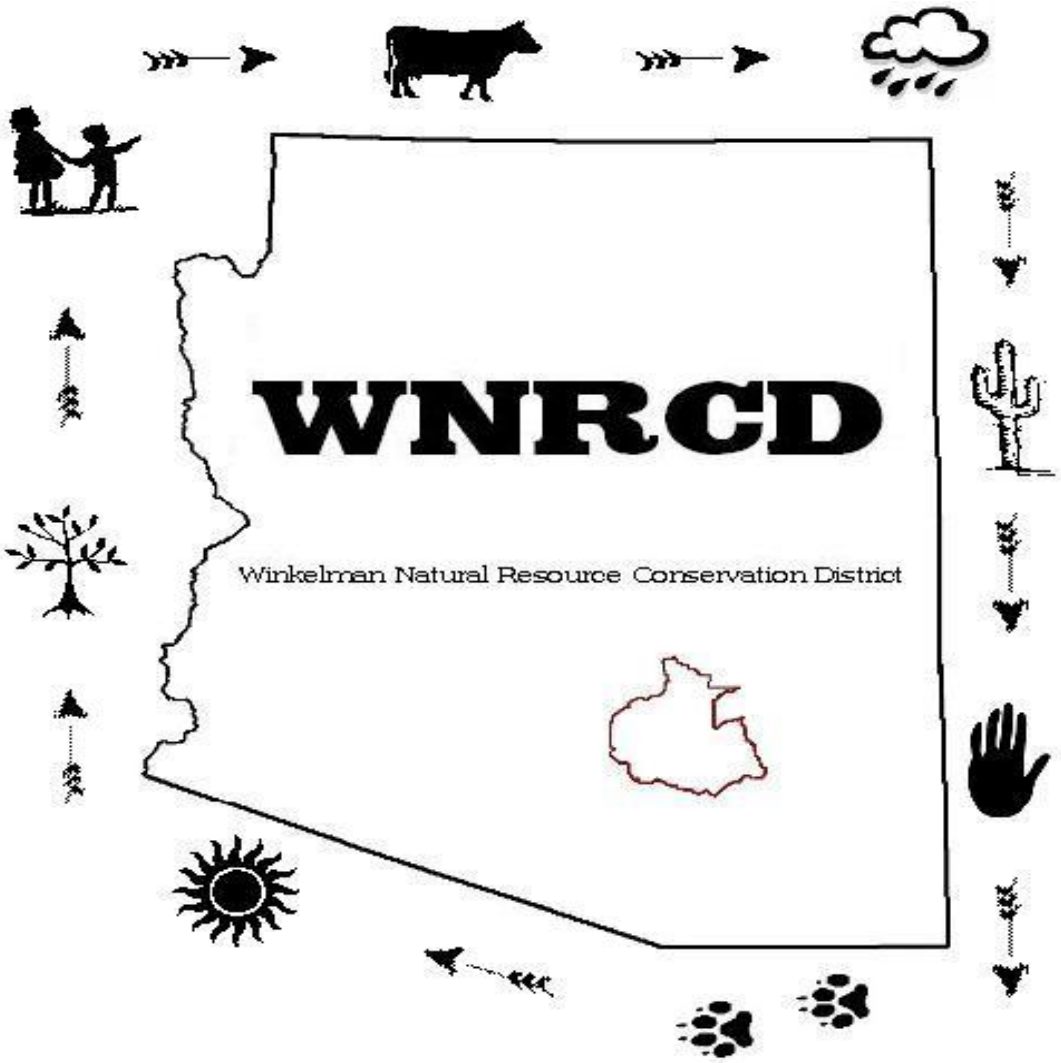
Winkelman Natural Resources Conservation District

2012 Field Report



Submitted to the Winkelman Natural Resource Conservation District
by:
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Board Accepted: October 17, 2012

Special Thanks…

Special thanks are warranted to specific individuals that contributed to the completion of this document. Their input of informational knowledge, specifics, statistics, references and/or editing that was included in this Filed Report helps portray the Winkelman Natural Resources Conservation District in the most accurate way possible.

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Throughout this document; it may be conspicuous that some sections include information that is somewhat vague or not given entirely. It is expected that specific projects that have occurred within the District boundaries was also not elaborated on; lack of time and information is a result for project non-inclusion into this report. Information from outside parties was sought in the formation of this updated Field Report but either was ignored or not given entirely. Information included in these sections is derived from the most reliable and accurate documentation that is available from libraries, the internet, books and historical accounts.

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Winkelman Natural Resource Conservation District Field Report

SECTION 1: INTRODUCTION

Overview of Assessment

This District Assessment is a concise report containing information on natural resource conditions and concerns within the Winkelman Natural Resources Conservation District (WNRCD). This assessment is a report containing maps, tables and other information to give a sufficient overview of the watersheds including physical characteristics and socioeconomic trends.

The assessment involves the collection of readily available quantitative and qualitative information to develop a District profile, and sufficient analysis of that information to generate an appraisal of the conservation needs of the District. This assessment was conducted by conservation planners, using Geographic Information System (GIS) technology and ground truthing to validate information. Conservation Districts and other local leaders, along with land management agencies, are involved in the assessment process.

This WNRCD assessment serves as a communication tool between the WNRCD, the Natural Resources Conservation Service (NRCS) and partners for prioritizing conservation work in the District. This assessment serves as a platform for conservation program delivery, provides useful information for development of NRCS and Conservation District business plans, and lays a foundation for future cooperative District planning.

General Description of the Winkelman Natural Resource Conservation District

District Background – The Winkelman Natural Resource Conservation District (WNRCD) was organized and became functional under the auspices of the Soil Conservation District Law, State of Arizona, in October, 1948. The Arizona State Attorney General issued the Certificate of Organization on October 4, 1948. The goal of the District is to foster and assist in programs that will ensure sustained yields of all natural resources within the District. The charter of the District instigates restoration, protection, and promotion of the soil, water, forage, wildlife, and other physical resources through sound and wise land and water use practices that will benefit all responsible resource users.

Land Ownership Background

In this section, a short summary of specific federal and state laws that were enacted to provide for land ownership and management within the United States will be found. It is important to have a little understanding of how the land ownership within the District was developed and for what reasons.

Homesteading Act – The Homesteading Act of 1862 is one of three federal laws that gave an individual or applicant freehold title to 160 acres of undeveloped federal land west of the Mississippi River to “prove up” at a minimum of five years. The law required three steps for a freehold title: file for an application, improve the land then file for a deed of title. Once these requirements were fulfilled, the applicant was awarded a freehold title of the land they claimed. There was no regulation of how many homesteading claims could be held in consecutive years. Only 40 percent of the applicants completed this process to obtain the title of their homesteaded lands.

Much of the prime lands along rivers had been homesteaded by the turn of the twentieth century; the Enlarged Homestead Act was passed in 1909 that increased deedable lands up to 320 acres. This act mainly targeted land suitable for dryland farming.

The Stock-Raising Homestead Act of 1916 – This act provided for settlers seeking a 640 acre deed of public land for ranching purposes only.

Unlike the Homestead Act, lands homesteaded under the Stock-Raising Act separated surface rights from mineral rights. Under this act, cultivation of lands was not required but range improvements were authorized as necessary.

Eventually 1,600,000 acres of homesteads were granted and 270,000,000 acres of federal lands were privatized between 1862 and 1934. Homesteading in the lower 48 states was discontinued in 1976. Approximately 10 percent of the total land acreage of the United States was homesteaded through these three acts ("The Stock-Raising Homestead Act of 1916". 1916).

Forest Reserve Act – The Forest Reserve Act of 1891 is a federal law that had several purposes – 1; to protect watersheds from erosion and flooding (this subsequently provided for individual allotment boundaries to be formed on a watershed basis), and 2; to preserve the nation's timber supply from over-exploitation. This consequently enacted the Land Revision Act of 1891. This act allowed a sitting president the authority to set aside forest reserves from land in the public domain to the National Forest System. Lands that were taken out of the public domain are those that are wholly or partially covered with timber or undergrowth for federal management. At this time, 13,000,000 acres of land was put into the National Forest. Since this time, 32,000,000 acres were set aside under two preceding presidencies. During the passage of this act, regulation enforcement was charged to the Deputy U.S. Marshals agents of the General Land Office of the Department of the Interior.

The Forest Management Act – This act was subsequently passed in 1897 by Congress to lay out purposes and conditions of the reserves such as: preserve water supply, preserve forested lands and provide a sustainable supply of timber. In 1905, management of these lands was moved to the new Division of Forestry in the Department of Agriculture then later designated as the National Forests (Wilma, David. February 28, 2003).

Through the passing of several other acts, there are now 155 National Forests containing approximately 190,000,000 acres of forest today that make up 8.5 percent of the total land area of the United States. Eighty seven percent of which lies west of the Mississippi River.

Arizona State Trust Land – The First Legislature of 1912 created the first State Land Commission and was charged in making recommendations for the land that was granted to the State by Congress. After review, the Commission concluded that Arizona should not sell its Trust land outright, as other states had done but instead, it should be put to their "highest and best use". They also recommended the creation of the State Land Department to manage these Trust lands.

During the creation of the Territory of Arizona in February, 1863, Congress granted sections 16 and 36 of each township for the benefit of the Common Schools. In 1881, the Territory of Arizona was granted approximately 60,000 acres to be held in trust for the University of Arizona. The State Enabling Act passed in 1910, allowed for the assignment of sections 2 and 32 to also be held in trust for the Common Schools. In 1929, an additional 50,000 acres for Miners' Hospital Trust was authorized to be held in Trust. To date, there are 14 beneficiaries the State Land Department is held responsible for. Total acreage of State Trust Lands at this time was approximately 10,900,000 acres. Since the State Land Department's inception, its mission has been to manage the Land Trust and to maximize its revenues for the beneficiaries.

All uses of the land must benefit the Trust, a fact that distinguishes it from the way public land, such as parks or national forests, may be used. While public use of Trust land is not prohibited, it is regulated to ensure protection of the land and reimbursement to the beneficiaries for its use.

Acreage of State Trust Lands in 2008 is estimated at approximately 9,260,253 acres ("State Land Department Historical Overview". 2012). Nearly 1,628,079 acres of Trust lands have been disposed of or exchanged.

Taylor Grazing Act of 1934 – During President Herbert Hoover's administration (1929-1933), it became apparent that federal regulation of public land use on lands that were not privatized, given to the States or taken up by the Forest Reserve Act was needed to improve rangeland conditions given that vast portion of land were used for livestock grazing. The Taylor Grazing Act was introduced into Congress to provide for this regulation.

The act was signed into Public Law in 1934 and initially permitted 80 million acres of previously unreserved public lands of the United States to be placed into grazing districts to be administered by the Department of Interior. As amended, the law now sets no limit on the amount of lands in grazing districts. There are currently approximately 162 million acres of allotments inside grazing districts. Grazing allotments are permitted using grazing fees to individuals for grazing privileges, maintenance and improvement responsibilities within these districts. The Taylor Grazing Act was named for Congressman Edward T. Taylor of Colorado ("Taylor Grazing Act of 1934". 1934).

District History

The Winkelman District was officially created in 1948 and has gone through one boundary withdraw and two expansions since its creation. The original District boundaries included land units found within the Mineral Strip of what is now part of the San Carlos Indian Reservation. Land units withdrawn from the District include: Reece Ranch, Apsey (Millers) Ranch, Bundrick Ranch, Hook and Line Ranch and the Eskimazene (Upshaw) Ranch. District acreage at this time was: 951,738 acres (Figure 1-1).

One of the major reasons the Mineral Strip was withdrawn back to the Reservations was because of its mineral resources; particularly coal, gold and copper (Meyer, W. Walter. Personal correspondence. 2012); hence the name "Mineral Strip". Privately owned real property was purchased by the Secretary of Interior in 1969 and taking title in the name of the United States in trust for the San Carlos Apache Indian Tribe ("Creation of Mineral Strip". 1973). There is also approximately 10,650 acres within the Mineral Strip that was administered by the Coronado National Forest and was transferred to the Secretary of Interior to administer surface rights in trust for the San Carlos Apache Indian Tribe signed into Public Law by George on October 22, 1990 ("San Carlos Mineral Strip Act of 1990". 1990).

Figure 1-1. Winkelman NRCD 1948 – 1974 original boundary.

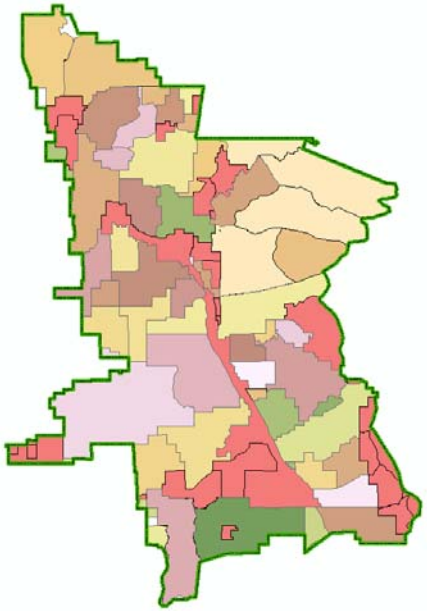


Image Source: ArcMap Map Layer: "WNRCD 1948 Land Units". 2011. USDA-NRCS
** Note: Boundaries of land units within the Mineral Strip is not accurate but drawn from memory. Actual information on these land units is unavailable.*

Much of the land units within and outside this District boundary were in the process of being fenced both with individual land unit boundary fences and interior pasture fencing. Fencing commenced in the mid 1940's and finally

completed in the mid to late 1950's (Meyer, W. Walter. Personal correspondence. 2012).

The second boundary change after the withdrawal of the Mineral Strip took place in 1974 (Figure 1-2) and included ranch units such as the (starting from the northern boundary, working clockwise; using current names): Government Springs Ranch, Pioneer Ranch, El Capitan, Mescal Creek Ranch, Piper Springs Allotment, Painted Cave Ranch, Panorama Ranch, Miller Ranch, Campstool Ranch, Hendrickson Ranches, Sacaton Ranch, north face of Catalina Mountain to the top of Samaniego Ridge, northern portion of the Falcon Valley Ranch, south eastern portion of the Willow Springs Ranch, Haydon Combe Ranch, A Diamond Ranch, Rafter 6 Ranch, Battleaxe Ranch and all ranches located within (Egen, Kristen. NRCS District File. 1989-1990.) Total acreage of the District at this time was approximately: 846,792.

Figure 1-2. Winkelman NRCD 1974 – 1990 original boundary.

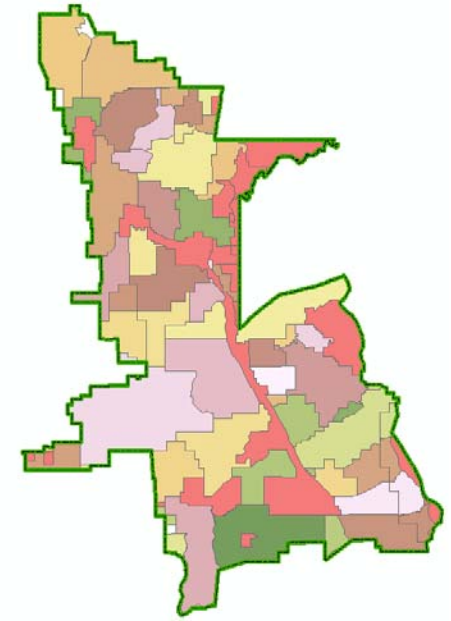


Image Source: ArcMap Map Layer: "WNRCD 1974 Land Units". 2011. USDA-NRCS

The first District expansion took place in the years 1989 and 1990. Approximately 737,546 acres of land was annexed from the Eloy NRCD making up the entire western half of the District (Figure 1-3). Ranch units added with this annexation are (starting from southern boundary, working clockwise; using current names): the entire Falcon Valley Ranch, Palo Verde Ranch, Rail X Ranch, Slash D Ranch, Newman Peak Ranch, Holt Ranch, Rail S Ranch, Granillo Ranch, Reed Ranches, Whitlow Ranch, Teacup Ranch and all ranches located within (Egen, Kristen. NRCS District File. 1989-1990.). This brought the District to an approximate acreage of 1,547,085.

Figure 1-3. Winkelman NRCD 1990 - 1996 original boundary.

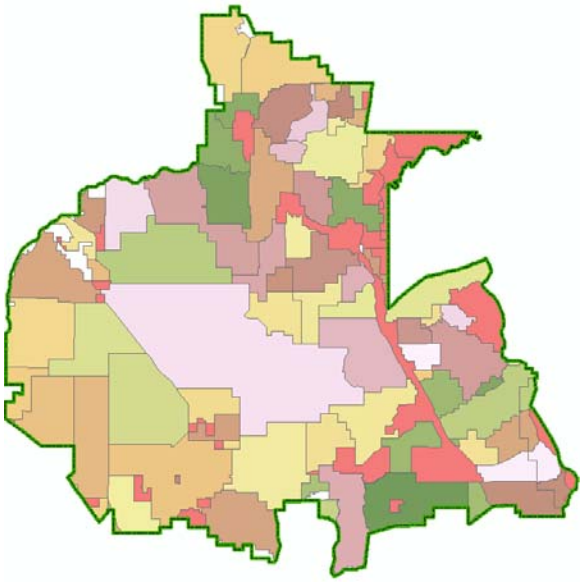


Image Source: ArcMap Map Layer: "WNRCD 1990 Land Units". 2011. USDA-NRCS

A second District expansion took place in 1996 to include the land units that are considered in the Winkelman District today. Lands were annexed from the Pima NRCD and the Redington NRCD to include the 3C/U Circle ranch boundaries on the southern boundary of the district, the entire north face of the Catalina Mountains and Catalina (Figure 1-4). One of the justifications for including such lands was to include remaining portions of watersheds that drain into the District to encompass the entire watersheds within the District. The current boundaries of the District are: the Pinal and Mineral Mountains on the north; the Mescal

Mountains, San Carlos Indian Reservation mineral strip and Galiuro Mountains to the Carlink Ranch boundary on the east; the Catalina and Tortolita Mountains on the south; I-10 to Newman Peak, the Florence Town limits and the Gila River on the west.

Figure 1-4. Winkelman NRCD 1990 - present original boundary.

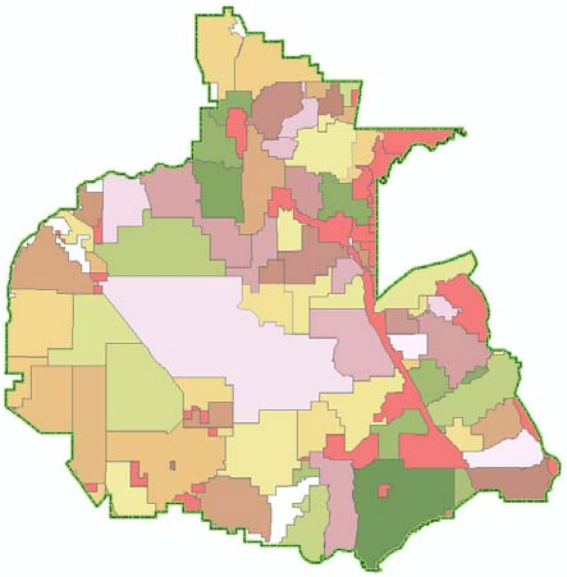


Image Source: ArcMap Map Layer: "WNRCD Consplan". 2011. USDA-NRCS

District Land Status

The WNRCD comprises 1,609,470 acres (2,514.8 square miles), and is located approximately 85% in Pinal County and about 8% in Gila County, 5% in Pima County and 3% in Graham County. 56% percent of the land is State of Arizona owned, 18% is privately owned, 17% is managed by the Bureau of Land Management, 8% is National Forest and 1% is other land ownership including Tribal Lands (NRCS ArcGIS information).

Land ownership and management programs are highly disseminated throughout the District. Private lands are greatly inter-dispersed with other lands. State of Arizona leased lands, which produce revenues for the state, form fairly contiguous blocks in many of the ranch units. Forest service lands are well blocked but apparently there is little continuity between allotments. Bureau of Land Management (BLM) lands are widely dispersed throughout the WNRCD with some differences in management philosophies between Phoenix, Tucson and Safford BLM Districts.

Table 1-1: Winkelman NRCD Land Management percentages.

Agency Land Ownership	Acreage per District Field Office	Percent of WNRCD
BLM	**270,709**	**17%**
Tucson	241,108	89%
Safford	29,601	11%
Forest Service	**147,674**	**8%**
Tucson	65,391	44%
Safford	24,659	17%
Globe	57,624	39%
State Land	**904,998**	**56%**
Phoenix	244,302	27%
Tucson	660,696	73%

Data Source: ArcMap Map Layer: "WNRCD Ownership". 2011. USDA-NRCS

There are approximately 1,160 acres of irrigated cropland in the watershed comprised of 10 farms; 2 farms produce food/fiber crops, 7 farms are irrigated pasture for livestock and one farm is orchard. Important crops include native grass, alfalfa, wheat, cotton and citrus. The total grazing area is approximately 1,379,147 acres with 62 ranches. Land acreage for this estimate includes Federal, State and private lands. Urban land is currently 40,663 and increasing annually with growth mainly near Oracle, Oro Valley, Catalina and Florence. Therefore, the land use is dominated by livestock operations of which most fall into two categories; ephemeral steer operations at the lower elevations and cow calf operations at the higher elevations.

Major towns and cities include Florence, Oracle and major communities in the District are Dudleyville, Hayden, Kearny, Kelvin, Mammoth, Catalina, Oracle, San Manuel, and Winkelman.

The communities of Globe and Superior lie just outside the resource District yet serve the residents of the District. Residential developments are commonplace along the Aravaipa, Dripping Springs, Gila and San Pedro Valleys. The metropolitan area of Tucson is south of the District and Casa Grande is west; both are outside the District boundary. Urban development utilizes 40,663 acres or 2.5% of the District.

Revenue

The mining industry still provides the major employment for residents in the District as well as State and Federal Prison systems in Florence as well as other employment in nearby metropolitan areas generates most of the revenues within these communities.

The second largest source of revenue within the District is livestock, agricultural, and agronomic related businesses. There are 24 farm units and 50 ranch units that utilize 795,155 acres or 97% of the land resource. Much of the mining property previously discussed is used in conjunction with livestock grazing. Agronomic croplands, approximately 4,920 acres, produce varied commodities. Listed in respective order of acres planted these crops are: irrigated pasture, hay, small grains, grain sorghum, cotton, pecans, apples, citrus, and smaller amounts of other varied crops.

Recreation and related services generate little revenue within the communities of the District even though the District land resources and physical improvements are exploited for their use. Revenues that are brought into the District by these related industries are generally in the form of salaries to technicians and employees who are on temporal assignment. Most site specific improvements, recreational and game habitat improvements, are made with monetary funds that are mainly generated from outside sources; while the majority of the beneficial land improvements, conservation, and restoration programs are achieved with monetary resources obtained from land resources within the District. The District tax base of private property and improvements, fees, and other fixed and variable expenditures produce substantial revenues for the communities in the District and various government agencies.

District Objectives

Pursuance of the District goals requires knowledge of resources and physical improvements within the District and the status of resource management programs. To acquire the needed knowledge this field investigation was instigated through a directive by the District members. The objectives of this report are to: (1) map ranch and farm units within the District; (2) elucidate present land status; (3) evaluate and enumerate the District's land resource areas; (4) evaluate rangeland improvement programs; (5) quantify established and needed physical improvements; (6) determine other resources in conjunction with the District rangelands.

Conservation assistance provided by private land owners and producers is provided by the Winkelman Natural Resource Conservation District and two U.S. Department of Agriculture (USDA) Service Centers; the first is located in Tucson and provided by the Natural Resources Conservation Service and a second is the Casa Grande Farm Service Agency. Technical assistance, volunteer work and financial program assistance for conservation measures is provided by both agencies.

Resource Concerns

Current major resource concerns in the District include soil erosion – sheet, rill, wind, concentrated water flow, excessive bank erosion; soil condition – compaction, degradation from salts and other contaminants; water quantity – insufficient water use; water quality – excessive nutrients, pesticide transportation and excessive sedimentation; air

quality – inefficient energy use, emission of particulate matter and precursors; animal – fish and wildlife habitat degradation, inadequate feed and forage, inadequate water; and plant condition – undesirable plant productivity and health, excessive plant pest pressure. ("2011 Local Workgroup Recommendations". June 16, 2010.).

SECTION 2: DISTRICT OVERVIEW

Physical Description

The WNRCD is in southeastern Arizona with rangelands that are located in eastern Pinal County, southern Gila County, western Graham County, and northern Pima County which covers several watersheds that are approximately 2,514.8 square miles (1,609,470 acres), representing about 2% of the State of Arizona. The watershed has a maximum width of about 57 miles east to west, and a maximum length of about 63 miles north to south; estimated by aerial view. The high point in the watershed is the Catalina Mountains north of Tucson at 8,400 feet, and the low point is the Gila River near Florence at 1,550 feet.

Figure 2-1. Winkelman NRCD Counties.

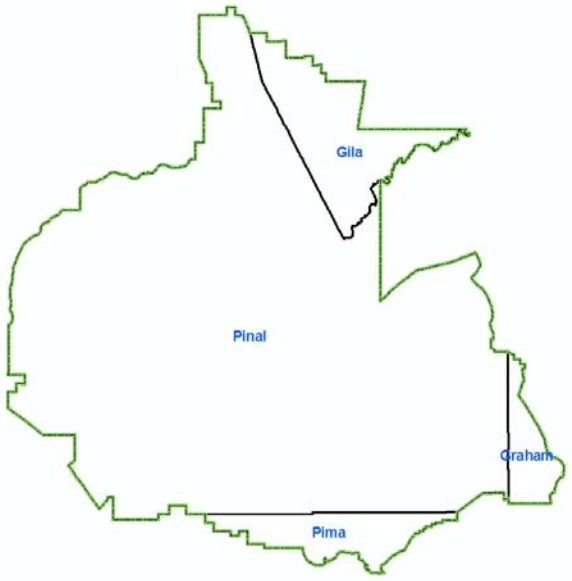


Image Source: ArcMap Map Layer: "WNRCD Counties". 2011. USDA-NRCS

The Winkelman NRCD watersheds were delineated by the U.S. Geological Survey and have been subdivided by the NRCS into smaller watersheds or drainage areas. Each drainage area has a unique hydrologic unit code number (HUC) and a name based on the primary surface water feature within the HUC. These drainage areas can be further subdivided into even smaller watersheds as needed. The watersheds found within the District are 8-digit HUC's and contain the following (Figure 2-2):

- 15040007 – San Carlos River
- 15050100 – Middle Gila River
- 15050203 – Lower San Pedro River
- 15050301 – Upper Santa Cruz River
- 15050302 – Rillito River
- 15050303 – Lower Santa Cruz River
- 15060103 – Upper Salt River

Figure 2-2. Winkelman NRCD Hydrologic Unit Areas.

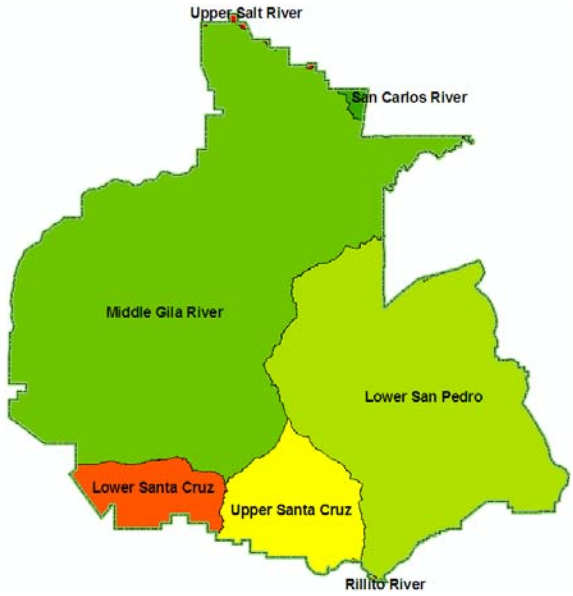


Image Source: ArcMap Map Layer: "WNRCD HUA 8". 2011. USDA-NRCS

Geology

The District is located within Arizona's Basin and Range Province. The Basin and Range Province of southern and western Arizona is an area where the Earth's crust has been stretched and broken by numerous faults so that mountain ranges and basins (broad valleys) have formed by the vertical motion of large crustal blocks.

The Basin and Range Province was formed from 28 to 12 million years ago as the Baja California portion of the Earth's tectonic Pacific Oceanic

plate began diverging from the continental plate, stretching the continental plate and forming the equivalent of stretch marks in the earth's crust, nearly parallel to the strike (direction) of the plate boundary. As the earth's crust is stretched, blocks of crust break and drop in a pattern of valley basins and high peak ranges, and is known as the Basin and Range Province within Arizona and other regions of Mexico and the western United States.

Geology is extremely varied with the largest geologic unit being Precambrian Ruin Granite followed by Tertiary alluvium, Quaternary alluvium, Precambrian sedimentary rocks, Tertiary volcanic rocks, and other geologic members. The western portion of the District mainly consists of unconsolidated to strongly consolidated alluvial and eolian deposits which include: a range of fine to coarse, poorly sorted alluvial fans and terrace deposits on middle and upper piedmonts and along large drainages; sand, silt and clay on alluvial plains and playas with wind-blown sand deposits.

In the lower elevations for the eastern and northern portions of the District; geology mainly consist of moderately to strongly consolidated conglomerate and sandstone deposited in basins during late Tertiary faulting. These include lesser amounts of mudstone, siltstone, limestone and gypsum and commonly forms high, widely exposed rounded hills and ridges in modern basins and locally form prominent bluffs. The majority of the upper elevations are a mix of either metasedimentary rocks, mostly derived from sandstone and shale with minor conglomerate and carbonate rock that includes quartz-rich, mostly non-volcanic Pinal Schist or variably volcanic-lithic sedimentary rocks or of lava, tuff, fine grained intrusive rock and diverse pyroclastic rocks. These compositionally variable volcanic rocks include basalt, andesite, dacite and rhyolite. Thick felsic volcanic sequences form prominent cliffs, range fronts and includes regionally extensive ash-flow tuffs.

Geology in the southern reaches of the District range from granite to diorite that represent solidified magma chambers that were the likely source of overlaying and nearby volcanic rocks. Granitic rocks are typically equigranular and fine to medium grained.

The major non-renewable mineral resources are copper and associated minerals, gypsum and gypsic earths, silicates, limestone, diatomite, and uranium. Most of these minerals are refined within the District but are removed from the District and have little agricultural application with the exception of gypsic earths and potentially diatomite. At the present status, mining and related industries utilize 30,260 acres or 1.8% of the land within the District however; approximately only half of this acreage is active.

Soils

Soils within the seven HUA-8 watersheds making up the Winkelman District are diverse and formed as the result of differences in climate, vegetation, geology, and physiography.

Within the District, three separate soil surveys were completed by the USDA Natural Resources Conservation Service (NRCS). The majority of the District falls within the Eastern Pinal and Southern Gila County (AZ661). A small portion of the Pinal County, Western Part (AZ659) lies on the southwestern edge of the District boundary and the Pima County, Eastern Part (AZ669) on the southern boundary of the District. Additionally, portions of two U.S. Forest Service Terrestrial Ecosystem Surveys are within the District; the Coronado (AZ723) and the Tonto (AZ687).

Additional soil data and maps from these Soil Surveys can be accessed through the NRCS Web Soil Survey website: http://websoilsurvey.nrcs.usda.gov.

Climate Characteristics

Several gauging stations are located around the State of Arizona and are a good source for climate data. Although some of the data is missing for some years or was not kept up after a period of years; it is worthwhile referring to this data when making management decisions or determining drought affects on local plant communities.

Below are general summaries of annual precipitation and temperatures found within the District.

Precipitation

This District has fairly unique physical and environmental conditions that cannot be justly compared with other parts of Arizona or the Southwest. Average annual rainfall ranges from 7 to 25 inches (177.8 - 635 mm). This District has two distinct growing seasons; late fall to spring and summer to early fall. As an average, 52% of the long-term average rainfall comes in the winter months while 48% occurs in the summer growing period. Winter storms which originate in the Pacific Ocean are usually of low intensity and of several-days duration although the District has received 5, one-hundred year stage floods over the last 40 years ("Arizona's Most Notable Storms". 2011). Summer rains originating in the Gulf of Mexico are usually of high intensity and short duration. These conditions provide for the establishment of warm and cool season plant communities elsewhere in the state; similarities with plant communities elsewhere in the state; but management programs for outside areas may not be adaptive or even desirable for those within the District.

Temperature

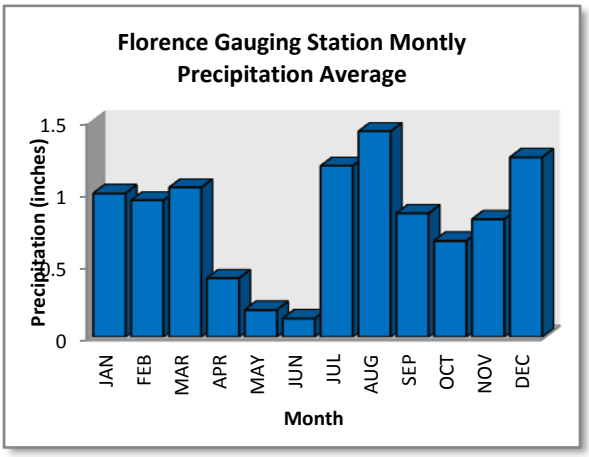
Temperatures vary widely within the district. Mean daily temperatures of 80.4 °F (26.9 °C) maximum to 48.5 °F (9.2 C) minimum in the lower elevations and 60.6 °F (15.9 °C) maximum to 38.5 °F (3.6 °C) minimum at the higher elevations. Below is some information pertaining to gauging stations found within the District:

District Climate – By Region

Below is some general precipitation information derived from gauging stations found within the District.

Florence – Based on data collected at the Florence Gauging Station (Station 023072); approximately 58% of precipitation falls in the winter months where 42% of precipitation received falls in the summer months. Average total rainfall received in Florence is 10.42 inches. The highest rainfalls recorded for this gauge were recorded in: 1941, 19.5 inches; 1978, 20.01 inches; and 1992, 18.45 inches. The lowest rainfalls recorded were: 1894, 1.13 inches; 1922, 1.79 inches and 1999, 1.43 inches. Data for this gauging station ranges from 1892 to 2006. Data thereafter is not available.

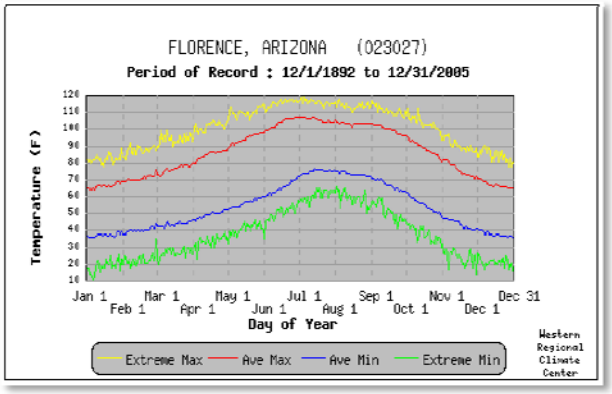
Chart 2-1: Monthly Precipitation Average for Florence for a 144 Year Period.



Data Sources: Arizona Climate Summaries; Florence Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azflor

The average mean temperature for Florence is 69 °F over the 144 year data series. The average temperature for the winter months is 59 °F and 81 °F in the summer months.

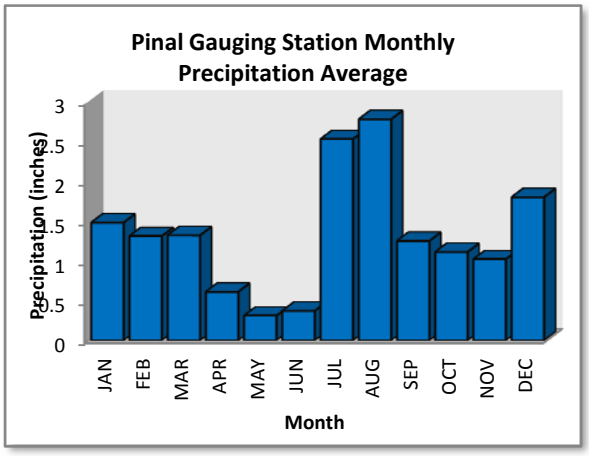
Chart 2-2: Monthly Temperature Average for Florence for a 144 Year Period.



Data Sources: Arizona Climate Summaries; Florence Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azflor

Pinal Mountain – Based on data collected at the Pinal Mountain Gauging Station (Station 023498); approximately 51% of precipitation falls in the winter months where 49% of precipitation received falls in the summer months. Average total rainfall received is 16.14 inches. The highest rainfalls recorded for this gauge were recorded in: 1935, 24.31 inches; 1941, 24.67 inches; and 1965, 23.84 inches. The lowest rainfalls recorded were: 1895, 2.81 inches; 1906, 3.92 inches; and 1975, 3.42 inches. Data for this gauging station ranges from 1894 to 1975. Data thereafter is not available.

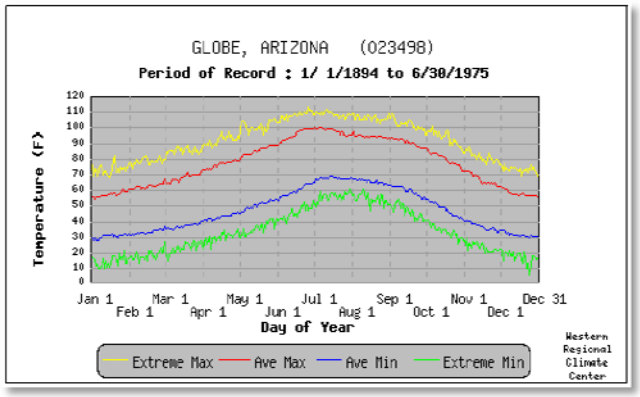
Chart 2-3: Monthly Precipitation Average for Pinal Mountain for an 81 Year Period.



Data Sources: Arizona Climate Summaries; Pinal Mountain Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azglob

The average mean temperature for Pinal Mountain is 61 °F over the 81 year data series. The average temperature for the winter months is 50 °F and 73 °F in the summer months.

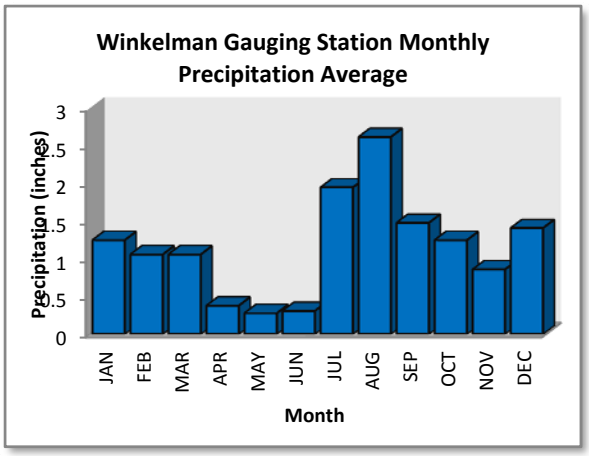
Chart 2-4: Monthly Temperature Average for Pinal Mountain for an 81 Year Period.



Data Sources: Arizona Climate Summaries; Pinal Mountain Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azglob

Winkelman – Based on data collected at the Winkelman Gauging Station (Station 029420); approximately 50% of precipitation falls in the winter months where 50% of precipitation received falls in the summer months. Average total rainfall received in Winkelman is 13.78 inches. The highest rainfalls recorded for this gauge were recorded in: 1957, 17.15 inches; 1974, 22.71 inches; and 1978, 24.49 inches. The lowest rainfalls recorded were: 1956, 5.55 inches; 1960, 5.91 inches; and 1962, 3.13 inches. Data for this gauging station ranges from 1942 to 1980. Data thereafter is not available.

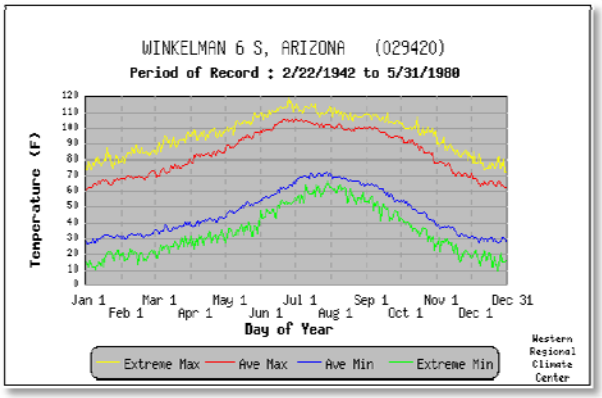
Chart 2-5: Monthly Precipitation Average for Winkelman for a 53 Year Period.



Data Sources: Arizona Climate Summaries; Winkelman Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwink

The average mean temperature for Winkelman is 65 °F over the 53 year data series. The average temperature for the winter months is 53 °F and 77 °F in the summer months.

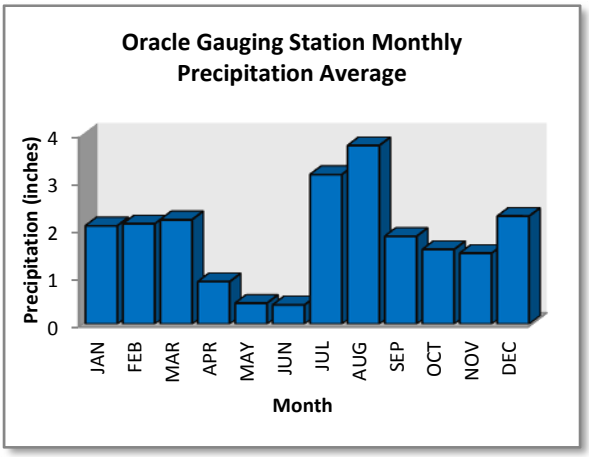
Chart 2-6: Monthly Temperature Average for Winkelman for a 53 Year Period.



Data Sources: Arizona Climate Summaries; Winkelman Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwink

Oracle – Based on data collected at the Oracle Gauging Station (Station 026119); approximately 53% of precipitation falls in the winter months where 47% of precipitation received falls in the summer months. Average total rainfall received in Oracle is 22.59 inches. The highest rainfalls recorded for this gauge were recorded in: 1978, 34.54 inches; 1983, 43.85 inches; and 1993, 34.87 inches. The lowest rainfalls recorded were: 1950, 10.21 inches; 1953, 10.32 inches; and 2006, 3.52 inches. Data for this gauging station ranges from 1950 to 2006. Data thereafter is not available.

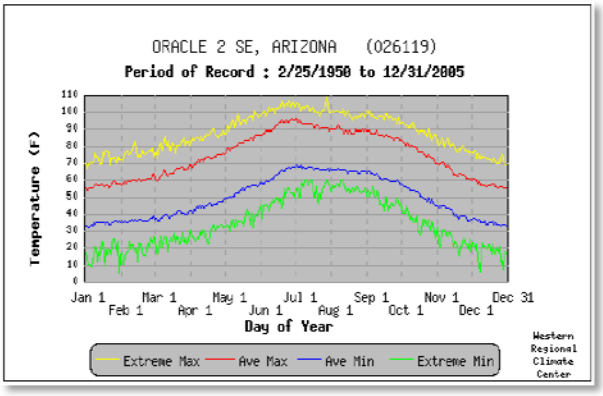
Chart 2-7: Monthly Precipitation Average for Oracle for a 38 Year Period.



Data Sources: Arizona Climate Summaries; Oracle Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azorac

The average mean temperature for Oracle is 61 °F over the 38 year data series. The average temperature for the winter months is 52 °F and 73 °F in the summer months.

Chart 2-8: Monthly Temperature Average for Oracle for a 38 Year Period.

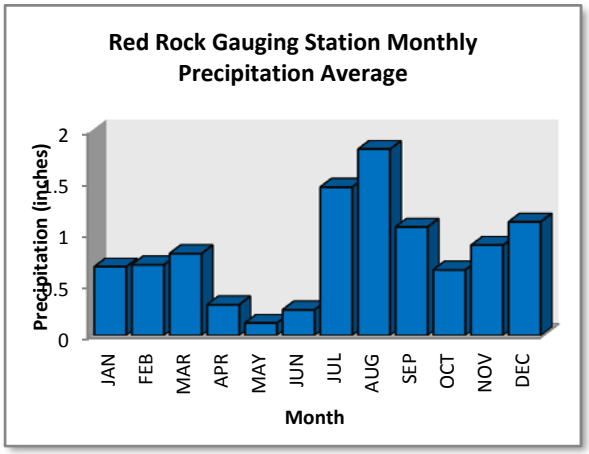


Data Sources: Arizona Climate Summaries; Oracle Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azorac

Red Rock – Based on data collected at the Red Rock Gauging Station (Station 027058); approximately 49% of precipitation falls in the

winter months where 51% of precipitation received falls in the summer months. Average total rainfall received in Red Rock is 9.87 inches. The highest rainfalls recorded for this gauge were recorded in: 1919, 15.16 inches; 1952, 13.45 inches; and 1971, 12.95 inches. The lowest rainfalls recorded were: 1920, 1.92 inches; 1934, 3.16 inches; and 1963, 2.06 inches. Data for this gauging station ranges from 1893 to 1973. Data thereafter is not available.

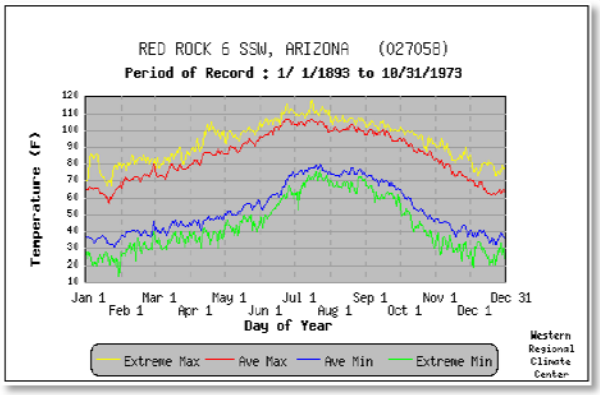
Chart 2-9: Monthly Precipitation Average for Oracle for an 80 Year Period.



Data Sources: Arizona Climate Summaries; Red Rock Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azredr

The average mean temperature for Red Rock is 61 °F over the 80 year data series. The average temperature for the winter months is 58 °F and 80 °F in the summer months.

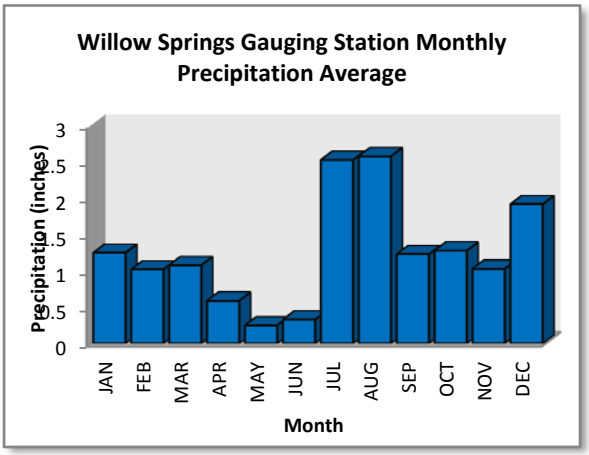
Chart 2-10: Monthly Temperature Average for Oracle for an 80 Year Period.



Data Sources: Arizona Climate Summaries; Red Rock Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azredr

Willow Springs – Based on data collected at the Willow Springs Gauging Station (Station 029382); approximately 50% of precipitation falls in the winter months where 50% of precipitation received falls in the summer months. Average total rainfall received on the Willow Springs is 15.02 inches. The highest rainfalls recorded for this gauge were recorded in: 1957, 23.8 inches; 1964, 19.35 inches; and 1971, 18.24 inches. The lowest rainfalls recorded were: 1953, 7.86 inches; 1956, 7.46 inches; and 1977, 4.30 inches. Data for this gauging station ranges from 1949 to 1978. Data thereafter is not available.

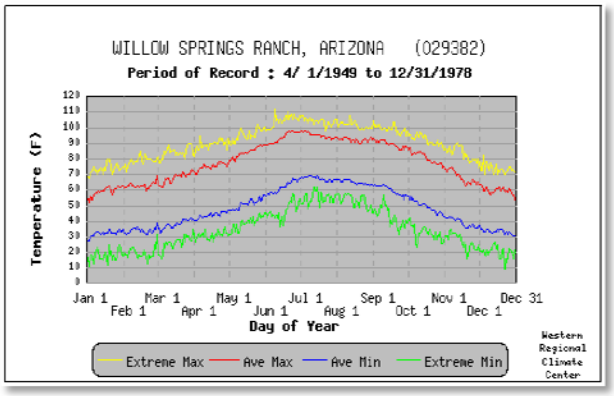
Chart 2-11: Monthly Precipitation Average for Willow Springs for a 29 Year Period.



Data Sources: Arizona Climate Summaries; Willow Springs Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwils

The average mean temperature for Willow Springs is 62 °F over the 29 year data series. The average temperature for the winter months is 52 °F and 73 °F in the summer months.

Chart 2-12: Monthly Temperature Average for Willow Springs for a 29 Year Period.



Data Sources: Arizona Climate Summaries; Willow Springs Gauging Station.
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwils

Major Land Resource Areas and Common Resource Areas

Major Land Resource Areas (MLRA) are broad geographical areas that are characterized by a particular pattern of physiographic features. Soils, climate, vegetative, water resources, and land use are used to delineate the different land resource areas throughout the state. Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional and national planning. There are several MLRA's found within the District and were mapped in accordance with NRCS guidelines.

The Winkelman NRCD is comprised of three Major Land Resource Areas (Figure 2-3 and Table 2-1). Names of MLRA's have changed somewhat since the 1980 Winkelman report. MLRA's are numbered throughout the United States. The Winkelman NRCD MLRA's are listed below.

Table 2-1: Winkelman NRCD Major Land Resource Areas

MLRA Type	Area (sq. mi.)	Percent of District
38 – Mogollon Transition	693.8	28%
40 – Sonoran Basin and Range	1,361.7	54%
41 – Southeastern Arizona Basin and Range	459.3	18%

Data Sources: ArcGIS map layer "MLRA_WNRCD". Arizona Ecological Site Information System, Natural Resource Conservation Service (NRCS 2011)

Figure 2-3: Winkelman NRCD Major Land Resource Areas. Detailed map in the Appendices.

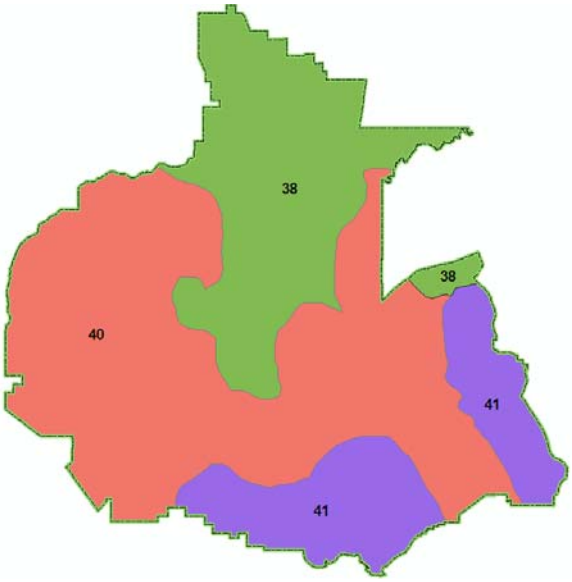


Image Source: ArcGIS map layer "MLRA_WNRCD". (NRCS 2011)

Common Resource Areas (CRA) is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA). Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area. The delineation of these map units is in compliance with information set forth by the United States Department of Agriculture Natural Resource Conservation Service (NRCS) (Common Resource Areas (CRA) and Sub-resource Areas Map. 2011) and by the NRCS Ecological Site Descriptions. CRA's are coded with the MLRA

listed first with the tiered CRA number following.

The Winkelman NRCD is comprised of six Common Resource Areas (Figure 2-4 and Table 2-2).

Table 2-2: Winkelman NRCD Common Resource Areas

Common Resource Area Type	Area (sq. mi.)	Percent of District
38.1 – Lower Mogollon Transition	**676.0**	**27%**
38.2 – Middle Mogollon Transition	**17.8**	**1%**
40.1 – Upper Sonoran Desert	**1,141.6**	**45%**
40.2 – Middle Sonoran Desert	**220.1**	**9%**
41.1 – Mexican Oak-Pine Forest and Oak Savannah	**148.1**	**6%**
41.3 – Chihuahuan – Sonoran Semidesert Grasslands	**311.1**	**12%**

Data Sources: ArcGIS map layer "CRA_WNRCD". Arizona Ecological Site Information System, Natural Resource Conservation Service (NRCS 2011)

Figure 2-4: Winkelman NRCD Common Resource Areas. Detailed map in the Appendices.

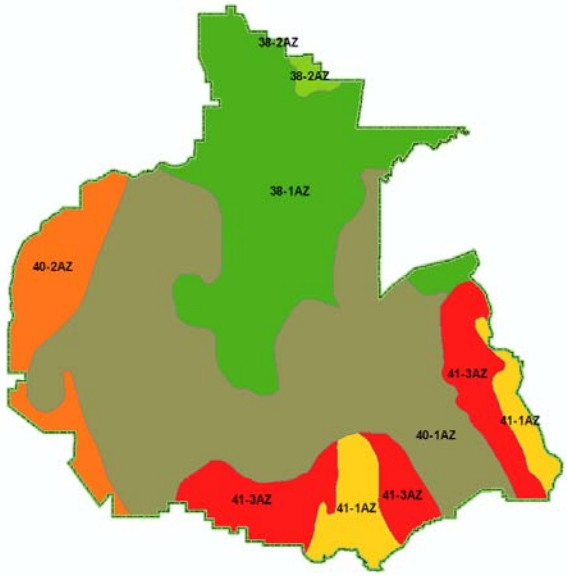


Image Source: ArcGIS map layer "CRA_WNRCD". (NRCS 2011)

38 – Mogollon Transition

38.1 – Lower Mogollon Transition: This CRA is found on the northern portion of the District boundary. 38.1 encompass the middle and lower elevations of the Pinal and Mescal mountain ranges, stretches into the Dripping Springs Valley and partially into the upper elevations of the San Pedro River Valley. Inclusions of the 38.1 CRA can be found as far down as Copper Creek and the Tortilla Mountain range. Elevations range from 3,000 to 4,500 feet and precipitation averages 12 to 16 inches per year. Vegetation includes canotia (*Canotia holacantha*), one-seed juniper (*Juniperous monosperma*), mesquite (*Prosopis velutina*), catclaw acacia (*Acacia greggii*), jojoba (*Simmondsia chinensis*), turbinella oak (*Quercus turbinella*), ratany (*Krameria* spp.), shrubby buckwheat (*Eriogonum wrightii*), algerita (*Mahonia trifoliolata*), skunkbush sumac (*Rhus trilobata*), tobosa (*Pleuraphis mutica*), vine mesquite (*Panicum obtusum*), bottlebrush squirreltail (*Elymus elymoides*), grama species (*Bouteloua* spp.), curly mesquite (*Hilaria belangeri*) and New Mexico feathergrass (*Hesperostipa neomexicana*). The soil temperature regime is thermic and the soil moisture regime is ustic aridic. This unit occurs within the Transition Zone Physiographic Province and is characterized by canyons and structural troughs or valleys. Igneous, metamorphic and sedimentary rock classes occur on rough mountainous terrain in association with less extensive sediment filled valleys exhibiting little integrated drainage.

38.2 – Middle Mogollon Transition: This CRA is located at the top of the Pinal and Mescal Mountain ranges at the northern boundary of the District. Elevations range from 4,000 to 5,500 feet and precipitation averages 16 to 20 inches per year. Vegetation includes turbinella oak, Wright silktassel (*Garrya wrightii*), hollyleaf buckthorn (*Rhamnus crocea*), desert buckbrush (*Ceanothus greggii*), one-seed juniper, alligator juniper (*Juniperus deppeana*), pinyon pine (*Pinus edulis*), algerita, sugar sumac (*Rhus ovata*), prairie junegrass (*Koeleria*

macrantha), blue grama (*Bouteloua gracilis*), curly mesquite, bottlebrush squirreltail, muttongrass (*Poa fendleriana*), cane beardgrass (*Bothriochloa barbinodis*), plains lovegrass (*Eragrostis intermidia*) and bullgrass (*Muhlenbergia emersleyi*). The soil temperature regime ranges from thermic to mesic and the soil moisture regime is aridic ustic. This unit occurs within the Transition Zone Physiographic Province and is characterized by canyons and structural troughs or valleys. Igneous, metamorphic and sedimentary rock classes occur on rough mountainous terrain in association with less extensive sediment filled valleys exhibiting little integrated drainage.

40 – Sonoran Basin and Range

40.1 – Upper Sonoran Desert: This CRA encompasses a little under half of the District and stretches nearly the entire length of the District from east to west. Much of this CRA is found south and east of Florence, around Kearny, Winkelman, Dudleyville and San Manuel. Elevations range from 2,000 to 3,200 feet and precipitation averages 10 to 13 inches per year. Vegetation includes saguaro (*Carnegiea gigantea*), paloverde (*Parkinsonia microphullum*), mesquite, creosotebush (*Larrea tridentata*), triangle bursage (*Ambrosia deltoidea*), prickly pear (*Opuntia* spp.), cholla (*Cylindropuntia* spp.), limberbush (*Jatropha cardiophylla*), wolfberry (*Lycium* spp.), bush muhly (*Muhlenbergia porteri*), threeawns (*Aristida* spp.), ocotillo (*Fouquieria splendens*), and globe mallow (*Sphaeralcea ambigua*). The soil temperature regime is thermic and the soil moisture regime is typic aridic. This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

41.2 – Middle Sonoran Desert: This CRA is found on the western edge of the District at the lowest elevations, stretching from Florence to Red Rock along the I-10 corridor. Elevations range from 1,200 to 2,000 feet and precipitation averages 7 to 10 inches per year. Vegetation includes saguaro, palo verde, creosotebush, triangle bursage, brittlebush (*Encelia farinosa*), prickly pear, cholla, desert saltbush (*Atriplex polycarpa*), wolfberry, bush muhly, threeawns, and big galleta (*Pleuraphis rigida*). The soil temperature regime is hyperthermic and the soil moisture regime is typic aridic. This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

41 – Southeastern Arizona Basin and Range

41.1 – Mexican Oak-Pine and Oak Savannah: This CRA is found on the eastern and southern most portion of the District. It is found at the highest elevations along the Catalina and Galiuro Mountain ranges as well as small inclusions around Oracle area and Black Mountain. Elevations range from 4,500 to 10,700 feet and precipitation ranges from 16 to 30 inches. Vegetation includes Emory oak (*Quercus emoryi*), Mexican blue oak (*Quercus oblongifolia*), Arizona white oak (*Quercus arizonica*), one-seed juniper, alligator juniper, sacahuista (*Nolina microcarpa*), California bricklebush (*Encelia californica*), skunkbush sumac, Arizona rosewood (*Vauquelinia californica*), wait-a-bit mimosa (*Mimosa aculeaticarpa* var. *biuncifera*), sideoats grama (*Bouteloua curtipendula*), blue grama, purple grama (*Bouteloua radicosa*), wooly bunchgrass (*Elionurus barbiculmis*), plains lovegrass, squirreltail, and pinyon ricegrass (*Piptochaetium fimbriatum*). The soil temperature regime ranges from thermic to mesic and the soil

moisture regime ranges from aridic ustic to typic ustic. This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

41.3 – Chihuahuan – Sonoran Desert Grasslands: This CRA is found at the middle elevations in the eastern and southern portions of the District along the Catalina, Galiuro and Tortolita Mountain ranges. Inclusions of this CRA can also be found into the Tortilla Mountain Range, from Black Mountain and Antelope Peak south. Elevations range from 3,200 to 5,000 feet and precipitation ranges from 12 to 16 inches per year. Vegetation includes mesquite, catclaw acacia, netleaf hackberry (*Celtis reticulata*), palo verde, false mesquite (*Calliandra eriophylla*), range ratany (*Krameria erecta*), fourwing saltbush (*Atriplex canescens*), tarbush (*Flourensia cernua*), littleleaf sumac, sideoats grama, black grama (*Bouteloua eriopoda*), plains lovegrass, cane beardgrass, tobosa, vine mesquite, threeawns, Arizona cottontop (*Digitaria californica*) and bush muhly. The soil temperature regime is thermic and the soil moisture regime is ustic aridic. This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges and sediments filling the basins represent combinations of fluvial, lacustrine, colluvial and alluvial deposits.

Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. Approximately 51% of the District has a slope less than 15%, while 29% of the watershed has a slope greater than 15%, and 20% of the District is 45% or greater (Table 2-3). There are very few areas within the District that are relatively flat. Most areas consist of rolling slopes and steep hills and ridge tops.

Table 2-3: *Winkelman NRCD Watersheds Slope Classifications*

Watershed Name	Percent Slope in Sq. Mi.		
	<15%	16-45%	>45%
San Carlos River 15040007	1.58	5.52	0.79
Middle Gila River 15050100	838.2	279.4	279.4
Lower San Pedro River 15050203	318.3	318.3	159.1
Upper Santa Cruz River 15050301	117.3	29.3	48.9
Rillito River 15050302	5.69	91.1	17.1
Lower Santa Cruz River 15050303	0.9	0.25	0.1
Upper Salt River 15060103	0.3	1.3	1.7
Winkelman NRCD Total	**1,282.4**	**725.2**	**507.1**

Data Sources: ArcGIS map layer "Slope_WNRCD". (NRCS 2011)

SECTION 3: HISTORICAL LAND USE REVIEW

It is necessary to have some understanding of historical land use within the District before valid considerations can be made of current resource uses. Within this section, information will be given for prehistoric occupation, early settlements and livestock interactions that aided in the inducement of land forms we know today.

Cultural Resources

San Pedro River Valley – There is evidence everywhere within the District of prehistoric beings making a living off of the land. The San Pedro River Valley has been almost continuously occupied since the Paleo-Indian period (circa 9500-8500 B.C.; see Bronitsky and Merritt 1986; Doelle et al. 1998). The big-game hunters of the late Pleistocene and early Holocene preyed on now-extinct mega-fauna, such as mammoth, mastodon, camel, and horse.

Pleistocene hunters were followed by people from what is referred to as the Archaic lifeway. Archaic peoples (formerly known as the Cochise culture; see Sayles 1983) maintained a seasonally mobile existence, utilizing the various natural resources available in the upland and lowland microenvironments. This subsistence strategy of intensive wild plant gathering and the hunting of small game persisted for approximately 6,800 years (circa 8500-1700 B.C.), during the Early and Middle Archaic periods.

At the beginning of the Early Agricultural period (circa 1700 B.C.-A.D. 150)–formerly known as the Late Archaic–domesticated crops such as corn, beans, squash, cotton, and tobacco were added to the group of plants used by ancient Southwestern peoples (Mabry 1998; Mabry et al. 1997; Stevens 1999). The Early Agricultural period is also characterized by the first permanent settlements (consisting of groups of pit houses), formal cemeteries, irrigation canals, pottery (Mabry 1998), and possibly by the transition from spears and atlatls (spear throwers) to the bow and arrow (Sliva 1997).

The Early Agricultural period was followed by a lengthy prehistoric occupation (A.D. 150 to 1400/1450) characterized by village-dwelling, ceramic-producing agriculturalists (Di Peso 1958; Doelle and Wallace 1997; Doelle et al. 1998; Franklin 1980; Masse 1982; Tuthill 1947). This era is divided into the pre-Classic (circa A.D. 150-1200), early Classic (circa A.D. 1200-1300), and late Classic (circa A.D. 1300-1400/1450) periods. The early part of the pre-Classic sequence is inadequately understood, and no phases have been named. Further, the archaeology of the lower (northern) portion of the drainage has, until recently, received much more attention (Altschul 1997; Van West et al. 1997; Vanderpot 1997) than that of the upper (southern) part of the river valley, above Benson. During most of the pre-Classic period, pithouses were the dominant type of domestic architecture. By circa A.D. 500, the archaeology of the lower portion of the valley developed a distinctly Hohokam flavor. Examples include: Redington Village (AZ BB:11:2 [ASM]), Soza Wash Ruin (AZ BB:11:18 [ASM]), and the Big Ditch site (AZ BB:2:2 [ASM]). After A.D. 700, the archaeology of the San Pedro is divided into phases which approximately correlate with those of the adjacent Tucson Basin and the nearby Phoenix Basin in terms of chronology and changes in architecture and material culture (Franklin and Masse 1976; Masse 1980; Tuthill 1947).

Circa A.D. 800, the large, "Snaketown-style" Hohokam ballcourt was introduced into the valley, with such features being constructed at all large pre-Classic sites recorded north of Benson (Doelle et al. 1998). North of Mammoth, pre-Classic sites commonly yield apparently locally produced versions of Middle Gila Buff Ware and Middle Gila Plain Ware (Doelle et al. 1998). South of Mammoth, the pre-Classic peoples of the San Pedro appear to have been participating in the manufacture,

use, and exchange of San Simon series pottery types (Sayles 1945).

During the A.D. 800s and 900s, large nucleated sites were established at the best-watered areas in the valley (e.g., at the confluence of Aravaipa Creek, Camp Grant Wash, and the San Pedro River. Between A.D. 900 and 1000, small "Casa Grande style" ballcourts were built at a number of sites. After A.D. 1000, the settlement pattern shifted from aggregation to a more dispersed arrangement. By A.D. 1050, it appears the ballcourt system, which had previously served to integrate multisite communities, collapsed.

In the lower San Pedro Valley between A.D. 1100 and 1200, villages moved from easily accessible locations to more defensible ones, although the same general areas–those with the best water and other resources–remained occupied. During this same period, domestic architecture shifted from pithouses to above-ground masonry and adobe compounds with rectangular rooms. Additionally, large areas of the bajada zone were cultivated, presumably as agave fields. These dry farming areas are marked by rock pile fields and water and soil control features such as contour walls, terraces, and small rock dams.

The early Classic period (circa A.D. 1200-1300) is characterized by pottery types including: San Carlos Red, Tanque Verde Red-on-brown, Cibola White Ware (in small quantities), and corrugated wares. Toward the end of the early Classic period, circa A.D. 1275, Pinto Polychrome appeared, and the first platform mounds in the San Pedro Valley were constructed (coeval with similar developments in the Phoenix, Tucson, and Tonto basins) (Doelle and Wallace 1997). The settlement pattern of this period represents a return to population aggregation and probably a renewed focus on community integration through ritual. The high percentage of corrugated ceramics and a number of architectural traits at some sites strongly suggest the presence of immigrants from the Mogollon highlands (Clark et al. 1999).

During the late Classic period (circa A.D. 1300-1400/1450), which is distinguished by the appearance of Gila Polychrome and Tonto Polychrome and the near disappearance of corrugated pottery, at least 11 platform mound sites could be found along the San Pedro River, from Dudleyville to Second Canyon, just north of Redington. Platform mound sites were usually constructed on steep-sided hills or mesas.

Routes that offered easy access were often blocked with “guard walls” (Reynard, Charles. 1934), suggesting conflict may have been a factor in site location. Compound sites were interspersed among the platform mound villages, either forming discrete clusters, or seemingly associated with a neighboring platform mound settlement. These villages were apparently members of multisite “subsistence communities,” which likely cooperated in agricultural endeavors in a manner similar to that proposed for the irrigation communities of the Phoenix Basin (Doelle et al. 1998; Gregory 1991). Some subsistence communities, such as the one at the confluence of the San Pedro and the Gila and those south of Redington, lack platform mounds and instead, consist solely of compound sites.

The Classic period ceramics and architecture in the portion of the valley south of Benson are quite different from what is described above for the northern San Pedro. This disjunction seems to represent a cultural boundary (Altschul 1997; Doelle et al. 1998). Classic period sites in the southern San Pedro exhibit circular compounds, with rooms attached to the outside of the compound wall. This is in contrast with those in the north that are rectangular, with rooms attached to the interior of the compound wall. Additionally, platform mounds were apparently not constructed south of Second Canyon. The ceramic assemblages of Classic period sites in

the lower San Pedro usually include considerable quantities of Roosevelt Red Ware (Salado polychromes), and Babacomari Polychrome is extremely rare to absent.

There is abundant evidence to suggest that many lower San Pedro compound sites (and perhaps some platform mound sites) dating to the late Classic period harbored immigrants from the Kayenta and/or Tusayan areas of northern Arizona (see Clark et al. 1999; Di Peso 1958; Doelle 1995; Gerald 1958; Lindsay 1987; Lyons 2001). Indications of the presence of Ancestral Pueblo groups in the San Pedro Valley include Maverick Mountain Polychrome, Tucson Polychrome, perforated plain ware ceramic plates, the entrybox complex, slab-lined fireboxes, and kivas. Some immigrant sites, such as Reeve Ruin, are located defensively and exhibit guard walls, whereas others, such as Davis Ranch Ruin, are located in the floodplain.

The collapse of the Classic period social systems of the San Pedro is not well understood, although it appears to have coincided with similar demographic upheavals in the Phoenix, Tucson, and Tonto basins, following catastrophic floods and devastating droughts at the end of the fourteenth century. It is currently unclear if a hiatus in occupation occurred following the A.D. 1400s. However, the archaeology of the following period is quite different, suggesting the arrival of newcomers. Spanish documentary evidence points to the Protohistoric (circa A.D. 1400/1450-1700) and Historic period (post-A.D. 1700) occupation of the San Pedro Valley by a Piman-speaking group called the Sobaipuri (see Masse 1981, 1985; Seymour 1989, 1993a). The Sobaipuri were visited by Kino and Manje in the late-1600s and early-1700s, and were found to be living in small villages of between 20 and several hundred houses, with 100 to 900 residents. Based on archaeological remains and written descriptions, Sobaipuri houses were dome-shaped huts, oval in plan, consisting of a bent pole superstructure (anchored in postholes and wedged with stones) and an outer covering of grass mats and earth (Di Peso 1953; Doyel, ed. 1977; Huckell 1984; Masse 1982).

The Sobaipuri people had a political organization that united multiple villages under the control of a chief (Seymour 1989). In Kino's day, the villages of the northernmost part of the valley were the domain of a man named Humari, while those to the south were under the control of a chief named Coro. Sobaipuri pottery (Whetstone Plain Ware) is distinctive in that it is almost always unpainted and unpolished, but quite thin and hard. Sobaipuri projectile points have a unique form that makes them easily distinguishable from other types found in southern Arizona (Mabry 1999). At contact with Europeans, the Sobaipuri were engaged in conflict with groups of Apaches and allied themselves with the Spanish, who brought presidios and vistas to the San Pedro Valley in the seventeenth and eighteenth centuries (Di Peso 1953; Gerald 1968). In 1762, after decades of raiding by Apaches and other groups, as well as intragroup conflict, the Sobaipuri abandoned the San Pedro Valley, joining other Piman-speaking groups at San Xavier del Bac, San Agustín del Tucson, and other villages along the upper Santa Cruz River (Masse 1981; Seymour 1989).

The Apache use of the valley continued until the late nineteenth century, when they were confined to reservations. After 1821, Mexican and, after the Gadsden Purchase of 1853, American ranchers, farmers, and miners began to establish themselves in the general area (McKelvey 1958). In 1871, after years of conflict between Hispanics and Anglos (including the United States Army and the allied Pima-Maricopa Confederation) and different Apache bands, as well as a truce with the Aravaipa Band of Apaches, 75 Aravaipa Apache women and children were murdered by a mob of Tucsonans and Tohono O'odham, in what has come to be called the Camp Grant Massacre (Basso 1983; Dobyns 1989).

Although agriculture, especially ranching, has traditionally dominated the economy of the lower San Pedro, since the late 1800s and throughout the twentieth century, copper mining has been a driving force behind the establishment and growth of a number of communities, including: Mammoth (established in 1873), Winkelman (post office dedicated in 1903, associated with the railroad), Hayden (1909), San Manuel (built by Magma Copper Company in 1958), and Kearny (constructed in 1958 by Kennecott Copper Company).

Pinal County – A cultural prehistory for the County is broadly sketched in this section. This prehistory supplies a simplified outline of events and processes that may have influenced human occupation in the middle Gila River basin from its earliest human inhabitants up through the Spanish exploration period.

Paleoindian Period (10000-7500 B.C.) – The Paleoindian are the earliest human occupants of the American Southwest. Traditionally viewed as small, highly mobile groups of big-game hunters, the Paleoindian are believed to have roamed portions of the Southwest from approximately 12000 to 10000 years ago. The period is primarily manifested in Arizona by isolated surface finds of Clovis and Folsom Paleoindian points and a small number of Pleistocene megafauna kill sites in southeastern Arizona (Haynes 1987; Huckell 1984; Mabry 1998).

The extent or intensity of PaeloIndian occupation in the County is unknown because any existing Paleoindian remains have likely been buried by Holocene alluvium that has been accumulating on the valley floors since the Late Pleistocene period. To date, Paleoindian sites in Pinal County are restricted to isolated occurrences of Clovis points (Mabry 1998) which do not merit consideration as priority areas.

Archaic Period (7500 B.C.-2100 B.C.) – The transition from the Paleoindian period to the Archaic period was accompanied by marked climatic changes. During this time, the environment came to look much like it does today. Archaic period groups pursued a mixed subsistence strategy, characterized by intensive wild plant gathering and the hunting of small game animals. This pattern of wild resource exploitation resulted in a high degree of residential mobility and low population density.

Although no Early Archaic (7500-6500 B.C.) sites are known in the middle Gila River region, Middle Archaic (6500-2100 B.C.) remains have been found in bajada and upland settings surrounding the basin (Bayham et al. 1986; Halbirt and Henderson 1993; Neily 1991). In addition, numerous surface finds of Archaic-style projectile points, as well as points recovered from later Hohokam sites, suggest widespread use of the Gila River region during the Archaic period (Loendorf and Rice 2002).

Archaic period sites, while numerous and widespread throughout the County, are often classified as Archaic from the surface materials (i.e. lack of ceramics, projectile points, ground stone) without reliable dating information and as such do serve as a catchall for many sites of indeterminate age. More so than other archeological sites their presence is often related to the level of survey.

Early Agricultural Period (2100 B.C.-A.D. 1) – The Early Agricultural period (previously identified as the Late Archaic period) was when domesticated plant species were first cultivated in the Greater Southwest. The precise timing of the introduction of cultigens is not known, although direct radiocarbon dates on maize indicate it was being cultivated in the Tucson Basin and several other parts of the Southwest by 2100 B.C. By at least 400 B.C., within the Tucson basin, groups were living in substantial agricultural settlements in the floodplain of the Santa Cruz River. Recent archaeological

investigations suggest canal irrigation also began during this Early Agricultural period.

Early Agricultural period sites are mostly known from the Tucson Basin and its vicinity (Ezzo and Deaver 1998; Huckell et al. 1995; Mabry 1998, 2002). While there is variability among these sites, all contain small, round or oval, semi subterranean pithouses, many with large internal storage pits. At some sites, a larger round structure is also present, which is thought to be for communal or ritual purposes. Stylistically distinctive Cienega, Cortaro, and San Pedro type projectile points are common at Early Agricultural sites, as are a range of ground stone and flaked stone tools, ornaments, and shell jewelry. The fact that shell and some of the material used for stone tools and ornaments were not locally available in the Tucson area suggests trade networks were operating. Agriculture, particularly the cultivation of corn, was important in the diet and increased in importance through time. However, gathered wild plants−such as tansy mustard and amaranth seeds, mesquite seeds and pods, and agave hearts−were also frequently used resources. As in the preceding Archaic period, the hunting of animals such as deer and rabbits, continued to provide an important source of protein.

Agricultural settlements such as those found around Tucson have not been identified in the Gila River region. However, if Early Agricultural period settlements are present in this area, they probably occur in locations proximate to the arable and irrigable floodplains, and consequently, are probably deeply buried in alluvium.

Early Ceramic Period (A.D. 1-A.D. 450) – This period marks the time when pottery became an essential component of the artifact inventory of local native groups, and domesticated plants are known to have been cultivated along the Salt and Gila rivers. The time frame encompasses the Red Mountain (A.D. 1-500) phase of the Phoenix Basin Hohokam chronology, but is separated here because the distinctive attribute of the Hohokam—red-on-buff pottery—is absent. Present research indicates population density was low and settlements small during most of this time. A seasonally sedentary settlement pattern has been inferred, with populations moving from winter habitations spread along the margins of floodplains to seasonal summer camps in upland areas (Cable and Doyel 1987). Although wild plants and animals composed an important part of the subsistence base, floodplain agriculture supported by irrigation canals seems to have been the principle focus of subsistence efforts. Current understanding of this period in the larger Gila and Salt River region is limited to data derived from a few sites in the lower Salt River Valley (Cable and Doyel 1987. Henderson 1989, 1995; Morris 1969). Other than a number of possible undated structures at Snaketown, AZ U:13:1 (ASM), Early Ceramic period remains have not been documented in Pinal County.

Hohokam Sequence (A.D. 450-1450) – The most common archaeological remains in Pinal County are those of the Hohokam culture. This tradition developed in the deserts of central and southern Arizona sometime around A.D. 500 and is characterized by the introduction of red ware and red-on-buff pottery (Haury 1976,). The Hohokam cultural sequence is divided into four general periods: Pioneer (A.D. 500-750), Colonial (A.D. 750-950), Sedentary (A.D. 950-1150), and Classic (A.D. 1150-1450).

The Pioneer period is distinguished by the introduction of red ware and, somewhat later, red-on-buff pottery, and the establishment of the first large, nucleated villages along the Gila and Salt rivers (Gregory and Huckleberry 1995;). This was followed by a rapid expansion of irrigation systems and habitation centers across the river basins during the Colonial period (Doyel 1991). Increasing social complexity also characterized the period. Pithouses were clustered into discrete courtyards, which, in turn, were organized into larger village segments, each with their own roasting area

and cemetery (Henderson 1987; Wilcox et al. 1981). Around A.D. 800, ballcourts were built at a number of the largest villages (Wilcox and Sternberg 1983). The presence of the ballcourts is thought to represent the emergence of a regional system with religious, economic, and political functions, tied together by the exchange of plain and buff ware ceramics, marine shell, foodstuffs, and other items (Wilcox 1991; Wilcox and Sternberg 1983).

Settlements across the Gila-Salt Basin continued to increase in number and size through the Sedentary period. Many of the canal systems were reconfigured during this time (Howard & Huckleberry 1991), with some reaching their greatest extent. The reconfiguration and expansion coincided with a more developed settlement hierarchy in the river basins—that is, each canal system having at least one large village in addition to smaller ones (Doyel 1980; Gregory and Nials 1985). By the late Sedentary, house clusters were arranged in more formalized rectangular patterns that forecast the development of the supra-household compounds seen in the Classic period (Wilcox et al. 1981).The Classic period is marked by dramatic changes in Hohokam material culture, architecture, and traditions. Surface adobe-compound architecture appeared for the first time, supplementing, but not replacing, the tradition of semi-subterranean pithouse architecture. Burial modes also changed, with an increasing dominance of inhumation over cremation burial. Buff ware pottery diminished in frequency during the period, being replaced by red ware pottery and, later, polychrome types. Ballcourts were largely abandoned during the late eleventh century, and sometime around the late thirteenth century (Gregory 1987), massive-walled platform mounds were constructed at large villages throughout much of the Hohokam region. Because construction of these features required considerable levels of organized labor, many think the mounds are symbols of a socially differentiated society (Doelle et al. 1995;; Fish and Fish 1992; Gregory 1987).

The period is also characterized by substantial changes in settlement pattern. Ancestral villages like Snaketown (U:13:1) and Grewe, AZ AA:2:2 (ASM), in the middle Gila River Valley were abandoned; other settlements like La Ciudad, AZ T:12:1 (ASM), and Las Colinas, AZ T:12:10 (ASM), in the Salt River Valley were reorganized; large tracts of land across the region, including the northern reaches of the Phoenix Basin, were depopulated, while areas like Queen Creek saw an influx of populations. Residential activity along Queen Creek apparently reached an apex during this time, as witnessed by numerous compounds and house mounds scattered widely along the floodplain margin at sites like Southwest Germann, AZ U:10:2 (ASM), and Pozos de Sonoqui, AZ U:14:49 (ASM). Within the larger central Arizona region, the Hohokam aggregated into fewer, but larger, villages as the Classic period progressed. Population declined steadily in most areas after the mid-fourteenth century, and by the mid-to-late fifteenth century, the manifestations of what are recognized as Hohokam disappear from the archaeological record.

Protohistoric Period (A.D. 1450-1700) – Little is known of the period between the disappearance of Hohokam cultural remains and the appearance of Spanish explorers in the late seventeenth century A.D. However, O'odham peoples were well established in the Gila River region when the Spanish first arrived at the end of the seventeenth century. Spanish accounts suggest O'odham settlements were loosely organized collections of round, brush-covered houses, most often located in riverine settings. Each small village seems to have been politically autonomous, self-sufficient, and focused on floodwater agriculture. Along the lower San Pedro River in Pinal County, another Oodham group of peoples collectively referred to as Sopaiburi were noted by Padre Eusebio Kino in his travels in the 1690s. Protohistoric sites are rare given the ephemeral nature of the

archaeological remains associated with O'odham people living in the region at this time.

Today, many of the known historic sites have been subjected to plundering by the general public and destroyed or ripped of important cultural resources. Much of what was known of these great civilizations in regards to artifact will more than likely never be known.

Resources and Livestock Interactions

Col. H. C. Hooker stated in a letter to Griffiths (1901) that in 1870 the San Pedro River area had an abundance of sacaton, grama grasses, and underbrush of many kinds and that "… the riverbed was shallow and grassy… with a luxuriant growth of vegetation." Hooker indicates that by 1900 the forage production had been reduced by 50% over the previous twenty-five year period. Cattle numbers were also reduced by 50% for this same time period.

A letter from C. H. Bayless, Oracle, Arizona, to Griffiths (1901) stated in 1880 "…grama grasses covered the country… (with) 'alfilaria' (*Erodium cicutarium*) furnishing limited but excellent pasture during spring and early summer." He indicates that the San Pedro River was a fertile valley in the 1880's but by the 1900's it had been overgrazed and became a "…sandy wasteland from bluff to bluff." He also states that average rainfall and environmental conditions had not changed and that the vegetational changes were a result of overgrazing and misuse. Forty thousand head of cattle were said to have grazed the region in 1880 whereas only 3,000 grazed by the 1900's.

In a 1904 bulletin, Griffiths described the rangelands between the Willow Springs Mountains (Black Mountain), Oracle, and Dudleyville as being grasslands with the dominant species being grama grasses. He also described "alfilerilla" (*Erodicum cicutarium*) as an abundant and valuable forage species. Jojoba (*Simmondsia chinensis*) was considered a valuable browse species and was stated as being abundant in the Dudleyville area. Photos in this bulletin indicate rangelands near Dudleyville as being grasslands; in contrast this area is now classed as Upper Sonoran Desert by the Natural Resources Conservation Service Major Land Resource Areas (MLRA) Site Descriptions.

Parr, et al. (1928) show that cattle numbers for the Arizona and New Mexico peaked between 1890 and 1893 then declined until 1900 and again increased until 1922. Sheep and goat numbers were lowest between 1890 and 1893 then increased to the maximum of 6,750,000 in New Mexico and Arizona in 1903. A gradual decline in numbers of sheep and goats is then indicated until 1927. No reliable information could be secured to attest to the number of Angora goats that utilized range resources in the District although the number was known to be considerable, over 500,000.

Long-time residents in the District indicate that severe droughts occurred between 1915 and 1921 and again between 1930 and 1941. Large numbers of livestock were lost during these periods. Weather records do not necessarily indicate severe drought conditions for those time periods, but below normal seasonal rainfall did occur. This, along with the excessive livestock numbers, would have had a devastating effect on livestock numbers and range forage species.

Livestock – cattle, goats, horses, and burros- traversed the District unimpeded in their movements, utilizing any available forage. There was no formal attempt to control livestock numbers or to instigate serious management programs with the exception of a federal program in the 1930's to purchase and destroy breeding herds in the District. This program met with limited success; only several thousand head at most were destroyed and buried along the San Pedro River Valley. In addition, large numbers of horses were gathered and shipped from the District by local ranching operators.

The Enlarged Homestead Act of 1909 and later the Stock-raising Homestead Act of 1916 encouraged exploitation of range resources by inferring that 640 acres were adequate to carry 50 head of cattle (Stoddart and Smith. 1955). The devastating impact of overgrazing coupled with the depressed national economy brought about the sale of many homesteads and a subsequent reduction in livestock numbers. The acquisition of these homesteads by local ranchers along with the allocation of lands by government agencies established many of the existing ranch units in the District. Fencing and establishment of ranch boundaries was essentially completed in the 1940's and 1950's.

The establishment of ranch units compounded the damage to range forage species because excess livestock was not removed. Transformation of rangelands from grasslands to desert shrub was essentially completed and persists to the present time. Serious attempts by ranchers to reestablish the grassland vegetation, whether by management or physical mechanical methods, have only met with limited success or failure.

York and Dick-Peddie (1969) suggest that historic excessive livestock grazing not only removed and damaged desirable forage species, but that it was also responsible for the introduction, spreading, and establishment of less desirable species such as mesquite (*Prosopis juliflora*). The establishment of a deep-rooted shrubby species such as mesquite is undesirable because such a species can manifest its own environment by its basic physiological characteristics (Simpson. 1977).

In the 2002 Arizona Agriculture Census report, there were an estimated 241,360 head of cattle inventoried rangelands and irrigated pastures within in Pinal County alone. The 2007 Census report indicates livestock numbers have risen by 156,157 head to a total of 397,517 head (2007 Census of Agriculture – County Data).

It was provided by the State Land Department in 2011 that 71% of the land units within the District claimed full use with an approximate total of 7,608 head of cattle on State Land leases within the District. Eighteen percent claimed partial use and 11% claimed no uses. Information provided by the Bureau of Land Management indicates that approximately 2,132 head of cattle were grazed within the District in 2011. Only one lease filed for non-use during this year. Estimates for 2011 of total livestock numbers in the District on State Lands and Bureau of Land Management lands is 9,740 head. Information on livestock totals on Forest Service leases was not available.

Fenced exclosures in the District reveal that vegetational changes in the rangelands occurred prior to the 1920's and 30's. The vegetational makeup of these exclosures is of very limited species composition. These monotypic communities vary in species makeup from exclosure to exclosure. An outstanding example is an area, on the old Panorama Ranch, where hairy grama (*Bouteloua hirsuta*) makes up about 90% of the composition and produces an estimated 95% of the total forage production. This information infers that livestock management (removal or manipulation) alone may not be adequate or desirable to achieve mixed communities of range forage plants, and may foster the establishment of similar monotypic communities. The sequencing of environmental conditions through time evidently favors a limited number of species through that particular time period (Jordan. 1974). For example, one sequence of environmental and plant interactions may favor plains bristlegrass (*Setaria leucopila*) one year; whereas, plains lovegrass (*Eragrostis intermedia*) may be favored by a slight alteration in that sequence another year. Once a single species is established it maintains a closed community (if all other influences are held constant) because of the high probability of the dominant species seedlings becoming established (Connell and Slatyer. 1977).

In review of monitoring data collected throughout the District since as early as 1978; woody species such as trees and shrubs have steadily increased over the past three decades. Cacti species, especially Engelmann's prickly pear (*Opuntia engelmanii*) have drastically increased and is nearing the point where non-invasive management practices have no affect on this species; mechanical or chemical treatment may be needed to reduce or control extensive stands of prickly pear. Much of the increase in numbers and size of individual woody species could be attributed to the warmer winters and change in timing of rainfall patterns that are more conducive to favorable climates for these species (see climate data in section 2).

Most perennial grass species and even annuals have fluctuated to match previous year's climatic variations. Much of the data that has been collected is indicating perennial herbaceous species such as black grama do not necessarily show distress by decadence or complete mortality in the year immediately following drought but are showing signs of stress two to three years post dry seasons. Other species such as curly mesquite immediately show lack in vigor and mortality after a season of drought.

It is near impossible to determine changes in annual grasses and forbs with climate fluctuations. It does not seem management has much of an effect on plant vigor or seed production; monitoring data is indicating that each annual species recorded on transects are regenerating as expected. Timing of rainfall and rainfall patterns seems to be the main factor in annual production and individual species frequencies over the years. Earlier rainfall seems to be conducive to production of a few annuals whereas later rainfall is more favorable to other annuals.

In the future, we may be able to get a better understanding of how climate and management is affecting rangelands within the District. To date, there have been over 130 permanent monitoring transects located on nearly every range type identified throughout the District. Consistency in collecting data such as climate and keeping up with individual guidelines on these sites are key to continue the establishment of baseline data and the attempt to determine factors that affect the Districts rangelands.

<u>Cultural Resources – Physical Structures and Settler Interactions</u>

Trapping – Trapping for pelts by early pioneers was a common practice for the exchange of commodities. Early exploration of the Gila and San Pedro River valleys in the pursuit of beaver pelts was one of the earliest recorded interactions of white travelers to the western states. James Ohio Pattie and his father led a party of fur trappers down the Gila River, then up the San Pedro River in 1826. Due to the abundance of beaver dams and the successfulness of the trapping party within the San Pedro River valley; the Pattie's initially named the river "Beaver River" (Pattie, James Ohio. 1988).

Land Surveys – Arizona was officially attached to the Surveying District of New Mexico in July of 1864 then again re-assigned by an act of Congress to the Surveying District of California. Arizona is split into five survey units. Four are cross sectioned by the Gila and Salt River meridian and the Baseline meridian; the fifth is a small outlier in northern Arizona called the Navajo Baseline. These were adopted in 1865 and 1869. The District is located within the southeastern region of these meridians. It was not until 1870 that the first U.S. Federal Land Office was first opened in Prescott; subsequent land offices were opened post this date including the Phoenix Land Office. Surveys were commenced using contracted services; lands were divided into Townships and Ranges then into sections. Land surveys were finalized by county and are as follows for the counties

involving the District: Pinal County, 1926; Gila County, 1932; Graham County, 1932; Pima County, 1939 (General Land Office Records. 2012). Information regarding original plats can be obtained from the Bureau of Land Management's General Land Office Records.

Forts and Military Interactions – Very few Calvary outposts were established within the current bounds of the Winkelman District. The most notable is the now known "Camp Grant". This fort has gone through several name changes and occupations in historical past. During its original establishment in 1858, the fort was named Fort Aravaypa (spelling of Aravaipa was known as Aravaypa at this time) and accommodated approximately 67 under the command of Lieutenant J. R. Cooke. The intent of this establishment of this fort was to help control Native American traversing through this territory. In August of 1860, the fort was renamed Fort Breckinridge in honor of the Vice-president of the time; J. C. Breckinridge. Fort Breckinridge was ordered to be destroyed in 1861 and abandoned. The Fort was then reoccupied and rebuilt in 1862; then being named Fort Stanford in honor of Leland Stanford, Governor of California until 1865 where it was then named Camp Grant in honor of Ulysses S. Grant (Muffley, Bernard W. 1938).

The fort was originally built in the flood plain of the confluence of the San Pedro River and Aravaipa Creek drainages and consequently washed away in a large flood in 1866; after which the fort was transplanted to the ridge above the river confluences. During the occupation of this fort, malaria was a major problem for soldier health due to the fact many beaver and beaver dams existed on the river which harbored perfect habitat for mosquitos. A Service term for individual soldiers was sometimes short and they were transferred to other forts in the territory with higher elevation due to the health conditions here (Muffley, Bernard W. 1938).

Image 3-1: Camp Grant, 1870.

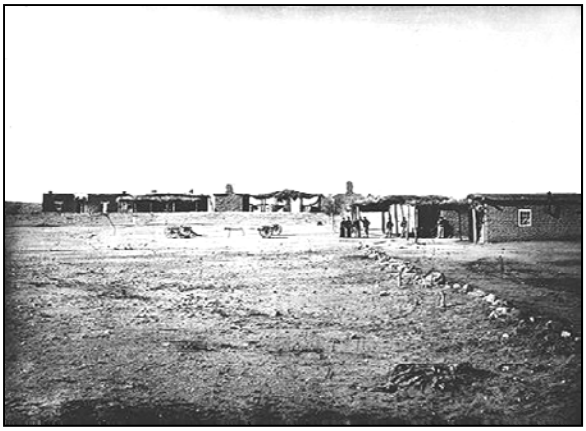


Image Source: John Karl Hillers. 2011.
http://www.legendsofamerica.com/photos-arizona/Old%20Camp%20Grant.jpg

Native American and Calvary Interactions – With the establishment of the San Carlos Apache Indian Reservation in 1871, there had been several widely known and not-so-well-known skirmishes that occurred between the Native American populations and the United States Calvary within the District. One of the most distinctive retaliations occurred on April 30, 1871.

During the 1850's and 1860's, the Aravaipa and Piman Indians became a frequent occupant of the San Pedro River and the Aravaipa Creek regions, especially around Camp Grant. At the time, the camp commander Royal Emerson Whitman formed a unique relationship with the tribe leader, Chief Eskiminzin and the local tribes. Against public perception, Whitman treated the Apache kindly, fed and provided some rations to the Indians in the form of flower and beef in exchange for cut hay for the fort livestock. Realizing this interaction couldn't last before some kind of struggle between settlers and Indians would ensue; Whitman tried to persuade Eskiminzin to take his people to the White Mountains to avoid future skirmishes, which he refused. Eskiminzin, expressing his wish for peace with whites and the military, began supporting his wishes through provision of hay, grain, wood and labor to the fort and local residence and congregated his people in a safe area approximately 5 miles

east of the fort near the Aravaipa Creek (Muffley, Bernard W. 1938) while awaiting word from Washington on what they could do.

Meanwhile, citizens of Tucson and surrounding areas not liking the kindness the fort was extending the Aravaipa Indians and blaming them for any depredation that had occurred to settlers in the area; organized a militia party with the sole purpose of eradicating the Aravaipa Indians. One hundred and forty-six Americans, Mexicans and Papagos rode from Rillito Creek to the Indian encampment on the Aravaipa Creek and proceeded to murder eighty five of the Aravaipa and Pima people on April 30, 1871. All but eight killed were women and children. Most the men were on hunting parties in the surrounding mountains (Spring, John, A. Date unknown.).

Stage Coach Routes – Several stage coach routes connected many of the existing town sites within the District with larger town sites such as Tucson, Benson, Globe and Phoenix from the early 1800's through the early 1900's. One of the more documented stage routes of the 1840's was initially named the "Cook Route" which crossed the territory by way of Tucson. The need to connect and improve roads between El Paso and San Diego was identified during this period and so the "Leach Route" was born and corresponded largely of the Cook Route. This route serviced Tucson, down the San Pedro River to the Aravaipa Creek and up Putnam wash to the table lands south of the Gila River.

Another stage route serviced the Globe and Riverside areas via Troy. This route either went onto Florence or across country to the Cottonwood stop, and on to Oracle and Tucson.

Early Town Sites – Several small towns were established in the District that today cease to exist; many of which were in occupation because of mining exploration. Although many of these sites do not exist today, remnants of them are still visible. Even though they may have been a one building town site and small; all of them were important in their time and served as substance for local residents and overland travelers as well as a source for information. Most of these sites had makeshift general stores, post offices and perhaps a hardware store. Old town sites within the District as well as their establishment association include:

- Alma (Aravaipa/San Pedro River, post office, general store)
- American Flag (American Flag Mine, post office, general store)
- Barcelona (Ray Mine)
- Barkerville (post office, school)
- Chilito (Chilito Mine)
- Copper Creek (Old Reliable Mine, post office)
- El Capitan (Stage route, post office)
- Feldman (post office, general store, San Pedro River route)
- Riverside (coke ovens, stage route, post office, general store)
- Mesaville (San Pedro River route, post office, general store)
- Ray (Ray Mine)
- Schultz (Tiger Mine, post office)
- Sonora (Ray Mine)
- Vail (school)

Image 3-2: Barkerville Post Office at Barkerville. Circa 1920.

Image Source: Walter Meyer.

Stage Stops – A few known stage stops were located within the District that served unnamed stage routes connecting local town sites. All of these stage stops were located out of private residence. As a note to this fact, all stage stops are still privately owned and closed to the general public. Stage routs and stops include:

- *Cottonwood (Circle S)*: The Cottonwood stage stop is located at the old Circle S Ranch headquarters on the Haydon Combe Ranch in the center of the District. Remnants of the stage road are still visible in the surrounding areas near this stage stop. The Circle S was established by Fannie Cartwright Burns whom exchanged for this property under a National Forest Exchange, property in California in 1899. This stage line ran from Troy or Florence, to Riverside then on to Mammoth, Benson or Tucson (Meyer. W. Walter. Personal communication. 2012).

Image 3-3: Cottonwood Stage Stop, old Circle S Ranch headquarters. Circa 1920's and 1930's.

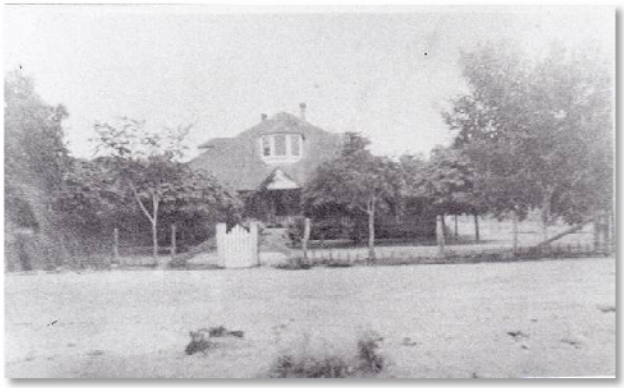


Image Source: Walter Meyer.

- *Manlyville*: Manlyville was located at the Willow Springs Ranch Headquarters, established by Joseph Chamberlin and sons in 1880. It was named after one of the Chamberlins sons, Manly (Muffley, Bernard W. 1938).
- *Mountian View Hotel*: The Mountain View Hotel in Oracle, owned and operated by the Neal family served as an overnight layover for the stage line. Travelers were able to enjoy a hot meal, bathing and entertainment at this hotel. Stage routes traveled to reach this site generally came from Tucson and off to the surrounding areas.
- *Sibley Castle (Monte Bonita)*: The Sibley Castle is perhaps one of the most spectacular stage stops within the District. This stage line was noted to connect Bonita/Klondyke, over a low point in the Galiuro to Copper Creek to Mammoth (Rowe, Jerry M. 2010).

Image 3-4: Copper Creek store and stage stop at Sibley Mansion.

Image Source: Jeremy Rowe Vintage Photography.
http://vintagephoto.com/reference/coppercreekarticle/coppercreekarticle.html

Overland Cattle Drives – Only a few large, overland cattle drives were known to have been accomplished in the mid to late 1800's and early 1900's. Numerous small drives that incorporated two to three individual ranches livestock were sporadically completed yearly but two of the most recalled drives originated in Winkelman by local livestock owners. Livestock were driven up the San Pedro River to mouth of and up Dodson Wash, across Star Flat on the Willow Springs Ranch, over to the headwaters of Big Wash on the Falcon Valley to Tucson. Additional livestock was incorporated to this drive ranches along this route (Meyer. W. Walter. Personal communication. 2012). It is unknown if this large drive commenced annually or semi-annually. It was also said this

route was previous to the Red Rock in the following paragraph.

A second known route initiated at the Gila and San Pedro River and drove livestock up James Wash through to the Haydon Ranch, to the Freeman Ranch (3 C Ranch) to Suizo where livestock were watered out and rested before being driven to Red Rock to catch the train headed east (Goff, Joseph. Personal communication. 2005).

Gila River Coke Ovens – The coke ovens located on the north bank of the Gila River west of the old Kelvin town site is one of the most notable physical structures in the area visited today. Although these are located just outside the District boundary, materials furnished form these ovens was used and transported by mining companies within the District. Coke was transported via box wagon to the local smelters for smelting copper, blacksmithing or common uses.

Image 3-5: Coke Ovens.

Image Source: Katie Cline. USDA-NRCS. 2009.

SECTION 4: DISTRICT RESOURCES

To form a proper viewpoint of the resources that provide for a variety of occupations, resource issues and management objectives/issues; it is essential to outline baseline information within the District. Baseline information is what is used by producers, land agencies and planners alike to develop sound management systems. Within this section, the types of baseline information will be given. Much of the information here will relies on information given in the previous section; Historical Land Use Review.

Mapping and Survey Information

Prior to the 1980 field investigation, less than 30% of the ranch and farm boundaries within the WNRCD were mapped. At that time only legal descriptions were used to define boundaries. The objective of the 1980 field investigation was to develop individual ranch mapping units within the District that could be used by the NRCD for future management programs and decision making tools; only infrastructure was inventoried during this investigation. This objective was considered an integral part of the project. Information disclosed within these map units provided the respective operators, field technicians, and the District with baseline information for decision making within each operation. The basic mapping units of the 1980 report are outlined in detailed map in appendices; Section 9. Detailed information for each land unit was also included in an accompanying District property file.

Since the 1980 report; 100% of the District has been mapped and described in three Soil Surveys and two Terrestrial Ecosystem Surveys by the USDA NRCS and Forest Service. Completion of the last Soil Survey, Pinal County, Eastern part was finalized in 2010. Approximately 65% of the District has been mapped both of physical infrastructure and ecological sites in coordination with land operators, land owning agencies, NRCS and the District. The current District ranch and farm unit map is in the appendices; Section 9. Information and maps from the original 1980 field review served as a baseline for a majority of the current resource inventories. Ranch and farm units are mapped using both legal descriptions and GIS software. Data for the current ranch and farm unit mapping is housed in the local NRCS Field Office and the applicable land managing agencies alike. A summary of previously installed and planned practices is illustrated in the Section 5.

Figure 4-1: Winkelman NRCD Soil Surveys.

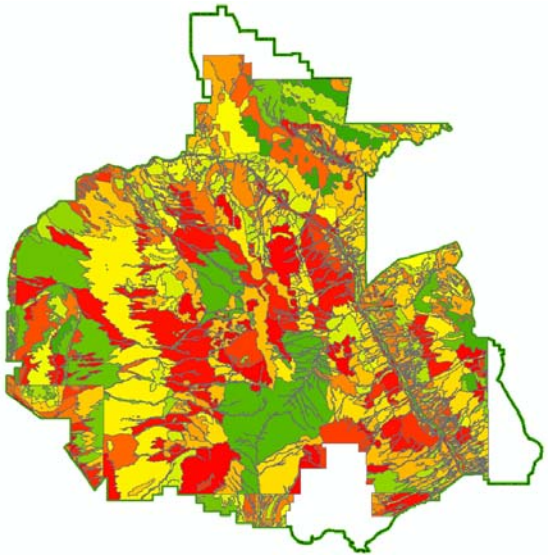


Image Source: ArcGIS map layer "WNRCD_Soils". (NRCS 2011)

Land Unit Considerations

It should be noted that the names of individual ranch units may not reflect current names used by producers, locals and agencies for those ranch units. By using old names on files and in references, it will be easier to keep track of historic information for each operation.

Land unit turnover rates are fairly high; approximately two thirds of the larger ranch units within the District have changed hands at least once since 1980; some 3 to 4 times. New

land owners consist majorly of absentee operators, cooperate mining companies and environmental groups such as The Nature Conservancy with very few small individual families purchasing large quantities of property.

The remainder of ranches within the District that have not experienced turnover in the last twenty years has remained in the same ownership for fairly long periods of time with many being held within the same family for at least 25 to 50 years, some well over 100 years. This is a great advantage to the District in that it can draw upon these residents' long-term experience and histories in operating under most all conditions.

Land Allocation

The charter of Forest Service land acquisition was based primarily on water resource yield values and visible forest stands. Little timber production other than salvage is realistic within the District boundary. On forest lands, mainly the Tonto National Forest; mineral resource exploration and development are still a potentially dominant monetary resource and becoming more practiced within the last decade. Currently, active mineral exploration being conducted within the District is located in the Devils Canyon, Oak Flats and Top of the World. Other areas within the District with mineral exploration are: Copper Butte, Troy, Dripping Springs and Copper Creek areas.

The distribution of BLM lands within the District is not purely random. There is a fairly strong correlation (r=-0.73, a conservative figure) between the occurrence of BLM lands and potentially exploitable mineral resources. These non-renewable natural resources are non-metallic minerals, metallic minerals, and metallic fuels, listed in order of abundance. Seventy-seven percent of the BLM lands have apparent exploitable mineral resources while only 17% of the private lands and 7% of the State Lands show evidence of potentially exploitable mineral resources.

It must be considered that the mineral resources on private lands, exclusive of mineral patents, are controlled by the Department of Interior through BLM as are some of the State Lands that have had minerals withheld. This information could suggest that priority for retention of ownership of BLM lands is based on the potential of generating revenues from a non-renewable resource, i.e. minerals, and with secondary regard to renewable resources, i.e. rangelands. The adage that BLM lands in the District are poor quality and are not desired by the private or state sector may be plausibly incorrect. Much of the BLM lands are fairly comparable in range forage production to the private or state lands.

BLM has also gone through several land exchanges to block up land tracts within the District. Lands around the Aravaipa Creek on the north and south rim were traded or acquired to expand BLM holdings and control on the Aravaipa Wilderness during the late 1970's. During this period, management of three separate allotments within the Aravaipa region were also moved to the Safford District from the Phoenix District (was under management of the Phoenix District at this time, bounded later to the Tucson District) for concise management of these allotments (Humphrey, Larry. Personal correspondence. 2011).

Figure 4-2: Winkelman Ownership.

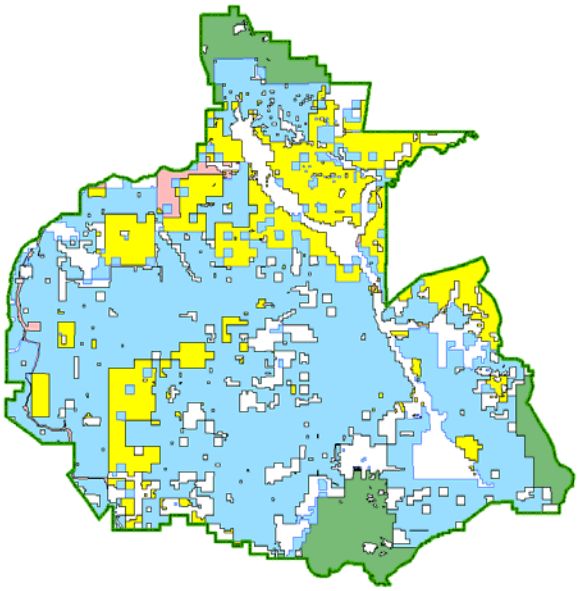


Image Source: ArcGIS map layer "WNRCD_Ownership". (NRCS 2011)

The dispersion of private lands is selective and dependent upon resources available to livestock or agronomic production or proximity to community centers. In previous years, this inter-dispersion of land ownership may have confounded attempts by District land operators to develop basic management programs with State and Federal agencies. The lack of consistency in land management policies and regulations between different land agencies typically had posed major issues in developing management systems and mainly was found to be counterproductive to all stakeholders. Rather dynamic steps towards successful cooperation have been taken by agencies and land holders to achieve true land management goals within the District. The development of the Coordinated Resource Management Planning (CRMP) process on ranch units with different land ownerships, differing agency policies and differing goals has enable agencies and land owners to take a huge step forward into developing successful and sustainable management systems. This process is ultimately voluntary and not required by the land owners nor agency personnel.

The basic concept of Coordinated Resource Management Plans is to allow all invested participants in an individual ranch or farm unit to come to the table, look at current resources, resource issues, voice concerns, understand other stakeholders policies and regulations, develop goals and objectives and come to an agreeance on a single management system that encompasses the entire ranch or farm unit. Interest in the coordinated process is generally initiated by the land operator or lessor. Plans are developed by the group as a whole and generally a plan is not signed off on by the participating agents until all concerns are addressed. This is a fairly informal process and can incorporate as many or as few participants as deemed necessary.

The District is within the Tucson Coordinated Resource Management Group with participants from each land owning agency and two other Districts; the Pima and Santa Cruz NRCD's. This group meets yearly to discuss any issues that have occurred in the past year on specific ranch units, to discuss potential projects and to delineate the current years monitoring priorities. To date, the District has 19 ranches with complete inventories and written CRMP's and 9 of these are on the Tucson CRM Group list. Some of these management plans are old or irrelevant today. It is suggested management plans should be continually updated to incorporate current activities and new issues that may arise.

Figure 4-3: Winkelman NRCD Coordinated Resource Management Plan Ranches.

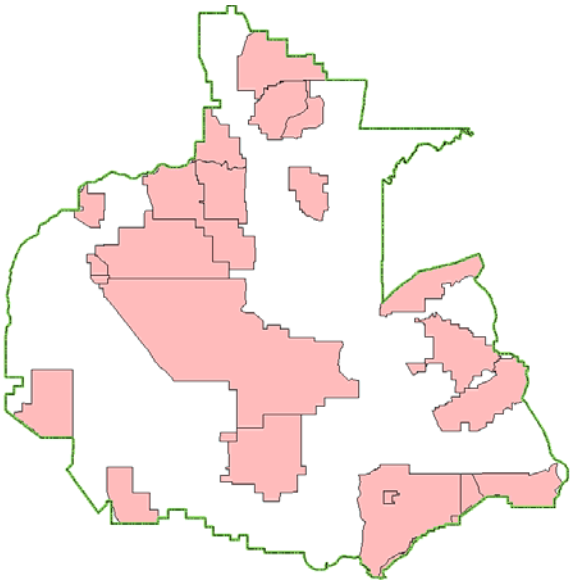


Image Source: ArcGIS map layer "CRMP_WNRCD". (NRCS 2011)

Land Unit Planning

For land planning purposes, it is also important to note that there are several different planning levels an individual operation can reach. These are also known as Baseline Systems, Progressive Systems and a Resource Management Systems (RMS) is also a potential for an operation or management level to reach what is called a Resource Management System (RMS). Baseline is defined as a low level of conservation adoption with landowners who are typically not participating in conservation programs. There are, however, a few practices that have been commonly adopted by all landowners in this District. Progressive is defined as an intermediate level of conservation adoption with landowners who are actively participating in conservation programs and have adopted several practices but not satisfied all of the Quality Criteria in the NRCS Field Office Technical Guide. Resource Management System (RMS) is defined as a complete system of conservation practices that addresses all of the Soil, Water, Air, Plant, and Animal (SWAPA) and even human related resource concerns typically seen for the specific land use.

Coordinated Resource Management

Many agencies and land owners have entered into the CRMP process to help better manage individual land units as a whole operation. CRMP's can be designed at many different planning levels and it is not a requirement to fulfill every aspect of a plan. The purpose of a CRMP is to resolve common issues that arise during managing around agency policies over land use, identify and treat resource concerns and come to a consensus on time tables and assistance. It is the goal of the CRMP field group to lay all plans and issues out on the table with the producer and work together to come to a mutual agreement on how to manage the particulars. This also helps create higher awareness and development of an invaluable knowledge base for agency personnel to a particular land unit which otherwise may not receive proper attention.

CRMP content should follow the Arizona Coordinated Resource Management guidelines established by the CRM Executive Group that consist of land owning agencies, managing agencies, Districts, Native American tribes, etc. These plans generally specify historical factors, resource concerns, limitation factors, and responsibility of each signing participant. The CRMP planning process is ultimately initiated by the producer and generally involves only those individuals who have a major stake on the land unit in question.

CRMP's generally entail a complete inventory of ecological conditions, installed infrastructure and documentation of resource concerns. The information that is gathered during the inventory phase serves as the baseline for the development of the plan and is used as justification for later determinations.

Several land units within the District have opted to develop CRMP's with land managing agencies and technical assistance agencies. Many of these plans include participants such as the

USFS, BLM, Arizona State Land Department, NRCS, Cooperative Extension, and finally the Winkelman District. Recently, there has been an increase on the number of CRMP's within the District due to policy changes by NRCS to qualify for financial assistance. To date, 17 CRMP's have been written for land units within the District. This includes rangelands, irrigated pasture lands and croplands. The oldest CRMP on record was signed in 1984.

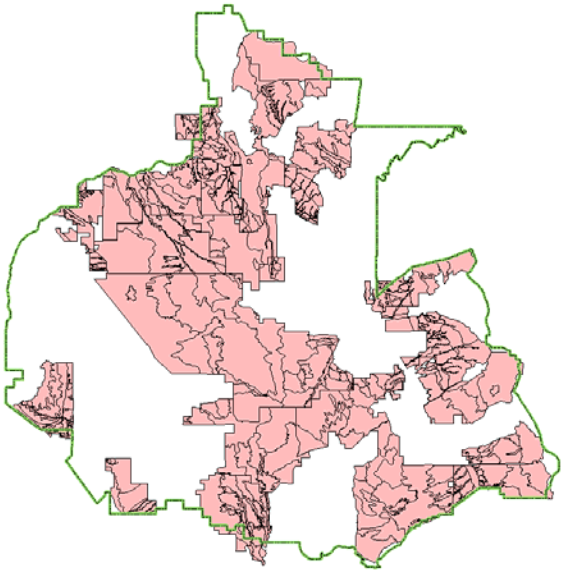
Ecological Site Information

The ecological concept of plant succession and historic climax plant community is the foundation by which universities, the NRCS, federal and state land management agencies, and other landowners and managers evaluate rangelands. The concept of plant succession is based upon the process of vegetation community development through time where an area is successively occupied by different plants of higher ecological order and greater species diversity. The historic climax plant community refers to the highest ecological development of plant community on a given site as determined by climate, soil and soil parent material, and by topographic, vegetative, fire and animal factors. Some species have greater genetic amplitude than others and may occur throughout the different plant successional stages. Sometimes the historic climax plant community is an impractical objective, such as where a naturalized plant community of non-native species becomes established.

The ecological site is the basic mapping unit used in this rangeland inventory. An ecological site is a distinctive kind of rangeland that has the potential to support a native community typified by an association of species different for that of other sites. Ecological site descriptions have been developed within each MLRA. For specific projects, ecological site are usually mapped in accordance with these guidelines. Non-native species are not included in the typical ecological site descriptions although, descriptions are currently being written for naturalized plant communities. When ecological site inventories are conducted, this information goes towards developing management goals on individual land units. By documenting this information, we are able to make a point in time assessment on states individual sites may be transgressing into and suggest one or numerous management treatment that may be applied to alleviate major resource concerns specific to that site.

To date, 60% of the District land units (40 individual land units) have been mapped of ecological sites (Figure 4-4). This is an approximate 100% (no ecological sites were inventoried pre 1980) increase of inventoried land unit post the 1980 Winkelman Field Report. These ecological sites are mapped to these specific units and are fairly specific. They do not necessarily transpond to a neighboring land unit and it should be cautioned that ecological site names and descriptions are continually being expanded and changed to better define individual sites. If a land unit was mapped in 1984, it would be worthwhile to revisit these sites.

Figure 4-4: Inventoried Land Units within the Winkelman District.



Data Source: NRCS Individual Land Unit Files. 2011.

Much of the ecological site information collected on these individual land units has helped develop the current Ecological Site Descriptions (ESD) relative to the specific CRA's found within the Distract. Information disseminated from these sites is generalized in these ESD's, sites are not specified and linked to individual land units. Ecological Site Descriptions is house with the NRCS and can be found at: Ecological Site Information System; http://esis.sc.egov.usda.gov/.

SECTION 5: DISTRICT RESOURCE CONCERNS AND RESOURCE ASSESSMENTS

Resource Concerns

Conservation Districts, local leaders, along with NRCS and other resource management agencies, have identified priority natural resource concerns for the Nation. Typical resource concern elements take into consideration: soil, water, air, plant, animal (SWAPA) and even human activities that contribute to both visible resource issues and non-visible resource issues (odors, greenhouse gasses, etc.). Many of these issues are things we see on a day-to-day basis and could be something as simple as an excessively dusty day, a deepening gully across a dirt road that is causing you to drive farther around each time, to the recognition of an increase in density of mesquite you see in the back side of the pasture.

These SWAPA and related natural resource concerns are all given equal initial consideration for treatment, but higher priority is given to areas where State or local governments offer financial or technical assistance and to areas where agricultural improvements will help producers in complying with Federal or State environmental laws, such as the Clean Water Act. Refer to Table 5-1 for a listing of priority resource concerns by land use within the District.

Table 5-1: Priority Resource Concerns within the Winkelman NRCD as of June 16, 2011.

Resource Concern	Concern Definition	Cropland	Irrigated Pasture	Rangeland
SOIL EROSION – Sheet, rill and wind	Detachment and transportation of soil particles caused by rainfall runoff, irrigation runoff or wind.	✔	✔	✔
SOIL EROSION – Concentrated flow erosion	Untreated classic and ephemeral gullies may enlarge by head cutting and/or lateral widening. This includes concentrated flow erosion caused by runoff from rainfall, snowmelt or irrigation water.			✔
SOIL EROSION – Excessive bank erosion from stream shorelines or water conveyance channels	Sediment from banks or shorelines threatens to degrade water quality and limit use for intended purposes.			✔
SOIL CONDITIOIN - Compaction	Management induced soil compaction resulting in decreased rooting depth that reduces plant growth, animal habit and soil.	✔	✔	
SOIL CONDITION – Organic matter depletion	Soil organic matter is not adequate to provide a suitable medium for plant growth, animal habitat and soil biological activity.	✔	✔	
SOIL CONDITION – Degradation; concentration of salts or other chemicals	Concentration of salts leading to salinity and/or sodicity reducing productivity or limiting desired use. Concentrations of other chemicals impacting productivity or limiting.	✔		
WATER QUANTITY – Insufficient water use	Irrigation water not stored, delivered, scheduled and/or applied efficiently.	✔	✔	
WATER QUALITY – Degradation; excess nutrients in surface/ground water	Nutrients transported to receiving waters through surface runoff and/or leaching.	✔	✔	
WATER QUALITY – Degradation; pesticides transported to surface and ground water	Pesticides are transported to receiving waters in quantities that degrade water quality and limit use for intended purposes.	✔	✔	

WATER QUALITY – Degradation; excessive sediment in surface waters.	Off-site transport of sediment from sheet, rill, gully and wind erosion into surface water that threatens to degrade surface water quality.			✔
AIR QUALITY – Inefficient energy use; Equipment and facilities	Inefficient use of energy in the Farm Operation increases dependence on non-renewable energy sources that can be addressed through improved energy efficiency and the use of on-farm renewable energy sources. As an example, this concern addresses inefficient energy use in pumping plants, on-farm processing, drying and storage.	✔		✔
AIR QUALITY – Inefficient energy use; Farming/ranching practices and field operations	Inefficient use of energy in field operations increases dependence on non-renewable energy sources that can be addressed through improved efficiency and the use of on-farm renewable energy sources.	✔		
AIR QUALITY – Emissions of Particulate Matter (PM) and PM Precursors	Direct emissions of particulate matter (dust and smoke), as well as the formation of fine particulate matter in the atmosphere from other agricultural emissions (ammonia, NOx, and VOCs) cause multiple environmental impacts, such as: - The unintended movement of particulate matter (typically dust or smoke) results in safety or nuisance visibility restriction - The unintended movement of particulate matter and/or chemical droplets results in unwanted deposits on surfaces - Increased atmospheric concentrations of particulate matter can impact human and animal health and degrade regional visibility	✔	✔	
ANIMAL – Fish & Wildlife; Habitat degradation	Quantity, quality or connectivity of food, cover, space, shelter and/or water is inadequate to meet requirements of identified fish, wildlife or invertebrate species.	✔		✔
ANIMAL – Livestock production limitation; Inadequate feed and forage	Feed and forage quality or quantity is inadequate for nutritional needs and production goals of the kinds and classes of livestock.		✔	✔
ANIMAL – Livestock production limitation; Inadequate livestock water	Quantity, quality and/or distribution of drinking water are insufficient to maintain health or production goals for the kinds and classes of livestock.		✔	✔
PLANT CONDITION – Degradation plant condition; undesirable plant productivity and health	Plant productivity, vigor and/or quality do not negatively impact other resources or meet yield potential due to improper fertility, management or pants not adapted to site.			✔
PLANT CONDITION – Degraded plant condition; excessive plant pest pressure	Excessive pest damage to plants including that from undesired plants, diseases, animals, soil borne pathogens and nematodes.		✔	✔

Data Sources: Tucson Local Work Group, June 2011. Priority Resource Concerns Worksheet.

Other resource concerns may potentially exist in the District but were not delineated as part of the priority resource concerns. A complete listing of resource concerns identified within the State by land use is located on the NRCS Electronic Field Office Technical Guide at: http://efotg.sc.egov.usda.gov/treemenuFS.aspx

Quality Criteria

Quality criteria are a basic method that Districts and NRCS interprets functionality of resources. Resources that are designated within specific areas are considered as meeting quality criteria only if they have reached an acceptable level of health or stabilization and have not progressed past a specific threshold unique to that resource. If a resource is considered to be a problem; that resource does not meet quality criteria and has fallen below the designated threshold and considerations for treatment may be initiated. Different types of land uses such as cropland, rangeland or forestlands have their own specific treatments and measurement tools that are tailored to delineate the capacity of departure from a healthy and functioning state.

Physical Improvements to Address Resource Concerns

Rangeland improvements are the physical improvements installed over a period of time to aid in land health and land management. These improvements are specifically applied to address resource concerns and issues identified in the planning process. A depiction of identifiable installed and/or applied management practices (brush management, range seeding, prescribed fire, and grazing management) according to resource concern are listed in the following summaries and tables under each identifiable resource concern. Tables presented include estimates from the 1980 Field Report, applied practices and estimated program dollar cost for conservation implementation of individual practices. Cost estimates have been generated from NRCS program monies spent since the 1996 Farm Bill. Program funds spent in the District pre-1996 are not available for record. This information was gathered from individual ranch units and federal agency records.

Descriptions of priority resource concerns, quality criteria, conservation practices applied for resource concern treatment, District resource assessments, general locations, issues associated with the resource concern and implemented treatments are listed in the section following.

Soil Erosion

Three categories of Soil Erosion were chosen as top priorities for the District: sheet, rill and wind erosion; concentrated flow erosion; and excessive bank erosion. Soil erosion is defined as the movement of soil from water (sheet and rill or gully) or wind forces requiring treatment when soil loss tolerance levels are exceeded. Sheet and rill erosion is a concern particularly on crop and rangeland in areas of shallow soils and/or poor vegetative cover. Soil loss results in reduced water holding capacity and plant productivity. Gully erosion can be a significant problem in areas of steep slopes and deep soils. Loss of vegetative cover and down-cutting of streams contribute to gully formation. Wind erosion can be locally significant where adequate vegetative cover is minimal or non-existent in ephemeral rangelands or baron farmlands.

Conservation practices applied to address these resource concerns are generally those that help improve vegetative cover, stabilize sites, and control water flows. Practices may include critical area planting, deferred grazing, grade stabilization structures, herbaceous wind barriers, conservation cover crop, irrigation water management, tillage management, residue management, prescribed grazing, range planting, stream channel stabilization, tree and

shrub establishment, water and sediment control basins, water spreading, windbreak establishment, use exclusion and wildlife upland habitat management

Soil Erosion – Cropland and Irrigated Pasture:

Increased sheet/rill erosion from farming activities may potentially exists along the San Pedro and Gila Rivers although realistically is minute. The majority of erosion that may occur along farm fields would be soil transportation from wind if no crop residue is present on the soil surface. On steeper fields (1% or greater rowfall and cross slope), irrigation water transports soil to the end of field runs as well as across the field. Over time this becomes an issue and fields should be laser planed in order to maintain proper irrigation grades. Laser planning should be performed every 2 or 3 seasons on cropland (Haynes, Chris. Personal correspondence. 2011). Soil erosion is considered a resource problem on cropland and irrigated pasture when the actual soil movement in tons per acre exceeds the expected soil loss "T" as defined in the soil survey for that specific soil series.

Soil Erosion – Rangeland:

On rangelands, periodic detachment of soil horizons due to possible lack of soil cover (combination of rock/litter/vegetative matter), increases soil movement in uplands. Large flooding events in turn transport detached soil into the San Pedro, Gila and Santa Cruz River systems increasing the potential of suspended sedimentation and turbidity in surface waters. Erosion on rangelands is considered a resource problem when Range Health Attribute ratings for Soil and Site Stability are Moderate or a higher departure from the Ecological Site Description.

Large active and ephemeral gullies currently exist in all land forms especially on rangelands with steeper grades, highly erosive soils and off of existing roadways. Some elongating rills leading to large gullies are a persistent problem; causing damage to roads and roadsides, creating large water gaps under crucial fencelines and potentially hindering activities necessary to implementing land management. Many times, large amounts of vegetation are lost and gully sides steepened and widened during storm activities. When this resource concern starts becoming a consistent problem to human activities, it is often at an extreme level. Conservation practices that may be applied for treatment frequently end up being quite large and very expensive.

Image 5-1: Large gully resulting from concentrated flow from a nearby roadway with highly erodible soil.

Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2011.

Soil Erosion – Additional:

Very few large scale projects have been implemented to aid in soil erosion within the District. Small scale projects have been constructed on individual land units. Some of these projects include small rock dams in gullies, contouring dirt with bulldozers or cutting and placing brush in deep gullies.

One of the largest erosion control task that was completed in the District was completed as part of an Emergency Watershed Protection (EWP) program in conjunction with NRCS and Pinal

County in Bonita Wash after the first affects of soil movement from the Aspen Fire. Several small gabions and water diversionary structures were installed in 2005 to protect domestic wells and channel water movement away from home sites in.

Image 5-2: Gabion and water diversion; Bonita Wash EWP, 2005.

Photo courtesy of: Thomas Reis, Tucson Area Office, NRCS 2005.

Another set of large gabions were installed on the Page Ranch in conjunction with the District, Ray High School students and Broken Hills Proprietary Mining Company in 2000. These gabions were installed to slow flood waters in a draw leading off the Willow Springs Road and stop heavy head cutting that was occurring near the site. This structure was designed by a University of Arizona Engineering Student. Ultimately, in 2003 after heavy winter rains, all three gabions failed and water cut around each structure and began continuing head cutting up stream. Partial reasoning for gabion failure is the type of fabric material designed to be installed within the gabion walls allowed for damming of finer, lighter soils instead of slow passage through the rock placed within the wire gabion cage as well as improper key-in into the gully bottom.

Image 5-3: Failed erosion control gabions on the Page Ranch.

Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2011.

Many individual land unit operators have initiated some type of smaller erosion control structure of their own. The Double Check Ranch has constructed several small rock structures in gullies and washouts in 1997 through 1999. Several of these structures have withheld smaller storm events. Sedimentation has deposited against the rock dams and has begun the process of filling in behind them. The Flying U W Ranch has constructed a series of larger dykes with drainage tubing installed starting in 1984 through 1999. The purpose of these structures is to encourage sedimentation while slowly draining water through a series of strainer pipes. With the exception of a few of the structures that receive excess water from roadways, these structures have held successfully. The Campstool Ranch has also built a series of dykes in some of the larger drainages near the San Pedro River with the purpose of slowing flood waters. With the exception of one structure, these have held fairly successfully.

Image 5-4: Series of dikes with strainer pipe system.

Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2011.

Image 5-5: Series of dikes with strainer pipe system.

Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2011.

The District also partook in building small erosion control structures that included hay bale and straw sausages in Summerhaven August, 2003 along with NRCS, the Pima NRCD, Redington NRCD, Santa Cruz NRCD Pima and Pinal County. Materials used in these structures were supplied by the US Forest Service. These structures were installed to slow water moving off hydrophobic soils above the Zimmerman School and Sewage Plant in the Sabino Canyon drainage. These structures have held successfully and have begun to decompose as intended.

The District has taken steps to aid local land owners as well as the US Forest Services' Burn Area Emergency Response Team (BAER) after wildfires destroyed or fire effects have left a threat to private property and infrastructure. The major goal of the District to partake as a BAER Team member is to serve as a liaison between Federal Agencies such as the Forest Service and the NRCS and private land owners. The District assist these agencies and the private entities by making contacts, conveying concerns, establishing priorities for dispersion of aid and helping install post fire structures.

Image 5-6: Construction of hay bale structures above Zimmerman School, Mt. Lemmon, 2003.

Photo courtesy of: Emilio Carrillo, Tucson Field Office, NRCS, 2003.

Image 5-7: Post construction of hay bale structures above Zimmerman School, Mt. Lemmon, 2007.

Photo courtesy of: Katie Cline, Tucson Field Office, NRCS, 2007.

Soil Erosion – Flooding:

Since the 1980 District Field Report, there has been three 100 year or greater stage floods that have drastically affected the District. The first flood occurred in 1983 as a result from a combination of Tropical Storm Octave, a stalled low pressure system off the coast of California and a wet winter with subsequent monsoon activity. The highest recorded rainfall during the 1983 flood was 12 inches on Mount Graham with Mount Lemmon coming in second at 10.45 inches between September 29 and October 4th. These two combined heavy rainfalls caused torrential flooding in the Gila and San Pedro Rivers, Aravaipa Creek and all tributaries leading into these waterways.

Image 5-8: Rainfall associated with Tropical Storm Octave, October 1983.

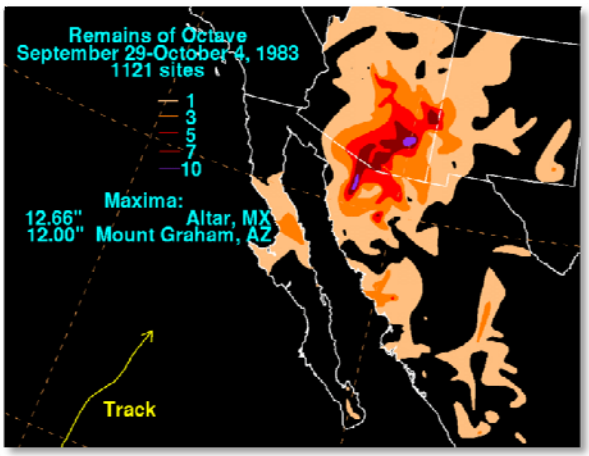


Photo courtesy of: NOAA.
http://www.hpc.ncep.noaa.gov/tropical/rain/octave1983.html

Several homes were lost during this flood which was located mainly along major waterways such as the Gila, San Pedro and Aravaipa. Subsequently, President Regan declared Gila, Graham, Pima and Pinal Counties as "major disaster areas".

The flood of 1993 was part of an unusual series of storms from the Pacific Ocean starting in early January and continuing through February, 1993. Portions of the jet stream during January was farther south than was normal, subtropical moisture from the Pacific Ocean west of Baja California was directed toward Arizona which created the excessive flooding. Precipitation was 520% of normal for January and 400% of normal for February (Smith, C. F. etal. 2005). As a result of this torrential rainfall; the Winkelman Flats community was completely submerged and ultimately destroyed. This storm event also washed out the Aravaipa Road above the old White's headquarters. The road was impassable for several months until Pinal County installed a bridge over the washout gap.

Image 5-9: Flooding of the Winkelman Flats, 1993.

Photo courtesy of: www.weatherstock.com

In July of 2006, high precipitation in the upper Aravaipa Creek watershed in Graham County caused the highest recorded flood event in the Aravaipa Creek. Much of the flooding that occurred downstream was contributed by the Aravaipa. Flood waters from this occurrence were reported to have "overtopped" the Aravaipa Bridge along highway 77 on October 1, 2006. This large flood event completely scoured the creek bottom, leaving open, cobbled areas where previously there was dense tree/shrub growth. Homes and livestock were lost and/or destroyed during this flood.

Image 5-10: Aravaipa Creek overlook 2005.

Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2005.

Image 5-11: Aravaipa Creek overlook 2008.

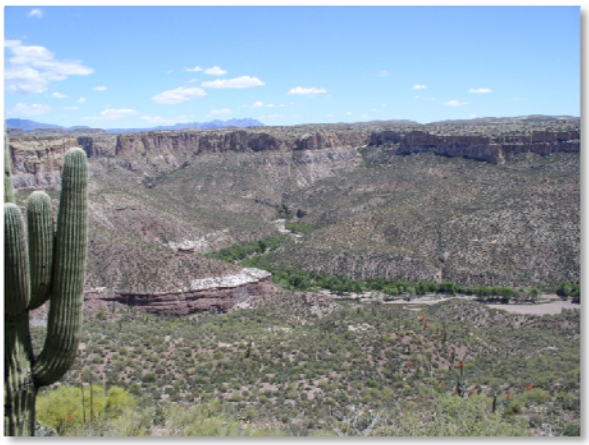


Photo courtesy of: Katie Cline, Tucson NRCS Field Office, 2008.

Table 5-2: Peak discharge during each 100 year flood period in the District.

Flood Year	Peak Discharge (ft^3/sec)	Drainage Area (mi^2)
1983 - Aravaipa	70,800	537
1983 - Gila	100,000	18,011
1983 - San Pedro	135,000	2,927
1993 - Aravaipa	13,000	537
1993 - Gila	79,900	18,011
1993 - San Pedro	19,100	2,927
2006 - Aravaipa	18,000	537
2006 - Gila	20,500	18,011
2006 - San Pedro	N/A	2,927

Data Source: NOAA, Advanced Hydrologic Prediction Service.
http://nwis.waterdata.usgs.gov/az/nwis/peak?search_criteria=county_cd&submitted_form=introduction

As a result of such extensive flooding of 3, 100 year floods occurring within a 23 year period; major sedimentation and streambank erosion has occurred. During the 1993 flood that approximately 10 foot of streambank sloughing into the San Pedro River in 1 minute intervals (Cline, Katie E. Personal observation. 1993).

To date, no conservation practices addressing this resource concern have been funded through program monies. All practices have been voluntary and out of pocket due to programmatic rules making these areas ineligible because they have received more than two, 100 year floods within a 25 year period. No actual numbers or cost data is available.

Soil Condition

Soil condition is an important indicator of soil health and a key to sustainable land management. Three categories of Soil Condition are considered a priority resource concerns within the District. They are: soil compaction, organic matter depletion and degradation due to concentration of salts or other chemicals. These problems are considered strictly for cropland and irrigated pasture. Soil Condition is defined as a resource concern that is related to depletion of soil organic matter content and the physical condition (tilth) of the soil. These factors affect the relative to ease of tillage, seedbed quality and deep root penetration. A decline in soil condition leads to declining productivity and declining profit.

Image 5-12: Good root development in Bermuda grass irrigated pasture.

Photo courtesy of: Chris Haynes, Tucson NRCS Field Office, 2011.

Practices that may be applied to critical areas include: residue management, tillage management, conservation cover crop, crop rotation, grazing management, irrigation water management, nutrient management, use exclusion and pasture and hayland planting. Many farmers apply additional 10 to 20% irrigation water (leaching) to address the resource concern. In most cases it is considered a resource concern when crop yields decrease by 10%.

Soil Condition – Cropland and Irrigated Pasture:

Soil compaction is generally considered a resource concern within the District. Compaction is considered a resource problem if soil compaction test using a Penetrometer exceed 300 psi or greater. Farm fields and irrigated pastures within the District have been tested and have been found to have compaction layers.

Image 5-13: Typical soil compaction on farmland at a 12 inch depth.

Photo courtesy of: Chris Haynes, Tucson NRCS Field Office, 2011.

Organic matter depletion is an issue on cropland if there is a long history of intensive tillage and lack of crop rotation and cover cropping. It is considered a resource problem if the Soil Condition Index shows a negative value. The Soil Condition Index is a tool used to predict the consequences of cropping systems and tillage practices on soil organic matter. Current farming and tillage activities within the District have not led to organic matter depletion.

Soil degradation by concentration of salts or other chemicals is a resource issue on fields where salts remain in the topsoil after the irrigation water has evaporated. It is considered a resource problem when crop yields decrease by 10%.

Management practices have currently been placed on cropland and irrigated pastures to improve soil condition. To date, conservation practices that have been applied within the District for Soil Condition under the 1996, 2002 and 2008 Farm Bills equates to:

Table 5-3: Conservation practices applied addressing Soil Condition.

Conservation Practice	Amount	Obligation Cost
Conservation Crop Rotation	2,490 ac	$0.00
Irrigation Water Management	544 ac	$1,000.00

Nutrient Management	542	ac	$500.00
Hayland Planting	100	ac	$0.00
Residue Management	406	ac	$0.00
TOTAL:			**$1,500.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Table 5-4: Conservation practices planned addressing Soil Condition through 2016.

Conservation Practice	Amount		Obligation Cost
Conservation Crop Rotation	21	ac	$2,996.00
Irrigation Water Management	270	ac	$2,890.00
Nutrient Management	114	ac	$1,000.00
TOTAL:			**$6,886.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Water Quantity

One resource concern was chosen by for the District as a priority; insufficient water use on irrigated land. Insufficient water use refers to inefficient or ineffective water systems; systems that produce too little or too much. Water quantity is a major issue in the southwestern states and has been one of Arizona's top priority resource concerns over the last decade. Water quantity is a resource concern whenever water supplies are inadequate and/or inefficient to meet the needs for agricultural or domestic uses. Existing irrigation systems that meet quality criteria have an Irrigation Rating Index score of at least 60 based on the Farm Irrigation Rating Index (FIRI). FIRI is a tool used to assess irrigation efficiency based on the structural components and water management. Water supply, length of run, field size, slope, and uniformity are considered during planning. In general, application efficiencies of 70% to 90% are planned. Irrigation water is conveyed to where it is needed with no more than 5% loss from seepage or leaks. ("Arizona Planning Guides". 2003). Specific efficiencies are planned with different irrigation systems including surface, sprinkler and irrigated pasture are generally those that improve the irrigation efficiency and distribution uniformity.

Conservation practices applied to address this resource concern on irrigated cropland are generally those that improve the quantity and efficient distribution of water. Practices may include irrigation land leveling, irrigation system, irrigation water conveyance (ditch or pipeline), irrigation water management, structure for water control, well, pumping plant for water control and row arrangement.

Water quantity is most likely the most essential issue throughout the southwest and most importantly the Winkelman District. Irrigated agriculture is the largest user of water in Arizona, using about 68% of the available supply. In the past, it was as high as 90% ("Agriculture Home Page". 2012). Reduction s has been the result of heavy investments by farmers, ranchers and the USDA in the form of farm conservation measures. Irrigated agriculture water quantity affects many attributes like: farming, mining, ranching, wildlife populations and human populations. Recognition of this issue and steps to alleviate major concerns is continually becoming more prevalent in everyday life.

Water Quantity – Cropland and Irrigated Pasture:

Approximately 70% of the existing irrigation systems meet quality criteria because of the existing irrigation system components combined with water and soil management. In recent years, a number of irrigated pastures and cropland operations developed plans with NRCS and reorganized irrigations systems in order to improve irrigation efficiency, reduce labor, and improve productivity. Center pivots and hand move sprinkler systems were installed. Surface irrigation systems with land leveling and buried PVC with alfalfa valves or concrete lined ditch were installed. Structures

for water control (flow meters) were installed in order to facilitate irrigation water management. These new systems allow for easier water management and a much better chance to save water. Most of the existing systems within the District currently meet quality criteria and have some sort of management and type of monitoring practices associated with them (Haynes, Chris. Personal correspondence. 2011). There have been a few irrigated pasture operations within the District that did not meet quality criteria and had taken steps to improve water efficiency on the pasture.

Table 5-5: Conservation practices applied addressing Water Quantity.

Conservation Practice	Amount	Obligation Cost
Irrigation Sprinkler	3 no.	$82,580.00
Irrigation Conveyance Pipeline	1,340 ft	$10,970.74
Irrigation Water Management	547 ac.	$1,500.00
Structure for Water Control	64 no.	21,600.00
Land Leveling	110,372 cuyd.	$63,531.89
Grand TOTAL:		**$180,182.63**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Table 5-6: Conservation practices planned addressing Water Quantity through 2016.

Conservation Practice	Amount	Obligation Cost
Irrigation Water Management	427 ac.	$4,780.00
Structure for Water Control	4 no.	$4,140.00
Grand TOTAL:		**$8,920.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

A major part of the Districts historic and current farming activities along the Gila River depends on irrigation waters diverted and allocated out by the San Carlos Irrigation Project. Specific quantities of water is diverted from the Ashurst-Hayden (Florence) Diversion Dam east of Florence and portioned out to local farming operations. Waters are also portioned out from the San Carlos Reservoir into the Gila River by the San Carlos Irrigation Project during specific times of the year to accommodate farming activities in the Florence Area.

Image 5-14: Areal image of the Ashurst-Hayden Diversion Dam, 2011.

Photo courtesy of: Farm Service Agency aerial photography, 2010.

Farming and irrigated pasture practices along the San Pedro River solely depend on private irrigation wells. Use of this type of water source lessens sedimentation concerns on irrigated fields. To date, there has only been a minimal number of new irrigation wells drilled along the Gila or the San Pedro River since the 1980 Field Report.

In recent years, completion of the Central Arizona Project Canal (CAP) added a water source to the District. Water feeding the CAP is diverted from the Hoover Dam and is transported clear to south Tucson through a system of canals and pumping stations. The CAP canal runs in the western edge of the District and is used partially by the Florence farming community. The CAP system is operated and managed by the Central Arizona Water Conservation District and water is sold by the acre-foot at prices determined by the Board of Directors. At present, almost all CAP use in Pinal County is for agricultural purposes. CAP

data indicates between 1999 and 2001, between 450,000 and 600,000 acre-feet is supplied annually to Pinal County (Pinal County Water Resources, Pinal County Comprehensive Plan. Date unknown).

Water Quantity – Additional:

There are currently 2 Active Management Area (AMA) within the District; Pinal and Tucson. The Pinal AMA includes Florence and the Tucson AMA includes the Dripping Springs, Lower San Pedro Basin and Donnelly Wash Basins. Areas with heavy reliance on mined groundwater were identified and designated as AMA's after the 1980, Arizona Groundwater Code recognized the need to aggressively manage the state's finite groundwater resources. Each AMA carries out its own programs in a manner consistent with Arizona Groundwater Code goals ("Active Management Areas and Irrigation Non-expansion Areas. 2011).

Active Management Areas play a major role in agriculture operations as well as domestic water use. If an operation has plans to implement a new water source within one of these districts, total water utilization has to be considered and use could possibly be restricted per each AMA's goals. Goals for each AMA within the District are as follows:

- *Tucson AMA* – has a statutory goal of achieving safe-yield by 2025 and maintaining it thereafter. Safe-yield means that the amount of groundwater pumped from the AMA on an average annual basis does not exceed the amount that is naturally or artificially recharged ("Water Management, Tucson AMA Home Page". 2011).
- The Tucson AMA consist of:
  - Over 3,800 sq. miles (not all within the District)
  - 2 sub-basins (watersheds)
  - Over 300,000 AF of annual water use

Figure 5-1: Tucson AMA region.

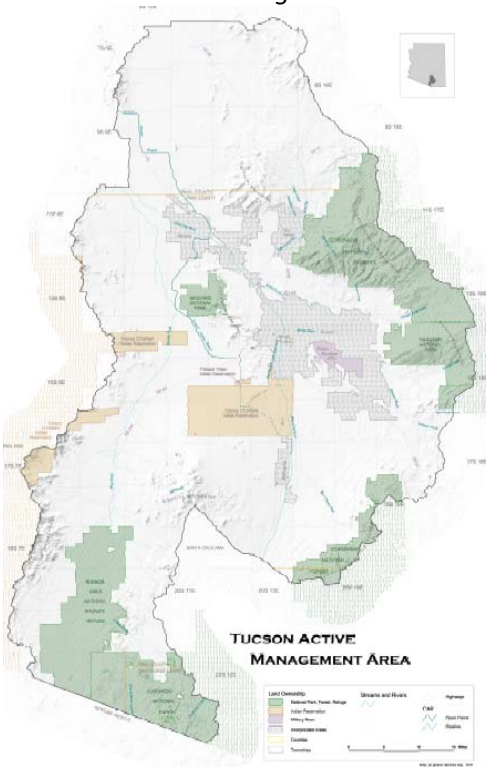


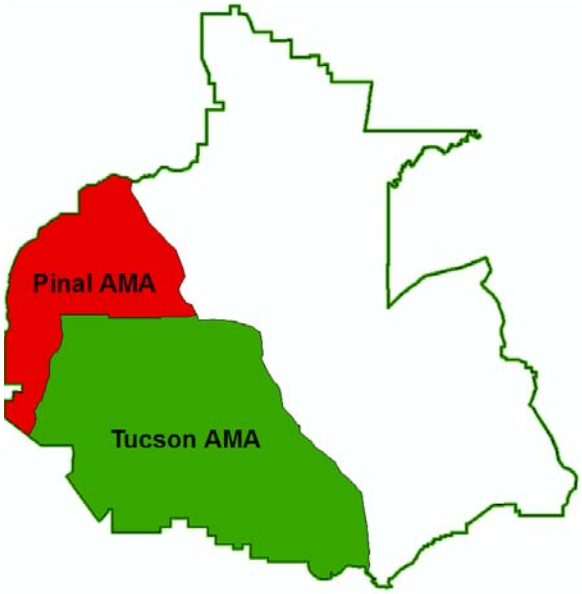
Image Source: ADWR website. 2011.

- *Pinal AMA* – has the statutory management goal to allow development of non-irrigation uses and to preserve existing agriculture economies in the AMA for as long as feasible, consistent with the necessity to preserve future water supplies for non-irrigation uses ("Water Management, Pinal AMA Home Page". 2011).
- The Pinal AMA consist of:
  - Over 4,000 sq. miles (not all within the District)
  - 5 sub-basins (watersheds)
  - 260,000 acres of non-Indian farmland
  - Over 800,000 AF of non-Indian annual water use.

Figure 5-2: Pinal AMA region.

Image Source: ADWR website. 2011.

Figure 5-3: District areas with active AMA's.



Data Source: ArcMap GIS layer: "WNRCD_AMA" and http://www.azwater.gov/azdwr/WaterManagement/AMAs/TucsonAMA/images/AMAs.jpg

Water Quantity – Mining Operations

Mine operations depend considerably on water for cooling. Production of raw materials, dust control, machinery cooling, etc. use large amounts of water. Many of the mining operations within the District have sole owned production wells. Very few water sources are transported from other watersheds into these mining operations with the exception of the KENICOT waterline that runs along Camino Rio Road, west of the San Pedro River. Water flowing through this large pipeline is transported from old irrigation wells near the PZ Ranch along the San Pedro River. Water requirements for daily operations for the ASARCO Mining Company, Haydon/Winkelman Complex are currently unavailable at the time of completion of this report.

Water Quality

Three water quality resource concerns were elected in the District and are: degradation by excess nutrients in surface and/or groundwater; degradation by pesticides transported to surface and ground water; and degradation of excessive sediments in surface waters. The Arizona Department of Environmental Quality (ADEQ) assesses surface water quality to identify which surface waters are impaired or attaining designed uses and to prioritize future monitoring. Strategies must be implemented on impaired waters to reduce pollutant loadings so that surface water quality standards will be met, unless impairment is *solely* due to natural conditions.

Once surface water has been identified as impaired, activities in the watershed that might contribute further loadings of the pollutant are not allowed. Agencies and individuals planning future projects in the watershed must be sure that activities will not further degrade these impaired waters and are encouraged through grants to implement strategies to reduce loading. One of the first steps is the development of a Total Maximum Daily Load (TMDL) analysis to empirically determine the load reduction needed to meet standards.

Conservation practices applied to treat this resource concern may need to be part of a Conservation Management System to achieve Quality Criteria. Some of these practices may

include: Controlled drainage, diversion, filter strips, flood water diversion, grade stabilization, land reclamation, mine shaft closing, use exclusion, water spreading and wetland development or restoration.

Water Quality – Farming, Rangeland, Mining, Additional Uses and Concerns

Some water quality exceedances found cannot necessarily be attributed to specific sources while others can. Below is a summary of water quality concerns that have been documented in waterways within the District.

The *2006 – 2008 Status of Ambient Surface Water Quality in Arizona* indicates that there are water quality issues within some of the watersheds within the District. There are three types of samples taken at selected test sites along these waterways. They include: Metals (total and dissolved), Nutrients and "Others". Metals tested for and found are: antimony, arsenic, beryllium, cadmium, chromium, copper, zinc, boron, lead, manganese, mercury and nickel. Nutrients include: ammonia, total nitrogen, nitrite/nitrate, total phosphorus, total Kjeldahl nitrogen dissolved oxygen and pH. The "other" category includes: *E. coli* bacteria, fluoride, total dissolved solids, suspended sediment concentration and turbidity. Each sampled waterway or water body is given a classification for monitoring purposes and are; high, medium or low. Below is a list of waterways that were tested within the District and exceedances.

- San Pedro River – from Buehman Wash to Peppersauce Wash. Exceedances include: Chromium, copper, dissolved copper, *E. coli* bacteria, lead and suspended sediment concentration. This stretch was classified as a medium priority.
- San Pedro River – from Peppersauce Wash to Aravaipa Creek. Exceedances include dissolved copper and lead. Dissolved copper exceeded only once in a 3 year test period. This stretch was classified as a medium priority.
- Copper Creek – from the headwaters to Prospect Canyon. Dissolved copper has been found in exceedance once during the assessment period in 2005. This stretch was classified as a medium priority.
- San Pedro River – from Aravaipa Creek to the Gila River. Exceedances include: arsenic, chromium, total copper, *E. coli* bacteria, lead, mercury, dissolved mercury, suspended sediment concentration and selenium. This stretch was classified as a high priority.
- Aravaipa Creek – from Stowe Gulch to end of Aravaipa Wilderness Area. No exceedance during test period. This stretch was classified as a low priority.
- Aravaipa Creek – from Aravaipa Wilderness Area to the San Pedro River. No exceedances were tested. This stretch was classified as a low priority.
- Gila River – from Dripping Springs Wash to San Pedro River. No exceedances were found. This stretch was classified as a low priority.
- Gila River – from San Pedro River to Mineral Creek. Several exceedances have occurred and include: *E. coli* bacteria, lead, suspended sediment concentration and selenium. This stretch was classified as a high priority.
- Mineral Creek – from Devil's Canyon to the Gila River. Three exceedances were sampled and include: dissolved copper, dissolved oxygen and selenium. This stretch was classified as a high priority.
- Kearny Lake. No exceedances were sampled. This water body was classified as a low priority.

Water Quality – Environmental Sites

There is no environmental Superfund or Water Quality Assurance Revolving Fund (WQARF) cleanup sites located within the District.

Air Quality

Three categories for Air Quality were chosen as priority resource concerns for the District. They are: inefficient energy use of equipment and facilities; inefficient energy use of farming or ranching practices and field operations; and emission of Particulate Matter (PM) and PM precursors. Air quality is a resource concern whenever human activities contribute significantly to airborne sediment and smoke, resulting in property damage and health problems; and is regulated by the Arizona Department of Environmental Protection Agency (EPA). Air quality, climate change and energy are three issues that are increasingly being addressed by agencies. Air quality already is a functional part of the NRCS conservation portfolio where climate change and energy are now becoming significant considerations in conservation planning.

The two resource concerns; inefficient energy use of equipment and facilities and inefficient energy use on farming or ranching practices and field operations, are relatively new resource concern to NRCS history. These two Energy Conservation Resource Concerns that are associated with Air Quality are inefficient use of energy in farm and ranching operations, which increases dependence on non-renewable energy sources that can be addressed through improved energy efficiency and the utilization of on-farm renewable energy sources ("Air Quality". 2011). Farmlands within the District do have some outdated irrigation pumping plants that may not be up to the energy conservation standards. There is a potential for these facilities to be replaced. Most ranching operations use non-renewable energy power sources on most livestock wells. Approximately less than 10% of livestock wells on individual ranches have installed new renewable pumping sources such as solar or wind powered pumps (Cline, Katie. Personal observation. NRCS. 2011).

Particulate Matter is described as coarse and fine particles, smoke, dust, and off-site effects from wind erosion and is generally visible to the naked eye. Particulate matter precursors include non-observable volatile organic compounds (VOC) and nitrogen oxides (NO_x) such as waste disposal vapors, fuel combustion, on road motor vehicle emissions, solvent evaporation and industrial processes. These elements combined contribute to PM10 districts within the State. If a resource concern is meeting quality criteria; dust from bare soils, tillage, dirt roads, off-road vehicle use, and other activities do not generate excessive PM-10 emissions. Stationary combustion engines meet federal emission requirements. Non-road diesel engine pm-10 emissions meet or exceed Tier 3 emission standards. Tier 3 emission standards must meet specific sulfur dioxide, nitrogen oxide and PM output ("Control of Emissions…Final Rule". 1998).

Air Quality – District Concerns

Although the District does not fall within a PM10 district, the EPA has proposed to re-designate the western portion of Pinal County, as a nonattainment for the 1987 24-hour National Ambient Air Quality Standards (NAAQS) for particulate matter (PM-10) based on ambient monitoring data that indicate widespread and frequent violations of the standard ("Particulate Matter in Pinal County, AZ". 2010).

Particulate matter in Haydon: EPA has signed a final rule determining, based on quality-assured, certified ambient monitoring data, that the Hayden area within the District attained the 1987 primary National Ambient Air Quality Standards (NAAQS) for particulate matter (PM-10) as of the applicable attainment date of December 31, 1994. The Act and our regulations require three years of quality-assured, certified ambient air quality data to

make this finding ("Particulate Matter in Hayden, AZ". 2010).

Sulfur Dioxide in San Manuel: The EPA has signed a direct final approval of Arizona's plan to maintain attainment of the short-term (24-hour) and long-term (annual) primary National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO2) in the San Manuel area, as well as Arizona's request to re-designate this area from nonattainment to attainment for SO2. The San Manuel area has not violated either the annual or the 24-hour health-based standard since 1985. The primary source of sulfur dioxide pollution in the area was the BHP Copper Inc. copper smelter, which was shut down in 1999 and dismantled in early 2007. Maintenance of the SO_2 standard in the San Manuel area relies upon the area's new source permitting program. There are no other SO_2 sources of this magnitude in the San Manuel area ("Sulfur Dioxide in San Manuel, Arizona". 2007).

The EPA has designated specific Best Management Practices (BMP) to mitigate particulate matter within these designated areas. BMPs are techniques verified by scientific research, that on a case by case basis are practical, economically feasible and effective in reducing dust emissions from commercial farming practices. The Governor of Arizona established a BMP committee comprised of local farmers, State and local agencies, and universities to develop these BMPs, a program designed to educate the agricultural community on the requirements under the State plan.

Conservation practices applied to address this resource concern are generally those that reduce wind erosion, smoke and emissions. Practices may include atmospheric resource quality management, critical area planting, heavy use area protection, road closures and treatments, conservation crop rotation, residue management and windbreak establishment.

Capping or covering mine tailing with crushed rock on the San Manuel tailings ponds and heap leach was commenced in 2003 and completed in 2008. Decision to finalize treatment of these mining sites was made to reduce the risk of air particulates and offsite erosion into the San Pedro River Valley. Completion of the tailings capping included several different phases; the first being areal application of surfactants over all 5 tailings ponds and heap leach, capping with 36 inches of borrow material, contorting and hydro-seeding (hydro-seeding only on the heap leach). Completion cost of this massive project is not currently available.

Image 5-15: Rock armoring of tailings pond in San Manuel.

Image source: Closure at San Manuel Plant Site. Garcia. 2007.

To date, there has only been one initiative by an independent producer to reduce air particulates within the District. Details of this project are to resurface roads with gravel and/or surfactants and implement cover crop rotations on irrigated fields to reduce airborne dust particulates. Initiation of this project started in 2010 and completion of this project is not projected until 2011.

Table 5-7: Conservation practices planned addressing Air Quality through 2016.

Conservation Practice	Amount	Obligation Cost

Conservation Cover Crop	21	ac	$2,996.0
Access Road Surfactant	2,456	ft	$5,117.00
Grand TOTAL:			**$8,113.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Animal – Fish and Wildlife, Domestic Livestock

Three animal resource concerns were selected as priorities within the District. They are: Fish and Wildlife, habitat degradation; Livestock production limitation, inadequate feed and forage; and livestock production limitation, inadequate livestock water.

Fish, wildlife and domestic animal concerns occur whenever the quantity and quality of food are not adequate to meet the nutritional requirements of animals, or adequate quantity or distribution of water is not provided. This is frequently a concern on rangelands and pasture lands when changes in species composition resulting from poor grazing management and drought can reduce the availability of suitable forage. This is also a concern where permanent water is not evenly distributed resulting in poor grazing management and habitat fragmentation.

Conservation practices applied to address this resource concern are generally those that maintain or improve the quantity, quality, and diversity of forage available for animals, reduce the concentration of animals at existing water sources, and insure adequate quantity and reliability of water for the management of domestic animals. Practices may include brush management, deferred grazing, fencing, pest management, prescribed burning, prescribed grazing, pipelines, ponds, range planting, water spreading, wells, spring development, watering facility, and wildlife upland habitat management.

Wildlife – Non-Game; Threatened and Endangered Species and Species of Concern

The District is home to numerous animal and plant species that are considered threatened, endangered or a species of concern as listed in Federal and State regulations (Table 5-8). Some of these species have specific critical habitat designated with their listing. Special consideration must be taken when planning any type of management practices whether they are installation of physical practices or planning grazing management. Several species have sensitive life stages that may be inhibited by human presence or even noise. Many agencies by law must take actions to consider species wellbeing when planning or reviewing agency management plans, planned infrastructure placements or coordinated management plans.

Wildlife is under the management policies of the Arizona Game and Fish Commission (AGFC). All other agency management programs must be subservient to AGFC management goals because of the AGFC manage all non-migratory wildlife in accordance to regulations and policies of the State of Arizona and through expressed philosophies of the citizens of Arizona. Wildlife upon private lands should be managed in coordination with land owners' management goals.

Table 5-8: Winkelman NRCD Species of Concern and Endangered Species Classifications and Observations.

Animal Species					
Common Name	**Scientific Name**	**FWS**	**USFS**	**BLM**	**STATE**
Gila Longfin Dace	*Agosia chrysogaster chrysogaster*	SC	S	S	

Animal Species					
Common Name	**Scientific Name**	**FWS**	**USFS**	**BLM**	**STATE**
Giant Spotted Whiptail	*Aspidoscelis burti stictogrammus*	SC	S		
Golden Eagle	*Aquila chrysaetos*	BGA			
Zone-Tailed Hawk	*Buteo albonotatus*		S		
Common Gray Hawk	*Buteogallus anthracinus*	SC	S	S	WSC
Common Black-Hawk	*Buteogallus anthracinus*		S	S	WSC
Northern Beardless-Tyrannulet	*Camptostoma imberbe*		S		
Buff-collared Nighjar	*Caprimulgus ridgwayi*		S		
Desert Sucker	*Catostomus clarkia*	SC	S	S	
Sonoran Sucker	*Catostomus insignis*	SC	S	S	
Tucson Shovel-nosed Snake	*Chionactis occipitalis klauberi*	C			HS
Mexican Long-tongued Bat	*Choeronycteris Mexicana*	SC	S	S	WSC
Yellow-billed Cuckoo (Western US DPS)	*Coccyzus americanus*	C	S		WSC
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	SC	S	S	
Black-Bellied Whistling Duck	*Dendrocygna autumnalis*				WSC
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	LE			WSC
American Peregrine Falcon	*Falco peregrines anatum*	SC	S	S	WSC
Roundtail Chub	*Gila robusta*	C	S	S	WSC
Cactus Ferruginous Pygmy-owl	*Glaucidium brasilianum cactorum*	SC	S	S	WSC
Sonoran Desert Tortoise	*Gopherus agassizii (Sonoran population)*	C	S	S	WSC
Bald Eagle – Winter Population	*Haliaeetus leucocephalus*	SAT, BGA	S	S	WSC
Bald Eagle – Sonoran Desert area Population	*Haliaeetus leucocephalus pop. 3*	LT, DPS, BGA	S	S	WSC
Reticulate Gila Monster	*Heloderma suspectum suspectum*		S		
Mississippi Kite	*Ictinia mississippiensis*			S	WSC
Western Red Bat	*Lasiurus blossevillii*		S	S	WSC
California Leaf-Nose Bat	*Macrotus californicus*	SC	S	S	WSC
Spikedace	*Meda fulgida*	LT			WSC
Western Small foot Myotis	*Myotis ciliolabrum*	SC			
Arizona Myotis	*Myotis occultus*	SC			
Cave Myotis	*Myotis velifer*	SC			
Pocketed Free-Tailed Bat	*Nyctinomops femorosaccus*		S		
Osprey	*Pandion haliaetus*			S	WSC
Saddled Leaf-nosed Snake	*Phyllorhynchus brownii*	PS			
Gila Topminnow	*Poeciliopsis occidentalis occidentalis*	LE			WSC
Lowland Leopard Frog	*Rana yavapaiensis*	SC	S	S	WSC
Speckled Dace	*Rhinichthys osculus*	SC		S	

Animal Species					
Common Name	**Scientific Name**	**FWS**	**USFS**	**BLM**	**STATE**
Arizona Gray Squirrel	*Sciurus arizonensis*		S		
Mexican Spotted Owl	*Strix occidentalis lucida*	LT			WSC
Loach Minnow	*Tiaroga cobitis*	LT			WSC
Thick-billed Kingbird	*Tyrannus crassirostris*		S	S	WSC
Tropical Kingbird	*Tyrannus melancholicus*				WSC
Designated and Proposed Critical Habitat					
CH for *Empidonax traillii extimus*	Designated Critical Habitat for Southwestern Willow Flycatcher				
CH for *Gila intermedia*	Designated Critical Habitat for Gila chub				
CH for *Strix occidentalis lucida*	Designated Critical Habitat for Mexican spotted owl				
CH for *Xyrauchen texanus*	Designated Critical Habitat for razorback sucker				
PCH for *Meda fulgida*	Proposed Critical Habitat from spikedace				
PCH for *Tiagroa cobitis*	Proposed Critical Habitat for loach minnow				
Plant Species					
Common Name	**Scientific Name**	**FWS**	**USFS**	**BLM**	**STATE**
Toumey Agave	*Agave toumeyana var. bella*				SR
Gooding Onion	*Allium gooddingii*	SC	S		HS
Arizona Hedgehog Cactus	*Echinocereus triglochidiatus var. arizonicus*	LE			HS
Acuna Cactus	*Echinomastus erectocentrus var. acunensis*	C			HS
Needle-spined Pineapple Cactus	*Echinomastus erectocentrus var. erectocentrus*	SC			SR
San Carlos Wild Buckwheat	*Eriogonum capillare*	SC			SR
Arizona Alum Root	*Heuchera glomerulata*		S		
Huachuca Water-umble	*Lilaeopsis schaffneriana var. recurva*	LE			HS
Varied Fishhook Cactus	*Mammillaria viridiflora*				SR
Stag-horn Cholla	*Opuntia versicolor*				SR
Catalina Beardtongue	*Penstemon discolor*		S		HS
Aravaipa Wood Fern	*Thelypteris puberula var. sonorensis*		S	S	

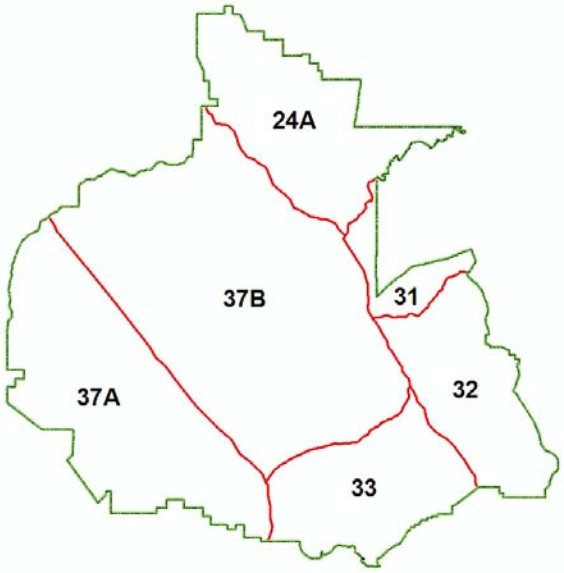
LT = Listed Threatened *LE = Listed Endangered* *C = Candidate*
SC = Species of Concern *HS = Highly Safeguarded* *WSC = Wildlife of Special Concern*
S = Sensitive *BGA = Bald & Golden Eagle Act* *SAT = Listed, Appearance Similarity*
SR = Salvage Restricted *PS = Partial Status* *DPS = Distinct Populations Segment*
Data Sources: Arizona Game and Fish Department Heritage Data Management System and Project Evaluation Program. August, 2011. http://www.azgfd.gov/hgis/

Wildlife – Game Species

Several Game Units make up the District. Technically, there is only one unit that is encompassed by the Distract boundaries and parts of other units fill in the rest of the District. Information given in the next section is data that was drawn from the Arizona Game and Fish Departments annual "Hunt Arizona; Survey, Harvest and Hunt Data." Data will be given for the entire game unit based on the fact that it is impossible to glean information specific to

areas found only within the District. The reader is cautioned to consider the tables and charts below with this specific fact in mind. It is important to list these types of activities and species surveys that are commenced within the District to obtain an idea of how valued the resources within the District are to the general public. Game units within the District are: 24A, 31, 32, 33, 37A and 37B ("2012-2011 Arizona Hunting and Trapping Regulations". 2010).

Figure 5-4: Game Units within the Winkelman District.



Data Source: Arizona Game and Fish Department, Hunting Units and ArcMap GIS layer "WNRCD_Hunting_Units".

Game units on the eastern and southern reaches of the District: 24A, 31, 32 and 33; have a wide range of big game species sought after by hunters. These include: Big Horn Sheep, whitetail deer, mule deer, bear, javelina and mountain lion. Game unit's central and on the western reaches are not near as diverse with the permanent habitation of those species although it is common for them to traverse these areas periodically. Major big game species in these units include: mule deer, javelina and mountain lion.

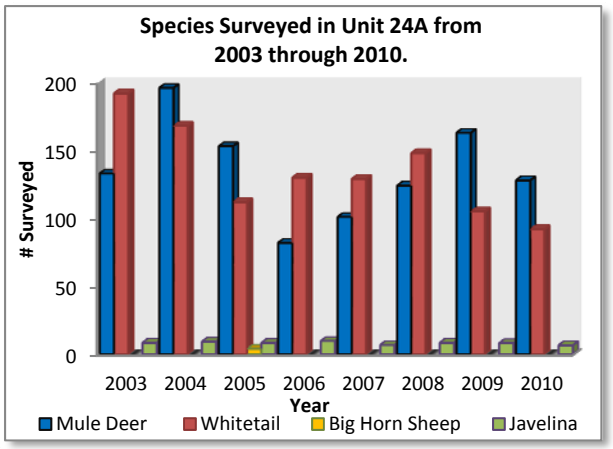
Population estimates of these large game species applicable to the District are derived from yearly, on-the-ground surveys commenced by the Arizona Game and Fish Department. Surveys of amounts and kinds of individual species are used to create a population density. It is unknown neither the method used for population estimates nor will the actual population estimates for each unit within the District be available at this time. This information was requested but was simply not given.

Survey information was extractable from the "Hunt Arizona; Survey, Harvest and Hunt Data" for only 7 years (2003-2010) previous to 2012. Information from these does not really give an accurate assessment of actual populations for each unit back to the 1980 report or even through the last century.

Unit 24A Game Surveys – Surveys of game wildlife in 24A include: mule deer, whitetail deer, javelina and big horn sheep. Elk is known to reside within the District on Pinal Mountain, hunting permits are even issued but, no surveys are recorded for this unit. Over the 7 year period, the highest mule deer survey was recorded in 2004 at 196 individuals (bucks, does, fawns and unclassified) and the lowest survey was in 2006 at 82 individuals. Whitetail deer is showing the highest surveys in 2003 at 192 individuals and the lowest as 92 individuals surveyed in 2010. Only 4 big horn sheep were surveyed in 2005.

Javelina is generally surveyed by individuals within one herd and by number of herds observed. An average herd size is derived from this information. The largest herd size observed was in 2006 at an average size of 9.7, the lowest in 2009 at 8.1. Javelina herds in 24A seem to stay fairly static and not deviating too drastically from year to year.

Chart 5-1: Unit 24A Game Surveys for mule deer, whitetail deer, javelina and big horn sheep.

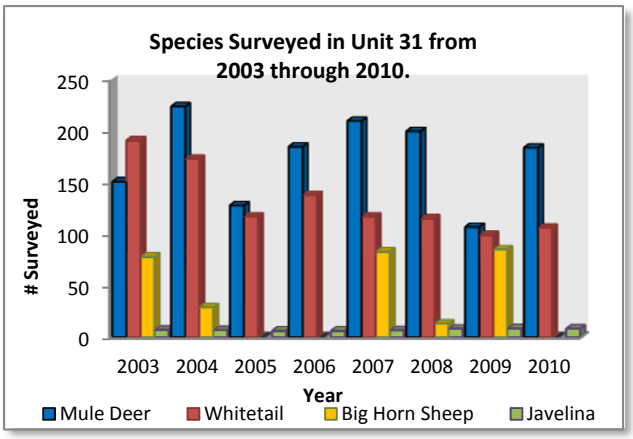


Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Unit 31 Game Surveys – This unit is much larger than what is outlined within the District boundary and includes areas in Aravaipa Creek headwaters. Although only a small portion of this unit is within the District, this unit receives quite a bit of hunting within this section. Big horn sheep surveys are generally combined with unit 33 and will only be considered in the unit in the attempt to minimize duplicating data and giving a false interpretation. For mule deer, 224 individuals were surveyed in 2004; the highest over the 7 year period. The lowest number survey was 107 individuals in 2009. Whitetail is showing the highest number surveyed in 2003 at 191 individuals and the lowest in 2009 at 99 individuals. Big horn sheep surveys in both units are fairly sporadic. For years that were surveyed, the highest number of individuals seen was in 2009 at 85 individuals and the lowest in 2008 only at 13 individuals.

Javelina surveys are somewhat reflecting the average herd size is increasing over the last 7 years. The highest average herd size recorded was in 2009 at 8.4 individuals and the lowest herd size recorded is tied at 6.1 between 2005 and 2006.

Chart 5-2: Unit 31 Game Surveys for mule deer, whitetail deer, javelina and big horn sheep.

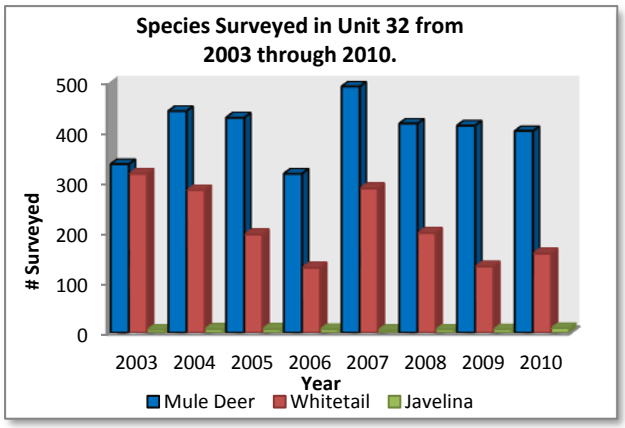


Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Unit 32 Game Surveys – Surveys in this unit include the same species as unit 31. This unit has the highest amount of game surveyed within the District. They indicate that mule deer numbers have remained fairly static with fairly little variation throughout the year with the exception of one or two years. The highest number surveyed was in 2007 at 492 individual and the lowest in 2006 at 318 individuals. Whitetail surveys are very different than the mule deer surveys. Numbers are lower and vary widely throughout the years. The highest number of whitetail individuals surveyed was in 2003 at 318 and the lowest in 2006 at 131 individuals.

Javelina surveys are also vitiating widely throughout the 7 year period. The highest surveys occurred in 2010 with an average herd size of 9.6 and the lowest surveyed was in 2003 at 6.3.

Chart 5-3: Unit 32 Game Surveys for mule deer, whitetail and javelina.

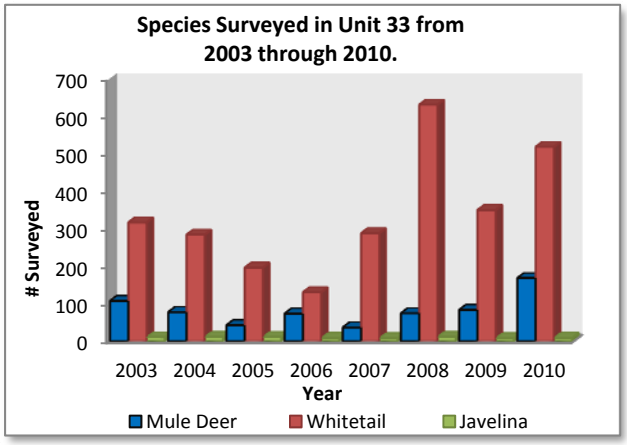


Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Unit 33 Game Surveys – This unit is showing the complete opposite of unit 32 where whitetail deer numbers outweigh the mule deer numbers. Mule deer surveyed were the highest in 2010 at 169 individuals and lowest in 2007 where 37 individuals were recorded. Whitetail numbers are showing that the highest number recorded were in 2008 at 633 individuals and the lowest in 2006 at 131 individuals.

This unit has one of the highest javelina populations based on surveyed herds within the District although it has fluctuated somewhat. The highest average herd size recorded was in 2008 at 12.1 and the lowest in 2009 at 8.3.

Chart 5-4: Unit 33 Game Surveys for mule deer, whitetail and javelina.

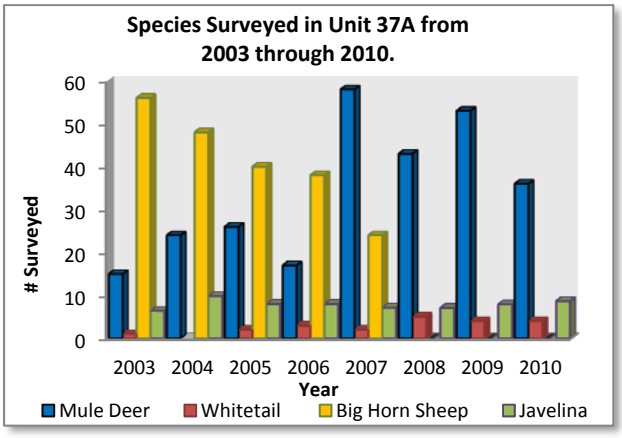


Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Unit 37A Game Surveys – This unit is showing some of the lowest numbers of mule and whitetail deer surveyed out of all the game units within the District. This may be due to the fact that this unit is covered by fairly flat alluvial's that are densely covered with trees and has a fairly large lack of permanent water sources. The highest number of mule deer surveyed was in 2007 at 58 individuals and the lowest in 2003 at 15 individuals. Whitetail numbers are typically low with the highest number surveyed in 2008 and the lowest in 2003 at 1 individual. This unit houses a few big horn sheep as well. Surveys indicate that the highest number of sheep recorded was in 2003 at 56 individuals and the lowest in 2007 at 24 individuals.

Javelina numbers in this unit are fairly consistent with the other units except unit 33. Average herd size does not seem to fluctuate too widely in this unit. The highest average herd size was recorded in 2004 at 9.9 and the lowest in 2003 at 6.4.

Chart 5-5: Unit 37A Game Surveys for mule deer, whitetail deer, javelina and big horn sheep.



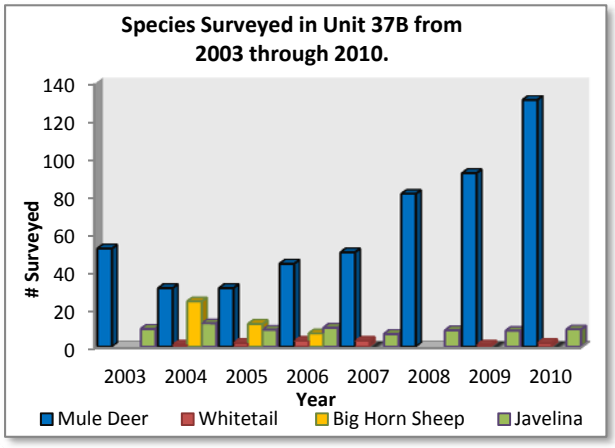
Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Unit 37B Game Surveys – Unit 37B survey data is similar to unit 37A. Mule deer surveyed

outweighs that of whitetail deer but seem to be increasing over the last few years. The highest number recorded was in 2010 at 131 individuals and the lowest number recorded is tied between 2004 and 2005 at 31 individuals. Whitetail deer are consistently low; the highest numbers recorded is tied between 2006 and 2007 at 3 individuals and the lowest recorded in 2004 and 2009 at 1 individual. Big horn sheep is fairly rare throughout this unit but do traverse the northern reaches perhaps to obtain access neighboring units. Surveys for big horn sheep are sporadic in this unit; the highest number surveyed was in 2004 at 24 individuals and the lowest number surveyed was in 2006 at 7 individuals.

Javelina surveyed in unit 37B seems to fluctuate widely throughout the years. In average herd size; the highest numbers were recorded in 2004 at 12.4 and the lowest recorded was in 2007 at 6.8.

Chart 5-6: Unit 37B Game Surveys for mule deer, whitetail deer, javelina and big horn sheep.



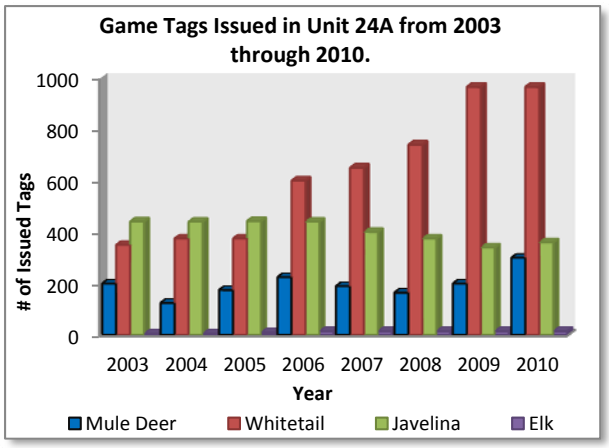
Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data".

Hunting has been a popularly increasing activity among the general public over the years. According to the "Historic Summary of General Hunts"; numbers of individual hunters has remained fairly static from the late 1950's through today. Number of hunters throughout the state generally ranges from 50,000 to 90,000 hunters during deer seasons and between 9,000 and 30,000 hunters during general javelina seasons per year. Based on information derived from the "Hunt Arizona" booklet; number of hunters to deer harvested ratios is currently running approximately 4:1 (four hunters to harvest one deer). The hunter, javelina harvest ratio is approximately 5:1 (five hunters per one javelina harvested). The highest number of hunters recorded throughout the state seems to be consistent in both deer and javelina hunts during the 1970's with ratios as high as 8:1.

Below are charts depicting the number of tags issued per hunt in each unit. It was noted while reviewing the available information from the "Hunt Arizona" booklets, the number of tags issued were actually higher than the number of tags permitted for specific hunts. It is unclear what the reasoning behind was as there is no explanation within the booklet. It is important to note that only permitted hunt tags issued were used in this depiction; no archery, junior hunts nor non-permit tags were included due to the fact that this information is unavailable. Summarization of tag numbers issued for each hunt will not be made within this section in order to avoid false interpretations; this information was not available.

Unit 24A Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, whitetail deer, elk, javelina, black bear and mountain lion.

Chart 5-7: Unit 24A Game Tags Issued for mule deer, whitetail deer, javelina and elk.

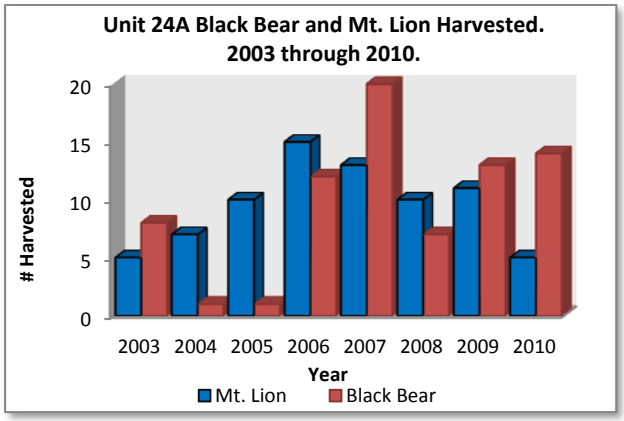


Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 24A for each hunt is currently ranging from: mule deer – 25% to 46%; whitetail deer – 31% to 51%; javelina – 23% to 30%; elk – 0% to 80%.

Black bear and mountain lion tags are issued over the counter and it is impossible to obtain information specific to units although information is given for number of animals harvested in each unit.

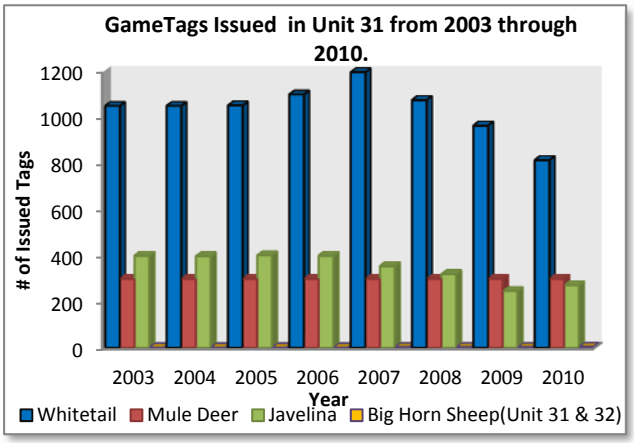
Chart 5-8: Unit 24A Harvest of black bear and mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Unit 31 Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, whitetail deer, javelina, black bear and mountain lion.

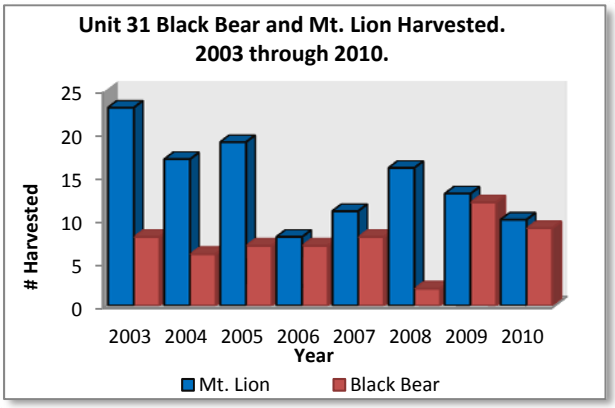
Chart 5-9: Unit 31 Game Tags Issued for mule deer, whitetail deer, javelina and big horn sheep.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 31 for each hunt is currently ranging from: mule deer – 17% to 30%; whitetail deer – 23% to 32%; javelina – 11% to 25%; big horn sheep – 100%.

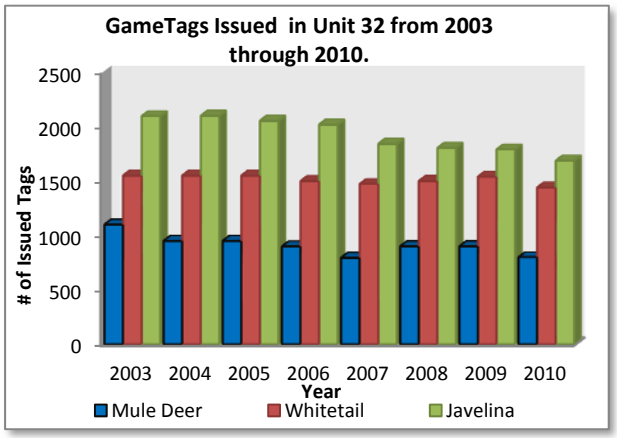
Chart 5-10: Unit 31 Harvest of black bear and mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Unit 32 Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, whitetail deer, big horn sheep (information located in unit 31 above) javelina, black bear and mountain lion.

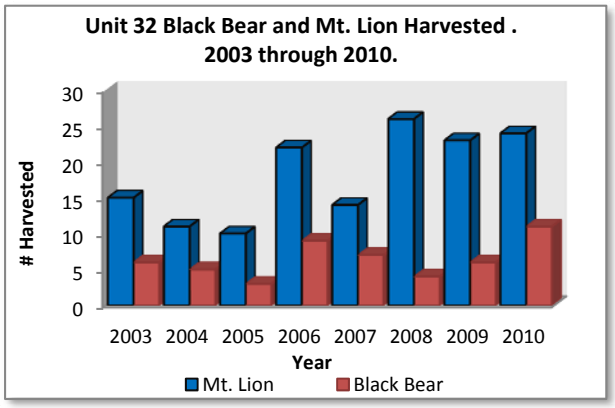
Chart 5-11: Unit 32 Game Tags Issued for mule deer, whitetail deer and javelina.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 32 for each hunt is currently ranging from: mule deer – 13% to 31%; whitetail deer – 35% to 50%; javelina – 20% to 36%.

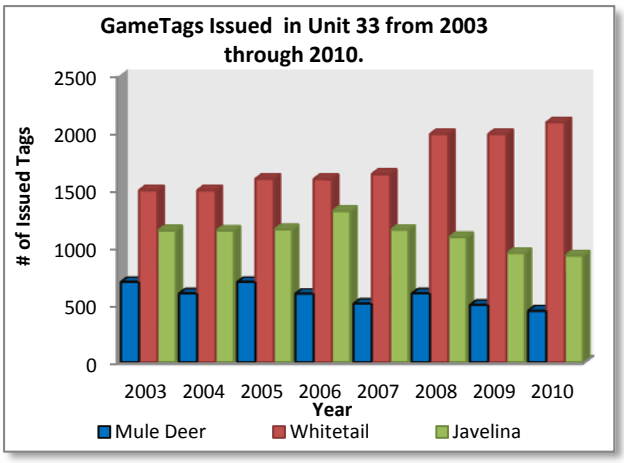
Chart 5-12: Unit 32 Harvest of black bear and mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Unit 33 Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, whitetail deer, javelina, black bear and mountain lion.

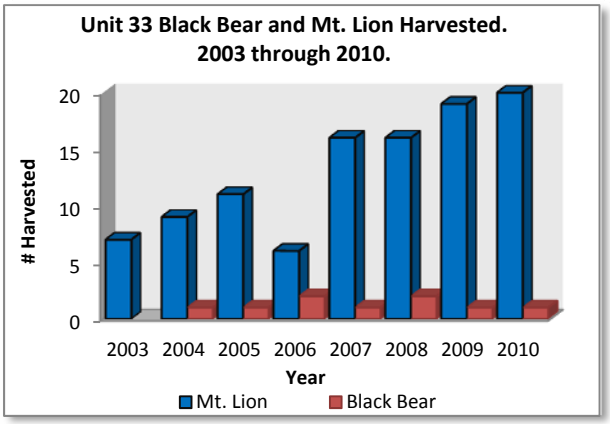
Chart 5-13: Unit 33 Game Tags Issued for mule deer, whitetail deer and javelina.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 33 for each hunt is currently ranging from: mule deer – 11% to 24%; whitetail deer – 39% to 50%; javelina – 15% to 30%.

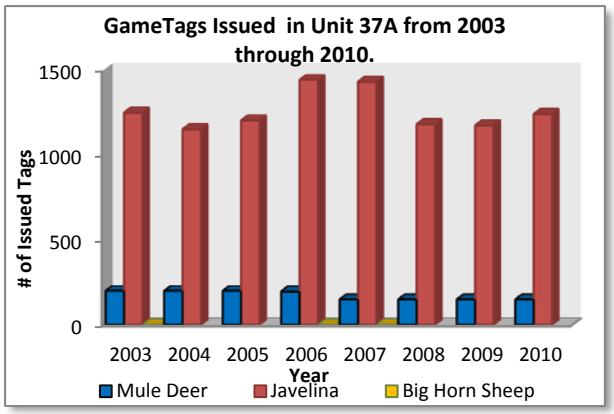
Chart 5-14: Unit 33 Harvest of black bear and mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Unit 37A Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, javelina, big horn sheep and mountain lion.

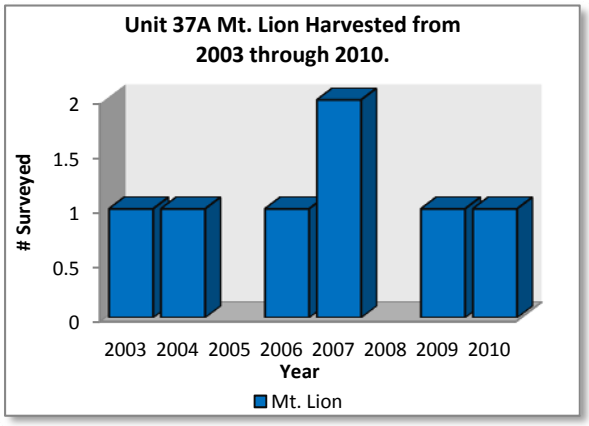
Chart 5-15: Unit 37A Game Tags Issued for mule deer, big horn sheep and javelina.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 37A for each hunt is currently ranging from: mule deer – 6% to 28%; big horn sheep – 100%; javelina – 13% to 25%.

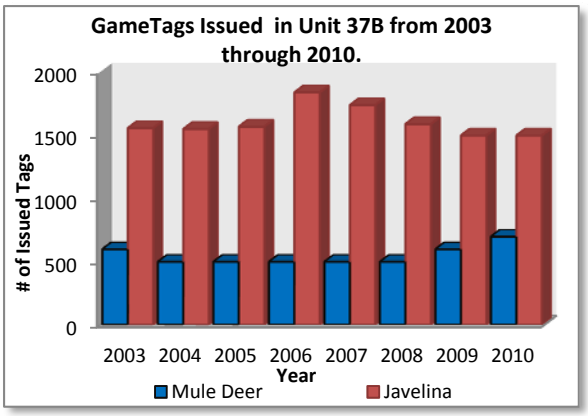
Chart 5-16: Unit 37A Harvest of mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Unit 37B Hunt and Harvest Information – Tags issued within this unit consist of: mule deer, javelina, big horn sheep and mountain lion.

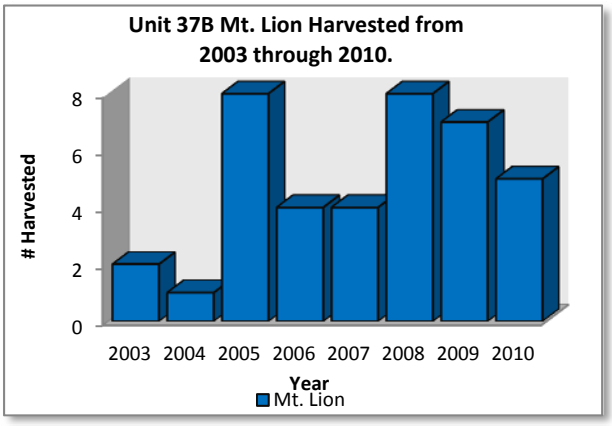
Chart 5-17: Unit 37B Game Tags Issued for mule deer, big horn sheep and javelina.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

Hunter success in 37B for each hunt is currently ranging from: mule deer – 9% to 24%; javelina – 15% to 22%.

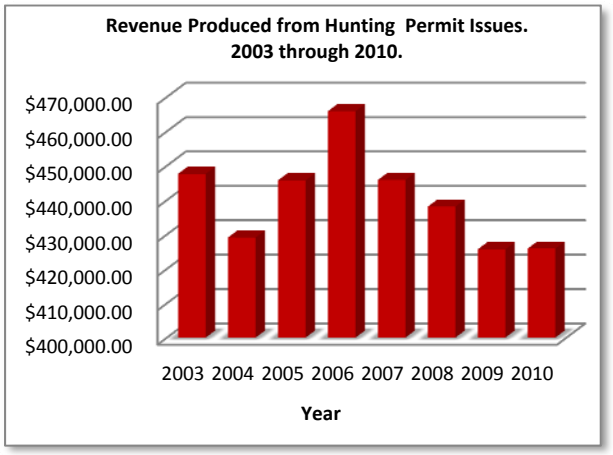
Chart 5-18: Unit 37B Harvest of mountain lion.



Data Source: Arizona Game and Fish Department, "Hunt Arizona; Survey, Harvest and Hunt Data"

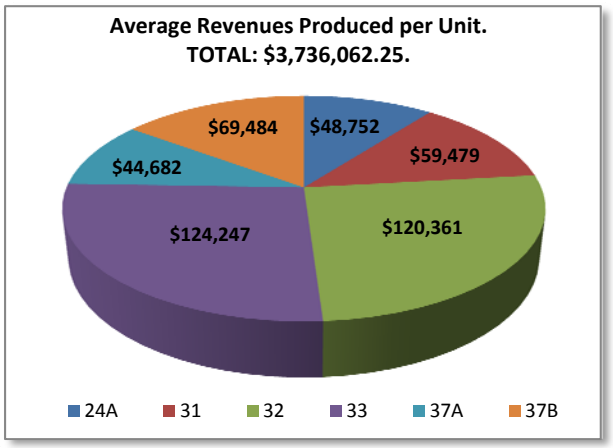
A fairly significant amount of revenue is produced solely through sale of issued hunting permits within the District. The average funds produced each year in all game units is approximately $77,834.63; the lowest average produced is in unit 37A at $44,682.47 per year and the highest funds produced is in game unit 33 at an average of $124,247.44 per year. Total funds derived within these units over the past seven years are approximately $3,736,062.25.

Chart 5-19: Revenues produced per year of big game permits issued over the last seven years in units: 24A, 31, 32, 33, 37A and 37B.



**Revenue derived is from ONLY permitted hunt tags issued and not from hunting license, non-permit tags issued (archery), combined unit hunts or other related cost for the entire unit. Deer tag: $34.75, Javelina tag: $28.75, Bear tag: $29.75, Big Horn Sheep tag: $272.50, Elk tag: $121.50.*

Chart 5-20: Average revenues produced per game unit of big game permits issued over the last seven years in units.



**Revenue derived is from ONLY permitted hunt tags issued and not from hunting license, non-permit tags issued (archery), combined unit hunts or other related cost for the entire unit. Deer tag: $34.75, Javelina tag: $28.75, Bear tag: $29.75, Big Horn Sheep tag: $272.50, Elk tag: $121.50.*

Animal – Fish and Wildlife Habitat Fragmentation:

A fish barrier has been constructed on the Aravaipa Creek and is intended to prevent upstream movements of nonnative fishes from the San Pedro River to portions of Aravaipa Creek populated with threatened native fishes. Construction of the Aravaipa Creek fish barriers was completed in April of 2001. This project was constructed by the Bureau of Reclamation (BOR) with specifically the Loach Minnow and Spike Dace in mind (U.S. Department of Interior. 1998). Final Environmental Analysis was completed by the BOR and approved through the US Fish and Wildlife Service in 1998.

Image 5-16: Fish barrier in the Aravaipa Creek.

Photo courtesy of: Bureau of Reclamation website; http://www.usbr.gov/lc/phoenix/biology/azfish/aravaipacreek.html

Several parcels of land along the San Pedro River have been purchased by wildlife, environmental groups, mining companies and other groups in an effort to preserve land for wildlife and specifically Threatened and Endangered species. Areas purchased by The Nature Conservancy include: the Bates Sale Ranch west of Dudleyville, now called the San Pedro River Reserve; the Nevitz Farm, north of Mammoth; the 111 Ranch river properties, Mammoth; 7B Ranch (Ben Patton) river property, Mammoth; the Woods property,

Dudleyville; the old Panorama Ranch, Aravaipa. The TNC also holds conservation easements on the deeded property of the Painted Cave (old Trails End Ranch) on the Aravaipa (Iming, Diana. TNC Parcels GIS layer. 2012). Lands purchased as mitigation property and water rights by ASARCO and the Salt River Project includes: unsystematic parcel along the Gila River and San Pedro River south of the confluence; PZ Farm, north of Aravaipa; the old Inez Black Farm, Aravaipa. The Arizona Game and Fish Department recently made purchase of the Triangle Bar Ranch including the deeded property along the San Pedro River and the State Lease Lands that compose the ranch for habitat conservation ("Triangle Bar Purchase". 2011).

There are also a few populations of Sonoran Desert big horned sheep located within the District. One is located on the northeastern side along the north rim of the Aravaipa and within the Mineral Mountain range.

Several Species were known to exist within the District at unknown population densities at one time or another but are either now extinct or very rare. One of the species included the Sonoran Pronghorn. This species historically populated areas around the Antelope Peak area. There was an attempt to re-establish populations in the same area but was met with failure. At present, habitat is not concise to this specific species needs. An increase of brush in the area has diminished the possibility of re-establishing the species.

Several different types of wildlife have been re-introduced into specific areas within the District. Some of the most recent introductions are beavers in the San Pedro River and Gould's Turkeys that were released in the Oracle area (Brochu, Ben. Personal correspondence. 2010). Several different types of listed fish species including the Gila Top-minnow and Gila Chub have also been introduced to some of the perennial live waters in upper elevations of the District including the Lyons Fork and Table Mountain areas (Humphrey, Amy and Stephen Williams. Personal correspondence. 2011). There is also documentation of large game species such as mule deer being transplanted from the Kaibab National Forest to locations throughout southern Arizona. One of the areas translocated to within the District includes the Pinal Mountains. Mule deer were transported to the south slopes of the Pinal's in the late 1920's, early 1930's where they dispersed among surrounding areas. Approximately 64 head were released during this time (Heffelfinger, Jim & Paul M. Webb. 2010).

Animal – Fish and Wildlife Water:

Steps have been taken by the Arizona Game and Fish Department to identify game water needs within the District. Several areas have been identified as being priority concerns which include: the 96 Hills and the Aravaipa north rim. Several self-sustaining game waters have been installed over the past three decades in an effort to establish ephemeral water sources specific for wildlife and game species.

Several new, self-sustaining game waters have been constructed and are planned to be constructed within the District. The oldest game waters known to date are located on the east face of Greyback Mountain near the Gila River and on the west face of Brandenburg Mountain, north of the Aravaipa Creek. It is unknown when exactly this water was constructed and if it is still functional. The newest constructed game water catchment, specifically for large game species was constructed on the east mesa of Brandenburg Mountain in Buzan Canyon, north of the Aravaipa Creek (Brochu, Ben. 2008). This game water was constructed in conjunction with the Arizona Game and Fish Department, the BLM, Big Horn Sheep Society and others. There are also several existing catchments on the west face of the 96 Hills and plans for approximately six new catchments to be constructed in the

same area by the Arizona G&F Department. Project commencement started in 2007 and is expected to be completed in 2011 (Brochu, Ben. 2007).

Image 5-17: 96 Game water catchments, 2010.

Photo courtesy of: CouesWhitetail.com. http://forums.coueswhitetail.com/forums/index.php?showtopic=17733

Image 5-18: 96 Game water catchments, 2010.

Photo courtesy of: CouesWhitetail.com. http://forums.coueswhitetail.com/forums/index.php?showtopic=17733

These projects were made possible with in-kind services as well as volunteer work. Estimated cost of pre-project construction is listed below. The 96 Hills Catchment project consist of two separate game waters; the Rock Corral and Coyote Peak catchments. Final costs post-construction are not currently available.

Table 5-9: Estimated project cost for game water catchments installed within the District.

Catchment	96 Hills Catchment – Phase 1	Painted Cave Catchment – Phase 2
Estimated Project Cost	$56,520.00	$10,000.00
Estimated In-Kind Cost	$40,000.00	$117,835.00
Grand TOTAL:	**$96,520.00**	**$127,835.00**

Data Source: Arizona Game and Fish project proposals; 96 Hills Catchment, 2007 and Painted Cave Catchment, 2008.

Animal – Domestic Livestock Water Irrigated Pasture:

Several livestock operations within the District depend on irrigated pasture to supplement livestock need or are the sole use for the livestock operation. Much like large scale ranch management, it is important to initiate grazing management on irrigated pastures as well. By doing so, a producer may ensure plant and livestock health and vigor is maintained throughout the life of the individual fields. One way of implementing grazing management is by installing precisely placed livestock waters and fencing. Most all of the irrigated pastures within the District are currently adequately watered to meet the needs of the stock and the producer.

Table 5-10: Conservation practices applied addressing Animal – Domestic Livestock Water on Irrigated Pastures.

Conservation Practice	Amount	Obligation Cost
Pumping Plant	2 no.	$12,750.00
Pipeline	2 mi.	$11,518.15
Watering Facility	2,900 gal.	$2,926.50
	14 no.	
Grand TOTAL:		**$27,194.65**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Animal – Domestic Livestock Water Rangeland:

Lack of domestic livestock water is a common resource concern throughout the district. Dependability of grazing management on individual ranch units continually suffer from inconsistent water sources, loss of water sources from drought and/or a complete lack of water source infrastructure in pastures. Livestock health as well as land health suffers from continual use around permanent water sources and from traveling long distances to water sources while trying to maintain a calf from year to year. Many steps have been taken by producers as well as agencies over the last few decades to alleviate this problem by providing permanent water sources to both domestic livestock and wildlife species alike.

Table 5-11: Conservation practices applied to address Animal – Domestic Livestock Water on Rangelands.

Conservation Practice	Amount	Obligation Cost
Wells	16 no.	$158,739.62
Pumping Plant	18 no.	$104,012.40
Pipeline	75 mi.	$377,985.64
Watering Facility	331,967 gal.	$144,715.39
	111 no.	
Stock Pond	1 no.	$3,7500
Grand TOTAL:		**$822,953.05**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Table 5-12: Conservation practices planned to address Animal – Domestic Livestock Water on Rangelands.

Conservation Practice	Amount	Obligation Cost
Wells	6 no.	$120,850.00
Pumping Plant	5 no.	$60,000.00
Pipeline	4.1 mi.	$55,676.00
Watering Facility	83,500 gal.	$88,355.00
	21 no.	
Spring Development	1 no.	$1,350.00
Grand TOTAL:		**$326,231.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

It is important to note that most all livestock waters are continually left on or full to provide water for several reasons such as minimizing maintenance on the facilities, provide water for local wildlife populations, and to provide water for stray livestock. Many of these livestock waters provide means for smaller wildlife such as birds or varmints to water and leave waters safely through use of different types of escape ramps.

Image 5-19: Typical wildlife escape ramp.

Photo courtesy of: Stu Tuttle. USDA NRCS. 2012.

Livestock Water Needs Estimates – 1980 Field Report

Comparing estimates of completed practices from the 1980 Field Report to the 2011 assessment on livestock water need for all land uses; the District is well underway to reaching needs goals. Some designated needs such as stock ponds are minimal partly due to cost of construction this practice, feasibility and policy changes within the State Land Department and Arizona Department of Water Resources. It is becoming more difficult to obtain permits to construct stock ponds because they are now seen as "encumbrances" and pond sizes must

match with water rights. There are strong concerns that any installed practice that requires movement of soil or any type of erosion control structure in gullies not be built to impound water.

Table 5-13: Conservation practices applied to address Animal – Domestic Livestock Water on Rangelands compared to the 1980 Field Assessments.

Conservation Practice		Completed	Planned	Percent to Estimated Goal
Well	no.	229	23	***69%***
Pumping Plant	no.	N/A	N/A	***N/A***
Pipeline	mi.	133	53	***141%***
Watering Facility*	no.	798	403	***28%***
Stock Pond	no.	2	4	***25%***

Data Source: WNRCD Field Report, 1980.
** Includes: haul waters, storage tanks and water troughs from the 1980 Field Report.*

Plant Condition

Two plant condition resource concerns were elected as priority resource concerns within the District. They are: degradation plant condition, undesirable plant productivity and health; degraded plant condition, excessive plant pest pressure.

Plant Condition – Undesirable Plant Productivity and Health

Plant condition is considered a resource concern whenever plants do not manufacture sufficient food to continue the growth cycle or to reproduce in its own capacity. Plant condition is frequently a concern where proper grazing management is not being applied, successive years of drought have altered grazing management schemes and/or invasive species have altered grazing management schemes.

Conservation practices applied to address this resource concern are generally those that maintain or improve the health, photosynthetic capability, rooting and reproductive capability of vegetation. Practices may include brush management, critical area planting, deferred grazing, fencing, herbaceous wind barriers, nutrient management, pest management, prescribed grazing, prescribed burning, range planting, recreation area improvement, wildlife upland habitat management, and windbreak establishment.

Currently, every land unit within the District is experiencing this resource concern to some degree. Successive years of drought, coupled with consistent stocking rates or unsystematic grazing habits as well as a lack of proper infrastructure have caused a decline in plant productivity, health and vigor in some areas. This also is a factor in discontinuity in wildlife species within the district. Many land owners and operators have taken steps in the past years to address this resource concern on their own or with the aid of agencies.

Livestock Management for Plant Condition

Most all producers within the District have experimented with or are practicing some type of grazing management over the years to sustain or increase plant productivity and health on their grazing lands. Approximately 50% of producers have initiated some type of proper rotational grazing program whether it is deferred grazing, the three pasture system, best pasture system or general rest/rotation. Over 80% of those ranches have large acreages (in comparison to their total acreages) of federal lands. On most of these ranches mandatory compliance with federal policy requires the incorporation of some grazing system.

Many producers that have voluntarily attempted to implement rest/rotational grazing have met extreme challenges during years affected by drought that ended up with

detrimental effects. Many that have run into these challenges have voluntarily chosen to revert to what had worked in the past. It was stated that several factors were causative to the failure of their programs. One was that acclimated livestock, most of which represent many years of intensive breeding to achieve the ranchers' livestock quality goals, have developed home range territories and tend to destroy pasture land by overgrazing and trampling along fences nearest their home range. Few of these operators would be willing to replace their developed herds with non-acclimated cattle. There cannot be economic justification for total replacement of resident herds: new cattle would not be familiar with native forage species; livestock will be lost from poisonous plants and stress-induced diseases; the feed conversion efficiency of the new livestock may not be known; and there would be a discrepancy in revenues generated from the sale of the resident herd versus the cost of the replacement herd. In addition, ranchers mentioned that most rotation systems were not flexible enough to take advantage of peak forage palatability periods (mainly of annual species) and much of the actual range forage production was not harvested (Meyer, W. Walter. 1980).

A third commonly mentioned failure was that economic losses from total revenue jeopardized the financial structure within the ranch unit. Monetary losses were commonly incurred from reduction in calf crop and animal weights and in an increase in variable costs (Meyer, W. Walter. 1980).

The variety of land types within the District also offer up specific challenges in implementing prescribed grazing rotations. Much of the District is considered to be in browse and winter annual type country where livestock may utilize these areas year round. Many producers choose to leave livestock in pastures year-round but stocked at low numbers to protect the carrying base. Other areas in the higher elevations are considered grasslands/pine forest and should experience some type of rotational grazing to protect the perennial grass base. Although land units that are solely considered as a perennial grass type condition a basically non-existent in the District, there are areas that have a majority of this land type mixed with chaparral/browse land types and can easily concoct some type of rest rotation/deferred grazing rotation.

Considering the capital and time investment by producers to develop established breeding herds, attempts to establish a universal remedy grazing system may be counterproductive. More progressive steps on individual operations must be made toward livestock with greater forage conversion efficiency, therefore assuring the production of more pounds of beef while using less forage. Optimization of range moisture or plant photo conversion efficiency is not necessarily attainable; we can only capitalize on animal efficiency in harvesting in rangeland energy resources and try to ensure sustained production of out rangelands.

Some grazing management changes have been initiated through technical assistance from NRCS and voluntarily by the producer. As encouragement to carry out a drastic change in livestock management, NRCS has selected to give an incentive payment to offset some of the cost of grazing rotation changes. To date, less than 1% of producers within the District have taken advantage of this incentive payment. Construction of new fencelines to create new pastures has also been a well utilized practice within the District. The goal of many new pastures is to change livestock management in certain areas, increase use efficiency and grazing timing.

Table 5-14: Conservation practices applied addressing Plant Condition – Undesirable Plant Productivity and Health on Rangelands.

Conservation Practice	Amount	Obligation Cost

Prescribed Grazing	259,666 ac.	$258,389.00
Fenceline	20 mi.	$192,000.65
Grand TOTAL:		**$450,389.65**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

Table 5-15: Conservation practices planned addressing Plant Condition – Undesirable Plant Productivity and Health on Rangelands.

Conservation Practice	Amount	Obligation Cost
Prescribed Grazing	3,402 ac.	$500.00
Fenceline	2.5 mi.	$30,412.00
Grand TOTAL:		**$30,912.00**

Data Source: Protracts report for Tucson NRCS Field Office. 2011.

It was stated in the 1980 Field Report that only 23% of livestock producers practiced some type of grazing management that incorporated deferred grazing or rest/rotation practices. With the construction of permanent water sources, installation of pasture fences, and incorporation of irrigated pasture in rangeland grazing activities; it is easy to say that nearly 50% of producers are currently practicing a scheduled grazing rotation. Awareness of management practices and flexibility of grazing timelines within agencies has aided in grazing practice successes throughout the District.

Table 5-16: Conservation practices applied to address Plant Condition on Rangelands compared to the 1980 Field Assessments.

Conservation Practice		Completed	Planned	Percent to Estimated Goal
Fenceline	mi.	1,240	65	***33%***
Prescribed Grazing	no.	N/A	N/A	***N/A***

Data Source: WNRCD Field Report, 1980.

Seeding

Several factors appear to be causative to seeding failures within the District. One is that not enough consideration has been given to the potential competition from annual species that can more efficiently utilize soil moisture and are more efficient in photosynthesis. The two distinct growing periods in the WNRCD produce two different crops of annual species that will complicate seeding programs. Another major causative factor is that not enough importance is given to rainfall when conducting seeding trials within the District.

During the early 1990's, the USDA-NRCS Tucson Plant Materials and Field Office implemented a Conservation Field Planting Pilot Project for the District. The objective of this pilot project was to: 1: Increase District insolvent in the SCS-PM (NRCS formerly the Soil Conservation Service); 2: Provide landusers/owners and incentive to become involved with Conservation Districts and SCS in development of resource management plans; 3: Increase knowledge about plant materials in testing or recently released seeds; and 4: Promote conservation field plantings. This pilot project required SCS and producers/land owners to develop planting plans and evaluate success of plant species distributed (NRCS, Plant Materials files). Several producers within the District participated in this specific seeding trial. The goals of these specific trials were to improve range condition, establish vegetational cover in holding areas and revegetation following mechanical brush management.

Table 5-17: Producer and District led seeding trials within the Winkelman District.

District Seeding Trials		
Box O Ranch - 1991		
Plant Species	**MLRA D40.2**	**Species/Trial Success**
Plains bristlegrass	*Setaria leucopila*	Fail
Sand dropseed	*Sporobolus cryptandrus*	Semi-establishment
Sideoats grama	*Bouteloua curtipendula*	Fail

Alkali sacaton	*Sporobolus airoides*	Fail
Cochise lovegrass	*Eragrostis atherstonii*	Fail
Rafter T Ranch - 1991		
Plant Species	**MLRA D40.1**	**Species/Trial Success**
Cochise lovegrass	*Eragrostis atherstonii*	Semi-establishment
Yellow bluestem	*Bothriochloa ischaemum*	Fail
Plains bristlegrass	*Setaria leucopila*	Fail
Sideoats grama	*Bouteloua curtipendula*	Fail
Sand dropseed	*Sporobolus cryptandrus*	Semi-establishment
Willow Springs Ranch - 1991		
Plant Species	**MLRA D 41.3**	**Species/Trial Success**
Saco barley	*Hordeum spp.*	Semi-establishment
Falcon Valley Ranch - 1991		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Fourwing saltbush	*Atriplex canescens*	Semi-establishment
Sand dropseed	*Sporobolus cryptandrus*	Semi-establishment
Magma Copper Nursery Plot - 1993		
Plant Species	**MLRA D40.1**	**Species/Trial Success**
Buffelgrass	*Pennisetum ciliaris*	Semi-establishment
Cane beardgrass	*Bothriochloa barbinodis*	Semi-establishment
Arizona cottontop	*Digitaria californica*	Semi-establishment
Quailbush	*Atriplex lentiformis*	Established
Mediterranean ricegrass	*Piptatherum miliaceum*	Fail
'Panochè' brome	*Bromus rubens*	Fail
Plains bristlegrass	*Setaria leucopila*	Fail
'Brando' brome	*Bromus hordeaceus*	Fail
Desert needlegrass	*Achnatherum speciosum*	Fail
Blue buffelgrass	*Cenchrus polystachion*	Fail
'Zoro' fescue	*Vulpia myuros*	Fail

Data Source: NRCS Tucson Field Office files.

Other seeding trials have commenced outside of this pilot program in conjunction with the NRCS. These sites are considered as "Nursery Plots" and plant species are expected to establish and re-establish without further maintenance. The following summarizations are of individual Nursery Plots that were established within the District.

Slash S Ranch Nursery Plot

This nursery plot was established in February of 1984. The plot is located on private lands south of the headquarters in the Dripping Springs Wash area. this site is in the Mogollon Transition (formerly the Arizona Interior Chaparral-Grassland CRA) CRA. Ecological sites is a loamy bottom that is somewhat protected from flooding. The plot size is approximately 100 ft by 50 ft. Species were mainly seeded by broadcast seeding.

Table 5-18: Slash S nursery plot seeding trial.

Slash S Ranch – 1984-88		
Plant Species	**MLRA D38.1**	**Species/Trial Success**
Notable wattle	*Acacia notabilis*	Fail
Crested wheatgrass	*Agropyron cristatum*	Fail
Fourwing saltbush	*Atriplex canescens*	Semi-establishment
Quailbush	*Atriplex lentiformis*	Fail
Saltbush	*Atriplex spp.*	Fail
Australian saltbush	*Atriplex semibaccata*	Fail
Yellow bluestem	*Bothriochloa ischaemum*	Fail
Cane beardgrass	*Bothriochloa barbinodis*	Fail
Sideoats grama	*Bouteloua curtipendula*	Fail
Black grama	*Bouteloua eriopoda*	Fail
Blue grama	*Bouteloua gracilis*	Fail
'Brando' soft chess brome	*Bromus hordeaceus*	N/A
'Panoche' red brome	*Bromus rubens*	N/A
Blue buffelgrass	*Cenchrus polystachion*	N/A
Orchard grass	*Dactylis glomerata*	Fail
Arizona cottontop	*Digitaria californica*	Fail

Boer lovegrass	*Eragrostis chloromelas*	Fail
Cochise lovegrass	*Eragrostis atherstonii*	Fail
Sandhill lovegrass	*Eragrostis trichodes*	Fail
Winterfat	*Krascheninnikovia lanata*	Fail
Kochia	*Kochia spp.*	Fail
Mediterranean ricegrass	*Piptatherum miliaceum*	Fail
Common kleingrass	*Panicum coloratum*	Fail
Fountain grass	*Pennisetum setaceum*	Fail
Koleagrass	*Phalaris aquatica*	Fail
Wintergreen harding grass	*Phalaris tuberosa*	Fail
Plains bristlgrass	*Setaria leucopila*	Fail
Alkali sacaton	*Sporobolus airoides*	Fail
Spike dropseed	*Sporobolus contractus*	Fail
Balloon pea	*Sutherlandia frutescens*	Fail
'Zorro' annual fescue	*Vulpia myuros*	Fail

Data Source: NRCS Tucson Field Office files.

Campstool Ranch Nursery Plot

This nursery plot was established in 1976 and a second trial was commenced in 1984. The nursery plot is located on private lands east of the ranch headquarters along the main road going to the Home Ranch. The nursery plot is located in the Sonoran Basin and Range (formerly the Upper Sonoran Desert Shrub CRA) CRA. Soils on the plot are moderately sloping in old alluvium from granitic, volcanic and sedimentary rocks. This plot is approximately 50 ft by 50 ft in dimensions. Seed beds were prepared by plowing or disking with broadcast seeding.

Table 5-19: Campstool nursery plot seeding trial.

Campstool Ranch - 1984-88		
Plant Species	**MLRA D40.1**	**Species/Trial Success**
Notable wattle	*Acacia notabilis*	Fail
Crested wheatgrass	*Agropyron cristatum*	Fail
Fourwing saltbush	*Atriplex canescens*	Semi-establishment
Quailbush	*Atriplex lentiformis*	Fail
Saltbush	*Atriplex spp.*	Fail
Australian saltbush	*Atriplex semibaccata*	Fail
Yellow bluestem	*Bothriochloa ischaemum*	Fail
Cane beardgrass	*Bothriochloa barbinodis*	Established
Sideoats grama	*Bouteloua curtipendula*	Semi-establishment
Black grama	*Bouteloua eriopoda*	Established
Blue grama	*Bouteloua gracilis*	Fail
'Brando' soft chess brome	*Bromus hordeaceus*	N/A
'Panoche' red brome	*Bromus rubens*	N/A
Blue buffelgrass	*Cenchrus polystachion*	Fail
Buffelgrass	*Cenchrus spp.*	Established
Orchard grass	*Dactylis glomerata*	Fail
Arizona cottontop	*Digitaria californica*	Fail
Boer lovegrass	*Eragrostis chloromelas*	Established
Cochise lovegrass	*Eragrostis atherstonii*	Established
Sandhill lovegrass	*Eragrostis trichodes*	Fail
Winterfat	*Krascheninnikovia lanata*	Fail
Kochia	*Kochia spp.*	Fail
Mediterranean ricegrass	*Piptatherum miliaceum*	Fail
Common kleingrass	*Panicum coloratum*	Established
Fountain grass	*Pennisetum setaceum*	Fail
Koleagrass	*Phalaris aquatica*	Fail
Wintergreen harding grass	*Phalaris tuberosa*	Semi-establishment
Plains bristlgrass	*Setaria leucopila*	Semi-establishment
Alkali sacaton	*Sporobolus airoides*	Fail
Spike dropseed	*Sporobolus contractus*	Fail
Needlegrass	*Achnatherum speciosum*	Fail
Balloon pea	*Sutherlandia frutescens*	Fail
'Zorro' annual fescue	*Vulpia myuros*	Fail

Data Source: NRCS Tucson Field Office files.

Flying U W Ranch Nursery Plot

This nursery plot was established in 1991 and again revisited in 2007. This plot is within the Southeastern Arizona Basin and Ranch (formerly the Chihuahuan Semidesert Grassland CRA) CRA. This site is located on private lands east of the old Rabbit Ranch, north of the Whitehead Well. Two different ecological sites are within this plot: loamy upland and sandy loam upland. This nursery plot is approximately 75 ft by 75 ft in dimension.

Table 5-20: Flying U W nursery plot seeding trial.

Flying U W Ranch – 1991 & 2007		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Notable wattle	*Acacia notabilis*	Fail
Crested wheatgrass	*Agropyron cristatum*	Fail
Fourwing saltbush	*Atriplex canescens*	Fail
Quailbush	*Atriplex lentiformis*	Fail
Saltbush	*Atriplex spp.*	Fail
Australian saltbush	*Atriplex semibaccata*	Fail
Yellow bluestem	*Bothriochloa ischaemum*	Established
Cane beardgrass	*Bothriochloa barbinodis*	Established
Sideoats grama	*Bouteloua curtipendula*	Semi-establishment
Black grama	*Bouteloua eriopoda*	Fail
Blue grama	*Bouteloua gracilis*	Fail
'Brando' soft chess brome	*Bromus hordeaceus*	Fail
'Panoche' red brome	*Bromus rubens*	Fail
Blue buffelgrass	*Cenchrus polystachion*	Fail
Buffelgrass	*Cenchrus spp.*	Fail
Orchard grass	*Dactylis glomerata*	Fail
Arizona cottontop	*Digitaria californica*	Semi-establishment
Lehmann lovegrass	*Eragrostis lehmanniana*	Established
Sandhill lovegrass	*Eragrostis trichodes*	Fail
Winterfat	*Krascheninnikovia lanata*	Fail
Kochia	*Kochia spp.*	Semi-establishment
Mediterranean ricegrass	*Piptatherum miliaceum*	Fail
Blue panic	*Panicum virgatum*	Established
Common kleingrass	*Panicum coloratum*	Established
Fountain grass	*Pennisetum setaceum*	Fail
Koleagrass	*Phalaris aquatica*	Fail
Wintergreen hardinggrass	*Phalaris tuberosa*	Fail
Plains bristlgrass	*Setaria leucopila*	Fail
Alkali sacaton	*Sporobolus airoides*	Semi-establishment
Spike dropseed	*Sporobolus contractus*	Fail
Needlegrass	*Achnatherum speciosum*	Fail
Balloon pea	*Sutherlandia frutescens*	Fail
'Zorro" annual fescue	*Vulpia myuros*	Fail

Data Source: NRCS Tucson Field Office files.

Several field trials were implemented within the District as well. These seedings were conducted following brush control, mostly bulldozing.

Flying U W Field Trial

This field trial occurred in 1987 after removal of dense mesquite, catclaw and whitethorn patches. This trial is located on private lands south of the headquarters and is approximately 5 acres in size. The site is on a clayey to loamy upland. Species were broadcast seeded and are listed in the following table.

Table 5-21: Flying U W Ranch field trial.

Flying U W Ranch – 1987		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Sideoats grama	*Bouteloua curtipendula*	Fail
Fourwing saltbush	*Atriplex canescens*	Established
Boer lovegrass	*Eragrostis chloromelas*	Established
Buffelgrass	*Cenchrus spp.*	Fail

Winterfat	*Krascheninnikovia lanata*	Fail
Yellow bluestem	Bothriochloa ischaemum	Semi-establishment
Prostrate kochia	Kochia prostrata	Fail

Data Source: NRCS Tucson Field Office files.

Haydon Combe Ranch Field Trial

This field trial occurred in 1981 in the Rabbit Pasture on private lands southeast of the ranch headquarters. The site is located in loamy uplands and loamy bottoms. The goal of this planting was to compare Cochise lovegrass to Boers lovegrass with an addition of Fourwing saltbush. A two-row grain drill was used as the planting method.

Table 5-22: Haydon Combe Ranch field trial.

Haydon Combe Ranch – 1981		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Cochise lovegrass	*Eragrostis atherstonii*	Fail
Fourwing saltbush	*Atriplex canescens*	Fail
Boer lovegrass	*Eragrostis chloromelas*	Fail

Data Source: NRCS Tucson Field Office files

Falcon Valley Ranch Field Trial

This field trial was established in 1981 with the objective to evaluate several strains of buffelgrass for cold hardiness at mid elevations. This site is on a sandy loam ecological site. Seedbed was prepared by ripping and disking with seeds drilled with a hand planter.

Table 5-23: Falcon Valley Ranch field trial.

Falcon Valley Ranch – 1988		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Buffelgrass	*Cenchrus spp.*	Established

Data Source: NRCS Tucson Field Office files

It is important to note that this site is currently being treated for eradication of buffelgrass by the NRCS due to its status of a noxious and invasive species.

Page Ranch Field Trial

This filed trial was established in 1984. The objective of this planting was to evaluate windbreaks, fuel wood and critical area stabilization on abandoned cropland to determine techniques and practices needed for establishment under dryland conditions. The seedbed was prepared by ripping and clearing with planning of individual 10 gallon tree container transplants with broadcast seeding of herbaceous species. A 10 ft by 10 ft plot was established.

Table 5-24: Page Ranch field trial.

Page Ranch – 1984		
Plant Species	**MLRA D41.3**	**Species/Trial Success**
Eucalyptus spp.	*Eucalyptus spp.*	Semi-establishment
Acacia spp.	*Acacia spp.*	Semi-establishment
Fourwing saltbush	*Atriplex canescens*	Semi-establishment
Cane beardgrass	*Bothriochloa barbinodis*	Fail
Hairy grama	*Bouteloua hirsuta*	Fail
Slender grama	*Bouteloua repens*	Fail
Mediterranean ricegrass	*Piptatherum miliaceum*	Fail
Penstemon spp.	*Penstemon spp.*	Fail
Sand dropseed	*Sporobolus cryptandrus*	Semi-establishment
Alkali sacaton	*Sporobolus airoides*	Fail

Data Source: NRCS Tucson Field Office files

These specific nursery plots have not been monitored or kept up so current success is of seeding trials is unknown. It was noted that much of the failure of establishment of these species was due to livestock grazing, ants, lack of weed control coupled with inadequate timing of rainfall. Seeding is also not a cost effective method for rangeland improvement because native seeds are expensive, it is hard to find

local native seed growers and climate does not always follow through as hoped.

Plant Condition – Drought Effects

Drought plays a major role in plant condition, health and vigor and how successful proper grazing management really is. Timing, duration and amount of precipitation are a key component to plant species wellbeing within the District that supports livestock management. Some plant species are more mesic, depending on winter and early spring precipitation to kick-start growth for spring and summer; where other plant species depend on monsoon rainfall for growth. Although precipitation changes are hard to predict because of variability, it has been an observation that rainfall patterns within the District have been changing over the last three decades. Winter and summer precipitation is falling later in the seasons, less precipitation per storm event or storm events that are drastic, intense and of short duration seem to be becoming the norm. There has also been an observation of less snowfall events in the lower elevations compared to two decades ago (Cline, Katie E. Personal Observation. 2012).

Drought has a lasting effect on many plant species throughout the District. Many plant species such as trees and shrubs are able to withstand long periods of drought where herbaceous (perennial grasses/forbs) cannot if proper timing of precipitation is not received. Livestock grazing can have a compounding effect on specific plant species and completely destroy them from areas thus changing the ecological sites into a threshold state forever. When considering grazing management practices, producers and agency personnel alike take into account these possibilities.

Portions of the District (Pinal, Pima, Gila, and Graham Counties) have been reported in a "moderate" to "severe" drought impacts periodically over the last 20 years although the District has only been declared in an actual "drought disaster area" very few times ("Drought Monitor Archives". 2011). Declaration of a drought disaster relies on reports produced by Federal agencies depicting production of standing biomass, amount of available water, supplementation of farming activities and livestock production, etc.

Plant Condition – Excessive plant pest pressure

Excessive plant pest pressure is a concern when excessive damage to plants including that from undesired plants (noxious or invasive), diseases, animals, soil borne pathogens and nematodes are in excess to a historically functioning resource. Noxious and invasive plants are a resource concern whenever these species cause unsuitable grazing conditions for livestock or wildlife and due to their potential to out-compete native species which are generally preferred for wildlife habitat value. Increases in noxious and invasive plants can result from poor grazing management, drought, climate change, motorized off-road travel, road paving, intentional transplanting and other causes.

Conservation practices applied to address this resource concern are generally those that control the establishment or reduce the population of noxious and invasive plant species. Practices may include brush management, deferred grazing, fencing, forest stand improvement, pest management, prescribed burning, prescribed grazing, and wildlife upland habitat management.

There is an extensive amount of land within the District; both on irrigated lands and rangelands, that are considered to be in an altered state or in a transition to an altered stated due to overabundance of a multitude of species. Species that are considered to be noxious and/or invasive on these land types are: mesquite, salt cedar, whitethorn, turpentine bush, snakeweed, burroweed, creosote bush, wait-a-bit, prickly pear, cholla, Lehman

lovegrass, Boer lovegrass, buffelgrass, fountain grass, Mediterranean grass, sand-bur, redstem filaree, silver-leaf nightshade, yellow star thistle, Sahara mustard, etc ("2011 Arizona NRCS Noxious and Invasive Species". 2011). A number of these species have been introduced by agencies as erosion control agents or better forage for livestock.

Producers within the District have independently taken on the challenge of minimizing or eradicating noxious and invasive species mainly with hand cutting or bulldozing practices. Although relief is immediate after completion of brush management, maintenance is an on-going and mostly neglected practice. Much of what brush has been removed already needs to be retreated if the original desired outcome is to succeed.

Bulldozing of individual undesirable species has been widely used for rangeland improvement throughout the District.

It was estimated in the 1980 Field Report that approximately 65,000 acres had been treated with few desired results. Since this time, less than 1% of that acreage has continued maintenance. Very little brush management on large scale has been undertaken by any producer since then.

Below is a table of producers and land units that have participated in some type of brush management. Land that is classed as potential mechanical treatment and seeding should take into account slopes and soil types that will remain stable and endure mechanical disturbance. Specific considerations in determining method of treatment in past practices were surface and subsurface soil textural classes, stoniness, degree of slope, and present vegetational composition.

Table 5-25: District land units with types of brush management implemented.

Land Unit	Method	Acreage	Year	Target Species	Follow Up	Cooperating Agencies
YLE	Hand Grubbing	60-80	1974/75	palo verde, cacti, mesquite, whitethorn	none	
Bar Flag*	Dozing/windrowing	N/A		Mesquite, catclaw	none	
Government Springs	Dozing/windrowing	N/A		Mesquite, catclaw	10 ac in 2010	NRCS
Willow Springs Ranch*	Chaining, cabling	400	1960/70's	Mesquite, catclaw, wait-a-bit	none	
Willow Springs Ranch	Mechanical grubbing, prescribed fire	N/A	1979, 1995	Catclaw, mesquite, whitethorn	none	NRCS
Flying U W Ranch	Dozing/chemical	40	1985/92	Mesquite, whitethorn	None	
Haydon Combe Ranch	Dozing	100	1989	Mesquite, catclaw, wait-a-bit, whitethorn	None	
Romero Ranch	Hand Cutting	20	1997/99	Mesquite	Periodic removal	
XT Ranch	Chaining, root plowing	N/A	1969	Mesquite, whitethorn, creosote bush	Seeding	NRCS
XT Ranch	Contouring, pitting	N/A			Seeding	NRCS, UofA, AED
Campstool Ranch	Hand Cutting, dozing	10	1980's	Chainfruit cholla	none	
Campstool Ranch	Prescribed burning	N/A	1980's	Creosote, whitethorn, catclaw, mesquite	Prescribed fire	NRCS

Data Source: Winkelman NRCD, 1980 Field Report. Tucson NRCS Plant Materials and Field Office files.
** Specific information for these land units was taken from the 1980 Field Report.*

Species such as pensia have been located in the Oracle area but, in small amounts. The District has taken the lead in the past to contact owners affected by this particular species and physically treat these areas during two separate treatments.

Initiatives have been taken by independent power companies to clear excess woody plant species growth from underneath power lines throughout the District. The largest of the projects was to completely remove tree and large shrub species under the 500 kVA that runs through the District from Red Rock to St. Joseph, Arizona. This project was completed in the District in 2009. Another such project has been partially completed under the power line that runs through the Falcon Valley Ranch to Oracle.

Image 5-20: Brush removal under the 500 kVA power line.

Image Source: Katie Cline. 2008.

Other Resource Concerns and Factors

Prescribed Fire – Prescribed fire has been a chosen alternative to brush management mainly by Federal agencies. It is difficult for private producers to fully commit to a fire management plan that utilizes prescribed fire because of liability alone. To date, there are no known large scale prescribed burns that have been privately funded within the District although, several prescribed burns have been completed by the US Forest Service on the Campstool Ranch in the late 1980's, early 1990's and on the Government Springs Ranch in the late 2000's.

Wildfire – Numerous large wildfires and smaller, less intensive fires have engulfed a large portion of the District since the 1980 Field Report. Many of these wildfires are not limited to the higher, more vegetated elevations, although most of the more devastating wildfires have occurred where located in the higher elevations. These wildfires have been a major factor in vegetational changes and the cause of severe sedimentation in lower elevations, even in residential areas.

Although this has not necessarily been the case in land managing agencies fire fighting directives; in recent history the USFS and the BLM fire managers have taken the perspective of actively managing wildfires for land benefit. In other words, when dynamic wildfires have a low severity fire behavior and do not pose threats to human interface or major structural damage; fires will be actively managed to maximize benefit to range or wildlands. These are decided on a case by case basis when wildfires occur. The State of Arizona also has a Fire branch within the agency. At current, directives are for fire suppression on State Trust Lands (Patton, John. Personal Correspondence. ASLD. 2010).

The use of fire for range improvement may be restrictive to land types other than chaparral vegetation until competitive, adaptable, desirable species are found or developed. Old burns in the 38.1 CRA, Lower and Middle Mogollon Transitions, in the Pinal Mountains (1950's) and Black Mountain (1968) regions did not completely remove the native chaparral species. Chaparral is commonly classified as a fire type, although it flourishes despite fire. Some chaparral species such as Manzanita, ceanothus and sumac species produce large quantities of hard-coated seeds that tend to lie

dormant in the soil until fire scarify or cracks the seed coat and promotes germination.

Periodic wildfires that occur at moderate intervals (15 to 30 years) can help maintain a balance between herbs and shrubs. In the absence of fire for longer periods, shrubby species and cacti can become dominant. The interactions of drought, fire and continuous livestock grazing can, over time, result in the loss of palatable grasses, half shrubs and suffrutescent forbs. In some situations non-native annuals can dominate the site. These species can, over time, diminish the soil seed-bank of native annual species. Non-native annuals can act to increase the fire frequency of areas of the site near roads and urban areas, where the incidence of man-made fires is high (Ecological Site Description, Plant Community Assessments. 2009).

A fire that was intentionally set by a landowner in the 1920's in the Tecoloté Ranch, 96 Ranch and Haydon Combe Ranch area in the 38.1 CRA completely changed rangeland dynamics from a Mogollon – Chaparral land type to a Sonoran Desert land type. It was said the intent of the fire was to open up scrub oak and beargrass dominated sites for livestock grazing. Intensity of the fire coupled with livestock grazing entirely changed the site from 60% to 70% canopy cover of these species to 0% to 5% canopy cover where shrubby buckwheat and turpentine bush now make up the greatest production on these sites; 50% to 70% canopy cover (Meyer, W. Walter. Personal correspondence. 2012).

A wildfire on the eastern boundary of the District on the Painted Cave Ranch in 2000 showed some benefit by initially reducing canopy cover of wait-a-bit and whitethorn by approximately 40% and increasing herbaceous cover on north facing slopes. Although herbaceous cover increased, the increase was mostly due to high production of red brome which is considered an invasive species. Native species such as sideoats, curly mesquite and slender grama were only able maintain normal production. To date, woody species production is back to a pre-burn state due to high resprouting and fairly favorable annual climate. Herbaceous cover is holding static due to the area being remote from water and very little ungulate grazing has occurred (Cline, Katie and Amy Humphrey. Monitoring data. 2008.)

Another wildfire in 1979 on the Dubois Ranch provided for a 100% kill of jojoba, a 90% kill of palo verde and creosote bush, and 80% kill of whitethorn. This burned area is now mainly annual species with some threeawns. Jojoba has made a slight comeback although cover on the site is still very low in 2012 compared to unburned sites; approximately 10% cover of jojoba where it was 50% previously. Major production of this site currently consists of turpentine bush, flattop buckwheat and globe mallow. (Cline, Katie and David Womack. Double Sampling monitoring. 2012).

Image 5-21: Post fire effects, 33 years of re-growth on the Dubois Ranch fire.

Image Source: Katie Cline. 2012.

Image 5-22: Unburned site, 200 yards adjacent to Dubois burned site.

Image Source: Katie Cline. 2012.

It appears that timing of burning is critical and should be based on the response of key species that are present on the proposed burn area. For example, if the aforementioned fire on the Dubois Ranch had occurred other than during the major growing season for jojoba, better results may have been obtained.

Burning in the 40.1, Upper Sonoran Desert CRA can effectively change the vegetational aspect. Fire in 1972 on the Triangle Bar Ranch removed approximately 95% of the palo verde, 70% of the mesquite, and varying amounts of other shrubby species. Sand dropseed, spike dropseed, Rothrock grama, sideoats grama, and similar species are strongly evident in the burned area, although the greatest amount of forage production is now produced by annual species. Today, this site has fairly recovered to the pre-burned state although vigor is low due to continual grazing.

Another large fire that burned on the Teacup Ranch in 1992 completely changed the dynamics of the Granitic Uplands on western slopes and uplands of Greyback Mountain. These sites that originally had a good dispersion of jojoba, flattop buckwheat, palo verde and saguaros have now changed into a brittle bush dominated site with a heavy understory of introduced annul grasses such as red brome and schizmus (Cline, Katie and David Womack. Double Sampling monitoring. 2012). A different fire on the 96 Hills in the same ecological site has shown to have the same affect (Carrillo, Emilio and John Patton. Monitoring data. 2001).

Extensive acreages of 40.1 have been burned throughout the WNRCD. Many wildfires have burned and re-burned the Dripping Springs Mountain range. Much of this rangeland is in fair condition with a good composition of perennial species. A six thousand acre plus wildfire in 1979 in the Black Mountain area killed most of the prickly pear species. An estimated 20% of the mesquite and less than 5% of the catclaw were killed. Compared to pre-fire vegetation, ragweed has become more abundant. The density of snakeweed greatly increases on burned areas in the Lower Sonoran Desert. This site has not been re-evaluated for production and composition information to date.

Fires that occur in the 41.3, Chihuahuan – Sonoran Semidesert Grassland CRA have shown to be fairly beneficial to this land type by knocking back woody species growth if proper timing occurs and if seasonal moisture is retained. Two separate fires that occurred in 1995 on the Willow Springs and Haydon Combe Ranch had shown to somewhat reduce canopy cover with partial kill in species such as wait-a-bit, turpentine bush, mesquite, juniper and oak for a short period of time. Kill is primarily found in canopies where previous mortality or decadence in the canopy is observed. This allows for longer burn time within a woody species. Herbaceous species that exist on these sites were not affected long-term because of appropriate rainfall that was received prior to the burns. Although these fires did not completely kill larger shrub and tree species, it did have a “set-back” affect where it has taken these species a period of years to regain vigor (Cline, Katie and Jenny Cordrey. Double Sampling monitoring. 2012).

Fire is not an uncommon factor in the 41.1, Mexican Oak – Pine Forest and Oak Savannah CRA due to high diversity of plant species and greater biomass production on this resource

area. Large scale, intense fires such as the Aspen Fire that spanned throughout this CRA and into higher elevations of the Catalina Mountain range have had a negative effect on some of these land types. Areas that had been properly managed with a lack of fire where herbaceous cover was successfully produced consistent throughout a pasture aided in a fairly intense burn mosaics that severely knocked back or killed some of the large, old growth Emory oaks and some of the older native perennial grass base (Womack, David. Personal correspondence. 2012). With normal fire regimes, these species are typically tolerant of fire effects. Loss of ground cover due to fire in steeper slopes with shallow bedrock has lead to fairly significant erosion in both uplands and bottom lands within and downstream for burned areas.

Seeding after fire in the WNRCD has received very limited attention. Since ash provides for a good seedbed for adaptive range forage species, seeding after fire should be considered in future management programs.

There have been very few attempts at prescribed fires within the District with the exception of the Hendrickson Ranches and the Campstool Ranch. Several prescribed fires were completed with the aid of the NRCS (formerly the Soil Conservation Service) and the Arizona State Land Department and separate prescribed fires on the Forest Allotments in the Galiuro Mountains on the Campstool Ranch. Monitoring data suggest that goals for a few of the lower elevation prescribed fires were not necessarily met over the long-term. Some kill of creosote bush and whitethorn was seen in the first two years post-burn. Favorable climate and plant characteristics have only restored the burn area back to the pre-burned state. Perennial grasses have not increased but have fluctuated greatly because of climate (NRCS Monitoring data. 1983-2010). Prescribed fires conducted by the U.S. Forest Service on the Galiuro's were conducted to 1) Improve vegetation diversity, density, and availability for livestock and wildlife; 2) To improve watershed conditions. Communication from the Forest Service indicates that prescribed fire goals were successfully met. Within the next ten years post-burn, watershed conditions improved on the mountain range with the addition of several smaller wildfires (Duncan, Chuck. Personal correspondence. 2012).

Below is a list of some recorded fires that have occurred within the District over the last 31 years. Most information is of recent years because wildfire information has not been readily accessible previously to the year 2000. Most incidents listed below before those dates are from historical accounts.

Table 5-26: Historic fire occurrences and types within the District.

Year	Fire Name	Acreage	Location	Vegetation Type
1972	N/A	180	Triangle Bar	Upper Sonoran Desert
1979	N/A	80	Dubois Ranch	Chaparral
1979	N/A	6,000	Black Mountain	Upper Sonoran /Semi Desert Grassland
1992	Greyback	2,000	Teacup Ranch	Upper Sonoran Desert
1992	N/A	500	96 Ranch	Upper Sonoran Desert
1995	Black Mt.	2,500	Black Mountain	Oak/Semi Desert Grassland
1995	N/A	50	Burro Pump	Semi Desert Grassland
1995	N/A	100	Haydon Combe Ranch	Oak/Chaparral
2001	N/a	3,250	Pinal Mountains	Pine Forest/Chaparral
2002	Bullock	30,000	Catalina Mountains.	Pine/Oak Forest/Semi Desert Grassland
2003	Aspen	84,750	Catalina Mountains	Pine/Oak Forest/Semi Desert Grassland
2004	N/A	N/A	Cross Triangle Ranch	Middle Sonoran Desert
2005	Cedar	1,500	Slash S Ranch	Oak/Semi Desert Grassland
2007	N/A	30	96 Ranch	Desert Scrub
2007	N/A	100	Black Mountain	Oak/Semi Desert Grassland

2009	Pioneer	1,375	Pinal Mountains	Chaparral
2009	Mescal	800	Mescal Mountains	Chaparral
2010	N/A	80	Little Butte	Oak/Semi Desert Grassland
2011	Aravaipa	158	Hells ½ Acre	Oak/Semi Desert Grassland
2011	Copper Creek	1,400	Copper Creek	Oak/Semi Desert Grassland
2011	Frio	2,375	Pinal Mountains	Chaparral

Data Source: InciWeb – Incident Information System; http://www.inciweb.org/

Mining and Minerals

Numerous mines are located within the District. The District probably has one of the most active mining histories in the southwestern part of the State as for mining per capita and over the years; they have been a staple for local income. Most land units within the District have their fair share of mining holes, claims and tunnels that predate 1950. Most of which have been left untouched and uncovered since the original assayer claimed the minerals. There have been known to be several after effects from mining activities. Some consequences include tailings left uncovered, acids and chemicals in streambeds, sterilization of soil and jackasses. Jackass was the preferred animal to transport materials, equipment and miners. Numerous animals were used in single operations and mostly left on the range to fend for themselves when the operation went belly up. After a period of years and reproduction of these animals persisted, these unattended livestock generally looked at as a nuisance to cattlemen as competition for grazing lands and they were also known to kill young calves by shaking them to death. By the mid 1950's most all jackass herds were eradicated after pasture fencing was completed by local livestock owners.

Mining activities make up approximately 10 percent of land use in the District. Listed below are few of the most locally known large scale active and inactive mines known to have operated within the District as well as metals and minerals harvested.

San Manuel Operation: The San Manuel ore bodies were originally discovered by Frank Schultz in 1879 but the main body was discovered by Henry W. Nicholas in 1942. Ore bodies included the San Manuel that was tabular and 300 meters thick, and the Kalamazoo which was "U" shaped and 1,140 meters thick. The San Manuel fault line divided the original cylindrical ore body into two halves, the upper San Manuel and the lower Kalamazoo ore bodies with a displacement of about 8,000 feet. It is estimated over 700,000,000 tons of ore were extracted during the time of operation ("San Manuel Mine". 2011). The San Manuel Operation in mostly known for producing low-grade, oxide copper ore but also produced: Copper, Silver, Molybdenum, Gold, Titanium, Rhodium and Iron. Ore was mined and shipped 8 miles south via rail road for processing.

BHP purchased the San Manuel Operation in 1996 from Magma Copper. Mining activities continued until 2003 when the decision was made to "moth-ball" the facility and close doors forever. The entire facility was dismantled both at the mine site and at the mill site. Completion of entire mine decommissioning ended in 2010 with the capping and contouring of the heap leach and tailings ponds. All surfaces were completely stripped of asbestos, copper ore, acids, oils, etc. and were sent to recycling facilities. Demolishing of the two smoke stacks was commenced in 2008; both stacks were knocked down with charges.

Image 5-23: Dismantled San Manuel mill site.

Image source: Closure at San Manuel Plant Site. Garcia. 2007.

Ray Operation: The Ray ore body was originally discovered in 1846. This mine was named after the mining town of Ray located nearby. The mine eventually engulfed the towns of Ray, Barcelona and Sonora (which no longer exists) when the underground shafts were collapsed and the operation expanded into an open pit mine in 1952. Residents were moved to the new mining company built town of Kearny a few miles to the south.

Image 5-24: Ray Copper Mine, Sonora in the distance. 1915.

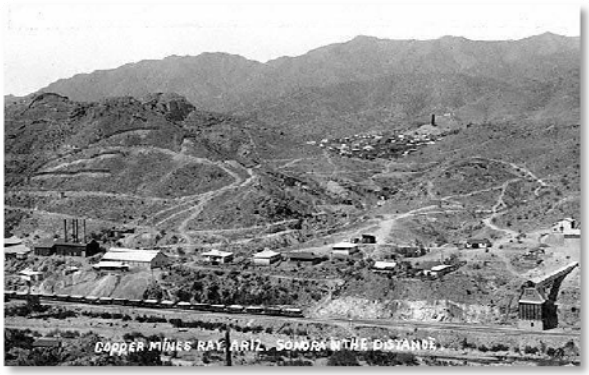


Image Source:
http://archive.library.nau.edu/cdm4/item_viewer.php?CISOROOT=/cpa&CISOPTR=6832&CISOBOX=1&REC=13

Image 5-25: Ray, Arizona with Sonora in right background. 1915.

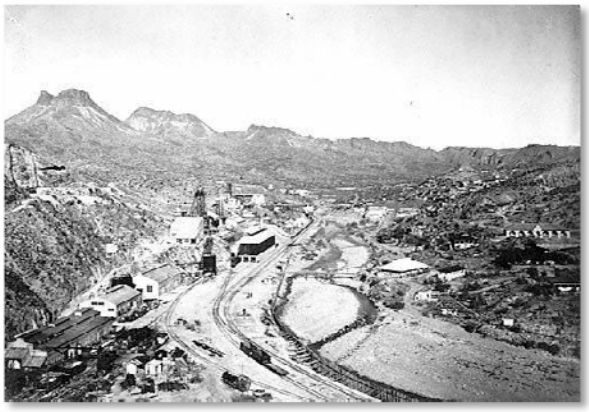


Image Source:
http://archive.library.nau.edu/cdm4/item_viewer.php?CISOROOT=/cpa&CISOPTR=6831&CISOBOX=1&REC=12

Mineralization is a porphyry copper deposit hosted in Pinal Schist, Granite Mountain Porphyry and Pioneer Shale of the Apache group; and Dripping Spring Quartzite. Ore control was at the intersection of a northwest and northeast fault zones. Ore concentration was a secondary enrichment. Area structures include the Broken Hill fault, West End fault, North End fault and numerous other un-named faults in the area. At current, minerals produced from this operation include: copper, silver, gold, molybdenum, lead and zinc ("Ray Mine". 2012).

The Ray Operations currently consists of a 250,000 ton per day open pit mine with a 30,000 ton per day concentrator, a 103 million pound per year solvent extraction-electrowinning (SX-EW) operation, and associated maintenance, warehouse and administrative facilities. Cathode copper produced in the SX-EW operation is shipped to outside customers and the Asarco Amarillo Copper Refinery. A local railroad, Copper Basin Railway, transports ore from the mine to the Hayden concentrator, concentrate from the Ray concentrator to the smelter, and sulphuric acid from the smelter to the leaching facilities ("ASARCO Ray Operations". 2012). The ASARCO Ray Operation has passed through several mining company ownerships in the past years such as Nevada Consolidated Copper Company

and Kennecott Copper Corporation but is currently owned by Grupo Mexico.

Image 5-26: Ray Pit.

Image Source: Katie Cline. USDA-NRCS. 2008.

Christmas Operation: The Christmas Mine property was located in 1880 by Messrs. Dennis O'Brien and William Tweed. The claims were later relocated in 1902 by G.B. Chittenden. Serious mining on this claim did not start until about 1905. Open shaft workings go to the 908 foot level but the deposits were drilled deeper beyond this point. There were 5 shafts including the No. 3 (main shaft; vertical, 3-compartment to the 908 foot level), the Hackberry shaft, the Christmas shaft, the No. 4 shaft, plus one additional un-named shaft. The initial claims (Deer Creek Coal Field) proved to be on the San Carlos Apache Indian Reservation and were declared invalid. In December, 1902, that portion of the reservation was restored to public domain by executive order and the claims were relocated on Christmas evening by Mr. G.B. Chittenden, hence the name. The mine was later owned by the Inspiration Copper Co. until its closure in January, 1982 ("Christmas Mine". 2012).

The mineral deposits are in a thick series of gently dipping Paleozoic limestone (Naco Limestone; Escabrosa Limestone and the Martin Limestone) that range from Devonian to Permian. The Christmas-Joker fault cuts northwest through the limestone, lavas and the quartz diorite intrusive materials. The eastern part has been depressed, bringing the lavas in contact with the limestone, which crop out west of the fault. The mineral deposits are a contact metamorphic or pyrometasomatic type. The mineralized zones extend to the surface, where there was an open pit mine as well. The ore zone is 1,524 meters long, 823 meters wide, with a depth-to-top of 15 meters, depth-to-bottom of 655 meters, at 24 meters thick.

The Christmas operation has been owned by numerous mining companies; the most recent purchaser is Freeport Macmoran and is currently closed from production. Total production from this mine is unclear; however, available statistics indicate a total of about 55,340,000 pounds of copper (1905 to the end of 1943), plus $160,000 of gold and $150,000 of silver (period values). Ores produced are: copper, silver, gold, monlybdenum, bismuth, lead, zinc, beryllium and tungsten ("Christmas Mine". 2012).

Image 5-27: Mine assayers in the Deer Creek Coal Field at the Christmas Mine.

Image Source:
http://forum.treasurenet.com/index.php?topic=289553.0

Bunker Hill District; Copper Creek: Numerous, formerly productive mines are located in Copper Creek. Some of the most infamous are: Bunker Hill Mine, Blue Bird Mine and Old Reliable Mine. At current, the Copper Creek and immediately adjoining areas are being re-explored for minerals.

The Bunker Hill Mine workings include numerous and extensive shafting. Several hundred thousand tons of silver-lead ores and a few thousand tons of manganiferous silver ore were produced from the 1880's to 1952. A former small underground silver, lead, zinc, copper and manganese was discovered in 1880 and produced from 1889 to 1931.

The Blue Bird Mine workings include 1 vertical shaft, 7 levels and 1 open stope. The workings achieved a depth of 163 meters and a length of 1,524 meters. This mine was worked intermittently during 1914, 1918-1930, 1939-1940, 1947-1948. From 1939-1940 the mine mill concentrated capacity of 25 tons per day. In 1947-1948, a 50 ton capacity concentrator was in operation and 598 tons were treated. Production prior to 1926 estimated at $150,000, mainly lead and silver (period values). During 1926-39, output of lead, silver and copper was approximately $350,000 (period values). 598 tons of ore mined in 1948 yielded 31,200 pounds of lead, 2,100 pounds of copper, 1,085 oz. silver and 3 oz. gold, valued in all at $6,021 (period values) ("Blue Bird Mine". 2012).

Old Reliable is a former underground copper, silver, gold, lead, molybdenum and barium mine located approximately about 1¼ miles west of the town of Copper Creek on the Copper Creek streambed. Production ensued from 1890 to 1981. The original mine workings are now obscured by subsequent mining operations. A local (within the narrow canyon) railroad serviced this mine as well as the area of the underground workings of the Childs-Adwinkle Mine in the adjacent peak.

Image 5-28: 14 horse teams pulling a small locomotive to the Bunker Hill Mine.

Image Source: Amy Humphrey, BLM Safford.

The most recent mining efforts at this site involved an attempt to mine this deposit in situ by drilling the mineralized areas of the breccia pipe and using a single large blast of some 20 tons of explosives to shatter the rock. An acid leaching operation was installed on the terraced mountain slopes afterward. The attempt was allegedly a failure due to an inadequate copper content of only some 0.5% copper. The operation left the entire mountain side scarred and stained yellow by the sulphur from the H_2SO_4, destroyed most of the specimen value of the deposit, and obliterated most of the original, conventional mine workings ("Old Reliable". 2012).

Antelope District: The Antelope Peak Mine is probably the only major mine within the Antelope District. Founded in 1875 by F. A. Meyer, this copper, silver and gold mine operated from 2885 to 1922. Workings include a 600 foot deep shaft ("Antelope Mine, 2012 and Antelope Peak Mining Company Files. 1922.), 6 levels of workings on a single shaft with the workings about 200 feet length on most levels, for approximately 1,800 feet of total workings. Ore was hauled by wagon to the smelter in Haydon. The mine was closed down in 1922 due to a flooding of mine shafts and plate shifts that collapsed shaft scaffolding.

Image 5-29: Ore being hauled by wagon to smelter.

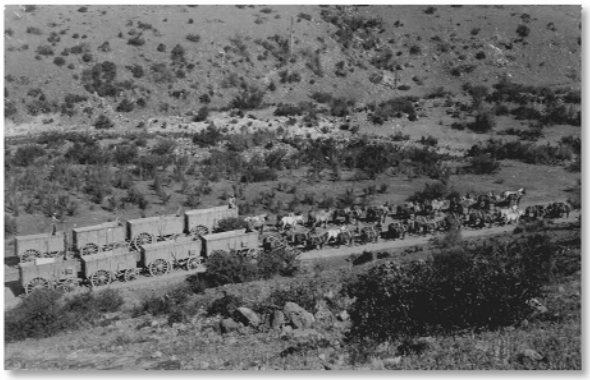


Image Source: Unknown.

Oracle District: Several former mines belong to the Oracle District. A few of the most well-known are: Pure Gold Mine, American Flag Mine and Maudina Mine; none of which are active nor currently being explored.

The Pure Gold Mine workings include two adits, at 175 and 88 feet long; 2 shallow shafts; two inclined shafts up to 35 feet deep; and one open cut 160 by 30 feet. Additionally, an adit of 315 feet long with a 40 foot deep winze are situated above the Cody Tunnel. Production equivalent to 11,815 short ton units of tungsten trioxide was produced. A former surface and underground mine was discovered in 1943 and operated from 1943 to 1944 ("Pure Gold Mine". 2012).

The American Flag Mine started 1939 by E.B. Lovejoy produced from 1901 to 1961. Workings included a shaft 165 feet long, 100 feet of drifting and stopes at the 75 foot level. Minerals extracted are: tungsten, silver, molybdenum, gold and vanadium ("American Flag Mine". 2012).

The Maudina Mine claimed in 1836 and mined from 1908 to 1916; workings include a 175 foot deep vertical shaft and an adit tunnel. Minerals extracted from this mine include: tungsten, gold, silver, lead, molybdenum and copper ("Maudina Mine". 2012).

Sand and Gravel

Several sand and gravel operations are within the District. Each provides a variety of size, type and color of material that is used for anything from erosion control, landscaping, road construction and mineral extrapolation. Some of the most notable in the District are the National and Superior Gypsum mines in the eastern edge of the District; Decorative Rock Sales in the White Hills west of Oracle, and the Kalamazoo Sand and Gravel. There had been past plans to create a sand and gravel operation on the Tecoloté Ranch near the headquarters in the Red Hills. Plans were solidified to develop transportation access from the Kelvin Highway. It is unknown where this operation stands at this time.

El Paso Natural Gas

Several, large gas lines cross the Winkelman District. Specifics such as pipe diameter, fuels transported, daily capacities and location is not readily available to the general public for security purposes.

During the 1993 winter floods, one of the EPNG lines that crossed the San Pedro River just north of Mammoth, was broken open and washed downstream from flood waters. Fuel service in this line was cut for an extended period of time to repair the line. The line was replaced with a "bridge" type crossing where it was originally buried in the river bottom (Cline, Katie E. Personal observation. 1993).

The most recent maintenance on these gas lines within the District include: replacing 90 degree angels in each pipeline with 45 degree bends starting in 2007 to allow for passing inner-pipe sensors that detect rust, weak walls and cracks in each pipeline; construction of a warming station on the west side of Black Mountain to better aid in fuel movement and; grounding with copper rods along one of the pipelines that runs parallel to the 500-KV power line directly in the center of the District.

Transmission Lines

Numerous transmission lines exist within the District. They range from small 33-KV transmission lines that service home and business sites to large, 500-KV interstate transmission lines.

The 500-KV line was installed in the 1970's and reaches from Joseph City, Arizona to Red Rock, Arizona. Access to the power line support towers were bulldozed and rehabilitated using bulldozers and seeding. Very few places exist along this power line where the original access road was created that is accessible today. The actual power lines were strung using helicopters and tightened across country with heavy equipment.

Image 5-30: 500 kVA Transmission line in the Winkelman District.

Image Source: Katie Cline. USDA-NRCS. 2012.

Also within the District are the several sub-stations that process power from the larger lines to the smaller transmission line. One of the larger sub-stations is located on the Falcon Valley Ranch and in Red Rock. Both stations convert power from the 500-KV line for sub-uses. The Coolidge dam had produced power through turbines in previous years. Today, power is not generated at this site anymore. The dam areas where the turbines are located were flooded in the 1993 flooding season and are no longer sufficient to produce power (Catalini, Lou. Personal correspondence. 2012).

There are continuing plans to install several new transmission lines within the District. The company SunZia has plans to construct a large line that would be built across the lower portions of the District will run from New Mexico to the Red Rock plant. It is proposed to use renewable energy such as solar and wind to power electricity running in this line.

Land Fills – There are several landfills within the District. Two are currently active; the Dudleyville Town Landfill north of Dudleyville and the Cactus Landfill on the Deep Well Ranch. The Dudleyville landfill generally receives local garbage from towns such as: Kearny, Winkelman, Hayden, Dudleyville, Aravaipa and Mammoth where the Cactus landfill receives municipal trash from Phoenix, Casa Grande, Florence and Tucson.

There is also a known radioactive landfill on the Page-Trowbridge Ranch. This landfill is inactive and belongs to the University of Arizona. Radioactive waste was placed on site between 1962 through 1986. A study to determine the current radioactivity of these dumpsites was conducted in 2001 and it was found that the earlier dumpsites only produced 9.003 curies, which poses no harm to persons that may be visiting or working on site ("External Radiation Summary – Page-Trowbridge Ranch Landfill". Date unknown.).

Human Interactions

The Winkelman District is a mosaic of federal, state, tribal and private lands where livestock grazing, agriculture, mining and recreation are the primary land uses. Significant populations and human habitation surrounds and is within the District. The District, being in such close proximity to large populations, is an ideal area for recreationalist alike to explore. The relatively easily traversable landscape is quite ideal and highly valued by the general public for entertainment of all sorts. Activities sought after by recreationalist or tourism is: bird

watching, hunting, fishing, hiking, geocaching, horseback riding, mountain biking, off-road vehicle (OHV) trails, river tubing, rock hounding, rock climbing, etc.

Major concerns have developed within the District over the rapidly increasing recreational use of public, State and private lands, resulting in impacts to vegetation and soil surfaces which may affect hydrologic function and result in acceleration of rangeland degradation. OHV use has increased 347% since 1998 ("Off Highway Vehicle Program: OHV". 2012). Very little law enforcement has been acquired to help aid in OHV miss-use since most activities occur in back country and on primitive roads. A large number of ranch units within the District are traversed by non-permitted users. Significant problems are derived by such high use. Vandalism, trespass, access, dumping, safety and erosion considerations are the top grievances expressed by land owners.

Pinal Partnership - Plans are in the future through the Pinal Partnership Group to create a county wide plan similar to Pima County's, Sonoran Desert Conservation Plan. Basic missions of the Pinal Partnership include: (1) To promote the value of existing and planned parks, trails, public lands and open space; and to influence stakeholders and landholders to plan for and provide and interconnected system of parks, trails, public lands and open space countywide; (2) To improve the quality of life and to drive economic development in Pinal County by supporting the adoption of clean renewable energy solutions and by attracting renewable energy investment jobs; (3) To advocate for a sustainable Pinal County economy through the preservation and creation of employment centers, to support organized economic development efforts throughout the region, and to encourage conditions that foster economic growth ("Uniting the Vision for Pinal County". 2008).

The Pinal Partnership has designated the eastern portion of Pinal County and encompassing the entire Winkelman District as a multi-use recreational corridor. Several OHV and multiple use corridors are currently planned for implementation and construction. This area also has been designated as the largest Open Space region within Pinal County ("Uniting the Vision for Pinal County". 2012).

Trails - The Arizona Trail is an 800 plus mile recreation trail from Mexico to Utah. It serves day hikers, backpackers, equestrians, mountain bicyclists, trail runners, nature enthusiasts, cross-country skiers, snowshoer's, and mule and llama packers. Initiation of the Arizona Trail was started by Dale Shewalter who began collaboration on the cross-state trail in the 1980's. To this date, several segments have not been completed throughout the state.

Five separate trail segments reside within the District. Trail segments include (from south to north):

Table 5-27: Arizona Trail segment information.

Trail Segment	Miles	Land Units Involved
Oracle Ridge	22.1	American Flag, 3c/U Circle
Oracle	8.3	Black Hills
Black Hills	27.4	Triangle Bar, Flying U W, Haydon Combe
Tortilla Mountains	28.4	Haydon Combe, Tecolote, A Diamond
Gila River Canyons	24.0	A Diamond, Battleaxe

Data Source: Arizona Trail Passages. http://www.aztrail.org/passages/passages.php

There are plans to create designated trailheads at the confluence of each of these trail sections. Parking, camping space and water caches will be available in the future. Continuing today, trail crews of various volunteer groups spend extended periods of time maintaining the trail. Although motorized vehicular traffic is forbidden on the Arizona Trail, there have been occurrences of motorcycle and ATV use of the

trail segments in the past five years (Cline, Katie E. Personal observation. 2010-2012).

The Grand Enchantment Trail is 730 miles long and runs through Phoenix and Albuquerque, New Mexico. This trail uses portions of the Arizona Trail from Phoenix and branches off in the center of the Black Hills segment at Beehive Well and runs east. One trail has been designated with a bypass route that are part of this trails system and runs as follows: trail) Black Hills trail down Camp Grant Wash over the San Pedro and up the Aravaipa Creek; bypass) Camp Grant Wash to the San Pedro River, turning south to Mammoth, turning east up Dry Camp Road, over Table Mountain. It appears this trail crosses a multitude of land ownership including private property and it is unclear if the proper permits or permissions have been given to recreationalist enjoying this trail ("Rediscover the American Southwest!". 2012).

Image 5-31: Grand Enchantment Trail with bypass route.

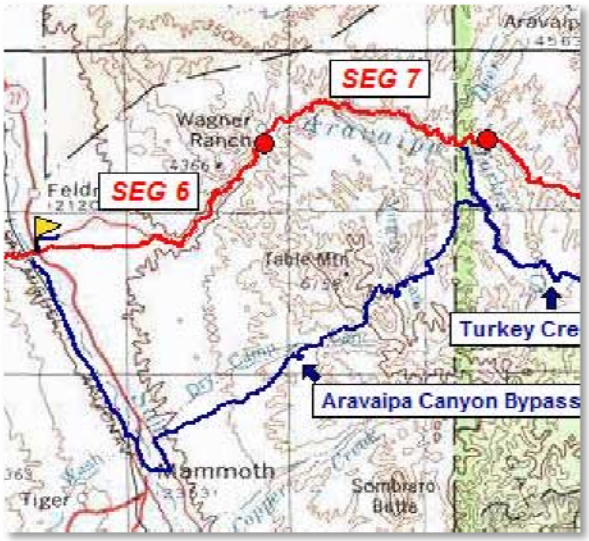


Image Source: *http://www.simblissity.net/500000_series_03.shtml*

Rock Crawling – Rock crawling or otherwise known as extreme off-road driving, is becoming a highly valued activity with some motor enthusiasts. Equipment used is highly modified four-wheel-drive vehicles that will traverse even some of the most difficult terrain. Trails generally are rock mountain sides and rocky canyon bottoms. At current, there are non-designated trails for rock crawling excursions within the District. The most notable trails are; Copper Creek and Rugg Road on the Campstool and Table Mountain Ranches. This activity has been frowned upon by land managers and land owners alike due to the fact these activities can cause erosion, contamination in bottoms, damage existing infrastructure and cultural resources.

Image 5-32: Typical rock crawling vehicle and course.

Image Source: *http://www.azrockcrawler.com/*

Gila River – Fishing has always been an attraction to the Gila River. Fish species mainly caught in the river are catfish, largemouth bass and sunfish. Two BLM maintained recreational sites equipped with facilities have been built over the past 10 years to cater to the fishing population.

Tubing in the Gila River has been difficult for recreationalist during many parts of the year due to intermittent and low water levels in the river. The river is also closed during part of the summer for sensitivity to Bald Eagle nesting.

Birding – Birding is a major draw to the San Pedro River and Aravaipa Creek due to the diverse population of threatened and endangered bird species that have been known to visit the areas. Several small scale events are

held throughout the year by The Audubon Society and Arizona Game and Fish Department that host bird walks. Within the District, there are also hot spot areas for bird viewing such as the Nature Conservancy's San Pedro Reserve, the BLM Aravaipa visitor center and trailhead, and Liz's Grove on the Double Check Ranch, which boast to have the largest population of the Southwestern Willow Flycatcher (Taylor, Bill. 2009).

Several other recreational activates such as Baja Truck Rally's and Rally car dirt road racing have been brought to the Winkelman District although they have to date, not initiated.

Recreational Events

The 24 Hours in the Old Pueblo mountain biking race held on the Willow Springs ranch is nearing its 13th year of completion. It is known as one of the largest mountain biking events in the world drawing over 3,500 people per year and is highly publicized. This public event held in February of each year is permitted by the State Land Department with a Special Land Use Permit for commercial off-road use and fetches revenue for the State of approximately $10,000.00 per year. Use is permitted for approximately 146 acres of land (Sommers, William. ASLD. Personal correspondence. 2012).

An annual Coyote Hunt is hosted by local sportsman on the Haydon Combe Ranch on an annual basis. The center of this event is for recreational hunting purposes and is to reward persons proving termination of the highest number of vermin over a 48 hour period. Typical participation ranges from approximately 100 to 300 individuals. Game killed includes predator species such as: bobcat, mountain lion, fox and coyote. Funds from the event are given to the winning participant minus event cost. No Special Use Permit is sought from the Arizona State Land Department.

Starting in 2009, new laws went into effect that requires an Off Highway Vehicle (OHV) decal to be placed on any OHV used for recreation within the State of Arizona. The decal is a yearly requirement and mandatory for any OHV traversing on any land ownership in the State although it is not required for land owners if they are using an OHV for specific land use maintenance. Revenues derived from this decal go directly to the Arizona State Parks (60%), Arizona Game and Fish Department (35%) and the Arizona State Land Department (5%) ("OHV Decal Revenue: What is it used for?". 2012).

Natural Areas

Several important natural areas are located within the District. The creation of the Aravaipa Canyon Wilderness, the Needleseye Wilderness, White Canyon Wilderness, Galiuro Wilderness, and the San Pedro River Preserve all have contributed to an increase of public interest in the area and a large majority of tourism in the District. There are also State and private Parks within the District including; Oracle State Park and Biosphere 2.

Much of the attraction to these areas is to enjoy seclusion from other human interactions, a chance to view a few of the many animal and plant species people would otherwise not see on a regular basis as well as many other reasons.

Non-District Group Activities and Directives

Land Purchase – In 2011, the Arizona Game and Fish Department made purchase of the Triangle Bar Ranch located on the San Pedro River. The acquisition of this property will contribute to the protection and recovery of species listed under the *Endangered Species* Act by protecting critical riparian habitat along the Lower San Pedro River. The Arizona Game and Fish Department (Department) considers the Triangle Bar Ranch property to hold significant wildlife values and recognizes riparian habitats as areas of critical environmental importance to wildlife and fisheries. The Lower San Pedro River epitomizes the riparian values that the

Department recognizes as critically important for protection and restoration. The Department proposes to purchase the Triangle Bar Ranch property with the help of USFWS habitat protection funds if this proposal is funded ("Triangle Bar Purchase". 2011).

Wildlife Refuge – The US Fish and Wildlife Service have recently started exploring the initiative of creating a wildlife refuge for the entire Lower San Pedro River Valley. This proposal was brought forth to in a public informational meeting held jointly by the Winkelman and Redington Districts. The main goal of the wildlife refuge is to create a one mile buffer on each side of the San Pedro River through sale of whole real estate, sale of developmental rights or gift of private lands within and immediately adjacent to the river. It was stated that private property owners would still have the right to commence business on a regular basis with minimal regulation. Future plans and information is not yet available for this wildlife refuge at this time.

SECTION – 6: DISTRICT ACTIVITIES

The Winkelman District has taken on numerous activities throughout the years. Many of the activities have reached beyond the District's boundaries to assist other districts and group activities. Some of which may include creation of informational pamphlets, federal agency coordination efforts, grade school field trips, individual ranch improvement, host of multi-agency meetings, etc. Within this section, information and specifics on some projects the District has lead or participated in will be found.

Publications

All Things Garbage – Littering and wildcat dumping has become a major issue within the District due to the increase of the local population and continual increase in landfill prices. Many land owners are affected by illegal dumping by the local population on their property and several ranchers within the District were receiving fines from county and land owning agencies for illegal dumping that had occurred on their property. In 2004, the Wildcat Dumping Task Force was initiated to coordinate with local and county entities and find a solution to this outstanding issue.

Through the process of collaboration, the District was able to assist Pinal County in making some major changes to specific laws that aids law enforcement to more easily prosecute individuals that were responsible for illegal dumping. Cooperating entities evolved in this guide include: Pinal County Attorney's Office, Pinal County Public Works Department, Pinal County Supervisors and Waste Management just to name a few.

Image 6-1: All Things Garbage Publication.

The publication All Things Garbage is a comprehensive master guide to all resources available in Pinal County for garbage disposal, clean up and illegal dumping enforcement. Information covered within this booklet includes:

- History of illegal dumping
- Laws applying to illegal dumping
- Litigation processes
- Ways to report illegal dumping
- Burning regulations
- Locations of landfills and transfer stations
- Recycling opportunities
- Free dumping opportunities
- Information on composting
- Cleanup programs and
- Contact information

A voucher system has also been established to allow for limited free dump days. This initiation has helped decrease the amount of large dump sites throughout the District.

Plant Booklets – Eight plant booklets that include numerous plants of southeastern Arizona has been completed in cooperation with several other districts and the USDA Coronado Resource Conservation and Development (RC&D) program. The Winkelman District was one of the major driving forces and financial contributors to the completion of these booklets. Since the completion of these eight booklets, two separate issues have been

completed by The University of Arizona Cooperative Extension and conservation districts. Booklets include:

- Trees
- Shrubs
- Summer Forbs
- Winter Forbs
- Cacti
- Native Grasses
- Poisonous Plants (U of A)
- Non-Native Invasive Plants (U of A)

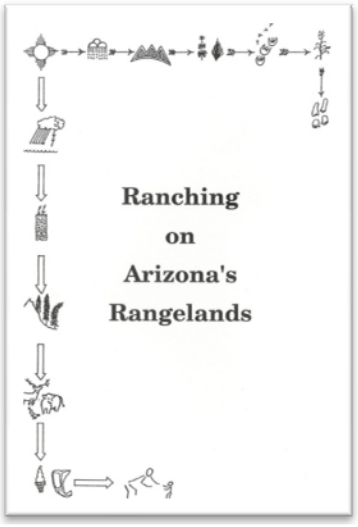
Plant booklets were originally housed with the Coronado R C&D office in Willcox, Arizona. Due to the termination of the program, all booklets for the Winkelman District are held with the Pima NRCD in the USDA-NRCS Tucson Field Office.

Range Etiquette – The Range Etiquette pamphlet was constructed to aid in educating the public on proper manners while enjoying recreation on rangelands. Items included within this pamphlet are:

- Leaving gates as they are found
- Pack-it-in, pack-it-out
- Importance of water developments and the detriments of vandalizing them
- Not disturbing livestock
- Staying on roads and
- Proper camping distances

Ranching on Arizona's Rangelands – This publication was completed in 1980 by the Winkelman District in conjunction with the Tohono O'odham Soil and Water Conservation District, the Pima NRCD and Magma Copper Company. This booklet describes what rangelands are, how they function, vegetation, land ownership, livestock production and health, ranch tools and wildlife. These booklets have been handed out at numerous grade school field days including the Tohono O'odham Range Days in Sells, Arizona.

Image 6-2: Ranching on Arizona's Rangelands book.



Arizona's Natural Resources Conservation Districts, "Conservation through Cooperation" – This pamphlet was produced through the Arizona State Land Department, Natural Resources Conservation Section with some input from the Winkelman District. It is a description of what a Conservation District is, what is its purpose, how they benefit the general public and its responsibilities.

Prescribed Burning in Southern Arizona, A Planning Guide for Ranchers – This guide was published by the Winkelman and Pima NRCS's in 1987. This booklet describes the benefits of burning, examples of burns within the District, planning prescribed burns and follow-up and monitoring methods.

Seasonal Diets of Cattle Grazing Rangelands in Pima and Pinal Counties, Arizona – This booklet was published by the District and the University of Arizona in 2003. Included in this booklet are seasonal diets on specific ranches. Fecal samples were collected at different times of the year to determine livestock diets. Ranches within the District that participated in this study include: the Campstool Ranch, Flying U W Ranch, Haydon Combe Ranch, Quarter Circle U Ranch, Rafter T Ranch, Rafter U Ranch and the Slash S Ranch.

High School Youth Forum Proceedings – In an effort to publish papers and presentations conducted by high school students at the Annual Society for Range Management parent society meetings every year; the District took on the challenge of collecting each paper and publishing them for the general public. The District felt that high school students put a lot of effort into finding topics to present at each of these meetings that deserve some kind of recognition. Many of the subjects range from ranch histories, grazing management, specific species management to exotic species.

Report to Governor, Jane Hull – The District participated in the Rangeland Technical Advisory Council to give an assessment of the U.S. Forest Service methods for determining livestock grazing capacities on National Forest in Arizona in 2001. This document was designed to make evaluations on processes and give recommendations to the Governor regarding the validity of currently utilized rangeland models.

<u>District Educational Activities, Outreach and Support</u>

The District has been involved in countless educational activities in the past, with many more planned in the future. Most of these activities have been in the form of workshops or casual meetings and reach far beyond the actual District Boundary. Many topics have been covered and technical assistance has been given to many different areas to support specific activities.

Flying U W Field Day – The Flying U W Ranch and the District hosted several annual Ranch Field Days for students ranging from grades kindergarten through high school starting in 1986. Participants in the educational booths included experts from the University of Arizona, NRCS (formerly the Soil Conservation Service), the Arizona State Land Department, Bureau of Land Management and the Arizona Game and Fish Department. Activities included: plant taxonomy, livestock health and laws, rangeland etiquette, ranch tools, wildlife, soils, water and ended with a demonstration on the entire process of branding cattle.

Image 6-1: Sixth graders learning about soils at the Flying U W Ranch Field Days.

Image Source: Francie Meyer.1993.

Soil surveys – The District participated in numerous soil survey reviews that were held by the Natural Resources Conservation Service when the Eastern Pinal Soil Survey was in progress during the years of 2005 through 2011. These reviews including traveling to individual survey sights, aiding in soil taxonomy, providing technical assistance of local geologic formations and providing suggestions or corrections to draft surveys.

Rangeland Monitoring Workshops – Several workshops have been hosted by the District in conjunction with agency personnel over the past. Items covered in these workshops include: why it's important to monitor rangelands, proper protocol, picking the right method, data collection and summarization of collected data. Several locations have been used throughout the District including the Page Ranch, Falcon Valley Ranch, Campstool Ranch and the Whitlow Ranch.

Payson's Star Valley – The District was asked to help support and give technical assistance to the Hohokam Resource Conservation and

Development in Star Valley because of large scale flooding that had occurred in the Tonto NRCD in the early 1990's. This project entailed finding funds to channelize a large drainage that went through the community.

Superior Mine Closure – The District was asked by the BHP Mining Company to participate in touring and giving technical assistance on revegetation the Superior Operations before the mine was officially closed. Items observed by the District included tailings, inactive mine holes and equipment use areas.

Pinto Creek Reclamation Workshop – The District participated in a reclamation workshop in Pinto Valley in cooperation with BHP to educate local producers and general public because tailings waste was eroding down the creek. Since this, all tailings in the headwaters of the Pinto Creek have been removed.

Summerhaven Small Land Owner Workshop – The District hosted a small land owner workshop in coordination with the NRCS in the town of Summerhaven on Mount Lemmon after the Aspen Fire in 2002. Three hundred and 340 structures were destroyed in this event. Topics such as expectation of erosion issues, treatment methods, evaluation of individual land owner's properties, aid in constructing erosion control structures as well as giving the appropriate contact information to individual land owners. The District also purchased seed and straw hay bales with the U.S. Forest Service to give to the local land owners.

Small Land Owner Workshops – Starting in 2011, the District has hosted a number of small land owner workshops at Central Arizona College in Aravaipa. Speakers from the University of Arizona Cooperative Extension and the NRCS Field Office and Plant Materials Center gave presentations on items such as: seeding, wildlife laws and issues, gardening, livestock health and laws and monitoring protocol.

Meetings – The District has been willing to host or co-host meetings of most any topic in conjunction with other Districts and/or agencies over the past years. Some of them include introduction of new Arizona State Land Commissioner to the general public, public scoping meetings on numerous topics, special meetings held to discuss concentrated topics concerning other Districts.

Coordination Committee – The Coordination Committee was established by the District in 2010 due to some projects and initiatives that would drastically affect the District. "Federal and state statutes require administrative agencies to work coordinately with local government - to "coordinate" with local government in developing and implementing plans, policies and management actions." (American Stewards of Liberty. 2009). This coordination mandate is included in every natural resource management statute Congress has passed since 1976, including the Federal Land Policy and Management Act, the National Environmental Policy Act, the National Forest Management Act and even the Homeland Security Act. Since Arizona's Natural Resource Conservation Districts are legitimate political subdivisions of Arizona State Government, the federal agencies are required to "coordinate" their policies and management activities on an equal government to government basis with the districts. Recognizing that local government has the duty to protect the general well-being of the community and the importance of local input into the management of the nation's resources, Congress precisely defined "coordination". Congress also acknowledged that local government expertise in local issues should give them a role in decisions that directly affect them. That definition elevates local government participation over and above "public participation".

In 2009, the Winkelman NRCD began coordination with the U.S. Fish and Wildlife Service (USFWS) following the October 2008 petition to list the Sonoran Desert Tortoise

(*Gopherus agasizzii* [since renamed *Gopherus morafkai*]) as an endangered species under the Endangered Species Act. Sonoran Desert Tortoises are a native species throughout much of the District thus the petition was an issue of concern for its members and cooperators. The Board formed a "Coordination Committee" to address those concerns. The committee enlisted the aid of Mary Darling of Darling Environmental and Surveying, LTD., Drs. Phil Ogden and Lamar Smith, and others and hosted many meetings with USFWS State Director Steve Spangle and lead biologist Jeff Servoss in order to present new information about the tortoise and resolve possible conflicts with district goals and plans. The District had three goals in this coordination effort: 1. Keep the tortoise from being listed, 2. If that was not possible, stop grazing from being considered a threat to the tortoise, 3. If that was not possible, to keep the District from being in the critical habitat area of the tortoise. Listing of the Sonoran Desert Tortoise was precluded due to higher priorities, and grazing is not considered a threat in the decision. This was the first time in the nation that a local government invoked coordination on a species listing. Coordination with USFWS on this species and others will be on-going.

In 2009, the Winkelman NRCD invoked its coordination authority with the Bureau of Land Management (BLM) after its designation as lead agency in overseeing the preparation of the Environmental Impact Statement for the SunZia Southwest Transmission Project. This proposed project is for a 460 mile high capacity (two 250 kilovolt) transmission lines that cross New Mexico and Arizona to transport electricity (generated purportedly by renewable resources) to western power markets. Several of the proposed routes cross critical areas within the Winkelman District and its neighbor, the Redington District. The two Districts joined forces in coordination efforts with BLM and hosted numerous meetings with BLM Project Manager Adrian Garcia, BLM Arizona State Director Jim Kenna, other BLM staff and Environmental Planning Group (SunZia's hired consulting company). The Districts addressed inconsistencies between their long range plans and the sighting of a major utility line. The districts offered much on-ground information regarding the project's possible environmental, cultural and socio-economic resource effects within the districts. Coordination efforts with BLM on this project are on-going.

The District will continue coordination efforts whenever future major federal actions affect its citizens and resources.

SECTION – 7: CENSUS AND STATISTICS

Although human censuses and statistics do not specifically concern the District activities, it is important to note the public base that the District serves. Statistics are not available specific to the District boundaries but they are available for each county that is part of the District. While this section is short and concise; the data provided below will aid in the understanding of the increase in the human population over the years and the pressures to natural resources within the District by human activities and residential areas. Detailed census data is only readily available for the years 2000 and 2010 due to the fact previous censuses have been moved to the National Archive and are only subject to physical inquiries; most evaluations listed below by county will be derived from these data sets. Only general population numbers are available by county for previous years. Agricultural statistic will also be generally covered for each county with a small portion of this section devoted specifically to the District.

Population Densities by County

Pinal County – According to the facts listed below, the total population of this county has increased by 48% from the year 2000. This is actually the lowest increase over a ten-year period out of the four counties that make up the District. Total housing units have increased by 51% where only 79% of those are actually occupied in 2010, 21% are vacant and 10% of which are used for recreational or seasonal purposes.

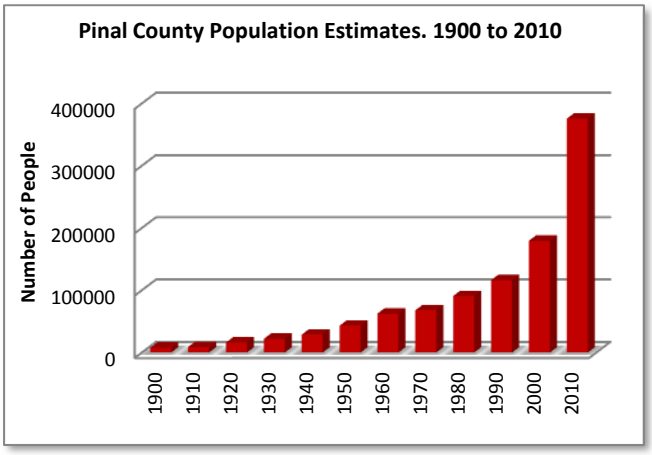
Table 7-1: Pinal County Population Quick Facts for 2000 and 2010.

Population Demographic	2000	2010	Percent Change
Total Population	179,722	375,770	48%
Male - % of total	53%	52%	-1%
Female - % of total	47%	48%	1%
White - % of total	70%	72%	2%
Hispanic - % of total	30%	28%	-2%
American Indian - % of total	8%	6%	-2%
African American - % of total	3%	5%	2%
Asian-Island Pacific - % of total	0.7%	2%	35%

Data Source: *http://quickfacts.census.gov/qfd/states/04/04021.html*

Population Data from 1900 through 2010 – In Pinal County, there has been an approximate 4,831% increase in population from 1900 to 2010.

Table 7-1: Pinal County Population Changes from 1900 to 2010.



Data Source: Census Data spreadsheet. 2012. USDA NRCS.

The greatest population change was seen in 1970 where the population increased by 92% over the previous ten years. The second highest increase was seen in the 1910 at an 86% increase over the previous ten years. The period of time where the lowest increase in population was seen was in the 2010 with the population increasing only 48% over the previous ten years.

Table 7-2: Pinal County Population Data and Percent Changes from 1900 to 2010.

Year	Population Estimates	Percent Change
1900	7,779	---

1910	9,045	86%
1920	16,130	56%
1930	22,081	73%
1940	28,841	77%
1950	43,191	67%
1960	62,673	69%
1970	67,916	92%
1980	90,918	75%
1990	116,379	78%
2000	179,722	65%
2010	375,770	48%
Percent Population Change from 1900-2010		***4,831%***

Data Source:
http://www.census.gov/population/cencounts/az190090.txt

Gila County – Gila County is showing a total population increase of 96% in 2010 from the 2000 census data. There is an 86% increase in total housing units broke down as 67% of those being occupied, 33% as vacant and 23% being used for recreational or vacation purposes in 2010.

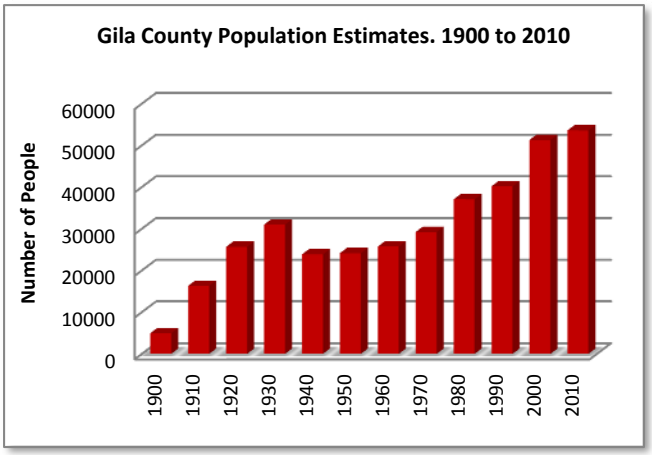
Table 7-3: Gila County Population Quick Facts for 2000 and 2010.

Population Demographic	2000	2010	Percent Change
Total Population	51,335	53,597	96%
Male - % of total	49%	50%	1%
Female - % of total	51%	50%	-1%
White - % of total	78%	77%	-1%
Hispanic - % of total	17%	18%	1%
American Indian - % of total	13%	15%	2%
African American - % of total	0.4%	0.4%	0%
Asian-Island Pacific - % of total	0.5%	0.6%	0.2%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Population Data from 1900 through 2010 – In Gila County, there has been an approximate 1,078% increase in population from 1900 to 2010.

Table 7-2: Gila County Population Changes from 1900 to 2010.



Data Source: Census Data spreadsheet. 2012. USDA NRCS.

The greatest population change was seen in 1950 where the population increased by 99% over the previous ten years. The second highest increase was seen in 2010 at a 96% increase over the previous ten years. The period of time where the lowest increase in population was seen was in the 1940's where the population dropped 77% over the previous ten years.

Table 7-4: Gila County Population Data and Percent Changes from 1900 to 2010.

Year	Population Estimates	Percent Change
1900	4,973	---
1910	16,348	30%
1920	25,678	64%
1930	31,016	83%
1940	23,867	-77%
1950	24,158	99%
1960	25,745	94%
1970	29,255	88%
1980	37,080	79%
1990	40,216	92%

2000	51,335	78%
2010	53,597	96%
Percent Population Change from 1900-2010		***1,078%***

Data Source:
http://www.census.gov/population/cencounts/az190090.txt

Graham County – Graham County is seeing a 90% increase in population since 2000. The number of total housing units has increased by 88% from 2000 with 86% of the units being occupied, 14% left vacant and 4% being used for recreation or vacation homes in 2010.

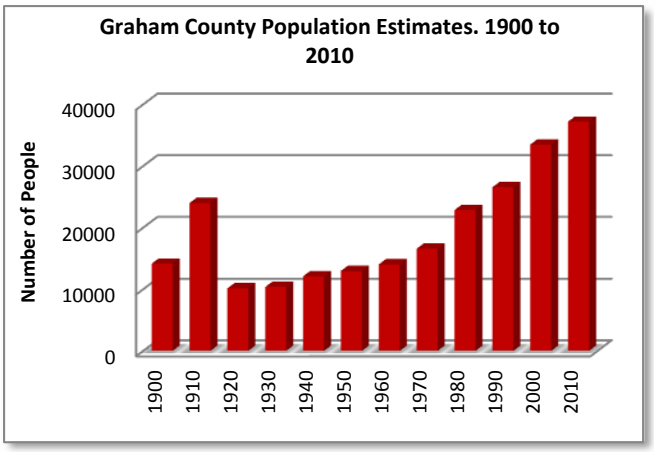
Table 7-5: Graham County Population Quick Facts for 2000 and 2010.

Population Demographic	2000	2010	Percent Change
Total Population	33,489	37,220	90%
Male - % of total	53%	54%	1%
Female - % of total	47%	46%	-1%
White - % of total	67%	72%	5%
Hispanic - % of total	27%	30%	3%
American Indian - % of total	15%	14%	-1%
African American - % of total	2%	2%	0%
Asian-Island Pacific - % of total	0.6%	0.6%	0%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Population Data from 1900 through 2010 – In Graham County, there has been an approximate 263% increase in population from 1900 to 2010.

Table 7-3: Graham County Population Changes from 1900 to 2010.



Data Source: Census Data spreadsheet. 2012. USDA NRCS.

The greatest population change was seen in 1940 where the population increased by 117% over the previous ten years. The period of time where the lowest increase in population was seen was in the 1920's with the population decreased by 42% over the previous ten years.

Table 7-6: Graham County Population Data and Percent Changes from 1900 to 2010.

Year	Population Estimates	Percent Change
1900	14,162	---
1910	23,999	59%
1920	10,148	-42%
1930	10,373	98%
1940	12,113	117%
1950	12,985	93%
1960	14,045	92%
1970	16,578	85%
1980	22,862	73%
1990	26,554	86%
2000	33,489	79%
2010	37,220	90%
Percent Population Change from 1900-2010		***263%***

Data Source:
http://www.census.gov/population/cencounts/az190090.txt

Pima County – Pima County is seeing an increase in population of about 86% in 2010 over the year 2000. Housing unit densities have increased 83% in the 10 year period where in 2010, 88% of the housing was occupied, 12% of the housing is vacant and 3% of the housing is used for recreation or vacation purposes.

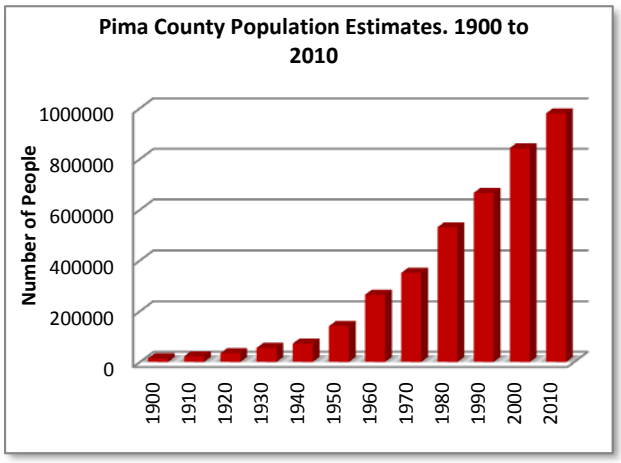
Table 7-7: Pima County Population Quick Facts for 2000 and 2010.

Population Demographic	2000	2010	Percent Change
Total Population	843,746	980,263	86%
Male - % of total	49%	49%	0%
Female - % of total	51%	51%	0%
White - % of total	75%	78%	13%
Hispanic - % of total	29%	35%	6%
American Indian - % of total	3%	4%	1%
African American - % of total	3%	5%	2%
Asian-Island Pacific - % of total	2%	4%	2%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Population Data from 1900 through 2010 – In Pima County, there has been an approximate 6,673% increase in population from 1900 to 2010.

Table 7-4: Graham County Population Changes from 1900 to 2010.



Data Source: Census Data spreadsheet. 2012. USDA NRCS.

Increase in population in this county had been fairly consistent compared to the other counties over the past 100 years. The greatest population change was seen in 2010 where the population increased by 86% over the previous ten years. The period of time where the lowest increase in population was seen was in the 1950's with the population decreased by 52% over the previous ten years.

Table 7-8: Graham County Population Data and Percent Changes from 1900 to 2010.

Year	Population Estimates	Percent Change
1900	14,689	---
1910	22,818	64%
1920	34,680	66%
1930	55,676	62%
1940	72,838	76%
1950	141,216	52%
1960	265,660	53%
1970	351,667	76%
1980	531,443	66%
1990	666,880	80%
2000	843,746	79%
2010	980,263	86%
Percent Population Change from 1900-2010		***6,673%***

Data Source:
http://www.census.gov/population/cencounts/az190090.txt

Housing Development Plans – Several large scale housing developments have surfaced or urbanized within the District over the past 20 years. Many increases in development have been isolated to small communities where no more than 20 new homes have been established. Others have been fairly large communities with over 500 new home sites; two of the most notable are the original Saddle Brooke east of Catalina and the new Saddle Brooke Ranch development on what was previously part of the Falcon Valley Ranch.

There have been long-term plans for future large scale developments in the District. One is located on the Willow Springs Ranch. This particular plan envelopes several private parcels on the ranch. These private in holdings of ANAM, INC. were presented to Pinal County for re-zoning in 2000. These plans were opposed by Pinal Citizens for Sustainable Communities (PCSC) due to the size and complexity of the zoning. ANAM then refined the zoning plan to one specific 4,600 acre parcel on the west side of Black Mountain, east of highway 79; otherwise known as the "South Village". Thus zoning plans were approved by Pinal County Planning and Zoning Commission ("Robson Ranch Mountains, L.L.C. vs. Pinal County and ANAM, INC. vs. Pinal County. 2002). To date, complete plans for this development have not materialized and have been put on hold for unknown reasons.

There have also been fairly recent plans to develop private holdings west of Mammoth. It is unclear if this property has already gone through zoning or if formal plans have been developed but, formal service from the NRCS had been sought to provide soil survey information for these parcels in the past (Cline, Katie E. Personal Coorespondenc. 2009)

It is unknown how many new large or small scale developmental plans are being made in the future for areas within the District boundaries. Below are a few tables of housing demographics for each county the District encompasses. It would be false to say that the District is seeing a majority of the developmental increases listed below for each county but, it is important to list these statistics to provide an evaluation of the influxes the District is experiencing to date.

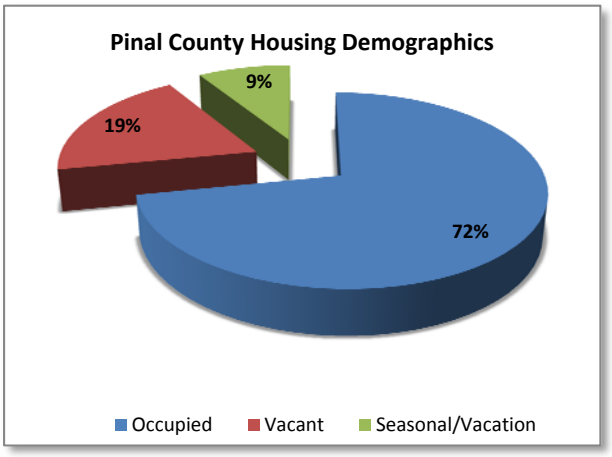
Pinal County Housing – Pinal County is seeing a 51% increase in housing densities over the previous ten years. Only 72% of the houses recorded in 2010 are occupied, 9% are vacant and 19% are used as vacation or recreational homes. In other words, individuals whom use these vacation/recreational homes are people whom own a second home removed from the District.

Table 7-9: Pinal County Population Quick Facts for 2000 and 2010.

Housing Demographic	2000	2010	Percent Change
Total Housing Units	81,154	159,222	51%
Occupied Housing Units	61,364	125,590	49%
Vacant Housing Units	19,762	33,632	59%
Seasonal, recreational Housing Units	11,764	15,499	76%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Table 7-5: Housing Demographics of Pinal County in 2010.



Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

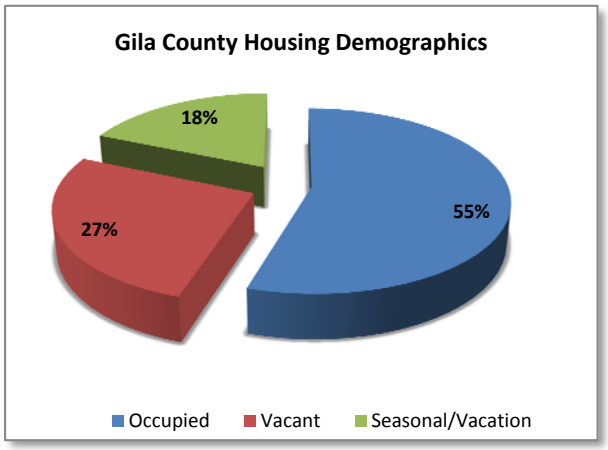
Gila County Housing – Total housing units in Gila County has increased 86% in 2010 compared to the 2000 numbers. Fifty-five percent of these homes were occupied in 2010, 18% were vacant and 27% were used as recreational homes. Gila County is showing the least amount of developmental growth compared to all three other counties that make up the District.

Table 7-10: Gila County Population Quick Facts for 2000 and 2010.

Housing Demographic	2000	2010	Percent Change
Total Housing Units	28,189	32,689	86%
Occupied Housing Units	20,140	22,000	92%
Vacant Housing Units	8,049	10,698	75%
Seasonal, recreational Housing Units	5,725	7,449	77%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Table 7-6: Housing Demographics of Gila County in 2010.



Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

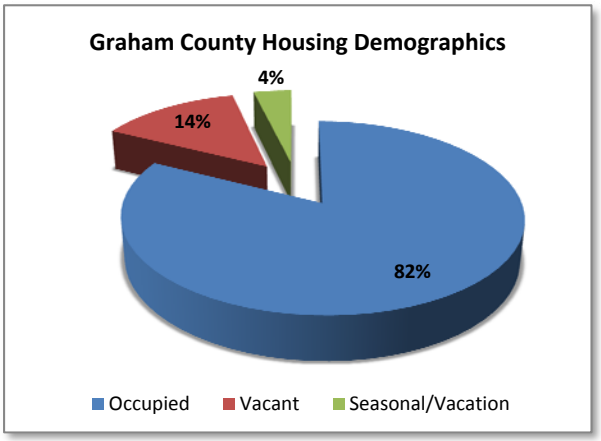
Graham County Housing – Graham County is showing an 88% increase in housing units in 2010 from the year 2000. This is the highest increase of all the counties in the District. This may be attributed to the opening of a new mining operation in Safford, Arizona and the increase of housing for the potential employees. Of the total number of homes, 82% were occupied, 4% were left vacant and 14% were used for recreational purposes.

Table 7-11: Graham County Population Quick Facts for 2000 and 2010.

Housing Demographic	2000	2010	Percent Change
Total Housing Units	11,430	12,980	88%
Occupied Housing Units	10,116	11,120	91%
Vacant Housing Units	1,314	1,860	14%
Seasonal, recreational Housing Units	289	502	58%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Table 7-7: Housing Demographics of Graham County in 2010.



Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

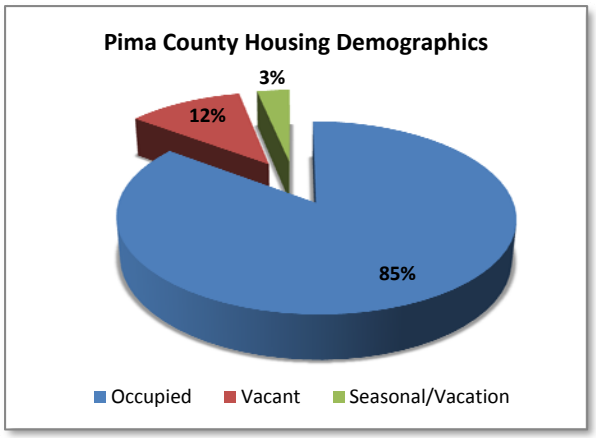
Pima County Housing – Total housing units in Pima County has risen 83% in 2010 over the previous 10 years. Eighty-five percent of the homes were occupied, only 3% were left vacant and 12% used as vocational or recreational homes.

Table 7-12: Pima County Population Quick Facts for 2000 and 2010.

Housing Demographic	2000	2010	Percent Change
Total Housing Units	366,737	440,909	83%
Occupied Housing Units	332,350	388,660	86%
Vacant Housing Units	34,387	52,249	66%
Seasonal, recreational Housing Units	10,622	14,862	71%

Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Table 7-8: Housing Demographics of Pima County in 2010.



Data Source:
http://quickfacts.census.gov/qfd/states/04/04021.html

Agricultural Statistics

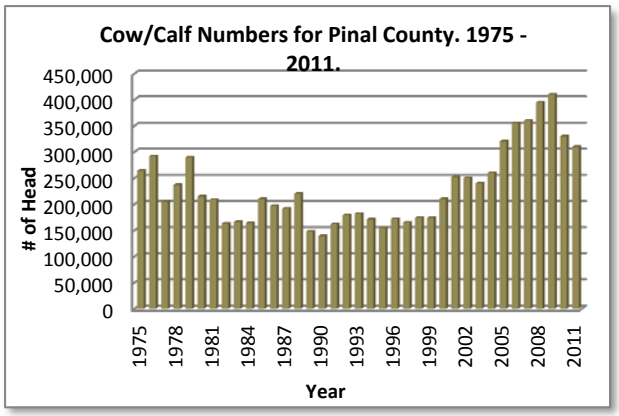
Agriculture is one of the major components of revenue produced with the District. There are two basic divisions in agriculture produced in the District; livestock and crop. Major livestock types include: cattle, horses, sheep, goats, swine, and poultry. Animal by-products are also important revenue for many producers. They include: milk, beef, tallow, fats, and fibers. Crop types include: fruits, vegetables, cereal grains, and livestock forage (Bermuda, alfalfa, vetch, wheat stubble, cotton seed/stubble), cotton fiber, legumes and other assorted grains.

In the following section, information about agriculture products and by-products will be provided for all four counties that the District partially encompasses. Although it would be false to assume the District provides all of the products that can be found in Agricultural Statistics; only ones that are known to be produced within the District will be covered. Although these products covered in this section do not solely come from within the District, it is important to give a depiction of what the revenue produced by these products totals.

Livestock – Livestock makes up the major component of the commodities produced within the District. Information provided by the National Agricultural Statistics Service (NASS) indicates livestock numbers in several different categories including: feeders, cows with calves, sheep, lambs, piglets, etc. Information can only be narrowed down by county within the state of Arizona. It will be extremely difficult to get a proper count on livestock numbers within the District without personally inquiring to individual producers simply due to the fact that the counties are larger and more land units exists within each then what the District encompasses. With that fact in mind, information provided within this section will only include livestock and crops by county and that are known to be produced in the District; they do not necessarily reflect the actual livestock numbers produced within the District but is meant to serve as example of the type of revenues that are produced by District land units. All other crops and livestock will be left out because they do not necessarily contribute to revenues produced within the District.

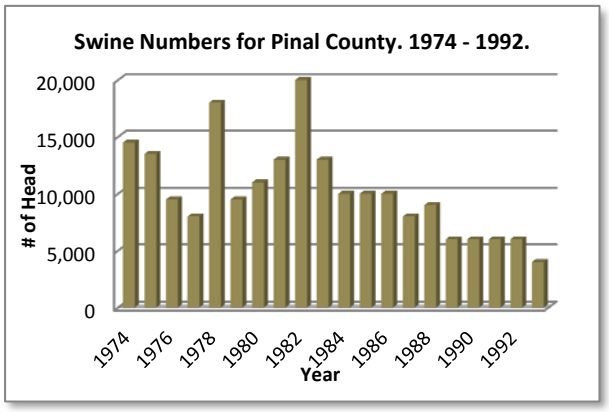
Pinal County Livestock – Statistics indicate that Pinal County is the only county out of the four that make up the District that has retained livestock numbers over the past 36 years. For cows with calves, the average count is approximately 230,730 head for over the 36 year period. The highest number of cattle that were counted was in 2009, totaling 410,000 head and the lowest numbers were counted in 1990 where 139,000 head were counted. The only other livestock that was known to be produced within the District included swine. The average number of hogs produced in the county is approximately 10,250 head where the highest numbers were recorded in 1982 at 20,000 head and the lowest in 1995 at 4,000 head. Numbers for swine is not consistent throughout the years nor is it continuous. It is unknown if any swine operations are left within the District boundaries.

Table 7-9: Cow with calves numbers for Pinal County from 1975 through 2011.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

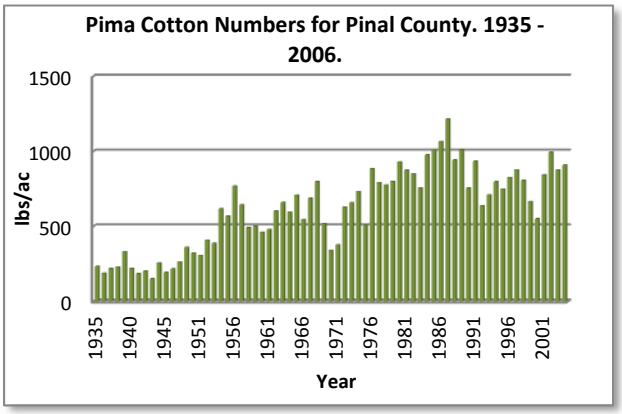
Table 7-10: Swine numbers for Pinal County from 1975 through 2011.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

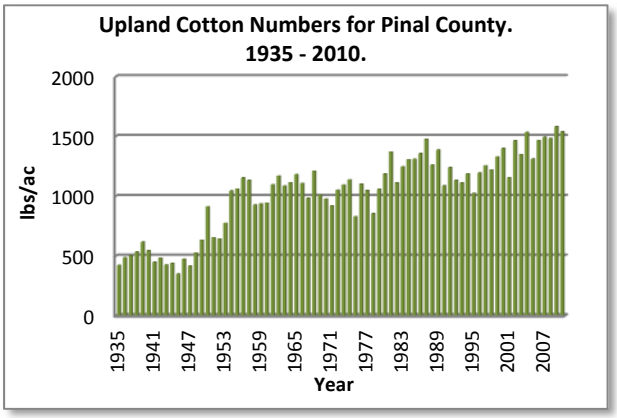
Pinal County Crops – There are only four major crops that are applicable to the District that are grown within the county. They are: Pima cotton, Upland cotton, forage based crops (alfalfa, Bermuda, vetch, sudan, sorghum) and wheat. As indicated by the NASS statistics, cotton production has fairly steadily increased over the last 75 years for both varieties. The average produced of the Pima cotton is 614 $^{lbs}/_{ac}$ with the highest production recorded in 1987 at 1,214 $^{lbs}/_{ac}$ and the lowest produced in 1943 at 150 $^{lbs}/_{ac}$. Upland cotton as proven to be a higher producer with an average of 980.5 $^{lbs}/_{ac}$. The highest production recorded for this species was in 2009 at 1,580 $^{lbs}/_{ac}$ and the lowest production recorded in 1945 at 349 $^{lbs}/_{ac}$.

Table 7-11: Pima cotton numbers for Pinal County from 1935 through 2006.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

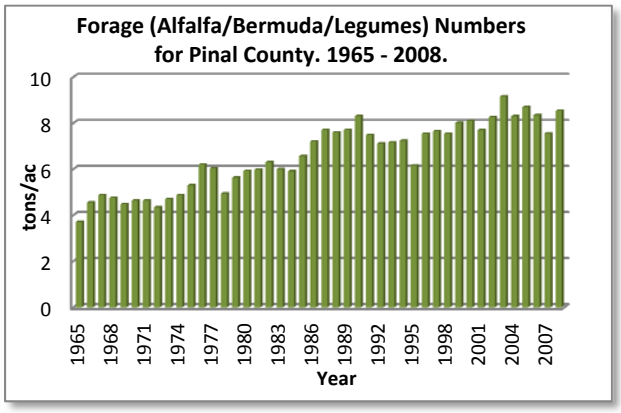
Table 7-12: Upland cotton numbers for Pinal County from 1935 through 2010.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

Forage species produced within Pinal County include alfalfa, Bermuda grass, vetch, sudan and sorghum. Either these species are bailed, physically grazed or used for silage to feed on feedlots or dairy farms. In Pinal County, the average tons per acre produced between 1965 and 2008 is approximately 6.6 $^{ton}/_{ac}$. The highest production recorded was in 2003 where 9.16 $^{ton}/_{ac}$ was grown and the lowest production recorded was in 1965 at 3.71 $^{ton}/_{ac}$.

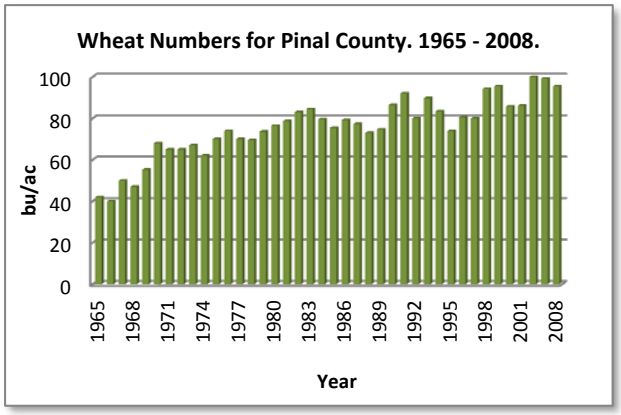
Table 7-13: Forage produced in Pinal County from 1965 through 2008.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

Wheat is the final product known to be produced consistently within the District. An average of 75.6 $^{bu}/_{ac}$ is produced within Pinal County. The highest production was recorded in 2003 at 100 $^{bu}/_{ac}$ and the lowest production was in 1966 at 40 $^{bu}/_{ac}$.

Table 7-14: Wheat produced in Pinal County from 1965 through 2008.



Data Source:
http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp

Other crops such as pinto beans, vegetables, and other cereal grains have been known to be produced within the District but only in small quantities. Numbers are not available for these crops.

SECTION – 8: District Land Units, Cooperators and Agencies

This section serves as a tribute to those land owners, producers and contributing agencies that help make this District function. Within this section, you will find a list of current and past District members (not all land owners are District members) and the land units that make up the District entirety.

District Land Units

111 Ranch – Owned by Broken Hills Proprietary; operated by Joseph and Charlie Goff.

3 C/U Circle Ranch – Owned and operated by Joseph and Charlie Goff.

7 B Ranch – Owned and operated by Michael Mercer. River property of the 7 B owned and operated by The Nature Conservancy.

96 Ranch – Owned and operated by ANAM, INC.; Jennifer and Joachim Sacksen.

A Diamond Ranch – Owned and operated by G & H Land and Cattle Co.; Gregg, Helen and Gary Vinson.

American Flag Ranch – Owned and operated by Joseph and Charlie Goff.

Aravaipa Canyon Ranch – Owned and operated by Louis Barassi.

Bar Flag Ranch – Owned and operated by Glen Links.

Bates Sales Ranch and Farm - Owned and operated by The Nature Conservancy.

Battleaxe Ranch – Owned and operated by Wade and Ashley Lueck.

Bingham Sacaton Ranch – Owned and operated by Joseph Bingham.

Black Hills Ranch – Owned and operated by Joseph and Charlie Goff.

Mountain Vista Ranch (old Box O) – Owned and operated by Gale and Sheri Brimhall.

Cactus Hill Ranch – Owned and operated by Garry VanSickle.

Campstool Ranch – Owned and operated by Michael Mercer and Laurie Brauch.

Clark Ranch – Owned and operated by the Clark Family.

Cross Triangle Ranch – Owned and operated by Joseph and Charlie Goff.

Deep Well Ranch – Owned and operated by Stanly Jolly.

Double Bar 7 Ranch – Owned and operated by Joseph and Jolene Phillips and family.

Double Check Ranch (formally part of what is now the Cactus Hill Ranch; river properties) – Owned and operated by the Schwenneson Family.

Dubois Ranch – Owned and operated by Frank "Button" and Carol Dubois.

Falcon Valley Ranch – Owned and operated by Ralph and Jan Wilson.

Flying U W Ranch – Owned and operated by W. Walter and Frances Meyer and family.

Goodman Ranch – Owned and operated by Joseph and Charlie Goff.

Gorman Ranch – Owned and operated by Kathrin Gorman.

Government Springs Ranch – Owned and operated by John and Nancy Hoopes.

Granillo Ranch – Owned and operated by Patrick Granillo.

Haydon Combe Ranch – Owned and operated by W. Walter and Frances Meyer and family.

Hillman Ranch – Owned and operated by Joseph and Charlie Goff.

Holt Ranch – Owned and operated by Ralph and Jan Wilson.

Home Ranch – Owned and operated by Joseph and Charlie Goff.

JI Ranch – Owned and operated by ASARCO.

Mescal Mountain Ranch (former Hook and Line Ranch is incorporated) – Owned and operated by Janice Dewey.

Newman Peak Ranch – Owned and operated by the Parsons family.

Nevitz Farm – Owned and operated by The Nature Conservancy.

Oracle State Park – Owned and operated by The State of Arizona.

Ortega Ranch – Owned and operated by the Ortega Family.

Page Ranch – Owned and operated by the University of Arizona.

Painted Cave Ranch – Owned and operated by Porter House Station; Langdon and Tori Hill.

Palo Verde Ranch – Owned and operated by William Tuttle.

Patsy's Ranch – Owned and operated by Patricia Reed.

Picacho Peak Land and Cattle – Owned and operated by Edwin Pickering.

Pioneer Mountain Ranch – Owned and operated by John Taylor.

PZ Farm – Owned by John Smith and operated by Becky and Jeff Heller.

Rafter 6 Ranch – Owned and operated by Kemp and Judith Morris.

Rail S Ranch – Owned and operated by Gloria and Bobby England.

Rail X Ranch – Owned and operated by Don Martin.

Rafter T Ranch – Owned and operated by Harry and Carl Hendrickson.

Reed Ranch – Owned and operated by Miriam Reed.

Romero's K Bar W Ranch – Owned and operated by Michael and Joan Romero.

Carter Farm – Owned and operated by Ruby Carter.

Sister Ryland Ranch – Owned and operated by Michael Mercer.

Slash D Ranch – Owned and operated by Thomas Penrod and family; Thomas Duke.

Slash S Ranch – Owned and operated by James Webb.

Stambaugh Ranch – Owned and operated by William Stambaugh and Becky Heller.

Steamboat Ranch – Owned and operated by Armando Rodriguez.

Sunspace Ranch (Biosphere) – Owned and operated by The University of Arizona.

Table Mountain Ranch – Owned and operated by Hattie Hedrick and family.

Table Mountain Farms – Owned and operated by Becky and Jeff Heller.

Teacup Ranch – Owned by Bader, Dobson; operated by Rick Bader.

Tecoloté Ranch (old XT) – Owned by Bader, Dobson; operated by Rick Bader.

Triangle Bar Ranch – Owned by Arizona Game and Fish Department and operated by John Smith.

Troy Ranch – Owned and operated by Richard Jodsaas.

Victory Cross Ranch – Owned and operated by Richard Jodsaas.

Wheeler Reese Ranch – Owned and operated by Dwayne Reese.

White Ranch – Owned and operated by???

Whitlow Ranch – Owned and operated by Rick Bader.

Willow Springs Ranch – Owned and operated by ANAM, INC; Jennifer and Joachim Sacksen.

YLE Ranch – Owned and operated by Thomas Hendrickson.

Zapata Ranch – Owned and operated by Jack Mann and Catharine Hedrick.

District Serving Agencies

Arizona Game and Fish Department
Tucson Regional Office
555 N Greasewood
Tucson, AZ 85745
Phone: (520) 628 – 5376

Arizona Natural Resource Conservation District State Association
P.O. Box 35625
Tucson, AZ 85740
Phone: (520) 850 - 8250

Arizona State Land Department – Phoenix
1616 W. Adams
Phoenix, AZ 85007
Phone: (602) 542 – 4625

Arizona State Land Department - Tucson
177 N Church Ave.; Suite 1104
Tucson, AZ 85701
Phone: (520) 209 – 4268

Bureau of Land Management
Lower Sonoran Field Office
21605 N 7th Ave.
Phoenix, AZ 85027-2929
Phone: (623) 580-5500

Bureau of Land Management
Safford Field Office
711 14th Ave.
Safford, AZ 85546
Phone: (928) 348 - 4400

Bureau of Land Management
Tucson Field Office
12661 E Broadway
Tucson, AZ 85748–7208
Phone: (520) 258-7200

USDA – National Forest Service
Coronado National Forest
Santa Catalina Ranger District
5700 N. Sabino Canyon Rd.
Tucson, AZ 85750
Phone: (520) 749 – 8700

USDA – National Forest Service
Coronado National Forest
Safford Ranger District
711 14th Ave., Suite D
Safford, AZ 85546
Phone: (928) 428 - 4150

USDA – National Forest Service
Tonto National Forest
Globe Ranger District
7680 S. Six Shooter Canyon Rd.

Globe, AZ 85501
Phone: (928) 402 – 6200

USDA – Natural Resources Conservation Service
Tucson Field Office
3241 N Romero Rd.
Tucson, AZ 85705
Phone: (520) 292 – 2999 x 105

USDA – Natural Resources Conservation Service
Tucson Plant Materials Center
3241 N Romero Rd.
Tucson, AZ 85705
Phone: (520) 292 – 2999 x 101

USDA – Farm Service Agency
Pinal County
520 N. Camino Mercado, Suite 2F
Casa Grande, AZ 85222
Phone: (520) 836-2048

SECTION – 10: REFERENCES

"2006 – 2008 Status of Ambient Surface Water Quality in Arizona". 2008. *Arizona Department of Environmental Quality*. http://www.azdeq.gov/function/forms/download/2008/NPS_Annual_Report_FY08.pdf

"2010-11 Arizona Hunting and Trapping Regulations". *Arizona Game and Fish Department Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. 2010.

"2011 Arizona NRCS Noxious and Invasive Species". *U. S. Department of Agriculture, Natural Resources Conservation Service*. Arizona. 2011.

"2011-12 Arizona Hunting and Trapping Regulations". *Arizona Game and Fish Department Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. 2011.

"2012 Spring Turkey, Javelina, Buffalo and Bear Hunt Draw Information". *Arizona Game and Fish Department Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. 2011.

"Active Management Areas (AMAs) and Irrigation Non-expansion Areas (INAs)". *Arizona Department of Water Resources*. 2012. http://www.azwater.gov/AzDWR/WaterManagement/AMAs/default.htm

"Agriculture Home Page". *Arizona Department of Water Resources*. 2012. http://www.azwater.gov/AzDWR/StatewidePlanning/Conservation2/Agriculture/

"Air Actions, Arizona". Pacific Southwest, Region 9. *EPA; United States Environmental Protection Agency*. 2010. http://www.epa.gov/region9/air/actions/az.html

"Air Quality". United States Department of Agriculture, Natural Resources Conservation Service. Arizona. 2011. http://www.az.nrcs.usda.gov/programs/air.html

Altschul, Jeffrey H. 1997. "From North to South: Shifting Sociopolitical Alliances During the Formative Period in the San Pedro Valley. In Prehistory of the Borderlands: Recent Research in the Archaeology of Northern Mexico and the Southern Southwest". Edited by J. Carpenter and G. Sanchez, pp. 57-69. *Archaeological Series* No. 186. Arizona State Museum, University of Arizona, Tucson.

"American Flag Mine (Bearcat group; Madre del Oro Mine; Lovejoy property), Campo Donito, Oracle District (Control District; Old Hat District; Santa Catalina District), Santa Catalina Mts, Pinal Co., Arizona, USA". *Mine Data Organization*. 2012. http://www.mindat.org/loc-43685.html

"American Stewards of Liberty. Call America, Coordinating America's Local Leaders". 2009. Pub. *American Stewards of Liberty*. Taylor, TX. 198 p.

"Antelope Mine (Antelope Peak Mine; Meyer Mine; Soldier Boy Mine; Unpatented claims MS 3589), Meyer Wash, Cedar Mountain area, Antelope District, Tortilla Mts, Pinal Co., Arizona USA". *Mine Data Organization*. 2012. http://www.mindat.org/loc-43105.html

Antevs, Ernst. 1953. "Artifacts with Mammoth Remains, Naco, Arizona: Age of the Clovis Fluted Points with the Naco Mammoth". *American Antiquity* 19:15-18.

Antevs, Ernst. 1959. "Geological Age of the Lehner Mammoth Site". *American Antiquity* 25:31-34.

"Arizona's Most Notable Storms". *National Weather Service Forecast Office*. Phoenix, Arizona. 2011. http://www.wrh.noaa.gov/psr/general/history/index.php?wfo=psr&page=top

"Arizona Planning Guides". *USDA – NRCS Electronic Field Office Technical Guide*. Pinal County, Arizona. 2003. http://efotg.sc.egov.usda.gov/treemenuFS.aspx

Basso, Keith. 1983. "Western Apache in Southwest. Handbook of North American Indians". *Smithsonian Institution Press*, Washington, D.C. vol. 10, edited by Alfonso Ortiz, pp. 462-488.

Bayham, F., D. F. Morris, and M. S. Shackley. 1986. "Prehistoric hunter-gatherers of south central Arizona: the Picacho Reservoir Archaic Project". Anthropological field studies no. 13. *Tempe: Department of Anthropology*, Arizona State University.

"BHP Copper, INC – State of Closure, San Manuel Operations. Arizona Mining Association. 2006. http://www.azcu.org/viewNews.php

"Blue Bird Mine (Bluebird Mine; Zilla Mine; Twin0S Mine; Cumberland Mine; Thornewood Mine; Blue Bird Silver Mining Co. property), Bunker Hill District (Copper Creek District), Galiuro Mts, Pinal Co., Arizona, USA". Mine Data Organization. 2012. http://www.mindat.org/loc-44361.html

Bolton, Herbert E. 1919. "Kino's Historical Memoir of Pimería Alta". Volume I. *Arthur H. Clark Company*, Cleveland.

Brochu, Ben. "Development of Wildlife Waters throughout the 96 Hills Mountain Range – Phase One". Arizona Game and Fish Department. Habitat Partnership Program, Project No. 09-521. September 1, 2007.

Brochu, Ben. "Painted Cave Water Project – Phase 2". Arizona Game and Fish Department. Habitat Partnership Program, Project No. 09-521. September 1, 2008.

Bronitsky, Gordon, and James D. Merritt. 1986. "The Archaeology of Southeast Arizona: A Class I Cultural Resource Inventory". Cultural Resource Series No. 2. *Bureau of Land Management*, Arizona State Office, Phoenix.

"Bunker Hill Mine (Mammoth Mine; Rattlesnake Mine; Rattlesnake deposit), Tombstone District, Tombstone Hills, Cochise Co., Arizona, USA". *Mine Data Organization*. 2012. http://www.mindat.org/loc-32899.html

Burrus, Ernest J., S.J. 1965. “Kino and the Cartography of Northwestern New Spain”. *Arizona Pioneer's Historical Society.* Tucson.

Burrus, Ernest J., S.J. 1971. “Kino and Manje, Explorers of Sonora and Arizona: Their Vision of the Future, a Study of Their Expeditions and Plans”. Sources and Studies for the History of the Americas: Volume XX. *Jesuit Historical Institute*, Rome.

Cable, John S., and David E. Doyel. 1987. “Pioneer period village site structure and settlement patterns in the Phoenix Basin. *In the Hohokam village: site structure and organization”n.* David E. Doyel, ed. Glenwood Springs, Colorado: *American Association for the Advancement of Science*.

“Check Your Water Supply”. Pinal’s Water Basins. *Arizona Department of Water Resources*. 2011. http://www.adwr.state.az.us/CkWaterSupply/Pinal.aspx

“Christmus Mine (Red Bird shafts; Inspiration Mine; Hackberry shafts), Christmas, Christmas area, Banner District, Dripping Springs Mts, Gila Co., Arizona, USA. 2012. http://www.mindat.org/loc-3326.html

Clark, Jeffery J. (editor). 2008. “Mounds and Migrants: Late Prehistoric Archaeology of the Lower San Pedro River Valley, Arizona”. Draft Ms. on file. *Center for Desert Archaeology*, Tucson.

Clark, Jeffery J., M. Kyle Woodson, and Mark C. Slaughter. 1999. “Tracking Puebloan Migrations into Southeastern Arizona”. Paper presented at the 64th Annual Meeting of the *Society for American Archaeology*, Chicago.

“Cline Library, Special Collections and Archives”. *Northern Arizona University*. 2012. http://archive.library.nau.edu/index.php

Connell, J. H. and R. O. Slayter. 1977. “Mechanisms of succession in natural communities and their role in community stability and organization”. *The American Naturalist*. 111:1119-1114.

“Control of Emissions of Air Pollution from Non-road Diesel Engines; Final Rule”. 1998. Federal Registrar. 40 CFR Parts 9, 86, and 89. *EPA; United States Environmental Protection Agency*.

“Control of Emissions of Air Pollution from Nonroad Diesel Engines, Final Rule”. *Federal Register.* Environmental Protection Agency. Vol 63. No. 205. (October 23, 1998): 40 CFR Parts 9, 86 and 89. p. 56968-57023.

“Creation of Mineral Strip” *Library of Congress, Thomas*. Public Law 93-530. H. R. 7730. 1973. http://thomas.loc.gov/home/thomas.php

Di Peso, Charles C. 1953. “The Sobaipuri Indians of the Upper San Pedro River Valley, Southeastern Arizona”. Archaeology Series No. 6. *Amerind Foundation*. Dragoon, Arizona. References Cited Page 40

Di Peso, Charles C. 1956. “The Upper Pima of San Cayetano del Tumacacori”. Archaeology Series No. 7. *Amerind Foundation*. Dragoon, Arizona.

Di Peso, Charles C. 1958. “The Reeve Ruin of Southeastern Arizona: A Study of a Prehistoric Western Pueblo Migration into the Middle San Pedro Valley”. Archaeology Series No. 8. *The Amerind Foundation.* Dragoon, Arizona.

Doelle, William H., David A. Gregory, and Henry D. Wallace. 1995. “Classic period platform mound systems in southern Arizona. In The Roosevelt Community Development Study: new perspectives on Tonto Basin prehistory”. M.D. Elson, M.T. Stark, and D.A. Gregory, eds. Anthropological papers no. 15. Tucson: *Center for Desert Archaeology*.

Dobyns, Henry F. 1989. “The Pima-Maricopa”. *Chelsea House*, New York.

Doyel, David E. 1980. “Hohokam social organization and the Sedentary to Classic transition”. In Current issues in Hohokam prehistory, David E. Doyel and Fred Plog, eds. Anthropological research papers No. 23. Tempe: *Arizona State University*.

Doyel, David E. 1991. “Hohokam exchange and interaction. In Chaco and Hohokam: prehistoric regional systems in the American Southwest”. Patricia L. Crown and W. James Judge, eds. *Santa Fe: School of American Research Press*.

Doelle, William H. 1995. “The Centuries Before Coronado: The Classic Period on the San Pedro River”. *Archaeology in Tucson*. 9:1-6.

Doelle, William H., and Henry D. Wallace. 1997. “Classic Period Platform Mound System on the Lower San Pedro River, Southern Arizona. In Prehistory of the Borderlands: Recent Research in the Archaeology of Northern Mexico and the Southern Southwest”. Edited by J. Carpenter and G. Sanchez, pp. 71-84. Archaeological Series No. 186. *Arizona State Museum.* University of Arizona, Tucson.

Doelle, William H., Jeffrey J. Clark, and Henry D. Wallace. 1998. “A Research Design for Studying Classic Period Interaction and Exchange in the San Pedro River Valley, Arizona”. Ms. on file. C*enter for Desert Archaeology*. Tucson.

Downum, Christian E., Adrienne G. Rankin and Jon S. Czapliki. 1986. “A Class III Archaeological Survey of the Phase B Corridor, Tucson Aqueduct, Central Arizona Project”. Archaeological Series 168. *Arizona State Museum*. University of Arizona, Tucson.

Doyel, David E. 1977. “The England Ranch Ruin. In Excavations in the Middle Santa Cruz River Valley, Southeastern Arizona”. Edited by David E. Doyel, pp. 112-193. Contributions to Highway Salvage Archaeology in Arizona No. 44. *Arizona State Museum*. University of Arizona, Tucson.

Doyel, David E. (editor). 1977. “Excavations in the Middle Santa Cruz River Valley, Southeastern Arizona”. Arizona State Museum Contribution to Highway Salvage in Arizona No. 44. *Arizona State Museum.* University of Arizona, Tucson.

“Draft 2010 Status of Water Quality in Arizona 305(b) Assessment and 303(d) Listing Report”. *Arizona Department of Environmental Quality*. Middle Gila Watershed Water Quality Assessment. Chp. II. p MG1-MG66. November 2009.

"Draft 2010 Status of Water Quality in Arizona 305(b) Assessment and 303(d) Listing Report". *Arizona Department of Environmental Quality*. San Pedro Watershed Water Quality Assessment. Chp. II. p SP1-MG56. November 2009.

"Drought Monitor Archives". *Drought Monitor*. 2011. http://droughtmonitor.unl.edu/archive.html

"Environmental Review On-line Tool". *Arizona Game and Fish Department*. 2011. http://www.azgfd.gov/hgis/

"External Radiation Summary – Page-Trowbridge Ranch Landfill". Radioactive Materials Summary. *The University of Arizona*. Date unknown. http://orcbs.arizona.edu/files/forms/Page%20Ranch%20External%20Radiation%20Summary.pdf

Ezzo, J. A and W. L Deaver. 1998. "Watering the Desert: Late Archaic Farming at the Costello-King Site". Technical Series No. 68. *Statistical Research, Inc*., Tucson.

"Fact Sheet. Aquifer Protection Permit". Arizona Department of Environmental Quality. BHP San Manuel Plant Site. Inventory #: 102370. No date given.

Fish, Suzanne K., Paul R. Fish, and John H. Madsen, eds. 1992. "The Marana community in the Hohokam world". Anthropological papers no. 56. Tucson: *University of Arizona*.

Franklin, Hayward H. 1980. "Excavations at Second Canyon Ruin, San Pedro Valley, Arizona". Arizona State Museum Contribution to Highway Salvage Archaeology No. 60. *Arizona State Museum*. University of Arizona, Tucson.

Franklin, Hayward H., and W. Bruce Masse. 1976. "The San Pedro Salado: A Case for Prehistoric Migration". The Kiva 42:47-55. Page 41.

Garcia P. G., Dawn H., Terry Braun, P.E. "Closure at the San Manuel Plant Site. How Closure Aligned with the Goal of Environmental Sustainability". *SRK Consulting (U.S.) INC*. October 2007.

"General Land Office Records". *U. S. Department of the Interior, Bureau of Land Management*. 2012. http://www.glorecords.blm.gov/search/default.aspx#searchTabIndex=0&searchByTypeIndex=1

Gerald, Rex E. 1958. "Davis Ranch Site" (ARIZ:BB:11:7 [AF]). Ms. on file. *Amerind Foundation*. Dragoon, Arizona.

Gerald, Rex E. 1968. "Spanish Presidios of the Late 18th Century in Northern New Spain". Museum of New Mexico Research Records No. 7. *Museum of New Mexico Press*. Santa Fe.

Gregory, David A. and Fred L. Nials. 1985. "Observations Concerning the Distribution of Classic Period Hohokam Platform Mounds". In "Proceedings of the 1983 Hohokam Symposium, Part I," edited by Alfred E. Dittert, Jr., and Donald E. Dove. *Arizona Archaeological Society Occasional Papers* 2: 373-388. Phoenix: Arizona Archaeological Society.

Gregory, David A. *1987*. "Morphology of Platform Mounds and the Structure of Classic Hohokam Sites. In: *The Hohokam Village: Site Structure and Organization"*, edited by David E. Doyel, pp. 183-210.

Glenwood Springs, Colorado: Southwestern and Rocky Mountain Division of the *American Association for the Advancement of Science*.

Gregory, David A. 1991. "Form and Variation in Hohokam Settlement Patterns. In Chaco and Hohokam: Prehistoric Regional Systems in the American Southwest". Edited by P. L. Crown and W. J. Judge, pp. 159-193. S*chool of American Research Press*. Santa Fe.

Gregory, David A., Michelle N. Stevens, Fred L. Nials, Mark R. Schurr, and Michael W. Diehl. 2007. "Excavations in the Santa Cruz Valley Floodplain: Further Investigations at Los Pozos". Anthropological Papers No. 27. *Center for Desert Archaeology*. Tucson, Arizona.

Gregory, David A., and Gary Huckleberry. 1995. "An archaeological survey in the Blackwater area: the history of human settlement in the Blackwater area". Cultural resources report no. 86(1). Tempe: *Archaeological Consulting Services*, Ltd.

"Groundwater Conditions in the Aravaipa Canyon Basin". Arizona Department of Water Resources. 2006. Sec. 3.1. p 82-108. http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/SEArizona/Groundwater/AravaipaCanyon.htm

"Groundwater Conditions in the Lower San Pedro Basin". Arizona Department of Water Resources. 2006. Sec. 3.8. p 293-334. http://www.azwater.gov/AzDWR/StatewidePlanning/WaterAtlas/SEArizona/Cultural/LowerSanPedro.htm

Halbirt, Carl D., Kurt Dongoske, and T. Kathleen Henderson. 1993. "Coffee Camp: a Late Archaic site on the Santa Cruz flats". In *Archaic occupation on the Santa Cruz flats: the Tator Hills Archaeological Project*. Carl D. Halbirt and T. Kathleen Henderson, eds. Flagstaff: Northland Research, Inc.

Haury, Emil W. 1953. "Artifacts with Mammoth Remains, Naco, Arizona: Discovery of the Naco Mammoth and the Associated Projectile Points". *American Antiquity* 19:1-14.

Haury, Emil W., E. B. Sayles, and William W. Wasley. 1959. "The Lehner Mammoth Site, Southeastern Arizona". *American Antiquity* 25:2-30.

Haury, Emil W. 1976. "The Hohokam: desert farmers and craftsmen". Tucson: *University of Arizona Press*.

Haynes, Chris. 2011. "Crop and Irrigated Pastures in the Winkelman District". Email correspondence. USDA - Natural Resources Conservation Service. Tucson, Arizona.

Haynes, C. Vance Jr. 1987. "Curry Draw, Cochise County, Arizona: A Late Quaternary Stratigraphic Record of Pleistocene Extinction and Paleo-Indian Activities. In Geological Society of America Centennial Field Guide". Cordilleran Section, pp. 23-28. *Geological Society of America*. Tucson, Arizona.

Haynes, C. Vance Jr. 1991. "Geoarchaeological and Paleohydrological Evidence for a Clovis-Age Drought in North America and its Bearing on Extinction". Quaternary Research 35:438-450.

Haynes, C. Vance Jr., and Emil W. Haury. 1975. “Archeological Investigations at the Lehner Site, Arizona, 1974-1975”. National Geographic Society Research Reports: 1973 Projects. *National Geographic Society*. Washington, D.C.

Heffelfinger, Jim & Paul M. Webb. 2010. History of Arizona Deer Translocations.

Henderson, T Kathleen. 1987. “Field Investigations at the Marana Community Complex”. Arizona State University Anthropological Field Studies 14. Tempe: *Department of Anthropology*, Arizona State University.

Howard, Jerry B., and Gary Huckleberry. 1991. “The operation and evolution of an irrigation system: the east Papago canal study”. Publications in Archaeology No. 18. Phoenix: *Soil Systems, Inc.*

Huckell, Bruce B. 1984. “Sobaipuri Sites in the Rosemont Area. In Miscellaneous Archaeological Studies in the Anamax-Rosemont Land Exchange Area”. Edited by M. D. Tagg, R. C. Ervin and B. B. Huckell, pp. 107-150. Archaeological Series No. 147. Arizona State Museum. *University of Arizona*, Tucson, Arizona.

Huckell, Bruce B. 1995. “Of Marshes and Maize: Preceramic Agricultural Settlements in the Cienega Valley, Southeastern Arizona”. Anthropological Papers of the University of Arizona No. 59. *University of Arizona Press*. Tucson, Arizona.

Humphrey, Amy. 2012. “BLM Permits in the Winkelman District”. Email correspondence. *U. S.* Department of the Interior, Bureau of Land Management. Safford, Arizona.

“Hunt Arizona, 2008 Edition. Survey, Harvest and Hunt Data for Big and Small Game”. *Arizona Game and Fish Department, Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. April 2008.

“Hunt Arizona, 2009 Edition. Survey, Harvest and Hunt Data for Big and Small Game”. *Arizona Game and Fish Department, Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. May 2009.

“Hunt Arizona, 2010 Edition. Survey, Harvest and Hunt Data for Big and Small Game”. *Arizona Game and Fish Department, Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. May 2010.

“Hunt Arizona, 2011 Edition. Survey, Harvest and Hunt Data for Big and Small Game”. *Arizona Game and Fish Department, Information and Education Division, Information Branch, Publications Section*. Arizona Game and Fish Department. June 2011.

Jordan, Gilbert l. 1974. Personal Communication through W. Walter Meyer. University of Arizona, Tucson.

Lance, John F. 1953. “Artifacts with Mammoth Remains, Naco, Arizona: Description of the Naco Mammoth”. *American Antiquity* 19:19-24.

Lance, John F. 1959. “Faunal Remains from the Lehner Mammoth Site”. *American Antiquity* 25:35-42.

Larson, Louise Fenn. 1999. “Pomerene, Arizona, and the Valley of the San Pedro: A History. *Cox Printing*. Mesa, Arizona.

Loendorf, Chris, and Glen E. Rice. 2004 Projectile Point Typology, Gila River Indian Community, Arizona. Anthropological Research Papers No. 2. Sacaton, Ariz.: Cultural Resource Management Program, Gila River Indian Community.

Lindsay, Alexander J. Jr. 1987. “Anasazi Population Movements to Southeastern Arizona”. *American Archeology* 6:190-198.

Lyons, Patrick D. 2001. “Winslow Orange Ware and the Ancestral Hopi Migration Horizon”. Unpublished Ph.D. Dissertation. *Department of Anthropology*, University of Arizona. Tucson, Arizona.

Karns, Harry J. 1954. “Unknown Arizona and Sonora, 1693-1721: Luz de Tierra Incógnita”. *Arizona Silhouettes*. Tucson, Arizona.

Mabry, Jonathan, Deborah L. Swartz, Helga Wöcherl, Jeffrey J. Clark, Gavin W. Archer, and Michael W. Lindeman. 1997. “Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Descriptions of the Santa Cruz Bend, Square Hearth, Stone Pipe, and Canal Sites”. Anthropological Papers No. 18. *Center for Desert Archaeology*. Tucson, Arizona.

Mabry, Jonathan (editor). 1998. “Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Analyses and Synthesis”. Anthropological Papers No. 19. *Center for Desert Archaeology*. Tucson, Arizona.

Mabry, Jonathan B. 1999. “A Rare Glimpse of the Sobaipuri from Colossal Cave”. *Archaeology Southwest* 13:11.

Masse, W. Bruce. 1980. “The Hohokam of the Lower San Pedro Valley and the Northern Papagueria: Continuity and Variability in Two Regional Populations”. In Current Issues in Hohokam Prehistory, edited by D. Doyel and F. Plog, pp. 205-223. Arizona State University Anthropological Research Papers No. 23. *Arizona State University*. Tempe, Arizona.

Masse, W. Bruce. 1981. “A Reappraisal of the Protohistoric Sobaipuri Indians of Southeastern Arizona. In The Protohistoric Period in the North American Southwest, A.D. 1450-1700”. Edited by D. R. Wilcox and W. B. Masse, pp. 28-56. Arizona State University Anthropological Research Papers No. 24. *Arizona State University*. Tempe, Arizona.

Masse, W. Bruce. 1982. “The Peppersauce Wash Project: Excavations at Three Multicomponent Sites in the Lower San Pedro Valley, Arizona”. Ms. on file. Arizona State Museum. *University of Arizona*. Tucson, Arizona.

“Maudina Mine (Campo Bonito gp; Bonito Mines; Other claims; Maudina claims/property), Campo Bonito Mines, Campo Bonito, Oracle District (Control District; Old Hat District; Santa Catalina District), Santa Catalina Mts, Pinal Co. Arizona, USA”. *Mine Data Organization*. 2012. http://www.mindat.org/loc-51771.html

McKelvey, Nat. 1958. “Reckless, Romantic Redington”. *Arizona Highways*. May 1958:34-39.
“Particulate Matter in Hayden, AZ”. Pacific Southwest, Region 9. *EPA; United States Environmental Protection Agency*. 2010. http://www.epa.gov/region9/air/az/hayden/index.html

Meyer, W. Walter. 1922. *Antelope Peak Mining Company file records*. Retrieved on 2011.

Meyer, W. Walter. “Winkelman Natural Resource Conservation District Field Report”. *Winkelman Natural Resource Conservation District*. 1980.

Morris, Donald H. 1969. “Red Mountain: an Early Pioneer Period Hohokam site in the Salt River Valley of central Arizona”. *American Antiquity* 34(1):40-53.

Muffley, Bernard W. “The History of the Lower San Pedro Valley in Arizona”. Masters of Arts Thesis. *Department of History*. The University of Arizona. 1938.

Neily, Robert. 1991. “An archaeological survey of existing El Paso Natural Gas Company pipelines on the Gila River Indian Community, Maricopa and Pinal Counties, Arizona”. Unpublished manuscript. *Tempe: Archaeological Consulting Services, Ltd.*

“Off Highway Vehicle Program: OHV”. Rules and Laws. *Arizona State Parks*. 2012. http://azstateparks.com/ohv/rules.html

“OHV Decal revenue: What is it used for?”. *Arizona Game and Fish Department, Wildlife Blog: Wildlife News*. 2012. http://www.azgfd.net/wildlife/ohv-news/ohv-decal-revenue-what-is-it-used-for/2009/03/12/

“Old Reliable Mine (Reliable Mine; Calumet Mine; Clark-Scanlon group; Copper Creek Mining Co. property), Copper Creek, Copper Creek (Copper Creek Canyon), Bunker Hill District (Copper Creek District), Galiuro Mts, Pinal Co., Arizona, USA”. *Mine Data Organization*. 2012. http://www.mindat.org/loc-52458.html

Pattie, James Ohio. “Personal Narrative of James O. Pattie. Ed. By Richard Batman”. *Mountain Press Publishing Company*. Missoula, MT. 1988. p. 200.

“Particulate Matter in Hayden, AZ”. Pacific Southwest, Region 9. *EPA; United States Environmental Protection Agency*. 2010. http://www.epa.gov/region9/air/az/hayden/index.html

“Particulate Matter in Pinal County, AZ”. Pacific Southwest, Region 9. *EPA; United States Environmental Protection Agency*. 2010. http://www.epa.gov/region9/air/az/pinal/index.html

“Period of Record Monthly Climate Summary”. *Arizona Climate Summaries*. Florence, Arizona (023027). 2005. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azflor

“Period of Record Monthly Climate Summary”. *Arizona Climate Summaries*. Globe, Arizona (023498). 1975. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azglob

"Period of Record Monthly Climate Summary". *Arizona Climate Summaries*. Oracle 2 SE, Arizona (026119). 2005. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azorac

"Period of Record Monthly Climate Summary". *Arizona Climate Summaries*. Red Rock 6 SSW, Arizona. 1973 (027058). http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azredr

"Period of Record Monthly Climate Summary". *Arizona Climate Summaries*. Willow Springs Ranch, Arizona (029382). 1978. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwils

"Period of Record Monthly Climate Summary". *Arizona Climate Summaries*. Winkelman, Arizona (029420). 1980. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?azwink

"Pima-Maricopa Irrigation Project, Education Initiative 2002-2003. Ashurst-Hayden Diversion Dam: 1916-1922". Moving Towards the San Carlos Irrigation Project. No date given. Part 31. p 43-45. http://gilariver.com/lessons/sancarloslesson31.pdf

"Pinal County Water Resources". Pinal County Comprehensive Plan. *Pinal County*. Part 7.0. p 52-69. Date unknown. http://pinalcountyaz.gov/Departments/PlanningDevelopment/Documents/PDCP/CWWaterElement.pdf

"Pure Gold Mine, Campo Bonito Mines, Apache Peak area, Campo Bonito, Oracle District (Control District; Old Hat District; Santa Catalina District), Santa Catalina Mts, Pinal Co., Arizona, USA". *Mine Data Organization*. 2012. http://www.mindat.org/loc-130446.html

"Ray Mine, Scott Mountain area, Mineral Creek District (Ray District), Dripping Springs Mts, Pinal Co., Arizona, USA". *Mine Data Organization*. 2012. http://www.mindat.org/loc-3377.html.

"Ray Operations". *ASARCO, Groupo Mexico*. 2012. http://www.asarco.com/about-us/our-locations/ray-operations

"Rediscover the American Southwest!". *Grand Enchantment Trail, 700 Miles Across the American Southwest.* 2012. http://www.simblissity.net/get-home.shtml

Reynard, Charles. 1934. "Kilberg [Kielberg] Mesa Pueblo". Ms. on file. Arizona State Museum Archives. *University of Arizona*. Tucson, Arizona.

Rice, Glen E. 1990. "Variability in the development of Classic period elites. In A design for Salado research". G.E. Rice, ed. Roosevelt monograph series 1. Anthropological field studies 22. Tempe: *Office of Cultural Resources Management, Arizona State University*.

"Robson Ranch Mountains, L.L.C. v. Pinal County and *ANAM, INC. v. Pinal County"*. Arizona Court of Appeals. Division 2. 2 CA-CV 2002-0054 and 0060. 2001.

Rowe, Jerry M. "Copper Creek; A Biographo fo Martin E. Tew". 2010. *Publish America, LLLP*. First Printing. Baltimore.

"San Carlos Mineral Strip Act of 1990". *Library of Congress, Thomas*. Public Law 101-447. H. R. 4593. 1990. http://thomas.loc.gov/home/thomas.php

"San Manuel Mine (Apex Lead & Vandium Mining Corp Mine; Quarellie group), San Manuel, San Manuel District, Pinal Co., Arizona, USA". *Mine Data Organization*. 2011. http://www.mindat.org/loc-6804.html

Sayles, E. B. 1945. "The San Simon Branch: Excavations at Cave Creek and in the San Simon Valley I: Material Culture". Medallion Papers No. 34. *Gila Pueblo*. Globe, Arizona.

Sayles, E. B. 1983. "The Cochise Cultural Sequence in Southeastern Arizona". Anthropological Papers of the University of Arizona No. 42. *University of Arizona Press*. Tucson, Arizona.

Sayles, E. B., and Ernst Antevs. 1941. "The Cochise Culture". Medallion Papers No. 29. *Gila Pueblo*. Globe, Arizona.

Seymour, Deni J. 1989. "The Dynamics of Sobaipuri Settlement in the Eastern Pimeria Alta". *Journal of the Southwest* 31(2):205-222.

Seymour, Deni J. 1993. "In Search of the Sobaipuri Pima: Archaeology of the Plain and Subtle". *Archaeology in Tucson* 7(1):1-4.

Seymour, Deni J. 1993. "Piman Settlement Survey in the Middle Santa Cruz River Valley, Santa Cruz County Arizona". MAI Project No. 751. *Mariah Associates, Inc*. Albuquerque, New Mexico.

Simpson, B. B. (Ed.) 1977. "Mesquite: its biology in tow desert ecosystems". U. S./ I. B. P. Synthesis Series: 4. *Dowder, Hutchingson, and Ross, Inc*. Stroudsburg, Penn. P. 250.

Sliva, R. Jane. 1997. "Atlatls to Arrows: Changes in Stone-tipped Projectiles along the Santa Cruz River". *Archaeology in Tucson* 11(3):11.

Smith, C. F., K. M. Sherman, G. L. Pope, P. D. Rigas. "Summary of Floods of 1993". *U. S. Geological Survey Kansas Water Science Center*. U.S. Geological Survey. 2005-02-23, pp. WSP. 2499. Retreived on August 8, 2011.

Sommers, William. "24 Hours in the Old Pueblo Land Use Permit". Email correspondence. *Arizona State Land Department*. 2012.

Spring, John, A. "Troublous Days in Arizona". *The National Tribune*. Date unknown.

"Standards of Performance for Stationary Compression Ignition and Spark Ignition Internal Combustion Engines, Final Rule". *Federal Register.* Vol 76. No. 124. (June 28, 2011): 40 CFR Parts 60, 1039, 1042, 1065 and 1068. p. 37954-37978.

"State Land Department Historical Overview". *Arizona State Land Department.* 2012. http://www.land.state.az.us/history.htm

Stevens, Michelle N. 1999. "Spectacular Results from Modest Remains". *Archaeology Southwest* 13(1):4-5.

Stoddart, L. A. and A. D. Smith. 1955. “Range Management”. *McGraw-Hill Book Co., Inc*. New York. P 433.

“Sulfur Dioxide in San Manuel, Arizona”. Pacific Southwest, Region 9. *EPA; United States Environmental Protection Agency*. 2007. http://www.epa.gov/region9/air/az/sanmanuel/index.html

“Table 11. Cattle and Calves – Inventory and Sales: 2007 and 2002”. 2007 Census of Agriculture – County Data. *USDA, National Agricultural Statistics Service*. 2007. P. 274-278. www.agcensus.usda.gov/Publications/**2007**/Full_Report/Volume_1

Taylor, Bill. “Liz’s Grove at the Double Check Ranch”. *vtha*. 2009. http://vhta.com/

“Taylor Grazing Act of 1934. Title 43. *U. S. Code* § 315-316o. 1934.

Taylor, Mary. 1995. “Cascabel: A Bare Bones Accounting of Some Significant Happenings along the San Pedro River”. Ms. on file. *Desert Archaeology*, Inc. Tucson, Arizona.

“Triangle Bar Purchase”. Environmental Impact Statement, Rosemont Copper. *U. S. Department of Agriculture, Forest Service*. 2011. http://www.rosemonteis.us/?q=node/669

Tuthill, Carr. 1947. “The Tres Alamos Site on the San Pedro River, Southeastern Arizona”. The Amerind Foundation No. 4. *The Amerind Foundation, Inc.* Dragoon, Arizona.

“Uniting the Vision for Pinal County”. 2008. *Pinal Partnership*. http://pinalpartnership.com/

“Uniting the Vision for Pinal County”. *Pinal Partnership*. Parks, Trails, Open Space, Public Lands Committee. Region 3. 2008. http://pinalpartnership.com/com_parks.html

U. S. Department of the Interior. Bureau of Reclamation. “Final Environmental Assessment, Construction of Fish Barriers on Aravaipa Creek”. Phoenix Area Office. Lower Colorado Region. November 1998.

U.S. Department of the Interior. 1997. “How to Apply the National Register Criteria for Evaluation”. National Register Bulletin 15. United States Department of the Interior. Washington, D.C.

Van West, Carla, Mark T. Swanson, and Jeffrey H. Altschul. 1997. “Cultural Resources Management Plan for Fort Huachuca Military Reservation, Arizona”. Technical Series No. 67. *Statistical Research, Inc*. Tucson, Arizona.

Vanderpot, Rein. 1997. “From Foraging to Farming: Prehistoric Settlement and Subsistence Dynamics in the San Pedro Valley. In Prehistory of the Borderlands: Recent Research in the Archaeology of Northern Mexico and the Southern Southwest”. Edited by J. Carpenter and G. Sanchez, pp. 33-45. Archaeological Series No. 186. Arizona State Museum. *University of Arizona*. Tucson, Arizona.

Wallace, Henry D., James M. Heidke, and William H. Doelle. 1995. “Hohokam Origins”. Kiva 60:575-618.

“Water Management Enhancement Activity – Irrigation Management”. USDA – Natural Resources Conservation Service. January 28, 2008. http://efotg.sc.egov.usda.gov/treemenuFS.aspx

"Water Management, Pinal AMA Home Page". *Arizona Department of Water Resources.* ADWR Third Management Plan. November 22, 2011. http://www.adwr.state.az.us/AzDWR/Watermanagement/AMAs/PinalAMA/default.htm

"Water Management, Tucson AMA Home Page". *Arizona Department of Water Resources.* ADWR Third Management Plan. November 22, 2011. http://www.azwater.gov/AzDWR/WaterManagement/AMAs/TucsonAMA/default.htm

"What is the Arizona Trail?". *Arizona Trail, National Scenic Trail*. The Arizona Trail Association. 2012. http://www.aztrail.org/at_about.html

Wilcox, David R., Thomas R. McGuire, and Charles Sternberg. 1981. "Snaketown revisited: a partial cultural resource survey, analysis of site structure, and an ethnohistoric study of the proposed Hohokam-Pima National Monument". Archaeological series no. 155. Tucson: *Arizona State Museum*, University of Arizona.

Wilcox, David R., and Charles Sternberg. 1983. "Hohokam ballcourts and their interpretation". Archaeological series no. 160. Tucson: *Arizona State Museum*, The University of Arizona.

Wilcox, David R. 1991. "Hohokam Political Organization: In Chaco and Hohokam: Prehistoric Regional Systems in the American Southwest". edited by Patricia L. Crown and W James Judge, pp. 253-275. Santa Fe: *School of American Research Press*.

Wilma, David. "Congress establishes the first federal forest reserves on March 3, 1891". *History Link*. February 28, 2003. http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=5322

York, John C. and William Dick-Peddie. 1969. "Vegetative changes in Southern New Mexico during the past 100 years". Arid Lands in Perspective, W. G. McGinnies and B. J. Goldman editors. *University of Arizona Press*. Tucson. P 157-166.

SECTION – 11: GLOSSARY

General Terminology

Active Management Area (AMA): Areas with heavy reliance on mined (well) groundwater. AMA's are usually in numerous watersheds with heavy agriculture or urban use. AMA's are formed to actively mediate ground water use to avoid exceedance of AMA goals.

Adit: An adit is an entrance to an underground mine which is horizontal or nearly horizontal, by which the mine can be entered, drained of water, and ventilated.

Alluvial: A fan-shaped deposit formed where a fast flowing stream flattens, slows, and spreads typically at the exit of a canyon onto a flatter plain. A convergence of neighboring alluvial fans into a single apron of deposits against a slope is called a bajada, or compound alluvial fan.

Andesite: An extrusive igneous, volcanic rock, of intermediate composition, with aphanitic to porphyritic texture. In a general sense, it is the intermediate type between basalt and dacite.

Aridic: Term for the moisture regime in different categories of the taxonomy. In the aridic (torric) moisture regime, the moisture control section is, in 6 or more out of 10 years: dry in all parts for more than half the cumulative days per year when the soil temperature at a depth of 50 cm from the soil surface is above 5°C; *and* moist in some or all parts for less than 90 consecutive days when the soil temperature at a depth of 50 cm is above 8°C. Soils that have an aridic or a torric moisture regime normally occur in arid climates.

Ballcourt: Ancient ballgames were played within a large masonry structure. Although there is a tremendous variation in size, in general all ballcourts are the same shape: a long narrow playing alley flanked by walls with both horizontal and sloping (or, more rarely, vertical) surfaces.

Baseline: A low level of conservation adoption with landowners who are typically not participating in conservation programs. There are, however, a few practices that have been commonly adopted by all landowners in this District.

BAER Team: Burn Area Emergency Response. Group of agency personnel and outside consultants forming a team to evaluate, suggest and implement treatments to areas subjected to large scale wild fires. Teams are usually formed when residential interface or infrastructure is threatened from after effects of fires.

Bajada: A broad slope of debris spread along the lower slopes of mountains by descending streams, usually found in arid or semiarid climates. A bajada is often formed by the coalescing of several alluvial fans. A bajada is usually composed of gravelly alluvium and may even have large boulders interbedded in it.

Ballcourt: A large structure of a type used to play the Mesoamerican ballgame, particularly the hip-ball version of the ballgame. Although there is a tremendous variation in size, in general all ballcourts are the same shape: a long narrow alley flanked by two walls with horizontal, vertical, and sloping faces.

Coke: A solid carbonaceous material derived from destructive distillation of low-ash, low-sulfur bituminous coal. Cokes from coal are grey, hard, and porous. While coke can be formed naturally, the commonly used form is man-made.

Colluvial: Loose bodies of sediment that have been deposited or built up at the bottom of a low-grade slope or against a barrier on that slope, transported by gravity. The deposits that collect at the foot of a steep slope or cliff are also known by the same name. Colluvium often outerfingers with alluvium (deposits transported downslope by water).

Common Resource Areas (CRA): A geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA). Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area.

Conglomerate: A type of rock consisting of individual clasts within a finer-grained matrix that have become cemented together. Conglomerates are sedimentary rocks consisting of rounded fragments and are thus differentiated from breccias, which consist of angular clasts. Both conglomerates and breccias are characterized by clasts larger than sand (>2 mm).

Coordinated Resource Management Planning (CRMP): Group of land managers, land owning agencies and invited, interested parties that's main goal is for better management of individual land units. Resolution from this group is derived from common issues that arise during managing around agency policies over land use, identify and treat resource concerns and come to a consensus on time tables and assistance. It is the goal of the CRMP field group to lay all plans and issues out on the table with the producer and work together to come to a mutual agreement on how to manage the particulars.

Coordinated Resource Management Executive Group: The CRM Executive group is the supervisory leadership within Federal agencies, Districts, Tribal and State Governments that meet yearly to discuss issues, delineate agreed-to's and provide guidance for the local CRM groups who make up the CRMP.

Dacite: An igneous, volcanic rock. It has an aphanitic to porphyritic texture and is intermediate in composition between andesite and rhyolite. Dacite is also defined by silica and alkali contents in the TAS classification.

Ecological Site: An ecological site is distinctive kind of land with specific soil and physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation, and in its ability to respond similarly to management actions and natural disturbances. Unlike vegetation classification, ecological site classification uses climate, soil, geomorphology, hydrology, and vegetation information to describe the ecological potential of land areas. A particular ecological site may feature several plant communities (described by vegetation classification) that occur over time and/or in response to management actions.

Ecological Site Description (ESD): Ecological site descriptions (ESDs) are reports that describe the a) biophysical properties of ecological sites, b) vegetation and surface soil properties of reference conditions that represent either i) pre-European vegetation and historical range of variation (in the United States) or ii) proper functioning condition or potential natural vegetation, c) state-and-transition model graphics and text, and d) a description of ecosystem services provided by the ecological site and other interpretations.

Electrowinning: Also called electroextraction, is the electrodeposition of metals from their ores that have been put in solution or liquefied. In electrowinning, a current is passed from an inert anode through a liquid *leach* solution containing the metal so that the metal is extracted as it is deposited in an electroplating process onto the cathode. In electrorefining, the anodes consist of unrefined impure metal, and as the current passes through the acidic electrolyte the anodes are corroded into the solution so that the electroplating process deposits refined pure metal onto the cathodes.

Emergency Watershed Protection (EWP): An USDA program that safeguards lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

Eolian: A type of soil ranging from sand dunes to loess deposits whose particles are predominantly of silt size.

Equigranular: Pertaining to the texture of rocks whose essential minerals are all of the same order of size.

Farm Bill: The primary agricultural and food policy tool of the federal government. The comprehensive omnibus bill is passed every 5 years or so by the United States Congress and deals with both agriculture and all other affairs under the purview of the United States Department of Agriculture. It usually amends some and suspends provisions of permanent law, reauthorizes, amends, or repeals provisions of preceding temporary agricultural acts, and puts forth new policy provisions for a limited time into the future.

Felsic: Relating to an igneous rock that contains a group of light colored silicate minerals, including feldspar, felspathoid, quartz and muscovite.

Fluvial: Produced by the action of a river or stream.

Freehold Title: The ownership of real property, being the land and all immovable structures attached to such land. Immovable property includes land and all that naturally or artificially goes with it, such as buildings, trees, improvements or underground resources, but not such things as vehicles or livestock (which are movable).

Heap leach: An industrial mining process to extract precious metals, copper, uranium, and other compounds from ore. The mined ore is usually crushed into small chunks and heaped on an impermeable plastic and/or clay lined leach pad where it can be irrigated with a leach solution to dissolve the valuable metals.

Hydrologic Unit Area (HUA): A hierarchical system of hydrologic units originally called regions, sub-regions, accounting units, and cataloging units. Each unit was assigned a unique Hydrologic Unit Code (HUC). As first implemented the system had 21 regions, 221 subregions, 378 accounting units, and 2,264 cataloging units. Over time the system was changed and expanded. As of 2010 there are six levels in the hierarchy, represented by hydrologic unit codes from 2 to 12 digits long, called regions, subregions, basins, subbasins, watersheds, and subwatersheds.

Hyperthermic: The mean annual soil temperature is 8° C or higher but lower than 15° C, and the difference between mean summer and mean winter soil temperatures is more than 6° C either at a depth of 50 cm from the soil surface or at a densic, lithic, or paralithic contact, whichever is shallower.

Igneous: Igneous rock is formed through the cooling and solidification of magma or lava. Igneous rock may form with or without crystallization, either below the surface as intrusive (plutonic) rocks or on the surface as extrusive (volcanic) rocks.

Lacustrine: Lake or open bodies of freshwater situated in depressions or dammed river channels. They are also referred to as lentic or standing water systems.

Lithic: Lithic contact - This is the boundary between soil and continuous coherent, underlying material that has a hardness > 3 on the Moh scale.

Major Land Resource Areas (MLRA): A broad geographical areas that are characterized by a particular pattern of physiographic features. Soils, climate, vegetative, water resources, and land use are used to delineate the different land resource areas throughout the state.

Mesic: Mesic environmental conditions are ones with medium moisture (water). Compare with very dry conditions (xeric) and very wet conditions (hydric).

Metamorphic: Metamorphic rocks are compacted by pressure and heat from deep inside the earth.

Metasedimentary: sediment or sedimentary rock that shows evidence of having been subjected to metamorphism. The overall composition of a metasediment can be used to identify the original sedimentary rock, even where they have been subject to high-grade metamorphism and intense deformation.

Mitigation: A term used primarily by the United States government and the related environmental industry to describe projects or programs intended to offset known impacts to an existing historic or natural resource such as a stream, wetland, endangered species, archeological site or historic structure. To "mitigate" means to make less harsh or hostile. Environmental mitigation is typically a part of an environmental crediting system established by governing bodies which involves allocating debits and credits.

Physiography: A description of the features and phenomena of nature.

Piedmonts: A soil that is generally clay-like and moderately fertile. In some areas they have suffered from erosion and over-cropping,

Pit houses: A dwelling dug into the ground which may also be layered with stone. These structures may be used as places to tell stories, dance, sing, celebrate, and store food. In archaeology, pit-houses are also termed sunken featured buildings and are found in numerous cultures around the world.

Precambrian: The name which describes the large span of time in Earth's history before the current *Phanerozoic* Eon, and is a Supereon divided into several eons of the geologic time scale. It spans from the formation of Earth around 4600 Ma (million years) ago to the beginning of the Cambrian Period, about 542 Ma, when macroscopic hard-shelled animals first appeared in abundance.

Progressive: An intermediate level of conservation adoption with landowners who are actively participating in conservation programs and have adopted several practices but not satisfied all of the Quality Criteria in the NRCS Field Office Technical Guide.

Pyroclastic: A fast-moving current of superheated gas (which can reach temperatures of about 1,000 °C (1,830 °F)) and rock (collectively known as tephra), which reaches speeds moving away from a volcano of up to 700 km/h (450 mph). The flows normally hug the ground and travel downhill, or spread laterally under gravity.

Pyrometasomatic: Forming of contact-metamorphic mineral deposits at high temperatures by emanations from the intrusive rock, involving replacement of the enclosing rock with the addition of materials.

Quality Criteria: The minimally acceptable level of treatment required to achieve a resource management system for identified resource considerations for a particular land use as defined in the technical guide of NRCS.

Quaternary: The most recent of the three periods of the Cenozoic Era in the geologic time scale of the ICS. It follows the Neogene Period, spanning 2.588 ± 0.005 million years ago to the present. The Quaternary includes two geologic epochs: the Pleistocene and the Holocene.

Resource Concern: The condition related to one or more resources that does not meet the minimum acceptable condition levels as established by resource quality criteria shown in the FOTG, Section III.

Resource Management Systems (RMS): a complete system of conservation practices that addresses all of the Soil, Water, Air, Plant, and Animal (SWAPA) and even human related resource concerns typically seen for the specific land use.

Rhyolite: An igneous, volcanic (extrusive) rock, of felsic (silica-rich) composition. It may have any texture from glassy to aphanitic to porphyritic. The mineral assemblage is usually quartz, alkali feldspar and plagioclase (in a ratio > 1:2).

Scarify: To slit or soften the outer coat of (seeds) in order to speed germination.

Stope**:** The removal of the wanted ore from an underground mine leaving behind an open space known as a stope**.** Stoping is used when the country rock is sufficiently strong not to cave into the stope, although in most cases artificial support is also provided. As mining progresses, the stope is often backfilled with tailings, or when needed for strength, a mixture of tailings and cement.

Surfactant: Compounds that lower the surface tension of a liquid, the interfacial tension between two liquids, or that between a liquid and a solid. Surfactants may act as detergents, wetting agents, emulsifiers, foaming agents, and dispersants.

Suffrutescent: A plant having a woody base that does not die down each year.

Tabular: Having a plane surface; flat or tending to split into thin flat pieces.

Tailings ponds: Also called mine dumps, slimes, tails, leach residue, or slickens, are the materials left over after the process of separating the valuable fraction from the uneconomic fraction (gangue) of an ore. Tailings are distinct from overburden or waste rock, which are the materials overlying an ore or mineral bodies that are displaced during mining without being processed.

Terrestrial Ecosystem Surveys (TES): Terrestrial Ecosystem Surveys contains information that should be used in land planning and management programs on National Forest: It contains predictions and limitations of soil and vegetation behavior for selected land uses. It also highlights hazards or capabilities inherent in the soil and the impact of selected uses on the environment. Other ecosystem properties that can affect land use are also described.

Tertiary: A deprecated term for a geologic period 65 million to 2.6 million years ago. The Tertiary covered the time span between the superseded Secondary period and the Quaternary. The period began with the demise of the non-avian dinosaurs in the Cretaceous–Tertiary extinction event, at the start of the Cenozoic era, spanning to the beginning of the most recent Ice Age, at the end of the Pliocene Epoch.

Thermic: The mean annual soil temperature is 15° C or higher but lower than 22° C, and the difference between mean summer and mean winter soil temperatures is more than 6° C either at a depth of 50 cm from the soil surface or at a densic, lithic, or paralithic contact, whichever is shallower.

Tuffs: A type of rock consisting of consolidated volcanic ash ejected from vents during a volcanic eruption.

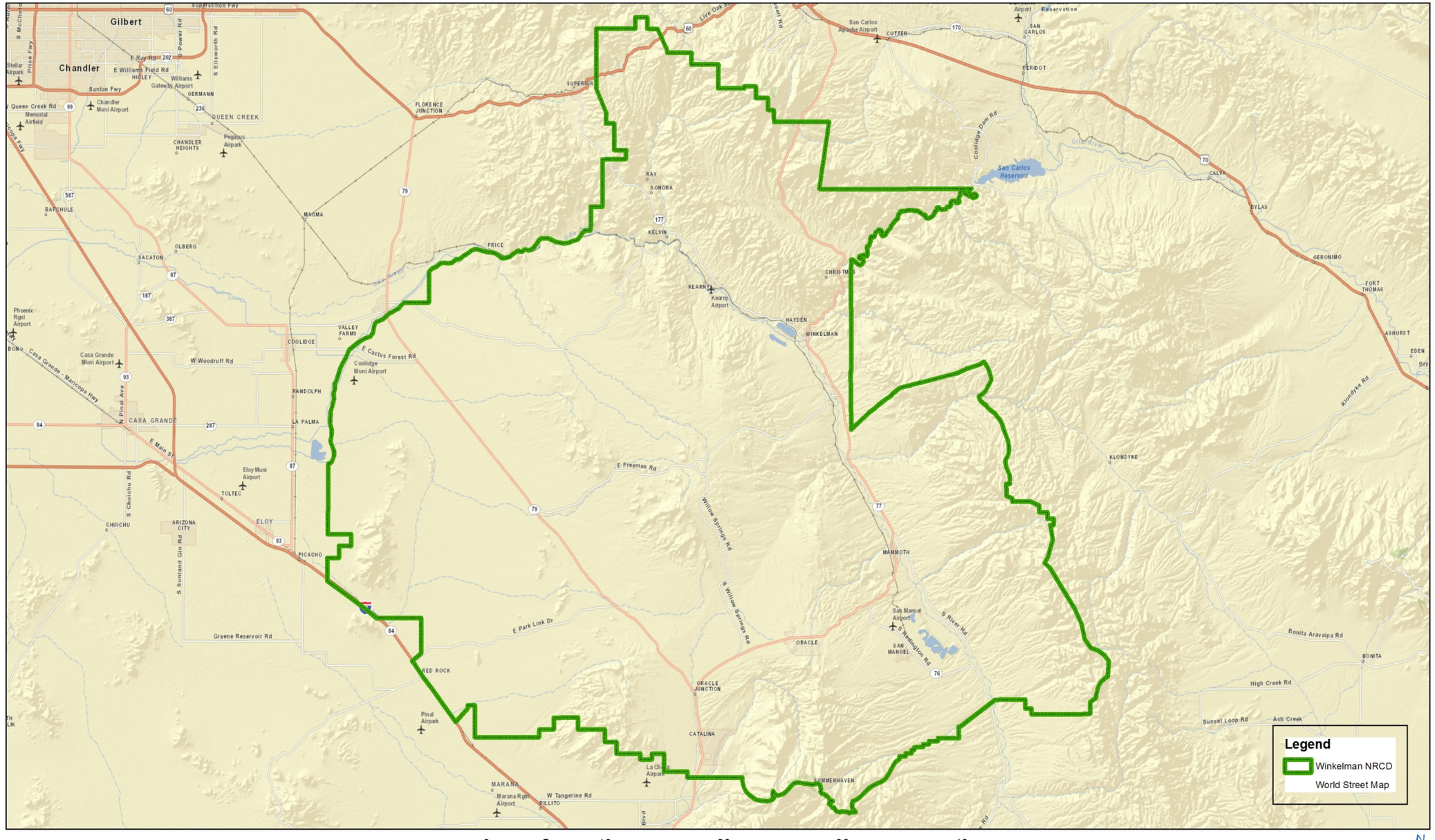
Typic: Of the nature of or serving as a type or representative specimen. Conforming to a particular type.

Ustic: Moisture regime is intermediate between the aridic and the udic regime. Its concept is one of moisture that is limited but is present at a time when conditions are suitable for plant growth.

Winze: An opening in an underground mine that is sunk downward (as opposed to a raise, which is mined upward) from inside to connect lower levels. The top of a winze is located underground, in contrast to a shaft where the top of the excavation is located on surface.

SECTION – 9: Maps

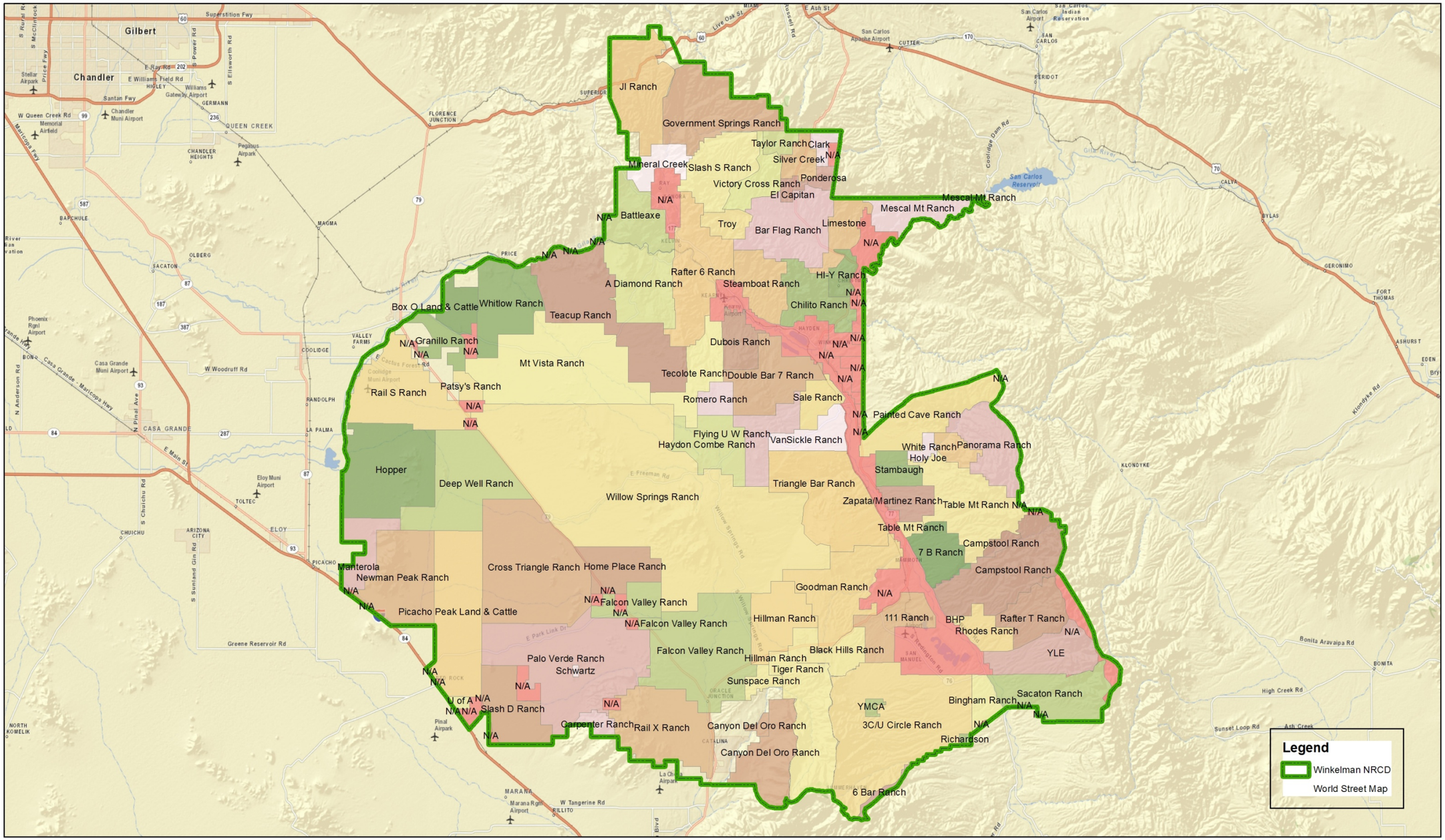
Winkelman NRCD
Boundary Map



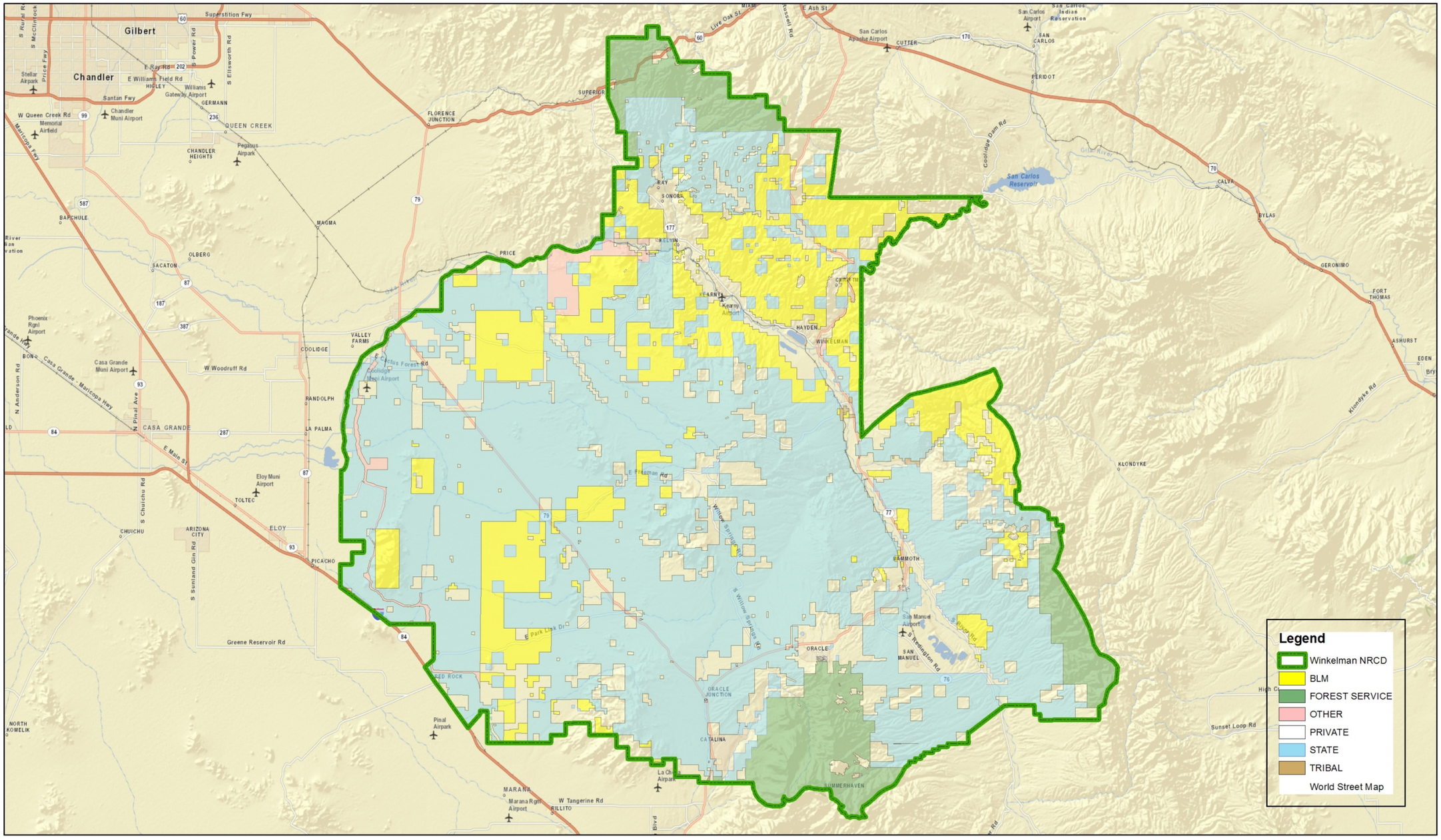
Courtesy: USDA NRCS

Date: 10/18/2012

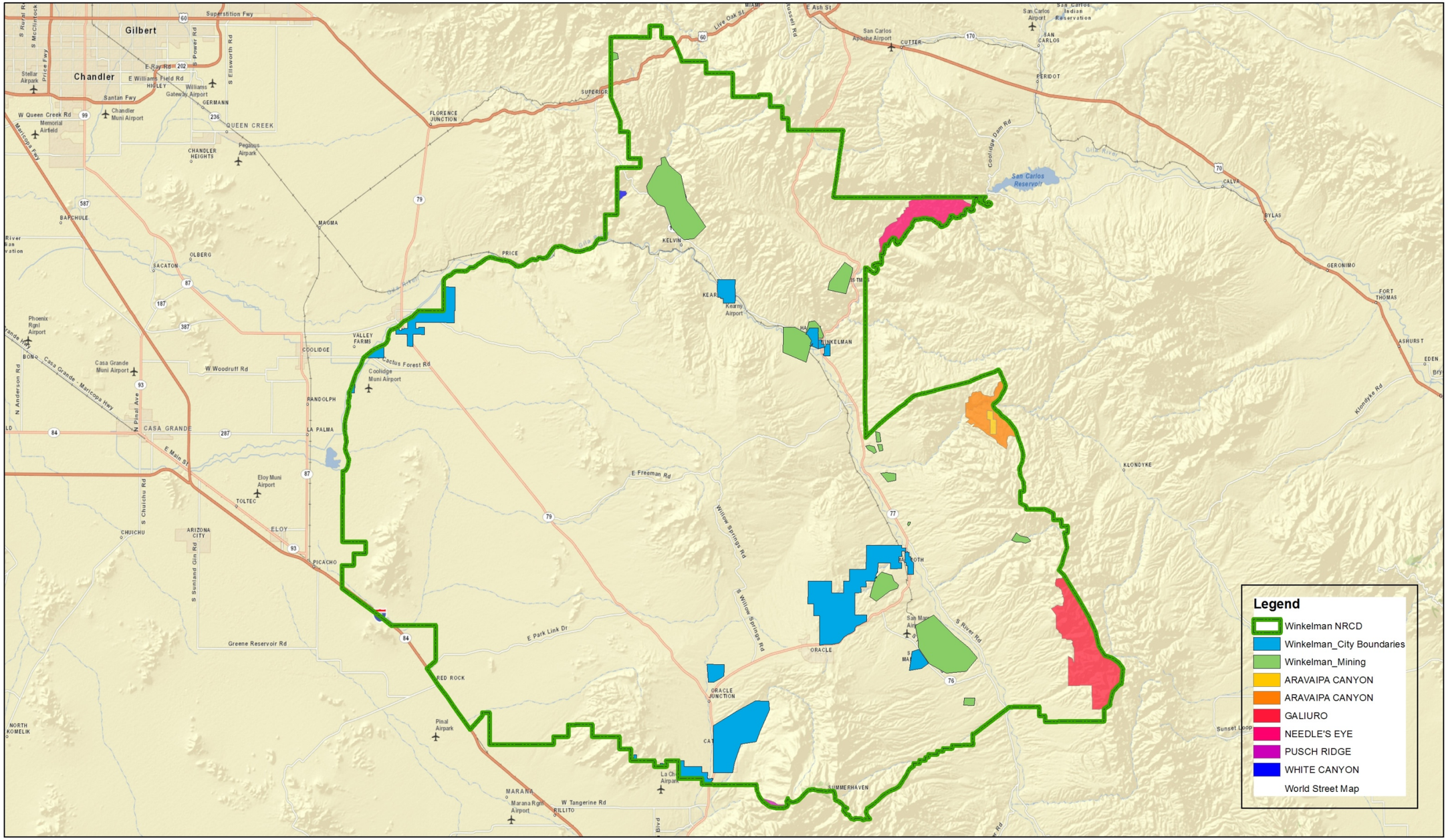
Winkelman NRCD
Land Units Map



Winkelman NRCD
Ownership Map



Winkelman NRCD
Cities, Mining and Wilderness Map



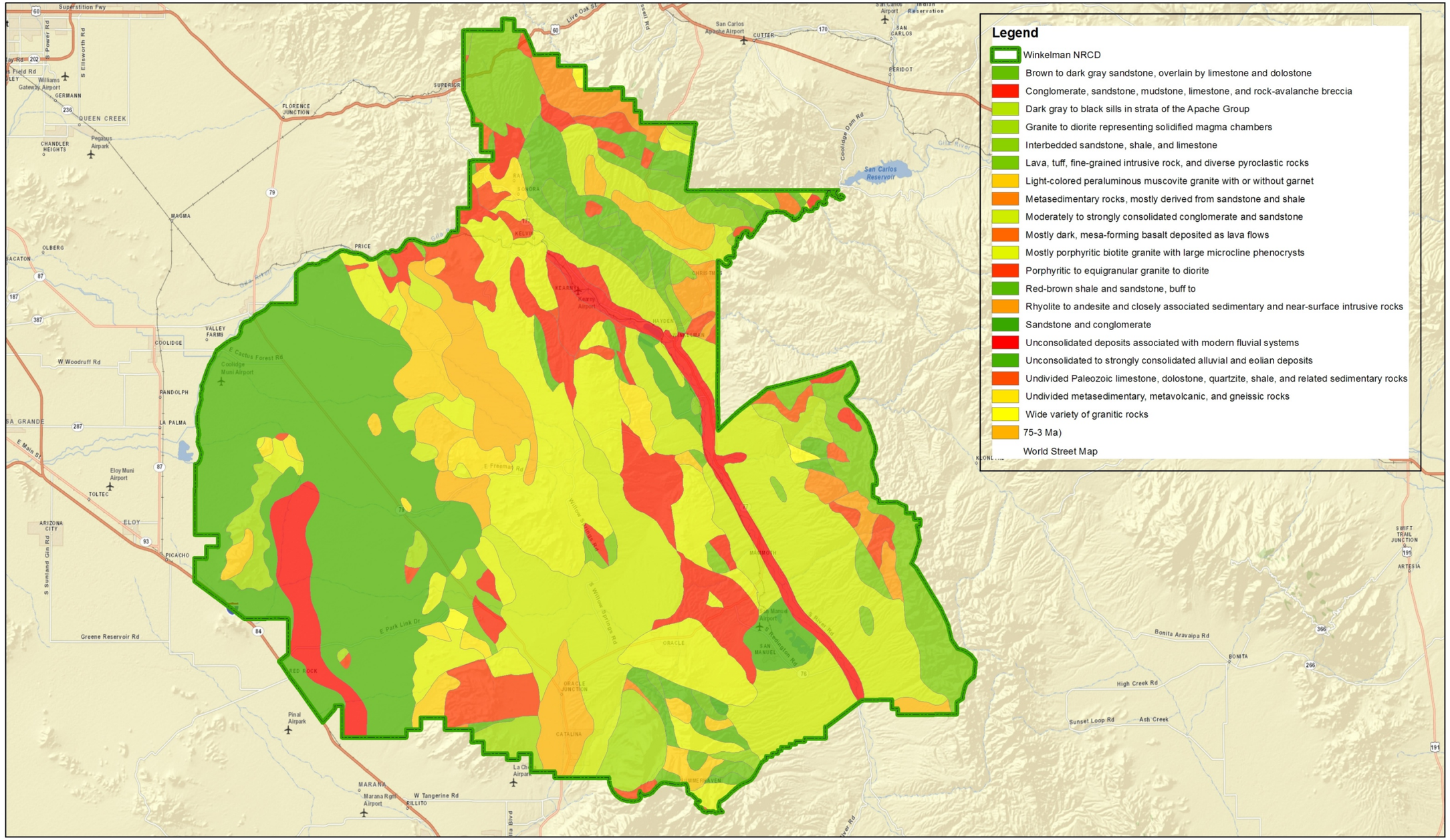
0 5 10 20 30 40 Miles

1 inch equals 7.29 miles

Courtesy: USDA NRCS

Date: 10/18/2012

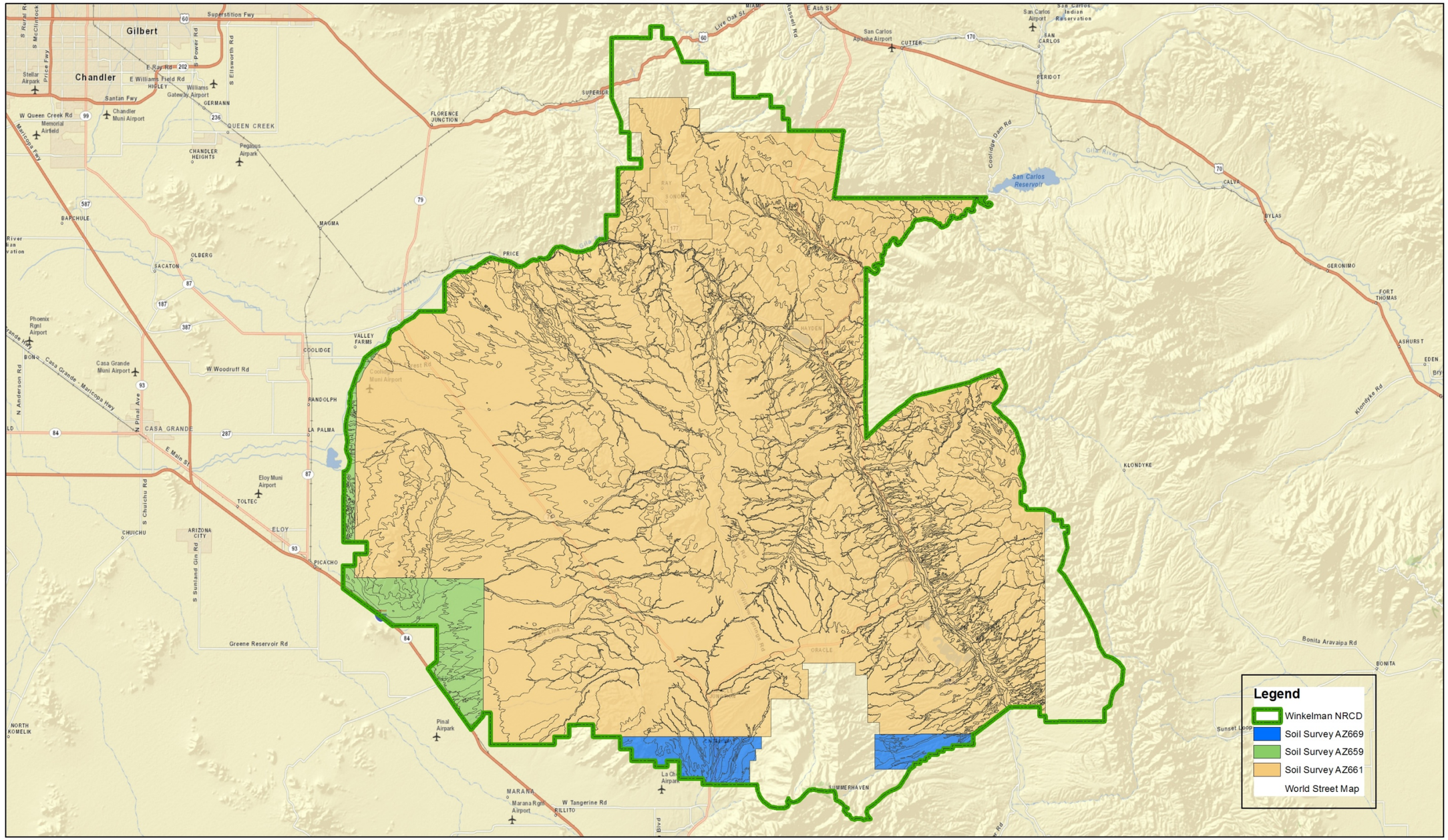
Winkelman NRCD
Geology Map



Courtesy: USDA NRCS

Date: 10/18/2012

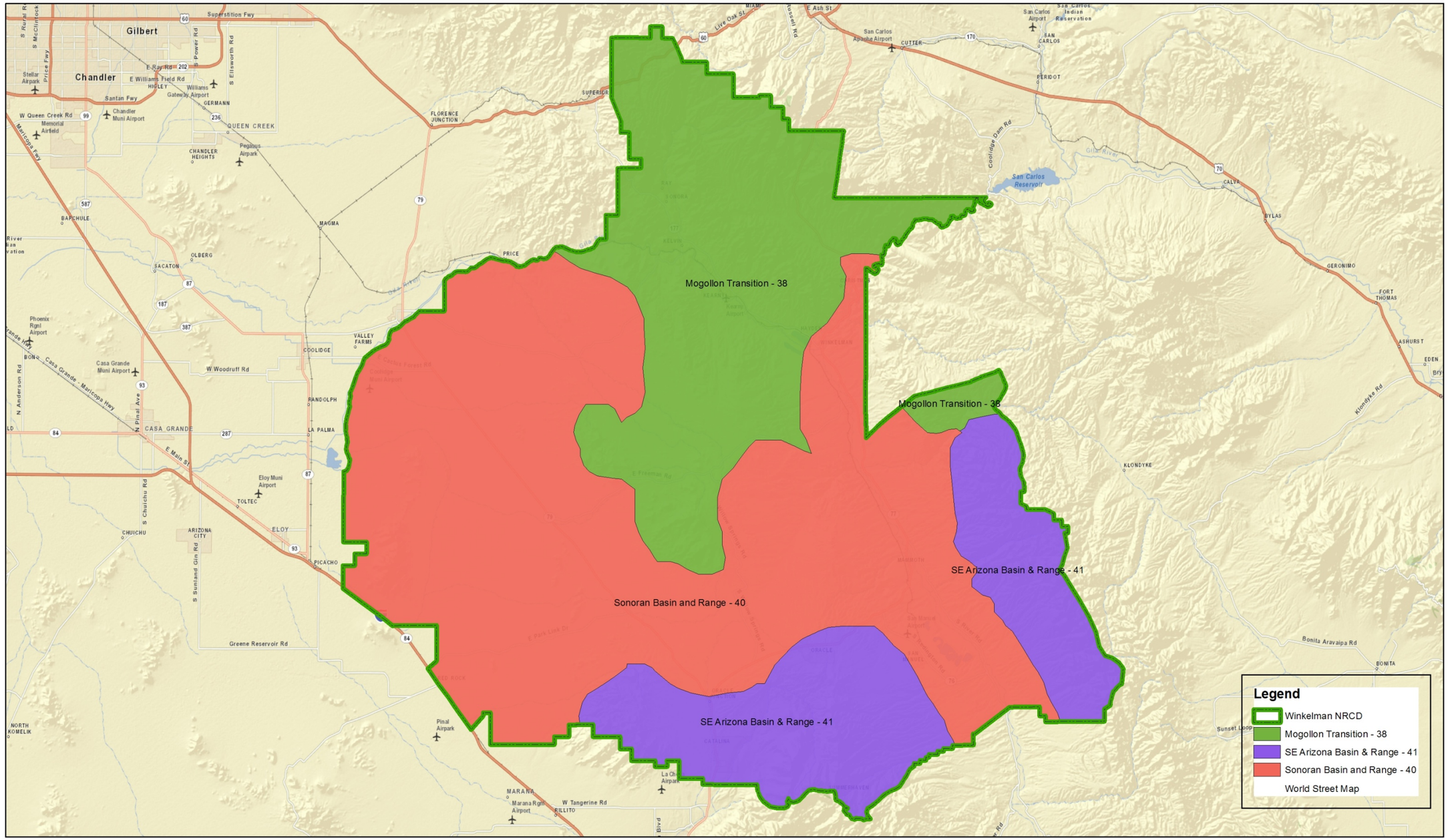
Winkelman NRCD
Mapped Soil Surveys



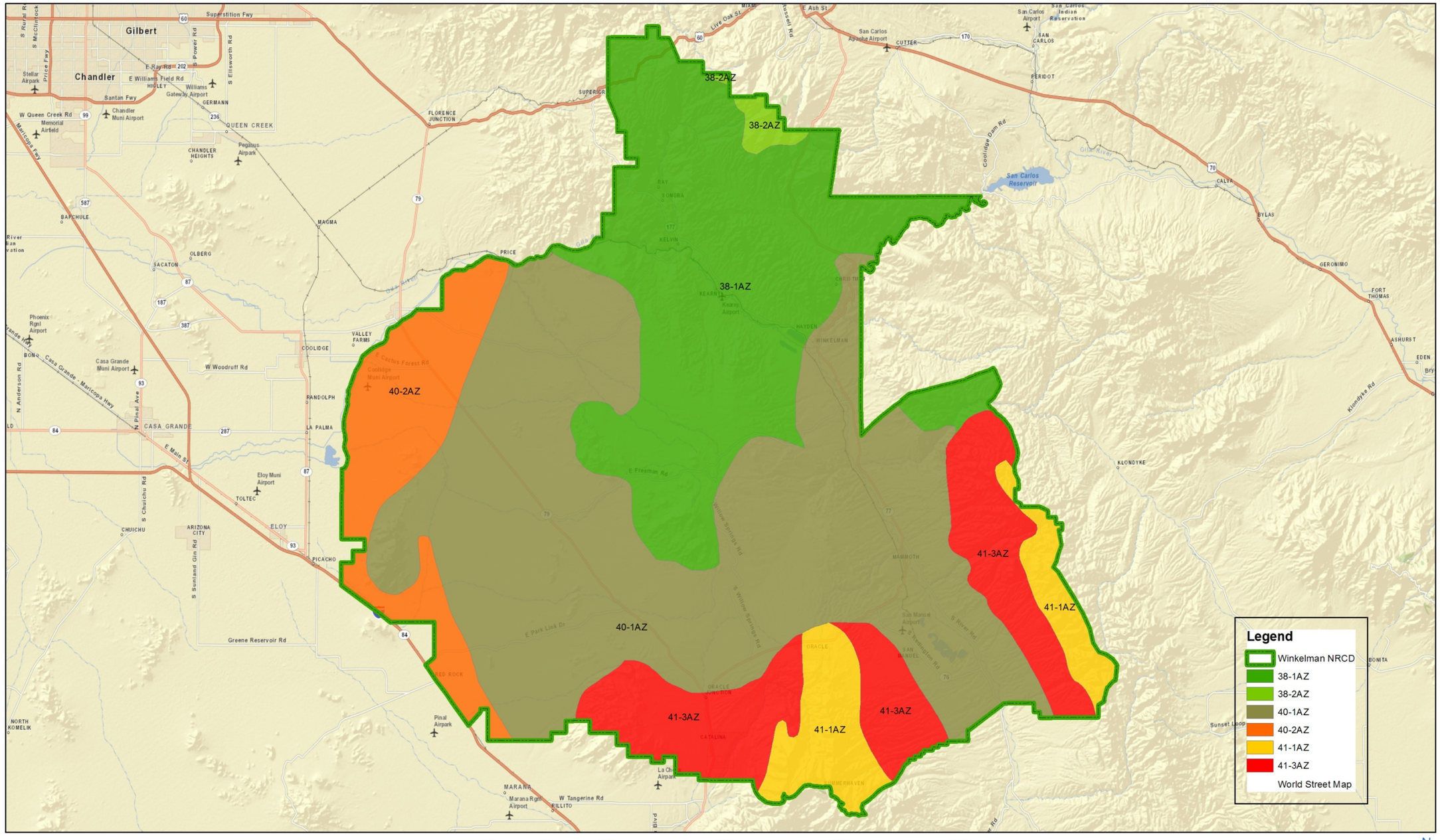
Courtesy: USDA NRCS

Date: 10/18/2012

Winkelman NRCD
Common Resource Area Map



Winkelman NRCD
Major Land Resource Area Map



Winkelman NRCD
Mapped Ecological Sites