

# Improving Native Plant Salvage & Reestablishment



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## Executive Summary

Pima County residents have reaped the benefits of protecting, salvaging, growing and using native plants for many years. This report examines the status of recommendations that grew from the 2001 Native Plant Program report, written by County staff as part of the Sonoran Desert Conservation Plan.

Pima County has completed most of the recommended actions in the Native Plant Program, thereby minimizing some of the more harmful aspects of urban development on native plants and plant communities, and creating a more beautiful and sustainable urban landscape. Participating departments have included Transportation, Flood Control, Water Reclamation, Development Services, Sustainability and Conservation, Natural Resources and Parks and Recreation, and Community Services and Development. Key achievements that support the recommended actions include:

- Protecting the wildlife habitat values that ironwood trees, saguaro cacti, and other native plants provide;
- Reducing and offsetting damage to riparian habitats during development by requiring mitigation;
- Using tens of thousands of native plants for County public works projects supplied by the Pima County native plant nursery;
- Minimizing impacts to the endangered Pima Pineapple Cactus and protecting its habitat;
- Showcasing the beauty of native plants in prominent settings, such as the County courthouse and public libraries, to promote their use more widely;
- Improving the opportunities for salvaging and re-using cacti, agaves and other native plants in the landscape;
- Integrating native plants into water harvesting and other low-impact development strategies;
- Leading efforts to manage invasive species on County lands and rights-of-way; and
- Assisting in the creation of the Southern Arizona Buffelgrass Coordination Center.

The range of expectations that is served by native plants has broadened over the years. While the original Native Plant Program report was primarily focused on values relating to wildlife, today Pima County is relying on many of these same measures to reduce pollutants in runoff and to minimize water use and long-term maintenance costs of landscaping in public rights-of-way.

Native plants increasingly contribute to Tucson's unique status and look as a desert-aware city and a leader in global water-conservation technology. Native plants provide food and habitat resources for pollinators such as the Monarch butterfly. Native plants are also called upon to contribute to shade and cover needed to reduce the urban heat-island effect, and to purify the air, via removal of greenhouse gases. In short, this report finds that native plants, and the ecological services they provide, are more important than ever to our well-being.

In preparing the report, staff identified a number of specific actions that have not yet been achieved. Staff also sees the need to share what we have learned about the use of native plants with new practitioners across County departments.

In particular, staff urges the creation of a native plant working group of departmental practitioners to:

- Share best practices and lessons learned more broadly among County departments and with jurisdictions;
- Improve the reporting of invasive species on County lands, especially as the observations might relate to detection of emerging invasive species;
- Develop guidelines for Pima County's use of both organic and inorganic groundcover treatments, used for the purposes of both re-vegetation and site stabilization;
- Improve water harvesting techniques, water-saving irrigation methods, and effective landscape maintenance practices including invasive species management;
- Reintroduce native plants like arrowweed that were lost during urbanization at County project sites, where suitable habitat might exist;
- Support public education efforts such as the "Grow Native" brochure;
- Integrate native plants with Low-Impact Development (LID) practices on all county landscape projects, including new public buildings;
- Improve availability of native seeds at Pima County Public Library seed bank;
- Develop guidelines and opportunities for traditional plant gathering where such uses do not conflict with other cultural or natural resource conservation or open space management objectives, as proposed in Pima Prospers;
- Expand the native plant landscaping palette with appropriate, but less common native plants, such as screwbean mesquite to promote species diversity.

## Purpose

This report examines the status of recommendations from the 2001 Native Plant Program Report<sup>1</sup> for the Sonoran Desert Conservation Plan. The purpose of the native plant program is to minimize the impacts of urban development on native plants and plant communities. One of the scientific underpinnings of the native plant program was a study by University of Arizona that non-native plants predominate in Pima County's urban environments, such that most land uses provide less than 10% vegetation cover in native species<sup>2</sup>. While non-native plants do provide habitat for some wildlife species, our native wildlife are better adapted to using native



plants as food and cover. Non-native plants that come with urbanization can not only reduce the suitability of an area for native wildlife, but can also increase fire intensities, alter pollination services, increase water demand, and promote incursions of non-native plants into adjacent protected areas.

This report examines what Pima County and its partners in the Sonoran Desert Conservation Plan have achieved since 2001 relative to the recommended strategies for increasing the use of native plants in the urban environment, and minimizing future introductions of invasive non-native species. We also identify impediments or changed conditions that might affect the desirability or ability to implement or continue to promote the use of native plants in the urban environment.

## Methods

This report was drafted by intern Brittany Taft at Community Services Department, who worked under the supervision of one of the original authors of the 2001 Native Plant Program report, Gary Bachmann. In 2013, Taft researched evidence for implementation of the native plant program. Her work was then further assessed through discussions with a staff team: Ellen Alster (Department of Transportation), Marisa Rice and Jennifer Becker (Regional Flood Control District), Julia Fonseca, Sherry Ruther, Robin Johnson and Brian Powell (Office of Sustainability and Conservation), Gary Bachmann (Community Services and Development), Karen Wilson (Regional Water Reclamation Department) Steve Steward, Doug Siegel and George Kuck (Natural Resources, Parks and Recreation). This team also provided the photographs used in this report.

In 2015, Julia Fonseca and Neva Connolly updated the intern's work to produce this document. Jessie Byrd (Natural Resources Parks and Recreation), Ellen Alster, Marisa Rice and Sue Morman (Development Services) provided additional information.

## **Findings**

The discussion below describes the degree to which each recommended action in the Native Plant Program has been addressed. **Complete** means the objective has been substantially accomplished, even though efforts may continue. **In Progress** means the objective has not been accomplished, and County staff sees room for improvement. **Incomplete** means the objective has not been accomplished, and there is no County support for the objective to move forward.

Because the 2001 Program was focused on minimizing the effects of County actions on native plant communities, most of the subsequent actions were completed by the County. However, many partners in the Sonoran Desert Conservation Plan have taken on native plant responsibilities, including Arizona Native Plant Society, Tucson Audubon Society, Tucson Cactus and Succulent Society, Sky Island Alliance, Southern Arizona Buffelgrass Coordination Center and others.

## **Reducing impacts of urban development**

### **Complete: Minimize project impacts by working with biologists and considering the biological information provided through the Sonoran Desert Conservation Plan**

Pima County adopted a number of measures to avoid and minimize effects to plants that are considered vulnerable to the effects of urbanization, and which are either federally protected or may become federally protected in the future.

These measures include:

- The Roadway Design Manual, which includes the Environmentally Sensitive Roadway (ESR) Design Guidelines. This guideline provides roadway design teams with environmental information early in the design effort. Environmental mitigation, including restoration of native plant communities, is dictated by the project impact on environmental resources. The ESR guidelines are applied to all transportation projects per Chapter 10.56 in the Pima County Zoning Code, titled "Community Participation and Mitigation."
- The Watercourse and Riparian Habitat Protection and Mitigation Requirements within the Floodplain Management Ordinance, Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines, and Regulated Riparian Habitat Offsite Mitigation Guidelines<sup>3</sup>. Mitigation is required when impacts to riparian habitats cannot be avoided and exceed 1/3<sup>rd</sup> of an acre. The Riparian Classification Maps delineate the

location of riparian habitat subject to regulation. Regulations apply to private property within unincorporated Pima County and to all Pima County projects within unincorporated and incorporated Pima County.

- Provisions added to the Native Plant Preservation Ordinance to encourage preservation in place for Pima pineapple cactus, needle-spined cactus, Huachuca water umbel, saguaro and ironwood.
- Additional guidance to promote the reduction of damage to the endangered Pima Pineapple Cactus, from County projects, mainly through avoiding them during construction, but also through establishing a conservation bank to protect their habitat;
- Sewer design standards which reduce impacts of new sewers to wash environments.

More recently, Pima County and City of Tucson have collaborated on a Low Impact Development and Green Infrastructure Guidance Manual (LID)<sup>4</sup>. Aspects of LID include site layouts that achieve multiple functions, including the minimization of disturbance to native vegetation and soils; reduction of runoff and runoff pollution from sites, and less reliance on structural engineering solutions. LID approaches are beginning to be integrated into our stormwater management along streets and other commercial, residential and industrial spaces. These practices provide additional water for the drought-tolerant native species currently being used, enabling them to establish more quickly with less reliance on supplemental irrigation.

At the neighborhood level, Tucson Audubon Society encourages use of native plants to provide wildlife habitat for specific kinds of birds. Watershed Management Group and Living Streets Alliance have been influential in reaching many city neighborhoods as well as agencies with their integration of water harvesting, pollution control strategies and use of mostly native or non-invasive plants.

**Complete: Conduct ground surveys of vegetation to determine the amount of species and native vegetation present**

The Pima County Department of Transportation uses the Environmentally Sensitive Roadway Design (ESR) Guidelines for native plant inventory and mitigation. ESR roadways are designed and maintained to preserve the natural character and vegetation density of the area and provide habitat for specific species. The objective is to leave the landscape as natural appearing as possible, with effort made to re-vegetate with plant species that were removed and/or are commonly found in the project environment, matching density, relative location patterns (e.g. small cactus under shrubs), slope and soil preferences. The guidelines require a complete inventory of all protected native trees and saguaros, which are vital resources for native wildlife. The inventory of other plants presents helps to ensure the existing vegetation density and appearance is replicated in the roadway landscape.

The Regional Flood Control District (RFCD) has approved Technical Procedure 116, which specifies methods for surveying native vegetation communities for total vegetation volume, plant density and diversity. RFCD is also standardizing methods used to survey vegetation communities at restoration projects.

The site analysis requirements for rezonings were amended in 2010 to require surveys for Pima Pineapple Cactus and Needle-spined Pineapple Cactus in certain parts of unincorporated Pima County that are defined as Priority Conservation Areas for the species. The forthcoming Section 10 Endangered Species Act permit to Pima County relies on this provision.

**Complete: Encourage a plant salvage program**

The Native Plant Preservation Ordinance was revised in 2008<sup>5</sup> to encourage preservation or salvage of the ironwood and saguaro, which provide support for local wildlife.

The Pima County Department of Transportation, through the Native Plant Salvage Program (NPSP)<sup>6</sup>, offers governmental agencies and non-profit native plant organizations the opportunity to salvage native plants. Thousands of cacti have been salvaged and relocated from road projects since this program was initiated in 2010.



*Recent salvage activity at the Hughes Access Road project site.*

Pima County has partnered with the Tucson Cactus and Succulent Society to landscape the Pima Prickly Park at 3500 W. River Road. The area was originally a borrow, or excavation pit that has been re-vegetated naturally, and through the efforts of volunteers from Tucson Cactus and Succulent Society and others. Many of the cacti salvaged from Pima County roadway projects were replanted at the Prickly Park (photos above right).

The Pima County Native Plant Nursery has recently been an active partner, salvaging native cacti from road projects and storing them at the Nursery. Many of these plants have been replanted at County facilities, including public libraries.

All departments should be encouraged to adopt and implement salvage measures when disturbing native plant communities.

**Complete: Use native species identified in the survey to guide re-vegetation**

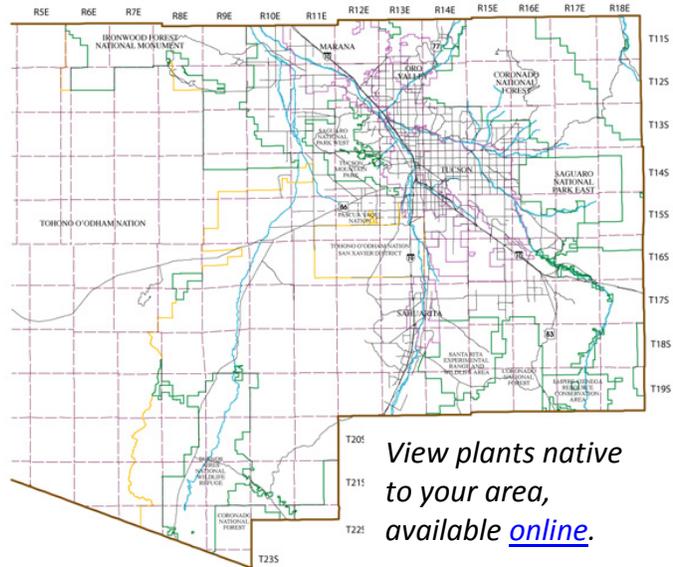
Since the ESR design manual was adopted, road projects have almost exclusively used native plants. The only exception, which occurs a very small percentage of the time, is extremely hot and harsh conditions where no appropriate native plant would thrive. Typically this occurs in road medians where due to site visibility issues, all plants must be less than 30" tall. In these cases, a succulent or cactus native to the Chihuahuan desert may be used.

Plant selection for transportation roadway projects is based on a native plant inventory of species found at the site. Sites are then re-vegetated with the same species found at the project site. An emphasis is placed on low water, indigenous plants, once established, that can eventually thrive without the reliance on supplemental irrigation.

The RFCD's Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines provide a list of native species by watershed for use in mitigation. The permittee also has the option to complete an on-site plant survey to determine appropriate plant species and densities to replace vegetation lost due to development.

RFCD has used plant surveys and site-specific historic flora information to develop watershed-specific plant lists. Both surveys and historic floras influence the selection of plants for restoration projects, such as on West Branch Santa Cruz River, Arroyo Chico Phase 2b, Paseo de las Iglesias Phase-One, and current designs for Canoa Ranch In Lieu Fee mitigation project.

Pima County provides the public an on-line native plant selection tool that is based on surveys by former state Department of Agriculture surveyor William Kendall. The species listings are available online by township and range.



**Complete: Do not use non-native species suspected of being invasive**

Pima County Department of Transportation does not use non-native plants in roadway projects. Plants used for re-vegetation are based on native plant inventories of the site. The Pima County Roadway Design Manual requires the review of a project site to determine which invasive species are likely to be encountered and specification of measures that will be employed to reduce the likelihood of further propagation. Measures include removal of invasive species before construction begins, and continued monitoring and removals during and post-construction.

The Regional Flood Control District typically uses only native plants on their projects. Native plants are used for meeting local, state and federal environmental compliance requirements. For the Loop/river park projects, sometimes there are insufficient funds available to install landscaping at the time of construction, but the District is making an effort to go back to these areas once funds are available to install native landscaping. Invasive non-native plants are not allowed in stormwater harvesting basins, except for turf grasses like hybridized Bermuda, which

are allowed within multi-use basins. RFCD requires the removal of invasive species before construction begins, as well as monitoring and treatment during and post-construction.

Non-native plants are still used in other County projects, but known invasive species are not being used.

**Complete: minimize impacts of activities; with consideration given to maintaining canopy structure and escape cover.**

The ESR guidelines require the identification of any threatened, endangered, proposed, and/or candidate species likely to be impacted by the project and any mitigation measures under consideration. Also required is the identification of invasive species likely to be encountered and measures that will be employed to reduce the likelihood of further propagation.

RFCD follows a standard protocol for maintaining drainage ways that fall under its maintenance responsibility. Natural washes are left in a natural state and no maintenance occurs within these areas. Constructed channels, which can include earthen sides and bottom, concrete sides and earthen bottom, or an entirely concrete channel, are maintained for conveyance. Maintenance includes mowing the understory but leaving all trees with a trunk diameter of 6 inches or greater. Lower branches of these trees are trimmed-up to allow for water flow. Major watercourses with bank protection, such as the Santa Cruz River, Canada del Oro, Rillito River, etc. are left natural. Occasionally maintenance occurs within the major watercourses after flood events to remove sediment or repair bank protection.

On county grazing lands, Pima County Range and Management Standards<sup>7</sup> require habitat will be managed to provide for ecosystem health and the maintenance of diverse plant and animal populations. Grazing plans balance stocking rates and pasture rotations with maintaining or actively improving rangeland habitats for native species. The percent of the current year's growth that has been removed from a forage plant by grazing, browsing or trampling is measured. The resulting trends in plant community composition are used to assist in achieving plant community objectives.

**In Progress: Minimize the use of decomposed granite and crushed rock as ground cover**

Overall, Pima County has not made much progress in minimizing the use of decomposed granite and crushed rock. Presently, the only design standards which minimize use of these materials are those dated 2014 for stormwater detention and retention basins. Crushed rock is expensive and requires much energy to produce. The mines from which landscaping rock are derived forever alter the natural landscape and destroy valuable wildlife habitat. When the materials are derived from mine waste, there may be concerns about the potential that harmful residual metals may be released to the soil.



*Crushed rock is a prominent, non-renewable resource used in County landscaping.*

Vegetative mulch could be used more often in construction sites where natural vegetation is cleared to provide an organic ground cover. This would also reduce the need for hauling debris and using landfills. For instance, Natural Resources, Parks and Recreation (NRPR) uses an on-site shredder to mulch trail trimmings.

However, crushed rock is sometimes appropriate. For instance, it has been used in combination with seeding on Department of Transportation (DOT) projects. This combination has been shown to promote seed germination. Depending on seeding alone has been

challenging; in some areas where seeding has been used alone, the main species germinating are invasive. The use of crushed rock on DOT projects is minimized nonetheless; it is used alone as a ground cover only where appropriate to site context. DOT has experimented with applying a 30% cover of larger rock size to restored areas with success. The rock cover helps to collect seed, organic matter and water to help with seed mix germination and establishment. Rock cover can help to reduce erosion on slopes.



*Hydroseed installed over ground with 50% rock coverage (first year post-construction on Orange Grove: Camino de la Tierra to La Cholla.*

Another alternative the RFCD is implementing is retention on site of all rock and acceptable non-deleterious rubble that is exposed during construction. Traditionally, the material “greater than 1” diameter” is specified to be raked up and removed. Savings result from less hauling of material both onto and off of the site.

### **Complete: Native Plant Nursery for Pima County projects**

Much of the 2001 Native Plant Program report explored concepts for creating a County Native Plant Nursery. Today the Nursery is a reality--it grows plants native to the Sonoran Desert region for transplant to public lands for re-vegetation, landscaping and habitat improvement. The goals as described in 2000 were to facilitate:

- Re-vegetation of degraded public lands
- Systematic replacement of non-native vegetation at county owned facilities
- Use of Native Plant Nursery vegetation in County landscaping contracts (roads, parks, riparian and other habitat restoration)
- Use of Native Plant Nursery vegetation in other county projects (housing, public buildings and capital improvements)
- Public education outreach (tours of the nursery, distribution of plants to schools)
- Research and scientific analysis
- Sale of native plants to other public or private projects consistent with our SDCP goals and where not in conflict with the private sector
- Creation of buffers at wastewater facilities and other locations

The Nursery has fulfilled all of these goals except research and scientific analysis, and buffering wastewater facilities with vegetation. The Nursery primarily serves Pima County public works departments, but also provides plants for projects by City of Tucson, and other public agencies. The Nursery does not provide plants for sale to homeowners, but does offer tours.



*Like plants? [Volunteer](#) at the Pima County Native Plant Nursery, which nurtures plants used on County projects.*

The Nursery was initially located at the County wastewater facility, and staffed at various times through contracts with Desert Survivors and Tucson Botanical Gardens.

Today, the Nursery is located at the Pima County Natural Resources, Parks and Recreation facility. The water source for the nursery is a high-nitrogen groundwater source which is not suitable for potable purposes, but excellent for plant propagation.

At present, there are over 20,000 plants in stock being grown for a variety of County and more recently City of Tucson public projects. Besides flats, typical container sizes include 1 gallon, 5 gallon, and 15 gallon pots, and 15, 24, and 30-inch tall pots. In addition, the nursery maintains a native seed library of 130 species (Appendix 1).

For the long-term financial stability of the Nursery, staff recommends a business plan be developed, perhaps in conjunction with a class project at the Eller School of Business at University of Arizona.

### **In Progress: Reintroduction of extirpated species**

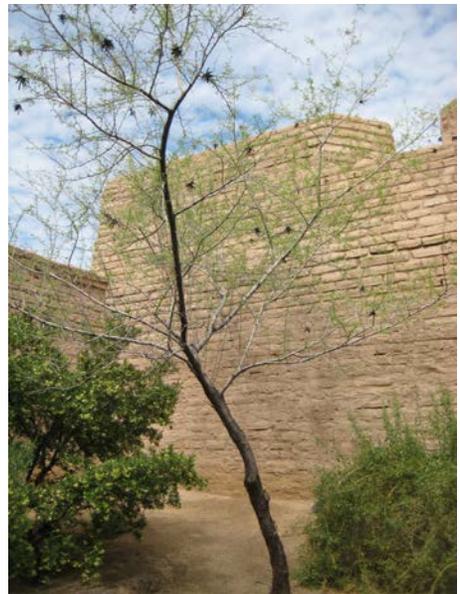
*Reintroduction of Huachuca water umbel on the upper Santa Cruz River, San Pedro River, Cienega Creek, Agua Caliente Spring, and the springs in the Las Cienegas National Conservation Area*

To date, Pima County has NOT reintroduced the Huachuca water umbel, primarily due to restrictions imposed by the U. S. Fish and Wildlife Service. Approval of the Pima County Multi-species Conservation Plan should ease the ability of Pima County to participate in expanding the distribution of the species. The Pima County Native Plant Nursery now has facilities where the Huachuca water umbel may be grown for re-establishment to suitable sites, but suitable sites are limited.

*Reintroduction of screwbean mesquite and arrowweed to the Santa Cruz River*

These two species were once part of the riverine plant communities along the Santa Cruz River. Relatively few projects have utilized the screwbean or arrowweed, in part due to lack of plant availability and project planners being unfamiliar with the plants. Today, both species are being grown at the Native Plant Nursery, as well as Desert Survivors. Future projects along the Santa Cruz River and the Rillito should consider these species. Both are salt-tolerant, hence ideal for areas irrigated with reclaimed water.

Paseo de las Iglesias. Phase One has installed 84 screwbean mesquite (on irrigation), and has inspired to installing a minimum of 30 Tumamoc globeberries (a salvage-restricted species also highlighted in the Sonoran Desert Conservation Plan). Although seed could not be acquired for this particular species, diligent efforts by the Native Plant Nursery staff resulted in acquisition of the seed for numerous other species which had previously been unavailable.



*Young screwbean mesquite in downtown Tucson.*

Arrowweed has been successfully re-introduced into Agua Caliente Park's Pond 2, and has proved to be quite drought-tolerant. Opportunities to restore Eryngium and Blue-eyed Grass, two rare species that once grew at the Park, will be explored as part of an upcoming rehabilitation of the ponds. Arrowweed has also been used with success at the Swan Riparian Project along the Rillito. The Paseo project is also using arrowweed from the Pima County nursery (generated from the Agua Caliente population).

## Native Plant Education and Outreach

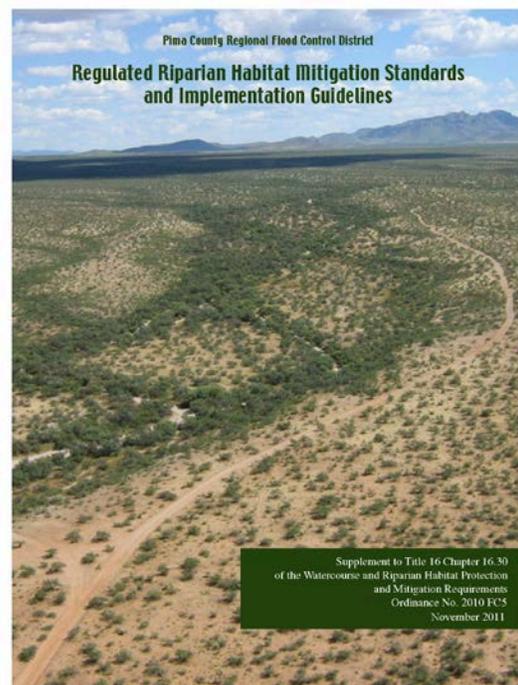
### **In Progress: Redesigning public works projects & re-evaluation of the landscape decision making process**

Pima County Regional Flood Control District has revegetated over 400 acres of abandoned farmland located along major watercourses. Their staff has gained much experience working with contractors and maintenance staff. These experiences could be shared with other departments to improve decision-making about erosion control, design of berms, use of hydroseeding and irrigation and other decisions that face public works managers using plant materials.

In 2011, the RFCD an illustrated guide called the Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines, which provide guidance about plant selection, installation, irrigation, water harvesting and maintenance. The manual is geared toward both developers and homeowners.

For County roadway projects, the Pima County DOT uses the ESR Guidelines previously discussed.

Pima County encourages the use of native shade trees and shrubs in stormwater harvesting basins to reduce air temperature, improve air and water quality, provide shade for people, reduce street noise, enhance wildlife habitat and provide visual screening (District, 2014)<sup>1</sup>. The new detention basin at the Water and Energy Sustainability Center exemplifies this approach by using native trees that are adapted to periodic inundation. Kolb Road Detention Basin was re-designed as part of a riparian habitat mitigation project, to use stormwater runoff to support native plants.



Excerpted from the Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines

“Smartscape” is a program offered by the Pima County Cooperative Extension Program. It is the principal training program for local landscape professionals and is designed to promote the best landscape management practices for the Sonoran Desert. Five Pima County Natural Resources Parks and Recreation employees completed the training on water-efficient landscape practices.

Meetings and briefings with County staff who oversee the construction of public facilities were held and a new reporting mechanism was created. The site will be evaluated before project design begins. The resulting data will improve avoidance and minimization of impacts to riparian habitats and protected species.<sup>8</sup>

**In Progress: Provide recognition for projects that adhere to the principles that have been established through the Sonoran Desert Conservation Plan**

To further use of green infrastructure and low-impact design, the Regional Flood Control District has compiled a number of [case studies](#). The case studies include costs and lessons learned, and showcase sustainability practices. This will continue as an on-going effort, but each of the current case studies was awarded a certificate at the 2015 Low Impact Development Workshop. The certificate recognizes the project’s success of “treading lightly on our community’s resources.” There is no similar showcase for development projects that have balanced biological and cultural conservation with development, except through specific project recognition awards given by outside organizations.

**Incomplete: Work with the State of Arizona Board of Technical Registration to establish continuing education unit requirements for landscape architects to retain licensing. The continuing education could incorporate restoration practices, propagation and use of native plants, ecology of riparian areas, design and maintenance needs related to invasive species management**

Pima County has not actively supported or opposed continuing education for landscape architects. According to American Society of Landscape Architects (ASLA) State-by-State Analysis of Continuing Education Requirements for Landscape Architects 2013<sup>9</sup>, continuing education requirements have not been implemented in Arizona.

As an alternative path to achieve this objective, staff has identified the need to share more information between departments about project successes and failures, and lessons learned about stormwater harvesting, use of native plants and other techniques. The timing is appropriate because of the growing movement toward Low Impact Design in urban planning. The Native Plant Nursery could improve outreach to project managers and landscape architects about how to best use the nursery’s services to their advantage.

**Complete: Public education about appropriate practices with a goal to alter the expectations when native plants are used**

This recommendation is deemed largely completed based on the many non-governmental organizations that provide public education about native plants in landscaping. Desert Survivors, Tohono Chul, Tucson Botanical Gardens, Arizona Native Plant Society, Civano Nursery, Tucson Audubon and Watershed Management Group are all actively engaged.

In 2010 the District contracted with Tucson Audubon Society (TAS) to develop the “Riparian Ecosystems in Pima County, Arizona”<sup>10</sup> brochure and perform community outreach through restoration work days and educational workshops in the Tanque Verde Creek watershed. The brochure was mailed to 7,522 Pima County residents in Board of Supervisor Districts 1 and 4 whose property contains mapped regulated riparian habitat.

Tucson Audubon Society held workshops for area residents which focused on how to protect and enhance existing riparian areas and create habitat for wildlife. Four restoration work days were also held utilizing local residents as volunteers to remove invasive species within Sabino and Tanque Verde creeks.

Pima County Public Library Seed Bank provides seeds for native plants and food crops. At present there is no formal mechanism for expanding the range of seeds provided, but the Native Plant Nursery hopes to make available native flower seeds to the public via the libraries.

**Complete: Provide better and more frequent training in horticulture practices such as pruning, irrigation, and fertilizing techniques**

Smartscape provides ongoing professional and residential classes. Pima County does not provide this training, but Pima County staff members have attended the classes, which are held at the Pima County Natural Resources, Parks and Recreation building.

**Complete: Research and develop lists of appropriate native plants for public spaces**

The County’s Native Plant Nursery maintains list of plants available as container stock, so that it can respond to inquiries for specific plants needed by project managers who are designing new public spaces. The nursery also holds tours for project landscapers to familiarize them with the characteristics of native plants. The nursery has an electronic inventory of its seeds on stock (Appendix 1).

- A list of low-water use plants appropriate for Pima County is available at: <http://www.azwater.gov/AzDWR/WaterManagement/AMAs/LowWaterUsePlantList.htm#Tucson>
- A list of plants native to Pima County can be generated for specific areas in Pima County at <http://www.pima.gov/cmo/sdcp/species/TRspeciesListing.html>. The species listings

are based on work done for native plant surveys through the Arizona Department of Agriculture.

The University of Arizona is working to develop a plant database for Tumamoc Hill that will help property owners in the area select a list of native plants that provide habitat for wildlife. This effort promotes the concept of reconciliation ecology, which is the ability to design and create new ecosystems that support people, their enterprises and the needs of wildlife. “Having our land and sharing it too.”<sup>11</sup> Since Pima County already has created a tool to generate plant lists tailored to specific areas, it would be appropriate to inform the University.

Pima County Regional Flood Control District’s Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines<sup>12</sup> provide lists of approved plant species by watershed for use in riparian mitigation areas. The District also has lists of riparian plants appropriate for various watersheds, currently used for mitigation project planning. These could be made available to the general public.

Currently, the Regional Flood Control District and Department of Transportation have access to lists of plant species observed through vegetation surveys completed throughout Pima County. It may be useful to compile these lists to create a native plant list by area or watershed, or to expand upon existing watershed plant lists (i.e., riparian list, add upland species to create a master list).

## **Addressing the Challenge of Invasive Plants**

### **Complete: Development of ordinances and their enforcement for the more noxious species**

In support of regional efforts to eradicate and manage buffelgrass, the Pima County Board of Supervisors adopted changes to the Pima County Code (Title 7, Chapter 33), identifying buffelgrass as a weed subject to regulation. The Pima County Code allows the County the authority to issue property owners in unincorporated Pima County an opportunity to correct, seek a court injunction, or abate the property when buffelgrass poses a significant public safety threat such as fire.

The Department of Transportation and RFCD have incorporated the removal of invasive species prior to any ground disturbance as standard practice for all new projects.

All new development plan and subdivision plat rezonings require a condition for the control and removal of invasive species. Relevant species are listed in the rezoning conditions.

The Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines require the control of invasive species when establishing riparian mitigation areas in compliance with Title 16, Chapter 16.30.

**Complete: Education of the public about the damage caused by invasive exotics**

Since 2000, Pima County has directed the Sonoran Desert Weedwackers, a volunteer group dedicated to removing infestations of buffelgrass, fountain grass and other invasive plants found in the Tucson Mountains and other natural areas in Pima County.



*Weedwackers at work on slope covered in buffelgrass.*

Pima County also created the Pima Exotic Species Council to provide brochures, training classes, and eradication programs. This evolved into the Southern Arizona Buffelgrass Coordination Center, a non-profit organization which provides regional information that emphasizes an integrated management approach to control buffelgrass in Southern Arizona. Pima County’s “Buffelgrass Wanted Dead and Gone” brochure and other publications are still in distribution.<sup>13</sup>

The Pima County Regional Flood Control District developed the “Wipe out Weeds” brochure.<sup>14</sup> Currently, the RFCD actively maps and removes invasive species from their lands, with plans to increase staff time devoted to mapping and removal. The “Riparian Ecosystems in Pima County, Arizona”<sup>15</sup> brochure developed with the Tucson Audubon Society outlines the importance of maintaining a healthy riparian habitat and also identifies the negative impacts of invasive exotic plants.

Pima County Roadway Invasive Weed Removal Program<sup>16</sup> seeks volunteer groups to remove buffelgrass and fountain grass along roadways. Volunteer groups must follow safety guidelines, have a designated leader and obtain a roadway permit. Pima County provides safety vests, tools, and bag pickup.

The Arizona Wildlands Invasive Plant Working Group has compiled a list of invasive non-native plants that threaten wildlands in Arizona.<sup>17</sup> The list is categorized by threat level and each species relative impacts on native ecosystems; it is a useful resource in avoiding the most problematic invasive plant species. This list is referenced in the Regulated Riparian Habitat Mitigation Standards and Implementation Guidelines.

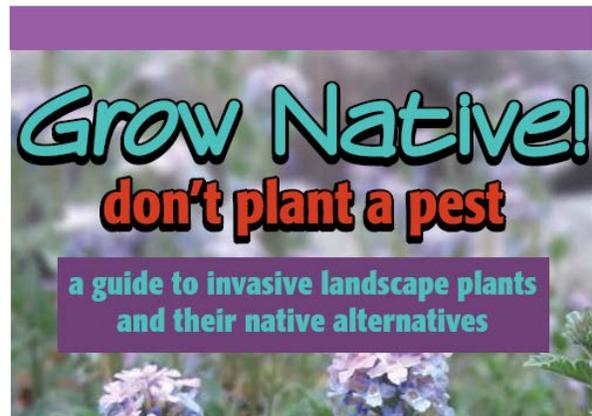
Although much has been accomplished, staff believes the need for education is never really finished. The measures below illustrate the need to continue to work on invasive species education.

### **Incomplete: Soliciting cooperation with the nursery industry to cease sales of invasive exotics**

The Arizona Department of Agriculture has a list of regulated and restricted noxious weeds as well as a list of prohibited noxious weeds. In 2005, Arizona Statute R3-4-244 approved listing of buffelgrass as a Regulated and Restricted Noxious Weed, with support from Pima County. No specific efforts have been made or are being made by Pima County with the nursery industry to cease sale of invasive exotics.

### **In Progress: Developing alternatives to invasive exotics**

Arizona Native Plant Society (AZNPS) provides information on individual invasive plants as well as native alternatives on their website and in a brochure titled “Grow Native, Don’t Plant a Pest”- a guide to invasive plants and their native alternatives.<sup>18</sup> AZNPS currently needs support in re-printing this brochure; nearly 100,000 have been distributed and there is still a demand for them. RFCD features the brochure on their website.



Arrowweed, a plant that was historically present along the Santa Cruz River, is an alternative hedge plant that can be used instead of Giant Reed (a noxious weed also known as Arundo or Wild Bamboo). Arrowweed is salt- and drought-tolerant, and provides dense screening. Its use should be promoted an alternative to Arundo, which is spreading into washes.

### **Incomplete: Research on predicting other invasive species and determining what qualities to look out for; an Exotic Species Research Center**

Pima County does not conduct such research, nor is there an Exotic Species Research Center in the area. Staff reviewers consider this particular goal a more appropriate role for the University of Arizona and other research facilities.

Pima County has contributed land and staff to interagency efforts to devise more effective and cost-efficient means of controlling buffelgrass.

When implemented, the ecological monitoring program required under the Multi-species Conservation Plan will provide additional information about the extent to which invasive perennial plants may affect lands in Pima County.

There is an opportunity to improve the detection of “emerging” new invasive plants. Pima County has “boots on ground”; County staff can and do provide field evidence to researchers

and other agencies of potential new invasive species. For instance, RFCD staff have documented the occurrence of willow-leaf acacia, an Australian landscaping plant, in flood control detention basins. This species, along with the invasive African sumac, is no longer being promoted or used by Trees for Tucson and other public agencies, in part due emerging evidence of invasiveness. What is lacking is a systematic mechanism to capture and disseminate information to other organizations that could use it.

Staff recommends that a more formal mechanism for reporting the spread of invasive species be adopted among the departments to facilitate communication between Pima County and other agencies and universities. The State of Arizona and many federal agencies are now using a reporting system called iMap Invasives; Pima County should use this to share information on the distribution of emerging invasive species with others.



## Conclusions

Pima County has made remarkable progress in implementing the recommended actions originally identified by staff in 2001. This has resulted in native plants being preserved in place, salvaged or replaced with natives when natural areas are disturbed. In other more urban sites, native plants grown in the County nursery are being used for landscaping, restoring wildlife habitat, providing beauty, attracting pollinators, and reducing water use.

At every turn, more uses for tough native plants are being found, most recently in addressing stormwater pollution, drought, lower maintenance costs, and urban heat island effects. These uses and benefits were not addressed in the original report, but act to validate the County's continued reliance on native plants.

The main need that County staff identified in the process of developing this report is more communication among departmental practitioners; a native plant working group should promote use of native plants, improve internal practices, and share lessons learned.

## Sources

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## Appendix 1. Native Plant Nursery Seed Library

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|--------------------------|----------------------------------|
| Abutilon sp.             | Baccharis salicifolia            |
| Abutilon reventum        | Bahia absinthifolia              |
| Acacia angustissima      | Bauhinia lunaroides              |
| Acacia constricta        | Baileya multiradiata             |
| Acacia greggii           | Bebbia janusia                   |
| Acacia millefolia        | Berberis trifoliata              |
| Acacia neovernicosa      | Bothriochloa barbinodis          |
| Acacia occidentalis      | Bouteloua chondrosoides          |
| Acacia smallii           | Bouteloua curtispindula          |
| Acacia willardiana       | Bouteloua hirsuta                |
| Acacia wrightii          | Bouteloua repens                 |
| Acourtia thurberi        | Bouteloua rothrockii             |
| Acourtia wrightii        | Bouteloua trifida                |
| Agave chrysantha         | Brickellia californica           |
| Agave mckelveyana        | Brickellia floribunda            |
| Agave palmeri            | Calliandra californica           |
| Agave parryi             | Calliandra eriophylla            |
| Agave parryi v. parryi   | Carex chihuahuensis              |
| Agave schottii           | Carnegiea gigantea               |
| Allium macropetalum      | Capsicum annum                   |
| Aloysia wrightii         | Ceanothus greggi                 |
| Ambrosia ambrosioides    | Celtis pallida                   |
| Ambrosia cordifolia      | Celtis reticulata                |
| Ambrosia deltoidea       | Cephalanthus occidentalis        |
| Andropogon scoparius     | Ceratoides lanata                |
| Anemopsis californica    | Chilopsis linearis               |
| Anisacanthus thurberi    | Cissus trifolitata               |
| Antigonon leptopus       | Clematis drummondii              |
| Arctostaphylos pungens   | Coursetia glandulosa             |
| Argemone sp.             | Curcubita digitata               |
| Aristida pansa           | Dalea albiflora                  |
| Aristida purpurea        | Dalea pulchra                    |
| Aristolochia watsonii    | Dalea versicolor v. sessiliflora |
| Asclepias albicans       | Dasylium wheeleri                |
| Asclepias asperula       | Datura wrightii                  |
| Asclepias currasavica    | Desmodium arizonicum             |
| Asclepias linaria        | Desmodium batocaulon             |
| Asclepias nyctaginifolia | Desmodium cinerascens            |
| Asclepias subulata       | Desmodium sp.                    |
| Atriplex lentiformis     | Digitaria californica            |
| Atriplex polycarpa       | Distichlis spicata               |

## Appendix 1. Native Plant Nursery Seed Library

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| <i>Dodonaea viscosa</i>                         | <i>Larrea tridentate</i>                    |
| <i>Encelia farinose</i>                         | <i>Leptochloa dubia</i>                     |
| <i>Eragrostis intermedia</i>                    | <i>Lotus rigidus</i>                        |
| <i>Ericameria laricifolia</i>                   | <i>Lotus sp. (Bear Canyon)</i>              |
| <i>Ericameria nauseosus</i>                     | <i>Lycium berlandieri</i>                   |
| <i>Eriogonum fasciculatum</i>                   | <i>Lycium exsertum</i>                      |
| <i>Erythrina flabelliformis</i>                 | <i>Lycium fremontii</i>                     |
| <i>Eupatorium greggii</i>                       | <i>Mammillaria grahamii</i>                 |
| <i>Eupatorium solidaginifolium</i>              | <i>Marah gilensis</i>                       |
| <i>Ferocactus cylindraceus</i>                  | <i>Marina parryi</i>                        |
| <i>Ferocactus wislizenii</i>                    | <i>Maurandya antirrhiniflora</i>            |
| <i>Ferocactus wislizenii v. flavispina</i>      | <i>Melampodium leucanthum</i>               |
| <i>Fouquieria splendens</i>                     | <i>Mentzelia sp.</i>                        |
| <i>Fraxinus velutina</i>                        | <i>Mimosa biuncifera</i>                    |
| <i>Foresteria shrevei</i>                       | <i>Mimulus guttatus</i>                     |
| <i>Gaillardia pulchella</i>                     | <i>Muhlenbergia emersleyi</i>               |
| <i>Gossypium thurberi</i>                       | <i>Muhlenbergia rigens</i>                  |
| <i>Guardiola platyphylla</i>                    | <i>Nissolia schottii</i>                    |
| <i>Guaicum coulteri</i>                         | <i>Nolina microcarpa</i>                    |
| <i>Guttierrezia sarothrae</i>                   | <i>Nolina texana</i>                        |
| <i>Haplophyton crooksii</i>                     | <i>Oenothera caespitosa</i>                 |
| <i>Herrisantia crispum</i>                      | <i>Oenothera elata ssp. hirsutissima</i>    |
| <i>Heteropogon contortus</i>                    | <i>Oenothera hookeri</i>                    |
| <i>Heterotheca subaxillaris</i>                 | <i>Olneya tesota</i>                        |
| <i>Hibiscus biseptus</i>                        | <i>Opuntia basilaris</i>                    |
| <i>Hilaria belangeri</i>                        | <i>Opuntia chlorotica</i>                   |
| <i>Hilaria rigida</i>                           | <i>Opuntia santa-rita</i>                   |
| <i>Holocantha emoryi</i>                        | <i>Panicum obtusum</i>                      |
| <i>Hymenoclea salsola</i>                       | <i>Pappophorum vaginatum (mucronulatum)</i> |
| <i>Hyptis emoryi</i>                            | <i>Pappophorum wrightii</i>                 |
| <i>Imperata brevifolia</i>                      | <i>Parkinsonia florida</i>                  |
| <i>Indigofera sphaerocarpa</i>                  | <i>Parkinsonia microphylla</i>              |
| <i>Ipomoea carnea</i>                           | <i>Parkinsonia praecox v. praecox</i>       |
| <i>Ipomoea longifolia</i>                       | <i>Passiflora mexicana</i>                  |
| <i>Isocoma tenuisecta</i>                       | <i>Peniocereus greggii</i>                  |
| <i>Jacquemontia pringleii</i>                   | <i>Peniocereus striatus</i>                 |
| <i>Janusia gracilis</i>                         | <i>Penstemon eatonii</i>                    |
| <i>Justicia californica</i>                     | <i>Penstemon parryi</i>                     |
| <i>Justicia sonorae</i>                         | <i>Penstemon psuedospectabilis</i>          |
| <i>Keckiella antirrhinoides</i>                 | <i>Penstemon superbus</i>                   |
| <i>Lachnostoma arizonica (same as Matalaea)</i> | <i>Phaseolus acutifolius</i>                |

## Appendix 1. Native Plant Nursery Seed Library

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| Phaseolus filliformis            | Tridens muticus        |
| Pleuraphis mutica                | Trixis californica     |
| Pluchea sericea                  | Vaquelinia californica |
| Plumbago scandens                | Washingtonia filifera  |
| Porophyllum gracile              | Yucca elata            |
| Proboscidea sp.                  | Yucca schottii         |
| Prosopis glandulosa v. torreyana | Zinnia acerosa         |
| Prosopis pubescens               |                        |
| Prosopis velutina                |                        |
| Purshia mexicana                 |                        |
| Rhus microphylla                 |                        |
| Rhus trilobata                   |                        |
| Salazaria mexicana               |                        |
| Salvia apiana                    |                        |
| Salvia henryi                    |                        |
| Sambucus mexicana                |                        |
| Sapindus drummondii              |                        |
| Sapindus saponaria               |                        |
| Schizachyrium sp.                |                        |
| Senna armata                     |                        |
| Senna bauginioides               |                        |
| Senna covesii                    |                        |
| Senna hirsuta v. glaberrima      |                        |
| Senna leptocarpa                 |                        |
| Senna lindheimeriana             |                        |
| Senna wislizenii                 |                        |
| Setaria sp.                      |                        |
| Sophora arizonica                |                        |
| Sphaeralcea ambigua              |                        |
| Sphaeralcea fendleri             |                        |
| Sphaeralcea laxa                 |                        |
| Sporobolus airiodes              |                        |
| Sporobolus contractus            |                        |
| Sporobolus cryptandrus           |                        |
| Sporobolus wrightii              |                        |
| Stephanomeria pauciflora         |                        |
| Stipa neomexicana                |                        |
| Tecoma stans                     |                        |
| Tecoma stans v. angustatum       |                        |
| Thymophylla pentacheata          |                        |
| Trichostemma arizonicum          |                        |