HALLELUJAH JUNCTION WILDLIFE AREA WEBBER'S IVESIA PLANT MONITORING PROTOCOL, 2018–2022 RESULTS, AND DISCUSSION

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

CDFW Photo by Cherilyn Burton

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INTRODUCTION

Webber's ivesia (*Ivesia webberi*) is a federally-threatened plant species that is restricted to the eastern foothills of the northern Sierra Nevada and the adjacent western edge of the Great Basin Desert in California and Nevada (Ertter 2012; USFWS 2014; Borokini et al. 2023). It grows in mid-elevation areas on shallow, rocky clay soils in sparsely vegetated low sagebrush (*Artemisia arbuscula*) communities (Witham 2000; USFWS 2014; Borokini et al. 2023). When this monitoring project started in 2018, there were two known populations of Webber's ivesia at the California Department of Fish and Wildlife (CDFW) Hallelujah Junction Wildlife Area (Wildlife Area). An additional population was discovered in the Wildlife Area by Dr. Israel Borokini in 2020, and another population was discovered by CDFW staff in 2022. Three of the populations are recorded in the California Natural Diversity Database (CNDDB) and have been assigned Element Occurrences (EOs). The population that was discovered by CDFW staff in 2022 is not yet recorded in the CNDDB and does not have an assigned EO number, but the survey information has been submitted to the CNDDB. This population will be referred to as New Population (2022) and the other populations will be identified by their EO number throughout this report.

The Wildlife Area is located approximately 15 miles north of Reno, Nevada and 11 miles east of Loyalton, California in Lassen and Sierra counties. The location of the Wildlife Area and the Webber's ivesia populations are shown on Figure 1. The Wildlife Area is approximately 54 square kilometers (13,394 acres) in size and elevation ranges from 1,520 meters (5,000 feet) on the floor of Long Valley to approximately 2,100 meters (6,900 feet) in the mountains. The State of California purchased the Wildlife Area in 1989 for the purpose of protecting the winter range and migration corridors of the Loyalton-Truckee deer herd (Sustain Environmental Inc. 2009). Properties that comprise the Wildlife Area have historically been used for livestock grazing and much of the Wildlife Area is still grazed. The Wildlife Area is largely fenced (Sustain Environmental Inc. 2009) and is closed to the public from February 1 through June 30. This document provides a protocol for monitoring the Webber's ivesia populations at the Wildlife Area, summarizes 2018-2022 monitoring results, presents an interpretation of results, and includes adaptive management recommendations. The monitoring process, results, and recommendations in this document are a critical step in the adaptive management process.

LIFE HISTORY AND THREATS

Webber's ivesia is a low-growing herbaceous perennial plant that can live for several years and reproduces in multiple years or growing seasons. New leaves and flowering stems of Webber's ivesia appear to emerge in response to higher soil temperatures in the spring, and flowering typically begins in May and

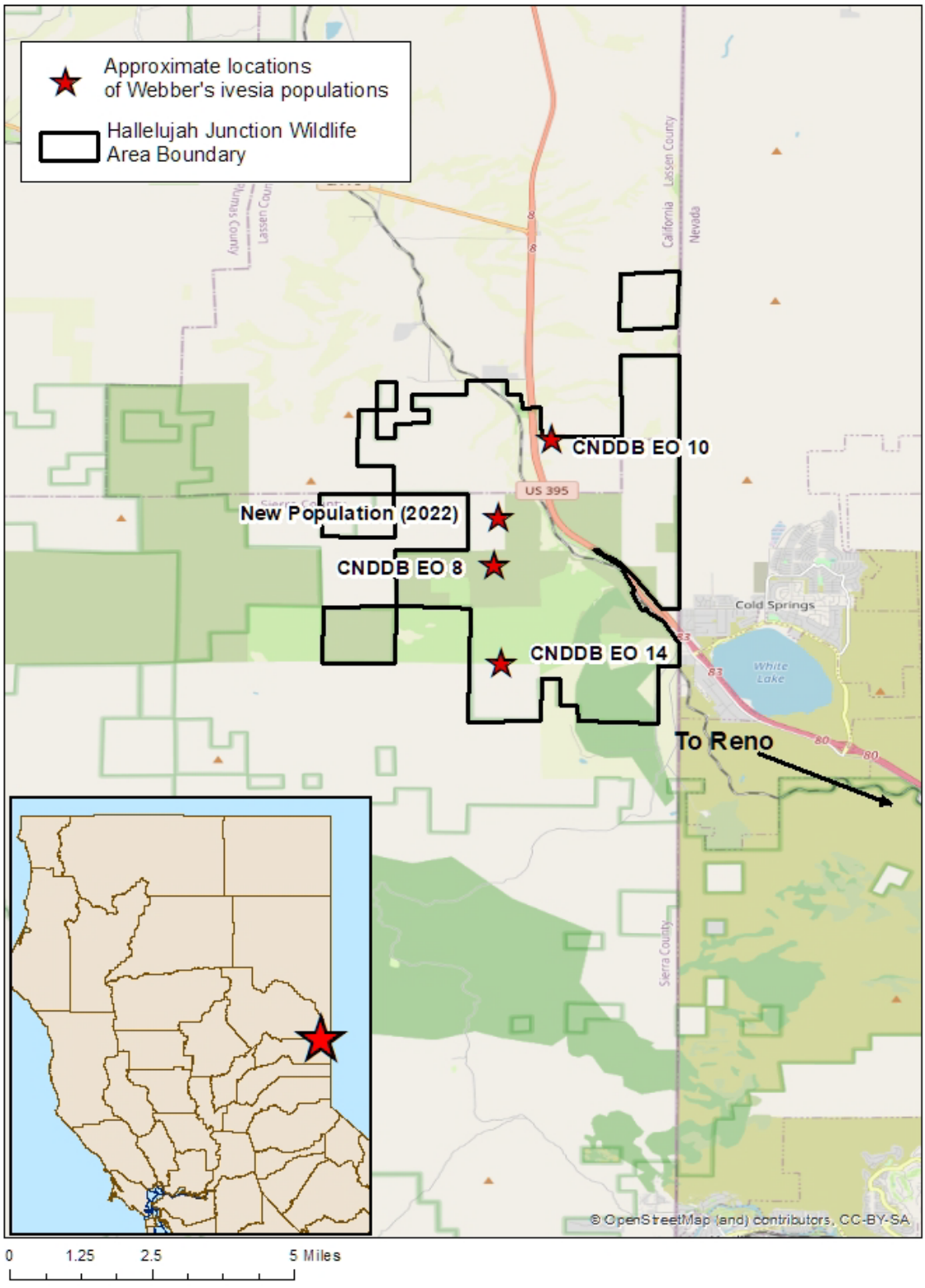

Figure 1 – Webber's ivesia populations at Hallelujah Junction Wildlife Area

extends through June (Witham 2000; Ertter 2012). Webber's ivesia has hairy grayish-green leaves, dark red stems, and small yellow flowers that are arranged in compressed, head-like clusters (Witham 2000; Ertter 2012; USFWS 2014). The flowers are about ten millimeters wide, with petals that are smaller than the sepals. Five to fifteen flowers are grouped as a ball on each flowering stalk, and the fruits are small, dry, and indehiscent (do not open to disperse seeds), and likely mature about one month after flowering, between mid-June and the end of July (Witham 2000; USFWS 2014). The whole plant becomes reddish-tinged late in the season (Witham 2000), and by late summer the plants dry out and die back to the root caudex, making them difficult to locate (USFWS 2014). Little is known about the dispersal dynamics of Webber's ivesia, but its seeds lack obvious features to aid in dispersal (Witham 2000; Borokini 2021).

Webber's ivesia occurs at mid-elevations between 1,364 and 1,901 meters (4,475 and 6,237 feet) on flats, benches, or terraces above and adjacent to large valleys (Witham 2000). Webber's ivesia is restricted to the eastern foothills of the northern Sierra Nevada mountain range and the adjacent western edge of the Great Basin Desert in California and Nevada (Borokini et al. 2023). It is found in open, sparsely vegetated plant communities and is usually associated with low sagebrush (*Artemisia arbuscula*) and other perennial, rock garden-type plants (Witham 2000), but it is also found growing in association with big sagebrush (*Artemisia tridentata*) (CDFW Observation; USFWS 2014). Webber's ivesia grows on shallow, moist, rocky, clay soils that shrink and swell upon drying and wetting with a gravelly surface layer over volcanic, generally andesitic bedrock (Witham 2000; USFWS 2014).

There are no studies available documenting the reproductive strategy of Webber's ivesia (Witham 2000; USFWS 2014; Borokini et al. 2021a), but vegetative regeneration from dormant root caudices and new recruitment from seed germination have been observed (Borokini et al. 2021a). Native Hymenoptera (bees, wasps, and ants), Diptera (flies), and Lepidoptera (moths and butterflies) have been observed visiting the flowers (Borokini et al. 2021a), and insect-median pollen exchange is the most likely reproductive mode in this species (Witham 2000; USFWS 2014). However, the pollinators and reproduction strategy for the species have not yet been formally identified (USFWS 2014; Borokini et al. 2021a).

Due to the restricted range, specialized habitat requirements, and limited recruitment and dispersal of Webber's ivesia, populations of this plant are vulnerable to ongoing and future threats that affect both individual plants and their habitat (USFWS 2014). Threats to Webber's ivesia include factors that currently alter habitat structure and composition. Specific examples of threats include: (1) non-native, invasive plant species, (2) altered fire regimes, (3) off-highway vehicle use and road development, (4) development associated with

agriculture, residential, or other land use, and (5) livestock grazing. Climate change may also influence the degree that these threats affect Webber's ivesia (USFWS 2014). Within the Wildlife Area, the primary threats are livestock grazing, non-native, invasive plant species, and altered fire regimes. Livestock use impacts to Webber's ivesia are primarily due to trampling and substrate disturbance (Witham 2000; USFWS 2014). Evidence of significant herbivory on Webber's ivesia has not been observed (Witham 2000), and grazing may present only a small direct impact to Webber's ivesia due foliage browsing (I. Borokini, University of Nevada, Reno, personal communication). The Wildlife Area currently allows grazing on pastures in the southern portion of the property; however, under the current grazing lease, which terminates in October 2025, grazing is limited to pastures that do not support known populations of Webber's ivesia. In addition to impacts from trampling and disturbance, livestock grazing has been shown to contribute to the spread of non-native invasive plant species, such as cheatgrass and red-stemmed filaree (*Erodium cicutarium*), which are found throughout the Wildlife Area and within the Webber's ivesia populations. Invasive cheatgrass and red-stemmed filaree do not appear to prevent annual vegetative regeneration of established matured Webber's ivesia plants (Borokini 2021), but dense stands of invasive plants can hinder new recruitment by outcompeting establishing seedlings (Chambers et al. 2007; Borokini et al. 2021b). Invasive plant species are also linked with altered fire regimes in the Great Basin Desert (Borokini 2021), and all populations of Webber's ivesia are potentially affected by a feedback loop between wildfire and non-native invasive plant species. Cheatgrass invasion has led to a grass/fire cycle throughout the west, where increasing cheatgrass populations promote larger fires that allow cheatgrass to increase further (Baker 2006). The grass/fire cycle occurs when an invasive annual grass colonizes an area and provides the fine fuel necessary for the initiation and propagation of fire, leading to an increase in frequency, area, and perhaps intensity of wildfires. Following these grass-fueled fires, invasive species can increase more rapidly than native species, creating a feedback loop that further increases susceptibility to wildfire, and areas that previously burned may burn again (Zouhar et al. 2008; Klinger and Brooks 2017). Wildfire was historically infrequent in the Great Basin because the native plant communities mostly consisted of annuals and perennial bunchgrasses, which did not provide sufficient fuel loads for large-scale wildfires. In addition, large bare interspaces between shrubs when combined with the low fuel load of the annuals and perennial bunchgrasses generally prevented fire from spreading far from the points of ignition (D'Antonio and Vitousek 1992; Brooks and Pyke 2001). Cheatgrass has dramatically shortened fire return intervals in the Great Basin by creating a more continuous fuel load (Whisenant 1990; Balch et al. 2013; Bradley et al. 2018), and the grass/fire cycle has caused substantial ecological impacts in the region (Brooks and Pyke 2001; Bradley et al. 2018; Brooks et al. 2018).

MONITORING PROTOCOL

This protocol should be implemented by CDFW staff at the Wildlife Area to facilitate the adaptive management of Webber's ivesia. If feasible, monitoring visits should be scheduled when Webber's ivesia is in peak bloom, which is generally in early to late May. Monitoring should occur every three years beginning in 2025 through 2034. At that time the monitoring effort should be reevaluated, and monitoring frequency should be adjusted as appropriate.

This monitoring protocol can be completed within two field days with two people. Re-mapping populations of Webber's ivesia and resurveying suitable habitat for additional populations would likely require additional field time. Monitoring consists of the following components:

- Conducting a census of Webber's ivesia within two CNDDB EOs at the Wildlife Area (all of EO 10 and a portion of EO 8).
- Conducting a visual population estimate at EO 14, the remainder of EO 8, and the New Population (2022) in the Wildlife Area.
- Periodic mapping of the distribution of Webber's ivesia at all four populations in the Wildlife Area.
- Photo monitoring at specific locations.

EQUIPMENT

- Pin flags (at least 100)
- Tally counters
- Monitoring camera (dSLR or similar style) and tripod
- Field notebook
- Compass set to the proper declination
- A sub-meter GPS receiver with the appropriate maps and geodatabase set up ahead of time and the Field Maps application ready to use on a mobile device

ACCESSING THE SITE

Access to the Webber's ivesia population located on the east side of Highway 395 (EO 10) is via an access road north of the Wildlife Area boundary where Highway 395 crosses County Lane, approximately 1.5 miles north of the agriculture checkpoint. The turnoff is on the east side of Highway 395 and leads to a dirt road which heads east, then makes a few southward turns before ultimately paralleling Highway 395. There is a small clearing near the top of a small hill that is large enough for a vehicle to park and turn around. This is the best place to park and continue on foot toward the population.

Two of the populations on the west side of Highway 395 (EO 8 and the New Population (2022)) can be accessed via the main access gate to the Wildlife

Area. A high clearance 4-wheel drive vehicle is required to cross Long Valley Creek along the main access road, or the vehicle can be parked before the creek crossing and monitors can cross the creek on foot and continue on to the populations. The Wildlife Area is closed to the public from February 1 through June 30, and the main gate is locked during that time.

The population in the southern portion of the Wildlife Area (EO 14) can be accessed through a locked gate on Balls Canyon Road. This gate is locked year-round.

Detailed access routes and locations of the populations are available from CDFW's Native Plant Program.

COLLECTING DATA

Distribution Mapping

The entire distribution of Webber's ivesia should be remapped every three years using a sub-meter GPS receiver with the appropriate maps and geodatabase and the Field Maps application on a mobile device. The purpose of this mapping is to document changes in distribution such as contractions or expansions in occupied areas. Large continuous groups of plants should be mapped as polygon features. Smaller and patchier groups of plants should be mapped as point features. GIS data should be uploaded for comparison with previously collected GIS data to evaluate trends in areas occupied and changes in distribution, such as groups of plants that are no longer present and groups of plants found in new areas. In addition, any new populations or areas of Webber's ivesia discovered during field visits should be opportunistically mapped.

Population Counts

Complete counts should be conducted at the two smaller populations of Webber's ivesia during every monitoring visit, the "northern patch" of EO 8 (see Figure 2, below) and all of EO 10. These two discrete areas have been censused every year from 2018 through 2022, except the "northern patch" of EO 8 was not censused in 2022. The "northern patch" of EO 8 was the only portion of EO 8 where we found plants in 2018 and 2019 and was thought to comprise the entire EO despite searching the area for additional plants. In 2020, two large additional patches were found by Dr. Israel Borokini upslope of the "northern patch" of EO 8, and another additional patch was found by CDFW staff in 2022 (see Figure 2). These additional patches are in close enough proximity by CNDDB mapping standards (less than ¼ mile) to the "northern patch" to be included in EO 8. Since we had already conducted a complete count of the "northern patch" of EO 8 in 2018 and 2019, we decided to continue our focus on censusing this

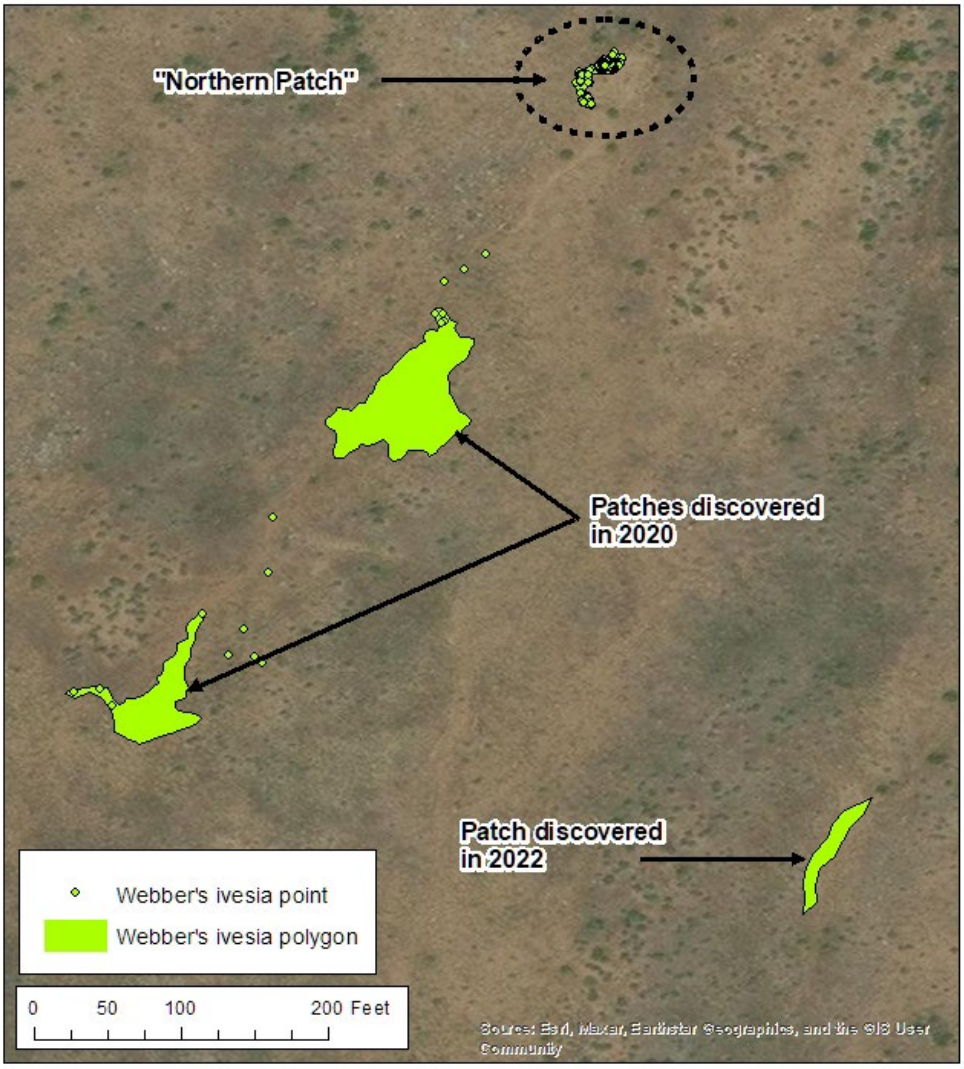

Figure 2 – Webber's ivesia at CNDDB EO 8

small, discrete patch so we could conduct direct comparisons of this area between years.

To conduct the census at the "northern patch" of EO 8 and at EO 10, monitors should carefully survey each area for Webber's ivesia using pin flags to mark the plant locations. Once the areas have been searched thoroughly, plants should be counted and classified as either reproductive (flowering or fruiting) or vegetative (no flowers or fruit present). The locations of each plant or groupings of plants should be recorded as either points or polygon features with a sub-meter GPS receiver.

The larger populations (EO 14, the remainder of EO 8, and the New Population (2022)) would require a larger time investment to conduct a complete census and we are not recommending that at this time. However, the approximate number of plants should be visually estimated, and the extent of each

population should be delineated and mapped to keep track of any population expansions or contractions.

PHOTO MONITORING

Photos should be taken at a population whenever data is collected for that population, or whenever you would like to quickly document the condition of the Wildlife Area. Monitoring photos are taken from four different locations, described below. Detailed maps showing the photopoint locations are available from CDFW's Native Plant Program. To duplicate roughly the same field of view from year to year, the camera should be set to a focal length that is equivalent to approximately 27 millimeters (mm) on a "full frame" camera (e.g., 35 mm film camera or a Nikon "FX" camera), and the horizon should be approximately ¼ of the way down from the top of the frame. Previous monitoring photographs were taken using a Nikon "DX" camera set to a focal length of 18 mm, which is equivalent to 27 mm on a "full frame" camera. Before visiting the site, check the specifications for digital cameras that may be used for monitoring to confirm that 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. The tripod should have its legs fully extended but the center piece on the camera mount should not be extended (camera lens approximately 4.5 feet off the ground). The camera should be set to automatic with no flash.

Photopoint A is approximately ten meters northwest of the "northern patch" of EO 8 on top of a small mound. We established this photopoint in 2018. A piece of square aluminum conduit was hammered into the ground to mark the photopoint location, and a tag was affixed to the conduit to identify the monument as "Photopoint A." Nine photos should be taken from this location in the following directions and identified by the following letters: (a) east; (b) southeast; (c) south; (d) southwest; (e) west; (f) northwest; (g) north; (h) northeast; and (i) looking 130 degrees on a compass bearing.

Photopoint B is near EO 10 and was established in 2019. Rebar with a piece of square aluminum conduit was hammered into the ground approximately five meters east of the edge of the population along the south side of the barbed wire fence that delineates the boundary of the Wildlife Area. Three photos should be taken from this location looking in the following directions and identified by the following letters: (a) southwest; (b) west; and (c) northwest.

Photopoint C is located at the southern extent of EO 8 and was established in 2020. Three photographs should be taken from this photopoint in the following directions and identified by the following letters: (a) north; (b) looking 30 degrees on a compass bearing; and (c) looking 45 degrees on a compass bearing.

Photopoint D is located at an old rebar marker approximately 20 meters north of the barbed wire fence and downslope from the main patch of Webber's ivesia plants in EO 8. This photopoint was established in 2020. One photo (photo a) should be taken from this photopoint looking south toward the population.

All monitoring photos should be saved to the project folder. Files should use the following naming convention: [uppercase letter of photopoint][lowercase letter of the photo][four digit year][two digit month][two digit day of the month]. For example, if a photo is taken as photo a of Photopoint A, on May 11, 2021, the file should be named "Aa20210511".

With the monitoring photos saved, use a photo previewer program and the left and right arrow keys on the keyboard to compare monitoring photos with those taken during previous site visits to look for shifts in population size, disturbance, and other differences in habitat condition.

Compare the photos to the distribution mapping. Talk to the Wildlife Area manager about the management of the site. **This is the most important part of adaptive management!**

SUMMARY OF RESULTS

CDFW staff visited the Wildlife Area to monitor Webber's ivesia on the following dates: June 28–29, 2018; June 5, 2019; May 20–22, 2020; May 11–13, 2021; and May 4–6, 2022. We provide a summary of the following information in this section:

- Distribution of Webber's ivesia in the Wildlife Area
- Number of Webber's ivesia plants within EO 10 and the "northern patch" of EO 8
- Rough estimates of the number of plants at the remainder of EO 8, EO 14 and the New Population (2022)
- Monitoring photographs at specific locations
- Other observations

The approximate location of Webber's ivesia populations in the Wildlife Area are shown in Figure 1, above. Only two EOs (EO 8 and 10) were known within the Wildlife Area during the 2018 and 2019 site visits. In 2020, an additional population was discovered by Israel Borokini (EO 14), and two additional patches of Webber's ivesia were identified within EO 8. In 2022, CDFW discovered another separate, large population (New Population (2022)) in the Wildlife Area, and an additional patch of Webber's ivesia at EO 8. The New Population (2022) has not yet been recorded in the CNDDB, so it does not have an associated EO number yet. CDFW staff have submitted the survey information to the CNDDB.

The results of population counts are shown in Table 1 below. Within the Wildlife Area, there are two smaller populations (EOs 8 and 10) and two large populations (EO 14 and New Population (2022)) of Webber's ivesia. In the field, polygon and point data were collected at Webber's ivesia populations. Back in the office, these data were reviewed carefully to assess naturally occurring groupings of the plants, and we adjusted the mapped polygons to include plants that were mapped as points within 15 feet of a mapped polygon to better capture occupied area. If plant points were greater than 15 feet from the edge of a mapped polygon, we left those as individual outlier plants and did not include them in the area calculations. Groups of three or more plants mapped in the field as points within 15 feet of each other were remapped as polygon features in the office.

Table 1 - Number of Webber's ivesia individuals at Hallelujah Junction Wildlife Area, 2018-2022

CNDDB EO	2018	2019	2020	2021	2022
EO 8 (Northern Patch)	92	172*	270*	92	N/A
EO 8 (excluding the Northern Patch)	N/A	N/A	700†	650†	N/A
EO 10	161	239*	173	142	148
EO 14	N/A	N/A	5,000 – 10,000†	N/A	N/A
New Population (2022) – no EO assigned yet	N/A	N/A	N/A	N/A	1000s†

*Indicates a year in which liberal survey methods were used to count number of individuals which may have resulted in an overestimation of population size. †Rough visual estimate.

EO 8

We counted all plants in the "northern patch" of EO 8 from 2018–2021. In 2018 and 2019, we only found plants in this "northern patch" despite searching the surrounding area, and presumed this was the extent of EO 8. In 2020, Dr. Borokini located two additional patches upslope from the "northern patch" of EO 8, and we mapped these additional areas and estimated the number of Webber's ivesia plants. We did not census these additional patches due to time constraints. In 2022, CDFW staff discovered and mapped another patch of approximately 75 Webber's ivesia plants (see Figure 2, above). In 2022, we did not census the "northern patch" or conduct a population estimate of the rest of EO 8 because the population appeared stable with a similar mapped distribution as in previous years, and we wanted to focus our time on searching for additional Webber's ivesia populations in the Wildlife Area.

The number of plants counted and estimated in EO 8 is presented in Table 1, above. In 2019 and 2020, our counting method was liberal, and we may have overcounted the number of individuals. If there was a possibility that clumps of leaves were multiple plants, we counted them as separate plants. In 2020, after we counted the plants in EO 8 (but before we counted EO 10, discussed below),

we met with Dr. Borokini in the field, who has extensive experience with Webber's ivesia. After consulting with Dr. Borokini, we learned that Webber's ivesia plants will often grow in clumps that form a ring as they mature, which can give the appearance of multiple individual plants. Thus, we likely overcounted the number of plants at EO 8 in 2019 and 2020. We applied the information that Dr. Borokini shared with us to the remaining censuses conducted in 2020 (at EO 10), and in 2021 and 2022 (at the "northern patch" of EO 8 and at EO 10).

Overall, based on an evaluation of the photos and the GPS data collected, the mapped distribution of the plants in the "northern patch" of EO 8 remained consistent from 2018–2022 and occupied an area of approximately 36 square meters (0.01 acre). The mapped distribution of the additional patches of EO 8 discovered in 2020 also remained consistent through 2022 and occupied a total area of approximately 524 square meters (0.13 acre). The total occupied area of EO 8, including the patch discovered in 2022, was approximately 621 square meters (0.15 acre). Figure 2 above shows the mapped area of EO 8.

We took photos at Photopoint A each year from 2018–2022, and at Photopoint C from 2020–2022. Figure 3 shows monitoring photo Ai taken in 2018, 2019, and 2022, which shows the distribution of Webber's ivesia plants in the "northern patch" of EO 8.

EO 10

We counted all plants in EO 10 during each monitoring visit. Overall, the number of plants was consistent from year to year. As discussed above, our counting method was liberal at this EO in 2019, and we may have overcounted the number of individuals in that year. Based on an evaluation of the photos and the GPS data collected, the distribution of the plants in EO 10 remained consistent from 2018–2022 and is shown in Figure 4. EO 10 occupies approximately 134 square meters (0.03 acre).

We took photos at Photopoint B in 2019–2022, and at Photopoint D in 2020–2022. Figure 5 shows monitoring photo Ba in 2019, 2021, and 2022, and Figure 6 shows monitoring photo Da in 2020, 2021, and 2022. Pin flags mark the locations of Webber's ivesia plants in the photos. Comparison of the photos shows that the extent of the population remained consistent from year to year.

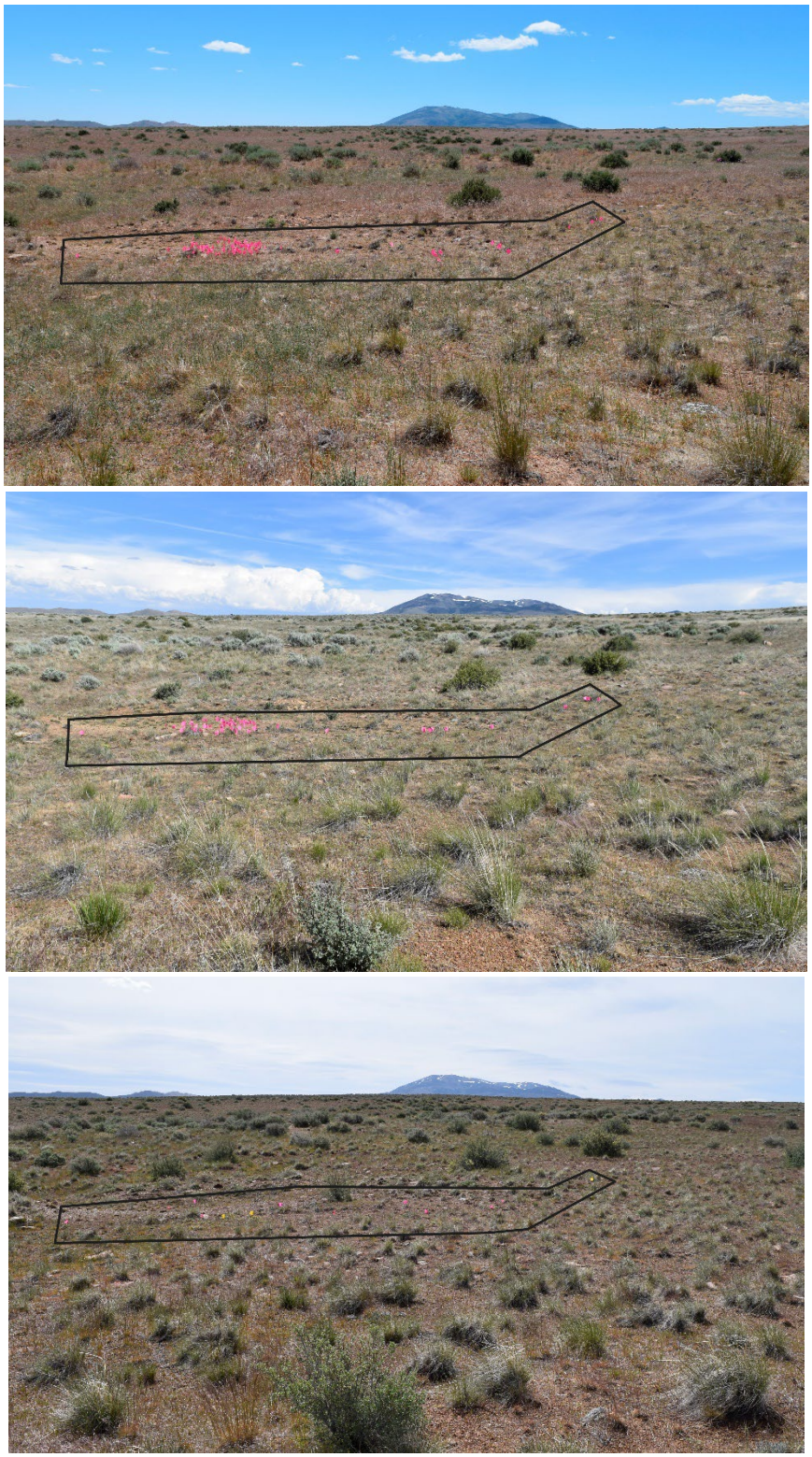

Figure 3 – Monitoring Photo Ai at the "northern patch" of CNDDB EO 8 in 2018 (top), 2019 (middle), and 2022 (bottom). Flags indicate the locations of Webber's ivesia plants.

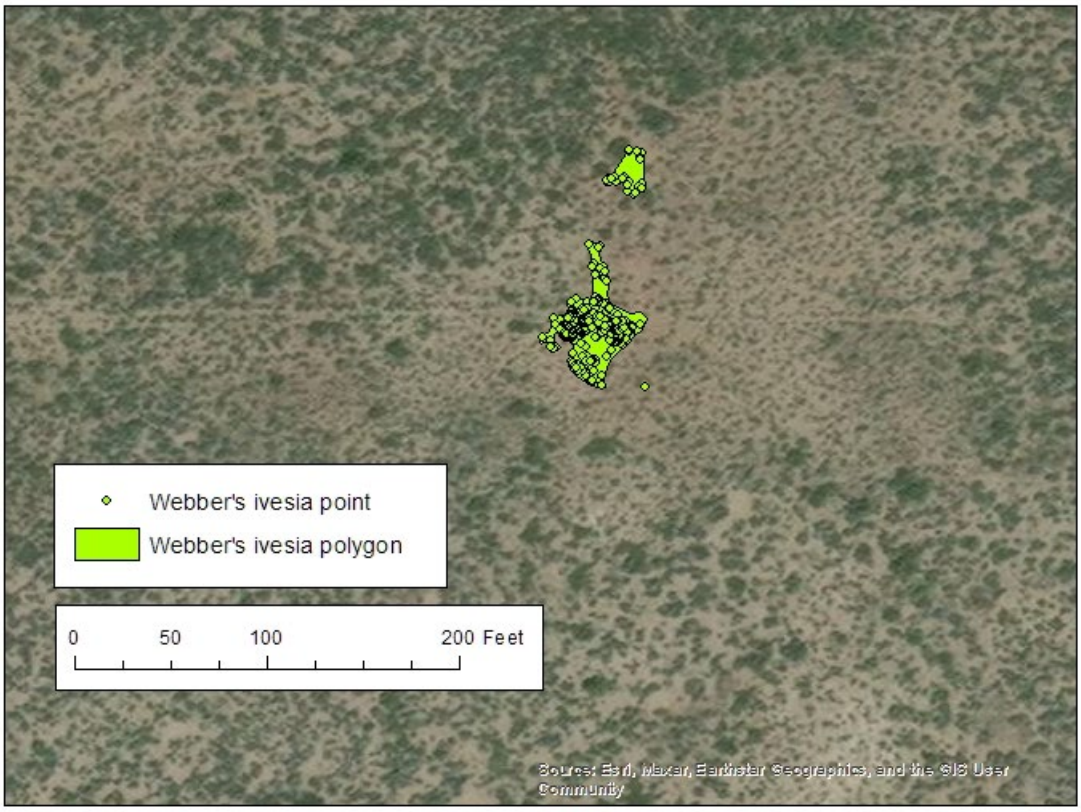

Figure 4 – Webber's ivesia distribution at CNDDB EO 10

Figure 5 – Monitoring photo Ba at CNDDB EO 10 in 2019 (top), 2021 (middle), and 2022 (bottom). Flags indicate the location of Webber's ivesia plants.

Figure 6 – Monitoring Photo Da at EO 10 in 2020 (top), 2021 (middle), and 2022 (bottom). Blue (top photo) and pink (middle and bottom photos) flags indicate locations of Webber's ivesia plants.

EO 14

In 2020, we mapped the extent of the new population discovered that year (EO14), but we were unable to conduct a census or systematic estimate of the total number of plants present due to time constraints and the large extent of the population. However, we roughly estimated between 5,000 and 10,000 plants were present in this EO in 2020. In 2021, we revisited EO 14 to check on the status of the population since the Loyalton Fire burned through the population in August 2020. We compared the locations of the plants in 2021 to the mapped area from 2020, and the distribution was similar in 2021, except for one patch of approximately 200 plants that was not relocated in 2021 despite our search efforts. We searched for additional plants in 2021 and mapped them with the sub-meter GPS unit. We found 26 additional plants that were not mapped in 2020. All were either within areas where plants were already mapped in 2020 or in nearby areas (within 300 feet). The total mapped area of EO 14 is approximately 10,450 square meters (2.58 acres). EO 14 is shown in Figure 7.

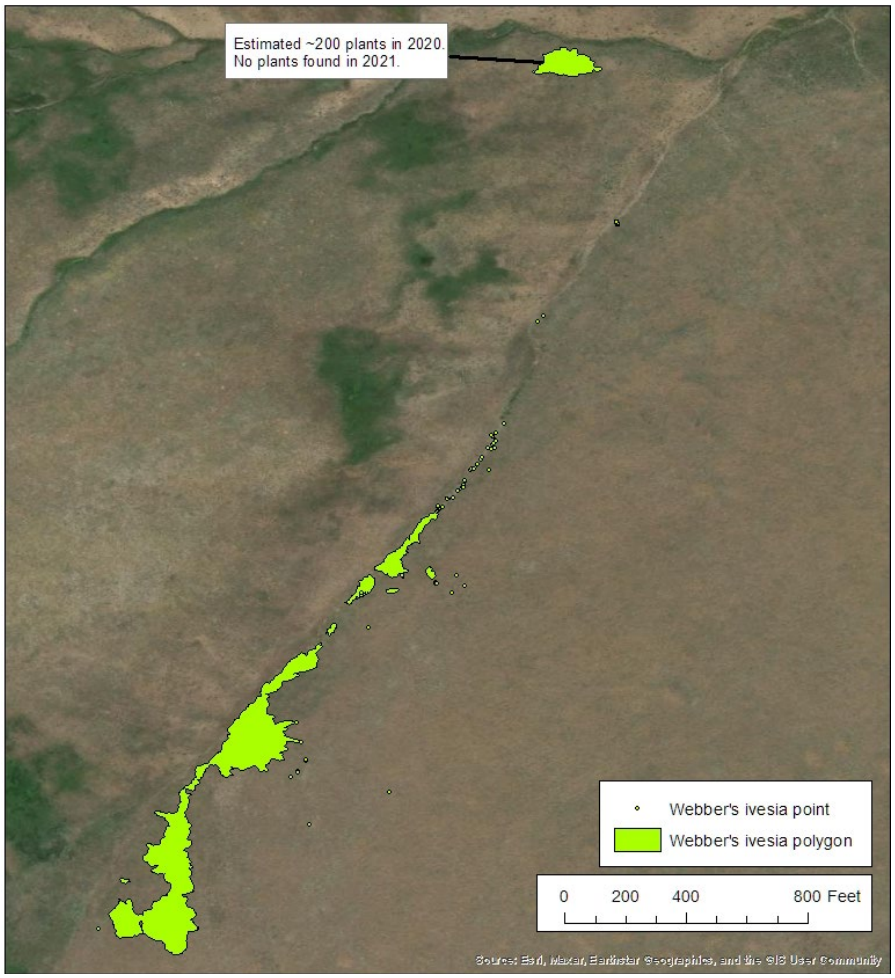

Figure 7 – Webber's ivesia plants at CNDDB EO 14

NEW POPULATION (2022)

CDFW discovered a new population of Webber's ivesia during surveys in 2022. Staff marked the extent of this large population with pin flags and mapped the population with the submeter GPS unit. A census was not conducted of this population due to the large number of plants and the extent of the population, but a rough visual estimate indicated that thousands of plants were present here. This population occupies approximately 14,930 square meters (3.69 acres). Figure 8 shows the extent of the New Population (2022).

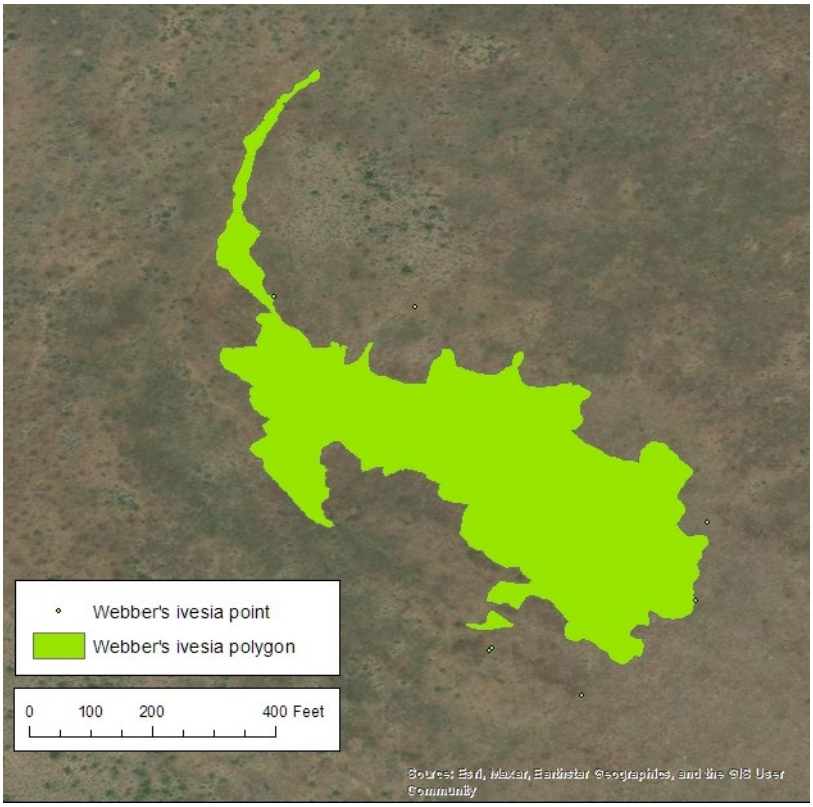

Figure 8 – Webber's ivesia at New Population (2022)

DISCUSSION AND INTERPRETATION OF RESULTS

Our fine scale mapping and photo monitoring of the Webber's ivesia locations at the Wildlife Area has shown that very little has changed in the extent of these populations from 2018–2022. Very few Webber's ivesia plants disappeared from areas where they were previously seen, and very few Webber's ivesia plants appeared in areas where they were not seen in a previous year. Although the results in Table 1 above indicate a potential trend or fluctuation in the population sizes at the northern patch of EO 8 and at EO 10, there was inconsistency in our counting methods as the project evolved. Therefore, the observations in Table 1 are likely not representative of a trend but are instead a result of inconsistency in methods. Although the populations of Webber's ivesia

appear stable in the short-term, changes in abundance for perennial plant species may occur slowly over a longer timescale as a result of climate change, non-native plant invasions, land use changes, and other factors. These data, however, provide an important baseline for future comparisons.

Most of the known locations of Webber's ivesia have experienced wildfires over the past 40 years, but the species has persisted in these locations. A fire burned through EO 10 in the Wildlife Area in July 2007 and Webber's ivesia plants were not observed in this population during surveys the following year in 2008 (Sustain Environmental Inc. 2009). However, 115–130 plants were observed at this location in 2013 (USFWS 2014), and we also found plants here during every annual monitoring visit between 2018 and 2022, indicating that the population was able to rebound post-fire. Field observations and natural history indicate that Webber's ivesia has high potential for recovery following disturbance, which may be linked to the dormant deep taproot caudices buried and firmly protected in the soil (Borokini et al. 2021a). Cheatgrass-fueled fires are mostly surface fires and the underground vegetative structures buried deep in the soil may withstand these surface fires, contributing to post-fire vegetation recovery (Humphrey and Schupp 2001; Klimešová and Klimeš 2007). In August 2020, the Loyalton Fire burned through EO14. In 2021, most of the population did not seem affected; however, one patch could not be relocated in 2021, and it is possible that the Loyalton Fire impacted that patch of the population, at least in the short-term. We were not able to survey EO 14 to check on the status of that patch in 2022 due to time constraints, but EO 14 should be revisited to survey for regeneration of this patch.

Assessment of the Monitoring Project

Our methods have resulted in important data on the current status and distribution of Webber's ivesia at the Wildlife Area. However, a complete census of all EOs in the Wildlife Area has not been possible given the large size of the area, the large extent of the newly discovered populations in 2020 and 2022, and time constraints for each site visit. Census data from EO 10 and the "northern patch" of EO 8 has been valuable to compare trends from year to year. Much of the time monitoring during this project was spent surveying the Wildlife Area for additional populations of Webber's ivesia. New populations were discovered in 2020 by Dr. Borokini and in 2022 by CDFW staff, and survey time was spent documenting the extent of those populations and roughly estimating the number of individuals present. A standardized monitoring method was not developed for most of the populations in the Wildlife Area.

Our survey efforts during this monitoring project resulted in the discovery of additional patches of Webber's ivesia within the Wildlife Area, including the discovery of the New Population (2022). Since much of the time at the Wildlife

Area was spent surveying for unknown populations, a large amount of time was spent gathering baseline data on the spatial extent of the populations. We were able to conduct focused censuses of two areas ("northern patch" of EO 8 and EO 10), but this level of monitoring was not feasible for the rest of the populations due to their large spatial extent and our time constraints. Future monitoring should focus on more detailed mapping of all populations, especially the two populations discovered during this monitoring project in 2020 by Dr. Borokini and 2022 by CDFW staff.

MANAGEMENT RECOMMENDATIONS

We currently do not have enough information to support meaningful management recommendations for the long-term persistence of Webber's ivesia at the Wildlife Area, and we do not recommend any management changes at this time. However, we do recommend that land managers of the Wildlife Area consider how the management of the site may affect the long-term persistence of Webber's ivesia in the future.

Management objectives and management implications for Webber's ivesia at the Wildlife Area are presented below with a discussion of whether the management implications should be triggered based on the monitoring results. Additional management recommendations are also included.

Management Objective #1: Maintain a consistent occupied area of Webber's ivesia with no detectable loss at all known populations (EO 8, EO 10, EO 14, and the New Population (2022)), at the Wildlife Area through 2034 (monitoring every three years beginning in 2025).

Management Implication #1: Detectable loss in occupied area of Webber's ivesia populations at the Wildlife Area will trigger additional monitoring to determine the reason for decline.

Recommendation: Since Management Objective #1 is set for the future, Management implication #1 has not been triggered. Monitoring to date has focused on establishing a baseline of the Webber's ivesia populations within the Wildlife Area and understanding its distribution. Monitoring should continue to document the extent of the Webber's ivesia populations noting any changes in habitat conditions, including the extent of grazing impacts, non-native plant invasions, and impacts from wildfire.

OTHER RECOMMENDATIONS

- CDFW staff in the Native Plant Program or in the North Central Region should continue to prioritize monitoring Webber's ivesia at the Wildlife Area. Monitoring should continue every three years beginning in 2025

through 2034. In 2034, the Management Objective should be reevaluated, and monitoring frequency may be adjusted as necessary.

- Conduct a qualitative assessment of the monitoring photos to visually detect any increase in non-native invasive species at all populations of Webber's ivesia with established photopoints. If non-native invasive species abundance increases, CDFW staff should assess any negative impacts on the Webber's ivesia populations and evaluate potential adaptive management actions.
- Continue to search for other populations of Webber's ivesia in the Wildlife Area.
- Ground disturbing activities (e.g., digging) should be avoided within Webber's ivesia populations. Any activities that may take place within the populations should be evaluated to ensure they will not negatively impact Webber's ivesia.

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