Huachuca Water Umbel

(*Lilaeopsis schaffneriana* ssp. *recurva*)

5-Year Status Review:

Summary and Evaluation

Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) in flower; Photo credit William Radke, 2016.

U.S. Fish and Wildlife Service

Arizona Ecological Services Office

Tucson, AZ

June 2024

5-YEAR REVIEW

Huachuca Water Umbel (*Lilaeopsis schaffneriana* ssp. *recurva*)

1.0 GENERAL INFORMATION

1.1 Listing History

Species: Huachuca Water Umbel (*Lilaeopsis schaffneriana* ssp. *recurva*)
Date listed: January 6, 1997
FR citation(s): 62 FR 665
Classification: Endangered

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: n/a

1.2 Methodology used to complete the review:

The U.S. Fish and Wildlife Service (Service) most recently evaluated the biology and status of the Huachuca water umbel as part of a status review conducted for the 2017 Recovery Plan. We examined whether new information was available and whether that new information would alter or affect analyses and conclusions made in the previous status review. Data for this current review were solicited from interested parties through a Federal Register notice announcing the review on January 25, 2024. We also contacted Federal agencies, local agencies, tribes, partners, and species experts to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

1.3 FR Notice citation announcing the species is under active review:

89 FR 4966

2.0 REVIEW ANALYSIS

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species" due to any of the five factors described below.

Section 4(a) of the Act describes five factors that may lead to endangered or threatened status for a species. These include: A) the present or threatened destruction, modification, or curtailment of its habitat or range; B) overutilization for commercial, recreational, scientific, or educational purposes; C) disease or predation; D) the inadequacy of existing

regulatory mechanisms; or E) other natural or manmade factors affecting its continued existence.

The identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In assessing whether a species meets either definition, we must evaluate all identified threats by considering the expected response of the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Service recommends whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

2.1 Updated Information and Current Species Status

2.1.1 Biology and Habitat:

We have no new information regarding the biology or habitat needs of the Huachuca water umbel. For a more in-depth review of the species' biology and its habitat, see the 2017 Recovery Plan (U.S. Fish and Wildlife Service 2017 entire). The Huachuca water umbel is a small perennial herbaceous plant in the carrot family that grows in patches (clusters of stems separated by areas without stems) and groups of patches (separated by hydrological features) called occurrences. The Huachuca water umbel is found between 610 and 2,170 m (2,001 and 7,060 ft) elevation in the Sky Island Region of southeastern Arizona and as high as 2,240 m (7,349 ft) elevation in adjacent portions of Sonora, Mexico (Titus & Titus 2008 p. 459; Vernadero Group 2011 p. 3; Vernadero Group & Desert Botanical Garden 2012 p. A-16). The taxon is found in deep riparian soils along the margins of flood plains, stream terraces, cienegas, and alluvial fans in 0 to 15 cm of water.

2.1.2 Threats Analysis (threats, conservation measures, and regulatory mechanisms):

Current or potential threats identified in the 2017 Huachuca Water Umbel Recovery Plan include: aquatic habitat degradation (Factor A); wildfire and resulting sedimentation (Factor A); invasive non-native plant competition (Factor A); livestock grazing (Factor A); recreation (Factor A); and the effects of drought and climate change (Factor E). These threats, enhanced in small more vulnerable occurrences, continue today, and are discussed below.

GENETICS

The conservation of large numbers of genetically distinct Huachuca water umbel occurrences may contribute to the preservation of genetic diversity and avoid the effects of genetic drift (USFWS 2017 p. 13). The 2017 Huachuca Water Umbel Recovery Plan lists augmentation and establishment of Huachuca water umbel occurrences as an action needed for the recovery of the species due to scattered and small occurrence size. Recent genetics work has shown the importance of clonal growth in the maintenance of Huachuca water umbel patches (Fehlberg & Moran 2023 p. 1). This research has shown that occurrences closer in geographic proximity are more genetically uniform than occurrences that are geographically distant. In addition, results indicate that plants grown both *in situ* and *ex situ* show genetic lines remain true over time. These findings are important for planning augmentation at existing occurrences, reintroduction at extirpated occurrences, and introductions of Huachuca water umbel into novel locations.

GROW OUT AND OUTPLANTING

Huachuca water umbel are grown and collections maintained at the Arizona Sonora Desert Museum (ASDM), the Desert Botanical Garden (DBG), The Phoenix Zoo (PZ), and the Pima County Nursery (PCN). These collections represent genetically different clones used for outplanting at appropriate geographic locations and, in most instances, are also used for public education. These collections include Clone A (ASDM, DBG, PCN, PZ), Clone C (ASDM, DBG), Clone D (DBG, PCN), Clone F (DBG), Clone G (ASDM), Clone L (ASDM, DBG, PZ). Clones A, C, and L are typically found at the southern portion of the San Pedro River, around Fort Huachuca, and near Kolb Ranch. Clone G is from the middle San Pedro River, Clone D is from the Las Cienegas National Conservation Area in the Rillito Watershed, and Clone F is from the San Bernardino and Leslie Canyon National Wildlife Refuges.

The US Fish and Wildlife Service's Partners Program has assisted with Huachuca water umbel outplanting at Mission Gardens and the Paton Center in 2019, both of which were thriving upon later visits in 2022 (Kaplan 2024 entire). This program is planning transplant efforts at the Ash Canyon Bird Sanctuary near Sierra Vista and at Goff Pond in Pima County in 2024. In 2022, a team of biologists from the Desert Botanical Garden conducted Huachuca water umbel outplanting in two small ponds at the Canelo Hills Preserve (Salywon 2022 entire), however the ponds dried up by 2023 and the plants did not survive (Blackwell 2024 entire). Also in 2022, the Bureau of Land Management (BLM) planted Huachuca water umbel in Las Cienegas National Conservation Area (Perez 2022 entire). The planting was visited in 2023 and again in 2024, and was thriving by April of 2024 (Condo 2024a entire, 2024b entire). In 2023, biologists with Pima County transplanted Huachuca water umbel at Canoa Ranch pond, Oracle Ridge, and Cienega Creek Preserve (Belk April 16, 2024, Murray 5-4-2023, Murray 4-21-2023, Grosch 2019, p. 4). They have had mixed success with Huachuca water umbel survival.

San Bernardino and Leslie Canyon National Wildlife Refuges maintain a source population of Huachuca water umbel at the Headquarters building which is weeded and

watered regularly. This population is available for public outreach and provides Clone F material for outplanting on the two refuges. Transplanting Huachuca water umbel on the two refuges began in 2007 and there have been multiple attempts at transplanting in the two refuges since that time, overall, with mixed success. Most recently, due to significant decline in Huachuca water umbel on the two refuges in 2022 and 2023, refuge staff attempted several more transplants to augment both refuges which will be assessed in 2024 to determine survival. Biologists with the Phoenix Zoo are working on increasing our understanding of Huachuca water umbel water depth tolerances and preferences, information that will be helpful for future outplanting success (Harris 2024 entire). Discussion of transplanted plants on Fort Huachuca can be found in the Monitoring section below.

MONITORING

Since the Huachuca Water Umbel Recovery Plan was finalized in 2017, there have been monitoring events of populations on BLM, Fort Huachuca, Leslie Canyon and San Bernardino National Wildlife Refuges, and National Forest Service lands.

The Bureau of Land Management

Researchers with the BLM note that the Huachuca water umbel numbers fluctuate due to drying of stream beds, channel incision, cattle presence, bank sloughing, flood scouring, and channel sections with deep water (Condo & Perez 2023 p. 1). They suggest patches are likely to continue to contract especially during dry years (Bureau of Land Management 2023b p. 1). The most recent monitoring efforts on BLM lands are reported below and are divided between the Babocomari and San Pedro Rivers.

Babocomari River

The BLM report that a Huachuca water umbel occurrence last seen in 2013 upstream from the Babocomari Allotment was searched for in 2023 and no plants were found (BLM 2023, p. 1). The reach at the time of survey had almost no surface water with the exception of a few deeper confined pools that had poor Huachuca water umbel habitat.

San Pedro River

In 2022, the BLM did not survey on the San Pedro National Conservation Area (SPRNCA) north of Boquillas and south of the Hereford Bridge due to the reduction in perennially moist soil and a trend toward drying (Condo & Perez 2023 pp. 5–9). Results by river reach for the other reaches follow. On the Boquillas to Boston Mill reach, where Huachuca water umbel had previously been recorded as recently as 2015; none were found. The loss of these plants is attributed to the drying and scouring of habitat. In the Boston Mill to Charleston Bridge reach, a single patch of Huachuca water umbel was located where eight had been previously recorded. Cattle were in this reach and cattle sign was observed throughout. In the Escapule to Lewis Springs and the Lewis Springs to Highway 90 reaches, there were historically 21 patches, however a single small patch was found in 2022. On the Highway 90 to Firebreak Berm reach, where up

to 6 patches occurred historically, no Huachuca water umbel were found, likely due to the long deep pools and no shallow water observed. In the Firebreak Berm to Miller Campsite stretch, 4 patches were found where 18 were found in 2015. In the Miller campsite to Hunter Wash reach, a section consistently supporting the highest density of umbel, 5 Huachuca water umbel patches were located where 27 had been reported in 2015; all five patches were disturbed by cattle trampling. In the Hunter Wash to Big Bend reach and the Big Bend to Hereford Bridge reaches, none of the previously recorded 7 and 13 patches, respectively, were found in 2022. Cattle were observed near the bridge and sign was observed throughout the area.

Fort Huachuca

Fort Huachuca has continued monitoring of transplanted and natural Huachuca water umbel populations in 2019 and 2023 (Directorate of Public Works 2019 p. 2, 2024 p. 2). They report flood damage and an emergency consultation to allow for emergency road repairs in Garden and Huachuca Canyons in 2022 and there was an overall decline in the number of Huachuca water umbel occurrences compared to 2019 (Directorate of Public Works 2024 p. 2). In addition, there were a number of dry river segments due to unusually dry conditions in 2023. The extent of Huachuca water umbel in 2019 was 145 meters and in 2023 was 103.9 meters (Directorate of Public Works 2019 p. 2, 2024 p. 2).

Similarly, within six Huachuca water umbel transplant sites on Fort Huachuca, four had no Huachuca water umbel in 2023 and the remaining two had decreased to below the 2010 baseline (Directorate of Public Works 2024 p. 2). In the San Pedro River National Conservation Area however, transplant sites at both Horse Thief Draw and Murray Springs maintained higher than baseline quantities of Huachuca water umbel, while a third transplant site, Frog Springs has been extirpated since 2014 (Directorate of Public Works 2024 p. 2). Fort Huachuca reports no habitat has been lost or degraded due to mission-related activities, their water conservation activities continue, and they are funding the propagation of plants at the Arizona-Sonora Desert Museum.

Leslie Canyon and San Bernardino National Wildlife Refuges

At both National Wildlife Refuges, Huachuca water umbel is regularly monitored (U.S. Fish and Wildlife Service 2023 pp. 43–44). The density of Huachuca water umbel patches fluctuates in response to specific habitat site characteristics and natural flood cycles (U.S. Fish and Wildlife Service 2023 p. 125). Historically, in 2004, at Leslie Canyon National Wildlife Refuge, Huachuca water umbel patches totaled almost 60 m^2 of area, but coverage rapidly decreased in 2010 until an apparent extirpation occurred between 2011 and 2014, likely due to drought conditions. On this same refuge in 2014, Huachuca water umbel was seen in a small area, but by the time of monitoring in 2019, had once again disappeared (U.S. Fish and Wildlife Service 2023 p. 125). Historically at San Bernardino National Wildlife Refuge, Huachuca water umbel patches totaled more than 40 m^2 of area in 2011, 2016, and 2017, but by 2020 and in each year since, there have been just a few patches remaining. Similarly, patch area diminished at both

the Leslie Canyon National Wildlife Refuge and the San Bernardino National Wildlife Refuge between measures in the spring and the following dry monsoon in 2023, causing many previously viable patches to fail (U.S. Fish and Wildlife Service 2023 pp. 44, 125).

CLIMATE

Warming temperatures have been documented in recent decades throughout the globe (Intergovernmental Panel on Climate Change 2021 entire). Since 2020, the mean annual temperature was above average in most of the southwestern United States, with some locations having the warmest ever recorded temperatures (Climate Assessment for the Southwest 2021 p. entire, 2022 entire; Diggins 2024 p. entire). Consistent with these recent observations, the outlook presented for the southwestern U.S., including the counties of Arizona that support the Huachuca water umbel, predicts increased temperatures and drought-like conditions, decreased snow pack, increased frequency of extreme weather events (heat waves, droughts, and floods), declines in river flow and soil moisture, and greater water demand by plants, animals and humans (Archer & Predick 2008 p. 23; Garfin et al. 2013 pp. 5–6; Meixner et al. 2016 p. 4; Samuels-Crow et al. 2023 p. 1).

On a regional scale, climate impacts riparian flow patterns; the reduction in rainfall distribution or intensity can change the distribution of water patterns across the landscape, reducing available habitat for understory species such as the Huachuca water umbel (Sabathier et al. 2023 pp. 237–238; Samuels-Crow et al. 2023 p. 2). In areas that are sensitive to precipitation like southern Arizona, a dry winter could lead to earlier drying of a stream that may otherwise flow through the Spring. Severe changes in rainfall regimes could change even the wettest stream reaches, reducing connectivity, and increasing isolation of the Huachuca water umbel. Drying of riparian areas may also have the effect of congregating cattle into smaller areas causing more damage to understory plants, including the Huachuca water umbel.

In addition to changes to the riparian plant community from climate alteration, there are many historical and current anthropogenic factors that impact riparian landscapes, such as agricultural development, urban development, fire suppression, and livestock grazing (Zaimes & Nichols 2007 p. 52). From the overall reduction in water availability, many negative impacts may occur which reduce habitat quality and quantity for the Huachuca water umbel, including woody plant encroachment, nonnative invasion, head cutting, and reduction in groundwater recharge.

Many springs (Ehret 2008 p. 2; Robinson 2010 p. 6), cienegas (Hendrickson & Minckley 1984 p. 130; Fonseca 2014 entire), and rivers (Turner & Richter 2011 pp. 2–3; Bureau of Land Management 2012 entire, 2023a p. 1) that have been perennial in the past are now intermittent, ephemeral, have more dry reaches, or have dried up entirely. As a result, many occurrences of Huachuca water umbel have become reduced in density or distribution, become ephemeral, or are now presumed extirpated. Reduced water flow can limit the ability of growth, reproduction, and expansion of Huachuca

water umbel. Even if individuals can survive long periods of drought as seeds or rhizomes (Hass & Frye 1997 p. 12), at some point increasing aridity would eliminate the species, including seed stock and rhizomes, from intermittent reaches (U.S. Fish and Wildlife Service 1999 p. 238).

2.2 Synthesis:

In summary, the Huachuca water umbel is managed by many Federal, State, County, and private landowners. Across the species range, annual monitoring and survey reports indicate further reduction in the number and density of Huachuca water umbel patches and occurrences due to a combination of factors including drought, livestock grazing, and nonnative invasion. Conservation measures including increasing our understanding of genetics, growing plants at botanical institutions, outplanting patches into appropriate microhabitats within existing occurrences, and continued survey and monitoring have all helped reduce the threat of extinction, however losses of appropriate microhabitat exceed these conservation measures.

After reviewing the best available scientific information, we conclude that the Huachuca water umbel remains an endangered species. At present, recovery criteria to downlist the Huachuca water umbel have not been achieved. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in the 2017 Recovery Plan remains an accurate reflection of the species current status.

3.0 RESULTS

3.1 Recommended Classification:

No change is needed

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The principal recovery strategy for the Huachuca water umbel is to conserve the habitat by decreasing groundwater pumping, increasing water conservation and recharge, and protecting occurrences and their seedbanks. Providing conservation and restoration of the taxon and its habitat will allow stable, self-sustaining occurrences to persist with some level of connectivity and opportunity for expansion and dispersal. Additional actions needed include monitoring, surveying, scientific study, outreach and partnership development, augmentation and introduction, and reduction or removal of stressors. Several recovery actions listed in the Recovery Plan are already under way, including water use reduction and effluent recharge. Also, some introductions have been made with varying success and more introductions are anticipated.

5.0 REFERENCES

Archer SR, Predick KI. 2008. Climate Change and Ecosystems of the Southwestern United States. Rangelands **30**:1–28.

Blackwell S. 2024, April 18. Huachuca water umbel at Canelo Hills transplant sites did not survive.
Bureau of Land Management. 2012. Wet - Dry Mapping 2006-2012 Lower Cienega Creek and Mattie Gulch / Upper Cienega Creek and Empire Gulch. Page 1.
Bureau of Land Management. 2023a. Babocomari River Huachuca Water Umbel Survey 2023. Page 3. Tucson Field Office.
Bureau of Land Management. 2023b. San Pedro River Huachuca Water Umbel Survey 2023. Page 5. Tucson Field Office.
Climate Assessment for the Southwest. 2021, January 21. Southwest Climate Outlook January 2021 | CLIMAS. Available from https://climas.arizona.edu/swco/jan-2021/southwest-climate-outlook-january-2021 (accessed April 6, 2023).
Climate Assessment for the Southwest. 2022, October. October 2022 Southwest Climate Outlook. Available from https://climas.arizona.edu/sites/climas.arizona.edu/files/SWCO_OCT2022.pdf (accessed December 28, 2022).
Condo T. 2024a. LCNCA Lilaeopsis Transplant Success.
Condo T. 2024b, April 30. Huachuca water umbel at Maternity Pond - update.
Condo T, Perez C. 2023. Huachuca Water Umbel Survey Report San Pedro Riparian National Conservation Area 2022. Page 13.
Diggins C. 2024, January 10. Hottest Year On Record.
Directorate of Public Works. 2019. Fort Huachuca Threatened and Endangered Species Annual Review Implementation of Conservation and Mitigation Measures 2019. Page 16. Department of the Army.
Directorate of Public Works. 2024. Fort Huachuca Threatened and Endangered Species Annual Review Implementation of Conservation and Mitigation Measures - 2023. Page 18. Department of the Army.
Ehret S. 2008. Welch & Freeman Spring Brief Trip Report. Page 3. Arizona Game and Fish Department.
Fehlberg S, Moran M. 2023. Genetic analysis and assessment of Huachuca Water Umbel. Page 16. Desert Botanical Garden.
Fonseca J. 2014, January 17. RE: Lilaeopsis at Bingham Cienega.
Garfin G, Jardine A, Merideth R, Black M, LeRoy S, editors. 2013. Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment. Island Press/Center for Resource Economics, Washington, DC. Available from http://link.springer.com/10.5822/978-1-61091-484-0 (accessed August 17, 2022).
Harris T. 2024, April 17. Conservation Efforts for Lilaeopsis at the Phoenix Zoo.
Hass S, Frye R. 1997. Hydrology and Water Quality Effects on *Lilaeopsis schaffneriana* ssp. *recurva* Project Report. Page 43. University of Arizona.
Hendrickson DA, Minckley WL. 1984. Cienegas - Vanishing Climax Communities of the American Southwest **6**:130–176.
Intergovernmental Panel on Climate Change. 2021. Climate Change 2021 The Physical Science Basis Summary for Policymakers. Page 3,949.
Kaplan J. 2024. Memo to Files: Site Visits with Leadership Team.
Meixner T et al. 2016. Implications of Projected Climate Change for Groundwater Recharge in the Western United States. Journal of Hydrology **534**:124–138.

Perez C. 2022, August 24. Lilaeopsis transplant at Maternity Well, LCNCA.
Robinson A. 2010. Arizona Native Fish Recovery and Nonnative Fish Control. Page 33. 201816J808. Arizona Game and Fish Department.
Sabathier R, Singer MB, Stella JC, Roberts DA, Caylor KK, Jaeger KL, Olden JD. 2023. High resolution spatiotemporal patterns of flow at the landscape scale in montane non-perennial streams. River Research and Applications **39**:225–240.
Salywon A. 2022, March 24. Lilaeopsis reintroduction opportunity at Canelo Hills Preserve.
Samuels-Crow KE et al. 2023. The importance of monsoon precipitation for foundation tree species across the semiarid Southwestern U.S. Frontiers in Forests and Global Change **6**:1116786.
Titus P, Titus J. 2008. Ecological Monitoring of the Endangered Huachuca Water Umbel (Lilaeopsis schaffneriana ssp. recurva: Apiaceae). The Southwestern Naturalist **53**:458–465.
Turner DS, Richter HE. 2011. Wet/Dry Mapping: Using Citizen Scientists to Monitor the Extent of Perennial Surface Flow in Dryland Regions. Environmental Management **47**:497–505.
U.S. Fish and Wildlife Service. 1999, July 29. Biological Opinion: On-going and Long-term Grazing on the Coronado National Forest in New Mexico (Hidalgo County) and Arizona (Cochise, Santa Cruz, Pima, Pinal, and Graham Counties).
U.S. Fish and Wildlife Service. 2017. Recovery Plan for *Lilaeopsis schaffneriana* ssp. *recurva* (Huachuca water umbel). Page 125. Tucson, AZ. Available from https://ecos.fws.gov/docs/recovery_plan/Recovery%20Plan%20for%20Lilaeopsis%20schaffneriana%20spp.pdf.
U.S. Fish and Wildlife Service. 2023. San Bernardino National Wildlife Refuge Leslie Canyon National National Wildlife Refuge Annual Narrative Report Calendar Year 2023. Page 182.
Vernadero Group. 2011. 2010 Huachuca Water Umbel (*Lilaeopsis schaffneriana* var. *recurva*) transplant report - San Pedro Riparian National Conservation Area, Cochise County, Azirona. Page 44. FH0310-06-56–0247.
Vernadero Group, Desert Botanical Garden. 2012. Assessing Genetic Distinctness of Huachuca Water Umbel (*Lilaeopsis schaffneriana* var. *recurva*) on Fort Huachuca, Arizona and Other Regional Sites. Page 60. FH0310-03-55–0306.
Zaimes G, Nichols M. 2007. Hydrologic processes in riparian areas. Understanding Arizona's Riparian Areas:31–39.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Huachuca water umbel

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, [Arizona Ecological Services Office]

Approve HEATHER WHITLAW

Digitally signed by HEATHER WHITLAW
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