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Sr. Plant Engineer
Mesquite Power, LLC
37625 W. Elliot Road
Arlington, AZ 85322
Tel: (623) 386-8538
Cell: (623) 866-3183
Fax: (623) 327-0387
sperrizo@mesquitepower.com

January 19, 2012

Arizona Corporation Commission
DOCKETED
JAN 23 2012
DOCKETED BY

Colleen Ryan, Supervisor
Document Control Center
Arizona Corporation Commission
1200 West Washington Street
Phoenix, Arizona 85007

Re: Mesquite Generating Station
CEC Decision No. 63232
Docket No. L-00000S-00-0101
2011 Annual Report

Dear Ms. Ryan:

On behalf of Mesquite Power, LLC, I am submitting the annual report outlining the status of the Comprehensive Land Management Plan per Stipulation 12 of the Certificate of Environmental Compatibility. Also included is the status of all of the remaining stipulations as agreed to in 2003.

Attached are thirteen copies of the Annual Report for 2011. Please contact me at (623) 386-8538 should you have any questions or need additional information.

Sincerely,

Steve Perrizo
Sr. Plant Engineer

cc: Bob Ellis, Mesquite Power
Marilyn Teague, Sempra Global

Certificate of Environmental Compatibility
2011 Annual Status Report
Mesquite Power Project
Docket No. L-00000S-00-0101

Submitted to

Arizona Corporate Commission

by

Mesquite Power, LLC

January 2012

Executive Summary

The Arizona Corporate Commission, on recommendation by the Line Siting Committee, approved a Certificate of Environmental Compatibility (CEC) for the construction of the Mesquite Generating Station, a 1,250-megawatt (MW) natural gas fired, combined cycle power plant. Stipulation 12 of the CEC requires Mesquite Power, LLC to submit an annual report outlining the implementation status of the Comprehensive Land Management Plan that was included with the application for this certificate. In June, 2003, Mesquite Power agreed to voluntarily submit a comprehensive overview of compliance to all the stipulations of the CEC.

The construction of the facility was completed in 2004. Block 1 of the facility was turned over to operations on May 20, 2003 and Block 2 of the facility was turned over to operations on November 12, 2003. Landscaping was started in November 2003 and was completed in summer 2004. Five (5) permanent production wells supply water to the plant for operations and the revegetation project at the water property.

The status of the implementation of the Comprehensive Land Management Plan is documented in the separate status report included as an attachment to this report.

List of Attachments

Certificate of Environmental Compatibility
2011 Annual Status Report

1.0 Introduction

The Arizona Corporate Commission, on recommendation by the Line Siting Committee, approved a Certificate of Environmental Compatibility (CEC) for the construction of the Mesquite Generating Station, a nominal 1,250-megawatt (MW) natural gas fired, combined cycle power plant. Stipulation 12 of the CEC requires Mesquite Power, LLC to submit an annual report outlining the implementation status of the Comprehensive Land Management Plan that was included with the application for this certificate. In June, 2003, Mesquite Power agreed to voluntarily submit a comprehensive overview of compliance to all the stipulations of the CEC.

2.0 Compliance with the Stipulations

The following is the status of the project relative to the stipulations from CEC Decision # L-00000S-00-0101.

Stipulation 1

The applicant and its assignees will comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans and regulations of the State of Arizona, the County of Maricopa, the United States, and any other governmental entities having jurisdiction.

Mesquite Power is in compliance with all applicable air and water pollution control standards and regulations.

Stipulation 2

This authorization to construct the Mesquite Project will expire five (5) years from the date the Certificate is approved by the Arizona Corporate Commission ("Commission") unless construction of the Mesquite Project is completed to the point that the Mesquite Project is capable of operating at its rated capacity by that time; provided, however, that prior to such expiration Applicant or its assignee may request that the Arizona Corporation Commission extend this time limitation.

Both power blocks were operating commercially as of December, 2003. The outstanding construction issues such as fencing, asphalt, and landscaping were completed in summer, 2004.

Stipulation 3

Applicant shall meet all applicable requirements for groundwater use set forth in the Third Management Plan for the Phoenix Active Management Area existing as of the date Applicant first begins withdrawing groundwater in connection with the Project. Applicant shall limit its aggregate annual withdrawal of groundwater to (i) 7,500 acre feet for the Mesquite Project site, and (ii) such additional volumes available within its Type 1 Groundwater Right as may be needed to implement the portion of the Comprehensive Land Management Plan provided for at Condition 11 (ii) below.

The five (5) permanent productions wells have been supplying water to the plant for operations and irrigation. The wells were converted to non-exempt wells in an Active Management Area and all reports required by ADWR are current.

The well spacing has resulted in a limitation on the amount of water each well can pump annually as follows:

	Annual Limit	2011 Usage
Well no. 55-587025 (#1)	1,500 acre-feet	**1,064** acre-feet
Well no. 55-587026 (#2)	1,615 acre-feet	**1,175** acre-feet
Well no. 55-587021 (#3)	2,150 acre-feet	**1,372** acre-feet
Well no. 55-587022 (#4)	1,370 acre-feet	**975** acre-feet
Well no. 55-587023 (#5)	1,370 acre-feet	**1,087** acre-feet

A total of **5,673 acre-feet** of water was used for the plant therefore not exceeding the 7,500 acre-feet of annual withdrawal allowed. In addition to the plant use, approximately **8** acre-feet of water was used in 2011 for irrigation for the plant site, water property revegetation, and the wildlife habitat. An additional **300** acre-feet was used for dust control for construction of the solar facility located on the water property.

In 2011 Mesquite Power did not quite meet the requirements of the 3rd Management Plan of the Phoenix Active Management Area. The Plan requires an average of 15 cycles of concentration for the cooling tower water, for which Mesquite averaged 14.6 cycles.

Stipulation 4

Applicant will provide to the Commission, not more than 12 months prior to the commercial operation of the plant, a technical study regarding the sufficiency of transmission capacity from the plant to the wholesale electric market.

Stipulation requirements met in 2003.

Stipulation 5

The plant interconnection must satisfy the Western Systems Coordinating Council's ("WSCC") single contingency outage criteria (N-1) without reliance on remedial action such as generator unit tripping or load shedding.

Stipulation requirements met in 2003.

Stipulation 6
Applicant will within fifteen (15) days of reaching such an agreement, submit to the Commission an interconnection agreement with the transmission provider with whom it will be interconnecting.

Stipulation requirements met in 2003.

Stipulation 7
Applicant or one of its affiliates will become a member of WSCC, or its successor, and file a copy of its WSCC Reliability Criteria Agreement or Reliability Management System (RMS) Generator Agreement with the Commission.

Stipulation requirements met in 2003.

Stipulation 8
Applicant will use commercially reasonable efforts to become a member of the Southwest Reserve Sharing Group, or its successor, thereby making its units available for reserve sharing purposes, subject to competitive pricing.

This was provided to the ACC in a letter dated July 11, 2003.

Stipulation 9
Applicant will use low profile structures, moderate stacks, neutral colors, compatible landscaping, and low intensity directed lighting for the plant.

The plant was designed and constructed using low profile structures, moderate stacks, and neutral colors. The landscaping involved the replanting of many mesquite trees removed from the site during construction. The outdoor lighting was designed and constructed by the engineering, procurement, and construction (EPC) contractor in accordance with Maricopa County and International Dark-Sky Association recommendations. The plant construction is complete and no other lighting is to be installed.

Stipulation 10
Applicant will operate the Project so that during normal operations the Project will not exceed (i) HUD residential noise guidelines or (ii) OSHA worker safety noise standards.

Noise emissions performance testing was performed on June 27-28, 2007 by GEC, Inc. To support compliance with OSHA worker noise exposure limits, in-plant sound pressure level measurements were conducted throughout the facility and those areas that experienced sound levels above 85 dBA during normal peak load operation were identified. In addition, A-weighted (L90) sound level measurements were taken at six property boundary locations during simultaneous base load operation of both power blocks.

Stipulation 11
Applicant will implement its Comprehensive Land Management Plan as presented to the Committee in hearing Exhibit A-13 for the plant site and the 3,000 acre Water Property that includes:

> *(i) Installation of a professionally designed landscape plan for the entrance of the facility and along Elliot Road.*

(ii) Implementation of a comprehensive revegetation program designed to restore portions of the water property with plant communities similar to the adjacent desert lands.

(iii) Where feasible, the development of ongoing working relationships with the Phoenix Zoo, Southwest Wildlife Rehabilitation and Educational Foundation, Inc. and Arizona Game and Fish Department to develop alternative land uses for the water property that can be beneficial to the community and consistent with an "open space" land use designation; and

Stipulation 11(i) - Was completed in 2004.
Stipulation 11(ii) - The revegetation was completed in spring, 2009. The watering was terminated after spring, 2011.
Stipulation 11(iii) - An enhanced wildlife habitat was completed in December, 2007 and is currently in operation.

Stipulation 12

Applicant will submit annual reports (for 10 years) to the Commission setting forth the status of implementation of the Comprehensive Land Management Plan and any feasible alternative land uses which may have been identified and agreed upon by Applicant and the aforesaid organizations. The first annual report shall be filed one year from the date this Certificate is approved by the Commission.

The status of the implementation of the Comprehensive Land Management Plan is documented in the Status Report on the Comprehensive Land Management Plan provided in **Attachment 1**.

This is the eighth annual report that voluntarily provides the status of all the stipulations.

ATTACHMENT 1

Status Report on the Comprehensive Land Management Plan

FINAL REPORT TO THE ARIZONA CORPORATION COMMISSION ON THE MESQUITE POWER/UNIVERSITY OF ARIZONA DESERT REVEGETATION EXPERIMENTAL PLANTING – ARLINGTON VALLEY, ARIZONA

Prepared for

Mesquite Power, LLC
A subsidiary of
Sempra Energy Resources

by

Travis M. Bean
and
Martin M. Karpiscak
Office of Arid Lands Studies
School of Natural Resources and the Environment
The University of Arizona
Tucson, Arizona 85719

October 2011

EXECUTIVE SUMMARY

This report describes the background behind and evolution of a successful strategy for returning severely disturbed lands in arid environments to productive and diverse native plant communities. We strongly recommend this strategy for revegetating similar lands such as the widespread, former agricultural lands in southern and central Arizona, given 2 conditions: 1) functioning wells are present to allow for a water supply to be made available as well as reasonable cost and 2) these lands are not otherwise slated for solar power generation development. It is our strong opinion that development of solar power generation on former agricultural lands is vastly preferable to disturbing "pristine" desert lands from an environmental conservation perspective, and may also be more cost effective in terms of proximity to existing electrical infrastructure, roads, and environmental permitting.

Our main strategy focused on drip-irrigated container stock of selected perennial native species. The drip system utilized drip-tape of custom spacings designed after low-cost vegetable production system used in the Yuma and Imperial Valleys. This allows only the soil in the immediate area around the planted stock to be disturbed and irrigated, reducing weed establishment and competition. It also allows for precise planting locations when pre-irrigated prior to planting. Plants were chosen for their nativity to the local area, their longevity and ability to self-seed, their desirability to attract wildlife for forage and cover, and their ability to serve as nurse plants for the reinvasion of other native plants onto the sites, further enhancing biodiversity. Small (1-gallon) container stock proved successful for most species, and 1 year of irrigation was usually enough to provide long term establishment. Selecting container stock instead of seed allows for precise control of plant community composition and plant densities. Our method also allows for the use of common, unspecialized farming equipment and labor, as well as the use of local knowledge and resources of current adjacent agricultural users. Costs for this method compared favorably to other, less successful but more common methods of revegetation in arid areas (e.g. seeding or hydroseeding with or without irrigation), especially given the long-term success of this method.

Many problems were experienced, and the vast array of uncontrollable factors point to the importance of long-term monitoring of the success of revegetation efforts in severely disturbed arid areas. Some problems experienced include severe browsing by jackrabbits, malfunctions in over-designed irrigation systems (initial system was designed for landscape rather than agricultural applications), random flooding during well maintenance, extreme weather events (unusually late freezes or wet winters/summers), rank growth of weed species following unprescribed soil disking, confusion with plant suppliers over species names and the resultant delivery of inappropriate species, damage caused by trespassing recreational vehicle users, and continuing encroachment and heavy grazing from trespass cattle on adjacent, overstocked but severely disturbed and denuded public lands. Without the continued monitoring of this effort over the span of a decade, none of these confounding factors could have been observed and accounted for in evaluating the revegetation effort.

Beginning with a small test planting in March 2002, over 2,000 acres of degraded former agricultural lands have since been successfully planted to native Sonoran Desert species on the Mesquite Power water properties in the last 7 years. The last scheduled planting, located on the property north of Elliot Road, was completed in early 2009. Ironically, just as the revegetation plantings have been completed, most of these fields are now likely to be cleared of vegetation in preparation for the development of a solar energy generation facility. At present, no solar arrays are planned for the area north of Elliot Road, hence, this is the only planting expected to survive the final construction phase of the new solar facility, and will provide opportunities for continued monitoring of vegetation into the foreseeable future, given that permission to do so is granted by the landowner.

INTRODUCTION

THE PROJECT SITE

The Mesquite Generating Station Plant, Arizona was developed on land in Arlington Valley and is operated by Mesquite Power, LLC (Mesquite Power), a subsidiary of Sempra Energy Resources ("Sempra"). This station is a combined cycle generating facility with a base rating of 1,024 megawatts (MW) and a peak output of 1,250 MW. The facility was developed on a 3,400-acre site about 40 miles west of the Phoenix metro area in Maricopa County. The overall site consists of two distinct properties: the power generating facility plant site (Project Site) and the nearby Water Property. The large Water Property site was acquired in order to obtain adequate water rights to operate the gas fired power generating facility. The site consists of both unfarmed land and retired agricultural fields. The operating facility only required a small part of the overall land area and was built on some of the unfarmed acreage. The primary purpose of this report is to address issues related to the revegetation of once actively-farmed portions of the overall site.

As part of the land management plan for the Mesquite Power Project, in 2001 the University of Arizona began to study the implementation of a comprehensive revegetation program to restore a large portion of the Mesquite Power Water Property with self-sustaining native plant communities similar to the adjacent, unfarmed desert lands. The purpose of the revegetation program is to return these former agricultural lands to beneficial use as open space that will attract wildlife and enhance the surrounding environment. As stated above, the scope of the project is large: approximately 3,000 acres of retired agricultural land exists on the site, having lain fallow for a period of 10-20 years. These properties are located about 2 miles west of the Mesquite Power generating facility. The Project Site is 8 miles south of Interstate 10 and the approximate coordinates of the site are latitude 33° 20' north, longitude 112° 51' east. The approximate legal description of the property is: the west half of Section 15, Township 1 South, Range 6 West, Gila and Salt River base and meridian, Maricopa County, Arizona. The Project Site is south of the Palo Verde Nuclear Generating Station (PVNGS) and is located at the southeast corner of 379th Avenue and Elliot Road, approximately 0.5 mile east of Wintersburg Road.

The project site is situated within the lower Colorado subdivision of the Sonoran Desert, the most arid and therefore the most difficult to revegetate. Revegetation of such harsh environments is a difficult and slow process, but by studying our successes and failures in this project we have an opportunity to improve our success in additional plantings at this location and to establish a sound scientific and practical basis for future revegetation plantings in low desert environments in Arizona and the southwest. An aerial photograph showing an outline of the overall site is presented in Figure 1, along with locations and approximate acreages of the planted fields, numbered in order of planting date. Additional acreage was recently purchased as part of the plans for the proposed solar facility. These areas are not shown in Figure 1. Table 1 provides additional information on the planted fields, including planting densities, container sizes used, perennial plant species richness within the fields, and any additional notes about discrepancies in planting method or other unplanned occurrences. Table 2 provides information about species found in the planted fields, including their common and botanical names, their 4-letter codes used when referring to them in tables and charts, and their life-forms.

BACKGROUND

An estimated 850 square miles of abandoned farmland exists in the Gila and Santa Cruz River Valleys of Arizona (Jackson *et al.*, 1991). Much of this barren land is dominated by exotic annuals such as *Salsola kali* (Russian thistle, aka "tumbleweed") and *Sisymbrium irio* (London rocket) (Karpiscak, 1980), existing in stark contrast to native desert lands dominated by *Larrea tridentata* (creosote bush) and *Atriplex* spp. (saltbush). This land is often associated with environmental problems such as dust pollution, a loss of wildlife habitat, accelerated soil erosion and downstream flooding caused by rapid runoff from barren surfaces, *S. kali* blowing onto roadways and adjacent properties, and auto accidents during dust storms. A typical retired farm field in the Sonoran Desert is shown in Figure 2. Until recently, there has been little interest in restoring the lowland scrub that is native to this part of the Sonoran Desert, likely due to a general lack of knowledge about its ecology. Few studies have been made of the lowland desert vegetation, that of Shantz and Piemeisel (1924) to evaluate the soils and vegetation for their agronomic potential and that of Karpiscak (1980) to study the process of secondary succession on abandoned farmland, are some of the most well known.

The revegetation of former agricultural lands is a complex process involving many challenges and often resulting in limited success. This is in part because the establishment of arid adapted vegetation on former agricultural lands is an evolving science and there is a general lack of an established proven methodology. Few documented examples exist of attempted revegetation efforts on retired farmland (Jackson *et al.*, 1991; Munda, 1986) and even fewer on a site as large as the project area (Thacker and Cox, 1992). Other concerns include the management of dust and invasive weeds, *Tamarix chinensis* (salt cedar), Sahara mustard (*Brassica tournefourtii*), and buffelgrass (*Pennisetum ciliare*), in particular.

Undisturbed or long-fallowed agricultural soils can develop a physical soil crust that limits the amount of dust that is capable of becoming airborne. Any soil-disturbing event breaks this crust and can increase the potential for dust problems and also provides an establishment site for invasive weeds. If not managed carefully, any irrigation used to establish native species can further aid in the establishment of undesired species. Additionally, new seedlings or container stock of native species can be particularly attractive to wildlife and losses to herbivory should be expected.

INVENTORY OF ADJACENT UNFARMED AREAS

The unfarmed areas to the east and west of the site were inventoried by the University of Arizona to provide an estimate of local vegetation parameters, once in 2001 and again in 2007 (Table 3). Vegetation densities on these areas were highly variable and were estimated at 102 and 375 plants ac^{-1} (252 and 927 plants ha^{-1}), respectively, and vegetative cover was estimated at 5% and 28%, respectively using line transects and the nearest individual distance method as described by Barbour *et al.* (1998). Average plant spacing was estimated at 7-13 ft (2-4 m) from any random point to the nearest individual plant. The most abundant species on the adjacent unfarmed lands is *L. tridentata*, which comprises about 60 – 80% of all plants on the inventoried areas. Figure 3 shows a *Larrea*-dominated area, adjacent to the revegetated fields, that has not been farmed. *Ambrosia dumosa* (white bursage) is the second most abundant species, comprising about 10 – 25% of all plants on the inventoried areas. Other common species occurring on the adjacent lands include *Prosopis velutina* (velvet mesquite), *Lycium exsertum* (wolfberry), *Atriplex polycarpa* (desert saltbush), *Opuntia ramosissima* (diamond cholla), *Acacia greggii* (catclaw acacia), *Krameria grayii* (white ratany), *Pleuraphis rigida* (big galleta), and *Dasyochloa pulchella* (fluffgrass), among others. Plant species were identified according to Kearney and Peebles (1960).

THE "TARGET" PLANT COMMUNITY

One challenge in revegetation of retired croplands in this region is determining the pre-disturbance (target) plant community. Reliable personal accounts are rare since much of the land was cleared more than 30 years ago, and any aerial photographs are of an inappropriate scale to accurately determine the plant species present. Often, the only clues that remain are the plant communities on lands adjacent to the cropland, although croplands in the Southwest typically are located adjacent to ephemeral watercourses (washes) and are lower in elevation and probably of a slightly different soil type than the areas that remain unfarmed. Early research by Shantz and Piemiesel (1924) in central Arizona supports this observation, stating that the best lands for agriculture were the desert saltbush-dominated shrub communities adjacent to washes, which transitioned into creosote bush-dominated communities as distance from a wash and elevation increased. Although the two communities sampled were creosote bush dominated, as a bet-hedging strategy, we decided to select common species from both communities in composing the species list for our revegetation project efforts. In retrospect, this proved to be a wise choice, as saltbush species have performed particularly well in the revegetation plantings.

PLANT MATERIAL SOURCES

Unfortunately, not all of the native species found during the inventory are commercially available. Of those that are, some are not readily available in sufficient quantities for a project of this scale. Special arrangements have been made with large nurseries specializing in desert plants, but orders must be made up to a year in advance. None of the available plant materials are source identified, meaning that none of the propagules can be traced back to a specific population at a specific locale. Some researchers suggest that most desirable plant materials for use in restoration efforts would come from the primary restoration gene pool (Booth and Jones, 2001), which includes those populations that are genetically connected to local populations. Custom seed collection is very expensive, can be an unreliable source of seed during dry years, and can be a significant source of introduction for noxious and invasive weed species depending on where the target species are collected. Others have argued that locally collected plant materials may no longer have an evolutionary advantage for revegetation of highly disturbed sites because current conditions are quite different from those found prior to its being brought into agriculture. In this effort the same plant species as those growing naturally on adjoining sites, or in some instances on the revegetation site itself, were used in the planting, their origins, however, are from various Arizona locales. Appropriate cacti species were unavailable in seed or container stock in sufficient quantities, and the workers performing the plantings were reticent to handle cacti, thus this functional group was left out of the planting palette. Similarly, *Krameria*, a common species on adjacent undisturbed lands, is thought to be a root parasite and both seed and container stock are extremely rare.

PLANTING HISTORIES

INITIAL PLANTINGS SPRING 2002 – FIELD 1

On March 6, 2002, approximately 50 ac (20 ha) of retired farmland was hand-planted using a mixture of 15 species of native shrubs, forbs, and grasses using rose pot (RP) container stock. RP container stock (sometimes sold as "liners"), measuring 2x2x3 in (5x5x8 cm), are commonly sold by wholesale nurseries to retail outlets, where they are then planted into larger size containers and sold to the consumer after a short period of growth. A seed mixture of 12 native species was hand-seeded in the 10 easternmost rows of the field. The entire field was drip irrigated using a system designed after vegetable production in the Yuma area. Planting rates for container stock were 200 plants per acre, or double the vegetation density found on the adjacent undisturbed and unfarmed areas. This was to compensate for the higher mortality of the smaller container stock size. Seed was applied at a rate of 15 lbs ac^{-1} (17 kg ha^{-1}) to a two ft (0.6 m) radius around each drip emitter within the selected portion of the field. Top performers for the container stock included all *Atriplex* spp., *P. velutina*, *L.exsertum*, and *P. rigida*. Initial germination and establishment of the seeded portions of the field was high, making it difficult to properly inventory the resulting stands. *A. lentiformis* (quailbush), has performed consistently well across all treatments. There was poor establishment of *L. tridentata* from seed and container stock, which is a dominant species in surrounding unfarmed areas.

A late frost was experienced by the plants just prior to planting, and may have increased mortality of certain species, especially *Baileya multiradiata* and *A. dumosa*. Irrigation was ceased in this field in early spring of 2003, due to the spread of the invasive exotic tree *T. chinensis*, which had become established at more than 30 percent of the emitters in the field as of 2008. Once irrigation was ceased, no further establishment of *T. chinensis* was witnessed, and some of the smaller trees died. Most of the native species planted in this field have not exhibited any signs of drought stress, with the exception of *A. lentiformis*, which was observed to drop leaves during the summer months but later recovered with the onset of cooler temperatures. Many "volunteer" (not intentionally planted) seedlings have been observed-these are most likely the progeny of the container stock. Species that have been particularly successful at reproducing include *P. velutina*, *Atriplex* spp., *Aristida purpurea*, *P. rigida, L. exsertum,* and *Sphaeralcea ambigua*. In 2008, we found an average of at least one volunteer for every 4 emitters surveyed.

Density and cover of planted species in this field for 2007-2010 can be seen in Tables 4 and 5. Ten species of perennial plants occur in this field, 9 of those being native. This planting experienced unusually high levels of encroachment of a native shrub, *Isocoma acradensis* (burroweed) and the invasive and federally listed noxious weed *T. chinensis* (see discussion above). As of 2010, the 5 most frequently encountered species in this field were *A.polycarpa, I. acradensis, P. rigida, P. velutina,* and *T.chinenis.* Changes in density and cover for these species over the last 3 sample dates is displayed in Figure 4 and 5. Overall native plant density in this field is 308 plants ac^{-1} (761 plants ha^{-1}) and cover is 18.7%, well within the parameters in the undisturbed areas. A photograph of this field is shown in Figure 6, taken September 2011.

SPRING 2003 PLANTINGS – FIELDS 2A AND 2B

Approximately 280 acres were planted with 60,000 RP container-sized plants near the end of February 2003. The same methods were employed (drip irrigation, hand planting, rose pot container stock) as in Field 1, and the species composition remained the same. No seed was used in this planting. The results from an associated study indicated that larger container stock (one-gallon-size containers [OG]) may be more effective for revegetation than the small RP container stock (Bean *et al.* 2004), but data was unavailable until after the order for the smaller container stock had been made. To accommodate the higher mortality of the smaller container stock this field was planted at double density. Some OG container stock of *L. tridentata*, became available at the last minute, however, and was planted in selected parts of the field (Field 2A) near the western and southern boundaries. This planting was completely covered by a rank growth of annual weeds that occurred in 2004 through 2006 (Figure 7). Prior to extreme flooding events in winter 2009/2010, visual results of the planting are quite satisfactory with *L. tridenata* doing particularly well in this planting. However, current data indicate that *L. tridentata* suffered significant mortality from the prolonged flooding (198 plants ac^{-1} [489 plants ha^{-1}] in 2009 to 98 plants ac^{-1} [242 plants ha^{-1}] in 2010), as seen in Figure 8. However, this field has shown a significant level of revegetation, as seen in Figure 9, taken in September 2011.

Density and cover of planted species in this field for 2007-2010 (Field 2A) and 2007-2008 (Field 2B) can be seen in Tables 4 and 5. As of 2010, 13 species of perennial plants occur in the portion of this field planted with RP container stock (Field 2B), 9 in the OG portion (Field 2A) of the field, all native. Encroachment of *Isocoma* was also high in this field, especially in the portion planted with RP container stock. This species is often symptomatic of heavy livestock grazing and its abundance here is likely as a function of the proximity to the heavily overgrazed state land to the south. Ongoing, heavy use by trespass cattle has been witnessed in this field on every visit made by University staff since the field was planted. Fortunately no *Tamarix* was found in the planted area in either portion of this field. A 2010 view of an undamaged part of 2A is shown in Figure 10. This field is heavily dominated by *Larrea tridentata,* followed by *A. polycarpa, I. acradensis, L. exsertum, P. rigida,* and *P. velutina* (Figure 11 and 12). As of 2010, overall perennial plant density in 2A is 244 plants ac^{-1} (603 plants ha^{-1}) and cover is 10%. Field 2B is dominated by *A. canescens, A. lentiformis, I. acradensis, L. exsertum,* and *P. velutina* (Figures 13 and 14). Perennial plant density, as of 2010, in Field 2B is 392 plants ac^{-1} (968 plants ha^{-1}) and cover is 12.2%. Both portions of the field are within the normal parameters of the undisturbed adjacent areas. Curiously, *Nicotiana trigonophylla* (native tobacco), a perennial native species not planted, was also found in this field.

FALL 2004/SPRING 2005 PLANTINGS – FIELD 3

A total of 425 acres was scheduled for planting in 2004 using the same mixture of fifteen native species that were transplanted in 2002. The 2004 planting utilized OG container stock, which was designed to allow us to compare survival between container stock of different sizes (RP vs OG) on the Mesquite Power property. The planting was split between the spring (72 ac) and fall (353 ac) months with the intention of comparing the differential survival of species planted in different seasons. Seasonal differences in temperatures, soil moisture, and animal activity are hypothesized to have significant effects on the survival of the container stock. We also expected the fall planting to have less germination and establishment of salt cedar and other undesirable species because of cooler temperatures, the 2004 planting scheme was designed to allow us to make this comparison. The fall 2004 plantings, however, were impacted by the very wet fall and winter of 2004/2005 and were not completed until the spring of 2005. Qualitatively speaking, this was a successful planting with apparent high survival and establishment of planted species

(Figure 15). In addition, a small area of about 40 acres was not planted due to the failure of the irrigation tape that collapsed under the compaction of the soil resulting from the persistent rains that started in October of 2004.

Perennial plan density and cover in Field 3 for the last 3 years surveyed can be seen in Tables 4 and 5. As of 2010, 12 species of perennial plants occur in this field, all native. Like the previous fields, this planting also experienced encroachment of *Isocoma,* but in much lower levels. As of 2010, the most frequently encountered perennial plant species in this field include *A. dumosa, A.polycarpa, L. tridentata, P. microphylla* and *P. velutina* (Figures 16 and 17). As of 2010, overall native plant density in this field is 269 plants ac^{-1} and cover is 11%, well within the parameters in the undisturbed areas (see above section on Inventory of Adjacent Unfarmed Areas for more discussion on these parameters).

SPRING 2006 PLANTINGS – FIELD 4

Plantings for Spring 2006 were originally scheduled to start in late October 2005 using the same plant palette as was previously used in the Fall 2004/Spring 2005 plantings. All the plants were OG container stock. The area selected for planting covers some 400 acres just south of Elliot Road and adjoining the Mesquite Wildlife Oasis development. However, the planting was delayed by a regional shortage of essential irrigation infrastructure components caused by Hurricane Katrina, which hit the New Orleans region and disables certain sectors of the oil industry and the resin manufacturing facilities. These components were finally obtained and were installed in early 2006 in preparation for the planting. The planting was completed in the spring of 2006 and last inventoried in 2010. This field was disked prior to planting, resulting in excessive growth of *Salsola* and preventing the U of A team from sampling in 2007 and 2008.

Perennial plant density and cover in this field from the last 3 survey dates can be seen in Tables 4 and 5. As of 2010, 13 species of perennial plants occur in this field, all native. This planting has not experienced high encroachment of *Isocoma,* though it is present and is expected to increase if livestock are not excluded from the site. As of 2010, the most frequently encountered perennial plant species in this field were *A. canescens, A. polycarpa, L. tridentata, L. exsertum,* and *P. velutina* (Figures 18 and 19). Perennial plant density in this field is 289 plants ac^{-1} (714 plants ha^{-1}) and cover is 12%. Excessive growth of *Salsola* is thought to have hindered initial establishment and resulted in lower density and cover of planted species in this field compared to other plantings, however Field 4 appeared to be experiencing an increase in both density and cover of perennial plants from previous years. This field was cleared in 2011 for construction of the new solar facility (Figure 20).

SPRING 2007 PLANTINGS – FIELDS 5A AND 5B

Plantings for Fall 2006 were scheduled to start in late October 2006 using the same plant palette as was previously used in the Fall 2004/Spring 2005 and Spring 2006 plantings. A delay was encountered because of administrative changes at the power company. The actual placement of the plants took place in early 2007. All the plants were OG container stock. The area planted covers some 300 acres south of Elliot Road and the Field 4 planting.

Perennial plant density and cover in this field from the last 3 survey dates can be seen in Tables 4 and 5. Field 5A was disked along with Field 4, while Field 5B was not disked. We predicted that the disked field would have lower survival of planted species due to competition from aggressive weeds encouraged by disking. The disked field, Field 5A contains 10 perennial plant species. Neither field has experienced high encroachment of *Isocoma,* though it is present and is expected to increase if livestock are not excluded from the fields. As of 2010, the most frequently encountered perennial plant species in Field 5A were *A. canescens, A. polycarpa, L. exsertum, P. veluntina,* and *S. ambigua* (Figures 21 and 22). As of the last sample date, perennial plant density was 133 plants ac^{-1} (329 plants ha^{-1}) and cover was 1.3%. Field 5B has been significantly invaded by *Tamarix,* however, which is not surprising given the close proximity of this field to a natural drainage that harbors a large infestation of that species. The most frequently encountered species in Field 5B were *A. canescens, A. polycarpa, L. tridentata, P. velutina,* and *T. chinensis* (Figures 23 and 24). As of the last sample date, perennial plant density was 388 plants ac^{-1} (958 plants ha^{-1}) and cover was 10%, both significantly higher than for the disked field. A view of field 5B during the construction of the solar facility is shown in Figure 25.

SPRING 2008 PLANTINGS – FIELD 6

Plantings for Spring were scheduled to start in late October 2007 using the same plant palette as was previously used. A delay was encountered because of the construction and planting of the Mesquite Wildlife Oasis trail and weather conditions at the site. The actual placement of the plants occurred in early 2008. All the plants were OG container stock. The areas selected to be planted covers some 200 acres south of Elliot Road and near the completed Mesquite Wildlife Oasis. Some of the plants were used in and around the Mesquite Wildlife Oasis, and that is the area that was surveyed for this planting. Densities are much higher in this field because it was planted at quadruple densities to create a visual effect for the Mesquite Wildlife Oasis and because of its close proximity to Elliot Road (Figure 26).

Perennial plant density and cover from the last 2 surveys can be seen in Tables 4 and 5. As of 2010, 13 species of perennial plants occur in this field, all native. Unlike the previous fields, this planting did not experience encroachment of *Isocoma,* but *Cynodon dactylon* (bermudagrass), an invasive sod-forming grass common to former agricultural areas is present. The most frequently encountered perennial plant species were *A. dumosa, A. canescens, A. lentiformis, A. polycarpa, L. tridentata,* and *P. velutina* (Figures 27 and 28). Perennial plant density in this field was 1,366 plants ac^{-1} (3,374 plants ha^{-1}) and cover is 34%, the highest of all planted fields at the Mesquite Power water properties. This is a dramatic decline in density and increase in cover from 2008, suggesting that the original plants suffered high mortality, perhaps due to crowding, but that the survivors put on significant growth and became much larger plants than would be expected.

WINTER 2008/2009 PLANTINGS – FIELD 7

Plantings for fall 2008 were scheduled to start in late October 2008 using the same plant palette used in previous plantings. The permitting process to install an irrigation line across Elliot Road delayed the planting, and the actual placement of the plants occurred in December 2008 and early 2009. All the plants were 1-gallon sized container stock. This area covers some 250 acres north of Elliot Road and west of the completed Mesquite Wildlife Oasis.

Perennial plant density and cover from the November 2009 survey can be seen in Tables 4 and 5. As of 2010, 13 species of perennial plants occur in this field, all native. The most frequently encountered perennial plant species were *A. dumosa, A. canescens, A. polycarpa, L. tridentata,* and *P. velutina* (Figures 29 and 30). Perennial plant density in this field was 347 plants ac^{-1} (857plants ha^{-1}) and cover is 8%. We hope to continue to survey this field over the long term as it is the only field not currently scheduled to be cleared for the installation of solar panels. A recent photograph of this field appears in Figure 31, taken in September 2011.

CURRENT STATUS OF THE MESQUITE PROPERTY REVEGETATION PROGRAM

A total of approximately 2,050 acres has been revegetated as of the end of 2009. The first small experimental planting of 50 acres was made in March 2002, followed by a scaled-up planting of 283 acres in February 2003, a small Spring 2004 planting of some 72 acres and a large, full-scale implementation planting of 353 acres for Fall 2004/Spring 2005. This in turn was followed an additional 400 acres planted in early 2006, 500 acres in 2007 and 2008, and 250 acres in early 2009, bringing the total planted area to 2,050 acres. A map showing the locations of individual field plantings, planting dates and the types of plant materials used is presented in Figure 1, and more detail on water property lands not chosen for revegetation can be found in Figure 32.

During 2005, the U of A team was able to work with Dr. Raymond M. Turner, a retired Botanist from United States Geological Survey (USGS) in Tucson to establish permanent photography stations on the site to document the long-term vegetation changes. Dr. Turner established 3 photo stations on the property and these were added to the photo collection of the USGS in 2006. This collection contains over 2,000 photographs of the Sonoran Desert some of which have been published in "The Changing Mile," a photographic study that uses matched photographs to evaluate long-term vegetation changes in the southern Arizona. These sites are in addition to those established by the U of A team specifically for the project.

Excessive growth of annual agricultural weeds is a normal phenomenon of recently retired or disturbed fields, as weed seed banks especially of species such as *Salsola kali* (tumbleweed) can persist for several years and thrive on newly disturbed soil. This should be less of a problem in future years as time since last disturbance increases, the soil surface forms a crust and the selected desired plants become fully established. However, the surge in annual plant growth during 2005 delayed and prevented the completion of some of scheduled revegetation activities. The debris from this rank growth continued to make it impossible to survey most sites in 2006, but comprehensive surveys were completed in 2007, 2008 and 2010. Another surge in annual plant growth occurred in early 2008, though a greater abundance of desirable native annuals was noted. Also during 2008 the Mesquite Wildlife Oasis was completed and became operational.

Many problems were experienced, and the vast array of uncontrollable factors point to the importance of long-term monitoring of the success of revegetation efforts in severely disturbed arid areas. Some problems experienced include severe browsing by jackrabbits, malfunctions in over-designed irrigation systems (initial system was designed for landscape rather than agricultural applications), random flooding during well maintenance, extreme weather events (unusually late freezes or wet winters/summers), rank growth of weed species following unprescribed soil disking, confusion with plant suppliers over species names and the resultant delivery of inappropriate species, damage caused by trespassing recreational vehicle users, and continuing encroachment and heavy grazing from trespass cattle on adjacent, overstocked but severely disturbed and denuded public lands. In fact, as construction of the solar facility began some 130 head of cattle were removed from the site (Roger Junken, verbal communication, September 2011). Without the continued monitoring of this effort over the span of a decade, none of these confounding factors could have been observed and accounted for in evaluating the revegetation effort.

The revegetation program has been an overwhelming success to date, with the goal of establishing self-sustaining populations of native vegetation being largely accomplished. Thought quantitative measurements have not been taken, avian, mammal, and reptile usage of this new habitat appears to have increased dramatically in the planted areas. During 2008 a mountain lion was reported on the site. These areas stand in stark contrast to the surrounding unplanted abandoned agricultural lands that contain little or no vegetation or animal life (Figure 2). Diversity of native perennials is high in the planted fields (9-13 species), with the dominant species being *Atriplex* spp., *Larrea tridentata, Lycium exsertum, Prosopis velutina, Ambrosia dumosa, Acacia greggii,* and *Pleuraphis rigida,* representing a wide variety of life forms including trees, shrubs, sub-shrubs, and grasses. Not including the anomalous Field 5A and Field 6, current densities of desirable species range from 244 to 392 plants ac^{-1} (603 to 968 plants ha^{-1}) and cover ranges from 8 to 19% (Figures 33 and 34). The majority of these fields have not received any irrigation for the past 6 years or more and have shown their ability to not only persist but reproduce and expand. This project has been a rare success in the very difficult field of arid land restoration, and provides an extremely unique opportunity to evaluate the long-term trajectories of this artificially established ecosystem.

The Winter 2008/2009 planting completed the revegetation planting activities on the Mesquite Power water property. The areas identified in previous reports as "to be re-evaluated/planted" have been re-classified as having adequate plant recovery during an on-site inventory in 2009 (Figure 25). There are no plans for additional plantings, especially given the current plans to remove existing plantings and vegetation for development of a solar power electrical generation facility. A new stipulation "W" was issued in December 2008 by the Maricopa County Planning and Development Department for modification of the existing Special Use Permit for the operation of the Mesquite Power electrical generating facility. This modification was issued for the possible development of a solar power electrical generation facilities on most of the Mesquite Power water property south of Elliott Road. This stipulation states the following in regard to revegetation:

All re-vegetated areas within the given portion of the water property are permitted to undergo vegetation removal as necessary for construction and operation of the solar energy generation facilities.

The University of Arizona team will provide assistance to Mesquite Power in developing plans for these solar facilities to ensure that the integrity of the restored plant community is maintained as much as possible consistent with the construction and operational needs of the solar facilities. At present, it appears that all vegetation in the revegetation plantings south of Elliot will likely be removed. Only the recently planted field north of Elliot Road and the area planted around the education center are expected to survive. We hope to continue to monitor these fields for as long as possible to assist with the enhancement of future strategies for revegetation success in such harsh environments. We anticipated submission of our current findings as publication in a peer-reviewed scientific journal such as Journal of Arid Environments.

EPILOGUE

In summary one could say that it is somewhat disappointing that after nearly a decade of effort most of the plants that have been established will, in time, be cleared for construction of large-scale solar facilities; however, the authors of this report clearly want to express support for the construction of the Mesquite Solar Facility. We believe that the use of this area for construction of a solar facility makes very good ecological as well as economic sense. The site is very close to several existing gas fueled power generating facilities, the Palo Verde Nuclear Plant, as well as a major switchyard and multiple major transmission lines. Thus, there is existing infrastructure for generating power in periods the sun does not shine as well as infrastructure for the distribution of the power that is produced.

Old farmland at this site as well as other such sites likely will have existing road access, some elements that connect the area to the power grid, and land that has been cleared, leveled and subject to a significant degree of disturbance. In addition, ownership, in many instances, is already in private hands.

This project was very successful in revegating the formerly farmlands of the Sempra Water Property and other nearby fields as seen from the data presented in this report. However, no matter the level of success of the revegation effort, the ecological quality of the replanted fields at this site are not equivalent to those existing on fields that have never experienced such intense disturbance. It will still require many decades before the revegetated fields in Arlington Valley achieve the same level of habitat quality as never farmed or undisturbed lands.

The time, energy and resources that have been expended on these old farm fields have provided the opportunity to determine, demonstrate and document one of the few truly successful re-establishments of native flora as well as native fauna on retired farmland in the Sonoran Desert. This multi-year study, hopefully, will continue on some level in the portions of these fields that will remain as open space into the future. The longer the period of observation and monitoring the better will be our understanding of the development of the plants on these revegetated areas.

The authors also wish to express a recommendation that with the construction of many large-scale solar facilities in Arizona and the southwest that former farmland and other highly disturbed areas such as old mines, capped landfills and closed evaporation ponds be considered in preference to undisturbed public lands and/or private lands. The development of large-scale facilities in remote undisturbed areas will likely require new and expensive infrastructure therefore incurring much greater economic and environmental costs. Additionally, we would also like to recommend that there be an assessment of the economical and environmental costs of clearing the vegetation from large areas for the construction of these solar facilities.

Factors that need to be evaluated include the following: the trade-offs between slightly increasing the height of the collectors to permit much of the native vegetation to remain intact verses removal of the native vegetation and/or hard-scaping large areas. If the native perennial vegetation is left intact this potentially could reduce surface water runoff and downstream flooding and maintain much of the habitat value of the site while decreasing the cost for vegetation removal and flood control infrastructure. On the other hand, if the native vegetation remains mostly intact there might be an increase in the potential for fire and human and animal encounters but there is also likely to be increased electrical production for photovoltaic based systems since these operate better at slightly cooler temperatures. These and other trade-offs related to the removal of the native vegetation for the construction of large-scale solar facilities need to be clearly understood before we destroy the open space and habitat value of large tracts of native desert communities in the Southwest.

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Figure 1: Aerial photo of Mesquite Power water properties showing locations of planted fields, planting dates, and their approximate planted acreages. Fields are numbered in order of planting date, with Field 1 being the first field planted.

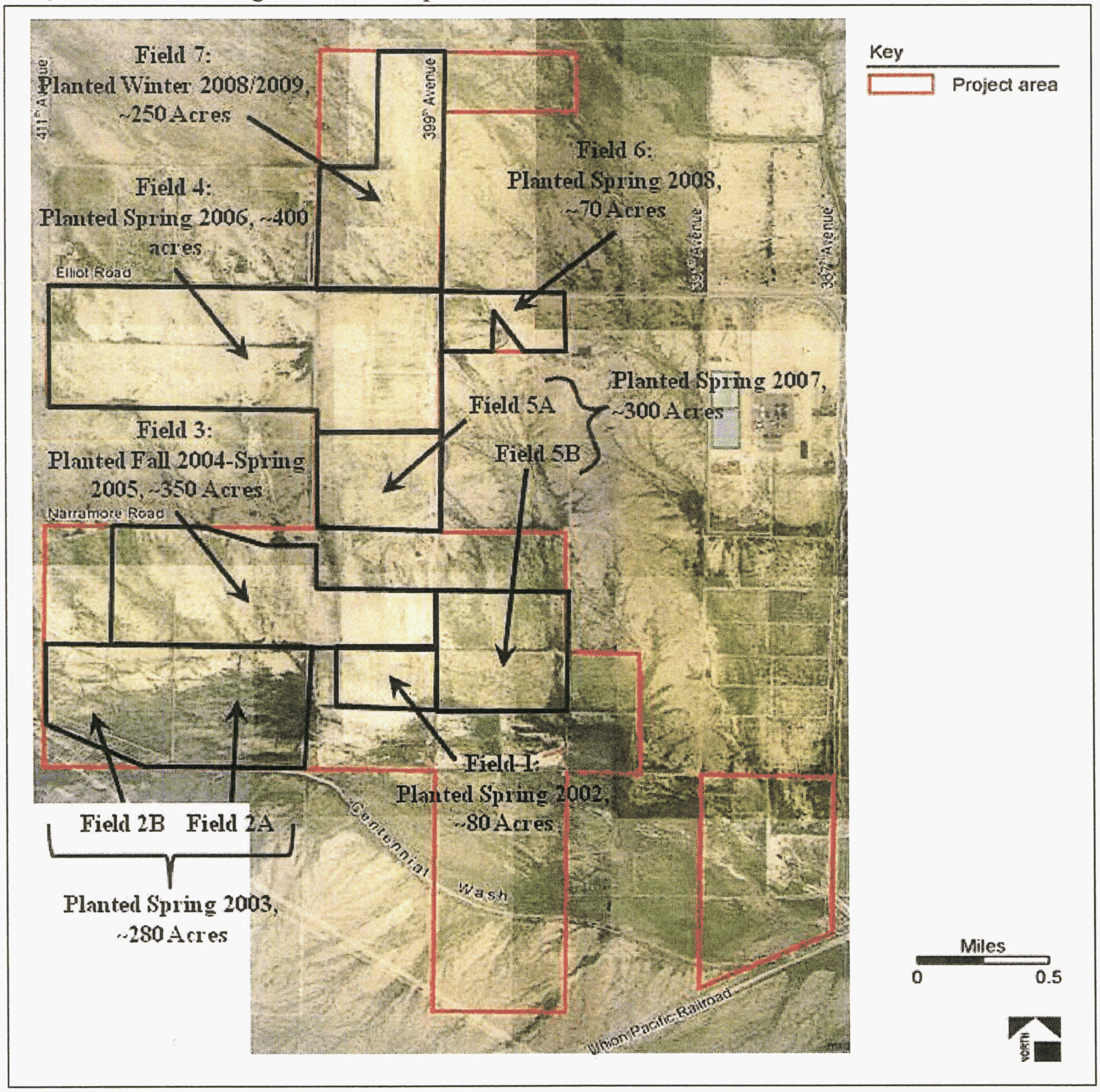


Table 1: Planting dates, planting densities, and container sizes used by field number.

Field number	Date Planted	Planting Density*	Container Size**	Perennial Plant Richness***	Other Notes
1	Spring 2002	1X	RP	12	
2A	Spring 2003	1X	RP	11	Also planted with OG LATR
2B	Spring 2003	1X	OG and RP	13	
3	Fall 2004 - Spring 2005	1X	OG	14	Planting delayed
4	Spring 2006	1X	OG	15	
5A	Spring 2007	1X	OG	10	Disked prior to planting
5B	Spring 2007	1X	OG	11	Not Disked
6	Spring 2008	4X	OG	16	
7	Winter 2008/2009	1X	OG	13	

* 1X = 20'x20'; 4X = 10'x10'

** "OG" = 1-gallon container size; "RP" = rose pot (2"x2"x3") container size

*** As of last survey date, includes species not planted.

Table 2: Species abbreviations, botanical and common names.

Species Abbreviation	Common Name	Botanical Name	Life Form
ACGR	catclaw acacia	*Acacia greggii*	large shrub/tree
AMDU	white bursage	*Ambrosia dumosa*	small shrub
ARPU	purple threeawn	*Aristida purpurea*	bunchgrass
ATCA	fourwing saltbush	*Atriplex canescens*	medium shrub
ATLE	quailbush	*Atriplex lentiformis*	large shrub
ATPO	desert saltbush	*Atriplex polycarpa*	medium shrub
CYDA	bermudagrass*	*Cynodon dactylon*	sod-forming grass
ISAC	burrowed**	*Isocoma acradensis*	small shrub
LATR	creosote bush	*Larrea tridentata*	medium shrub
LYEX	wolfberry	*Lycium exsertum*	medium shrub
MUPO	bush muhly	*Muhlenbergia porter*	bunchgrass
NITR	desert tobacco	*Nicotiana trigonophylla*	forb
PAMI	littleleaf paloverde	*Parkinsonia microphylla*	large shrub/tree
PLRI	big galleta	*Pleuraphis rigida*	bunchgrass
PRVE	velvet mesquite	*Prosopis velutina*	large shrub/tree
SPAM	globemallow	*Sphaeralcea ambigua*	forb
TACH	salt cedar*	*Tamarix chinensis*	large shrub/tree
UNK	unknown		forb

*Non-native, invasive species. Not planted.

**Native species, sometimes considered invasive. Not planted.

Figure 2: A typical un-revegetated field prior to planting. This small part of one field was left un-planted to use as a control site to compare to fields that were to be planted. Note the lack of any perennial plant cover in foreground. The March 2002 planting is visible in the background.

Table 3: Perennial plant density (plants ac^{-1}) and cover (%) of adjacent unfarmed areas as surveyed in 2001 (Natural E) and 2007 (Natural W).

Species	NATURAL W		NATURAL E	
	density	cover	density	cover
Acacia greggii			0.5	0.2%
Ambrosia dumosa	41.6	0.4%	25.5	0.3%
Atriplex polycarpa			1.0	0.0%
Dasyochloa pulchella			2.0	0.0%
Krameria erecta			0.5	0.1%
Larrea tridentata	291.5	25.9%	61.3	4.1%
Lycium exsertum			5.6	0.2%
Opuntia ramosissima	36.4	0.6%	4.1	0.0%
Pleuraphis rigida	5.2	0.8%	0.5	0.0%
Prosopis velutina			1.0	0.4%
TOTAL	374.8	27.6%	102.1	5.4%

Table 4: Perennial plant densities (plants ac^{-1}) for each planted field by survey date. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

Field	Date Surveyed	Total Density	ACGR	AMDU	ARPU	ATCA	ATLE	ATPO	CYDA	ISAC	LATR	LYEX	MUPO	NITR	PAMI	PLRI	PRVE	SPAM	TACH	UNK
1	3/14/2007	241	4	0	0	26	34	26	0	26	0	13	4	0	0	34	30	0	43	0
1	3/5/2008	353	7	0	0	13	60	33	0	80	0	27	0	0	0	27	67	13	27	0
1	2/24/2010	308	9	0	0	3	6	81	0	59	3	34	0	0	0	25	37	0	50	0
2A	3/13/2007	279	0	0	4	7	15	18	0	0	187	7	4	0	0	18	15	0	4	0
2A	2/28/2008	350	0	0	0	0	7	26	0	13	198	26	0	0	0	7	73	0	0	0
2A	2/17/2010	244	0	0	0	7	7	12	0	32	98	10	0	0	0	10	63	5	0	0
2B	3/13/2007	166	7	2	12	12	19	2	0	40	7	16	2	0	0	12	35	0	0	0
2B	3/5/2008	392	29	7	7	29	44	7	0	80	15	44	7	7	0	22	94	0	0	0
3	3/13/2007	356	15	49	0	19	19	122	0	29	34	10	5	0	5	0	34	15	0	0
3	2/28/2008	337	12	47	17	23	35	70	0	17	35	6	12	0	23	0	23	17	0	0
3	1/11/2010	269	3	27	3	13	8	67	0	16	54	8	0	0	30	11	30	0	0	0
4	3/10/2009	146	0	2	0	24	4	55	0	4	20	18	0	0	2	0	6	10	2	0
4	1/11/2010	289	9	14	3	23	17	113	0	6	58	3	3	0	12	12	17	0	0	0
5A	3/10/2009	78	0	0	0	7	0	61	0	2	0	0	0	0	0	0	5	0	0	0
5A	3/3/2010	133	0	0	0	21	8	42	0	8	3	16	0	0	0	3	5	26	0	3
5B	3/12/2009	308	0	0	0	104	0	91	0	9	14	9	0	0	0	0	36	5	41	0
5B	2/24/2010	388	0	4	0	101	8	136	0	12	19	8	0	0	0	0	66	0	35	0
6	3/19/2008	1865	190	190	63	190	158	411	32	0	126	95	95	0	32	95	158	0	0	0
6	3/3/2010	1366	27	55	55	55	191	437	0	55	246	0	82	0	27	0	109	27	0	0
7	11/19/2009	347	14	45	7	31	10	97	0	7	59	10	7	0	3	0	42	14	0	0

Table 5: Perennial plant cover (%) for each planted field by survey date.

Field	Date	Total Cover	ACGR	AMDU	ARPU	ATCA	ATLE	ATPO	BASA	CYDA	ISAC	LATR	LYEX	MUPO	NITR	PAMI	PLRI	PRVE	SPAM	TACH	UNK
1	3/14/2007	17.6%	0.1%	0.0%	0.0%	2.3%	6.0%	2.1%	0.0%	0.0%	0.2%	0.0%	0.4%	0.0%	0.0%	0.0%	0.4%	2.7%	0.0%	3.7%	0.0%
1	3/5/2008	18.0%	0.1%	0.0%	0.0%	0.5%	7.0%	2.4%	0.0%	0.0%	0.9%	0.0%	0.7%	0.0%	0.0%	0.0%	0.3%	4.7%	0.1%	1.5%	0.0%
1	2/24/2010	18.7%	0.9%	0.0%	0.0%	0.0%	0.9%	5.4%	0.0%	0.0%	0.6%	0.6%	1.0%	0.0%	0.0%	0.0%	0.1%	4.7%	0.0%	4.5%	0.0%
2A	3/13/2007	7.5%	0.0%	0.0%	0.0%	0.1%	1.1%	0.7%	0.0%	0.0%	0.0%	4.3%	0.1%	0.0%	0.0%	0.0%	0.2%	1.0%	0.0%	0.0%	0.0%
2A	2/28/2008	12.5%	0.0%	0.0%	0.0%	0.0%	1.8%	1.7%	0.0%	0.0%	0.2%	7.5%	0.4%	0.0%	0.0%	0.0%	0.1%	0.9%	0.0%	0.0%	0.0%
2A	2/17/2010	10.0%	0.0%	0.0%	0.0%	0.3%	0.2%	0.5%	0.0%	0.0%	0.5%	5.0%	0.2%	0.0%	0.0%	0.0%	0.0%	2.4%	0.8%	0.0%	0.0%
2B	3/13/2007	4.5%	0.1%	0.0%	0.0%	0.4%	1.7%	0.1%	0.0%	0.0%	1.3%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%
2B	3/5/2008	10.2%	0.3%	0.1%	0.0%	0.9%	3.9%	1.4%	0.0%	0.0%	0.8%	0.5%	0.9%	0.0%	0.0%	0.0%	0.1%	1.3%	0.0%	0.0%	0.0%
3	3/13/2007	12.2%	0.8%	0.7%	0.0%	0.5%	1.7%	3.9%	0.0%	0.0%	0.2%	0.8%	0.1%	0.0%	0.0%	0.1%	0.0%	1.7%	1.7%	0.0%	0.0%
3	2/28/2008	13.6%	0.2%	0.8%	0.1%	2.2%	3.1%	4.2%	0.0%	0.0%	0.2%	1.2%	0.2%	0.1%	0.0%	0.3%	0.0%	1.1%	0.1%	0.0%	0.0%
3	1/11/2010	10.8%	0.0%	0.3%	0.0%	0.6%	1.1%	5.2%	0.0%	0.0%	0.2%	1.5%	0.2%	0.0%	0.0%	0.3%	0.1%	1.3%	0.0%	0.0%	0.0%
4	3/10/2009	6.4%	0.0%	0.0%	0.0%	2.2%	0.7%	2.8%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.0%
4	1/11/2010	11.8%	0.2%	0.3%	0.0%	0.9%	1.3%	7.2%	0.0%	0.0%	0.1%	0.9%	0.1%	0.0%	0.0%	0.1%	0.1%	0.7%	0.0%	0.0%	0.0%
5A	3/10/2009	0.8%	0.0%	0.0%	0.0%	0.1%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5A	3/3/2010	1.3%	0.0%	0.0%	0.0%	0.2%	0.1%	0.4%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%
5B	3/12/2009	5.7%	0.0%	0.0%	0.0%	2.4%	0.0%	2.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	0.0%
5B	2/24/2010	9.6%	0.0%	0.0%	0.0%	2.0%	0.3%	4.7%	0.0%	0.0%	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.8%	0.0%
6	3/19/2008	7.5%	0.1%	0.1%	0.0%	0.6%	0.3%	0.9%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	5.1%	0.0%	0.0%	0.0%
6	3/3/2010	33.7%	0.4%	0.4%	0.3%	1.2%	7.9%	7.5%	0.0%	0.0%	0.4%	4.3%	0.0%	0.8%	0.0%	0.2%	0.0%	10.1%	0.2%	0.0%	0.0%
7	11/19/2009	8.4%	0.1%	0.6%	0.2%	0.7%	0.8%	1.7%	0.0%	0.0%	0.0%	0.8%	0.1%	0.1%	0.0%	0.0%	0.0%	3.0%	0.2%	0.0%	0.0%

Figure 3: Unfarmed area adjacent to planted fields showing *Larrea*-dominated vegetation community.

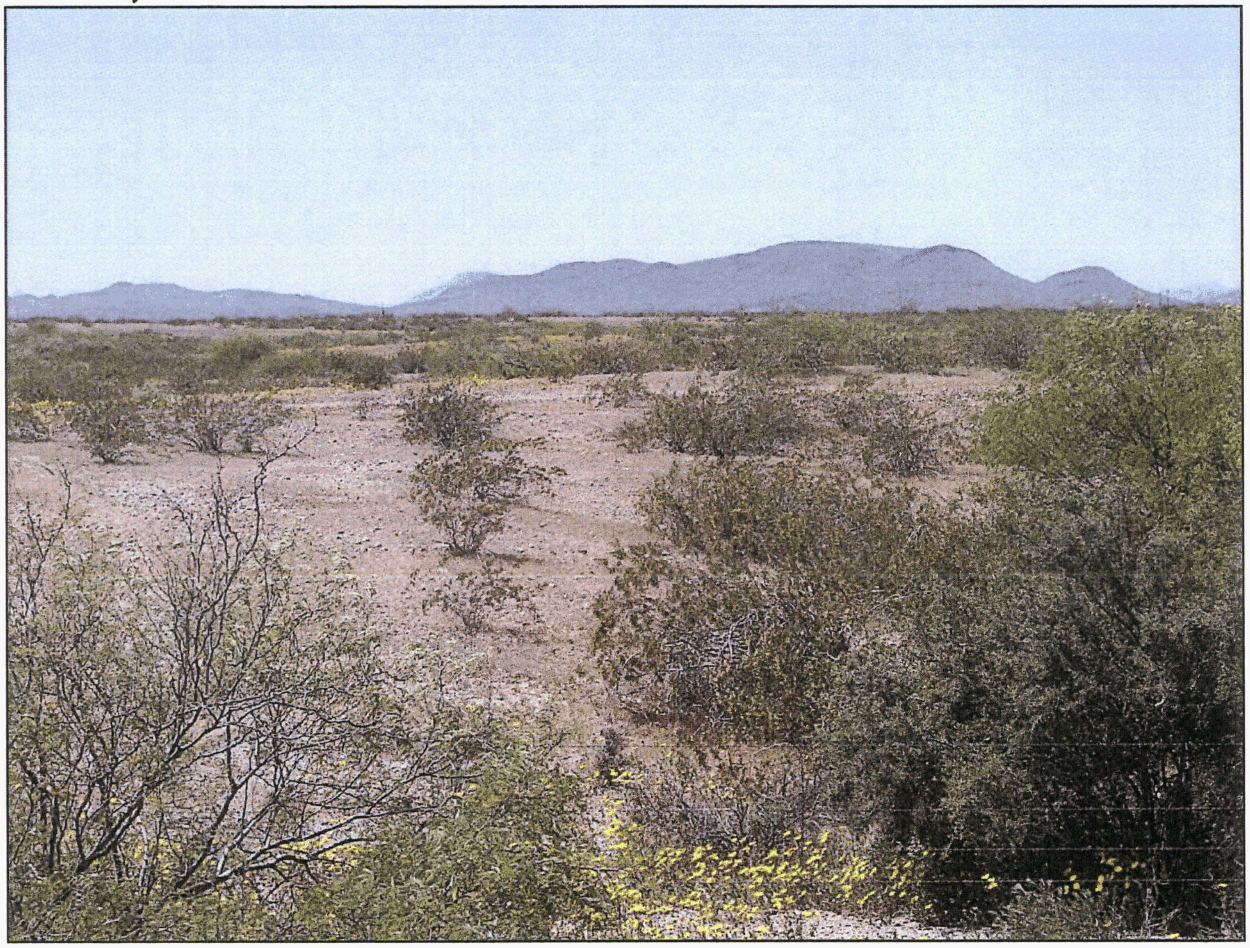


Figure 4: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 1. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

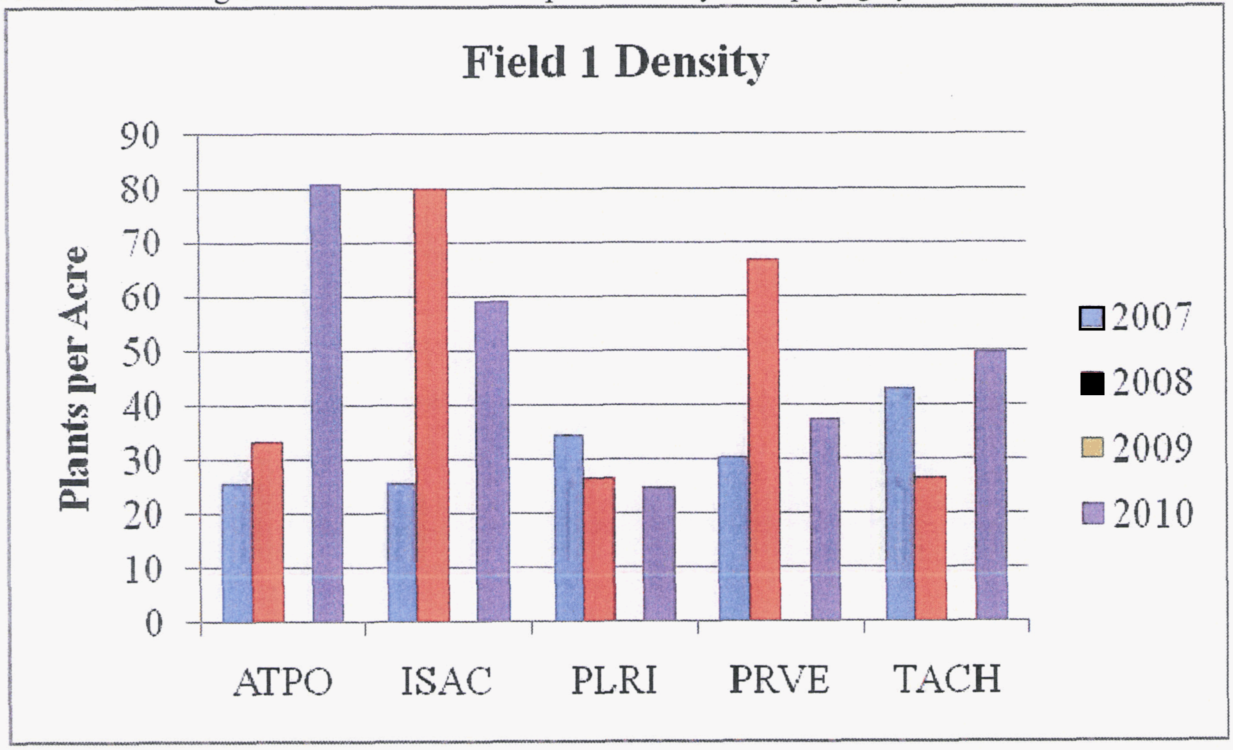


Figure 5: Cover (%) of the most frequently encountered perennial plant species in Field 1.

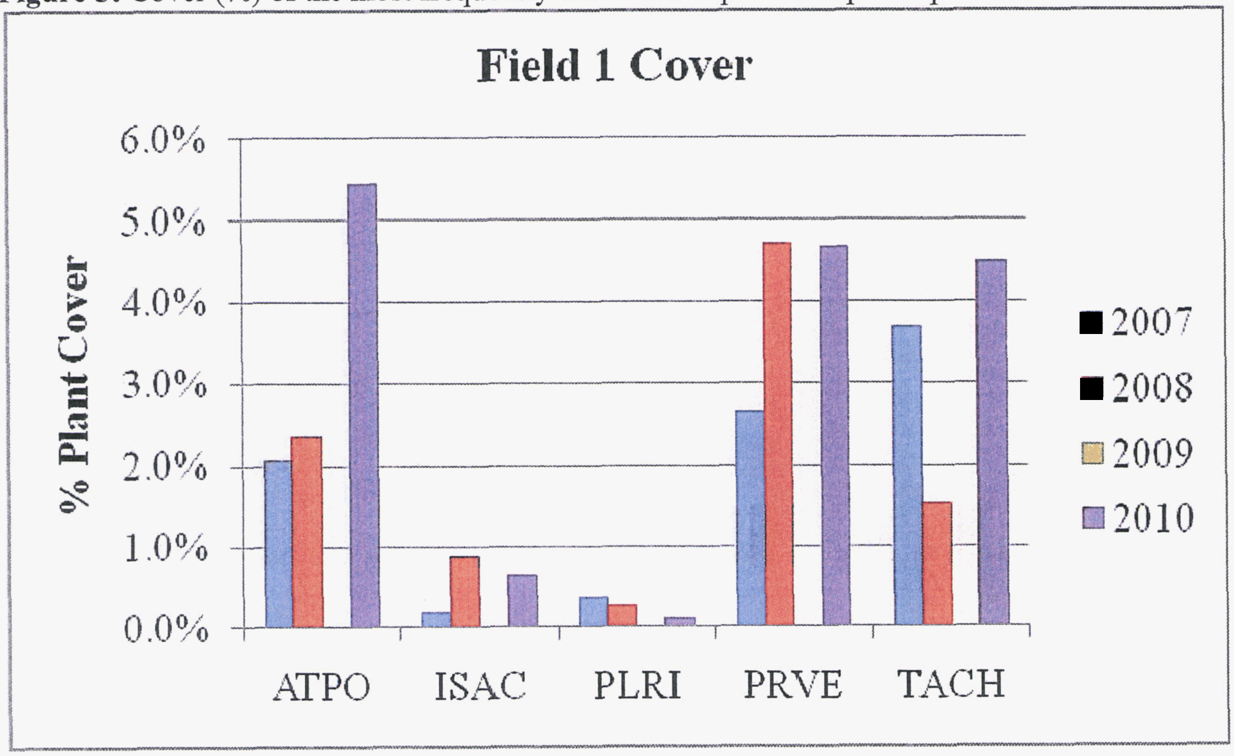


Figure 6: Initial planting made in Spring 2001. Photo taken in September 2011.

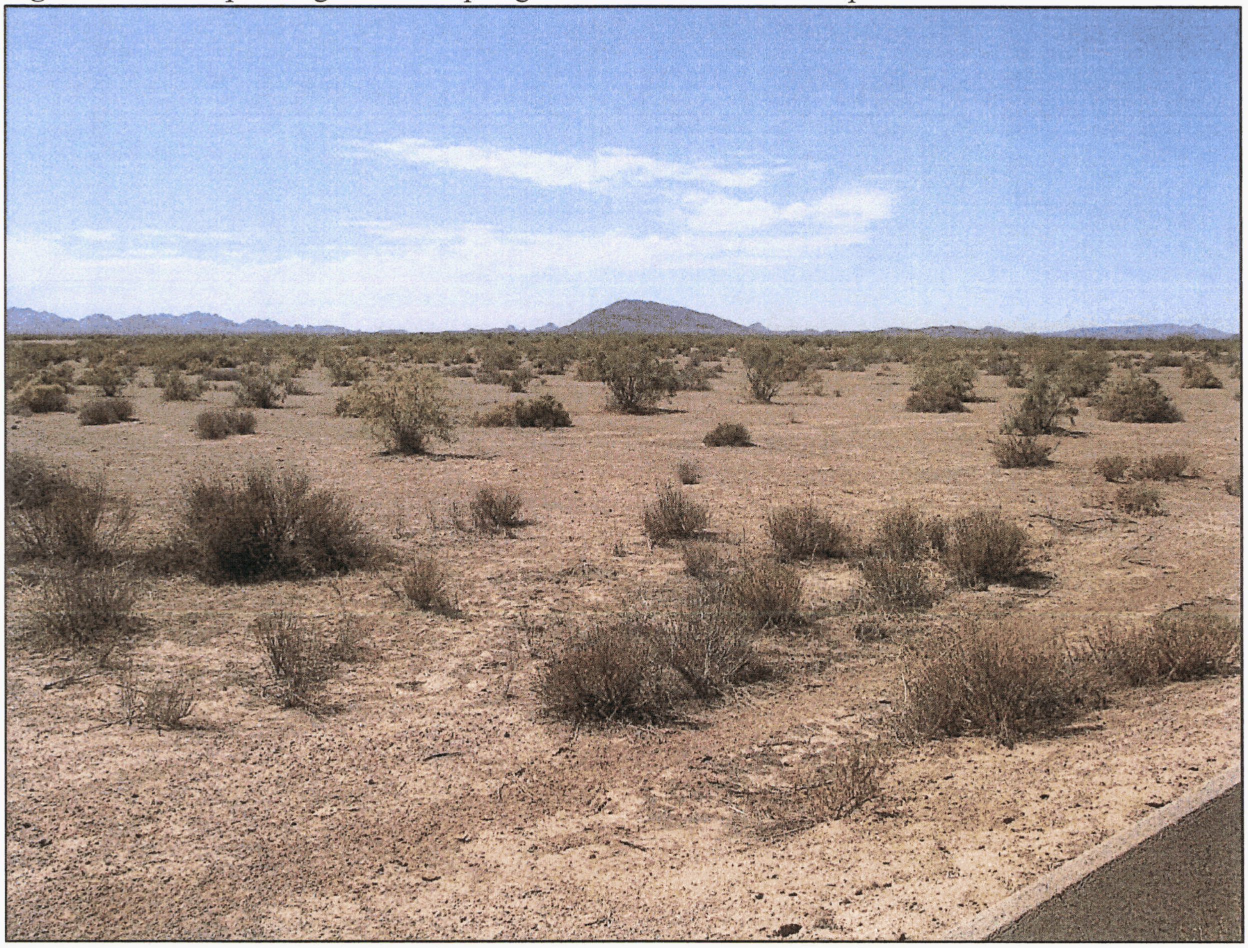


Figure 7: Photograph showing rank growth of winter annual weeds in 2005 that prevented plant field counts. This view is of one of the fields planted in 2003.

Figure 8: Extreme flooding occurred in Field 2 during the winter of 2009/2010.

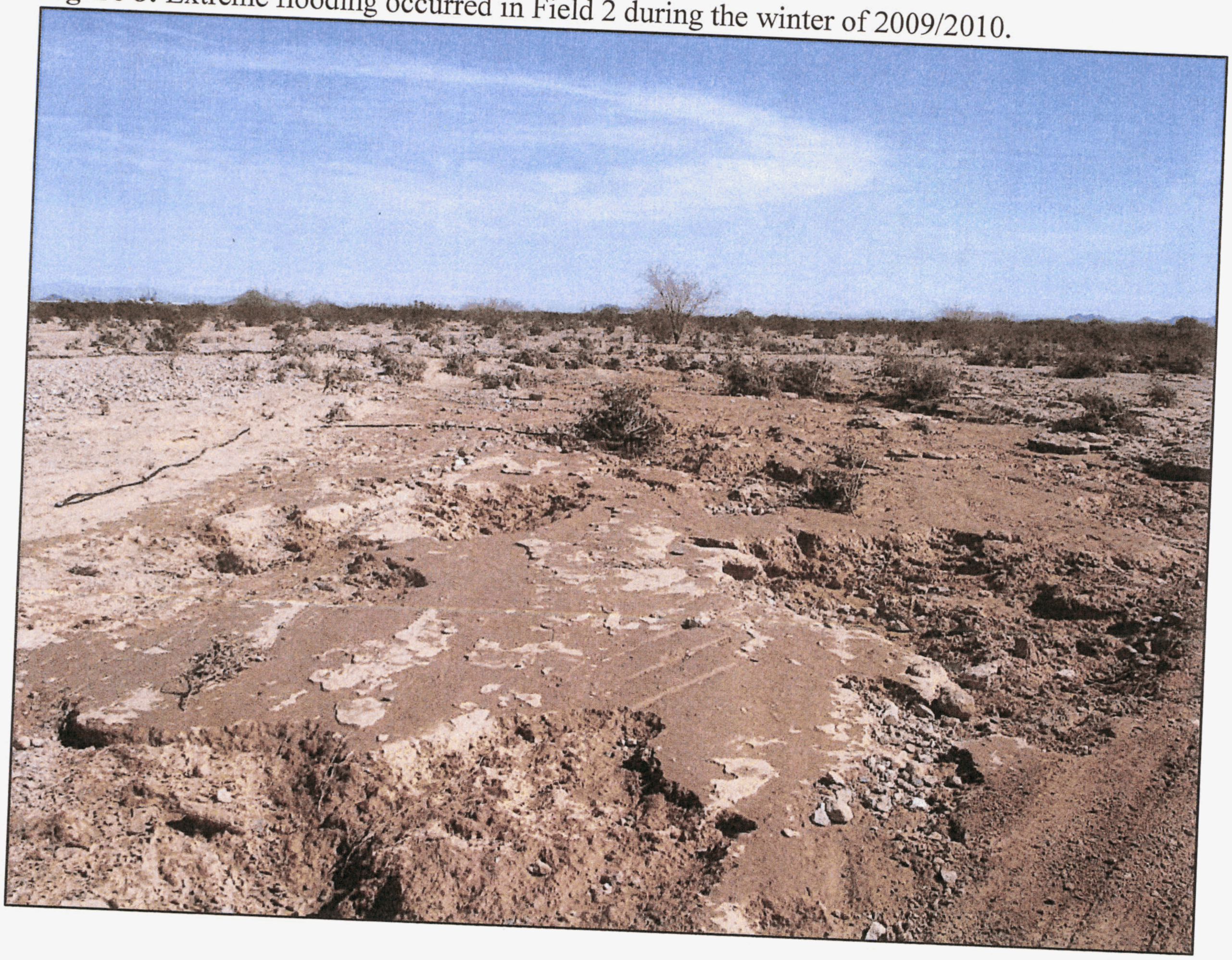


Figure 9: Second planting made in Spring 2003. Photograph taken September 2011.

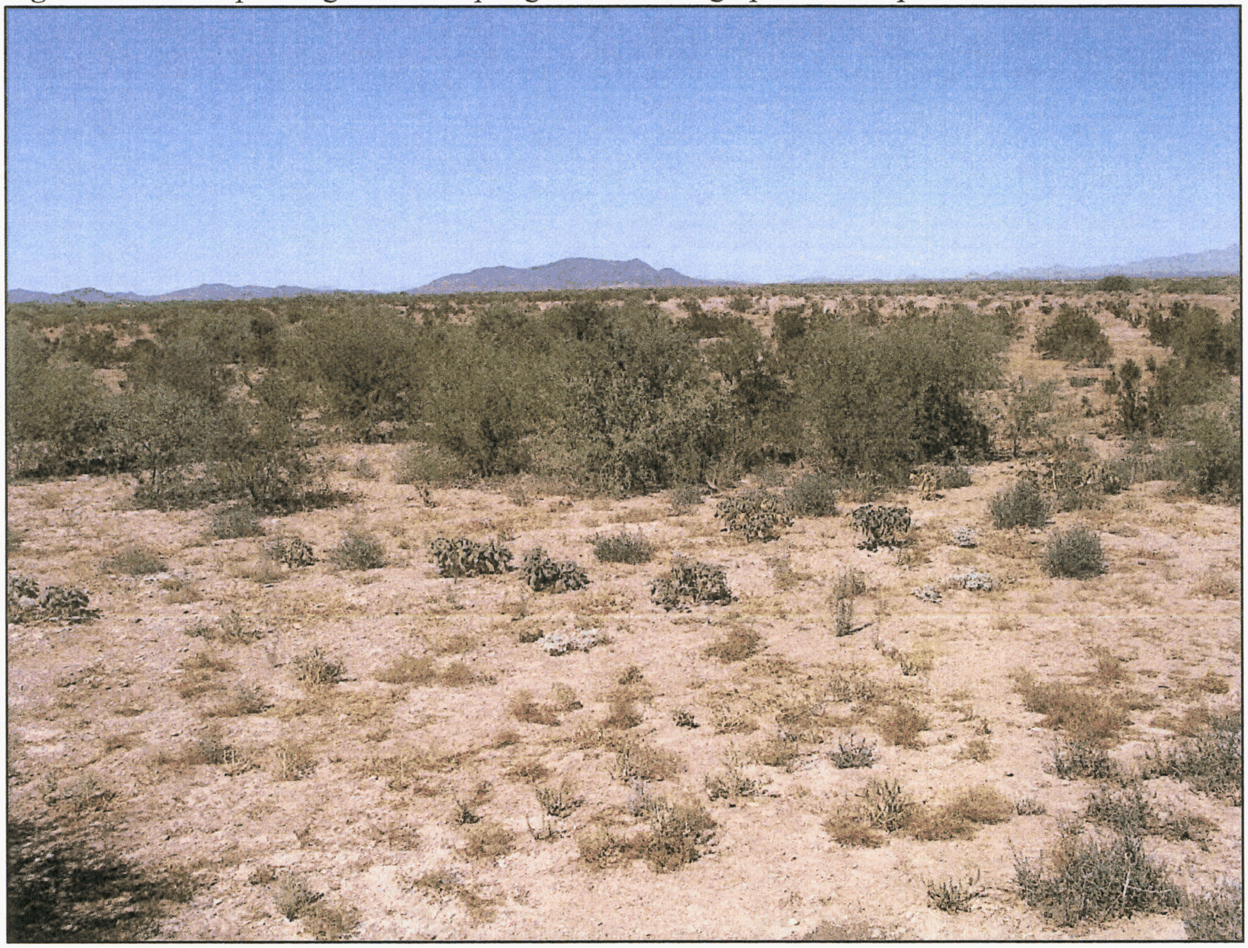


Figure 10: A 2010 photo of Field 2A showing the dominance of *L. tridentata.* Other dominant species in this field include *A. polycarpa, I. acradensis, L. exsertum,* and *P. velutina.*

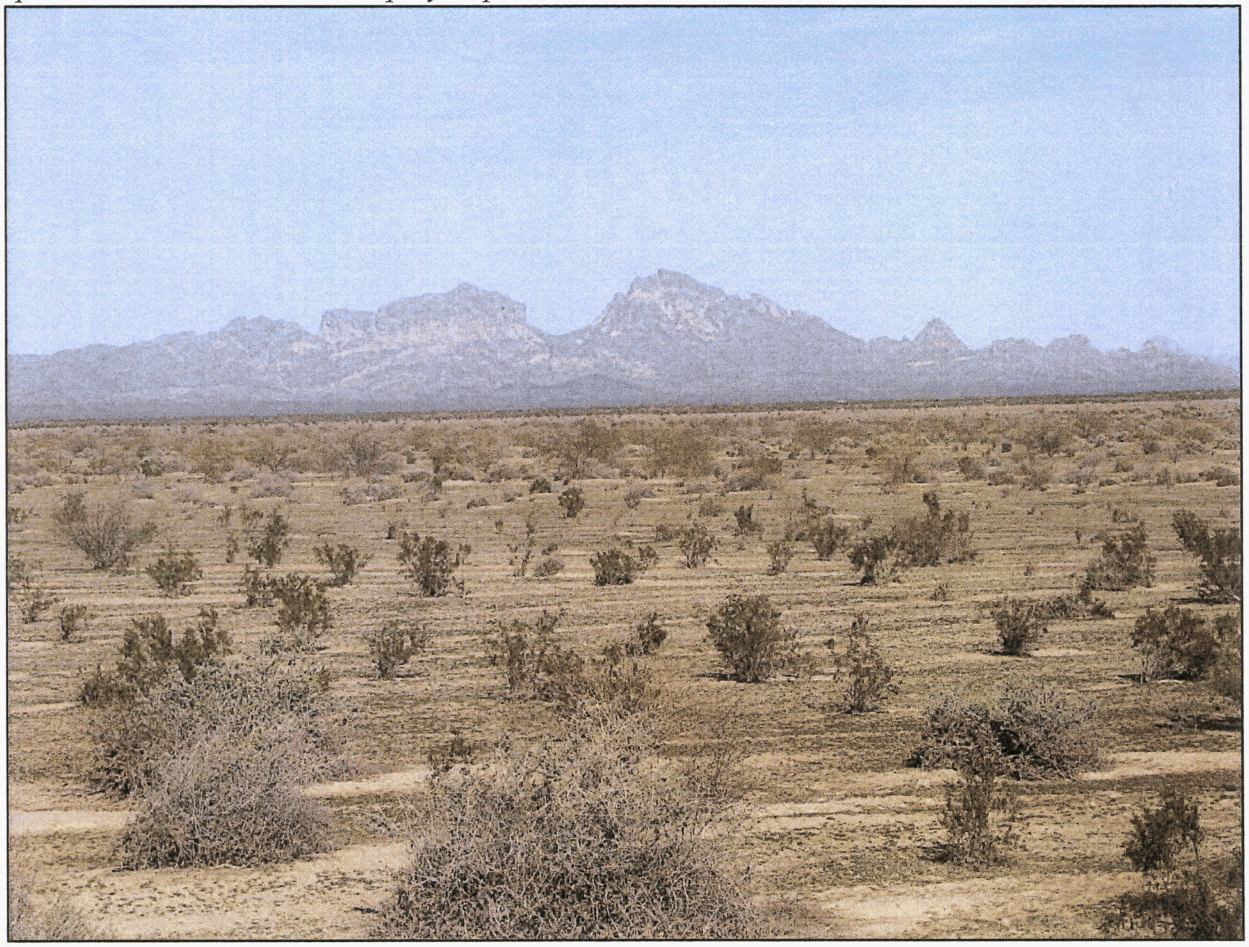


Figure 11: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 2A. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

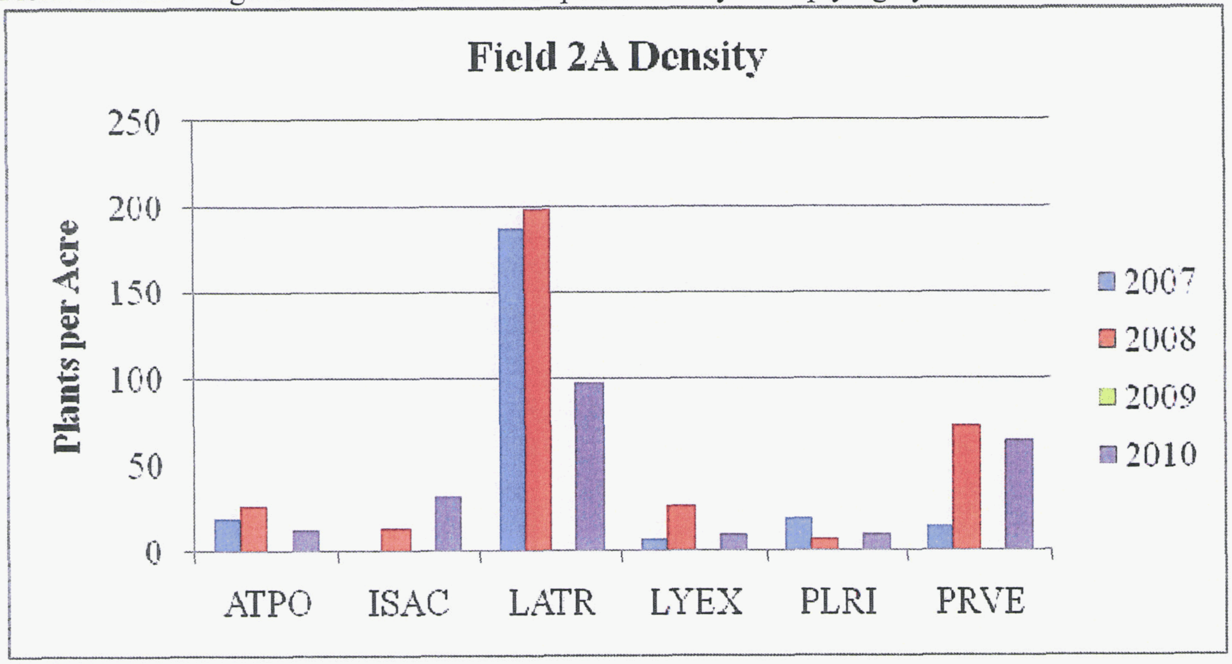


Figure 12: Cover (%) of the most frequently encountered perennial plant species in Field 2A.

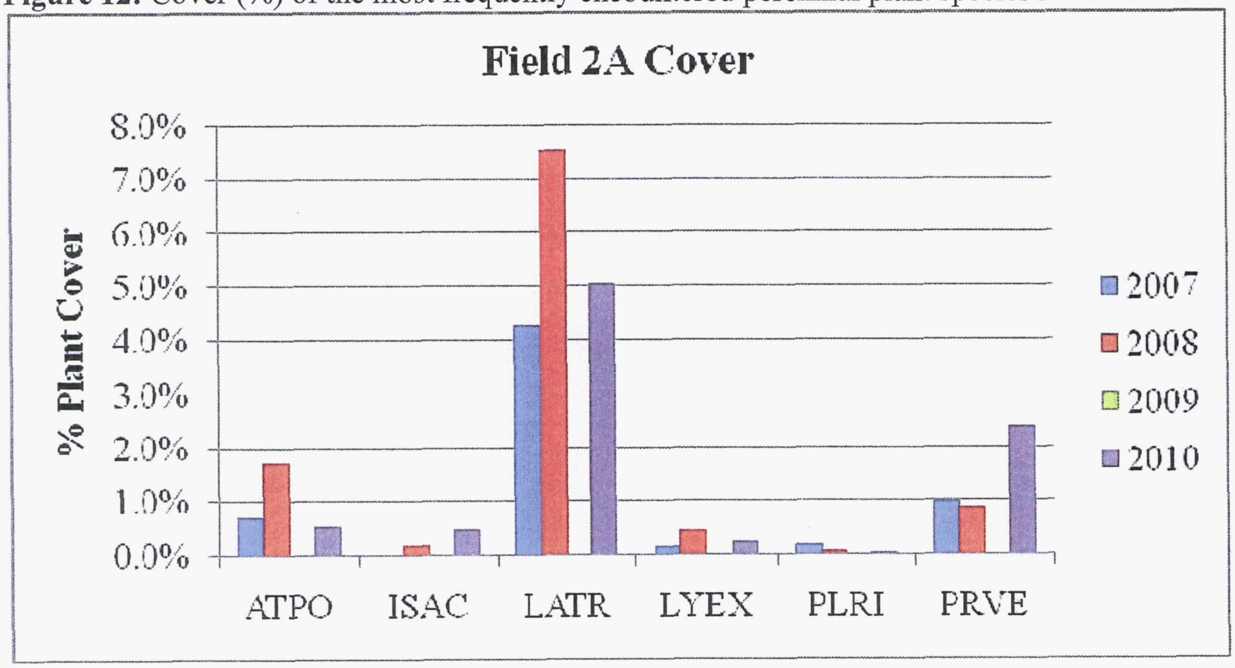


Figure 13: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 2B. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

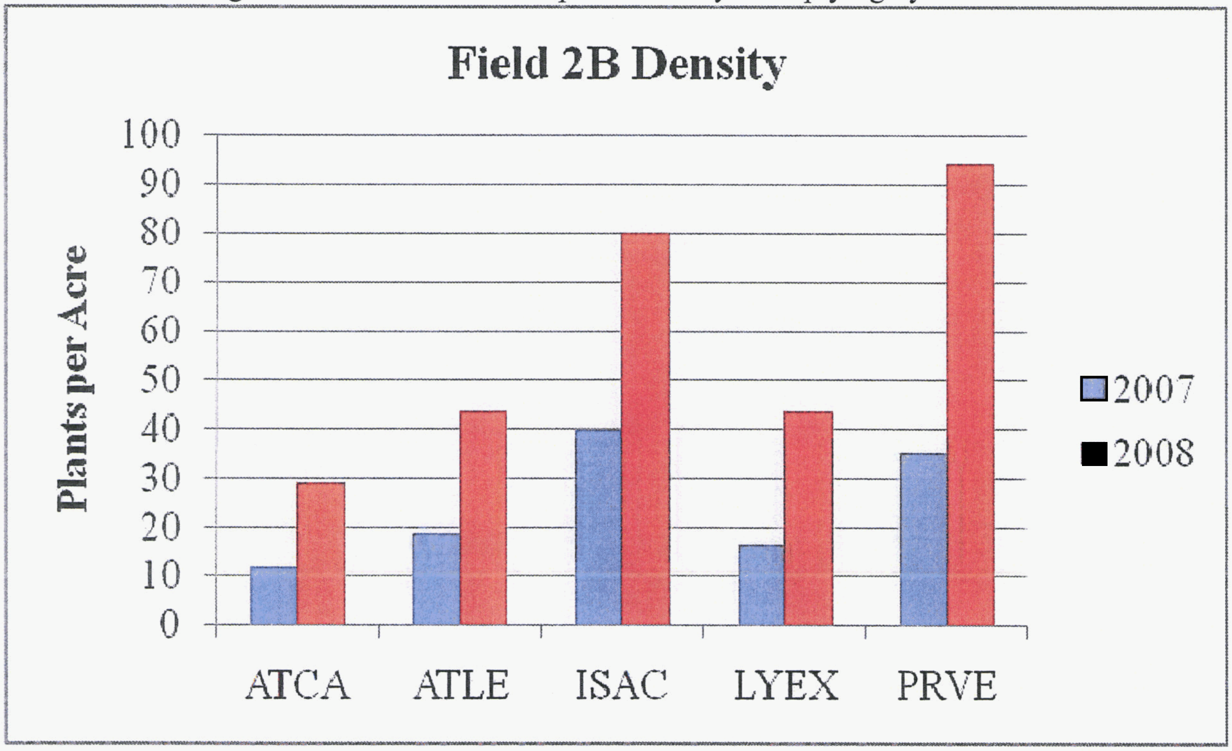


Figure 14: Cover (%) of the most frequently encountered perennial plant species in Field 2B.

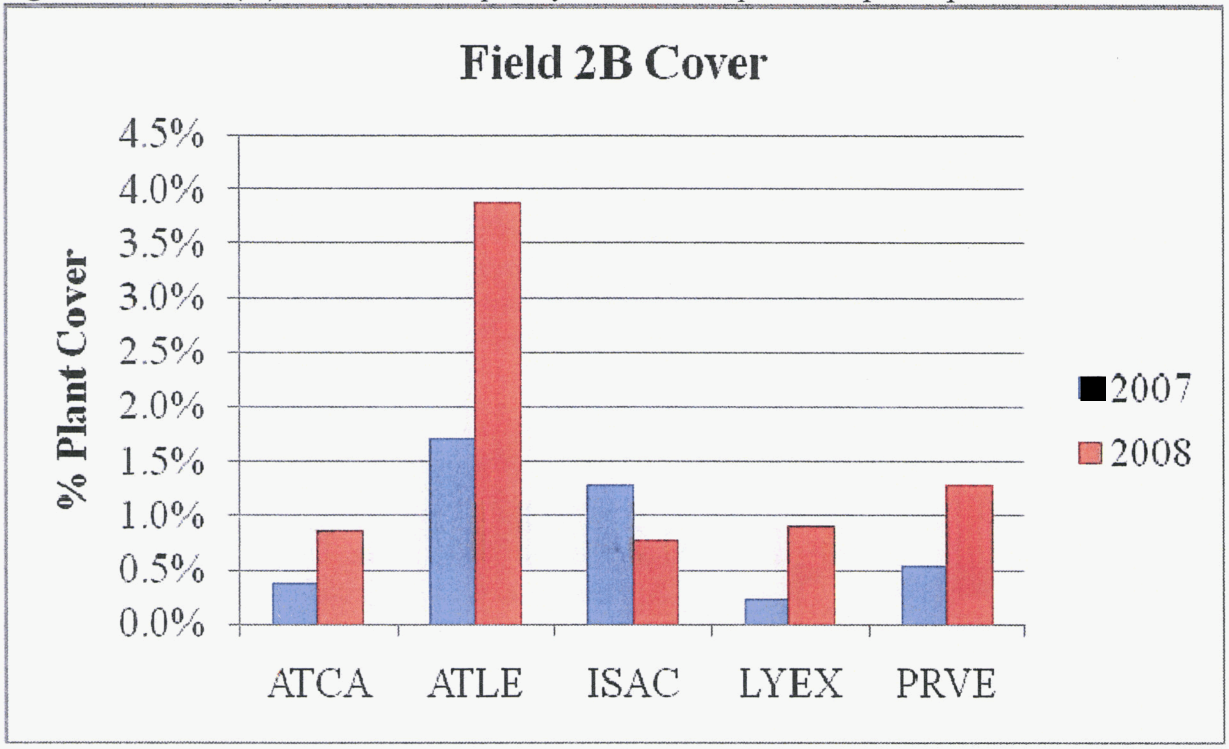


Figure 15: A 2010 view of Field 3. This field had high survival and establishment of planted species, and current dominant perennial plants include *A. dumosa, A. polycarpa, L. tridentata, P. microphylla,* and *P. velutina.*

Figure 16: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 3. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

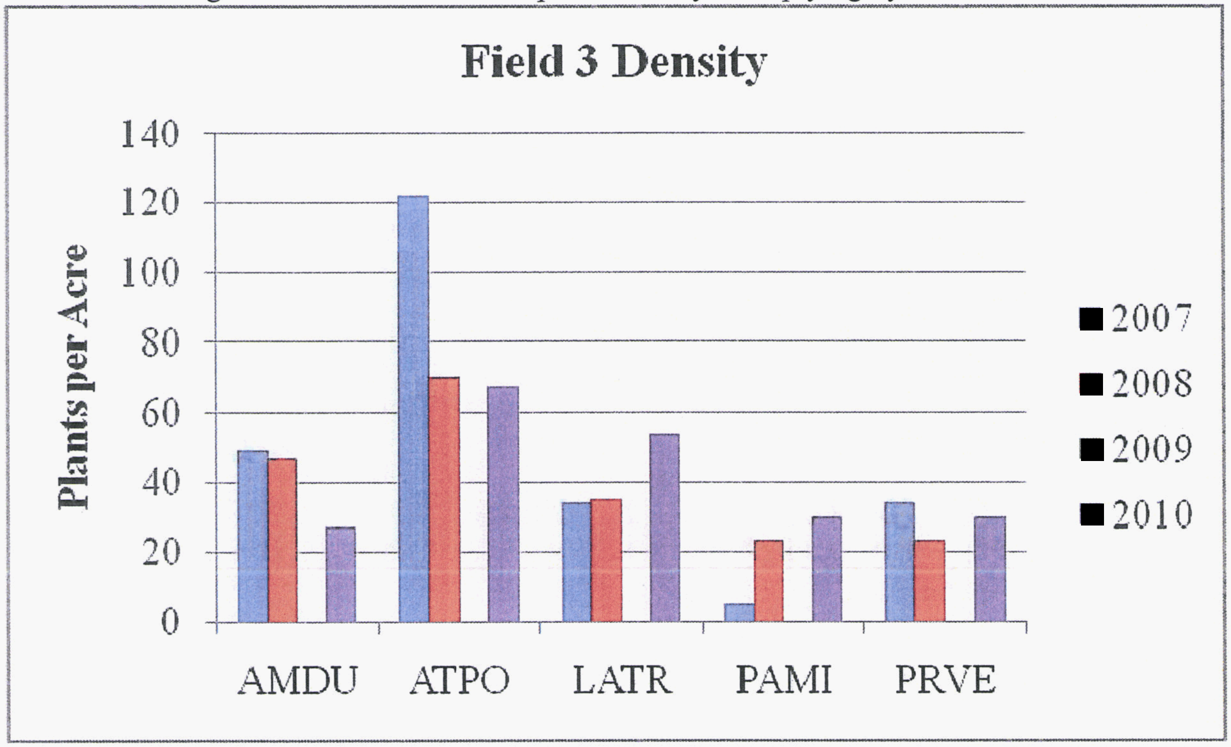


Figure 17: Cover (%) of the most frequently encountered perennial plant species in Field 3.

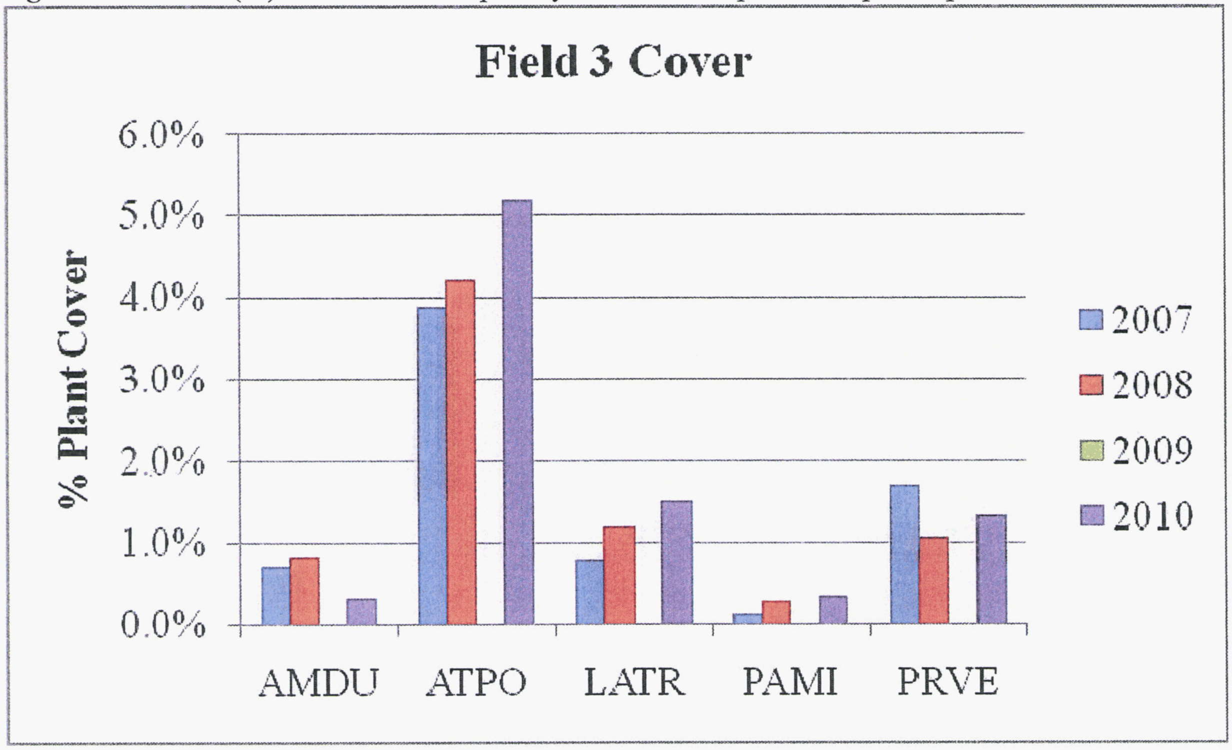


Figure 18: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 4. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

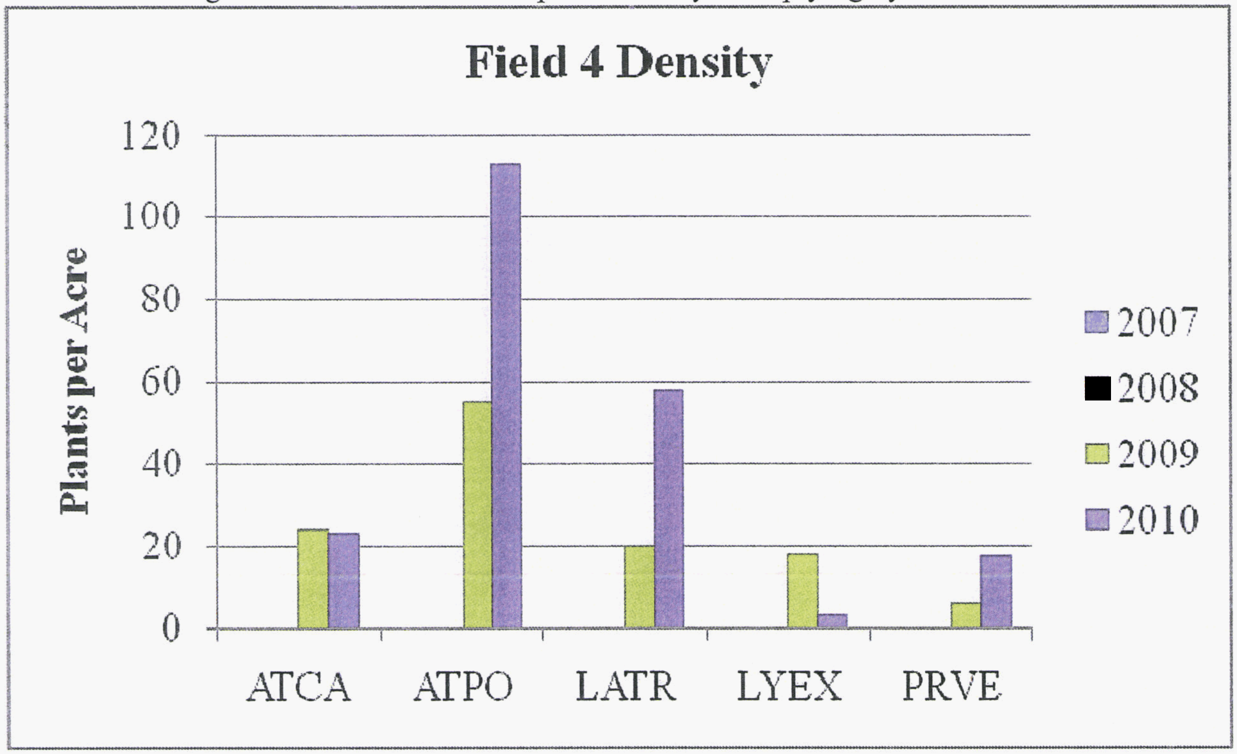


Figure 19: Cover (%) of the most frequently encountered perennial plant species in Field 4.

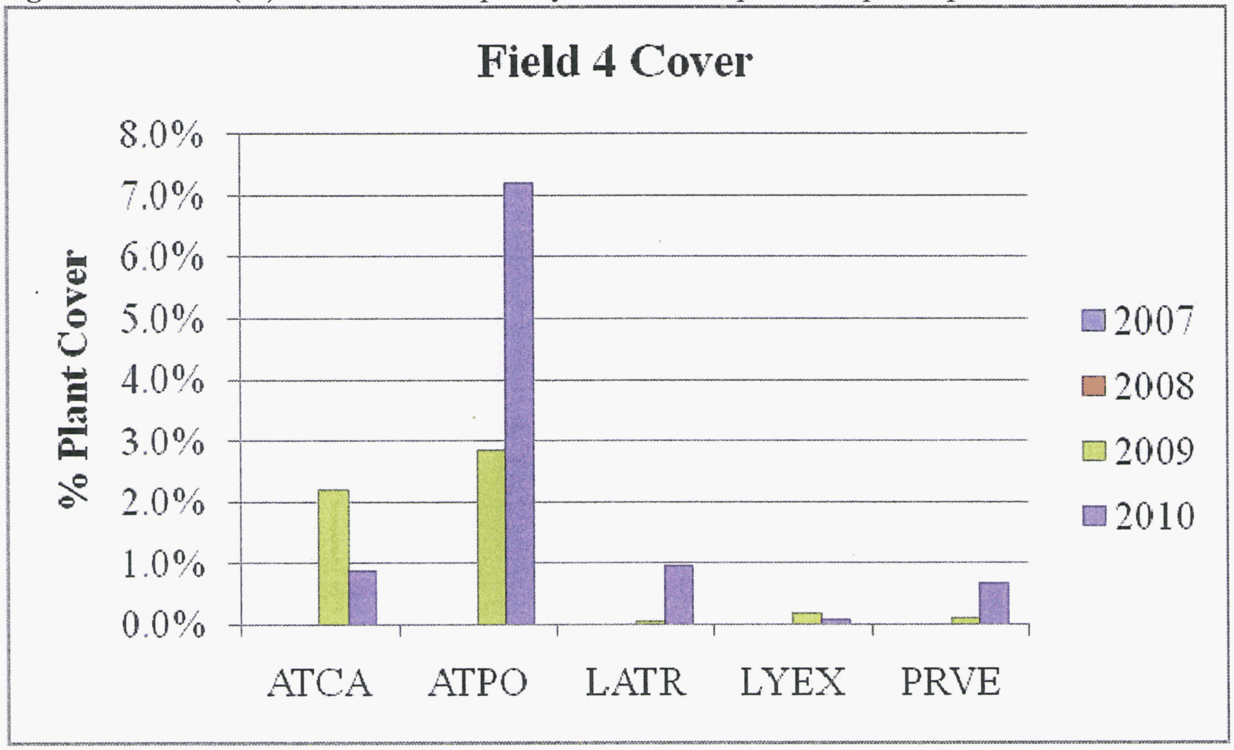


Figure 20: Spring 2006 planting, cleared in 2011 for solar generation facility. Photograph taken in September 2011.

Figure 21: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 5A. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

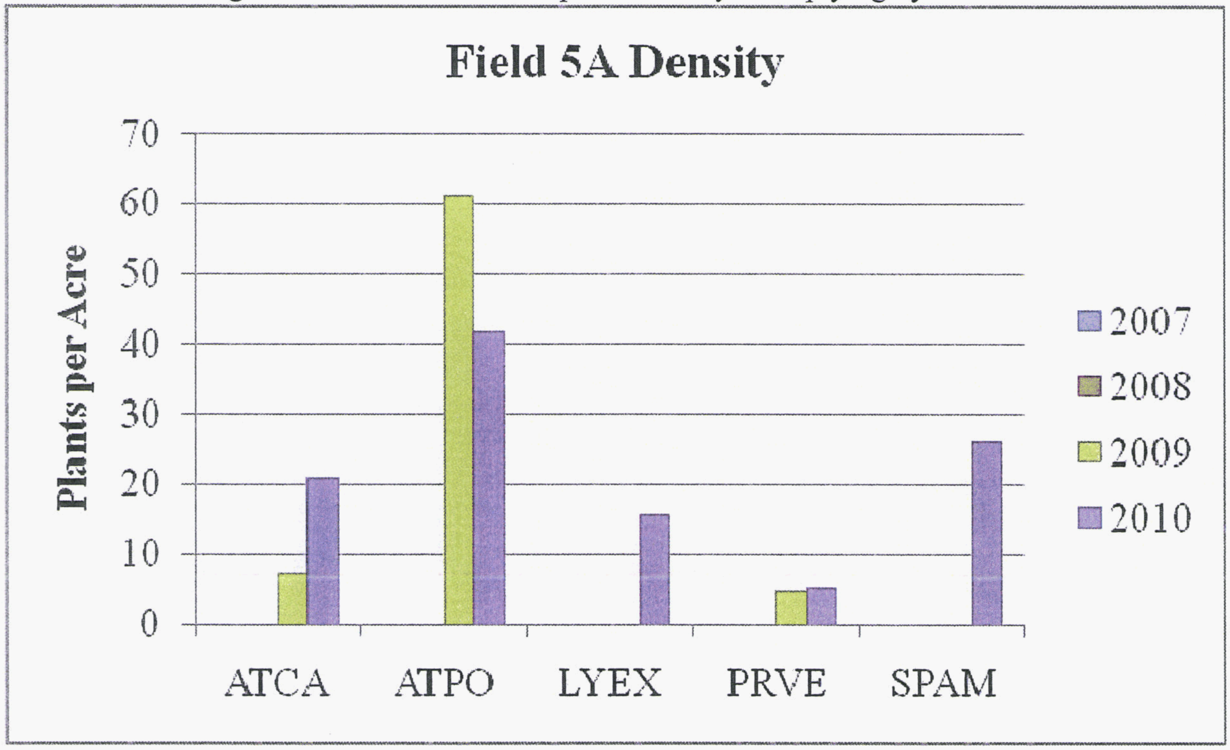


Figure 22: Cover (%) of the most frequently encountered perennial plant species in Field 5A.

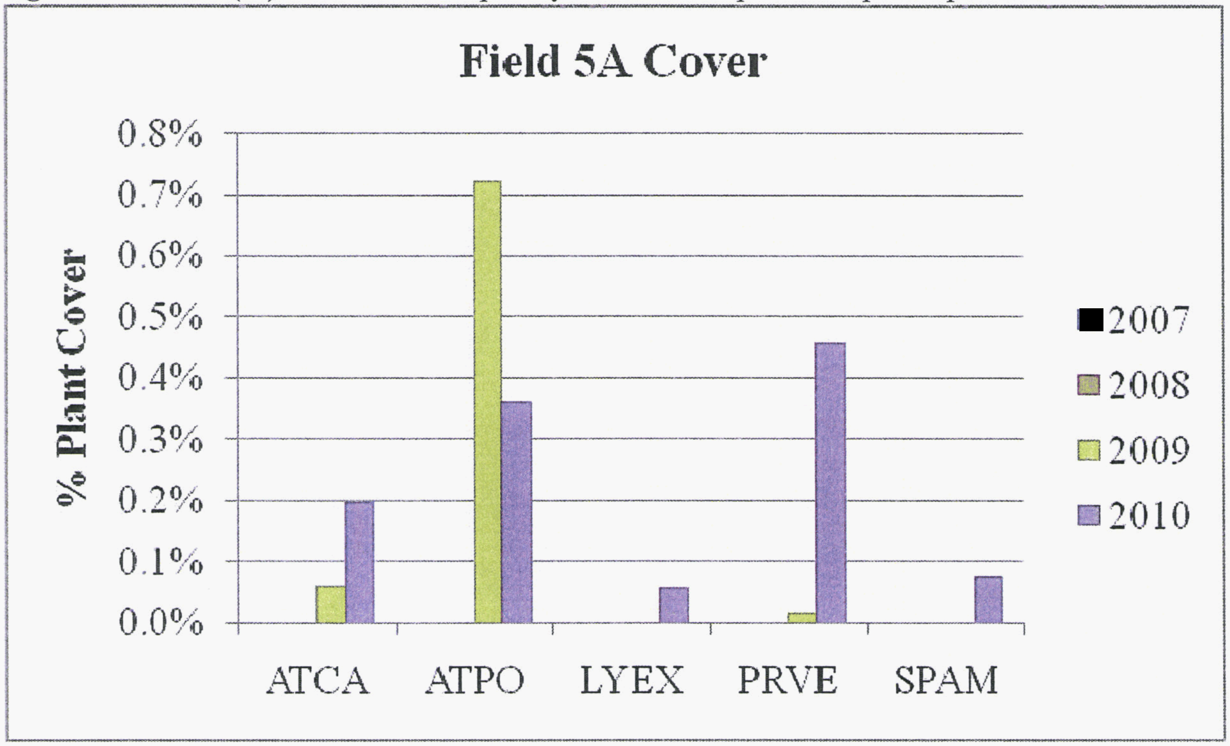


Figure 23: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 5B. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

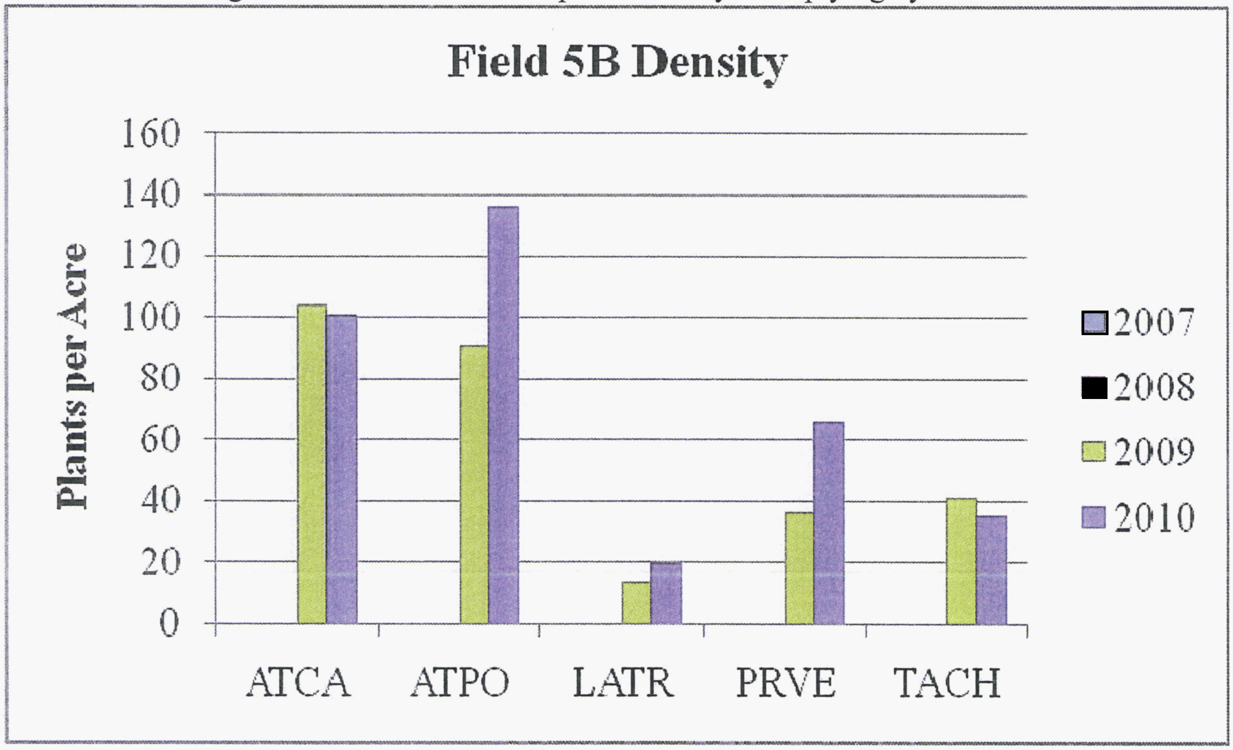


Figure 24: Cover (%) of the most frequently encountered perennial plant species in Field 5B.

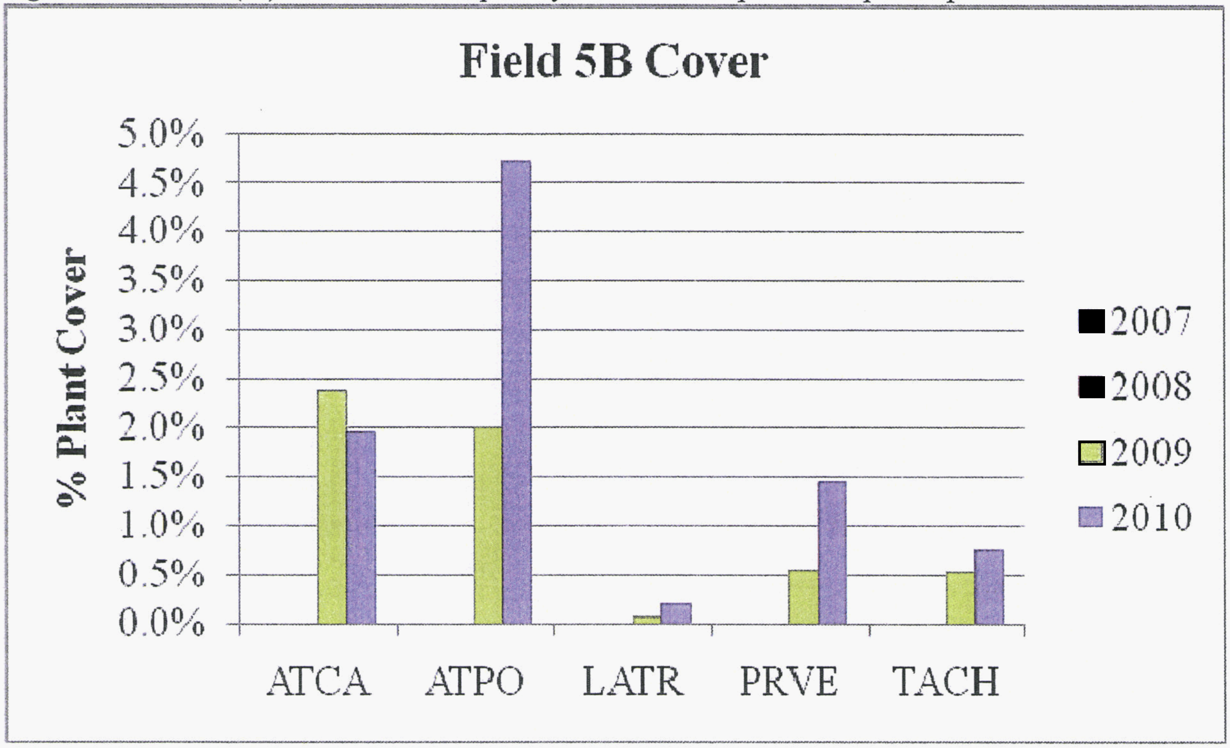


Figure 25: A view of the spring 2007 planting shown during construction of the solar facility in 2011.

Figure 26: View of spring 2008 planting, located adjacent to Mesquite Wildlife Oasis and planted at 4x density for visual screening from Elliot Road. Photograph taken September 2011.

Figure 27: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 6. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

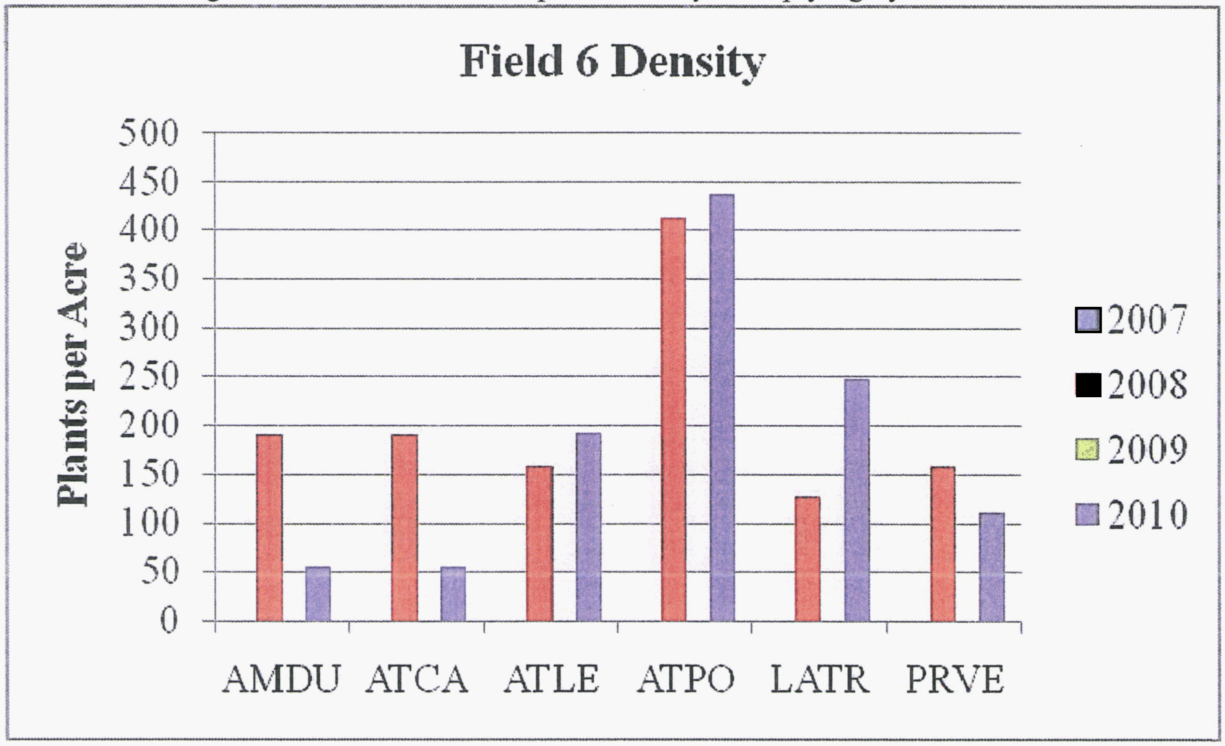


Figure 28: Cover (%) of the most frequently encountered perennial plant species in Field 6.

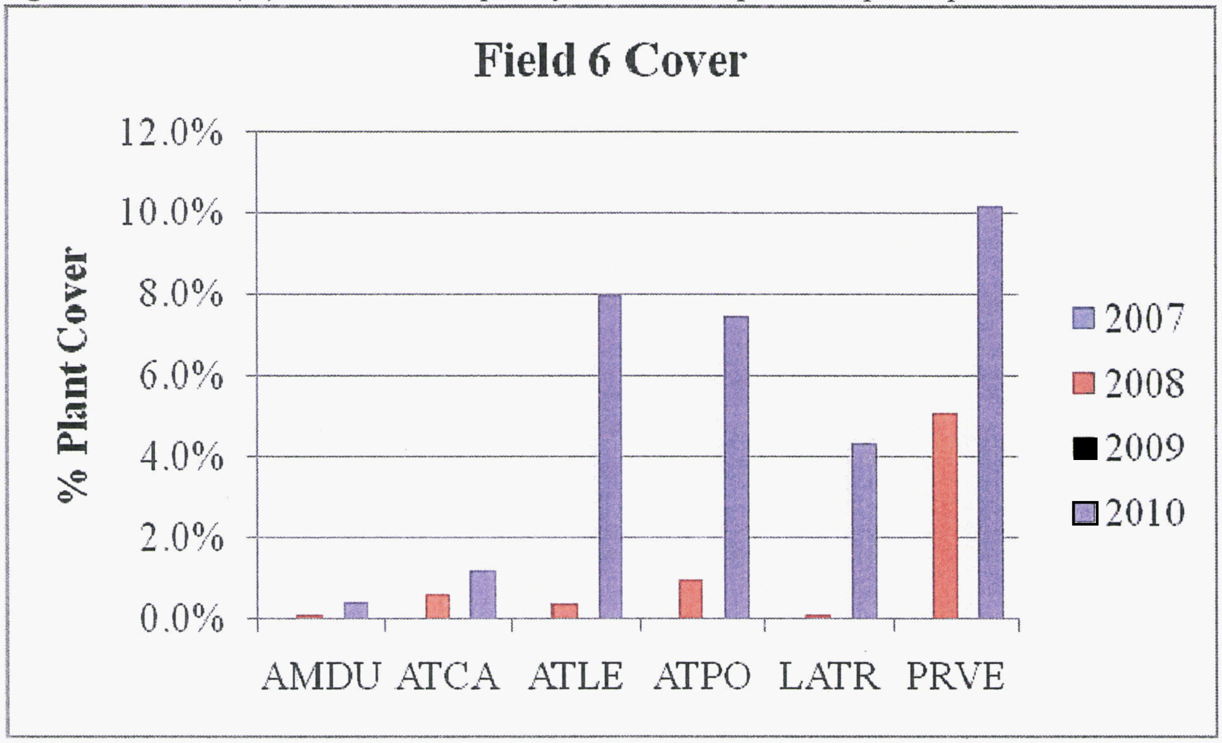


Figure 29: Density (plants ac^{-1}) of the most frequently encountered perennial plant species in Field 7. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

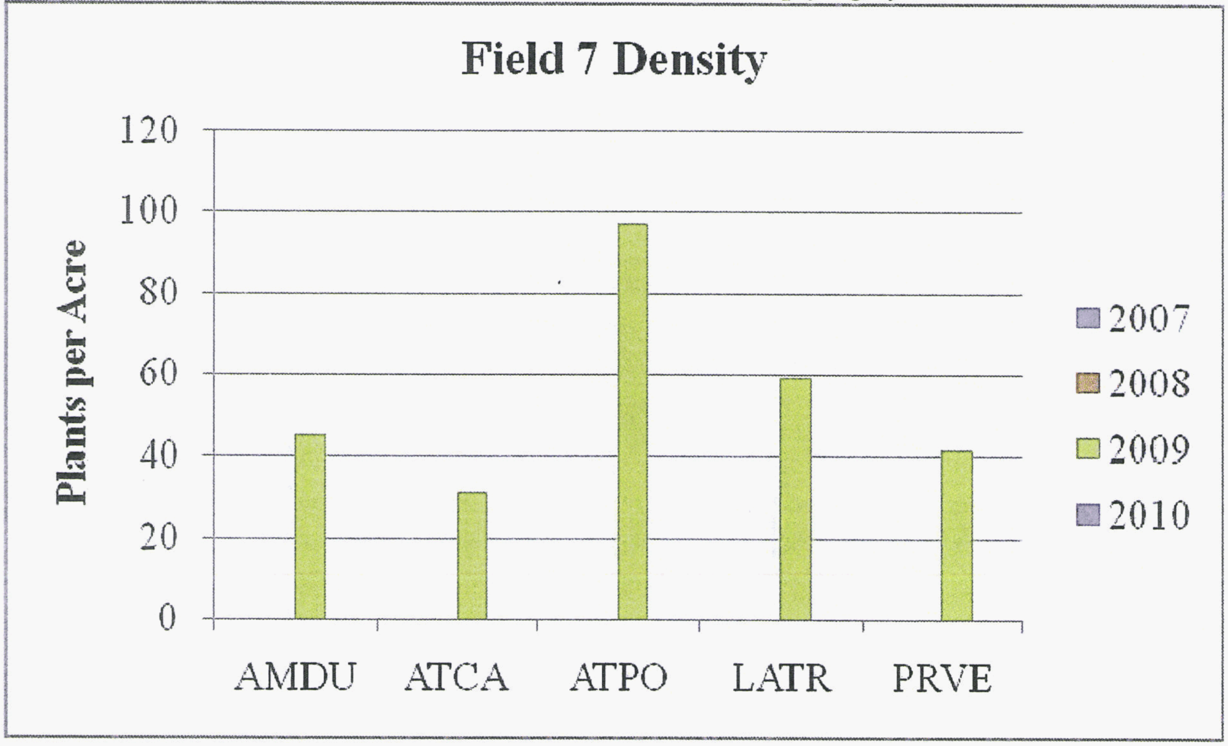


Figure 30: Cover (%) of the most frequently encountered perennial plant species in Field 7.

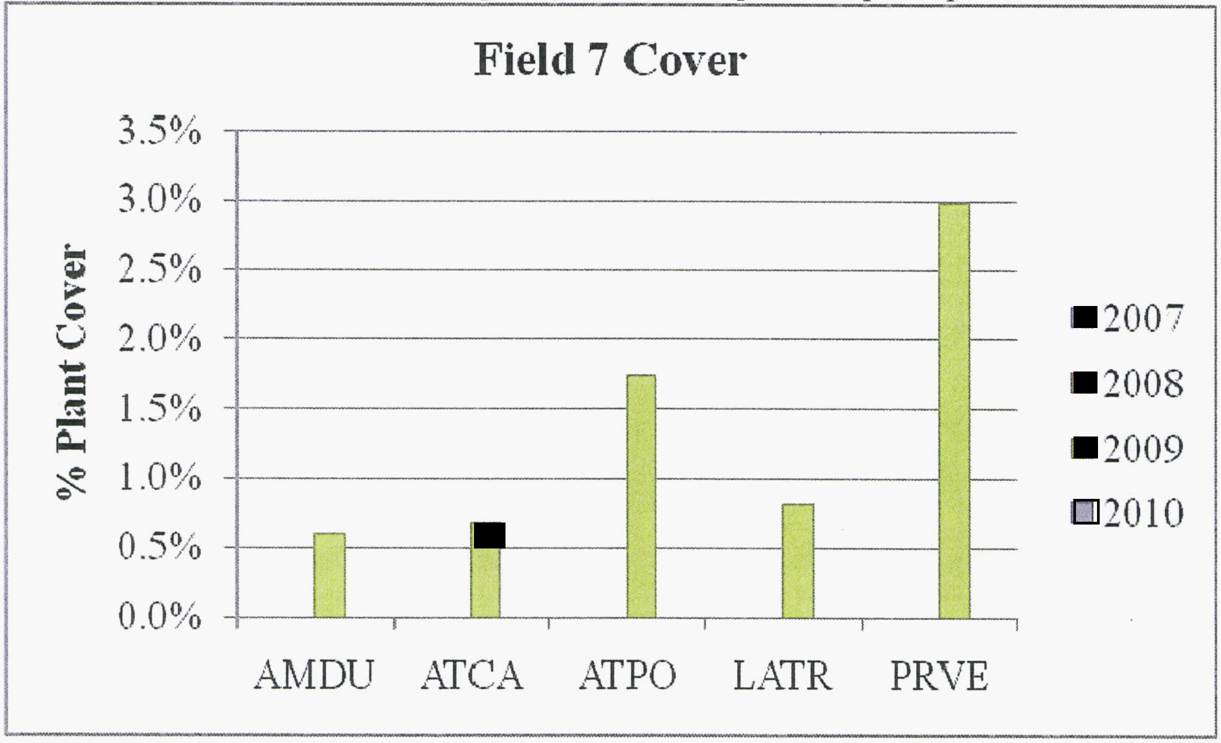


Figure 31: Winter 2008/spring 2009 planting. This is the only field not currently scheduled to be cleared for the installation of solar panels. Photograph taken September 2011.

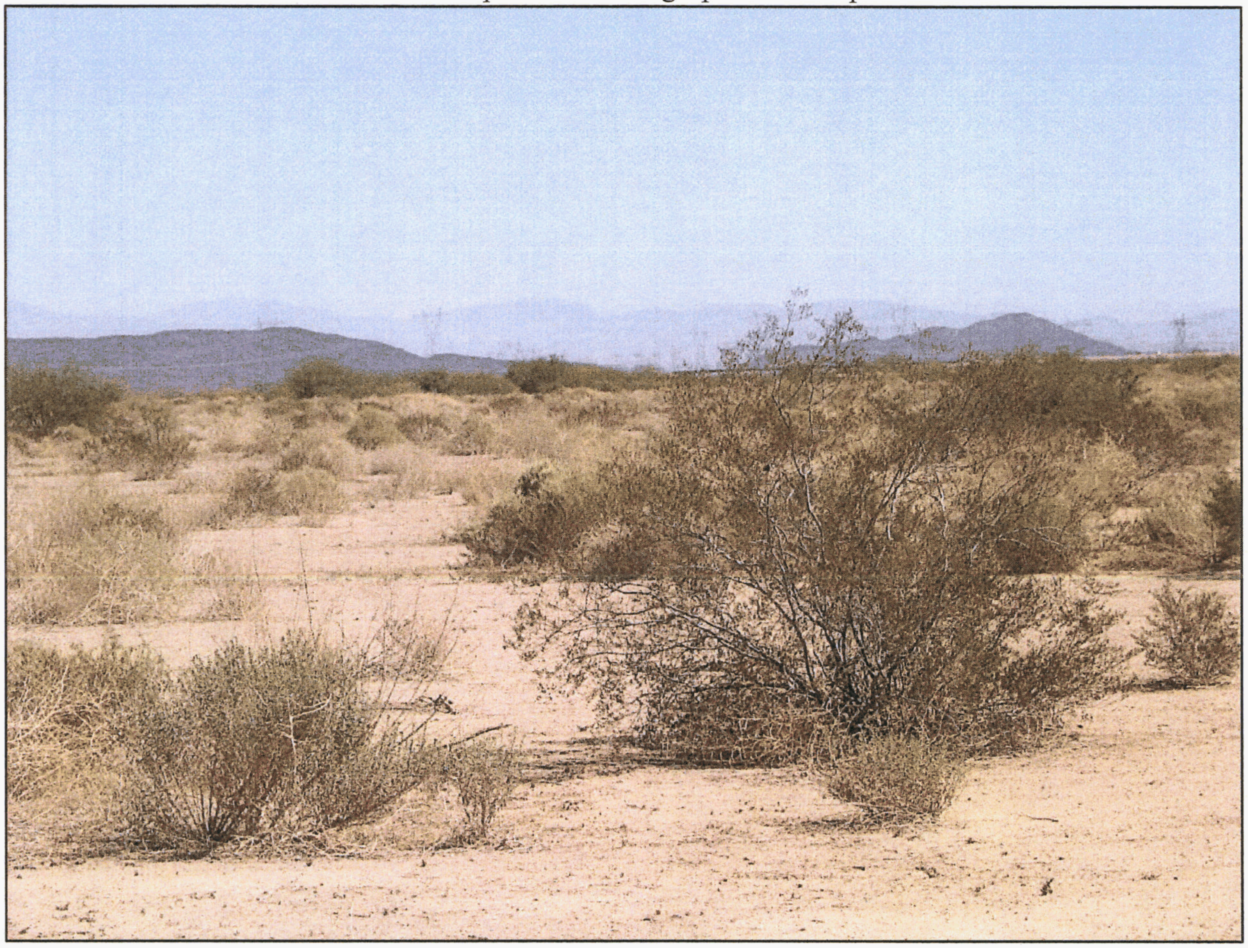


Figure 32: More detailed information on field locations, including fields not planted.

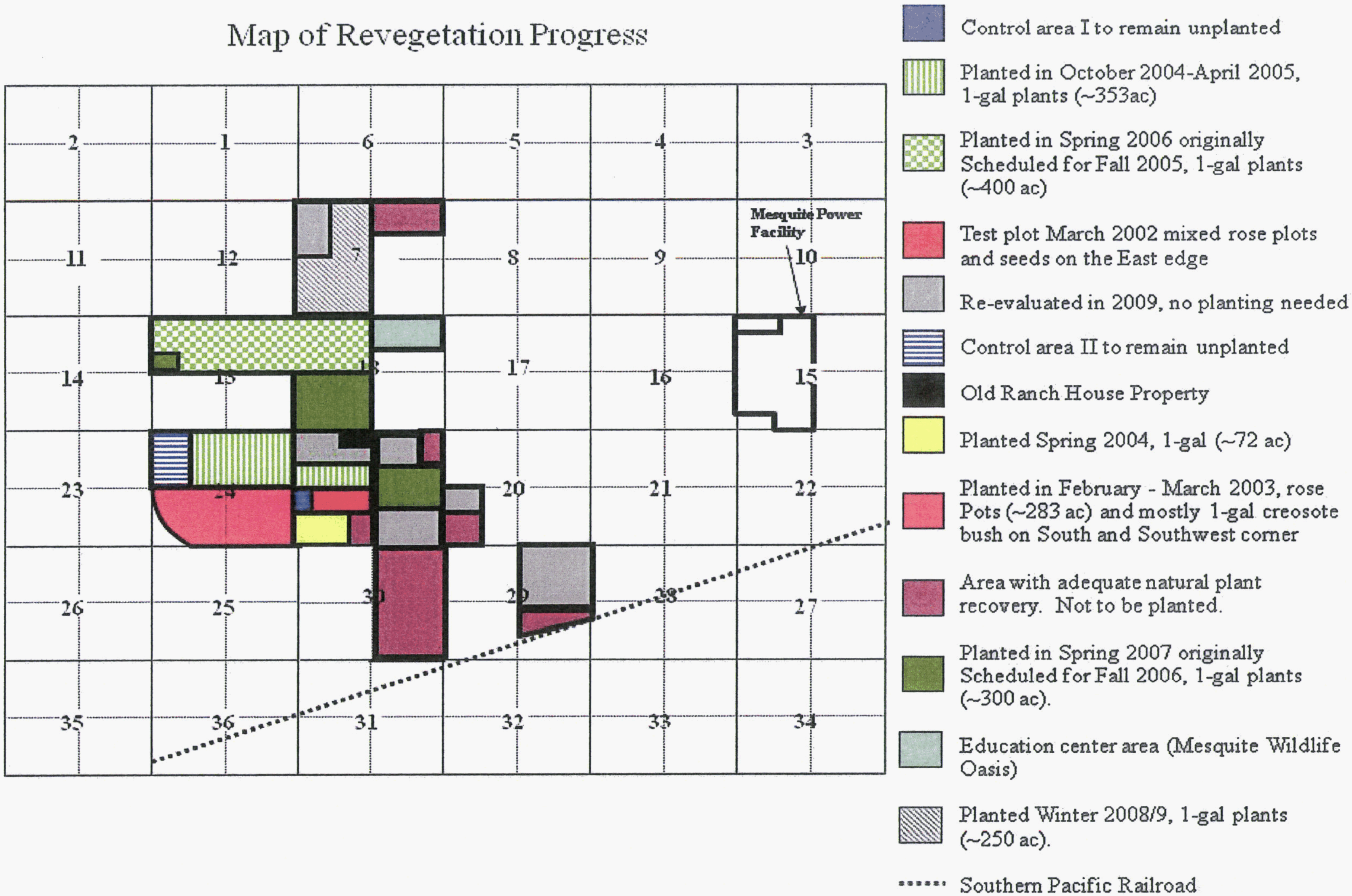


Figure 33: Combined density (plants ac^{-1}) of all perennial plant species by Field number for the most recent years surveyed. These figures can be converted to plants ha^{-1} by multiplying by 2.47.

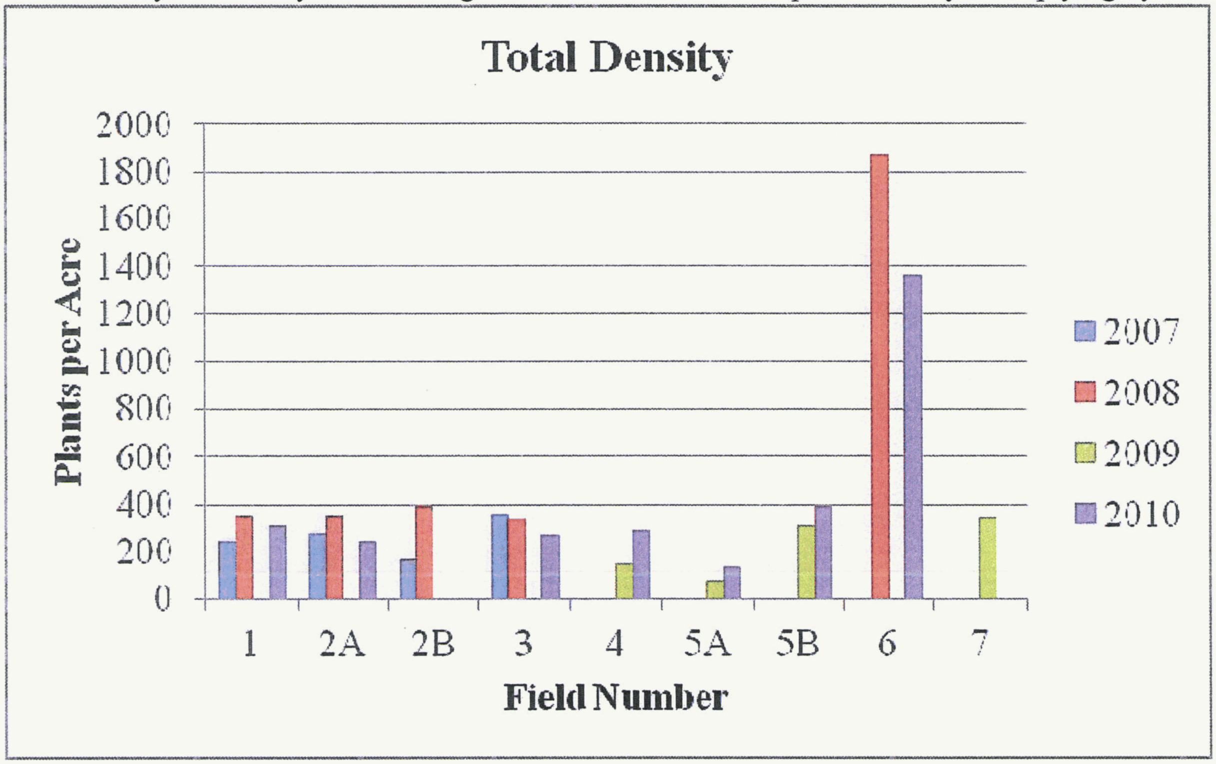
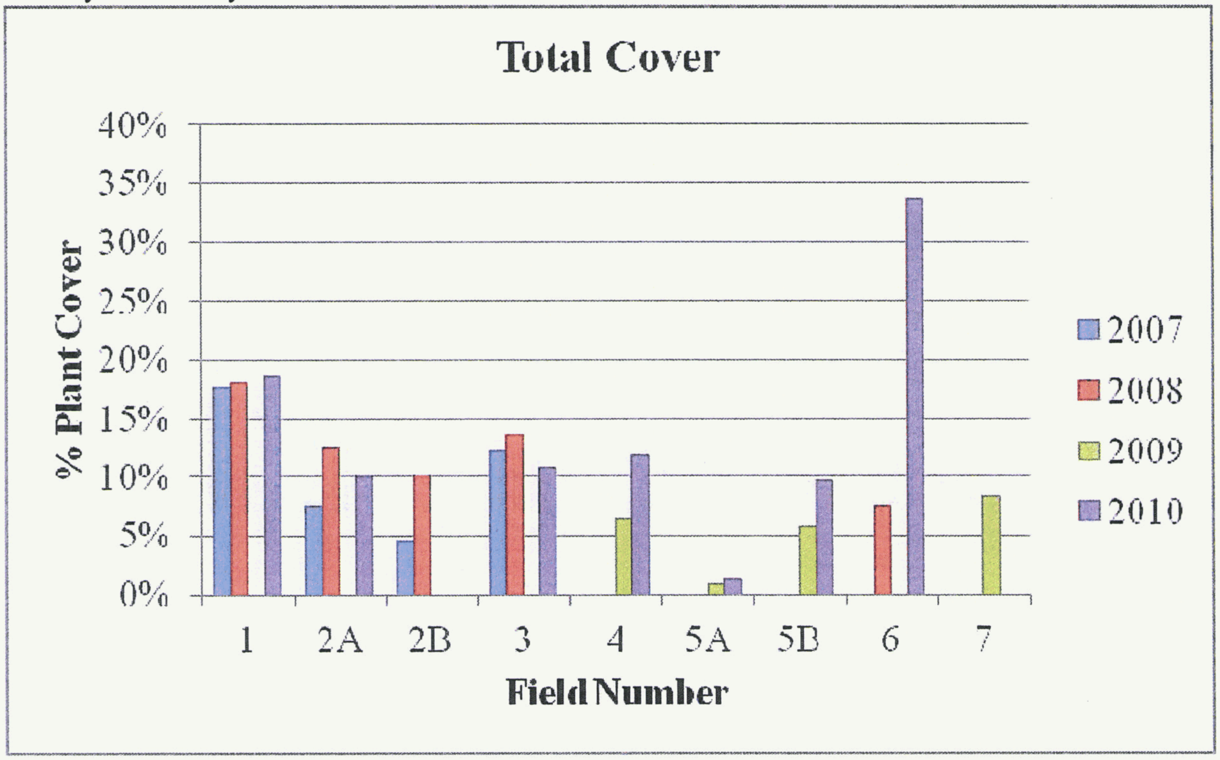


Figure 34: Combined cover (%) of all perennial plant species by field number for the most recent years surveyed.



Appendix A: The Recommended Prescription

- DO use irrigation: native plants in arid environments experience "episodic establishment," meaning that they only successfully emerge as seedlings and establish as adults in rare, successive years of favorable conditions (usually equating to successive years of above average and well-timed rainfall). This means that in the absence of supplemental irrigation, one could be left waiting for decades before appropriate conditions for establishment are experienced.
- DO use drip irrigation, preferably drip tape or another "disposable," low-cost and water-efficient method for irrigating only the immediate area around the planted stock. This will reduce water costs, cut down on weeds, and give planters a visual cue where to place the plants when pre-irrigation spot wet the fields which are being planted.
- DO NOT remove the well or irrigation infrastructure prior to revegetation. Without the ability to irrigate, chances for success are slim and reinstalling well and other irrigation components could be cost-prohibitive.
- DO NOT overdesign the irrigation system. This can cause unnecessary expense and complexity to regular irrigation operations. The system should be installed with inexpensive equipment and designed to last only a few years. The system may often be operated by unskilled labor and needs to be repairable with readily available parts.
- DO use 1-gallon sized container stock or alternatively seed. Unlike seed, container stock allows one to skip the critical step of seedling emergence. Container stock allows for precise control of species composition, densities, and placement. In addition, container stock may already be mature enough to flower and set seed within the first year following planting. This may allow for a steady rain of seed onto the site promoting a self-sustaining vegetation community on site when weather conditions permit.
- DO pre-irrigate. Planting container stock into dry soil will dramatically reduce survival rates as the dry soil wicks away any moisture in the roots of the container stock. It also gives a visual cue to the field crew planting as to where to place the plants.
- DO select native perennial shrubs that are adapted to site conditions. Usually, these plants are mesquite (*P. velutina*), saltbushes (*A. canescens, A. lentiformis, A. polycarpa*), and creosote bush (*L. tridentata*). These plants are able to establish with only one year of irrigation, live for several decades or more, provide food and shelter for numerous wildlife species, serve as nurse plants for smaller perennials shrubs, perennial grasses, and annual species, eventually adding structural diversity to the site, and unlike annual plants, will persist on the site all year long instead of merely seasonally under specific climatic conditions. Other less successful potential Sonoran desert native perennial species include little-leaf palo verde (*P. microphylla*), catclaw acacia (*A. greggii*), wolfberry (*L. exsertum*), and white bursage (*A. dumosa*).
- DO install and maintain a perimeter fence. Once vegetation is planted and established at a site, it will attract cattle and native fauna and recreational vehicle users. It is in the

interest of your investment in the revegetation effort to protect the vegetation from damage it cannot support and to protect yourself from legal liabilities.

- DO NOT, if at all possible disk fields prior to planting. Soil surface disturbance should be kept to a minimum during field activities. The longer a field has lain fallow, the better. Weed competition will be greatly reduced, and survival of planted species will be enhanced. Disturbances such as disking or flooding may cause weeds with closed canopies that will shade and outcompete container stock or seeded species.
- DO communicate unequivocally with plant suppliers. They may not be aware of actual botanical names, so it is important to know the names they are familiar with. Container stock should be developed from seed to improved genetic diversity (as opposed to being produced clonally from cuttings). As field planting is unlikely to be conducted more than once it is critical that more than one supplier be used to provide stability of supply if crop failure is experienced by a supplier.
- DO NOT over water. Many native desert plants will die with too much water, especially creosote bush. Overwatering will also lead to establishment of undesirable noxious weeds like salt cedar.
- DO kill or remove any salt cedar within ½ mile of areas receiving irrigation to avoid the establishment of this noxious weed in planted fields. This should be done at least 120 days prior to planting. The same is recommended for other perennial noxious weeds like buffelgrass.
- DO continue to monitor the revegetation areas for success or failure and attempt to identify factors responsible. The longer a field can be monitored, the better, though economics may dictate that monitoring intervals lengthen.

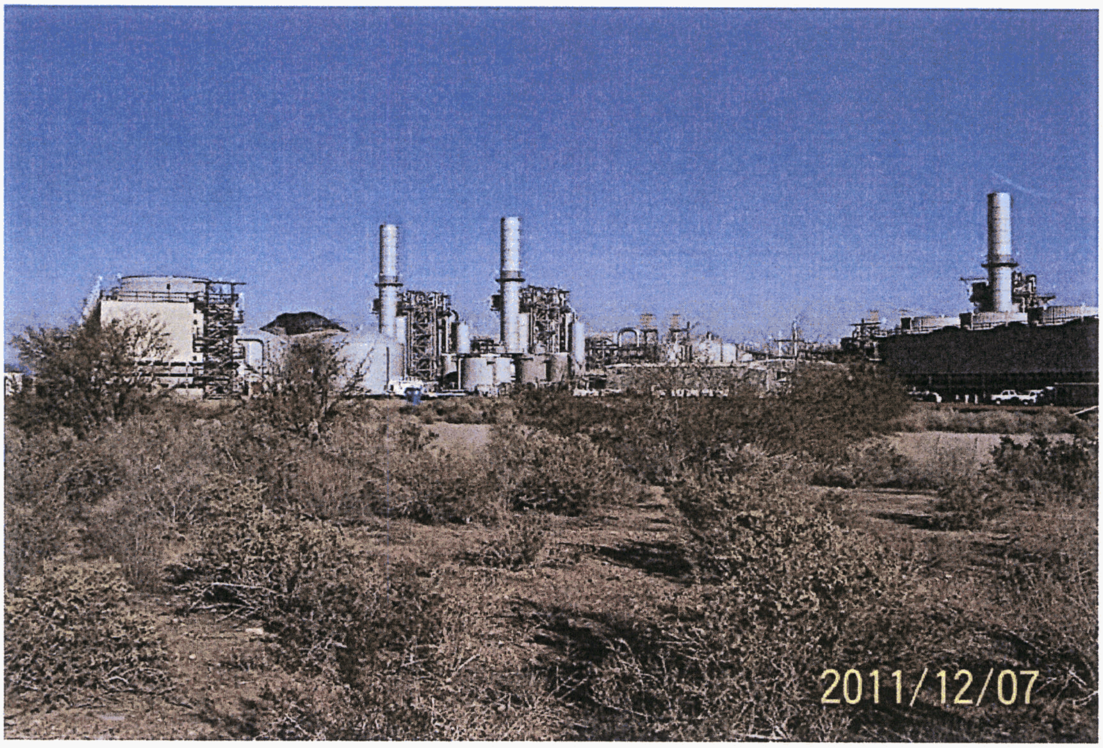
ATTACHMENT 2

Site Pictures

View looking south

View looking west

View looking north



View looking east