

Interim Core Map Documentation for Huachuca Water-Umbel

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Draft Core Map Developer: Compliance Services International (CSI) on behalf of Bayer CropScience.

Species Summary

Huachuca water-umbel (*Lilaeopsis schaffneriana* var. *recurva*; Entity ID 1030) is a dicotyledonous endangered plant found in Arizona. The U.S. Fish and Wildlife Service (FWS) has assigned designated critical habitat for Huachuca water-umbel. This species inhabits ciénegas, rivers, streams, and springs in perennial, shallow, and slow-flowing or quiet waters or in active stream channels. Additional habitat information is provided in **Appendix 1**.

EPA Review Notes

The developers created this core map using the U.S. Environmental Protection Agency's (EPA) process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. EPA reviewed the draft interim map and documentation and evaluated if: (1) the map and documentation are consistent with the agency's process; (2) areas included or excluded from the interim core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the GIS data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species and was consistent with EPA's mapping process. This documentation was not prepared by EPA, but EPA may have edited this documentation for clarity or other purposes. Some views in this documentation may not necessarily be the views of EPA or its staff.

The core map developed for this species is considered interim and can be used to develop pesticide use limitation areas (PULAs). This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. EPA graded the best professional judgment level for this map as limited (2). The developer expressed high confidence in the map, and the spatial extent of the map is well defined, areas outside of the critical habitat were removed based on interpretation of FWS documents. This interim core map may be revised in the future to incorporate expert feedback from FWS.

This core map does not replace or revise any range or designated critical habitat developed by FWS.

Description of Core Map

The core map for the Huachuca water-umbel is biological information type, based on critical habitat supplemented with potential habitat areas within the species' range. The species' Recovery Plan document (FWS 2017) includes textual descriptions of habitats where the species is known to occur. Known location information from the iNaturalist and Global Biodiversity Information Facility (GBIF) databases, and NatureServe, corroborated the use of range as the core map extent, but were not otherwise used in core map development.

Within the core map extent (the species' range), potential habitat areas were represented using critical habitat, a spatial layer of ciénegas, and the National Wetlands Inventory (NWI) water bodies with attributes matching descriptions of species habitat. Ciénegas are freshwater to brackish North American wetlands associated with fluvial systems of arid/semi-arid areas of the southwestern U.S. and northwestern Mexico.

The core map developed in this document for the Huachuca water-umbel spans 2,563 acres (Figure 1). A summary of acreage by National Landcover Database (NLCD 2021) land use type is provided in

Table 1.

Based on EPA’s “best professional judgment classification” system, CSI has graded this core map as “average” (3) because assumptions were made when connecting species life history and/or biological needs (*i.e.* habitat preferences) to a Geographical Information System (GIS) dataset, in this case the NWI dataset (FWS 2023) and ciénegas location data from U.S. Geological Survey (USGS 2022). These assumptions involved associating the species’ habitat— ciénegas, rivers, streams, and springs—with corresponding NWI classifications, in this case, select riverine wetlands listed in **Appendix 2** Section 3. Other data from FWS (critical habitat) and the U.S. Geological Survey (ciénegas locations) were relatively precise; the critical habitat provided good validation of the NWI selections made. More information about the best professional judgment classification system and its definitions can be found in the core map process document (EPA 2024).

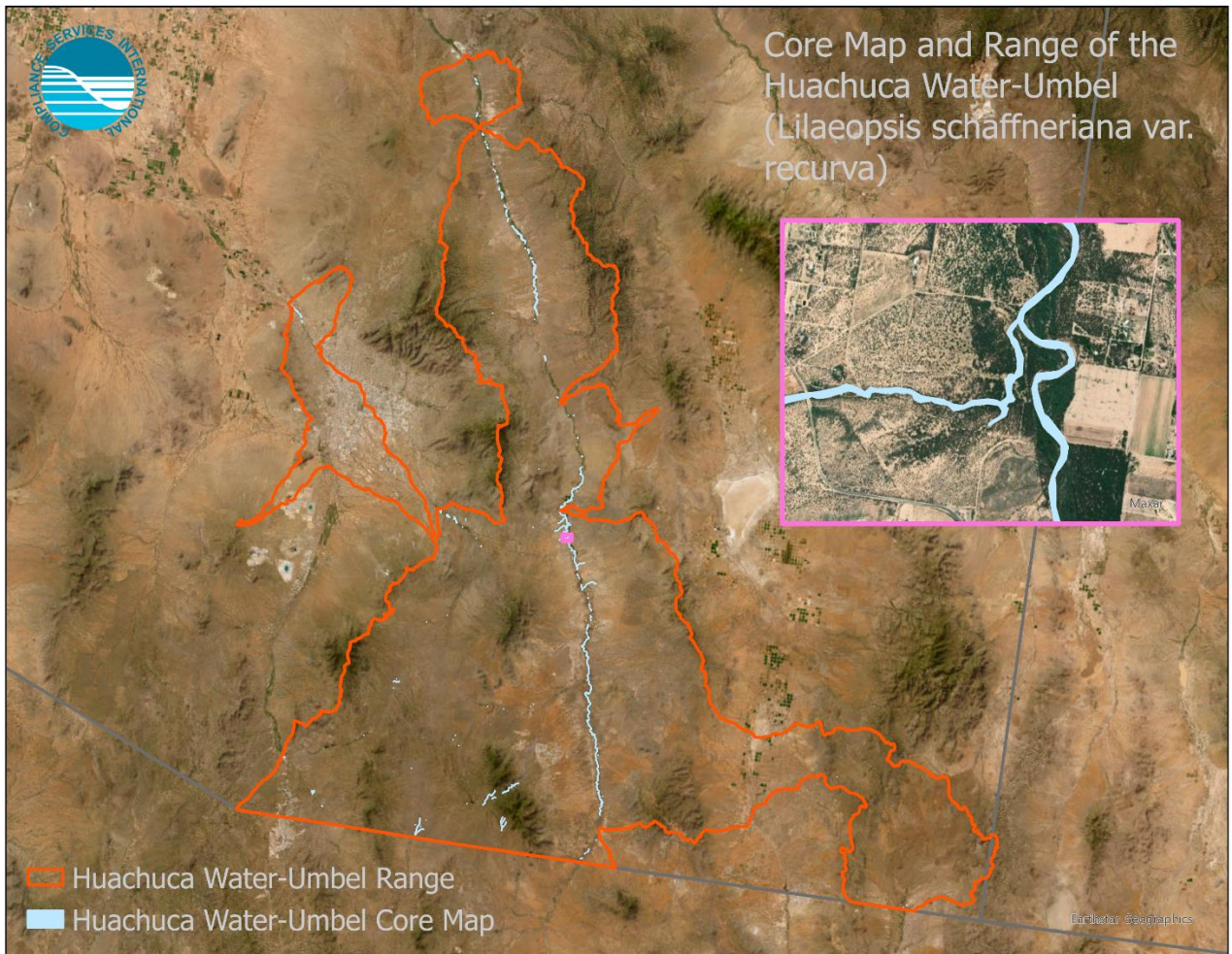


Figure 1. Interim core map for the Huachuca water-umbel (*Lilaeopsis schaffneriana* var. *recurva*; Entity ID 1030). The core map spans 2,563 acres, while the range is 3,149,679 acres.

Table 1. Acres by National Land cover Database (NLCD 2021) class within the core map of the Huachuca water-umbel. Total core map area (based on NLCD pixel count): 2,560 acres¹.

| NLCD_Land_Cover_Class | Acres |
|------------------------------|-------|
| Shrub/Scrub | 1,819 |
| Woody Wetlands | 442 |
| Evergreen Forest | 79 |
| Herbaceous | 61 |
| Emergent Herbaceous Wetlands | 56 |
| Cultivated Crops | 38 |
| Deciduous Forest | 31 |
| Developed, Open Space | 13 |
| Open Water | 11 |
| Developed, Low Intensity | 6 |
| Developed, Medium Intensity | 2 |
| Mixed Forest | 2 |
| Developed, High Intensity | - |

Evaluation of Known Location Information

There were three evaluated datasets with known location information:

- Occurrence locations in iNaturalist;
- Occurrence locations in GBIF; and
- Occurrence locations in NatureServe.

Compliance Services International evaluated these three datasets before developing the core map. Overall, there were nine usable research-grade observations found in iNaturalist². The GBIF dataset comprised eight georeferenced observations, five of which were considered usable based on the criteria described below. The iNaturalist dataset was useful to validate the general accuracy of the Huachuca water-umbel range, but not precise enough to be used as a meaningful refinement of range in core map development. The GBIF dataset was entirely a subset of the iNaturalist data, so was not used.

Approach Used to Create Core Map

The core map was developed using EPA’s process for developing core maps for species listed by the FWS and their designated critical habitat (referred to as “the process”). This core map was developed by CSI using the four steps described in the process document:

¹ This acreage is slightly different from the core map acreage (2,563) due to the pixelation of NLCD land cover. The core map is not developed from raster data.

² According to iNaturalist, an observation is designated as “research grade” if it 1) is verifiable with date, coordinates, photos/sounds, and not captive; 2) achieves community agreement defined as “more than 2/3 of identifiers needs to agree on the species level ID or lower;” and 3) “must pass a data quality assessment, which includes checks for accurate date and location, evidence of a wild organism, and clear evidence of the organism itself”

(<https://help.inaturalist.org/en/support/solutions/articles/151000169936-what-is-the-data-quality-assessment-and-how-do-observations-qualify-to-become-research-grade->).

1. Compile available information for a species;
2. Identify core map type from among the following defined types: critical habitat, range, and biological information. From EPA, summaries of each core map type are provided below (EPA 2024).
3. Develop the core map for the species; and
4. Document the core map.

For step 1, CSI compiled available information for Huachuca water-umbel (*Lilaeopsis schaffneriana* var. *recurva*) from FWS, as well as observation information available from various publicly available sources including iNaturalist, GBIF, and NatureServe. The information compiled for Huachuca water-umbel is included in **Appendix 1**. Influential information that impacted the development of the core map includes a description of the species habitat from the species' Recovery Plan:

- '*Lilaeopsis schaffneriana* ssp. *recurva* inhabits ciénegas (marshes), rivers, streams, and springs. It generally occurs in perennial, shallow, and slow-flowing or quiet waters or in active stream channels containing refugial sites where most plants can escape the effect of scouring floods' (FWS 2017).

For step 2, CSI used the compiled information including the species range, known locations, and habitat location information to determine the core map type. Compliance Services International compared the known location data to the range and found that known locations from iNaturalist, GBIF, and NatureServe were not usable as meaningful refinements either because the data were not precise enough (iNaturalist and NatureServe) or because they were redundant datasets (GBIF).

Review of the available data also suggested that the core map should exclude landcover types inconsistent with the Huachuca water-umbel habitat. To represent the species' potential habitat, the NWI dataset was used to identify habitat classes associated with the species habitat description above; using the "ATTRIBUTE" field. These habitat areas were merged with critical habitat and a layer of ciénegas, and then had contiguous cultivated areas > 25 acres (EPA 2025) removed to develop the core map.

For step 3, CSI used the best-available data sources to generate the core map. Data sources are discussed in EPA's core map process document. For this interim core map, CSI followed EPA's decision framework to arrive at a core map type of critical habitat; this is because the Huachuca water-umbel has designated critical habitat that more accurately identifies critical areas for core map development than its significantly more widespread range. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

Discussion of Approaches and Data that were Considered but not Included in Core Map

Known Observation Datasets

Datasets such as iNaturalist, GBIF, and NatureServe were considered but not used as the basis for the core maps.

Appendix 1. Information compiled for Huachuca water-umbel

1. Recent FWS documents

- 5-Year Review (2014): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2220.pdf
- 5-Year Review (2018): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2566.pdf
- 5-Year Review (2024): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/14334.pdf
- ECOS Species Profile Page (2025): <https://ecos.fws.gov/ecp/species/1201>
- Recovery Plan (2017): https://ecos.fws.gov/docs/recovery_plan/Recovery%20Plan%20for%20Lilaeopsis%20schaffneriana%20spp.pdf
- Critical Habitat (1999): <https://www.govinfo.gov/content/pkg/FR-1999-07-12/pdf/99-17403.pdf#page=1>

2. Background information

- Status: Federally listed as endangered in 1997.
 - Resiliency, redundancy, and representation (the 3Rs) were not evaluated for this species.
- Habitat, Life History, and Ecology
 - '*Lilaeopsis schaffneriana* ssp. *recurva* inhabits ciénegas (marshes), rivers, streams, and springs. It generally occurs in perennial, shallow, and slow-flowing or quiet waters or in active stream channels containing refugial sites where most plants can escape the effect of scouring floods (62 FR 665, p. 667; 64 FR 37441-37442); see Figures 4a and b which depict some of these habitats. Historically, drainages in southeastern Arizona consisted of broad, shallow waterways in valley bottoms that gradually collected overland flow from large watersheds. The San Pedro River, for example was reported to be a meandering marshy creek where beaver (*Castor canadensis*) and fish were described as plentiful (Bureau of Land Management 1993, p. 7). *Lilaeopsis schaffneriana* ssp. *recurva* appears to be adapted to this type of hydrological regime and resulting conditions. During larger flood events, small, weakly rooted clumps of the plant may tear off, float downstream, and are deposited elsewhere in the drainage. Some of these clumps survive if appropriate habitat conditions are present' (FWS 2017).
 - '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, ciénegas, and alluvial fans in 0 to 15 cm of water' (FWS 2024).
 - 'Flowering has been observed episodically from March through October, peaking in July and occurring with abundance irregularly' (FWS 2017).
 - 'The pollination biology of the taxon is unknown. It is presumed to be insect pollinated due to floral features and the predominance of insect pollination in the Apiaceae. Radke (pers. comm. April 22, 2014) documented a *Formica* ant species feeding on the nectar of *L. schaffneriana* ssp. *recurva* flowers along the San Pedro River in both 2012 and 2013; he

believes this may be an important pollinator for the taxon. Whether or not the taxon is an obligate outcrosser or is self-compatible is unknown, however experiments suggest that most if not all *Lilaeopsis* spp. are self-compatible (Affolter 1985, p. 22) and self-compatibility is common in the Apiaceae (Schlessman and Graceffa 2002, p. 410) (FWS 2017).'

- 'Germination in *L. schaffneriana* ssp. *schaffneriana* occurs one to two weeks after seeds disperse (Gori 1995, p. 3). Similarly, Titus and Titus (2008a, p. 317) found *L. schaffneriana* ssp. *schaffneriana* to have a high germination rate (90 percent) in a greenhouse study with seed less than one year old. The seeds in this study were not cold stratified (a cold treatment that simulates natural winter conditions), so stratification does not appear to be a pre-requisite for germination (Titus and Titus 2008a, p. 317). The taxon reproduces both sexually via seed and asexually through rhizome spread and fragmentation. Clonal establishment following flooding events is thought to be important for maintaining diversity in the taxon' (FWS 2017).
- '*Lilaeopsis schaffneriana* ssp. *recurva* competes poorly with other wetland plant species, making intermediate levels of disturbance from flooding, fire, grazing, or other sources necessary to reduce competition and promote dispersal and the preservation of genetic diversity (62 FR 665, pp. 671, 676; Vernadero and the Desert Botanical Garden 2012, p. 13). As *L. schaffneriana* ssp. *recurva* possesses weak and shallow roots, the need to be able to compete for sunlight, water, and nutrients must be balanced with some unknown extent of companion plants that enable bank stability along riparian channels. Refugial sites such as backwaters in active stream channels (62 FR 665, p. 667; 64 FR 37441, p. 37442) or cobble pavement in ephemeral streams afford an escape from scouring floods and hoof action, respectively (Service 2014a, p. 5). During scouring flood events, plants may be removed from areas of erosion and move downstream to areas of deposition or may be completely lost, if area of deposition is unsuitable habitat or plants are damaged' (FWS 2017).
- Taxonomy (FWS 2017)
 - '*Lilaeopsis schaffneriana* ssp. *recurva* is a member of the Apiaceae (carrot family). Within the Apiaceae, *Lilaeopsis* is in tribe Oenantheae and subfamily Apioideae (Bone et al. 2011, p. 789). The genus is considered to be taxonomically difficult because all members of the genus have similar simplified vegetative morphology of linear, hollow, transversely septate (divided) leaves. These characteristics, however, are unlike those of most other genera in this family. *Lilaeopsis* is a genus of 15 perennial, rhizomatous herbs of damp, marshy, or aquatic habitats found in temperate regions of North and South America and Australasia (Affolter 1985, p. 1; Bone et al. 2011, p. 789). *Lilaeopsis schaffneriana* is found in southeastern Arizona, central and northern Mexico, and northwestern South America.'
- Relevant Potential Pesticide Use Sites (FWS 2017)
 - There are no pesticide use sites listed. Herbicide use to control exotic invasive plant species is listed as a control measure in the Recovery Plan. Herbicide use is estimated to cost \$200/acre.
- Relevant Recovery Objectives and Actions
 - Recovery Objectives (FWS 2017)
 1. Protect and restore functional aquatic habitat and reduce dewatering threats to

- historical, existing, newly discovered, and newly established *L. schaffneriana* ssp. *recurva* occurrences and habitat.
2. Conserve historical, existing, newly discovered, and newly established *L. schaffneriana* ssp. *recurva* occurrences and their seedbanks; augment existing occurrences; establish new occurrences in appropriate habitat; establish plants at botanical gardens and other 35 36 Service approved facilities for research, recovery, and educational purposes; and maintain seeds for conservation and recovery at seed storage facilities
 3. Remove stressors related to invasive non-native plants and poorly managed livestock grazing to historical, existing, newly discovered, and newly established *L. schaffneriana* ssp. *recurva* occurrences and their habitats.
 4. With the aid of affected parties, develop a standardized monitoring technique based on existing protocols; monitor historical, existing, newly discovered, and newly established *L. schaffneriana* ssp. *recurva* occurrences, threats, and outcomes from management actions allowing for adaptive management.
 5. Encourage scientific study to improve our understanding of *L. schaffneriana* ssp. *recurva* geography, ecology, viability, genetics, propagation, habitat restoration, and threats in the United States and Mexico.
 6. Develop public outreach, collaborative partnerships, agency management plans, and agreements with private landowners in the United States and Mexico that encourage *L. schaffneriana* ssp. *recurva* conservation.
- Downlisting Criteria (FWS 2017)
 1. A minimum cumulative extent of 2,000 square meters (0.2 ha / 0.5 ac) of naturally occupied habitat exists in the San Pedro Watershed, 20 percent of which occurs in tributary streams, springs, or ciénegas; and a minimum of 2,000 square meters (0.2 ha / 0.5 ac) in the Santa Cruz Watershed, 90 percent of which occurs in tributary streams, springs, or ciénegas, distributed among the areas of Cienega Creek (35 percent), Sonoita Creek (10 percent), the San Rafael Valley uplands and mainstem (10 percent), and the western Huachuca Mountains (35 percent); and a minimum of 125 square meters (0.01 ha / 0.03 ac) exists in the Rio Yaqui Watershed; this level of occupancy is sustained or improved for a minimum of 10 years over a 15 year period;
 2. At least 3 separate introduced occurrences with a minimum cumulative extent of 150 square meters (0.015 ha / 0.037 ac) of occupied habitat are placed in each of the 3 United States watersheds and are stable or increasing over a 10-year period;
 3. Threats to the taxon and its habitat have been managed and reduced, and long-term management is in place for a minimum of 20 years to ensure the persistence of occurrences with minimum cumulative extent (as reflected by the achievement and maintenance of downlisting criteria 1 and 2 measured above) in each of the three United States watersheds;
 4. A living collection of as many plugs as resources allows, collected from genetically distinct regions (*e.g.* Fort Huachuca / SPRNCA north; San Rafael / Las Cienegas / Sonoita; SPRNCA south / San Bernardino), from both the San Pedro and the Santa Cruz watersheds is maintained in at least one botanical garden in southern Arizona for recovery and educational purposes; and
 5. Seeds of *L. schaffneriana* ssp. *recurva* are collected following Center For Plant Conservation guidelines, which include collecting from no more than 10 percent of the standing seed crop from 50 individual seed-bearing plants per population (if

the population size permits), and collecting from a variety of microsites and physical characteristics within the stand of plants. These seeds are stored at both the Agricultural Research Service National Center for Genetic Resources Preservation in Fort Collins, Colorado and stored according to protocols at a local facility such as the Desert Botanical Gardens in Phoenix, Arizona, for long-term conservation and recovery purposes.

- Delisting Criteria (FWS 2017)
 1. To delist *L. schaffneriana* ssp. *recurva*, the criteria for down-listing must be met and the level of occupancy in the downlisting criteria's is sustained or increasing for a minimum of 20 years over a 30-year period.
- Recommendations for Future Actions (FWS 2024)

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.

3. Range

- Historical Range (Figure 2)
 - The type specimen of *L. schaffneriana* ssp. *recurva* was collected in the Santa Cruz Valley of southern Arizona near Tucson on May 19, 1881, in an area that is now encompassed by the City of Tucson and no longer provides suitable habitat for the species (Affolter 1985, p. 61). The following history was determined using the Southwest Environmental Information Network (SEINET observations). It was not collected again until September 28, 1947, by L.N. Gooding in Bear Canyon of the Huachuca Mountains. Gooding made six additional collections through 1961, documenting *L. schaffneriana* ssp. *recurva* from the San Pedro River and Garden Canyon in the Huachuca Mountains. Additional collections were made by other researchers from Sonoita Creek, the Huachuca Mountains, and the San Pedro River in the 1960s. In the 1970s, additions to the range included collections from the San Rafael Valley and Canelo Hills; in the 1980s, San Bernardino National Wildlife Refuge was also added to the list of known locations. In the 1990s, the taxon was collected from Empire Gulch and northern Sonora, Mexico; in the 2000s, it was documented from the new locations of Bingham Cienega and the Babocomari Ranch; and in the 2010s, it was found further south in Arizona along the San Pedro River. Figure 2 represents the general distribution of the taxon by watershed across its range; locations believed to be extirpated are delineated, as are locations where the plant has not been seen in recent history, but where a seedbank may still persist' (FWS 2017).
- Current Range
 - 'Within the Santa Cruz, San Pedro, and Rio Yaqui watersheds in southern Arizona, we are aware of 17 locations supporting extant occurrences of *L. schaffneriana* ssp.

recurva, 8 locations where all *L. schaffneriana* ssp. *recurva* occurrences are considered extirpated, and 6 locations where historical occurrences have not been seen in recent years. Within the Santa Cruz, San Pedro, Rio Yaqui, Rio Sonora, and Rio Concepcion watersheds in Sonora, Mexico, we are aware of 21 locations supporting *L. schaffneriana* ssp. *recurva* occurrences, though most of these locations have not been revisited in recent years. Many of these locations were documented after the plant was listed under the Act, extending the known geographic range to the north and west in Arizona, and expanding the previous elevation limits of 1,148 to 2,133 meters (m) (3,500 to 6,500 feet (ft)) known at the time of listing, to the current known range of 610 to 2,166 m (2,001 to 7,100 ft)' (FWS 2017).

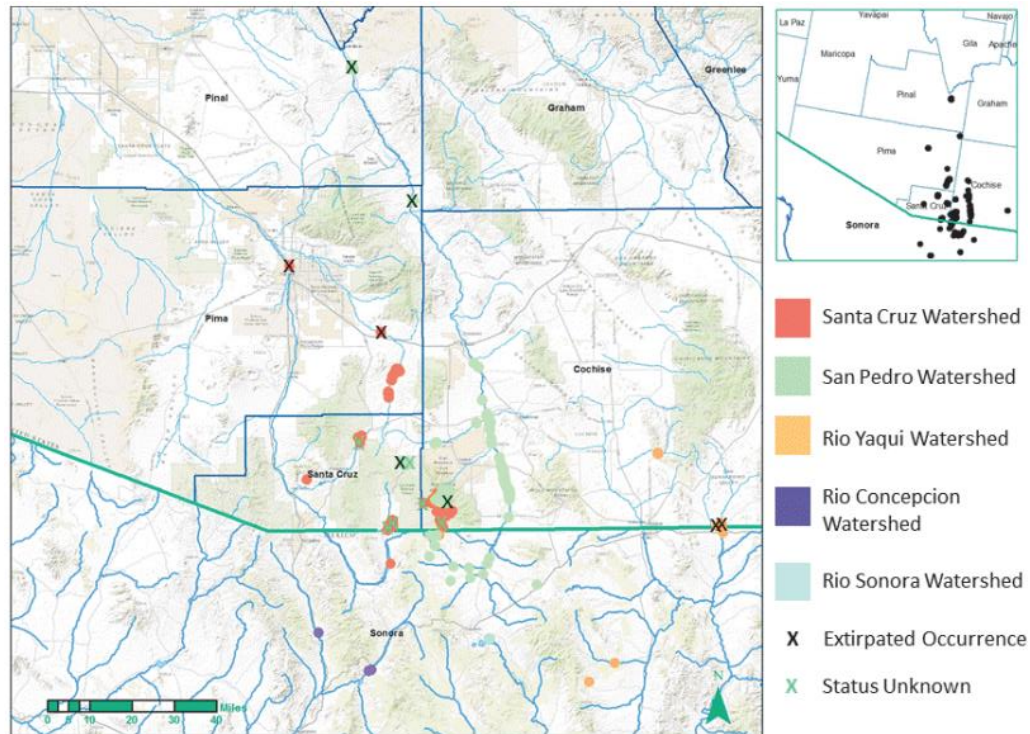


Figure 2. Range-wide distribution and status of the Huachuca water-umbel by watershed in southern Arizona and northern Sonora, Mexico. Copied from Figure 2 of the Recovery Plan (FWS 2017).

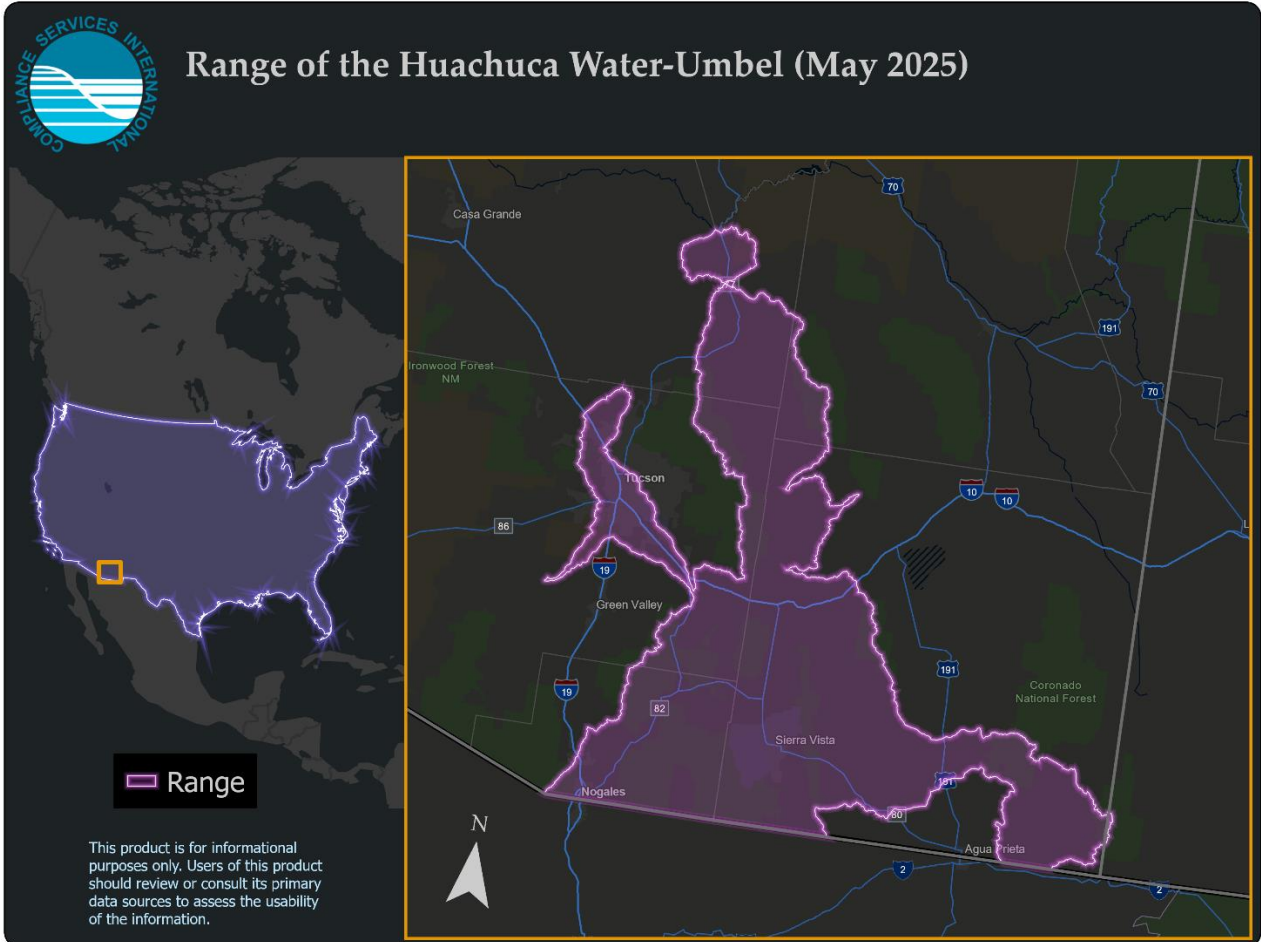


Figure 3. Range of the Huachuca water-umbel (FWS 2025).

4. Description of Critical Habitat (FWS 1999)

- Critical habitat designated in 1999
- Designated habitat includes a total of 83.2 kilometers (km) (51.7 miles (mi)) of streams or rivers in Cochise and Santa Cruz counties (Figure 4).
- The primary constituent elements include, but are not limited to, the habitat components which provide:
 1. Sufficient perennial base flows to provide a permanently or nearly permanently wetted substrate for growth and reproduction of *Lilaeopsis*.
 2. A stream channel that is relatively stable, but subject to periodic flooding that provides for rejuvenation of the riparian plant community and produces open microsites for *Lilaeopsis* expansion.
 3. A riparian plant community that is relatively stable over time and in which nonnative species do not exist or are at a density that has little or no adverse effect on resources available for *Lilaeopsis* growth and reproduction.
 4. In streams and rivers, refugial sites in each watershed and in each reach, including but not limited to springs or backwaters of mainstem rivers, that allow each population to survive catastrophic floods and recolonize larger areas.

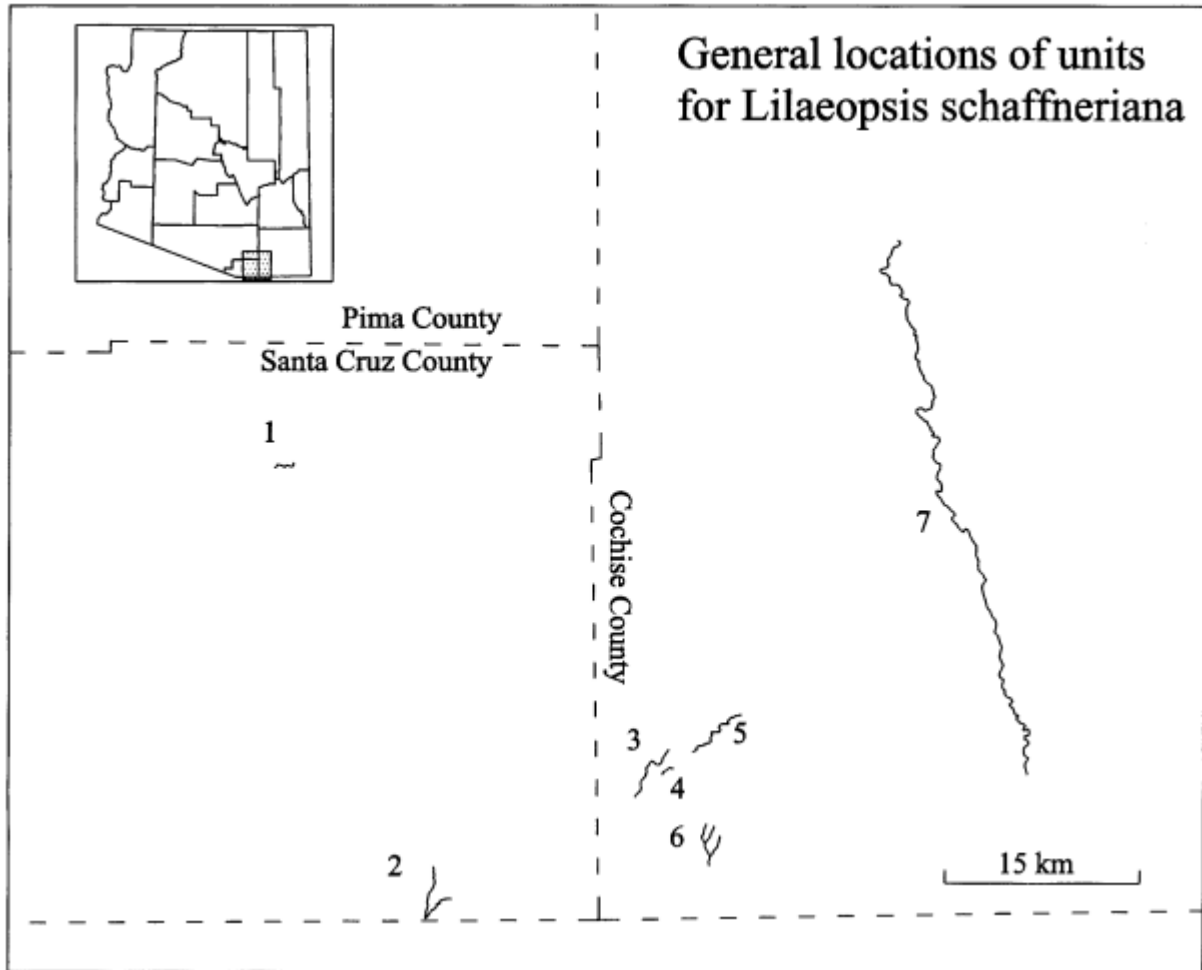


Figure 4. General locations of critical habitat units for the Huachuca water-umbel. Copied from the critical habitat designation document (FWS 1999).

5. Known Locations

- Known populations (FWS 2017).
 - Within the Santa Cruz, San Pedro, and Rio Yaqui watersheds in southern Arizona, we are aware of 17 locations supporting extant occurrences of *L. schaffneriana* ssp. *recurva*, 8 locations where all *L. schaffneriana* ssp. *recurva* occurrences are considered extirpated, and 6 locations where historical occurrences have not been seen in recent years. Within the Santa Cruz, San Pedro, Rio Yaqui, Rio Sonora, and Rio Concepcion watersheds in Sonora, Mexico, we are aware of 21 locations supporting *L. schaffneriana* ssp. *recurva* occurrences, though most of these locations have not been revisited in recent years. Many of these locations were documented after the plant was listed under the Act, extending the known geographic range to the north and west in Arizona, and expanding the previous elevation limits of 1,148 to 2,133 meters (m) (3,500 to 6,500 feet (ft)) known at the time of listing, to the current known range of 610 to 2,166 m (2,001 to 7,100 ft) (Vernadero 2011b, p. 3; Vernadero Group and the Desert Botanical Garden 2012, p. A-16). There are no occurrences that appear to be increasing in size and many are reported from single patches among competing vegetation or in aquatic habitat that is in danger of being lost to groundwater pumping or drought. Numerous other

occurrences have not been relocated in many years and are believed extirpated due to degradation and contraction of suitable habitat.'

- GBIF: <https://www.gbif.org/species/6449217>
 - GBIF includes seventy occurrence records; eight of which are georeferenced (Figure 5). Five of these had usable coordinate data based on these criteria:
 - U.S. only (excludes Mexico)
 - Latitude and longitude precision were both 3+ decimal places.
 - Coordinate uncertainty values no greater than 30 km.
 - Relative recency (2010-present)
 - Must include date information.
 - No “preserved specimen” observations; only “human observation.”
 - The 5 usable coordinates were mapped against the species range to evaluate their utility in representing species extent (Figure 6). It was observed that all the usable GBIF coordinates are originally sourced from iNaturalist, which also had more records. Therefore, the GBIF dataset was not used for core map development.

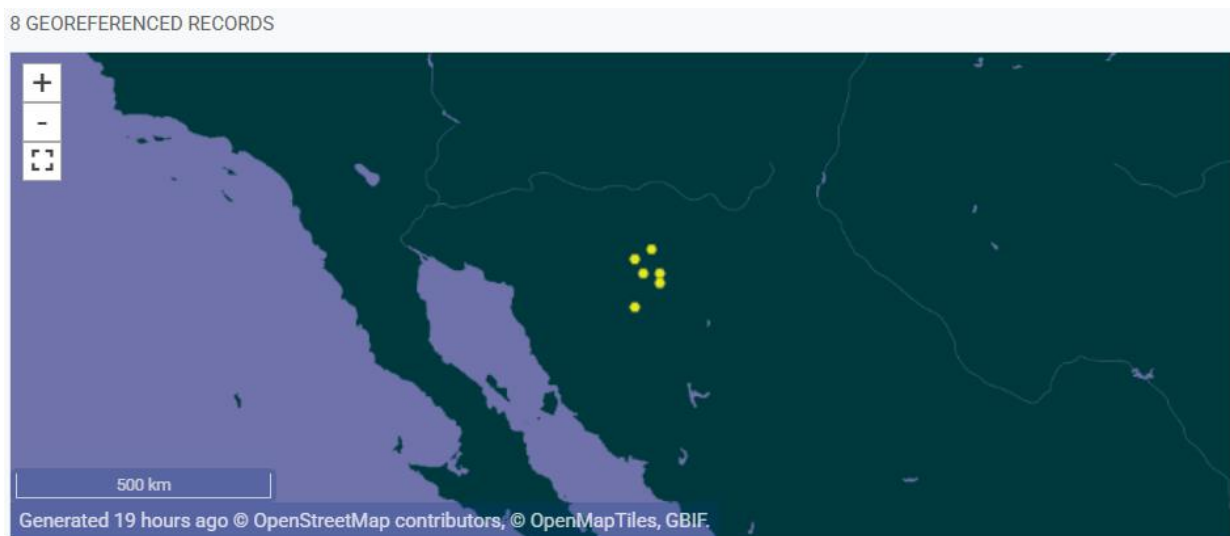


Figure 5. GBIF occurrences for the Huachuca water-umbel (GBIF 2025).

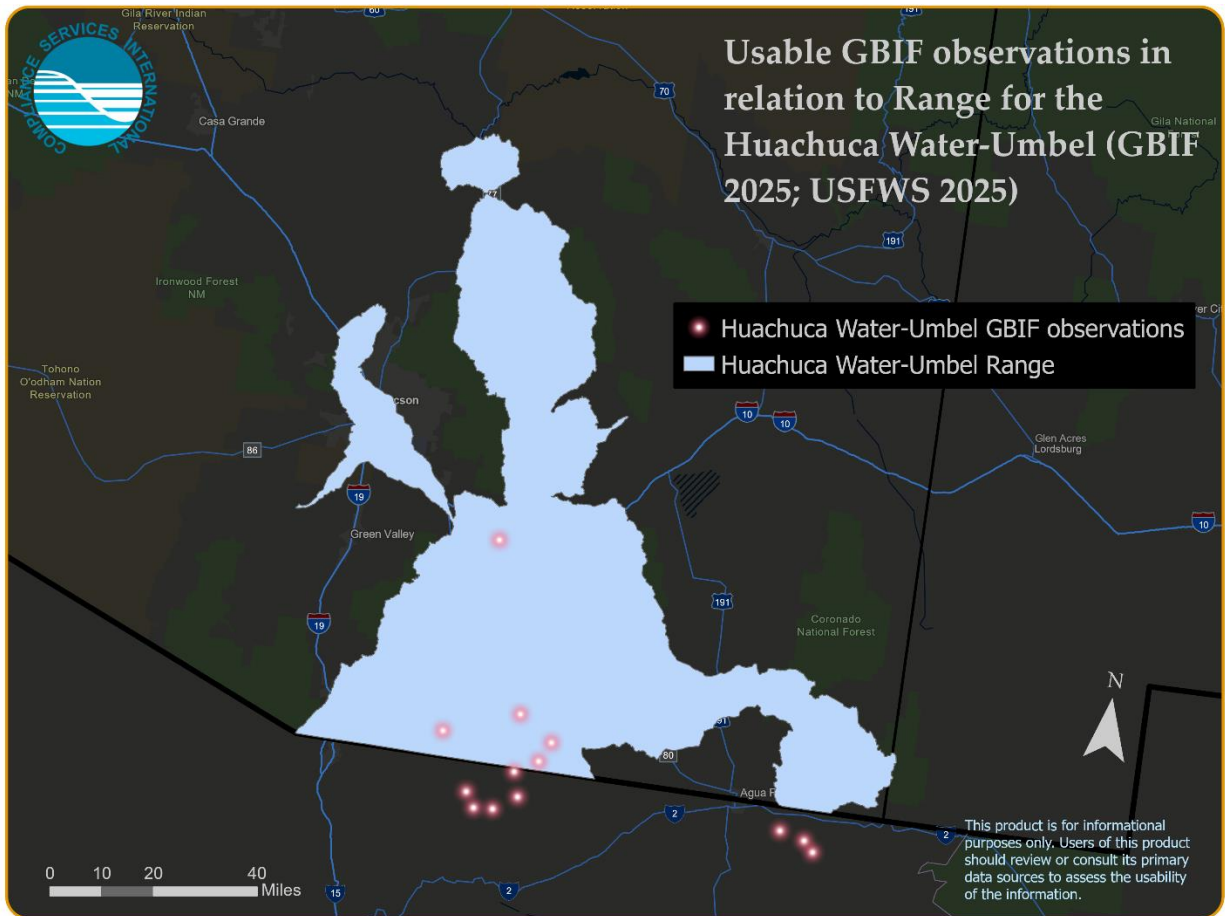


Figure 6. Usable GBIF occurrences (pink) in relation to the range of the Huachuca water-umbel (GBIF 2025; FWS 2025).

- iNaturalist: https://www.inaturalist.org/observations?subview=map&taxon_id=241379
 - iNaturalist includes twenty-four total observations (Figure 7), nine of which are research-grade with usable coordinate data based on these criteria:
 - U.S. only (excludes Mexico)
 - Latitude and longitude precision were both 3+ decimal places
 - Relative recency (2010-present)
 - Observation description did not include the text “intentionally incorrect”
 - Public positional accuracy (PPA) value no greater than 30 km³
 - This did not result in the exclusion of any records.
 - Locations are consistent with GBIF, which is expected because all the GBIF observations are imported from iNaturalist.
 - Ten of eleven iNaturalist locations outside of the range of the Huachuca water-umbel are in Mexico and therefore not relevant to core map development.
 - The iNaturalist data are neither comprehensive (exclusive of areas of critical habitat) nor precise enough to be used in core map development. However, these data may provide insight into where the species is more commonly found.

³ For “obscured” observations, public positional accuracy (PPA) represents the diagonal of a 0.2 x 0.2 arc cell. See the iNaturalist geoprivacy page for more details on this and related terms [What is geoprivacy? What does it mean for an observation to be obscured? : iNaturalist Help](#).

Observations

Huachuca Water Umbel

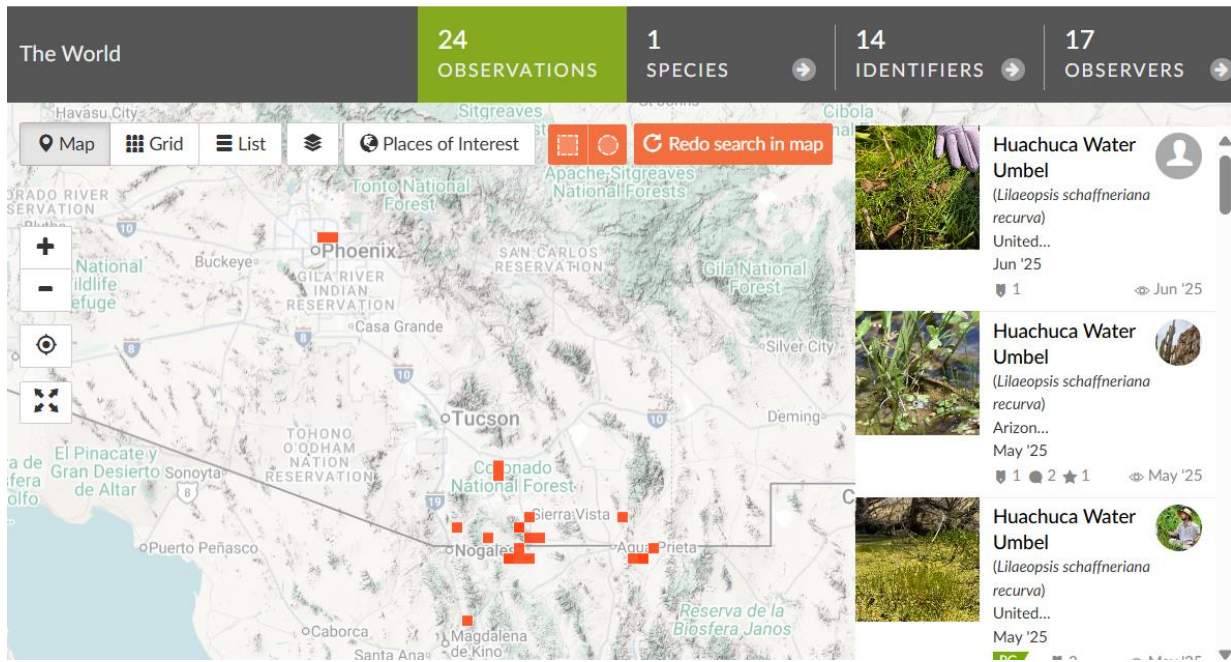


Figure 7. iNaturalist occurrences for the Huachuca water-umbel (iNaturalist 2025).

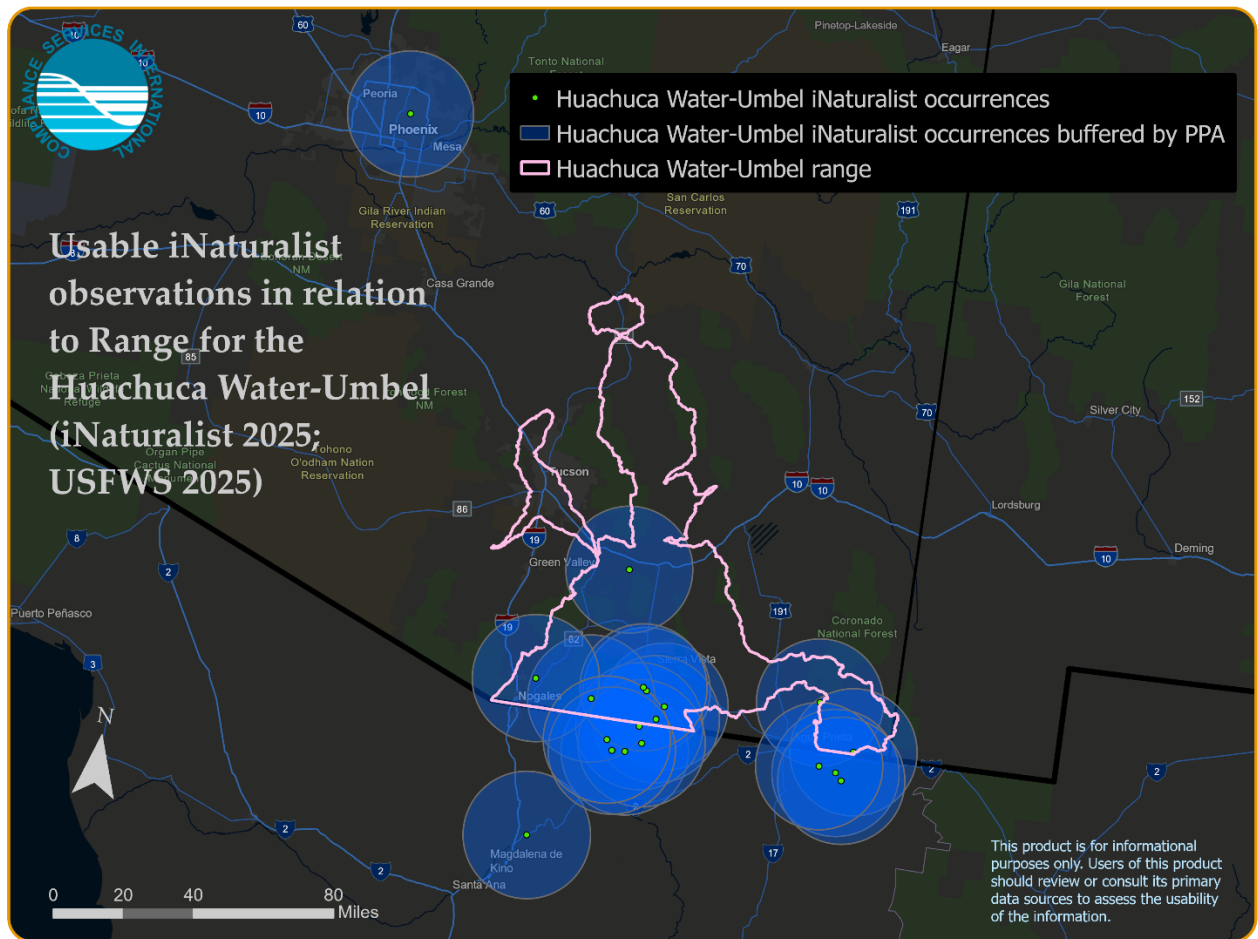


Figure 8. Usable iNaturalist observations, buffered by public positional accuracy (PPA), for the Huachuca water-umbel in relation to species range (iNaturalist 2025; FWS 2025).

- NatureServe Explorer: <https://explorer.natureserve.org/>
 - Available public occurrence information from NatureServe Explorer aligns with the information from iNaturalist and GBIF and additionally includes more area consistent with the range.
 - EOs were used to support the decision to use the species range as the outer extent of the core map.

Appendix 2. GIS Data Review and Method to Develop Core Map

The core map for this species is based on critical habitat, supplemented with identified habitats based on biological information. The core map identifies all areas within the extent (range) matching the species' habitat description from **Appendix 1**. Professional judgment was used to match "ATTRIBUTE" classes in the National Wetland Inventory (NWI) dataset as described below (FWS 2023). NWI is regarded as a high quality national-level dataset that is appropriate to identify habitat for aquatic species such as the Huachuca water-umbel. Additionally, a spatial layer of ciénegas developed by the U.S. Geological Survey (USGS) was used to represent potential habitat in other areas.

1. References and Software

- Ciénegas Locations: <https://www.usgs.gov/data/database-cienega-locations-southwestern-united-states-and-northern-mexico>.
- National Wetlands Inventory (FWS 2023): <https://www.fws.gov/program/national-wetlands-inventory>.
- Software used: ArcGIS Pro version 3.2.
- FWS Species Range and Critical Habitat: <https://ecos.fws.gov/ecp/species/1201>.

2. Datasets Used in Core Map Development

2.1. Range and Critical Habitat

The range for this species was last updated by FWS on April 12, 2022, and its critical habitat was established July 12, 1999. A shapefile including species range for all listed species and critical habitat for all species with critical habitat were downloaded from the FWS ECOS website on June 23, 2025. The shapefile was converted to a feature class stored in a file geodatabase and reprojected to WKID #102008 ("North America Albers Equal Area Conic").

1. Using an ArcGIS Web Map the species was queried based on the ECOS listed "Entity ID" of 1030 and exported as a feature class to a temporary file geodatabase as a standalone Entity ID-specific layer.
2. The area of the range and critical habitat were calculated automatically by loading them into the software (ArcGIS Pro version 3.2) and reading their respective areas from the attribute table ("Shape_Area"), then converting their units (square meters) into acres with a conversion factor of 0.000247105.

These shapefiles were added to an ArcGIS Pro map and compared against each other, the ciénegas layer, and the observation information from iNaturalist. The range was used to establish the outer boundary ("extent") of the core map. The critical habitat was used to form part of the final shape of the core map.

2.2. Database of Cienega Locations (USGS)

Descriptions of species habitat for the Huachuca water-umbel include ciénegas, which are wetlands characterized by alkaline, freshwater, spongy wet meadows with shallow-gradient, permanently saturated soils. A database of ciénega locations (a spatial layer of points) was published by the U.S. Geological Survey in 2022 and used to develop this core map; Huachuca water-umbel habitat is consistent with these wetland features (USGS 2022). These point locations were buffered by 30 m to capture the extent of the wetland areas, as identified in Wilson et al. 2016. The buffered points were then clipped to the species range and merged with other layers to form the core map. Details on the procedure used to develop the core map are provided in **Appendix 2**.

2.3. National Wetlands Inventory (NWI) Dataset

The NWI dataset was preliminarily vetted to determine its appropriateness in representing aquatic areas matching descriptions of the Huachuca water-umbel habitat. The species inhabits ciénegas, rivers, streams, and springs in perennial, shallow, and slow-flowing or quiet waters or in active stream channels. CSI reviewed NWI attribute classes in relation to this description and determined that the species' potential habitat is best represented by a selection of riverine systems:

- Riverine (NWI code = R)
 - Subsystems: Lower Perennial (2), Upper Perennial (3), and Streambed (5).
 - Classes: Aquatic Bed (AB), Streambed (SB), and Unconsolidated Shore (US).

The NWI was clipped to the species range, according to the procedure given in **Appendix 2** Section 3.1. This subset of NWI water bodies was queried for the riverine water body types listed above, according to the following SQL query:

- `ATTRIBUTE LIKE '%R2AB%' OR ATTRIBUTE LIKE '%R2SB%' OR ATTRIBUTE LIKE '%R2US%' OR
ATTRIBUTE LIKE '%R3AB%' OR ATTRIBUTE LIKE '%R3SB%' OR ATTRIBUTE LIKE '%R3US%' OR
ATTRIBUTE LIKE '%R5AB%' OR ATTRIBUTE LIKE '%R5SB%' OR ATTRIBUTE LIKE '%R5US%'`

The selected water body features were merged with other layers (critical habitat and buffered ciénegas) to represent potential habitat of the Huachuca water-umbel within the core map extent (species range).

3. Creating the Core Map

3.1. Defining Habitat

The core map for the Huachuca water-umbel was developed using critical habitat, ciénegas locations, and selected water bodies from the NWI. The extent used for core map development was the range; a layer representing the species' potential habitat was developed as follows:

1. Import the species critical habitat as a feature class named "HWU_CH." Choose to export this layer—and all subsequent layers—into the preferred projection (WKID #102008).
2. Import the NWI state-level dataset for Arizona. Verify that its extent covers the entirety of the species range (it does).
3. Use the Pairwise Clip tool to clip all NWI wetlands by the species range, and save as a new layer ("NWI_AZ_pcRange").
4. Use the Select by Attributes tool to select only features from the previous layer ("NWI_AZ_pcRange") with "ATTRIBUTE" field values consistent with the species habitat description for the Huachuca water-umbel according to the classes listed in Appendix 2 Section 2.3, using the following SQL query. Save as a new layer, "NWI_AZ_pcRange_sel".
 - `ATTRIBUTE LIKE '%R2AB%' OR ATTRIBUTE LIKE '%R2SB%' OR ATTRIBUTE LIKE '%R2US%' OR
ATTRIBUTE LIKE '%R3AB%' OR ATTRIBUTE LIKE '%R3SB%' OR ATTRIBUTE LIKE '%R3US%' OR
ATTRIBUTE LIKE '%R5AB%' OR ATTRIBUTE LIKE '%R5SB%' OR ATTRIBUTE LIKE '%R5US%'`
5. Import the USGS layer of ciénegas and save it as "Cienegas".
6. Use the Pairwise Buffer tool to buffer the previous layer ("Cienegas") by 30 m and save as a new layer, "Cienegas_pb30m".

7. Use the Pairwise Clip tool to clip the previous layer (“Cienegas_pb30m”) by the species range and save as a new layer, “Cienegas_pb30m_pcRange”.
8. Use the Merge tool to merge the following three datasets into a single layer representing the Huachuca water-umbel’s potential habitat (“HWU_habitat”).
 - HWU_CH
 - NWI_AZ_pcRange_sel
 - Cienegas_pb30m_pcRange
9. Use the Pairwise Dissolve tool to dissolve features from the previous layer (“HWU_habitat”) into a feature class with a single shape, saved as “HWU_habitat_pd”.

3.2. Cultivated Lands-based Refinement

The Huachuca water-umbel is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture was applied. Here agricultural areas are represented by EPA’s modified cultivated layer, which includes areas spanning at least 25 acres. This was done as follows:

1. Use the Pairwise Erase tool to exclude cultivated areas > 25 acres from the previous layer (“HWU_habitat_pd”) according to a layer developed by EPA (“CultivatedAreas_Over25acres”). Save as a new layer (“HWU_habitat_pd_peCultivated25ac”).
2. (Optional) Export features from the previous layer (“HWU_habitat_pd_peCultivated25ac”) into a new layer recognizable as the Huachuca water-umbel core map, “HWU_CoreMap”.

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