline.

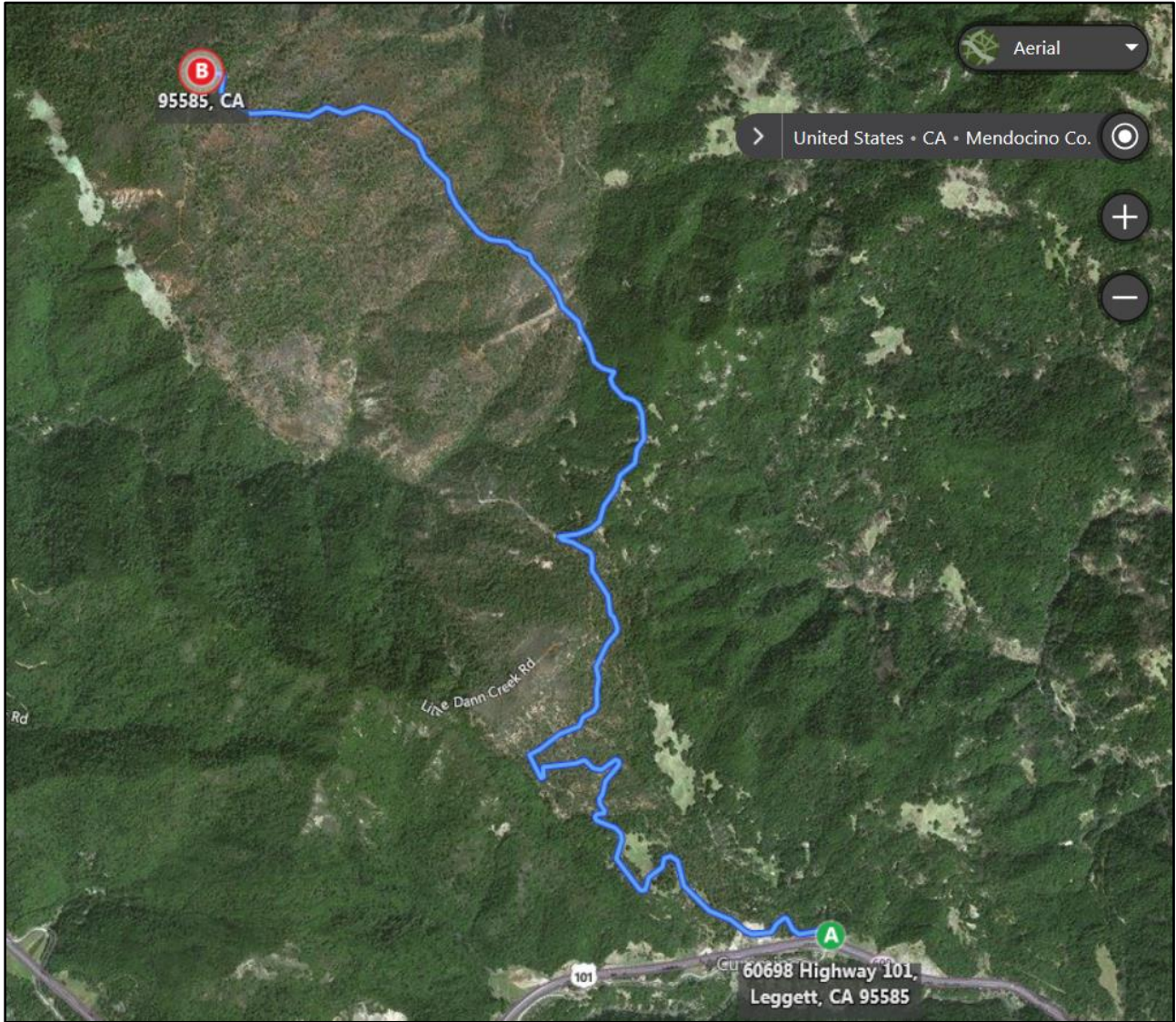


Image source: <https://binged.it/2sYmy7o>

Figure 3
Access Route to Little Red Mountain Ecological Reserve Study Area



Figure 4

Photos of *Eriogonum kelloggii* (top) and Plot 1 North Monument (bottom)

If any of the monuments are missing, they should be replaced before monitoring begins. If a monument cannot be relocated, monitors should use meter tapes, the remaining rebar monuments and compass bearings to place new rebar monuments in the appropriate positions, and continue the monitoring. Monitors should also add additional back-up monuments if necessary. Any missing and replacement monuments should be documented in the field notes for the day.

Collect Data

Flag all Kellogg's buckwheat plants with pink pin flags, being extremely careful not to disturb any soil in the steep, and easily erodible areas above the road cut (see Figure 4). Some very small Kellogg's buckwheat plants may be in the road, so be careful not to step on them when you first arrive at the population. Next, lay a meter tape between the two monuments (from south to north), and use a tape measure and compass bearing to measure the location of each plant, or clump of plants relative to the baseline. Record the point where each plant is closest to the baseline. If separate plants are less than 10 cm apart from each other, they are counted as one "clump". In addition, record the widest part of each clump, and the phenological condition of each plant or clump (flowering, fruiting, or not). Finally, photograph each clump in a way so that you can reference each photo to the monitoring data collected for that clump. Writing the plant number on a pin flag next to the plant is a good way to do this.

A third monument, named "Plot 1 photo point" was placed on the east side of road, due east of the 7.5 meter mark on the baseline (half-way between the plot monuments that are on the west side of the road). Take the seven monitoring photographs that are described in the photomonitoring datasheet.

Complete a qualitative monitoring datasheet.

4.1.3. 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\Priority Plant Surveys\Project Files\Little Red Mountain. This project folder is likely to change in the future.
- Compare the results with previous years results and make graphs of the data. Talk to the Reserve manager about adaptive management of the site. **This is the most important part of adaptive management!**
- Download and rename field photos (Section 4.2) and compare them with monitoring photos from previous years.

4.2. PHOTOMONITORING FOR ADAPTIVE MANAGEMENT

Photomonitoring should be conducted at the same time that the population census data is collected for the Study Area.

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 type of digital camera and tripod that will be used. The following equipment is required:

- Clipboard with photomonitoring log sheet;
- Pen or pencil;

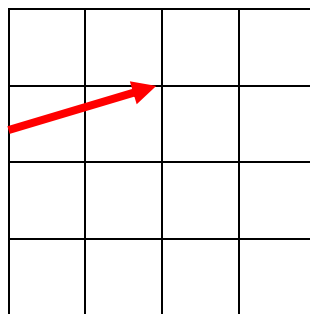
- Digital camera with fully-charged batteries and available memory: a compact digital SLR camera with a standard 18-55mm zoom lens is preferred for ease of photo comparison;
- Tripod;
- Compass set to the correct declination for the site (14 degrees east).

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 initial 2015 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

All monitoring photographs are taken from a monument, or a certain distance from a monument. Refer to the photomonitoring datasheet for the locations of monuments, and the order that monitoring photos should be taken. Once at the location of the monitoring photograph, do the following:

- **Set up the tripod and camera** so that the center of the camera lens is 5 feet (152cm) above the ground (the maximum height for many tripods), and directly above the appropriate location on the ground.
- **Populate Each Page of the Photomonitoring Log** with the date, photographer name, focal length, camera, lens and camera settings, and any other relevant information.
- **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 monitoring photos** in the order that they are listed on the photomonitoring datasheet. 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’s zoom lens is set to the correct focal length (e.g. 18 mm on a Nikon d3100/d3300).
 - Set up the camera so that the horizon is 1/4 of the way down from the top of the frame. Many cameras have a focus point at this location within the viewfinder.
 - Make sure the horizon in the viewfinder is as horizontal as possible.
 - Make sure that the camera focuses properly before taking the picture, and use the preview function of the camera to make sure that the photo has been taken correctly.



Center the horizon in the camera viewfinder at the area indicated with the red arrow

4.2.3. BACK IN THE OFFICE

Save all monitoring photos in the in a folder on the shared drive that corresponds with the year of the field visit, for example: "U:\Groups\HCPB\Shared Folders\NPP\Section 6\2014\Priority Plant Surveys\Project Files\Little Red Mountain\2017 Monitoring Visit"

Carefully change the names of the photo files using the following convention: Plot [plot number] Photo [uppercase photo letter] [four digit year][two digit month][two digit day of the month]. For example if a Photo A is taken at Plot 1 on June 9, 2015 the file should be named "Plot 1 Photo A 20150609".

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\Little Red Mountain\All Monitoring photos. The location of this folder may change in the future.

With the monitoring photos saved, use the Windows Photo Viewer or similar program and the left and right arrow keys on the keyboard to compare monitoring photos with those taken during previous site visits. If the monitoring photos are misaligned, it may be difficult to interpret the differences between monitoring photos. It is possible to align the monitoring photos more precisely by carefully manipulating them using Photoshop or other photo editing software. This is helpful for showing precisely how specific areas of the ground have changed over the years. Guidelines for aligning monitoring photos using Photoshop CS6 is provided as an appendix to this Monitoring Plan.

4.3. OPPORTUNISTIC SURVEYS OF THE STUDY AREA

The Study Area is seldom visited. CDFW staff should attempt to survey areas that have not been visited and make additional observations during the course of site visits. CDFW staff should search for additional populations of Kellogg's buckwheat, Red Mountain catchfly, Sonoma canescent manzanita, redwood lily, Raiche's manzanita, and other rare plants that may be present. Scientific collections of plant specimens should be made, and the plant list for the Study Area should be updated.

5. RESPONSIBLE PARTIES

CDFW staff in the Native Plant Program or Northern Region (Region 1) should implement this Monitoring Plan and report results and recommended actions to the Reserve manager after each site visit. 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 (F15AP00059) and other funding sources including funds from the Rare and Endangered Species Preservation Fund to prepare this Monitoring Plan and collect monitoring data in 2015 and 2017. 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 Rare and Endangered Species Preservation Fund, general fund, and other programs to do so. 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 Plan could also be implemented by staff in CDFW's Northern

Region or by CDFW volunteers. It is estimated that implementation of this Monitoring Plan 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: 28 hours by one environmental scientist or senior environmental scientist (specialist) and one other field helper = **56 hours**

In-office data analysis, typing of field notes and reporting: 24 hours by one environmental scientist or senior environmental scientist (specialist) = **24 hours**

TOTAL STAFF TIME NEEDED: Approximately 96 hours of staff time every five years, or approximately **19 hours per year**

Preparation of periodic summary reports and presentation of results will likely require additional time. A summary report for 2015-2017 has been prepared, and is included as part two of this report.

7. MANAGEMENT IMPLICATIONS OF POTENTIAL RESULTS

Management Implication 1: If a population of at least ten Kellogg's buckwheat (*Eriogonum kelloggii*) plants with a diameter of 10 centimeters or greater is not present at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022, CDFW shall organize and initiate an effort to collect seeds from remaining plants in 2023, and preserve them in long-term conservation storage.

Management Implication 2: If a population of at least ten Kellogg's buckwheat (*Eriogonum kelloggii*) plants with a diameter of 10 centimeters or greater is not present at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022, CDFW shall organize and initiate a seed germination study, and attempt to grow Kellogg's buckwheat plants in a controlled environment, in an effort to obtain information that could lead to reintroduction of Kellogg's buckwheat to Little Red Mountain Ecological Reserve, if necessary.

8. REFERENCES

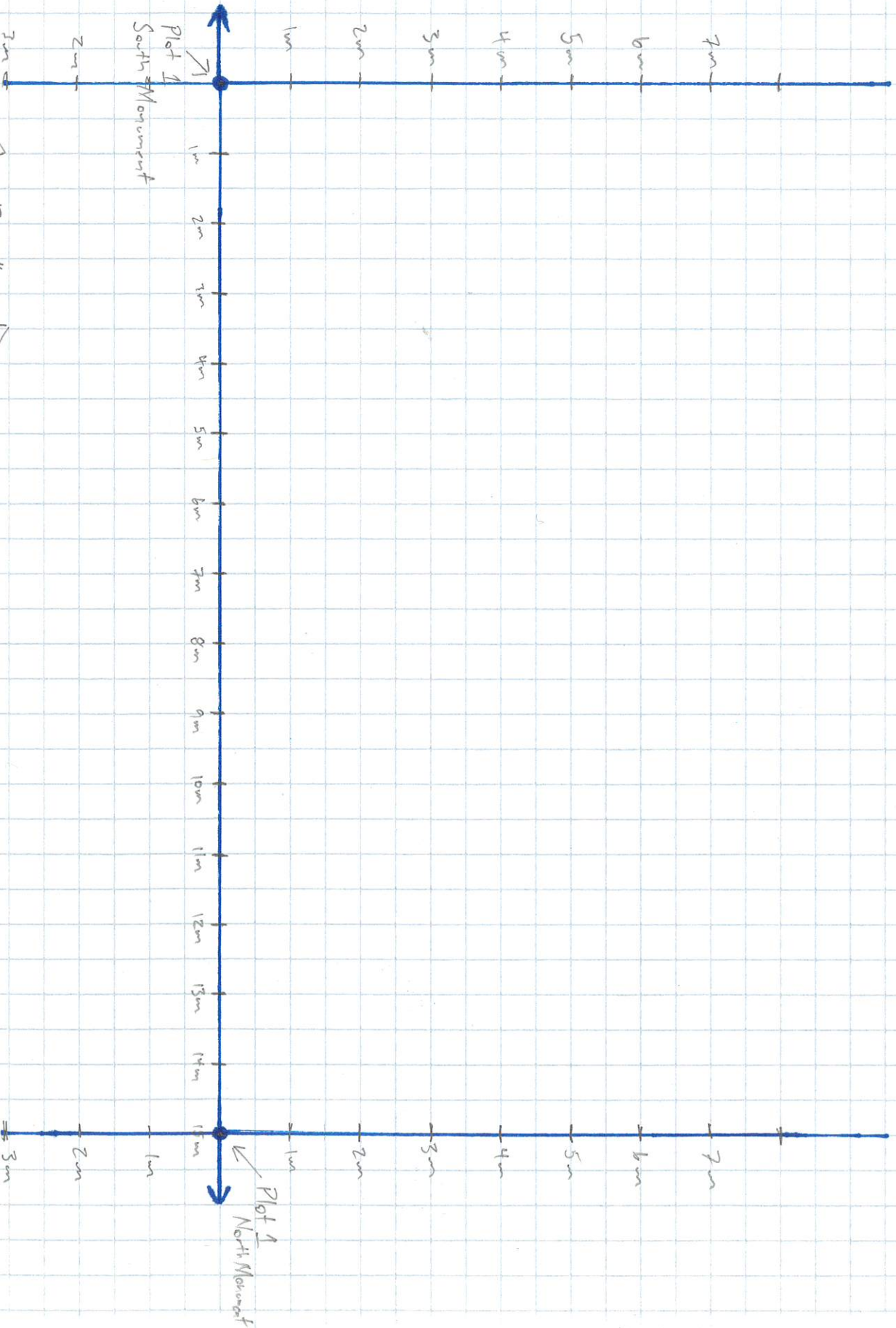
Anderson, D.G. (2006). *Eriogonum exilifolium* Reveal (dropleaf buckwheat): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. <http://www.fs.fed.us/r2/projects/scp/assessments/eriogonumexilifolium.pdf> [Accessed March 28, 2018]

Baad, M. F. Ph.D. 2002. The monitoring of rare plant populations permanent plot studies Red Mountain, Mendocino County, California, Permanent plot study update 2002. Prepared for Bureau of Land Management, Arcata Resource Area Office, Arcata, California, 46 pages.

Elzinga, C.L., D.W. Salzer, and J. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. U.S. Dept. of the Interior, Bureau of Land Management, Denver, CO. 492 pp.

9. DATA SHEET EXAMPLES

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



Road

Plot 1 Photo Movement

Plot 1 South Monument

Plot 1 North Monument

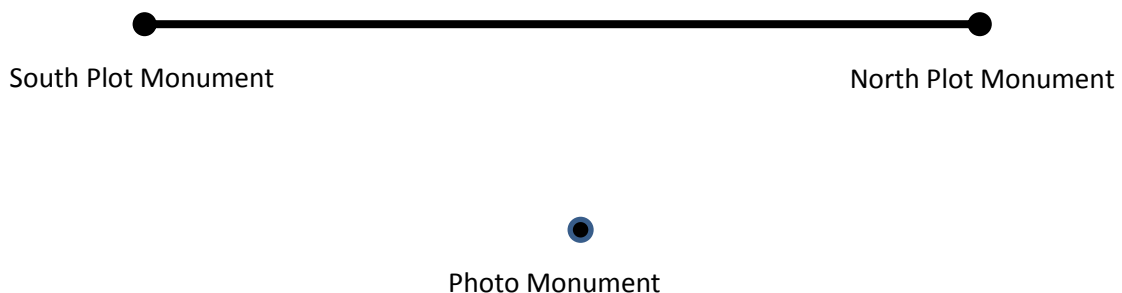
Photomonitoring Log: Little Red Mountain Ecological Reserve Plot 1

Shoot all with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). All photos should be shot from 5 feet above the ground, with the subject framed as described below.

Date of observation: _____ **Camera and Lens:** _____

Observer(s): _____ **Focal Length:** _____ **Camera Setting:** _____

Photo point	From	Toward	Description/Notes	Photo file name in camera
A	Photo Monument	South Plot Monument	Monument centered in bottom 1/3 of view	
B	Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	
C	Photo Monument	North Plot Monument	Monument centered in bottom 1/3 of view	
D	North Plot Monument	South Plot Monument	Monument centered in top 1/3 of view	
E	South Plot Monument (camera moved 150 cm east of monument to avoid manzanita)	North Plot Monument	Monument centered in top 1/3 of view	
F	Approximately 3 meters south of Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	
G	Approximately 3 meters north of Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	



Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised March 27, 2018)

For Office Use:	Final database #:	Final vegetation type: Alliance Association
I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION		circle: Relevé or RA
Database #:	Date:	Name of recorder:
		Other surveyors:
	UID:	Location Name:
GPS name: _____ For Relevé only: Bearing °, left axis at ID point _____ of Long / Short side		
UTME _____ UTMN _____ Zone: 11 NAD83 GPS error: ft./ m./ PDOP _____		
Decimal degrees: LAT _____ LONG _____		
GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____ and record: Base point ID _____ Projected UTMs: UTME _____ UTMN _____		
Camera Name:	Cardinal photos at ID point:	
Other photos:		
Stand Size (acres): <1, 1-5, >5 Plot Area (m²): 100 / _____ Plot Dimensions _____ x _____ m RA Radius _____ m		
Exposure, Actual °: _____ NE NW SE SW Flat Variable Steepness, Actual °: _____ 0° 1-5° >5-25° >25		
Topography: Macro: top upper mid lower bottom Micro: convex flat concave undulating		
Geology code: _____ Soil Texture code: _____ Upland or Wetland/Riparian (circle one)		
% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)		
H₂O:	BA Stems:	Litter: Bedrock: Boulder: Stone: Cobble: Gravel: Fines: =100%
% Current year bioturbation _____ Past bioturbation present? Yes / No % Hoof punch _____		
Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.		
Site history, stand age, comments: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____		
Disturbance code / Intensity (L,M,H): _____/_____/_____ "Other" _____/_____		
II. HABITAT DESCRIPTION		
Tree DBH : T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)		
Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)		
Herbaceous: H1 (<12" plant ht.), H2 (>12" ht.)		
Desert Riparian Tree/Shrub: 1 (<2ft. stem ht.), 2 (2-10ft. ht.), 3 (10-20ft. ht.), 4 (>20ft. ht.)		
Desert Palm/Joshua Tree: 1 (<1.5" base diameter), 2 (1.5-6" diam.), 3 (>6" diam.)		
III. INTERPRETATION OF STAND		
Field-assessed vegetation Alliance name: _____		
Field-assessed Association name (optional): _____		
Adjacent Alliances/direction: _____/_____, _____/_____		
Confidence in Alliance identification: L M H Explain: _____		
Phenology (E,P,L): Herb _____ Shrub _____ Tree _____ Other identification or mapping information: _____		

LITTLE RED MOUNTAIN ECOLOGICAL RESERVE KELLOGG’S BUCKWHEAT 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 2018 Little Red Mountain Ecological Reserve Kellogg's Buckwheat Monitoring Plan (Monitoring Plan). The Monitoring Plan is included as Part 1 of this report and includes detailed instructions on how to implement the monitoring protocol for Kellogg's buckwheat (*Eriogonum kelloggii*) at the California Department of Fish and Wildlife (CDFW) Little Red Mountain Ecological Reserve (Reserve). The purpose of the Monitoring Plan is to facilitate adaptive management of the population of Kellogg's buckwheat in the approximately 850 acre western area of the Reserve that is associated with serpentine habitat (Study Area). Implementation of the Monitoring Plan began in 2015 and an additional monitoring visit was conducted in 2017. CDFW recommends that another monitoring visit be conducted in 2022, with subsequent monitoring visits occurring every five years thereafter. 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 documenting the size and location of all Kellogg's buckwheat plants in the Study Area relative to a baseline,
2. Photomonitoring of the Kellogg's buckwheat population, and
3. Opportunistic surveys of the Study Area for Kellogg's buckwheat and other plants.

In addition, precipitation information generated using a PRISM climate model is presented and general observations of other rare plants on the Reserve are reported. Abridged site visit summaries from 2015 and 2017 have also been included as Appendix A and Appendix B.

2.1. CENSUS OF POPULATION

For the purposes of the census, a "clump" of Kellogg's buckwheat is defined as an individual Kellogg's buckwheat plant or group of plants that is at least 10 centimeters away from another Kellogg's buckwheat plant. A "large" clump is defined as a clump that is at least 10 centimeters in diameter in any direction, and a "small" clump is defined as a clump that is less than 10 centimeters in diameter in all directions.

There were a total of 31 clumps of Kellogg's buckwheat found in the Study Area in 2015 (15 large and 16 small), and a total of 20 clumps of Kellogg's buckwheat in the Study Area in 2017 (10 large and 10 small). 12 clumps of Kellogg's buckwheat identified in 2015 were missing in 2017 (6 large and 6 small), 19 clumps from 2015 remained present in 2017, and 1 small clump that was not present in 2015 was found in 2017. 11 of the 12 plants that died between 2015 and 2017 were located in an approximately two meter by three meter area.

The changes in the Kellogg's buckwheat population from 2015 to 2017 are represented in Figure 1.

Two plants were observed blooming during the monitoring visit in 2015 and four plants were observed blooming during the monitoring visit in 2017. All of the blooming plants were greater than ten centimeters in diameter.

Changes in the population of *Eriogonum kelloggii* in Plot 1 at Little Red Mountain Ecological Reserve between 2015 and 2017

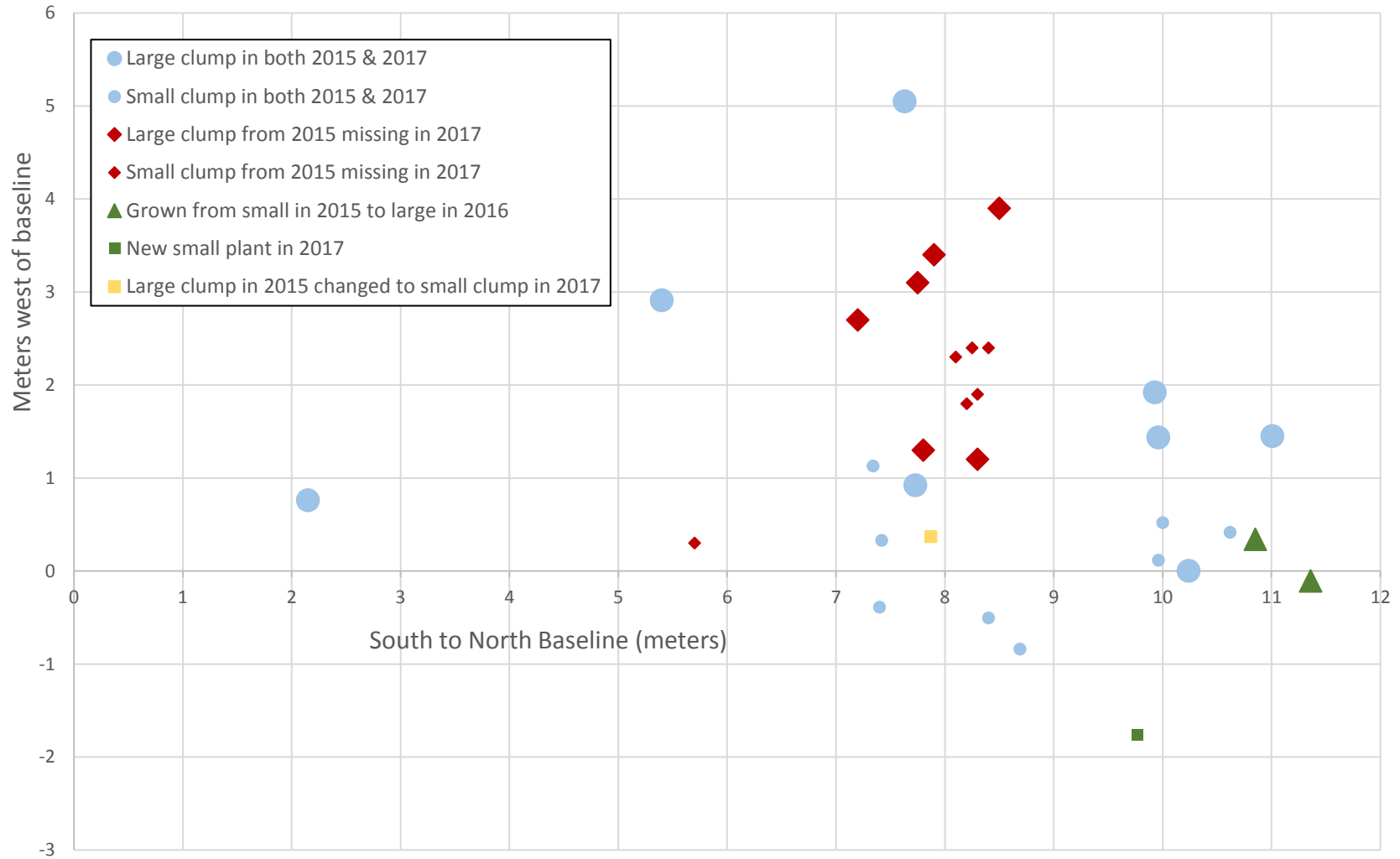


Figure 1

Changes in *Eriogonum kelloggii* population in Plot 1 at Little Red Mountain Ecological Reserve between 2015 and 2017

2.2. PHOTOMONITORING

Seven monitoring photo positions were used in the Study Area in 2015 and 2017. Monitoring photos are presented in Figures 2 through 9.

2.3. ADDITIONAL SURVEYS

CDFW surveyed the areas of the Study Area indicated in Figure 10, but did not locate any additional populations of Kellogg's buckwheat.

2.4. PRECIPITATION

Precipitation information generated using a PRISM climate model is presented in Figure 11 (PRISM 2018). Kellogg's buckwheat is a perennial plant that likely germinates in the fall after the onset of winter precipitation, and blooms between May and August. Growing season annual precipitation (fall to summer) is assumed to be an important factor for Kellogg's buckwheat growth and survival. Growing season precipitation was below average in the 2013-2014, and 2014-2015 growing seasons, but was above average in the 2015-2016 and 2016-2017 growing seasons.

2.5. OTHER OBSERVATIONS

In addition to Kellogg's buckwheat, other rare plants were also observed in the Study Area in 2015 and 2017 (see Figure 10). The California endangered Red Mountain catchfly (*Silene campanulata* ssp. *campanulata*) was observed in Study Area in 2015 and 2017, and the rare white-flowered rein-orchid (*Piperia candida*) (California Rare Plant Rank of 1B.2) was observed at two locations in the Study Area and north of the Study Area on Bureau of Land Management (BLM) land. Despite attempts in 2015 and 2017, CDFW was not able to locate the *Arctostaphylos stanfordiana* ssp. *raichei* shrub (California Rare Plant Rank 1B.1) that was noted in the summary of the 2003 visit to the Study Area. Additional observations are available within the abridged site visit summaries from 2015 and 2017 that have been included as Appendix A and Appendix B.

3. INTERPRETATION OF RESULTS

Considering field notes from 2003 (Golec 2003) and information generated from monitoring visits in 2015 and 2017, it is clear that the population of Kellogg's buckwheat in the Study Area suffered a significant decline between 2003 and 2017. Clare Golec observed the Kellogg's buckwheat population in the Study Area in both 2003 and 2015, and observed the population to be less extensive in 2015 than it was in 2003. Instead of occurring on both sides of the road, as it did in 2003, the population now only occurs on the west side of the road. Monitoring visits in 2015 and 2017 also clearly show a significant decline in the population, primarily due to the death of six plants that were greater than ten centimeters in diameter and six plants that were less than ten centimeters in diameter. This mortality event was concentrated in an approximately two by three meter area of the population (see Figure 4). This loss in population could have occurred due to a small land slide localized in this area or some other factor. The carcass of one of the large dead plants is apparent in Figure 4, but there is no obvious reason for the deaths of plants in this area.



Figure 2

Little Red Mountain Ecological Reserve Photopoint A, 2015 (above) and 2017 (below)



Figure 2

Little Red Mountain Ecological Reserve Photopoint A, 2015 (above) and 2017 (below)



Figure 3

Little Red Mountain Ecological Reserve Photopoint B, 2015 (above) and 2017 (below)



Figure 4

Little Red Mountain Ecological Reserve Photopoint B (closeup), 2015 (above) and 2017 (below)



Figure 5

Little Red Mountain Ecological Reserve Photopoint C, 2015 (above) and 2017 (below)



Figure 6

Little Red Mountain Ecological Reserve Photopoint D, 2015 (above) and 2017 (below)



Figure 7

Little Red Mountain Ecological Reserve Photopoint E, 2015 (above) and 2017 (below)



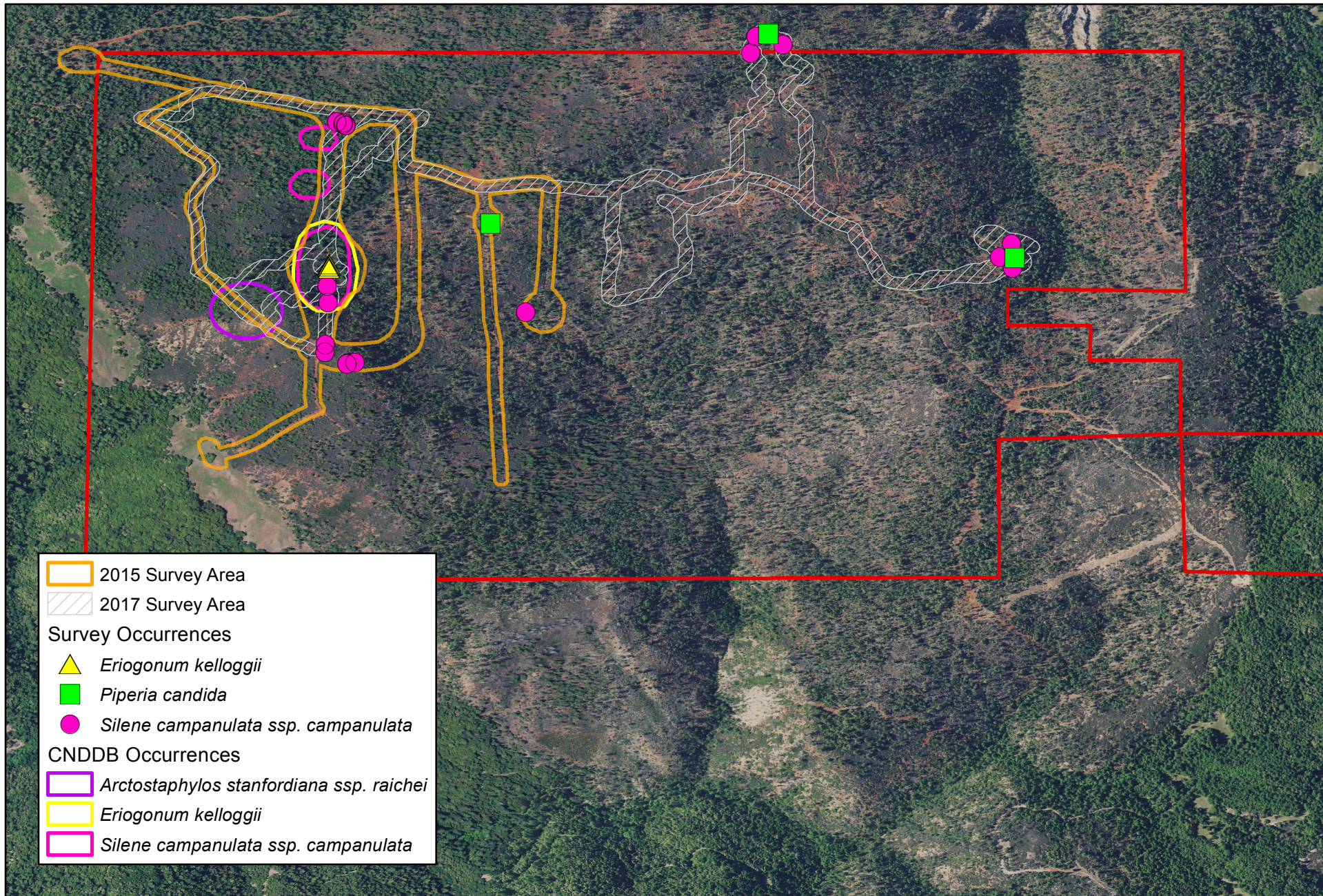
Figure 8

Little Red Mountain Ecological Reserve Photopoint F, 2015 (above) and 2017 (below)



Figure 9

Little Red Mountain Ecological Reserve Photopoint G, 2015 (above) and 2017 (below)



Data Sources: NAIP (2016), CDFW CNDDDB (June 2017)

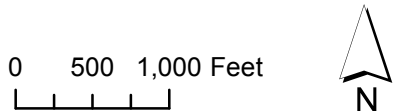


Figure 10: Locations of Rare Plants and Survey Areas at Little Red Mountain Ecological Reserve

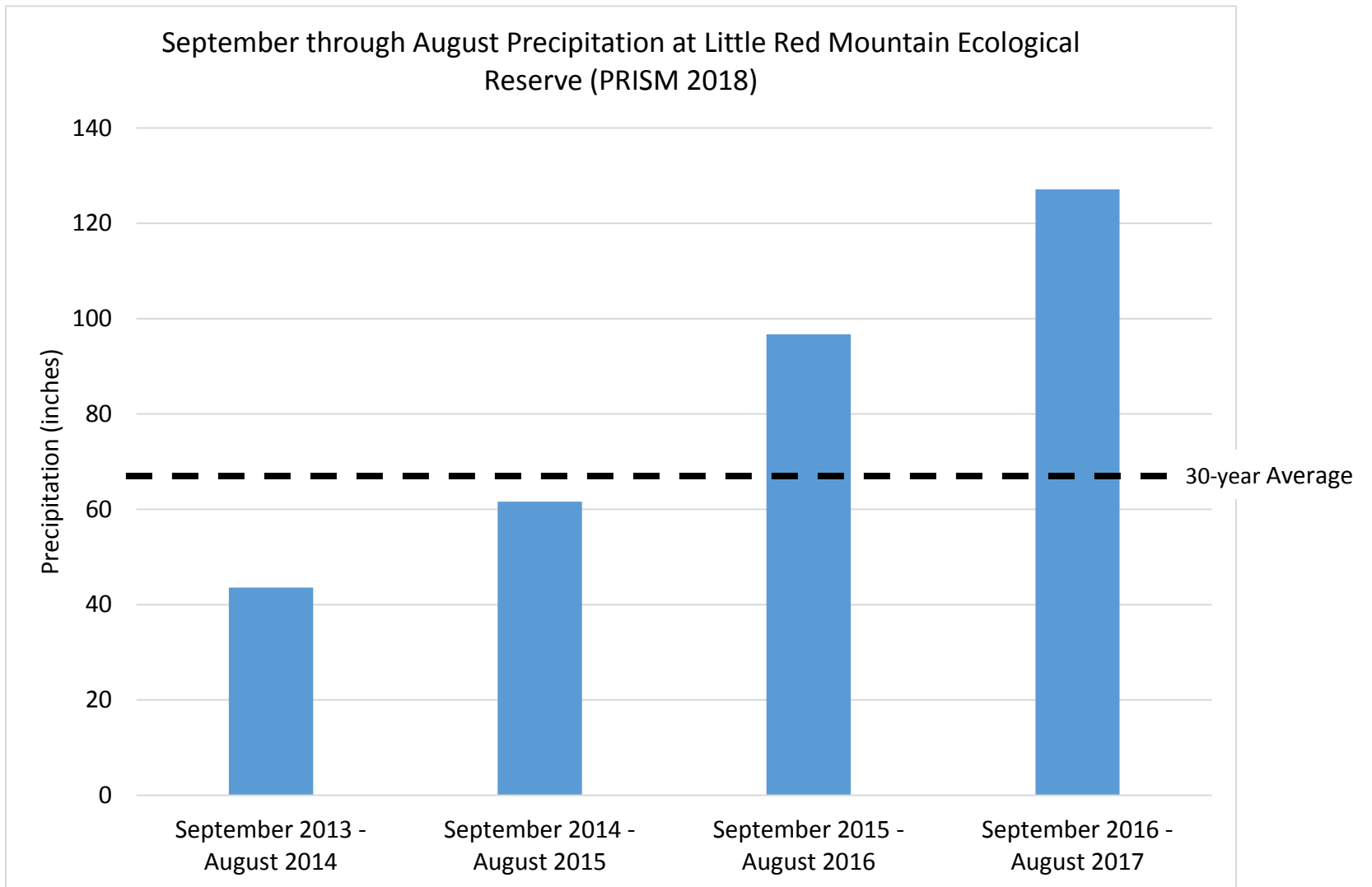


Figure 11
 Little Red Mountain Ecological Reserve Precipitation September 2013 – August 2017

4. ASSESSMENT OF THE MONITORING PROJECT

The monitoring project has been largely successful. Our methods have resulted in an understanding of the current extent of the Kellogg's buckwheat population in the Study Area, and a greater understanding of the botanical diversity of the Study Area, in general. The monitoring requires spending the night on the Reserve and significant planning, therefore the Monitoring Plan may be difficult to implement, long-term.

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 very 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 Adobe Photoshop before insightful comparisons become possible. Because correcting the differences in perspective requires photo editing expertise and a considerable time commitment, every effort should be made to standardize monitoring photos as much as possible in the field. A workflow for correcting images in Photoshop has been included with this report as Appendix C.

5. MANAGEMENT RECOMMENDATIONS

The management objective and management implication identified in the Monitoring Plan are repeated below, with a discussion of whether the management implication should be triggered based on the monitoring results.

5.1. MANAGEMENT OBJECTIVE #1

*Maintain a population of at least ten *Eriogonum kelloggii* plants with a diameter of ten centimeters or greater at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022. (This is a target/threshold type of management objective.)*

Management Implication 1 from Monitoring Plan: If a population of at least ten *Eriogonum kelloggii* plants with a diameter of 10 centimeters or greater is not present at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022, CDFW shall organize and initiate an effort to collect seeds from remaining plants in 2023, and preserve them in long-term conservation storage.

Recommendation: This management implication would not be triggered until 2022; however, because the population is so small, any additional loss of mature plants in the population in the next five years would likely trigger this management implication.

Management Implication 2 from Monitoring Plan: If a population of at least ten *Eriogonum kelloggii* plants with a diameter of 10 centimeters or greater is not present at Little Red Mountain Ecological Reserve at the time of the next monitoring visit, expected to be in 2022, CDFW shall organize and initiate a seed germination study, and attempt to grow *Eriogonum kelloggii* plants in a controlled environment, in an effort to obtain information that could lead to reintroduction of *Eriogonum kelloggii* to Little Red Mountain Ecological Reserve, if necessary.

Recommendation: This management implication would not be triggered until 2022; however, because the population is so small, any additional loss of mature plants in the population in the next five years would likely trigger this management implication.

5.2. OTHER RECOMMENDATIONS

CDFW should continue to survey the Study Area and Reserve whenever site visits are conducted, and collect additional scientific information. CDFW should continue to engage CDFW staff and others with the monitoring and management of the Study Area.

6. REFERENCES

Elzinga, C.L., D.W. Salzer, and J. Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM Technical Reference 1730-1. U.S. Dept. of the Interior, Bureau of Land Management, Denver, CO. 492 pp.

PRISM Climate Group. 2018. Oregon State University. Available online at: <http://prism.oregonstate.edu>. [Accessed April 12, 2018].

7. REVIEWERS

This document was prepared by Jeb McKay Bjerke, a Senior Environmental Scientist (Specialist) in the CDFW's Native Plant Program. The following individuals reviewed this document:

- Isabel Baer, CDFW Native Plant Program
- Cherilyn Burton, CDFW Native Plant Program
- Pete Figura, CDFW Northern Region Wildlife Management Services Supervisor
- Scott Koller, Reserve Manager, CDFW Northern Region
- Kristi Lazar, CDFW California Natural Diversity Database

Appendix A

Notes and Monitoring Data from Field Visit to California Department of Fish and Wildlife's Little Red Mountain Ecological Reserve, June 8 – June 10, 2015. Prepared by Jeb Bjerke.

- Jeb Bjerke (Native Plant Program)
- Cherilyn Burton (Native Plant Program)
- Clare Golec (Region 1) (6/9 and 6/10 only)
- Scott Koller (Region 1, reserve manager) (6/8 only)
- Kristi Lazar (California Natural Diversity Database)
- Brandon Rose (warden) (6/8 only)



Eriogonum kelloggii closeup of foliage

Narrative Summary:

Monday June 8: Hot sunny and clear. Jeb, Cherilyn and Kristi met with Scott and Warden Rose on the north side of Highway 101, exit 609. Scott and Warden Rose were speaking with the adjacent landowner. Access to the Ecological Reserve requires crossing through private property. The property owner cleared some downed trees from the access route for CDFW staff to be able to access the reserve. Jeb, Cherilyn and Kristi were traveling in the Habitat Conservation Planning Branch's 4WD Dodge Durango, and Scott and Warden Rose drove in their respective trucks. Scott told us that the road ahead was blocked by downed trees and Warden Rose let us borrow his tow chain to move them. We said goodbye to Scott and Warden Rose and headed further along the road, having to use the tow chain to move several large downed trees off of the road. We tried to get to an old wildland firefighting campsite just outside of the western edge of the Ecological Reserve, but the clearance of our vehicle was not sufficient to pass a rocky and eroded water bar that crossed the road, so we parked and camped at a road junction near the rare plant populations. We used the rest of the day to scout the area and mark targeted rare plants with pin flags (*Silene campanulata* subsp. *campanulata* and *Eriogonum kelloggii*).

Tuesday June 9: Warm, sunny and clear at 7:30am. Jeb, Cherilyn and Kristi resumed scouting for plants and found several populations of *S. c. campanulata* but only one small population of *E. kelloggii*. We completed a CNDDB form for the *Silene* populations and took GPS points to document the location of these populations. Clare Golec joined us at around noon. The *E. kelloggii* was observed at the same location that it was observed in 2003, however Clare told us that the population is now less extensive and instead of occurring on both sides of the road, as it did in 2003, it now only occurs on the West side of the road. We installed 3 field monuments each consisting of a rebar stake sheathed in a length of PVC pipe with a red cap, all sheathed in a length of square aluminum conduit, all hammered into the ground and labeled with an aluminum tag (photo right).



One monument was placed south of the *E. kelloggii* population and one monument was placed north of the *E. kelloggii* population. These monuments are 15 meters away from each other along the road. A third monument was placed on the opposite side of the road from the *E. kelloggii* population to serve as a permanent photopoint. We defined two different size classes for "clumps" of *E. kelloggii* plants; large clumps were defined as having a long diameter of more than 10 cm, and small clumps were defined as having a long diameter of no more than 10 cm. If

two plants or clumps were less than 10 cm apart from one another, they were counted together as one clump. We counted all *E. kelloggii* clumps and documented their location relative to a 15 meter-long baseline that ran between the South monument (the 0 meter mark) and the north monument (the 15 meter mark) (see figure and datasheet). We counted a total of 31 clumps of *E. kelloggii*, consisting of:

- 16 small (<10 cm) clumps of *E. kelloggii*
- 15 large (>10 cm) clumps of *E. kelloggii*
 - 2 of these large clumps were blooming (and none of the small clumps were blooming)

The *E. kelloggii* was found growing in and above the road cut, and some small clumps, often consisting of only one plant, were found growing in the road. We searched along both sides of the road and a significant distance both upslope and downslope from the population and were unable to find any additional *E. kelloggii* plants.

With the rest of the afternoon, we scouted additional areas of the reserve to look for *E. kelloggii*, *S. c. campanulata* and other plant species, and were able to find an additional population of *S. c. campanulata* (see CNDDDB form). Clare said goodbye for the day in the late afternoon, and we went for an evening stroll to continue scouting for plants.



Silene campanulata subsp. *campanulata* flowers

Locations of *Eriogonum Kelloggii* clumps at Plot 1 of Little Red Mountain Ecological Reserve on June 9, 2015

• Small Clump
(< 10 cm diameter on longest side)

• Large Clump
(> 10 cm diameter on longest side)

• Flowering Large Clump

Slope

Uphill

Downhill

Plot 1
South Monument
South

Plot 1
North Monument
North

ROAD
(Relatively flat)

Approx 5 meters

Plot 1
Photo Monument

West

West



6m
5m
4m
3m
2m
1m

6m
5m
4m
3m
2m
1m

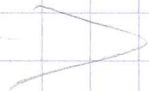
1m 2m 3m 4m 5m 6m 7m 8m 9m 10m 11m 12m 13m 14m 15m

South

North

East

East



- Small Clump (< 10 cm diameter on longest side)
- Large Clump (> 10 cm diameter on longest side)
- Flowering Large Clump

Plot 1 South Monument

Plot 1 North Monument

ROAD (Relatively flat)

Approx 5 meters

Plot 1 Photo Monument

West

West



6m
5m
4m
3m
2m
1m

6m
5m
4m
3m
2m
1m

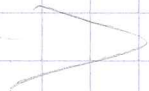
1m 2m 3m 4m 5m 6m 7m 8m 9m 10m 11m 12m 13m 14m 15m

South

North

East

East



Little Red - Jeb Bjerke,
Mtn - Cheryl Lynn Burtons, Kristi Lazar (Clare Golec joined
6/9/2015, *Eriogonum kelloggii* counts us around noon)

Continued
on reverse

a clump diameter
 ≤ 10 cm (longest side)

1 (570N/30W)

1 (740N/40W)

1 (1000N/15W)

1 (1000N/60W)

1 (1070N/50W)

1 (1090N/40W)

1 (730N/120W)

1 (820N/180W)

* NOTE ≤ 10 cm = 1 clump; measurements are along slope for tape measurements
apart

a clump diameter
 > 10 cm (longest side)

1 (220N/80W)

1 (780N/130W)
1 (770N/100W)

1 (810N/40W) - 7 small clumps that
combined are > 10 cm

1 (1030N/5W)

1 (1120N/150W) - composed of 2 smaller
clumps (1 blooming)

1 (1000N/150W)

1 (1000N/210W)

1 (830N/120W) -
several smaller
clumps ~ 45 cm long

Habitat:

Roadcut, west side of road

Calocedrus decurrens, tan oak, *Arctostaphylos*, Jeffrey pine/sugar pine,

Silene campanulata campanulata, *Polygala*

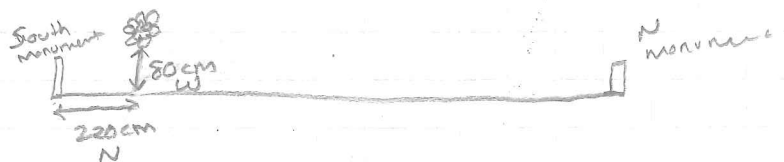
Notes:

2 monuments hammered into west side of road (15 meters apart along road North/South)
PVC pipe with cap over rebar; square aluminum conduit over it

monument named CDFW Plot 1 South and CDFW Plot 1 North

Plant measurements along tape

- closest edge toward tape measured



A third monument on East side of road about $\frac{1}{2}$ way between
monuments on west side of road. (Plot 1, photo point)

- Photo monitoring

A - From photo monument towards South plot monument;
centered in bottom $\frac{1}{3}$ of view.

B - Photo toward 7.5 m mark (center)

centered in bottom $\frac{1}{4}$ of camera

C - From photo monument towards north plot monument;
centered in bottom $\frac{1}{3}$ of view

D - North marker toward South marker, centered in top $\frac{1}{3}$

E - South marker toward North marker

- camera moved 150 cm East of South marker since
monument blocking view.

- toward 7.5 meter mark, bottom $\frac{1}{4}$

- F - ≈ 3 meters south of photo monument
 - toward 7.5 m mark, bottom 1/4
- G - ≈ 3 meters north of photo monument
 - toward 7.5 m mark, bottom 1/4

Counting continued:

Small clumps

- 1 (810N/230W)
 1 (830N/190W)
 1 (840N/240W)
 1 (825N/240W)
 1 (740N/30E)
 1 (840N/40E)
 1 (860N/80E)
 1 (1130N/10E) - series of
 small, just
 barely > 10cm

Large clumps

- 1 (560N/310W) (Flowering
 largest clump present
 directly behind cedar)
- 1 (720N/270W)
 1 (775N/310W) - 2 small + 1 3cm in diameter
 clumps
- 1 (790N/340W)
 1 (850N/390W)
 1 (730N/520W)



Eriogonum kelloggii

Wednesday June 10: We met back up with Clare in the morning and continued to scout the reserve for additional populations of the species. We went on a loop hike and left the previously cleared roads to hike up a steep slope and after crawling through dense manzanita we found some additional populations of *S. c. campanulata* near an area that was cleared for a helicopter landing pad during a fire that took place in the area in (2008?). The *Arctostaphylos* regenerating within the helicopter landing area appeared to be diseased. All of the *S. c. campanulata* that we observed during our visit seemed to occur in areas with at least some shade or shelter, whether it be a north(ish)-facing slope with some tree overstory, underneath an *Arctostaphylos* shrub canopy, or on the bank of a dry drainage channel with tree overstory. Next we hiked down to an area of the reserve with a grassland/oak woodland plant community without red soil. We returned to our vehicles at about noon and left the reserve.

An updated list of plant species discovered on the reserve is attached, along with a very approximate map of the areas that were traveled and surveyed.

***Eriogonum kelloggii* Monitoring Data and Photos:
Little Red Mountain Ecological Reserve, 6/9/2015**

Field Personnel: Jeb Bjerke, Cheryl Burton, Kristi Lazar; Clare Golec joined around noon
Location: Roadcut on west side of old mining/fire road. Associated plant species: *Calocedrus decurrens*, tan oak, *Arctostaphylos* sp., *Pinus jeffreyi*, *Pinus lambertiana*, *Silene campanulata* ssp. *campanulata*, *Polygala* sp.

2015 Monitoring Methods: Two (2) rebar monuments were hammered into the west side of the road, 15 meters apart along the road; PVC pipe with a cap was placed over the rebar and square aluminum conduit was placed around the PVC. The monuments were named CDFW Plot 1 South (UTM: 4413592 northing, 442717 easting) and CDFW Plot 1 North (UTM: 4413607 northing, 442717 easting). A meter tape was laid between the two monuments (from south to

 = Approximate
Areas Surveyed
6/8/2015 - 6/10/2015



Image source: NAIP 2014

0 0.05 0.1 0.2 Miles



Little Red Mountain Site Map

north), and the locations of plants, relative to the tape were measured. The point where plants were closest to the baseline was recorded. If separate plants were less than 10 cm apart from each other, they were counted as one “clump”. Plants were recorded at the following locations:

16 Small clumps (<10cm in diameter on all sides):

570N/30W
740N/40W
1000N/15W
1000N/60W
1070N/50W
1090N/40W
730N/120W
820N/180W
810N/230W
830N/190W
840N/240W
825N/240W
740N/30E
840N/40E
860N/80E
1130N/10E (Series of small plants, just barely <10cm)

15 Large Clumps (>10cm diameter on any side)

220N/80W
810N/40W (7 small clumps that combined are >10cm)
1030N/5W
1120N/150W (Composed of 2 smaller clumps, 1 blooming)
1000N/150W
1000N/210W
780N/130W
770N/100W
830N/120W (Several smaller clumps ~45cm long)
560N/310W (Flowering, largest clump present directly behind cedar)
720N/270W
775N/310W (2 very small plants and one 1x3cm clump)
790N/340W
850N/390W
730N/520W

Photomonitoring Methods:

A third monument, named Plot 1 photo point (UTM: 4413600 northing, 442721 easting) was placed on the east side of road about 4.6 meters(?) east of the 7.5 meter mark on the baseline. (half-way between the plot monuments that are on the west side of the road). Seven monitoring photos were captured:

A – From photo monument with south plot monument centered in bottom 1/3 of image



B – From photo monument with 7.5m mark (center) of baseline centered in bottom 1/4 of image



C – From photo monument with north plot monument centered in bottom 1/3 of image



D – From north monument with south monument centered in top 1/3 of view



E -From 150cm east of south monument (due to blocked view) with 7.5m baseline mark in bottom ¼ of image



F – Approximately 3m south of photo monument with 7.5m baseline mark centered in bottom ¼ of image



G- Approximately 3m north of photo monument with 7.5m baseline mark centered in bottom 1/4 of image



Appendix B

Notes and Monitoring Data from Field Visit to California Department of Fish and Wildlife's Little Red Mountain Ecological Reserve, June 13 – June 15, 2017. Prepared by Jeb Bjerke.

- Jeb Bjerke (Native Plant Program)
- Cherilyn Burton (Native Plant Program)
- Danielle Castle (Region 1 Timber Program, Mendocino County) (June 13 and 14)

Narrative Summary:

Tuesday June 13: Sunny and mild. Jeb and Cherilyn met with Danielle in her work truck on the north side of Highway 101, exit 609 and proceeded through the first gate to the Reserve. Access to the Ecological Reserve requires crossing through private property. Jeb coordinated with the property owner prior to the visit via phone. The property owner volunteered to check and clear the road of obstructions prior to the visit. The road to the reserve was very rutted and worn, and passage required a high clearance vehicle (<https://binged.it/2sYmy7o>). We encountered the property owner after going through the second locked gate. The property owner was cutting and splitting wood along the access road. We introduced ourselves and chatted with the property owner before proceeding to the reserve.



Eriogonum kelloggii with flowers almost open

On our way to the west side of the reserve we drove over 4-5 foot tall regenerating shrubs and cleared some minor woody debris by hand. We parked at the junction of the road that leads to the *Eriogonum kelloggii* population (39.874455°, -123.668826°) and proceeded on foot. We found a few state endangered *Silene campanulata* ssp. *campanulata* near the road, near areas the species has been known to occur. We marked the known population of *Eriogonum kelloggii* with pin flags and proceeded to search for the *Arctostaphylos stanfordiana* ssp. *raichei* shrub that was observed in 2003. We searched the area, but were unable to find the plant, and suspect that it may have been cut down during a fire that took place in the area in 2008. We bushwacked uphill and searched some of the area above the known *Eriogonum kelloggii* population. We returned to the trucks and camped at 39.874344°, -123.667687°.

Wednesday June 14: Sunny and mild. We monitored the *Eriogonum kelloggii* population by recording the location of every plant clump, or group of plant clumps we found relative to the baseline created by extending a meter tape from the South Plot Monument to the North Plot Monument (15 meters). We numbered each clump, recorded the maximum diameter of each clump or group of clumps, whether the clump had flowers, and made other notes. We also took monitoring photos, and took a photo of each clump.

We counted a total of 19 clumps of *E. kelloggii*, consisting of:

- 10 small (<10 cm) clumps of *E. kelloggii*
- 10 large (>10 cm) clumps of *E. kelloggii*

- 4 of these large clumps were blooming (and none of the small clumps were blooming)

It appears that a number of plants present at about 8 meters along the baseline and 3.5 meters to the west of the baseline that were present in 2015 were no longer present in 2017. The carcass of the largest plant on the slope was still present, but we did not see any remnants of the other (smaller) missing plants.

After completing the monitoring we returned to camp and then began scouting for other populations of *Eriogonum kelloggii* on the reserve. Danielle collected some moss from a rock at (39.870451, -123.653190) to send to bryophyte experts, and collected one voucher specimen of *Silene campanulata* ssp. *campanulata* to deposit in an herbarium. We said farewell to Danielle at about 3:00 pm, and we continued searching. We did not find any additional populations of *Eriogonum kelloggii* during the afternoon, but we did discover some additional populations of the state endangered *Silene campanulata* ssp. *campanulata*, and several individuals of the rare orchid *Piperia candida* (see attached figure).

Thursday June 14: Warm, with high clouds. We continued scouting for other populations of *Eriogonum kelloggii* on the reserve, and searched above the known population. We reached the top of Little Red Mountain and searched the paths along the west and north sides of the mountain. We searched another area to the east of our campsite, and then left the reserve.

***Eriogonum kelloggii* Monitoring Data and Photos: Little Red Mountain Ecological Reserve, 6/14/2017**

Field Personnel: Jeb Bjerke, Cherilyn Burton, Danielle Castle

Location: Roadcut on west side of old mining/fire road. Associated plant species: *Calocedrus decurrens*, *Notholithocarpus densiflorus* var. *densiflorus*, *Arctostaphylos* sp., *Pinus jeffreyi*, *Pinus lambertiana*, *Silene campanulata* ssp. *campanulata*, *Polygala californica*.

2017 Monitoring Methods: A meter tape was laid from south to north between the South Plot Monument and the North Plot Monument (15 meters), and the locations of plants, relative to the tape were measured. The point where plants were closest to the baseline was recorded. If separate plants were less than 10 cm apart from each other, they were counted as one "clump". Plants were recorded at the following locations:

Description	Number of Plants	Date	Feature Type	Species	Latitude	Longitude
sicaca2	0	20150609	Plant	Silene campanulata ssp. campanulata	39.874153	-123.669356
sicaca3	0	20150609	Plant	Silene campanulata ssp. campanulata	39.869997	-123.669842
sicaca4	0	20150609	Plant	Silene campanulata ssp. campanulata	39.869565	-123.669826
sicaca5	0	20150609	Plant	Silene campanulata ssp. campanulata	39.868483	-123.669897
erikel1	0	20150609	Plant	Eriogonum kelloggii	39.870448	-123.669799
erikel2	0	20150609	Plant	Eriogonum kelloggii	39.870511	-123.669812
erikel3	0	20150609	Plant	Eriogonum kelloggii	39.870565	-123.669800
silene campanulata campanulata	75	20150609	Plant	Silene campanulata ssp. campanulata	39.869324	-123.664702
sicaca1	0	20150609	Plant	Silene campanulata ssp. campanulata	39.874153	-123.669356
sicaca1	0	20150609	Plant	Silene campanulata ssp. campanulata	39.874180	-123.669438
sicaca1	0	20150609	Plant	Silene campanulata ssp. campanulata	39.874234	-123.669427
sicaca1	0	20150609	Plant	Silene campanulata ssp. campanulata	39.874242	-123.669591
silene campanulata campanulata	200	20150609	Plant	Silene campanulata ssp. campanulata	39.868019	-123.669133
silene campanulata campanulata	100	20150609	Plant	Silene campanulata ssp. campanulata	39.867973	-123.669331
silene campanulata campanulata	200	20150609	Plant	Silene campanulata ssp. campanulata	39.868285	-123.669907
SILENE CAMPANULATA CAMPANULATA	25	20170614	Plant	Silene campanulata ssp. campanulata	39.870458	-123.652109
PIPERIA CANDITA	1	20170614	Plant	Piperia candida	39.870730	-123.652051
SILENE CAMPANULATA CAMPANULATA	80	20170614	Plant	Silene campanulata ssp. campanulata	39.871095	-123.652135
SILENE CAMPANULATA CAMPANULATA	1	20170614	Plant	Silene campanulata ssp. campanulata	39.870732	-123.652443
SILENE CAMPANULATA CAMPANULATA	10	20170614	Plant	Silene campanulata ssp. campanulata	39.876240	-123.658047
PIPERIA CANDITA	0	20170614	Plant	Piperia candida	39.876523	-123.658429
SILENE CAMPANULATA CAMPANULATA	25	20170614	Plant	Silene campanulata ssp. campanulata	39.876542	-123.658407
SILENE CAMPANULATA CAMPANULATA	25	20170614	Plant	Silene campanulata ssp. campanulata	39.876442	-123.658749
SILENE CAMPANULATA CAMPANULATA	25	20170614	Plant	Silene campanulata ssp. campanulata	39.876023	-123.658877
PIPERIA CANDITA	1	20150609	Plant	Piperia candida	39.871600	-123.665616

Notes

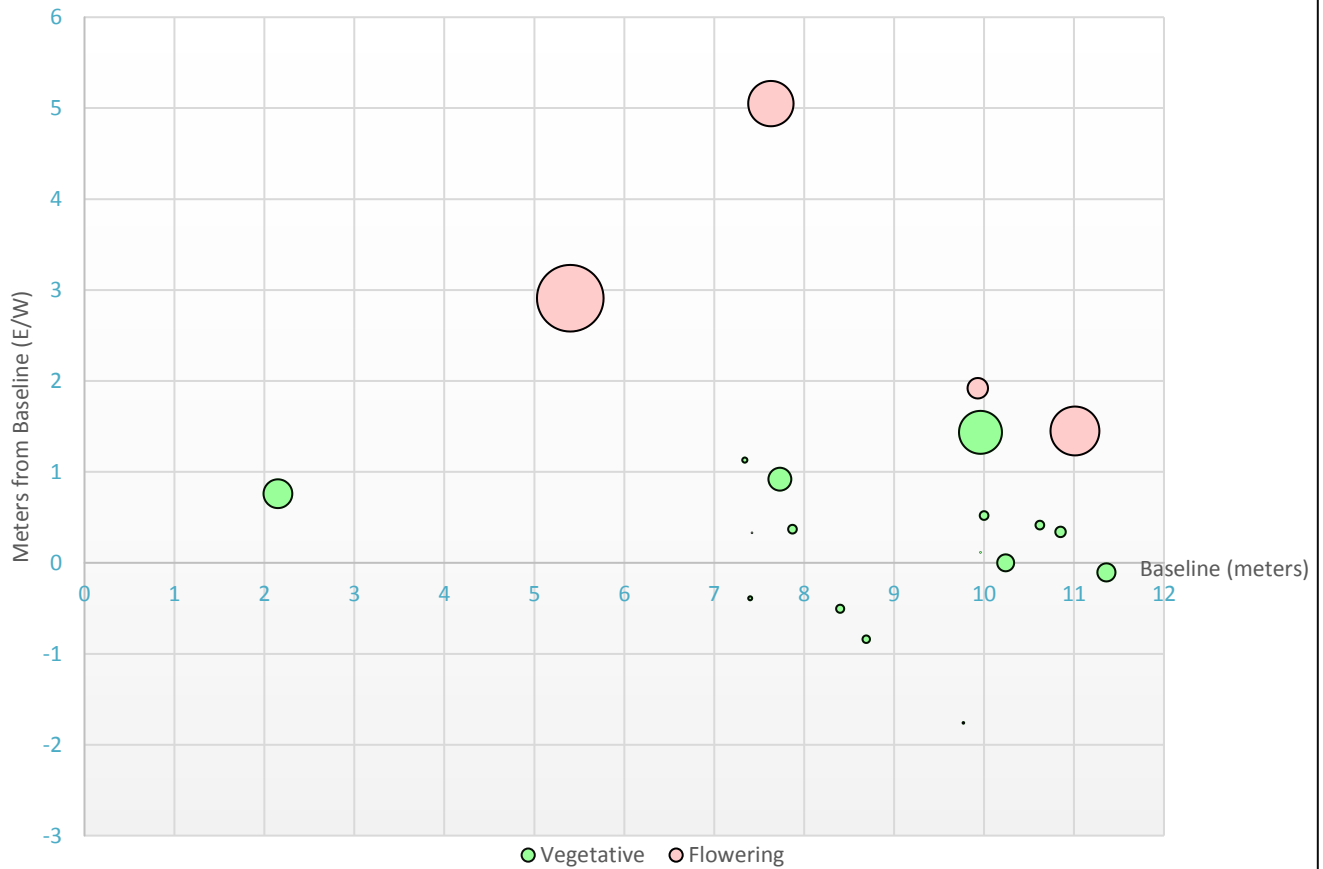
5% flowering, under tanoak and dead manzanita

almost flowering, under sugar pine, lots of bear grass nearby

near red huckleberry, manzanita and bear grass

flowering

Relative sizes of *Eriogonum kelloggii* plant clumps at Little Red Mountain Ecological Reserve on June 14, 2017



Clump Number	Distance in Meters along baseline (from south to north)	Distance from baseline (East or West)	Widest part of clump (cm)	Flowering
1	2.15	West 0.76	26	No
2	7.4	East 0.39	5	No
3	7.42	West 0.33	1	No
4	7.34	West 1.13	6	No
5	7.73	West 0.92	21	No
6	7.87	West 0.37	9	No
7	8.4	East 0.505	8.5	No
8	8.69	East 0.84	8	No
9	7.63	West 5.05	58	Yes
10	5.4	West 2.91	40	Yes
11	9.77	East 1.76	3	No

12	9.96	West 0.115	2	No
13	10	West 0.52	9	No
14	10.24	0	16	No
15	9.96	West 1.435	38	No
16	9.93	West 1.92	19	Yes
17	10.62	West 0.415	9	No
18	10.85	West 0.34	10.5	No
19	11.01	West 1.45	43	Yes
20	11.36	East 0.105	17	No

Photomonitoring Methods:

Each clump was photographed, and photographs are saved in the Native Plant Program's files. A third monument, named Plot 1 photo point (UTM: 4413600 northing, 442721 easting) was placed on the east side of road about 4.6 meters(?) east of the 7.5 meter mark on the baseline. (half-way between the plot monuments that are on the west side of the road). Seven monitoring photos were captured:

A – From photo monument with south plot monument centered in bottom 1/3 of image



B – From photo monument with 7.5m mark (center) of baseline centered in bottom ¼ of image



C – From photo monument with north plot monument centered in bottom 1/3 of image



D – From north monument with south monument centered in top 1/3 of view



E -From 150cm east of south monument (due to blocked view) with 7.5m baseline mark in bottom ¼ of image



F – Approximately 3m south of photo monument with 7.5m baseline mark centered in bottom ¼ of image



G- Approximately 3m north of photo monument with 7.5m baseline mark centered in bottom ¼ of image



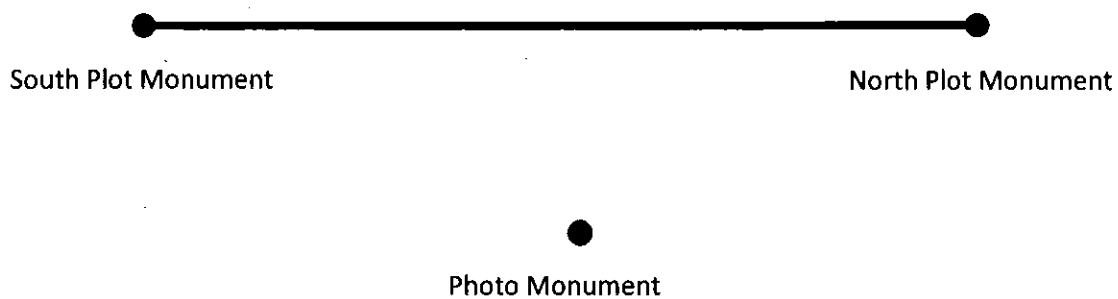
Photomonitoring Log: Little Red Mountain Ecological Reserve Plot 1

Shoot all with a focal length equivalent to 27mm on a full frame camera (e.g. 18mm on a Nikon dx lens). All photos should be shot from 5 feet above the ground, with the subject framed as described below.

Date of observation: 6/14/2017 Camera and Lens: Nikon D3300

Observer(s): J. Bjerke, C. Butler, Dantelle Castle Focal Length: 18mm Camera Setting: Auto no flash

Photo point	From	Toward	Description/Notes	Photo file name in camera
A	Photo Monument	South Plot Monument	Monument centered in bottom 1/3 of view	
B	Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	
C	Photo Monument	North Plot Monument	Monument centered in bottom 1/3 of view	
D	North Plot Monument	South Plot Monument	Monument centered in top 1/3 of view	
E	South Plot Monument (camera moved 150 cm east of monument to avoid manzanita)	North Plot Monument	Monument centered in top 1/3 of view	
F	Approximately 3 meters south of Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	
G	Approximately 3 meters north of Photo Monument	7.5 meters (halfway between monuments)	7.5 meter mark centered in bottom 1/4 of frame	



Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised April 28, 2016)

Location of *Eriogonum Kelloggii* @ Little Red Mt ER

$TP^2 = 10000$

178 m

For Office Use:	Final database #:	Final vegetation type:	Alliance
		Association	
I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION			circle: Relevé or RA
Database #:	Date:	Name of recorder:	<i>C. Burton</i>
	<i>6/14/19</i>	Other surveyors:	<i>D. Costley, J. Bjerke</i>
Location Name:			
GPS name:	For Relevé only: Bearing°, left axis at ID point _____ of Long / Short side		
UTME	UTMN	Zone: 11 NAD83 GPS error: ft./ m./ PDOP _____	
Decimal degrees: LAT _____ LONG _____			
GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____			
and record: Base point ID _____ Projected UTMs: UTME _____ UTMN _____			
Camera Name:	Cardinal photos at ID point:		
Other photos:			
Stand Size (acres):	<i><1, 1-5, >5</i>	Plot Size (m ²):	<i>100 / _____</i> Plot Shape _____ x _____ m RA Radius <i>7.8</i> m
Exposure, Actual °:	<i>120</i> NE NW SE SW Flat Variable	Steepness, Actual °:	<i>20</i> 0° 1-5° <i>>5-25°</i> >25
Topography: Macro:	top <i>upper</i> mid lower bottom	Micro:	<i>convex</i> flat concave undulating
Geology code:	<i>Serp</i> Soil Texture code: _____	Upland or Wetland/Riparian (circle one) <i>w/Roadcut</i>	
% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)			
H ₂ O:	<i>0</i> BA Stems: <i>3</i> Litter: <i>5</i> Bedrock: <i>1</i> Boulder: <i>1</i> Stone: <i>1</i> Cobble: <i>4</i> Gravel: <i>15</i> Fines: <i>25</i> =100%		
% Current year bioturbation <1 Past bioturbation present? Yes / <i>No</i> % Hoof punch <i>0</i>			
Fire evidence: <i>Yes</i> No (circle one) If yes, describe in Site history section, including date of fire, if known.			
Site history, stand age, comments: <i>Charred logs, burn scars on trees, dead patches of shrubs. Old roadcut - no other disturbance noted</i>			
Disturbance code / Intensity (L,M,H): <i>B/L</i> _____ "Other" _____			
II. HABITAT DESCRIPTION			
Tree DBH: T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)			
Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)			
Herbaceous: H1 (<12" plant ht.), H2 (>12" ht.)			
Desert Riparian Tree/Shrub: 1 (<2ft. stem ht.), 2 (2-10ft. ht.), 3 (10-20ft. ht.), 4 (>20ft. ht.)			
Desert Palm/Joshua Tree: 1 (<1.5" base diameter), 2 (1.5-6" diam.), 3 (>6" diam.)			
III. INTERPRETATION OF STAND			
Field-assessed vegetation Alliance name: <i>Arctostaphylos somnensis camerosus alliance</i>			
Field-assessed Association name (optional): _____			
Adjacent Alliances/direction: _____			
Confidence in Alliance identification L M H Explain: _____			
Phenology (E,P,L): Herb Shrub Tree Other identification or mapping information: _____			

Little Red Mountain Ecological Reserve Plant Species List

This list is an updated version of the June 2004 plant list prepared by Clare Golec. Updated scientific names and additional plant species are marked with an asterisk(*). Some plant species on grassland habitat within the reserve that was not on the characteristic “red” serpentine soil were also included in the list below and are designated with “(grassland)”. Areas visited in 2015 and 2017 are identified on the figure in this report.

Family

Scientific Name Listing status

Common Name

Alliaceae

Allium falcifolium

scythe-leaved onion

*Allium amplexans**

narrow-leaved onion

Anacardiaceae

*Toxicodendron diversilobum**

western poison oak

Apiaceae

Lomatium sp. (*engelmannii*? ^{4,3})

lomatium

*Sanicula laciniata**

coastal blacksnakeroot

Apocynaceae

Apocynum androsaemifolium

bitter dogbane

*Asclepias speciosa**

showy milkweed

Asteraceae

Achillea millefolium

common yarrow

*Arnica discoidea**

rayless arnica

Cirsium douglasii var. *breweri*

swamp thistle

Cirsium sp.* (grassland)

thistle

Erigeron reductus var. *angustatus**

little rayless fleabane

Eriophyllum lanatum var. *achilleoides**

woolly sunflower

Hemizonia congesta ssp. *tracyi** (grassland)

Tracy's tarplant

*Hieracium bolanderi**

Bolander's hawkweed

Boraginaceae

Eriodictyon californicum

California yerba santa

Caryophyllaceae

Silene campanulata ssp. *campanulata* ^{SE, 4.2}

Red Mountain catchfly

Cupressaceae

Calocedrus decurrens

incense cedar

Cyperaceae

Carex amplifolia

ample-leaved sedge

Dennstaedtiaceae

Pteridium aquilinum var. *pubescens*

western bracken fern

Dryopteridaceae

Polystichum imbricans ssp. *imbricans**

sword fern

Ericaceae

Arctostaphylos canescens ssp. *sonomensis*

Sonoma manzanita

Arctostaphylos manzanita ssp. *manzanita**

Common manzanita

Arctostaphylos stanfordiana ssp. *raichei*^{1B.1}

Raiche's manzanita

Chimaphila menziesii

little prince's pine

*Pyrola aphylla**

leafless wintergreen

Vaccinium parvifolium

red huckleberry

Fabaceae

*Lupinus andersonii**

Anderson's lupine

Trifolium eriocephalum ssp. *eriocephalum**
(grassland)

hairy head clover

Fagaceae

Notholithocarpus densiflorus var. *densiflorus*

tanbark oak

*Quercus vacciniifolia**

huckleberry oak

Hydrangeaceae

Whipplea modesta

yerba de selva

Iridaceae

Iris purdyi

Purdy's iris

Juncaceae

Luzula comosa

common wood rush

Liliaceae

Calochortus tolmiei

pussy ears

*Calochortus vestae**(grassland)

Mariposa lily

Erythronium sp.*

fawn lily

Lilium rubescens^{4.2}

redwood lily

Linaceae

*Hesperolinon clevelandii**

dwarf flax

Malvaceae

*Sidalcea diploscypha**(grassland)

fringed checkerbloom

Melanthiaceae

Toxicoscordion micranthum

death camas

Xerophyllum tenax

bear-grass

Onagraceae

*Epilobium minutum**

willowherb

Orchidaceae

Piperia candida^{1B.2*}

white-flowered rein-orchid

Orobanchaceae

Castilleja applegatei ssp. *pinetorum**
Cordylanthus tenuis ssp. *brunneus**
*Orobanche pinorum**
*Orobanche uniflora**
Pedicularis densiflora

wavy-leaved indian-paintbrush
 serpentine bird's-beak
 broomrape
 naked broomrape
 Indian warrior

Pinaceae

*Pinus attenuata**
Pinus jeffreyi
Pinus lambertiana
Pseudotsuga menziesii var. *menziesii*

knobcone pine
 Jeffrey pine
 sugar pine
 Douglas-fir

Poaceae

Avena sp.* (grassland)
*Briza minor** (grassland)
*Bromus hordeaceus** (grassland)
*Bromus diandrus** (grassland)
*Cynosurus echinatus** (grassland)
Deschampsia caespitosa ssp. *caespitosa*
Elymus sp.
*Elymus caput-medusae** (grassland)
*Festuca californica**
*Festuca idahoensis**
*Festuca rubra**
Melica sp.

wild oat
 little quaking grass
 soft chess
 rippgut grass
 dogtail grass
 tufted hair-grass
 wild rye
 medusa head
 California fescue
 blue bunchgrass
 red fescue
 oniongrass

Polygalaceae

Polygala californica

California milkwort

Pteridaceae

Aspidotis densa

Indian's dream

Polygonaceae

Eriogonum kelloggii ^{SE, FC, 1B.2}
Eriogonum nudum var. *nudum**

Kellogg's buckwheat
 naked wild buckwheat

Ranunculaceae

Delphinium sp.* (grassland)
Ranunculus sp.* (grassland)

larkspur
 buttercup

Rhamnaceae

Ceanothus foliosus var. *foliosus*
Ceanothus pumilus
Frangula californica ssp. *occidentalis**

wavy-leaf ceanothus
 Siskiyou ceanothus
 California buckthorn

Rosaceae

Heteromeles arbutifolia
Holodiscus discolor var. *glabrescens**
Horkelia tridentata var. *flavescens**
Potentilla?*

toyon
 oceanspray
 horkelia

<i>Rosa</i> sp.*	Rose
Rubiaceae	
<i>Galium ambiguum</i> ssp. <i>siskiyouense</i> *	Yolla Bolly bedstraw
<i>Galium</i> sp. #2	bedstraw
Themidaceae	
<i>Brodiaea elegans</i> ssp. <i>elegans</i> * (grassland)	harvest brodiaea
Violaceae	
<i>Viola ocellata</i> *	two-eyed violet
<i>Viola lobata</i> spp. <i>lobata</i>	pine violet

Bird species list by C. Burton:

- Anna's hummingbird
- black-throated gray warbler
- California quail (call)
- dark eyed junco (song)
- hermit thrush (song)
- mountain quail (call)
- northern flicker (call)
- olive-sided flycatcher (song)
- red-breasted nuthatch (song)
- red-tailed hawk (call)
- spotted towhee (song)
- Stellar's jay
- turkey vulture
- wrentit (song)
- western wood-pewee (song)

Other observations:

- bear scat with evidence of red huckleberry and grass consumption
- red velvet ant
- chanterelle
- moss collected by Danielle at (39.870451, -123.653190)
- many red-colored western fence lizards, likely due to dust

Appendix C

Workflow for Aligning Monitoring Photos in Photoshop

This procedure provides a rough outline of a technique for aligning monitoring photos taken from the same location using Photoshop CS6.

1. Open Photoshop CS6
2. Under “**File**”, select “**Scripts**” > “**Load Files into Stack**”
3. Select “**Browse**” and select all monitoring photos you would like to align
 - a. Only check “**Attempt to Automatically Align Source Images**” if there are lots of buildings or other visually distinct aspects to the image, and even then, this may not work well. If the result does not look good, start over and uncheck this box.
4. Select “**Image**”, and “**Canvas Size**” and increase the vertical and horizontal canvas size by a few inches.
5. Select the top layer in the layers window, select “**Filter**” and “**Lens Correction...**” For “**Edge**” select “**Edge Extension**”. Select **OK**.
 - a. **NOTE:** For photos taken with an SLR camera (Nikon d3100/d3300) a lens profile is available, and should be used. The Native Plant Program point and shoot Sony camera does not have a lens profile, so skip the lens correction step for photos taken on the Sony.
6. Use the **eye button** to make the top layer that was just corrected invisible, click on the next layer down to select it, and repeat Step 5 for all remaining monitoring photos.
7. Make the top layer visible again and click it to select it in the layers window. Click and hold the **eyedropper icon** in the tools window, and select the **ruler tool** in the submenu.
8. Click and hold on a specific feature on the horizon on the left side of the image, and drag a ruler line to a specific feature on the horizon on the right side of the image. Click the “**Straighten Layer**” button at the top of the window. Repeat steps 6 and 7 for the remaining layers so that the horizon is straightened in the same way for all monitoring photos.
9. Select a reference photo with lots of landmarks and identifiable features, and move it down to the bottom layer in the layers window. (This will be your Reference Photo)
10. Make all layers invisible in the layers window, except for the bottom two layers. Make the layer above the bottom layer about 50 percent transparent by selecting it in the layers window, and using the “**Opacity**” slider, so that you can see features from both images at the same time.
11. Use the “**Move Tool**” by pressing **V** on the keyboard, and dragging the top layer so that it matches the bottom layer as best as possible. Getting the horizon to match as much as possible is a good first step. Matching features in the foreground is more difficult. There are several techniques that can be used to help with this:
 - a. Resizing the layer by holding the **shift key** (to maintain aspect ratio) and clicking and dragging a corner of the layer. -> be sure that “**Show Transform Controls**” is checked.
 - b. “**Edit**” > “**Transform**” > “**Warp**” can be used to drag features to where they need to be. If a rock or tree needs to be moved to line up with the same rock or tree underneath, simply drag it and move it. You will likely need to go back to other areas of the photo to stretch everything into the right place. Just work on the photo until you are happy with

the result. (**Important note:** do not accept the changes and apply the transformation by pressing the “**enter**” key until you are completely happy with the result. Every time you accept a transformation, the act is destructive, and it permanently degrades the quality of the image)

- c. “**Edit**” > “**Transform**” > “**Perspective**” can also be used if a side of the image is skewed in one way or the other. Grab the edge you want to move and move it. I have only used this successfully a few times, typically if most of the telephone poles are leaning in one direction, for instance.
 - d. Once you have begun transforming the layer, you cannot turn the layer on and off to check your work anymore, and you should therefore use the “**Opacity**” slider to see what is underneath and check your work.
12. When you have completed a layer, make it invisible with the eye button, and make the next layer above visible, select it, and continue with Steps 8, 9 and 10 until you have edited all of the layers.
 13. Select “**File**” > “**Save As**” and save the photoshop file as the photopoint name in the appropriate location on the U Drive, for example: U:\Groups\HCPB\Shared Folders\NPP\Section 6\2014\Priority Plant Surveys\Project Files\Butte County Limnanthes Files\Stone Ridge\All renamed photos here for comparison\Aligned Photos\Aq
(You might need to make a new Aligned photos folder in renamed photos folder)
 14. Make all layers visible and select all layers. Select “**View**” > “**Show**” > “**Layer Edges**” to give you an idea of where all of the layers overlap. Select the Rectangular Marquee Tool from the toolbar window (a dashed rectangle).
 15. Draw a selection within the area that all (or most) of the layers overlap. -> The layer edges will disappear once you start to draw your rectangle so be sure to get a good idea of where to draw before you start.
 16. After the photoshop file has been saved, crop the image down by selecting “**Image**” > “**Crop**”
 17. Make only the top layer visible and select it. If there are any areas along the edges where you can see the transparency underneath and want to fill it in with camouflage, select the area using the **magic wand tool** from the toolbar. After selecting the transparency, select “**Select**” > “**Modify**” > “**Expand**” and increase the selection by **5** pixels.
 18. Next click “**Edit**” > “**Fill...**” and select “**Content Aware**” to fill the blank areas.
 19. Next click “**File**” > “**Save as**”, change the file type to JPEG and save the file in the appropriate photopoint folder on the U drive, with the filename corresponding with that photopoint and the date the photo was taken.
 20. Repeat steps 15, 16 and 17 for the remaining layers.