2013 Funded Section 6 Plant Proposals – AZ

The following proposals were funded in 2013 (Segment 17). Federal shares include Arizona Department of Agriculture administration costs.

1) **Continued implementation of Grand Canyon National Park Recovery Plan actions for sentry milk-vetch (*Astragalus cremnophylax* var. *cremnophylax*)**
Principal Investigator(s): **Janice Busco, Lori Makarick, and Gregory Holm, Grand Canyon National Park**
Federal Share: $12,067

Objective(s): 1) Refine and finalize a habitat model for sentry milk-vetch to select the most appropriate microsites for planting and seeding, 2) Compare phenology and morphology of all now-known South Rim populations in a greenhouse common garden study, 3) Compare phenology and morphology of the three disjunct *Astragalus cremnophylax* varieties, as well as a potentially new taxon from the North Rim, in a greenhouse common garden experiment and perform controlled crosses of all varieties, 4) Provide continued, long-term, consistent monitoring and care of natural and introduced sentry milk-vetch at Maricopa Point, and 5) Continue to develop improved techniques for propagating the species from cuttings.

Final Report Abstract: This important research filled gaps in our knowledge about sentry milk-vetch's ecology and allowed for the greatest likelihood of success at the sites selected for reintroduction. It helped the team determine which of the 26 potential reintroduction sites best met the species' ecological needs, and also guided the selection of the microsites within the larger planting sites. This work allowed park staff to refine the techniques for propagation by cuttings, which reduced the pressure on material collection needs from the limited number of plants at the existing known locations. The concurrent common garden experiments and genetic analyses informed the recommendations and decisions park staff and partners made prior to and during the 2014 reintroduction planning meeting.

2) **Effect of fire on a population of the endangered cactus, *Coryphantha robustispina,* on three pastures of the King's Anvil Ranch, State Trust Land, Altar Valley, Pima Co., AZ**
Principal Investigator(s): **Pat King, Dr. Robert Schmalzel, Kristen Egan, Katie Cline, and Tom Sheridan**, **private** and **NRCS**
Federal Share: $25,556

Objective(s): 1) Conduct pre-prescription burn surveys for Pima pineapple cactus on the King-Anvil Ranch in the Altar Valley, 2) Document burn intensity and coverage, 3) Conduct post-prescription burn surveys and compare individuals before and after the fire to increase our knowledge of short-term fire effects on this species, 4) Relocate plants previously mapped in 1994 and 1997-1998 prior to earlier burning, thus also providing a study of long-term effects.

Final Report Abstract: During several surveys conducted in 2012 and 2013, 48 miles (76.8 km) of 24 two-mile 100-m wide belt transects were surveyed on West San Pedro, East San Pedro and West Mill pastures [King Anvil Ranch, Altar Valley, Pima County, AZ]. The

majority of these belt transects were surveyed in 2013 by a 5-person Southwest Conservation Corp team with Robert Schmalzel. All 24 belts were surveyed at least once under the supervision of Robert Schmalzel. About 170 plants of *Coryphantha robustispina* plants were found in the belt transects of East San Pedro and West Mill, the two pastures for which prescribed burns are planned in May, 2014. With an additional set of 1-ha blocks searched to the east and west of those 1-ha blocks on the belt transects that had two or more plants, 90 more live plants were added to the total for East San Pedro and West Mill. West San Pedro Pasture, which is not included in the pastures to be burned, was surveyed so that long-term post-fire mortality rates of the cohort on the burned pastures could be compared to a cohort on an adjacent unburned pasture. In August and September, 2014, I revisited 251 of the 412 plants (both dead and alive) that had been located by the end of November, 2013. Of the 251 plants, 40 were dead by September 2014. I encountered 19 additional live plants while visiting the 251 plants. The number of plants captured by the surveys, ca 250 in the pastures to be burned and 77 in the unburned adjacent pasture, should provide enough plants to test several null or no effect hypotheses.

3) **A workshop to develop survey and monitoring protocols for Fickeisen's plains cactus**
Principal Investigator(s): **Dr. Steven W. Carothers and William Cardasco. SWCA** and **Babbitt Ranches**
Federal Share: $9,611
Objective(s): 1) Review current monitoring and research efforts related to Fickeisen's Plains Cactus population assessment, 2) Develop range-wide, standardized protocols for surveying and monitoring, and 3) Enhance communication among biologists and managers involved in monitoring efforts. Asking they invite Drs. Baker and Cockman (see below).

Final Report Abstract: In partnership with Babbitt Ranches LLC and their Landsward Foundation, the Flagstaff Office of SWCA Environmental Consultants (SWCA) co-hosted a "Workshop to Develop Survey and Monitoring Protocols for Fickeisen Plains Cactus." Overall, the workshop was successful in producing quality discussions of survey protocols and bringing together managers and biologists to share knowledge and ideas on surveying and monitoring. Points raised during the workshop were incorporated into the draft protocols.

4) **Peebles Navajo cactus: Characterization and assessment of phenotypic attributes between two populations near Joseph City, Arizona**
Principal Investigator(s): **Dr. Jony Cockman, Bureau of Land Management**
Federal Share: $9,889

Objective(s): 1) Measure and compare phenotypic characteristics between two metapopulations of Peebles Navajo Cactus located one mile apart near Joseph City, 2) Count individual cacti at both populations, 3) Re-read plots established in 1979 and read periodically since, and 4) Provide reconnaissance of additional potential habitat. Researcher will coordinate both with Dr. Baker (see below) and with Dr. Phillips who established and read the plots historically, as well as, will attend the workshop of Dr. Caruthers (see above).

Final Report Abstract: The primary purpose of this research is to 1) provide surveillance through areas of potential habitat 2) provide an estimate of the number of cacti already in

protection 3) provide pilot testing of morphological attributes selected by Baker (2014) 4) collaborate with a work group organized by SWCA Environmental Consultants to discuss inventory and monitoring methods (SWCA 2014). The first objective was not accomplished due to droughty field conditions which prevented new surveillance work. The second objective consisted of utilization of existing data for the Phillips plots, reconnaissance of the 250 acre exclosure constructed in 2013 and re-examination of the Butterwick plots. In addition, a review and update of the US Fish and Wildlife Service Conservation Recommendations is provided with this report.

5) **Improved genetic resources for the study of Huachuca water umbel**
Principal Investigator(s): **Dr. Shannon Fehlberg, Desert Botanical Gardens**
Federal Share: $11,178

Objective(s): Augment a previous population genetic study that described diversity within and among populations of Huachuca water umbel by adding new microsatellite data to the existing data set. The previous study provided significant information about the likely importance of clonal growth, the low amount of genetic diversity maintained in populations, and the distribution of genetic diversity across the species' range. Results also showed that additional microsatellite markers are necessary for definitive conclusions to be made.

Final Report Abstract: Population samples were collected from 13 sites across the range (287 total samples), and genetic diversity data were gathered for 13 microsatellite regions (5 of which were discovered to be monomorphic). Results of genetic data analyses of eight variable microsatellite regions revealed that most populations are dominated by a single multi-locus genetic clone; only two populations have more than one multi-locus genetic clone present (represented by more than one individual). Genetic diversity is very low within populations, but genetic differences do exist among most populations. Those populations that are very similar to one another are likely experiencing recent or ongoing gene flow. Conservation considerations should include preserving a number of distinct populations, maintaining local population connectivity, and determining the environmental and ecological factors that promote the establishment of new clones and/or sexually-produced seedlings within populations.

6) **Monitoring of *Cimicifuga arizonica* (Arizona bugbane, Ranunculaceae) populations on Bill Williams Mountain related to Forest Service plans to burn the mountain**
Principal Investigator(s): **Glenn Rink**, private
Federal Share: $1,289
Objective(s): Information on the resiliency of Arizona bugbane to fire is lacking. This research will continue the collection of monitoring data on the Bill Williams Mountain population of Arizona bugbane, which was collected every five years between the 1990s and mid-2000s. Collecting data this year is critical for a pre-fire comparison, as the US Forest Service will carry out a prescription burn through the population in the next few years. Follow-up monitoring for plant response will be necessary and will inform management decisions regarding fire disturbance and the response of this species.

Final Report Abstract: We conducted monitoring of long-term plots and compared results with previous monitoring efforts. The population has steadily increased up until the 2005 visit, with a slight decline since 2005 until 2013, while the number of fruiting stems has continued to increase.

7) **Demography Studies for *Carex specuicola* (Navajo sedge, Cyperaceae)**
Principal Investigator(s): **Glenn Rink,** private
Federal Share: $13,524
Objective(s): 1) Further document and verify the furthest north populations of *Carex specuicola* at Natural Bridges National Monument and vicinity in Utah, 2) Establish a monitoring protocol for *Carex specuicola* that is repeatable and will provide an objective measure for determining population trends and changes in hydrology over time; will apply this protocol to eight populations across the range of the species within the Navajo Nation, as well as any Utah populations found, and 3) Document unoccupied habitat.

Final Report Abstract: This work documents our initial monitoring work for the Federally Listed Threatened plant, *Carex specuicola*, (Navajo sedge) at nine hanging gardens on the Navajo Nation. We also surveyed for *Carex specuicola* on Cedar Mesa, in southeastern Utah, at the northern limit of its range, where it was previously poorly documented. We documented *Carex specuicola* at 24 hanging gardens or springs (sites) where it had not been previously documented. These 24 sites were grouped into 8 new Element Occurrences. For the purposes of this report, an element occurrence is defined as a site or group of sites harboring *Carex specuicola*, all within 1 kilometer (km) of each other and within the same canyon (for further discussion, see Methods: Documentation of *Carex specuicola* in its northern range. Lastly, we revised the Arizona Game and Fish Department Abstract for *Carex specuicola*.

8) **Distribution and morphological studies of *Pediocactus peeblesianus* (Cactaceae)**
Principal Investigator(s): **Dr. Marc Baker**, private
Federal Share: $21,873

Objective(s): Conduct field surveys and use existing data in a multivariate study that compares the degree of morphological variation of stem characters within populations to that among populations of *P. peeblesianus* throughout its known range. Work will be done in cooperation with the BLM (including Dr. Cockman above), USFWS, Babbitt Ranches, USFS, and the Navajo Nation; will participate in the workshop of Dr. Carothers (see above).

Final Report Abstract: A study was undertaken to determine whether there are groups of populations within Pediocactus peeblesianus that possess combinations of morphological characters that are significantly different between or among groups and whether any such groupings correlate with geography. A total of 323 individuals were measured for 17 stem characters in 11 populations, including three populations of the outgroup, *P. sileri*. The data suggested no practical manner in which to segregate groups of populations within *P. peeblesianus*, and that several morphological groupings of populations are possible, none of which correlate well with geography. A weak morphological cline occurred from west to east, in which central spines increase in number and length, and radial spines decrease in

thickness. Values for four characters correlated significantly for those for stem diameter, indicating that a significant amount of the morphological variation within *P. peeblesianus* can be explained by plant size. Historically, *P. peeblesianus* var. *peeblesianus* were evidently based on neotenous individuals occurring on very shallow soils, while those of *P. peeblesianus* var. *fickeisenii* occurred on deeper soils and from farther west along the cline.