

Final Report to NFWF: Youth Engaged Stewardship YES! at the Las Cienegas National Conservation Area in Southeast Arizona (AZ), National Fish and Wildlife Funding Initiative: Project ID: 2100.16.051716

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Project Work Accomplishments and Status Summary: Youth Engaged Stewardship YES! Projects at the Bureau of Land Management (BLM) Las Cienegas National Conservation Area.

YES! in 2016: YES! youth participated in several projects including inventory and monitoring of critical riparian habitat zones. YES! youth also tested water quality and sampled macro-invertebrates to measure habitat pond health, and transplanted milkweed around the pond banks. The participants developed and implemented restoration strategies for Sacaton Grassland experiencing rapid die off, dramatic increases in soil salinity, and overall landscape desertification and biomass reduction. Based on discussions with scientists from the University of Arizona and The Nature Conservancy, participants hypothesized that these were all secondary effects of water being unable to infiltrate due to a variety of land use and natural processes. Youth devised several strategies for mitigating the negative effects on biomass and increasing moisture absorption. Sixteen one-meter experimental plots were remeasured from 2015. Youth also planted alkaline tolerant Sacaton grass plugs, and transplanted cryptobiotic soil crusts in control areas, i.e. cattle exclusion fences, and uncontrolled sections.

300 alkali-tolerant Sacaton grass plugs were distributed across plots, and healthy bio-crust, i.e. cryptobiotic soil, was transplanted to aid in water infiltration and mechanically assist in plant establishment. In addition to plots, the group installed 2 French-style drains, i.e. large holes filled with gravel and rock to reduce soil-surface compaction and mitigate the spread of bare patches within the grassland. All efforts were documented with GPS and field data sheets to establish baseline plot data. Youth participants organized and hosted a summer volunteer event to aid their restoration efforts on the Sacaton experimental plots. Students completed their summer restoration work by communicating the importance of grasslands to watershed health, and restoration initiatives they had implemented by designing educational signage for the site. The sign was completed and installed in January 2017 by past YES! participants and Empire High School students (sign funded by a BLM grant).

Continuing Work: Empire High School (Vail) students monitored study sites through the academic year, specifically collecting data on the enclosed study plots at the Gardner Sacaton site on soil stability, pH, and, biocrust and alkaline sacaton survivability. Students continued to monitor 3 habitat pond sites, collecting water quality data and macro invertebrate counts. On March 25, 2017, twelve Empire students held a volunteer workday and removed invasive aquatic plants from 2 habitat ponds.

YES! in 2017: Youth participated in several inventory and monitoring initiatives during this season. Associated activities included monitoring and inventory of endangered Blacktailed

Prairie Dog colonies, archaeological survey, and historic site documentation, but the focus was on a major desert wetland (i.e., "cienega") habitat restoration effort. Participants also organized volunteers for an extensive invasive plant removal and habitat restoration initiative at the Cieneguita Wetlands, critical habitat for several special designation species including Mexican gartersnake (*Thamnophis eques*), Gila Topminnow (*Poeciliopsis occidentalis*), Desert Pupfish (*Cyprinodon macularius*), Chiricahua Leopard Frogs (*Lithobates chiricahuensis* syn. *Rana chiricahuensis*), and Huachuca Water Umbel (*Lilaeopsis schaffneriana* subsp. *recurva*). Students took water quality samples to assess habitat viability and quantify solubilized lead oxide levels at multiple wetland locations (as a result of land use, hunting mainly, results in progress). Participants also worked closely with National Park Service Sonoran Desert Network biologists to establish wildlife camera wildlife occupancy and human land use protocols, which were installed cooperatively with BLM managers and researchers.

Continuing Work: The Empire High School students monitored study sites in the 2017 and 2018 academic years with special attention placed on re-measurement of the Gardner Sacaton restoration site, and continuous monitoring of water quality data at 2 habitat pond sites. Students assessed wildlife camera captures and maintained photo documentation. One volunteer day was held to remove aquatic invasive species from 2 habitat ponds.

YES! in 2018: Participants inventoried Blacktailed Prairie Dog populations, collected wildlife camera trap occupancy data, re-measured Sacaton restoration areas, documented a historic site and collaborated with BLM archaeologists to implement a resource preservation strategy (Hummel House), and inventoried and restored critical riparian habitat (Cottonwood and Bill's Pond). Youth focused the majority of their efforts on wetland critical habitat restoration. More specifically, participants transplanted wetland plants, stabilized stream and pond banks, re-routed water inputs to increase oxygen levels in riparian habitats, established hibernation areas for specially designated species (spp. noted in 2017 summary), and measured water quality.

Continuing Work: Two YES! interns were selected for post-season work to monitor wildlife cameras. Empire high school students will continue to monitor habitat ponds and the sacaton site. They will be establishing hibernation areas for threatened and endangered species at 2 new habitat ponds with materials purchased by the YES! 2018 students. A minimum of 2 additional volunteer days will be scheduled to remove invasive aquatic species from ponds. On Sept. 26, 7 seniors from Empire High School worked the Research Ranch pond to improve habitat.

Activities and Outcomes

2016: 1.1 hectares (2.6 acres) of Sacaton grassland habitat restoration, i.e. transplanting of grasses and living soil crusts; installation of drainage systems. Treatments were successful (observed 2017 and 2018) and have likely stayed the collapse of the grassland system and expansion of desertification in this particular area.

The experimental approach initiated by YES! participants was a rigorous approach to grassland restoration. Students applied multiple treatments in order to determine what action

would have the best success in mitigating grassland recession. Over the 2017 and 2018 season these experiments were monitored closely, and all treatments and installations had a positive effect, with some clearly encouraging strong plant recruitment and survivorship. The design of these successful initiatives at the Las Cienegas National Conservation Area (LCNCA) were part of a discourse with academics, land managers, and ranchers. As a result, YES! students have advocates for their restoration methods at the BLM, The Nature Conservancy, University of Arizona, Northern Arizona University and among the southern Arizona ranching community, and their approach has already begun to permeate through the management community^[2]. Further, participants have broadly engaged the communities in southern Arizona, inspiring conservation advocacy via outreach, public education on public lands, volunteer restoration and conservation events, and collaboration with land managers and stakeholders.

In addition, these results were achieved with the help of many volunteers from Tucson, Vail, and the surrounding areas. Many of these individuals were not familiar with the concept of public land, land management, or ecology in general. Youth participants educated individuals unfamiliar with the area. They discussed the connectivity of the LCNCA with important aspects of human-natural systems, a good example being the Vail water supply. This education clearly inspired volunteers to develop personal connections with the LCNCA, and to become advocates for the area.

2017: Plants were transplanted to establish 1 hectare (2.5 acres) of critical riparian habitat and to stabilize eroding banks (Bill's Pond), and invasive plant mitigation and habitat restoration over 1.7 hectares (4.2 acres) of critical riparian habitat at the Cieneguita Wetlands. Wildlife camera trap occupancy protocols were implemented for continuous documentation and monitoring. Students re-measured and monitored previous restoration efforts, i.e. the Frog Project, Sacaton grassland restoration, and produced reports.

The primary habitat establishment at Bill's Pond is an important step in creating a highly connected landscape scale critical habitat matrix in the Cienega Watershed. The pond is an ideal location for two reasons. First, the pond is located near an ephemeral water source that, during certain times of the year, becomes a 'highway' for the aforementioned species of special concern. It is relatively common here to have weather events, i.e. mechanism for moving native plants, fish, and invertebrates, to connect continuously to the Rillito and Santa Cruz Watersheds. Second, the pond is ideally located in a large dry season habitat gap, i.e. it provides an important seasonal refuge for animals and will over time increase survivorship, diversity, and provide necessary habitat and resources for nearly all fauna species utilizing the Cienega Watershed. As with previous years, participants also have a strong community impact through outreach, education, volunteer restoration and conservation events, and collaboration with land managers and stakeholders.

2018: Plants were transplanted to establish 1 hectare (2.5 acres) of critical riparian habitat, hibernation structures were built added to restoration areas, and mechanical habitat alterations were made to improve long term water quality and plant/animal survivorship^[3]. Students produced written and photo documentation on the Hummel House and surrounding area and submitted to BLM archaeologists. Wildlife camera data were compiled and submitted to BLM biologists.

Similar to the 2017 season, the participants focused on increasing habitat connectivity and establishing critical riparian refugia for at risk species. Secondary benefits, such as

dispersal of species via seasonal flooding, will in many years reach as far as Vail, the Rillito, and the Santa Cruz. There are also extensive benefits for local and migratory animal species and plants, i.e. necessary habitat, availability of nutritional resources, and increased landscape resilience.

Formal Program Evaluation:

In 2015 we engaged Dr. Amanda Jaksha to conduct a formal evaluation of the Youth Engaged Stewardship Program in order to measure program success and identify areas for improvement. The evaluation aimed to answer the following questions:

- Are we meeting the goals of the program?
- Which parts of the program are the most valuable and which are the least valuable?
- Do participants participate for fun and because they get a stipend or does it impact them in a larger way? How has the program changed the youth?
- Is time used effectively as possible during the program?
- 2-3 recommendations for moving forward.

This program evaluation of YES! was conducted by analyzing surveys from 8 mentors and 8 participants after they had been involved with YES! 4 mentors were also interviewed over the phone about their experiences with YES! Both participants and mentors mentioned that a strong and successful component of YES! is leadership skill development. Participants noted the importance/applicability of these skills to their current endeavors. Below are four recommendations based on the findings of this evaluation.

- Continue focus on leadership skill development. Both mentors and participants spoke to the development of participant's leadership skills the benefit of developing these skills for future endeavors.
- Clarify the schedule for mentors at the start of the program and share any updates as they are available. The schedule should include date, time, location, and who is required to attend.
- Consider ways to help participants stay involved with land management projects after YES! has ended.
- Improved tracking of current and past participants would assist with conducting future program evaluations and provide a way to let participants know about other opportunities. Consider putting participants in charge keeping these type of records and reaching out to alumni as part of leadership skill development.

Evaluation Results and Discussion

The YES! program had major effects in both social and ecological spheres. Above specific participant actions were briefly summarized; however, the full extent of these actions is difficult to quantify for several reasons. Primarily, restoration initiatives have tenuous beginnings, and true success needs to be measured in the long term, i.e. decades and not years. Further, ecological drivers are in a state of flux and to fully assess the sustained impact of many projects we simply need to wait and observe interactions with a changing climate and landscape. Similarly, the social effects, especially community involvement and advocacy, can only truly be reflected upon after a period of time has passed where some sustained action and involvement has occurred. In a program such as YES!, it is difficult to track such grassroots advocacy (aside from anecdotally or individually) without it becoming the primary draw of labor and research in

itself. For the purposes of this report, we will discuss program initiatives based on the language of the original NFWF funding proposal, the current observed status of each, and finally report on an external program evaluation that independently measures program efficacy.

The first major funding strategy of the grant is habitat restoration. Our initial proposal noted that we would do the following restoration and monitoring: “1 acre in 3 locations, transplanting of native plants, sedges and other BLM approved plants in wetlands and ponds, removal of bulrush and cattails in wetland areas and aquatic ponds,” and, “2 acres monitoring for success of 2015 treatments to restore sacaton grasslands along Gardner Canyon and new treatments for bare spots.” We worked on habitat restoration and monitoring at three primary sites - Gardner Canyon Sacaton Flat, Cottonwood Pond, and Bill’s Pond. Total habitat restoration acres in our project amount to 5.61 treated or preserved acres, and monitoring comprised 68.84 acres (See Table 1). Following are summaries of observed restoration results, and considerations for work in the near future.

At the Gardner Sacaton Flat we observed a dramatic shift in local desertification processes, i.e. expanding patches slowed or stopped growth and native vegetation partially or fully infilled and spread through bare patches. Most recently (summer 2018) the entire restoration area was covered in Carelessweed (*Amaranthus palmeri*). We expect that these shifts will aid in water infiltration, benefit soil health, reduce increases in soil salinity, and potentially provide a successional pathway to a fully restored Giant Sacaton Grassland. It is important to mention that local ranchers have documented the water table in this area to have dropped to just below the level of the adjacent Gardner Canyon. Long term health of this Sacaton flat therefore will therefore require close monitoring and, likely, rehabilitation initiatives for the deeply incised drainage in order to bring the water table up to an accessible level for the vegetation.

| Site Name | Field Season | Area Treated (Acres) | Area Monitored (Acres) |
|---|------------------|----------------------|------------------------|
| Bill’s Pond | 2017, 2018 | 2.21 | 2.21 |
| Blacktailed Prairie Dog Reintroduction Site | 2016, 2017, 2018 | 0 | 13.4 |
| Cottonwood Pond | 2016, 2017, 2018 | 0 | 2.75 |
| Empire Gulch Hist. Site | 2017 | 0.2* | 0.2* |
| Empire Orchard | 2016, 2017 | 0 | 35* |
| Gardner Canyon/Sacaton | 2016, 2017, 2018 | 2.1 | 2.1 |
| Hummel House | 2018 | 1.1* | 2.98* |
| Totals | N/A | 5.61 | 68.84 |

Table 1. Area actively restored and monitored with NFWF funding. Note that an asterix in the “Area Treated” or “Area Restored” column denotes historic site preservation work and not habitat restoration.

We proposed to include “80 volunteers comprised from YES! youth, YES! interns, other student and adult volunteers and students from field trips in 2016 and 2017. Over the duration of our work, we engaged 232 volunteers in over 5500 hours of participation in three summer seasons plus volunteer events and school class on-site activities.

Engagements during the grant period

- YES! 2016 Summer Sessions and associated Volunteer Day July 9, 2016
- Empire High School Advanced Desert Ecology students throughout 2016 academic year
- January 17, 2017 Sacaton Restoration Sign Installation
- March 25, 2017 Volunteer Event at the Cieneguita Wetlands
- April 24, 2017 Esmond School at the Gardner Canyon Sacaton Site
- YES! 2017 Summer Sessions and associated Volunteer Day July 8, 2017
- Empire High School Advanced Desert Ecology students throughout 2017 academic year
- April 2018 Volunteer Event at the Cieneguita Wetlands
- YES! 2018 Summer Sessions and associated Volunteer Day July 14, 2018 at Bill’s Pond
- September 26, 2018 Senior Volunteer Day at the Research Ranch Pond
- YES! graduations 2016, 2017, 2018 included parents, grandparents, mentors, siblings, friends, and school officials.

| Numbers of Participants by Year | YES! participants | YES! Interns | Other Youth | Total youth participants | Adults Volunteers | Total Participation |
|---------------------------------|-------------------|--------------|-------------|--------------------------|-------------------|---------------------|
| 2016 | 11 | 2 | 20 | 33 | 19 | 52 |
| 2017 | 12 | 2 | 74 | 88 | 31 | 119 |
| 2018 | 9 | 6 | 35 | 50 | 11 | 61 |
| Totals | 32 | 10 | 129 | 171 | 61 | 232 |
| | | | | 74% | 26% | |

This table does not include any contracted staff paid for with grant funds nor graduation events.

| Participation by hours | 2016 | 2017 | 2018 | Total | Percentage |
|------------------------|------|------|------|------------|------------|
| Youth | 1240 | 1714 | 1618 | 4,572 | 83% |
| Adult | 351 | 305 | 308 | 964 | 17% |
| Totals | 3607 | 4036 | 3944 | 5536 Hours | |

LESSONS LEARNED:

1. Restoration as an educational tool:

We observed that the YES! program was an excellent educational approach in several ways. Primarily, students were able to experience and obtain first-hand knowledge of environmental needs from working scientists and land managers. In addition, students were challenged to critically think as they integrated new and previous knowledge into original restoration projects. Further, students had the opportunity to measure short term progress, and plan for long term change. Finally, students experienced personal growth in leadership and communication skills, and bettered their conceptual understanding of stewardship of public lands.

The experiential, and subsequently personal, approach to ecological education has a very powerful effect on students. The personal relationships that participants developed with Las Cienegas were quite profound. Students are not simply learning a topic. Instead, YES! participants developed extensive knowledge of appropriate management needs, and also a personal relationship to the place. They have become exemplary of the personal investment, advocacy and sense of stewardship needed to maintain and manage our public lands.

2. Effective restoration on a landscape scale: We found that many of the projects undertaken during YES! were ultimately very cost effective. Much of landscape restoration is understood to be prohibitively expensive (i.e. forest thinning to reduce fuels), however this was not our experience. The main costs associated for project work were generally quite affordable, a few hundred dollars for Sacaton plugs, rocks etc. This affordability is in part a product of using native plants and low-tech bottom up style solutions. For example, in our critical zone habitat restorations youth utilized plants that were already growing in a previous restoration area. Plants that would have otherwise been expensive, difficult to find, and potentially contaminated with fertilizers, insecticides and pests were simply just down the road in another wetland. YES! participants proved to be very adept at designing projects with great efficiency, i.e. utilizing a limited budget and local resources to great effect.

Community partners, educators, researchers and academics were also a fundamental part of informing participant projects and maintaining the affordability of restoration. We found that many researchers were very willing to volunteer time to share their findings and assist in project development. Further, the majority of project work was accomplished through community volunteers recruited by YES! participants. This, of course, had the added benefit of educating a larger section of the public in local restoration needs. The firm assistance of the public, land managers, and the scientific community facilitated participant projects that were fundamentally well informed and implemented successfully.

Youth Personal Investment: Perhaps the most important realization that we have had from YES! is the profound capacity of youth to personally and passionately invest in bettering their local landscapes. As educators, we greatly underestimated the drive and empathy that youth brought to these projects. This investment transcended the simple personalization of classroom material, and in fact became a fundamental part of the program's success. More specifically, we found that many participants actively wanted to return and help in successive programs and volunteer events. Further, we were able to rely on these participants as organizers and fundamental drivers for projects. Repeatedly we saw participants and interns readily dedicate summers and other personal time to a landscape that they had learned to deeply care for. YES! students did this with a firm sense of passion, purpose, and empathy for the landscape that is beyond uncommon in youth this age.

Working with partners/mentors:

An invaluable part of the program is the adult mentorship.

Professional scientists, land managers and stakeholders bring experience, differing perspectives and guidance to the students.
 Takes special knowledge and skill to translate material to students, mentors need input and training with working with youth.
 Takes lots of time in coordination and communication to build ongoing relationships.

Engaging volunteers/promoting stewardship:

A substantial piece of the program relied on students and mentors recruiting volunteers. Engaging friends/family and general public in restoration efforts, not just in an informational setting but with novel restoration projects on the land.

Funding Strategy:

Since the inception of the YES! program with a pilot program in 2012, we have utilized grant and partner funding to cover the basic program expenses ranging from stipends to transportation. The 2012 through 2015 program years provided a baseline of matching hours for each summer session ranging from \$14,000 to \$17,000 each year. Our intentions for YES! program activities during the grant period were to include grants, partner support and in-kind matching for work at the Las Cienegas National Conservation Area managed by BLM Tucson. The original plan was to contract a CWP Project Manager and an Educator to replace the two board members that had completed these roles in 2012-2015. The two board members, however, decided to continue these roles in 2016-2018 permitting the planned \$ 6,000 to be used to support interns and student stipends into 2018.

Year one 2016 involved using BLM grant already awarded to the Cienega Watershed Partnership for educational, youth and outreach activities allowing the 2016 activities to proceed while the NFWF grant was initially awarded and processed. Only \$2,576 NFWF funds were utilized in 2016; \$11,312 BLM funds.

Year two 2017 NFWF funds were utilized heavily to support the YES! activities with only \$1,067 of BLM grant funding.

At the end of 2017, CWP and partners realized that between the underutilized NFWF grant and BLM funds already awarded to CWP, we could support an additional year of work into 2018. CWP requested and received a NFWF amendment to permit the project work to continue through September 30, 2018 with no significant change in the planned programs.

Tables below show use of BLM funding to support the program 2016-2018 and CWP contributions:

Other Federal (BLM) Grants:

| | Contr | Travel | Supplies | Rental | Printing | Insurance | |
|------|------------|------------|------------|----------|----------|-----------|-------------|
| 2016 | \$8,521.00 | \$1,492.00 | \$1,149.00 | \$150.00 | \$0.00 | \$0.00 | \$11,312.00 |

| | | | | | | | |
|------|----------|----------|----------|--------|---------|----------|-------------|
| 2017 | \$792.00 | \$222.00 | \$0.00 | \$0.00 | \$53.00 | \$0.00 | \$1,067.00 |
| 2018 | \$975.00 | \$682.81 | \$107.61 | \$0.00 | \$0.00 | \$250.00 | \$2,015.42 |
| | | | | | | | \$14,394.42 |

Cienega Watershed Partnership Contributions 2016-2018

Cash:

| | | |
|---------------------|--|----------|
| Snacks and Supplies | | \$302.05 |
| Youth tshirts | | \$567.49 |

In-kind hours of board members: \$19, 596

*Included in matching hours below

In-kind matching: With the amending in Sept 2017, the required matching for the project became \$ 84,000. The final matching as of Sept 30, 2018 totals \$ 98,707. The assigned value of hours donated to the project varies by student/youth \$8 to \$15, mentor \$24 to \$45; board \$30 and other adults \$24 generally.

| Planned Matching | | 2016 Actual | 2017 Actual | 2018 Actual | Total |
|-------------------------------|----------|-------------|-------------|-------------|----------|
| CWP Project Mgr | \$3,000 | \$3,438 | \$1,530 | \$2,218 | \$7,186 |
| YES! Educator | \$3,000 | \$3,830 | \$4,200 | \$4,380 | \$12,410 |
| Scientists Mentors Profess | \$7,500 | \$2,660 | \$2,296 | \$600 | \$5,556 |
| Youth Vol Hrs | \$32,000 | \$14,148 | \$21,392 | \$22,970 | \$58,510 |

| | | | | | |
|---------------------|----------|----------|----------|----------|------------|
| Adult Volunteer Hrs | \$2,760 | \$1,154 | \$1,769 | \$1,994 | \$4,917.00 |
| Empire High School | 24,900 | \$2,532 | \$5,064 | \$2,532 | \$10,128 |
| | \$73,160 | \$27,762 | \$36,251 | \$34,694 | \$98,707 |

Actuals include hours (mainly) and mileage at federal rate

Youth Volunteer hours also include Empire HS students