



Water Resources Research Center

College of Agriculture and Life Sciences, The University of Arizona

***“Projects to Enhance Arizona’s Environment:
An Examination of their Functions, Water
Requirements and Public Benefits”***

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Study Purpose and Questions

Purpose

- To assemble information about environmental enhancement projects in Arizona and understand their purpose, design, long-term viability, and public benefits.

Questions

- Who are the key players?
- What are the project's drivers?
- What are the project's benefits?
- How are the projects using scarce water resources?
- What are the lessons learned?



Methodology



Ed Pastor Kino Environmental Restoration

1) Project selection

- Continuing study
- Stakeholder meetings
- Selection criteria

2) Project summaries

- Standardized information
- Sources





San Pedro Preserve

Location and Size: Three miles of river outside of Dudleyville in Pinal County. The restoration area is 850 acres.

Primary Sponsor(s): The Nature Conservancy

Other Sponsors: Arizona Water Protection Fund, US Bureau of Reclamation

History: San Pedro River Preserve was established by The Nature Conservancy in 1997. The area contains Sonoran desert scrub, river terraces and primary floodplain on the San Pedro River. The uplands and terraces have been substantially modified for agricultural and aquaculture uses. A flood in 1993 severely damaged aquaculture ponds and the eroding banks in these areas created an unstable river shoreline. When farming and aquaculture ended the land was invaded with exotic species such as tumbleweed, tamarisk, and Johnson grass.

For most of its history the property was operated as a small livestock operation. The prior owners acquired the ranch in 1963 and operated it as the Sale Cattle Company from 1967 to about 1987. When cattle operations ceased about 40 acres of bottomlands were converted to aquaculture ponds for production of channel catfish, large mouthed bass and other exotic game fish. Aquaculture, pecan and alfalfa cropping continued until early 1993 when there was a flood that wiped out 15 acres of the orchard and many ponds. All but two ponds were allowed to dry up and the alfalfa operations ceased.¹²⁹

Planning Objectives: Overall objectives are to: protect and enhance existing riparian forest habitat; restore native grassland communities on the river slopes and terraces; maintain these communities through a program of prescribed burning; stabilize banks and reestablish native riparian forest in areas where the old aquaculture ponds create erodible shorelines; and develop and demonstrate agricultural techniques for use in large scale habitat restoration.¹³⁰

Current Phase: Monitoring and maintenance the AWPf grant was complete in July 2002.

Phases: Phases of the project included: draft revegetation and monitoring plans (Nov 2000); construct groundwater piezometers, conduct groundwater level monitoring, contour mapping, and install flow meters (Nov 1998 - May 2000); conduct groundwater flow modeling, fluvial geomorphic characterization study (May 2002); plant agricultural research plots (Nov 1998 - May 2002); grade and restore ponds (Nov 99 - May 02); revegetate pond areas (Nov 2001); revegetate stream banks (Nov 2001); construct and maintain preserve fencing (Nov 98 - May 02); and photo point, floodplain and vegetation monitoring (Nov 98 - Nov 02).¹³¹

Recommended or Implemented Plan: Restoration was based on depth to groundwater, which was determined as part of the project. The first step was to install piezometers, monitoring wells, flow meters and establish stream flow monitoring transects. The second step was to overlay the two-foot contour map of the preserve on the groundwater elevation contour mapping. Restoration planning then proceeded based on the depth to groundwater in a given area.¹³²

Restoration of abandoned agricultural fields and ponds consisted initially of repeated forced germination of weed seeds, tilling under of weeds and drilling native seeds into tilled soil. Irrigation was used to supplement natural rains until vegetation was established.¹³³

Monitoring/Management: "Monitoring will be done every fall for a minimum of three years beginning with

the first fall after restoration sites have been planted. Approximately 10-15 permanent transects per site will be established perpendicular to the hydrological gradient using stratified random sampling... Plant species will be recorded at set intervals along each transect using the point intercept method, whereby the identity of the plant(s) intercepting a vertical line is recorded. This information can then be converted to percent cover... Monitoring will continue until the outcome of the restoration can be determined from the data collected and therefore may extend beyond the three-year minimum."¹³⁴

Funding and Cost: Funding for the project totaled \$646,702 and came from the AWPf \$336,127, the applicant \$37,632, BOR \$276,843 and Center Desert Archeology \$5100.

Land Ownership: The Nature Conservancy (TNC obtained a grant from BOR in 1996 to acquire the land.)

Water: Prior to implementation of restoration extensive hydrologic analysis was conducted. This analysis allowed the sponsors to divide up the area based on depth to groundwater and revegetate accordingly. The three classes of areas were: depth to groundwater less than eight feet, between eight and sixteen feet and greater than sixteen feet.

Public Outreach:

Challenges/Lessons Learned: One of the objectives of this project was to determine the best way to recruit Giant Sacaton through seeding in a field setting. In the test plots used for this project they found that germination times vary but that if the seeds are irrigated there is a fair rate of germination. The plot that fared the best was one that received a post seeding treatment of herbicide. It was also found, in this case, that applying mulch to the seedlings did not increase the cover of Sacaton.¹³⁵

The most challenging aspect of this project was weed control and "is possibly the most significant factor influencing the relative success of any restoration project." One lesson learned with regards to invasives is with soils and field preparation. They intended to prepare a seed bed using tractor drawn discs and conduct multiple irrigations followed by disking to kill germinating weeds. The idea being that they would deplete the soil weed seed bank and thus effect weed control. Due to funding restrictions they could only go through this process twice and found that it is not adequate to resolve the weed problems and it creates a seed bed that is as well suited for weed germination as for native seed. A better alternative turned out to use Truax no till range drill that cuts a series of one centimeter deep furrows into with native seed is introduced which minimizes weed seed germination due to disturbance.

They have also found at this site (and others) that extended post germination irrigation favors non-native weeds over native grasses. However, longer-term monitoring may lead to other conclusions.¹³⁶ In general, the restoration team recommends that future restoration projects: "1) Don't depend on irrigation water in the desert country to make a successful project. Irrigation water is an unnatural commodity and its use brings unnatural results. Drought is natural but it is also a major obstacle to successful restoration of native riparian grasslands. Pray for rain at just the right time and don't expect to get it. 2) Be flexible and prepared to adaptively manage the process as new information becomes available or new conditions arise. And 3) Try to design so that the restoration process doesn't depend on a particular team of workers or equipment to accomplish the work as they will change many times."¹³⁷

Other notes: Statement of problems: creation of aquaculture ponds was accomplished w/o the use of clay lining and in place of that the pond bottoms were impregnated with salt to break down soil structure. W/o agriculture and aquaculture and no effort to establish new native vegetation area has been encroached by exotic and other weedy species

Original plan called for grading and restoring cut banks but was later removed due to the archeological sensitivity of the area.

Drivers: Part of TNC campaign to restore and preserve San Pedro River watershed.



Methodology (con't)

3) External review and information validation

- Submitted full draft document to all parties contacted during project
- Stakeholder meetings

4) Verified information

- Distributed survey and summaries
- Conducted additional clarification interviews



Project Water Requirements

Question #1.

Please check the box that apply to your project.

- Project does not require any supplemental water.** No supplemental water was supplied to the project site during any phase of the project and none will need to be provided to support vegetation in its current form. *Please Proceed to question 3.*
- Project Requires only temporary supplemental water.** Water is artificially supplied to the project area for 1 to 3 years to foster the establishment of vegetation. After this period no supplemental water is supplied and vegetation is expected continue to develop with similar characteristics and diversity as during irrigation. *Please proceed to question 2.*
- Project Requires supplemental water to be applied indefinitely into the future.** Project characteristics will change significantly if supplemental water is not supplied to the project area. *Please proceed to question 2.*

Question #2.

Please specify the source of water used to supply water to the project. Please check all boxes that apply to your project.

- | | | | | |
|--|--|---|---|--|
| <input type="checkbox"/> Surface Water | <input type="checkbox"/> Groundwater | <input type="checkbox"/> Stormwater | <input type="checkbox"/> Rainwater Harvesting | <input type="checkbox"/> Effluent |
| <input type="radio"/> Source is Firm | <input type="radio"/> Source is Firm | <input checked="" type="radio"/> Source is Firm | <input type="radio"/> Source is Firm | <input type="radio"/> Source is Firm |
| <input type="radio"/> Source is not Firm | <input type="radio"/> Source is not Firm | <input type="radio"/> Source is not Firm | <input type="radio"/> Source is not Firm | <input type="radio"/> Source is not Firm |

*Water source is firm if there is a contract or agreement in place which guarantees the provision of water to project site for the entire period of time for which supplemental water is required.

Additional Comments

Project Sponsorship

Question #3.

Please specify who is/was the primary sponsor for the project. The primary sponsor is the group or groups who did the restoration work. (This is not funding).

	<input type="checkbox"/> Federal Government	<input type="checkbox"/> State Government	<input type="checkbox"/> Local Government	<input type="checkbox"/> County Agency	<input type="checkbox"/> NGO	<input type="checkbox"/> Private Entity
Please Specify Agency	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Additional Comments	<input type="text"/>					

Project Benefits

Question #4.

Please specify what benefits are derived from the project. Benefits should be considered in a broad definition. Benefits do not necessarily have to accrue to human populations. Please check all that apply.

- | | | | | |
|--|---|---|--|---|
| <input type="checkbox"/> Recreation | <input type="checkbox"/> Education | <input type="checkbox"/> Protection of Watershed function | <input type="checkbox"/> Water Quality | <input type="checkbox"/> Water Quantity |
| <input type="checkbox"/> Knowledge/ Research | <input type="checkbox"/> Economic Development | <input type="checkbox"/> Cultural | <input type="checkbox"/> Habitat | <input type="checkbox"/> Other (please specify below) |

Additional Comments

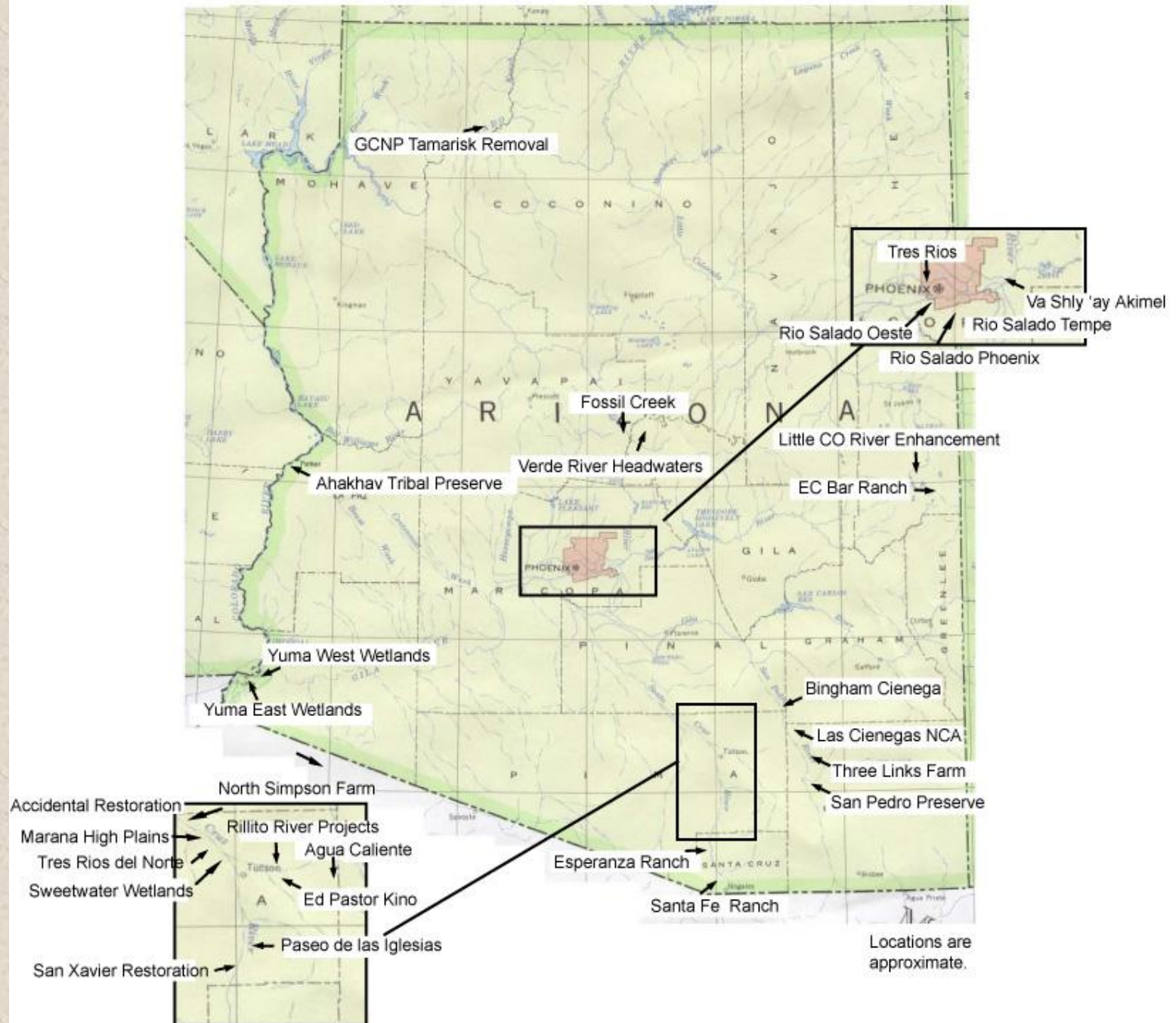


Project List

- Accidental Restoration in Pima County
- Agua Caliente Spring
- 'Ahakhav Tribal Preserve
- Bingham Cienega
- EC Bar Ranch
- Ed Pastor Kino Environmental Restoration
- Fossil Creek Restoration
- Esperanza Ranch
- Grand Canyon Tamarisk Management & Tributary Restoration
- Las Cienegas NCA
- Little CO River Enhancement Demonstration Project
- Marana High Plains Effluent Recharge Project
- Paseo de las Iglesias
- Rillito River Projects
- Rio Salado Oeste, Phoenix, & Tempe
- San Pedro Preserve
- San Xavier Indian Reservation Riparian Restoration
- Santa Fe Ranch Riparian Restoration
- Simpson Farm Riparian Recovery
- Sweetwater Wetlands
- Three Links Farm
- Tres Rios
- Tres Rios del Norte
- Va Shly'ay Akimel
- Verde River Headwaters Restoration
- Yuma East and West Wetlands



Projects to Enhance Arizona's Environment



Findings

- Drivers
- Benefits
- Water Requirements
- Sponsorship
- Lessons Learned

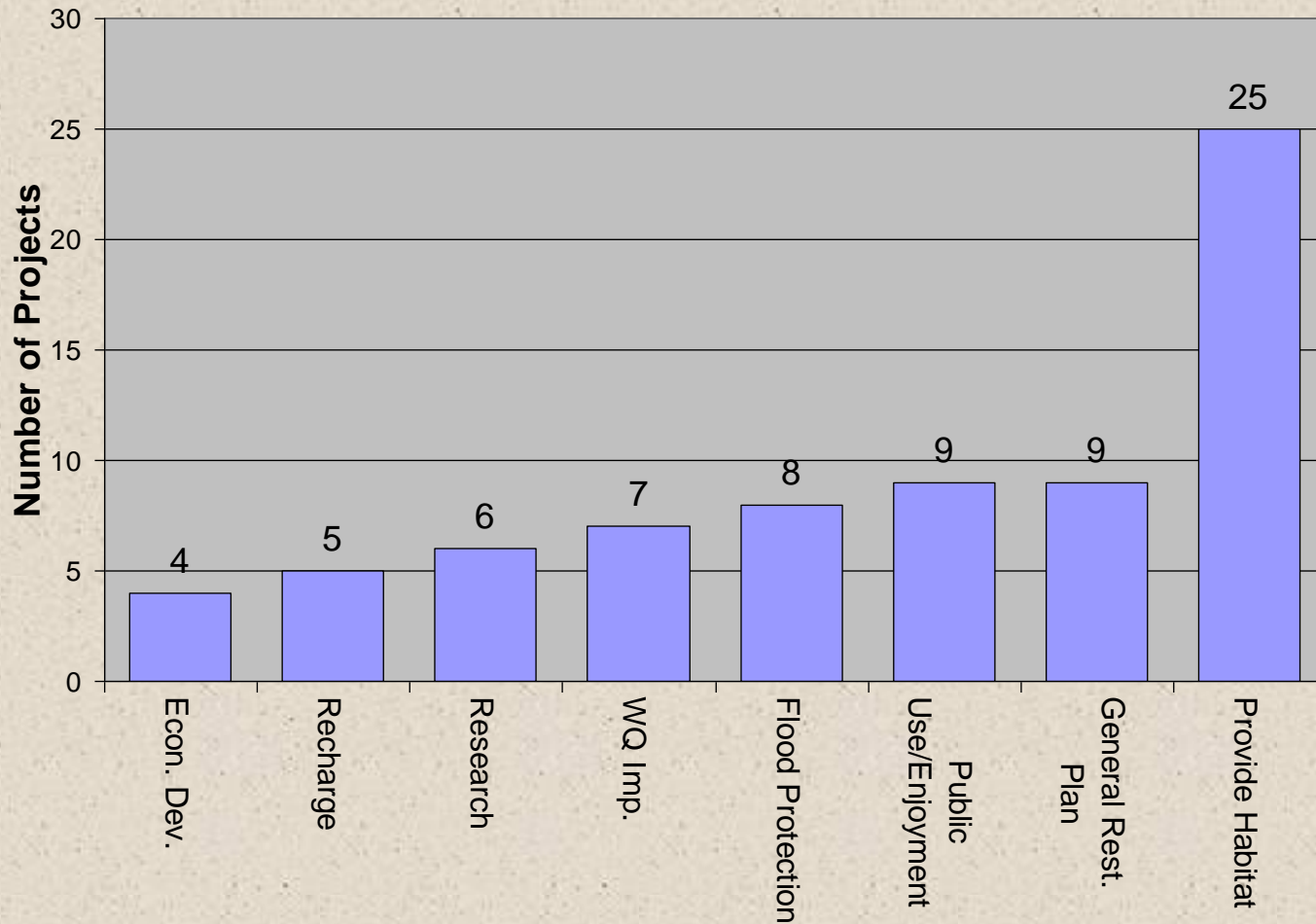


Fossil Creek Restoration



Most Frequent Project Drivers

“Driver” is defined as the primary reason a project was undertaken



Other Drivers

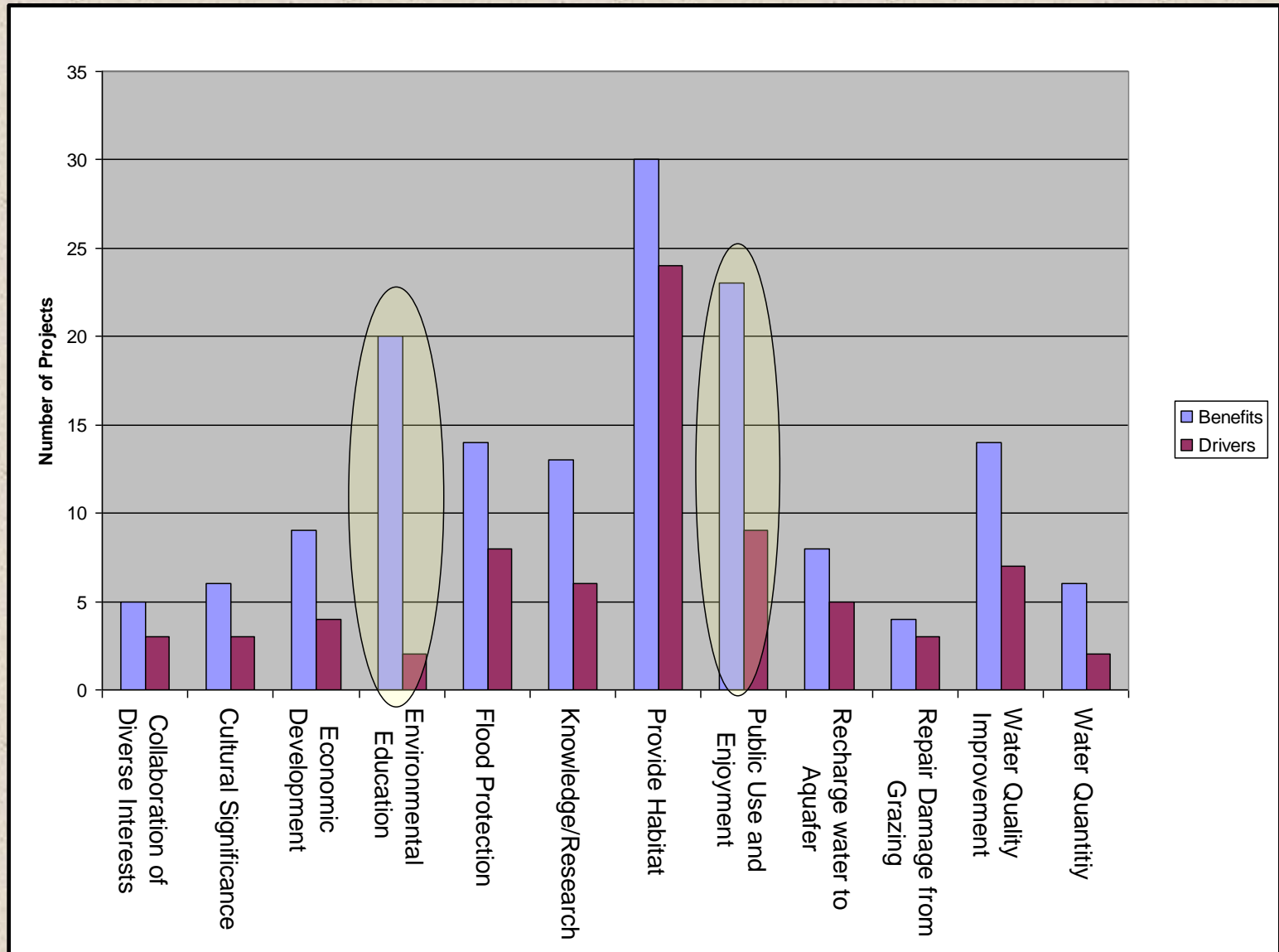
- Collaboration of Diverse Interests
- Cultural Significance
- Multi-use facility
- Prevent Urban Encroachment
- Repair Damage from Grazing
- Environmental Education
- Maintain a Threatened System
- Protection of a Unique Resource
- Water Quantity



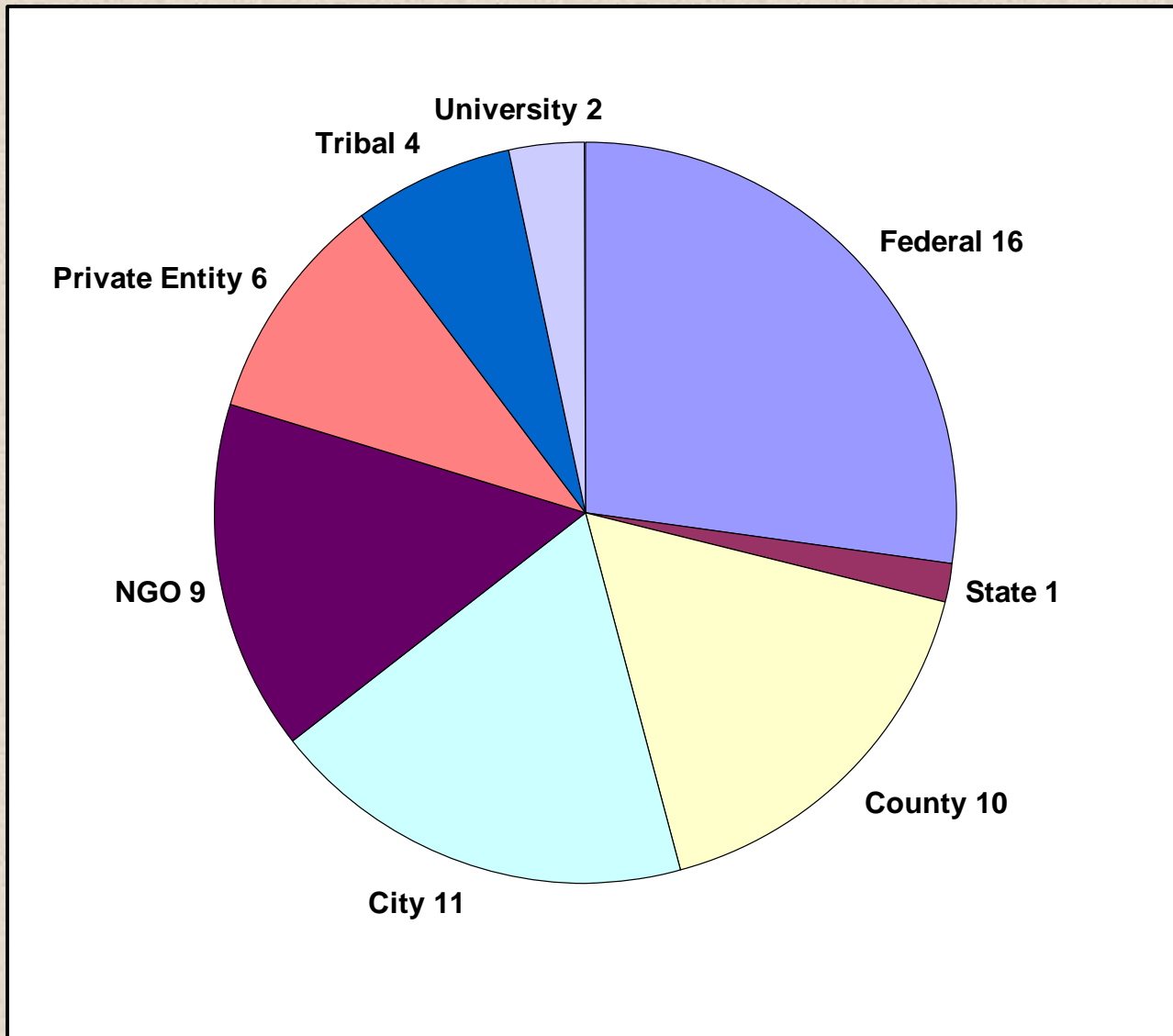
Yuma West Wetlands



Benefits vs. Drivers

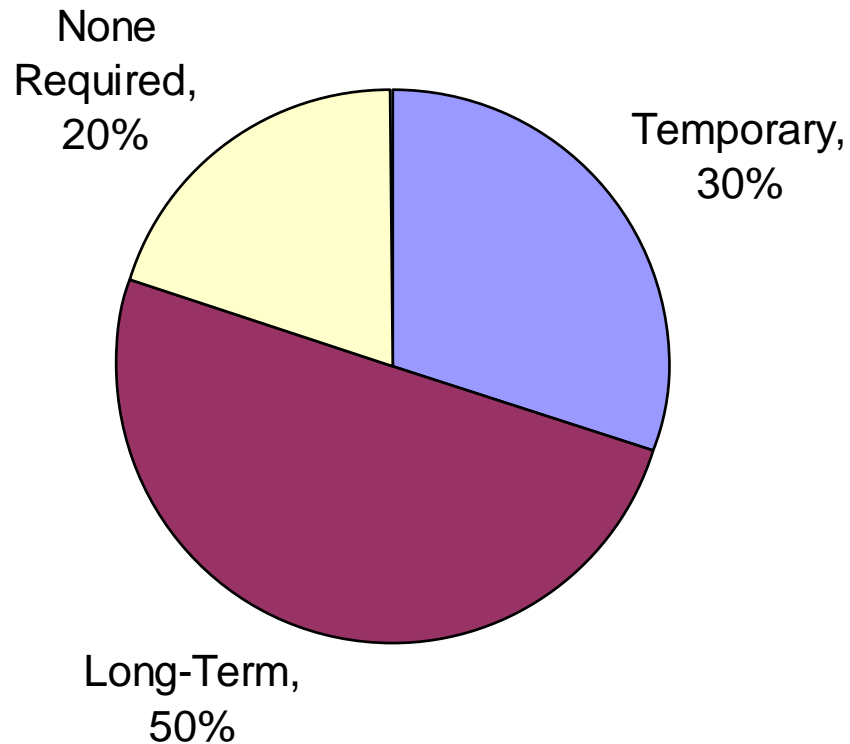


Sponsors

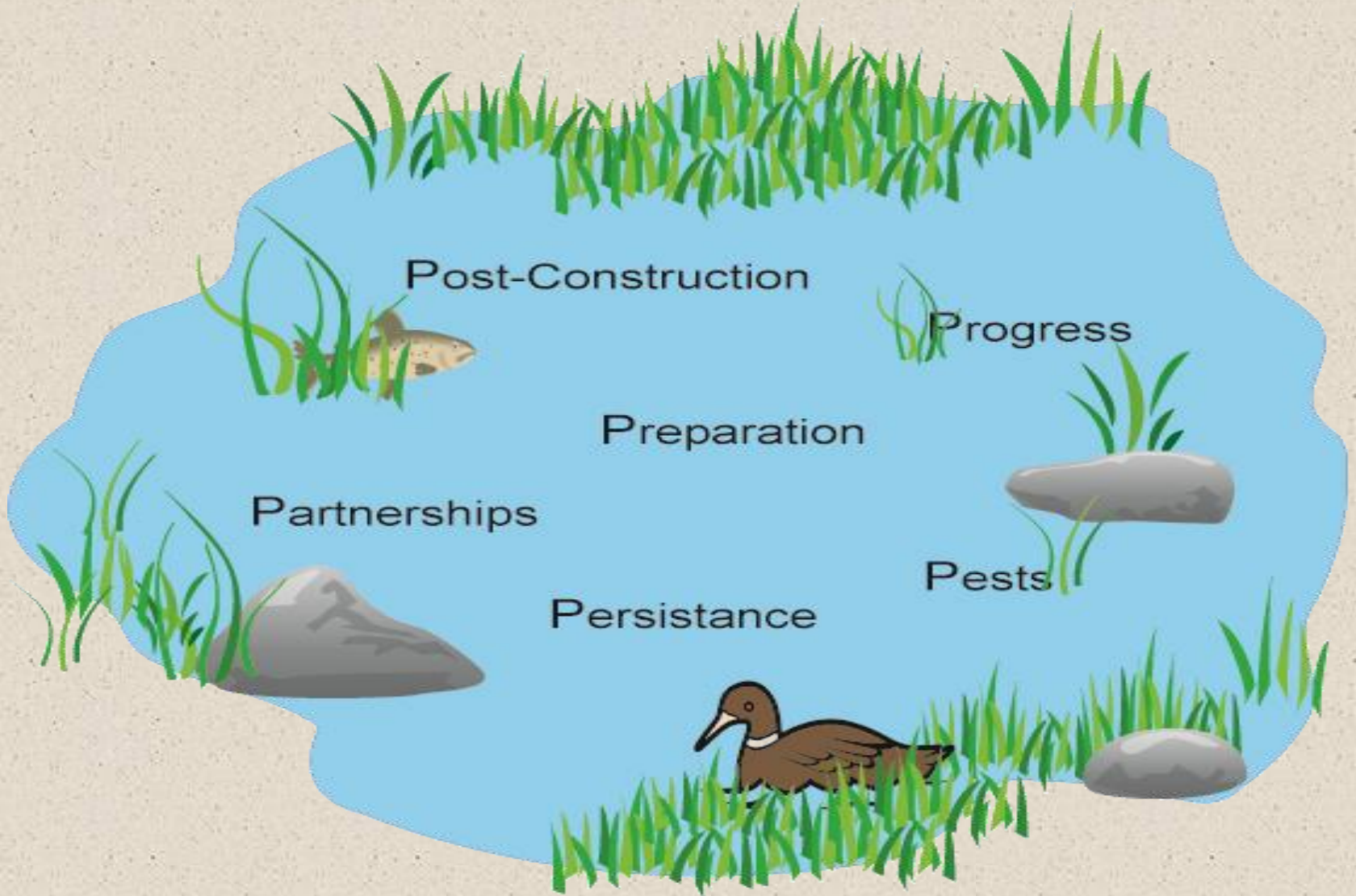


What are the water requirements of these projects?

Supplementary Irrigation Requirements



6 P's in the Pond



Preparation

- Increased pre-construction information
- Foreseen and unforeseen adverse conditions
- Permitting and bureaucratic navigation
- Costs



Rio Salado Phoenix



Partnerships



EC Bar Ranch

- Benefits from combining efforts
- Crossing property lines and jurisdictions
- Communication with stakeholders and property owners



Progress

- Little use of quantitative measurements
- Few retrospective evaluations



Three Links Farm



Pests

- Invasive species problems
- Other pests
- Long time horizon important



Grand Canyon Tamarisk Management & Tributary Restoration



Persistence



'Ahakhav Tribal Preserve

- Flexibility, ability to modify project design
- Project failure before success



Post-Construction

- Importance of monitoring and maintenance
- Conservation easements can be difficult



Little Colorado Enhancement Demonstration Project



Where do we go from here?

- Web based presentation; GIS
- Additional look at how the projects relate to endangered species concerns
- Other Geographic Areas
- Other?



Questions?

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Verde Headwaters Restoration

Photos courtesy of AzWPF and WRRRC

