Agua Nueva Water Reclamation Facility 2024-2025 Huachuca Water Umbel Outplant Report

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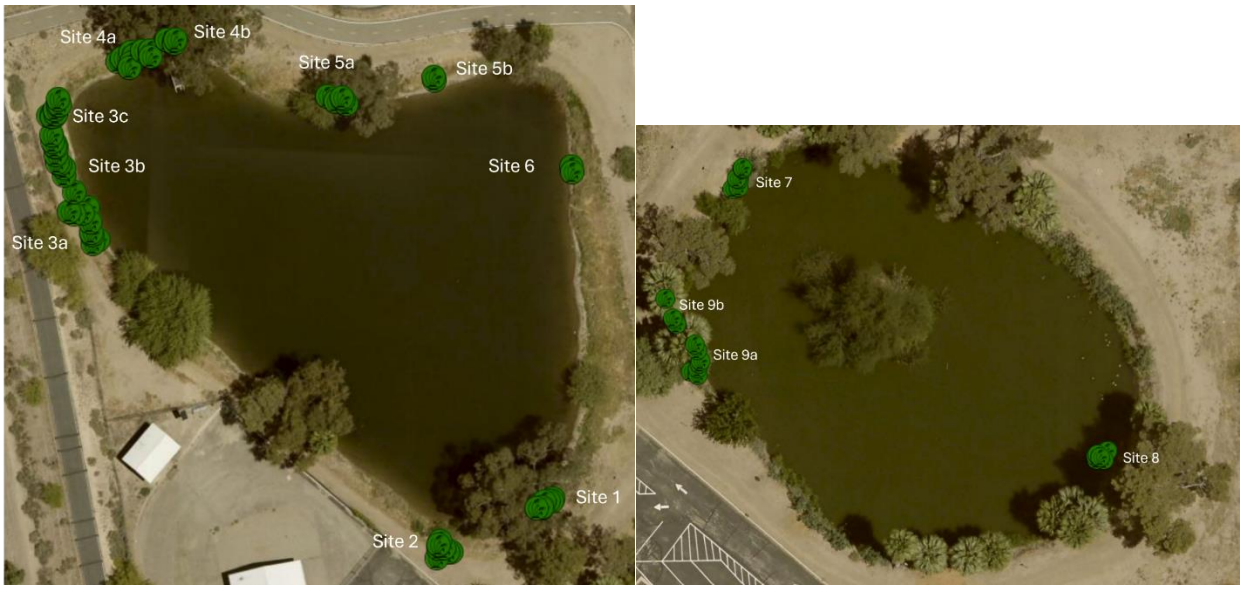
INTRODUCTION

Between October 16 and October 18, 2024, Pima County's Conservation Lands and Resources (CLR) department introduced 89 individual "plugs" of Huachuca water umbel (*Lilaeopsis schaffneriana* ssp*. recurva*) to the 2 ponds at the Agua Nueva Water Reclamation Facility (AN-WRF). This federally recognized endangered subspecies has only 17 known extant populations in the United States (USFWS 2018) and so Pima County has grown plants in its Native Plant Nursery as part of an effort to establish outplant populations on its conservation lands. The particular plants used for this project were grown from the Santa Cruz River clone of the subspecies found in a similar environment to Tucson. Cultivation and the creation of outplants is part of the countywide Multi-species Conservation Plan under which Huachuca water umbel is covered alongside 43 other plant and animal species such as Tumamoc globeberry (*Tumamoca macdougalii)* and the Chiricahua leopard frog (*Lithobates chiricahuensis*) (Pima County 2016). Compared to other outplants, this project is notable for the number of umbel plugs and the variety of sites on the ponds where they were introduced. Because of this, the AN-WRF sites were monitored from fall of 2024 through early spring 2025 to assess plug health and gain insights about growth to apply to future outplant projects.



Figs. 1a and 1b – the northwest (1a) and southeast (1b) ponds at the AN-WRF labeled with site locations and marked with green dots for initial plug locations of Huachuca water umbel outplants.

Methods

Monitoring occurred roughly once every 3 weeks from 10/30/2024 through 03/06/2025 and consisted of repeat photography, recording notes on activity at sites, and taking measurements on the width, length, and height of individual plugs. In addition to assessing the overall growth of the young umbel plants, we wanted to record potential sources of disturbance and protect the plants from them if possible. Some groups of umbel plugs (at sites 1, 4a, 6, 7, 8, and 9a) were surrounded by a chicken wire cage to

protect them from disturbance by wildlife and other animals. All plugs not found to be missing after the 11/20/2024 monitoring session (60 of the original 89) were marked with flags to aid in monitoring and make their presence known to pedestrians. Other specific details of the monitoring process are provided in the document "AN_WRF_HWU_Outplant_2024-25_Protocol.docx." **RESULTS**

Overall growth and survival

More than 50% (58.43% as of 03/06/2025) of the Huachuca water umbel plugs introduced to AN-WRF were able to survive, grow, and spread along the edges of the ponds. The average length and width of plugs increased steadily, with the cespitose nature of Huachuca water umbel growth causing many to eventually merge into larger clusters. After an initial rise in water level that removed plugs at sites 3a, 3b, and 5b, the main factor causing plugs to be unmeasurable on a particular occasion was submersion.

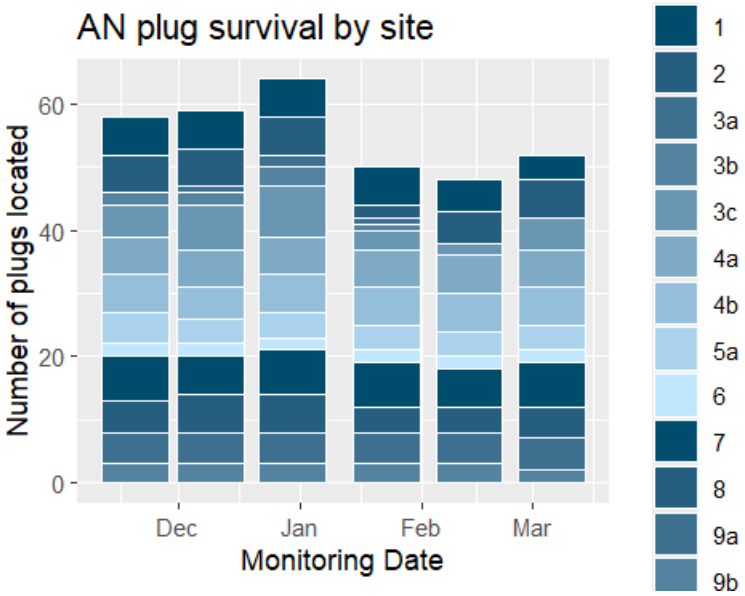
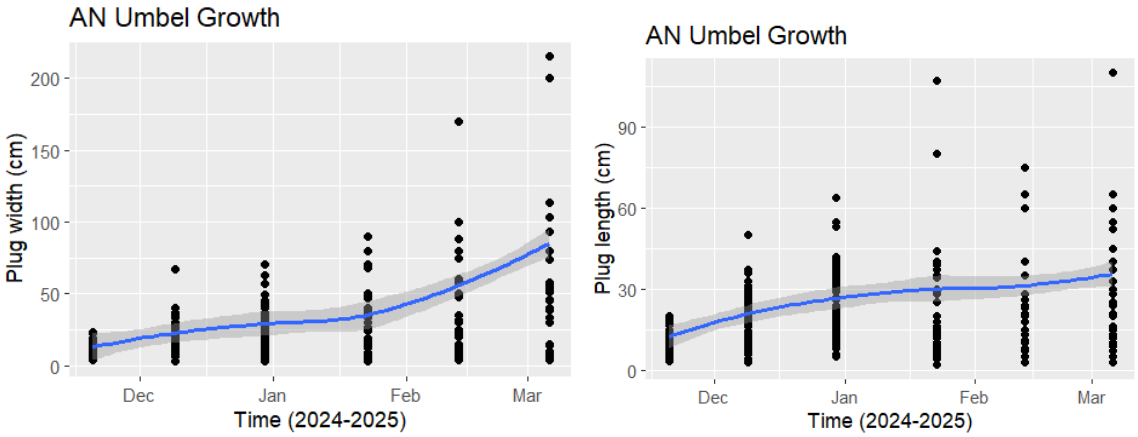
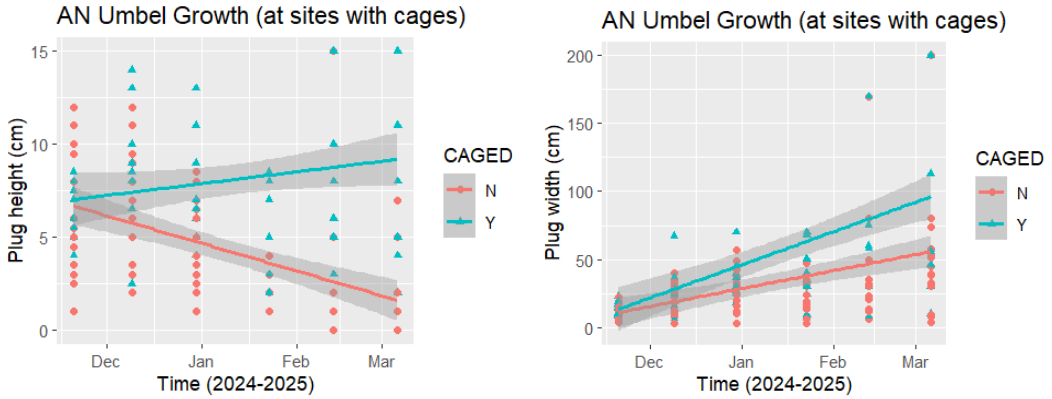


Fig. 2 – Number of plugs able to be located and measured at each site for each monitoring occasion. Note that dark colors begin again for the sites on the southeast pond (7-9b).



Figs. 3a and 3b – Overall changes in width measured parallel to pond (3a) and length measured perpendicular to pond (3b) for umbel plugs. Outliers arose from sites where plugs "merged" and could not be distinguished from each other and so were measured as all having the width or length of the entire merged cluster.

The chicken wire cages benefitted growth significantly by reducing interference and allowing plugs to retain height and spread out along the edges of the pond.



Figs. 4a and 4b – Changes in height and width for caged and uncaged plugs at only the sites where cages were installed (sites 1, 4a, 6, 7, 8, and 9a).

Response to disturbance

Changes in the height of plugs were much more variable and not consistently positive. Plugs that were surrounded by cages avoided animal disturbance and remained taller on average during the monitoring period. The similar pattern of change between caged and uncaged plugs in Fig. 5 suggests a factor separate to animal disturbance affecting all plugs. Judging by the similarity of this pattern to that of overall plug survival and detection (see Fig. 2) I would suggest the depth of water in both ponds to be a major disturbance factor affecting all plugs.

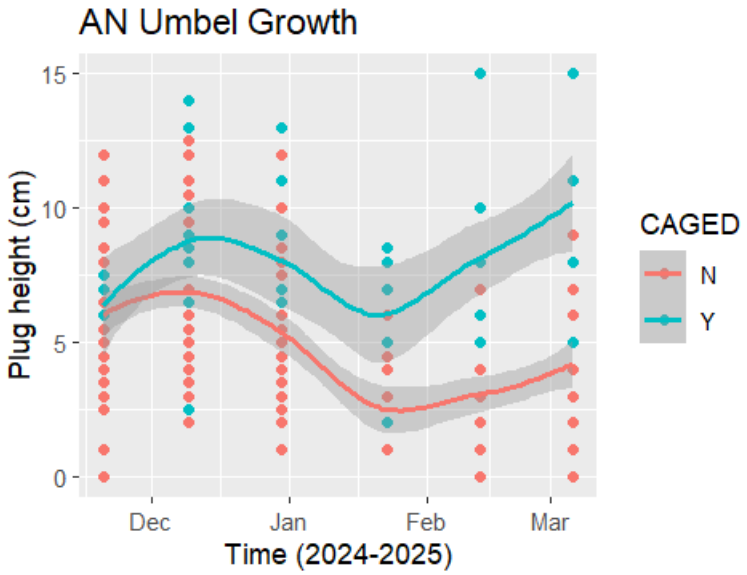


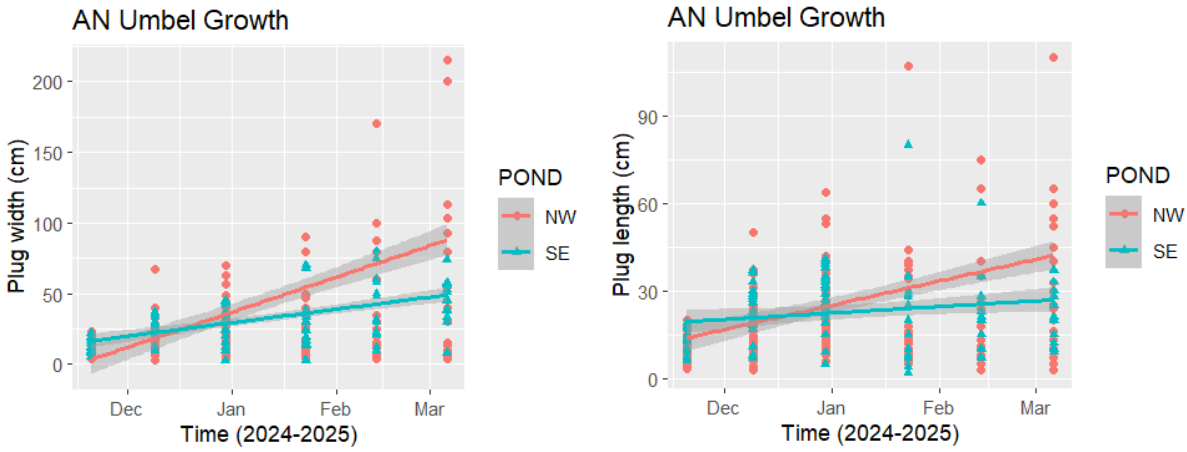
Fig. 5 – Change in heights of caged and uncaged plugs over time.

Fig. 6a – Repeat photography at site 2 on 12/30/2024

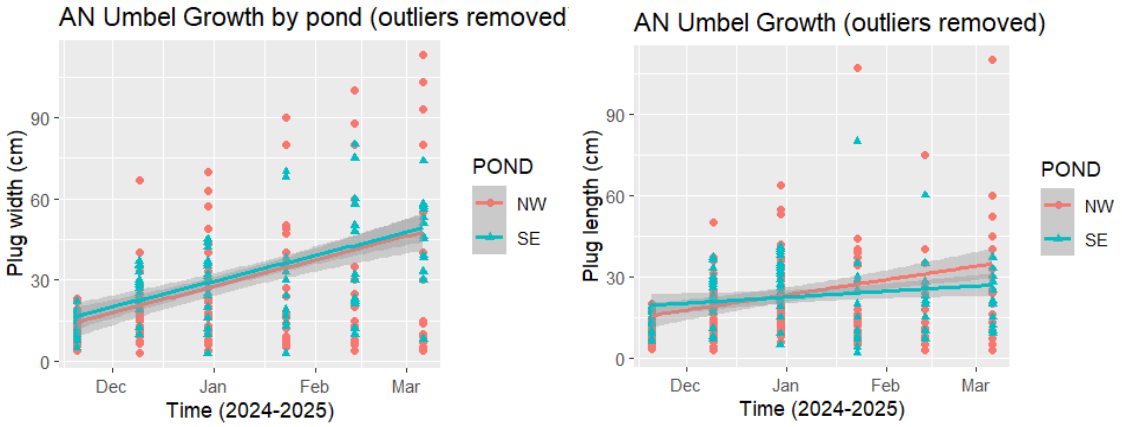
Fig. 6b - Repeat photography at site 2 on 01/23/2025. Note the change in water level and lack of ability to see any plugs from the photo location.

Differences between sites

Initial comparison of growth between ponds suggests that plugs on the northwest pond grew more successfully than those to the southeast. After accounting for the bias imposed by merged plugs (see description of Figs. 3a and 3b) outliers where plug width was measured as more than 150cm were removed and the difference between ponds was found to be much less notable. The existence of more very successful outliers on the northwest pond may owe to the fact that the pond had a much greater number of plugs introduced (66 out of the total 89, with 33 plugs detected and measured as of most recent monitoring occasion 03/06/2025) as well as a greater number of caged plugs (7 compared to 5 on the southeast pond). This greater diversity of plugs and sites may have provided more opportunities for a select few plugs to thrive disproportionately.

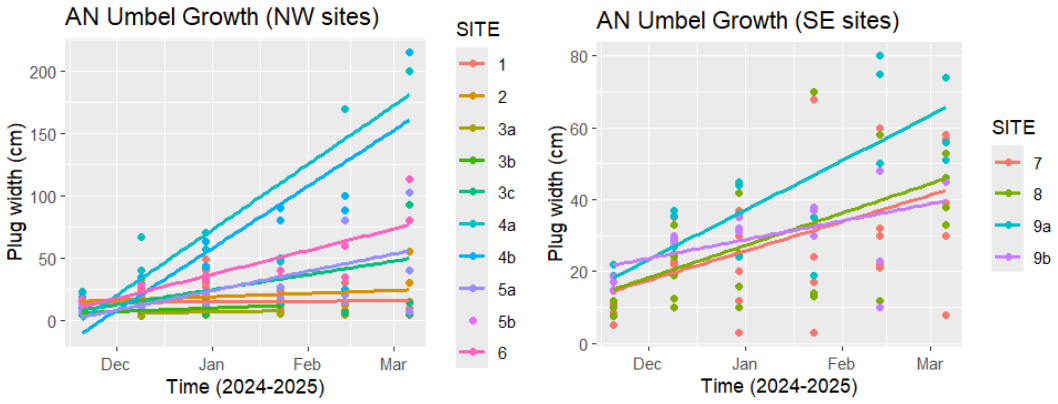


Figs. 7a and 7b – Changes in width and length over time for plugs on the northwest and southeast ponds.



Figs. 7c and 7d – Changes in width and length over time for plugs on the northwest and southeast ponds with plugs where width > 50cm removed.

A multitude of other factors may have been influential to umbel survival and growth but were not measured in a consistent or quantitative way. In Fig. 8a below, note that some sites such as 4b and 5a seem to have plugs increasing in width more efficiently despite not having a cage like the leading 4a and 6.



Figs. 8a and 8b – Changes in plug width separated by individual sites.

RECOMMENDATIONS FOR FUTURE OUTPLANTING

For future monitoring, the most important improvement would be to collect data on factors not consistently measured during this project. The angle of the slope on which plugs are planted seemed anecdotally to affect their survivability. Plugs at the steep sites 3a and 3b were nearly entirely wiped out before the first monitoring occasion. This variable, along with some others like general level of shade, could be measured for new sites on the day when plugs are first introduced to inform future analysis. The relative depth of water in the pond, amount of vegetative competition, and class of disturbance are all factors that appeared to matter for umbel survival and would benefit from being regularly measured for each site or plug. Additionally, merged groups of plugs should be treated as new plugs with new names in data collection to avoid the awkward outliers that come with applying measurements to their constituents.

Based on the data collected during monitoring, I would recommend including cages around new Huachuca water umbel outplants for the first 3-6 months of their development. From observations, I would recommend introducing plugs in flat areas where the soil is regularly saturated with water but further from standing water so as to be submerged less frequently and for shorter durations. Removing vegetation that is very close to the new umbel plugs, especially within cages, is something that was not done during this project (we have scheduled to do it in May of 2025) but would likely benefit new outplants.

References

Pima County. 2016. Multi-species Conservation Plan for Pima County, Arizona: Final. Submitted to the Arizona Ecological Services office of the U.S. Fish and Wildlife Service, Tucson, Arizona.

U.S. Fish & Wildlife Service (USFWS). 2018. *Huachuca Waterumbel (Lilaeopsis schaffneriana var. Recurva)*. https://www.fws.gov/species/huachuca-waterumbel-lilaeopsis-schaffneriana-var-recurva