

Pima County Regional Flood Control District Ecosystem Restoration Projects



Pima County Ecosystem Restoration

RFCD has planned, implemented and manages Ecosystem Restoration Projects within the following watersheds (HUC):

- Upper Santa Cruz River (USCR)
- Lower Santa Cruz River (LSCR)
- Canada Del Oro/Big Wash (LSCR)
- Rillito River (RR)
- San Pedro River (SPR)

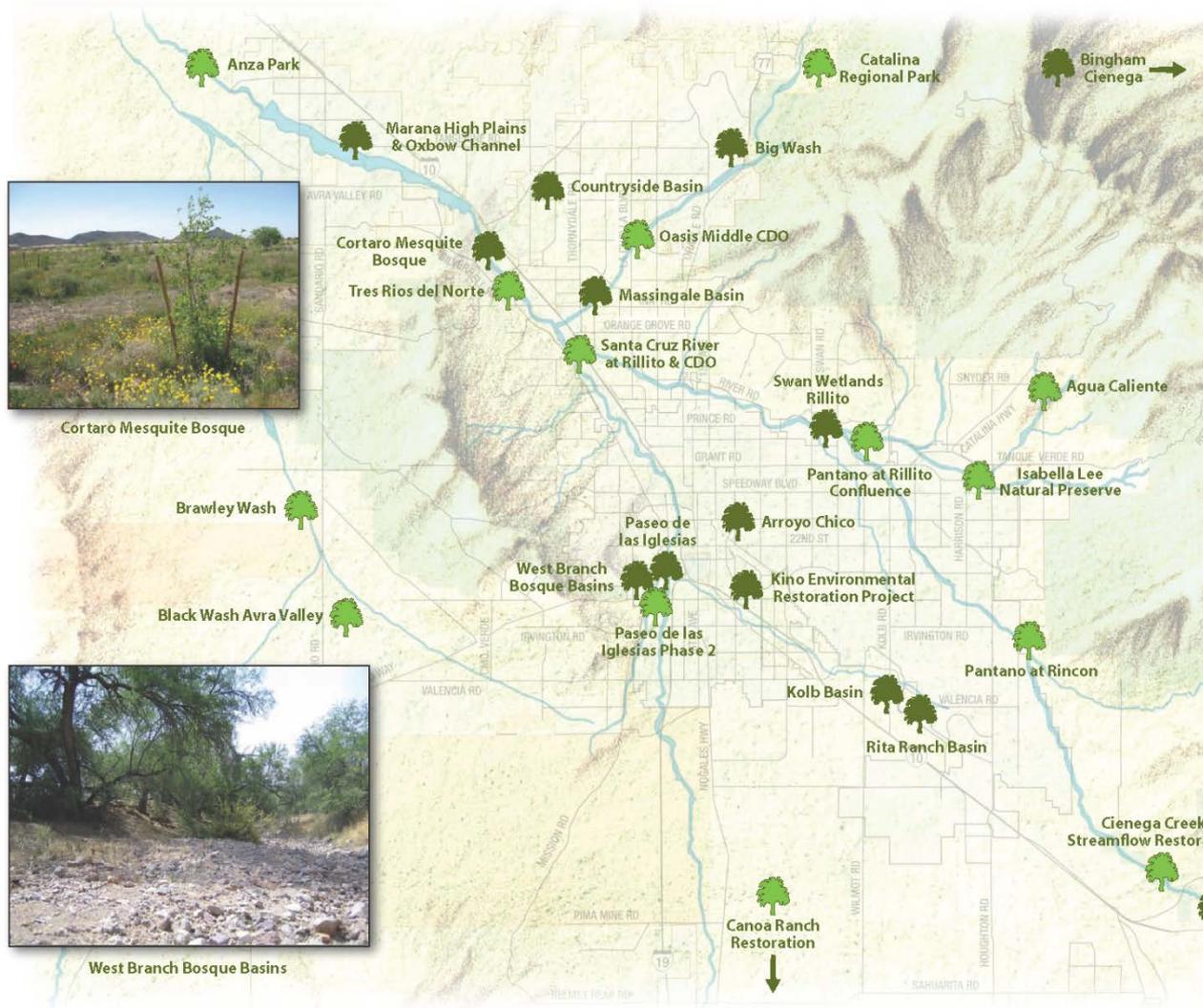
Ecosystem Restoration Project Sites

Projects chosen based on the following criteria:

- Realistic potential to improve aquatic resources and habitat corridors
- Maximize impact of County-wide restoration efforts
- Conform with goals of SDCP
- Located on RFCD/Pima County owned property

Pima County Environmental Restoration Projects

-  Existing Environmental Project
-  Proposed Environmental Project



Cortaro Mesquite Bosque



West Branch Bosque Basins

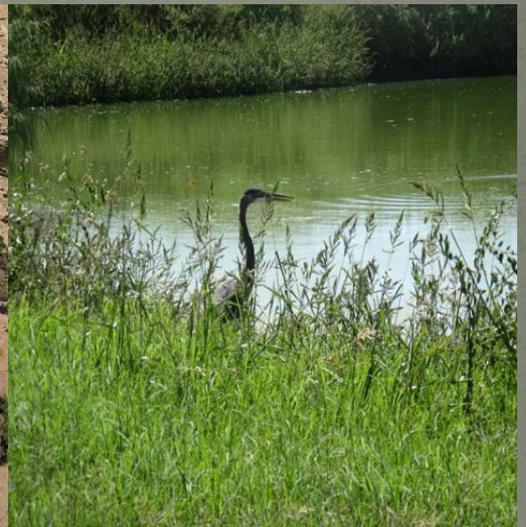


Kino Environmental Restoration Project

Marana High Plains Oxbow Channel



Basin



Basin – Great blue heron



Oxbow Channel

Marana High Plains Oxbow Channel

Purpose

- Multipurpose underground storage facility
- Groundwater replenishment
- Environmental enhancement

Design Elements

- 11 acres aquatic habitat
- 28 acres preserved riparian habitat
- Habitat to support aquatic & terrestrial species & neotropical migratory birds

Partners

RFCD, PCRWRD, BOR, AZ Water Protection Fund, Town of Marana

Marana High Plains Oxbow Channel



Great Egrets



Mallard family



Black necked stilt



Black necked stilt nest

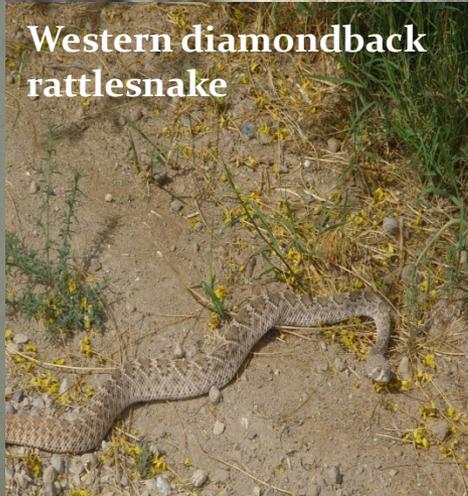


Nest

Marana High Plains Oxbow Channel



Checkered garter snake



Western diamondback rattlesnake



Desert iguana



Western screech owl

Interpretive sign

Planning for the construction and operation of the Marana High Plains Oxbow Channel is a joint effort of the Marana, Arizona, Water Recharge Project, Marana High Plains Oxbow Channel Recharge Program, Arizona Water Recharge Project, Pima County Flood Control District and the General Land Office.

Marana High Plains Effluent Recharge Project

RIPARIAN VEGETATION

The riparian zone is the area adjacent to a water body, or river or stream, which includes the banks and the adjacent upland areas. Riparian vegetation is typically associated with riparian environments and is often an indicator of riparian health.

The riparian environment is a critical component of the Marana High Plains Effluent Recharge Project. It is essential to protect the riparian environment to ensure the success of the project.

Riparian areas are often called "corridors of life" and are "hotspots" of biodiversity. They are also important for water quality, sediment transport, and wildlife habitat.

While many of the plants of the Marana High Plains Effluent Recharge Project, such as some of those mentioned below, are native to the area, many others are being introduced to support the project's goals.

NON-NATIVE SPECIES
Non-native species in the environment include the introduction of species that can negatively influence riparian environments by competing for resources, altering water chemistry, or outcompeting native plants and wildlife.

REIMOND COTTONWOOD
(Populus fremontii)
Preferred by beavers for food and dam building. It is favored by people for its riparian shade and beauty.

FLUTE TOP BUCKWHEAT
(Eriogonum fasciculatum)
Best are attracted to light soils. Some varieties were used as an indicator by the military.

GOOSEWING WILLOW
(Salix pyramidalis)
The largest willow species in the region. It has a deep root system and is used for erosion control.

TOURNEFORTIA
(Tournefortia)

CAULIFLOR ACACIA
(Acacia greggii)
The thorns of this shrub are sharp, curved and very sharp. Also called the "Wool of Missouri". The flowers attract bees and other insects.

TOLIVARIE OF SALT CEDAR
(Tamarix chinensis)
Tamarisk can cause serious harm to riparian vegetation by increasing the frequency and intensity of flooding and water availability in riparian areas. Unchecked, it can crowd out native plants and animals, and pose a threat to water quality and availability for most wildlife.

CREOSOTE BUSH
(Larrea tridentata)
Some varieties are among the oldest living plants, up to 11,000 years old. Produces a distinctive fragrance often a resin. Used as a glue and for medicinal purposes by Native Americans.

SCREBBIN MESQUITE
(Prosopis juliflora)
The seed pods were an important and nutritious food source for Native Americans. The wood, seed pods have been used for many products.

How Vegetation Helps Recharge

Infiltration rates are impacted by accumulation of soils and algae, compaction for roots and during by the sun. Unvegetated recharge beds must be reseeded to restore natural and healthy soil with mechanical aeration, both of which increase infiltration and increase soil.

Traditional Recharge
An irrigation channel with a concrete lining.

Vegetated Recharge
An irrigation channel with a vegetated lining.

Continuous growth of riparian grasses, sedges and other plants binding silt up the surface, slowing down runoff and allowing water to infiltrate the soil, which increases soil growth and helps drying, all of which contribute to increased infiltration.

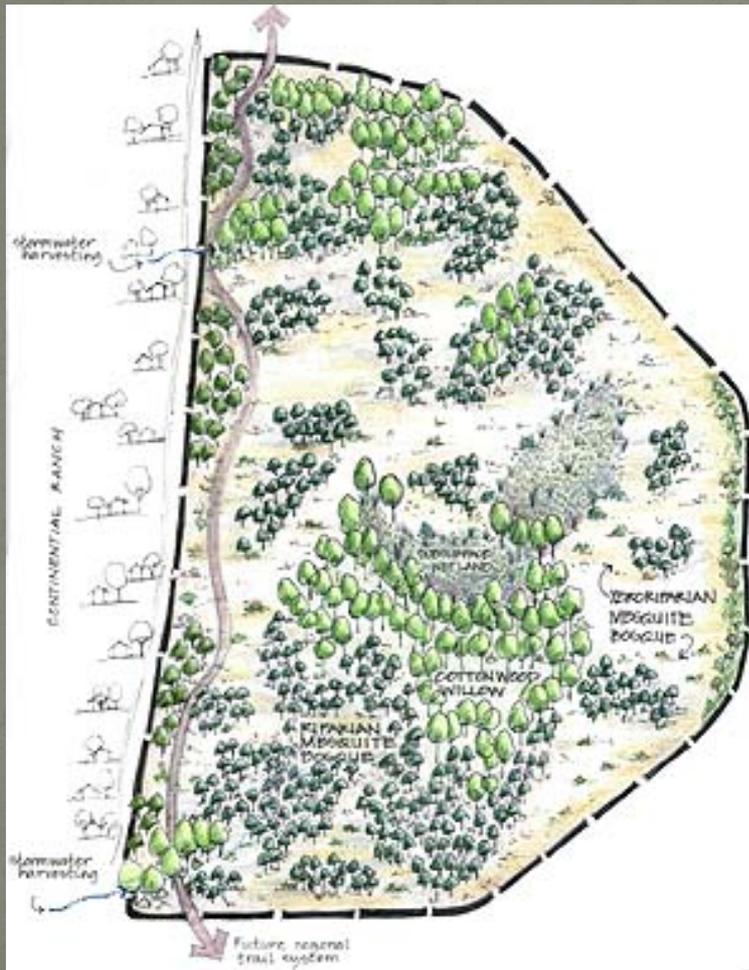
WILLOW *****
MEQUITE *****
TOURNEFORTIA *****
WILLOW *****
MEQUITE *****
CREOSOTE *****
CREOSOTE *****
COTTONWOOD *****

Note: the different Riparian plant communities that occur throughout the project.

Marana High Plains Oxbow Channel



Cortaro Mesquite Bosque



2012
5-yr
post
constr.

Cortaro Mesquite Bosque

Purpose

- Increase biodiversity and riparian vegetation structure on 80 acres of degraded floodplain terrace of Santa Cruz River
- Provide wildlife habitat with diverse vegetation communities (riparian, xeroriparian, riparian scrub, riparian grassland). 'Edge' habitat to maximize wildlife use

Design Elements

- Non-potable irrigation water for plant establishment & maintenance
- Stormwater harvesting for habitat sustainability
- Native plants propagated from locally collected seeds and provided by Pima County Native Plant Nursery

Cortaro Mesquite Bosque

Aerial view
2010
3-yr post
construction



August 2007
Large scale water harvesting basin during
construction



June 2011
3.5 - yr post construction

Cortaro Mesquite Bosque



Top Photos
March 2008
(1st Spring post-
constr.)

Bottom Photos
August 2012
(4 yr post-constr.)



Cortaro Mesquite Bosque



Basin Nov. 2007



Basin March 2008



Basin August 2012

Cortaro Mesquite Bosque



Cortaro Mesquite Bosque



Western kingbird



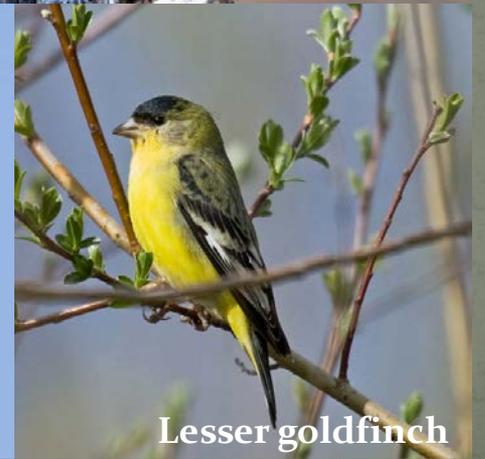
Abert's Towhee



Lark sparrow



Red tailed hawk



Lesser goldfinch

Paseo de las Iglesias



Paseo de las Iglesias

Partners USACE & Pima County
multi-phase, multi-purpose project
completed in 2015

Project Objectives

Public Safety, Recreation; Ecosystem restoration, Erosion & Flood control, River Park project

Design Elements

- Wildlife habitat restoration, preservation of existing habitat
- Water harvesting basins, diverse native plant communities, toad and lizard salvage & reintroduction
- Trail linkage; shared use urban river park system 'The Loop' links & Juan Bautista de Anza National Trail

Paseo de las Iglesias



Blind snake/
Western thread snake



Zebra tailed lizard



Regal horned lizard



Desert spiny lizard

Paseo de las Iglesias



Lizard Salvage/Preservation Fencing

Paseo de las Iglesias

Amphibians

- all 6 species survived construction
- 3 species augmented from nearby populations (2015)
- 4 species known breeding (2015)



Recently metamorphosed Couch's spadefoot toads at Mesquite Circle Pond

Paseo de las Iglesias



Cooper's Hawk



Burrowing Owl



Great Egret



Greater Roadrunner



Gambel's Quail

Paseo de las Iglesias

Post-Project Mitigation



Pre-Project Erosion



Paseo de las Iglesias



Paseo de las Iglesias



Red spotted toad



West Branch Preserve Bosque Basins



Design Elements

- Preserve & enhance habitat connectivity
- Preserve historical plant community
- Habitat for locally rare giant spotted whiptail lizard & narrow-mouthed toad
- Water harvesting, invasive species control, delineation of equestrian & pedestrian paths for neighborhood use, erosion repair and control along river bank

West Branch Preserve Bosque Basins



Couch's spade foot toad



Great Plains toad



Narrow-mouthed toad



West Branch Preserve Bosque Basins



August 2012
Project construction



September 2014
2-yr post construction

West Branch Preserve Bosque Basins



KERP Kino Environmental Restoration Project



KERP Kino Environmental Restoration Project



KERP Kino Environmental Restoration Project

Partners

USACE Section 1135/Pima County
completed in 2002

Project Objectives

Retain original flood control storage capacity of 125 acre regional basin, add environmental benefits, and conserve groundwater.

Design Elements

- 20 acres of lined ponds and streams
- 7 acre (50-ft deep) pond – provides 92 ac-ft of harvested storm water storage for regional use
- 52 acres of cottonwood willow gallery, mesquite bosque, and riparian shrub vegetation communities

KERP Kino Environmental Restoration Project

January 1996 (pre-project)



October 2002 (during construction)



May 2015

June 2011

KERP Kino Environmental Restoration Project



Great Plains toad



Great blue heron



Hooded merganser



Arroyo Chico

Tucson Drainage / Arroyo Chico Project Park Avenue Detention Basins



Project Overview
May, 2010



Arroyo Chico

Phase 2b Park Avenue Basins

USACE multi-phase, multi-purpose project completed in 2012

Project objectives

- Provide extensive flood damage reduction by removal of residential, railroad, and interstate from 100-year floodplain.
- Restoration and mitigation focused on creation of naturally sustainable riparian vegetation and habitat for native lizards, amphibians, and bird species.

Design elements

- 33 acre, 3-basin project excavated 12 to 20 feet below grade
- 22 acres of riparian ecosystem restoration, mitigation, and preservation
- Supports 6 species of native lizards, 2 species of native toads, and dozens of nesting and migratory bird species

Arroyo Chico

Phase 2b Park Avenue Basins

April 2008



May 2014

Arroyo Chico

Phase 2b Park Avenue Basins



Regal horned lizard



Side blotched lizard

Arroyo Chico

Phase 2b Park Avenue Basins



Great plains toad



Diving beetle

Aquatic
Invertebrates



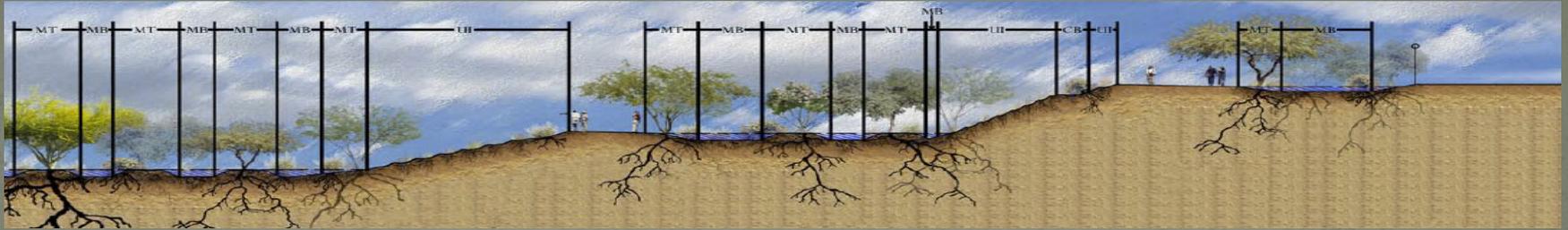
Backswimmer

Arroyo Chico

Phase 2b Park Avenue Basins



Kolb Basin Environmental Restoration



Purpose

Serve as mitigation (under RFCO Riparian Habitat Ordinance) for disturbance to xeroriparian habitat downstream within the Julian Wash watershed

Design Elements

- Repair and prevention of side slope erosion
- Invasive species control
- Establishment of native vegetation
- Utilization of harvested stormwater for plant sustainability
- Tall-pot planting technique to encourage deep rooted plants provided by Pima County Native Plant Nursery

Kolb Basin

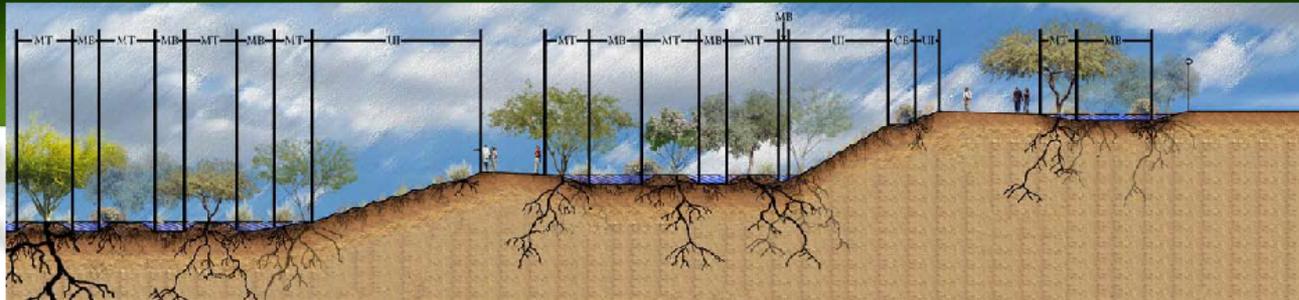


Figure 8.12.2: Planting zone codes: The zones of a detention basin are characterized by frequency of inundation, and can, in this way, be compared to a natural floodway analog. Plant species can withstand varying periods of inundation, and have been categorized by the following zonation:

1. planting zones

2. tall pots



Figure 8.12.3 (top left,) 8.12.4 (top center): Long pots, such as these provided by Stuewe and Sons, allow for desert leguminous tree seedlings to grow to saplings much as they do in natural conditions, extending a deep tap root to reach available groundwater, as demonstrated by the three-month seedling at right. Traditional bucket pots, as deep as they are across, promote shallow roots that can become bound too tightly for optimal field planting.

3. hydroseeding



Figure 8.12.5 (top right): Within water harvesting basins located on a riparian terrace of the Rillito River/Swan Wetlands Ecosystem Restoration Project, hydroseeded saltbush (*Atriplex*,) following broadcast sprinkler irrigation, has established thick mono-typic stands, though, overall, species evenness is low.

- Microbasin Bottom (MB): analogous to naturally-occurring depressions, these areas are subject to long periods of inundation and fine sediment deposits; generally, species in this group are non-woody and annual.
- Microbasin Terrace (MT) and Channel Bank (CB): analogous to the margins of depression and streams, these areas are inundated only in times of moderate to large storm events. Plant species within them can withstand temporary inundation, and depend up increased water availability in the soils of adjacent zones for root growth.
- Upland Inundated (UI): analogous to upland areas that experience rare sheet flow inundation, the species within this zone must be able to withstand rare inundation from the master detention basin in large events, and are either non-woody, succulent, or woody. Sonoran desert species common to dry hillsides are excluded from this group.

Key Questions for Design Decision:

1. Which zones of the site will experience high-velocity flow, preventing plant growth?
2. In which areas must maintenance vehicles be able to pass?
3. Which zones of the site will experience frequent inundation? infrequent inundation? no inundation?
4. Based upon site soil conditions, subsurface improvements, and volume of inflow, how long will the rooting zone remain saturated over the course of the year? What is the target plant community based upon these conditions?
5. Are there invasive plant species in the contributing watershed?

Kolb Basin

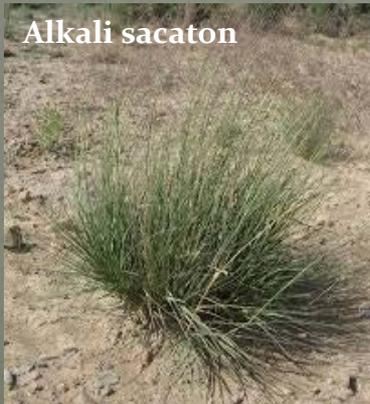
Pre-Project 2011
Side slope erosion



Planted Bench June 2015
Erosion mitigation



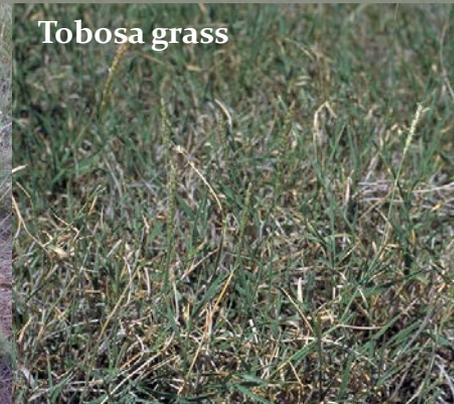
Alkali sacaton



Cane bluestem



Tobosa grass



Whiplash
pappusgrass

Kolb Basin Environmental Restoration



Regal horned lizard



Javelina



Wilson's warbler



Wildlife drinker



Harris' antelope squirrel



Cottontail rabbit

Detention Basins

– Countryside - Massingale - Kolb - Rita –



Countryside



Massingale



Kolb



Rita

Big Wash Ecosystem Restoration Project

Purpose

Mitigation for disturbance to riparian habitat and floodplain terrace (under RFCD Riparian Habitat Ordinance)

Design Elements

- 77 acres of degraded agricultural floodplain terrace
- Water harvesting for sustainability
- Diverse planting to benefit SDCP Priority Vulnerable Species, particularly endemic Rufous –winged sparrow, Bell's Vireo and Abert's Towhee
- Replacement of invasive species with native plants to increase biodiversity
- Locally collected seed used to propagate project plants

Big Wash



Pre-Project

Abandoned
Agricultural
Field

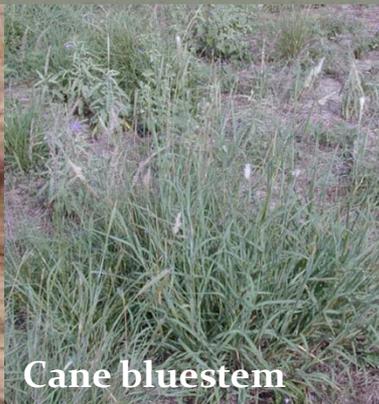


July 2009 (1-yr post constr.)



June 2014 (5-yr post constr.)

Big Wash Ecosystem Restoration Project



Big Wash Ecosystem Restoration Project



Javelina
Coyote
Common kingsnake

Gray fox
Bobcat
Couch's spadefoot

Round-tailed ground squirrel
Mule deer
Regal horned lizard

Big Wash Ecosystem Restoration Project



Bell's vireo



Vesper sparrow



Abert's towhee



Yellow-rumped warbler



Rufous-winged sparrow



White-crowned sparrow

Swan Wetlands Rillito River Environmental Restoration Project



Rillito at Swan Wetlands Ecosystem Restoration Project
Project Area Location Map

Approximate Project Limits



NOT TO SCALE

Swan Wetlands

Project Objectives

- Mitigation for adverse environmental impacts of soil cement bank protection.
- To restore habitat for native flora and fauna while also providing passive recreation.
- Preserve functionality of flood control infrastructure

Design Elements

- Water harvesting for sustainable habitat
- Increase aquatic habitat through channel meander
- Reclaimed water use for establishment irrigation
- Amphibian preservation, salvage & translocation
- Monitoring & invasive species control

Swan Wetlands

- 2005 Pre-Project
- 2008 Construction
- 2010 2-yr Post-Constr.



Area 3



RECON

Swan Wetlands

Pre-Project 2004



2010 6-yr Post Constr.



Swan Wetlands



Atriplex lentiformis -
Quail bush

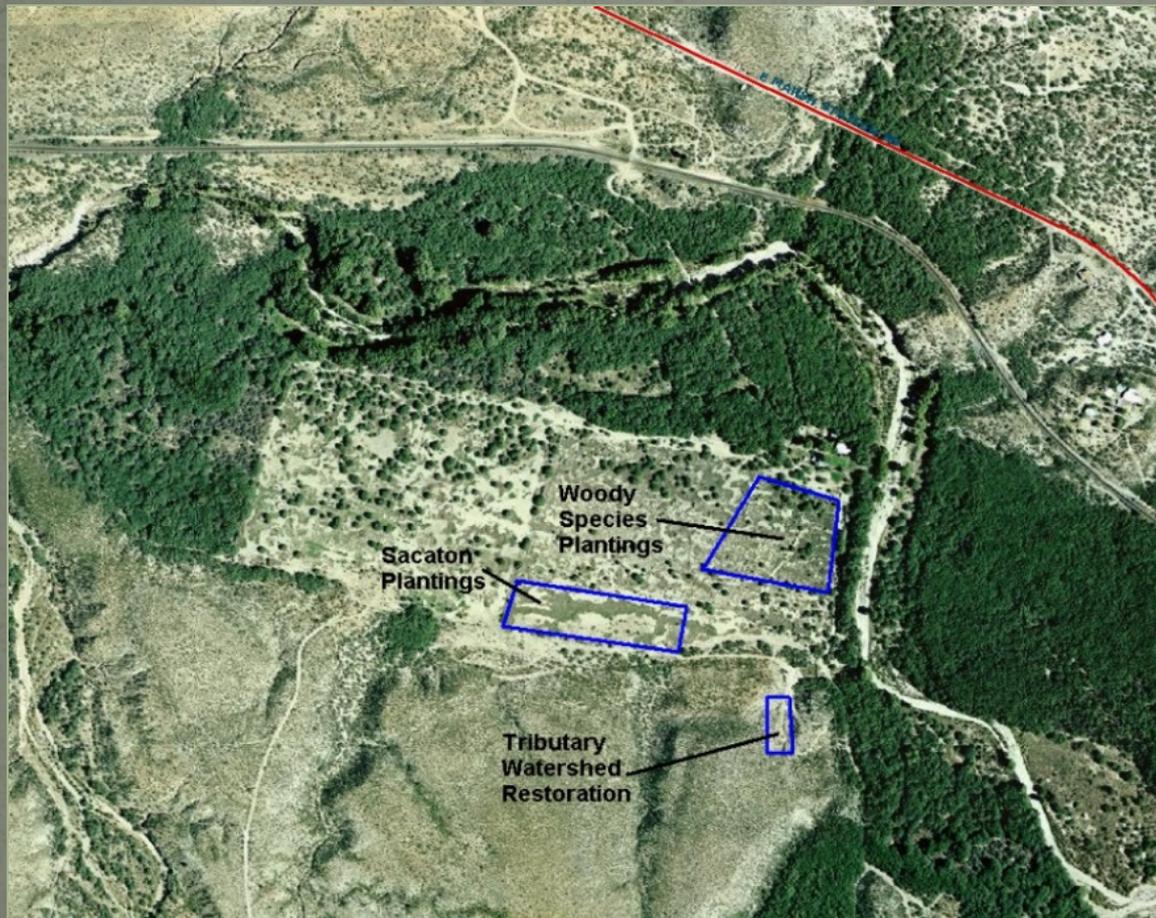


Atriplex canescens -
Fourwing saltbush



Atriplex species provide excellent habitat for Gambel's quail

Pantano Jungle 1 & 2



PARTNERS FOR WILDLIFE PROJECT

2002 Aerial Photo from Pima County MapGuide



North

scale 1 : 13,800



Wright's Sacaton
Sporobolus wrightii

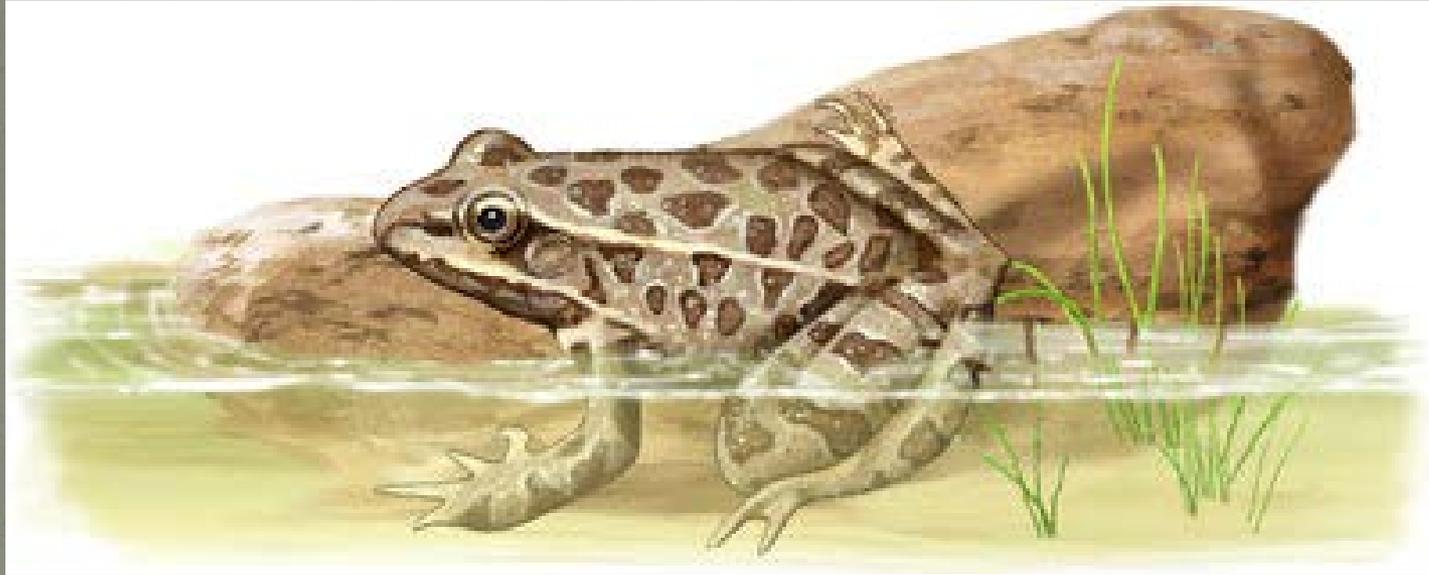
Pantano Jungle 1 & 2

Design Elements

- **1996** – Partnership with USFWS & AZGFD Partners for Wildlife
- Establishment of mesquite bosque & sacaton grassland on former agricultural land adjacent to Cienega Creek
- Increase structure & diversity of native habitat for benefit of neotropical birds
- Improve stream function & control erosion
- Seed collected onsite for plant propagation
- Monitoring program for restored sacaton & stream function

- **2014** – Lowland Leopard Frog Conservation; RFCD & Cienega Watershed Partnership
- Ponds to provide permanent refuge & breeding habitat to protect frog population during flooding and cold winter temperatures
- Habitat restoration benefit Mexican garter snake, Huachuca water umbrel, and Gila topminnow

Pantano Jungle 1 & 2



Lowland leopard frog



Bingham Cienega

Deciduous Riparian Woodland Restoration
Bingham-Cienega (1989, 2001, 2004)
Stewardship/monitoring/restoration



1999 Pre-Project



2004 5-yr post construction

Bingham Cienega

Design Elements

- 300 acre agricultural site contains a rheocrene spring
- 1989 restoration - breach agricultural dam for 30 acre marsh re-establishment
- 1997 - AZ Water Protection Fund Grant - sustainable restoration of 50 acres of sacaton grassland and mesquite bosque, plus 10 acres of Sonoran Deciduous Forest for Botteri sparrow habitat
- 2004 - RFCDD, TNC, AZGF partners in Long-fin Dace release
- Seed for trees and sacaton propagation collected onsite
- Habitat for yellow billed cuckoo, willow flycatcher, zone tailed hawk, narrow mouthed toad, gray fox
- Recent drought conditions have caused diminished flows in San Pedro River and the spring but obligate wetland species such as yerba mansa, netleaf hackberry & cottonwood persist

Bingham Cienega



Net leaf hackberry



Yellow-billed cuckoo



Zone-tailed hawk



Yerba mansa



Botteri's sparrow



Willow flycatcher

Instant Bosque

Just add water.....

