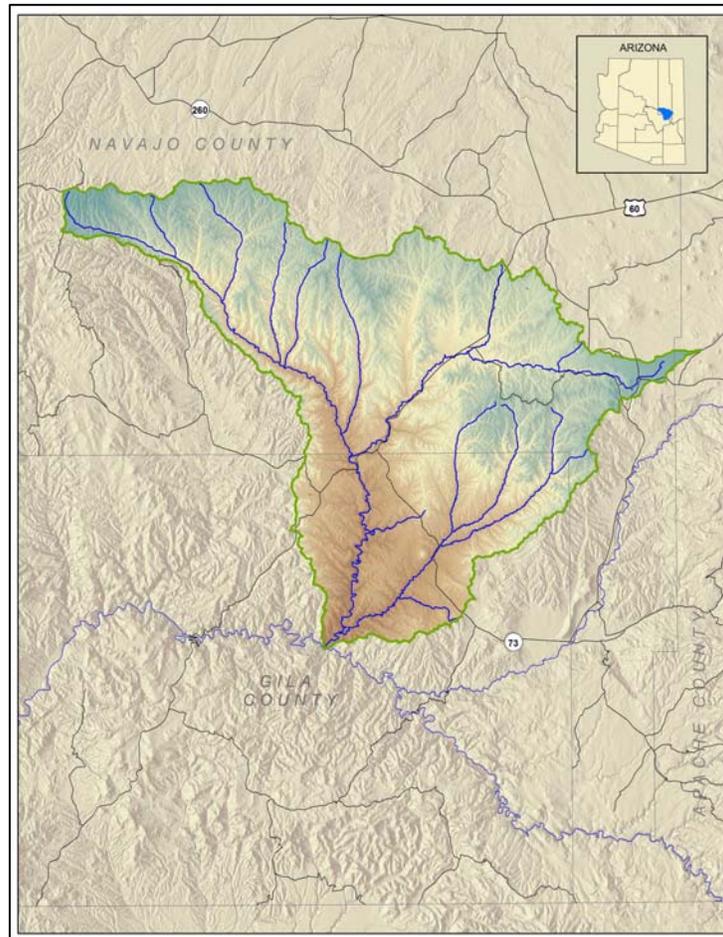


# Carrizo Creek Watershed – Arizona

## Rapid Watershed Assessment

June 2007



The University of Arizona

*Prepared by:*

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University of Arizona, Water Resources Research Center

*In cooperation with:*

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Arizona Department of Environmental Quality  
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**Carrizo Creek – 15060104**  
**8-Digit Hydrologic Unit**  
**Rapid Watershed Assessment**

**Section 1: Introduction**

Overview of Rapid Watershed Assessments

A Rapid Watershed Assessment (RWA) is a concise report containing information on natural resource conditions and concerns within a designated watershed. The "rapid" part refers to a relatively short time period to develop the report as compared to a more comprehensive watershed planning effort. The "assessment" part refers to a report containing maps, tables and other information sufficient to give an overview of the watershed and for use as a building block for future planning. RWAs look at physical and socioeconomic characteristics and trends, as well as current and future conservation work.

The assessments involve the collection of readily available quantitative and qualitative information to develop a watershed profile, and sufficient analysis of that information to generate an appraisal of the conservation needs of the watershed. These assessments are conducted by conservation planners, using Geographic Information System technology, assessing current levels of resource management, identifying priority resource concerns, and making estimates of future conservation work. Conservation Districts and other local leaders, along with public land management agencies, are involved in the assessment process.

An RWA can be used as a communication tool between the Natural Resources Conservation Service (NRCS) and partners for describing and prioritizing conservation work in selected watersheds. RWAs provide initial estimates of conservation investments needed to address the identified resource concerns in the watershed. RWAs serve as a platform for conservation program delivery, provide useful information for development of NRCS and Conservation District business plans, and lay a foundation for future watershed planning.

General Description of the Carrizo Creek Watershed

The Carrizo Creek Watershed is located in the eastern-central part of the state of Arizona, about 18 miles west of the New Mexico border (Figure 1-1). The basin comprises 453,760 acres (706 square miles) and is situated in Navajo, Gila, and Apache Counties. Ninety-nine percent of the land is tribal owned, less than 1% is managed by the Forest Service, and less than 0.01% is privately owned.

Major towns and cities include Carrizo and Cedar Creek. The NRCS field office for the area is located in Whiteriver, about 30 miles south of Show Low. Conservation assistance is provided through the White Mountain

Apache Natural Resource Conservation District (Figure 1-1).

This area has historically been used primarily for commercial timber cutting. However, environmental concerns and past forest fires have severely curtailed timber cutting since the 1990's. Cattle grazing occurs on a significant portion of this area throughout the year, except at higher elevations where grazing occurs only during the summer months. This area does not support a significant amount of cropland or pastureland.

Resource concerns in the watershed include soil erosion, rangeland site stability, rangeland hydrologic cycle, excessive runoff (causing flooding or ponding), water quality concerns for surface water (suspended sediment and turbidity), plant condition – productivity, health and vigor, noxious and invasive plants, wildfire hazard, and domestic animals – inadequate quantities and quality of feed, forage, and stock water.

## Section 2: Physical Description

### Watershed Size

The Carrizo Creek Watershed covers approximately 706 square miles (451,863 acres), representing about 1.0% of the state of Arizona. The watershed has a maximum width of about 32 miles east to west, and a maximum length of about 30 miles north to south.

The Carrizo Creek Watershed was delineated by the U.S. Geological Survey and has been subdivided by the NRCS into smaller watersheds or drainage areas. Each drainage area has a unique hydrologic unit code number, or 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 Carrizo Wash is an 8-digit HUC of 15070102 and contains the following 10-digit HUCs:

- 1506010403 (Carrizo Creek Local Drainage)
- 1506010401 (Corduroy Creek)
- 1506010402 (Cedar Creek) (Figure 1-2)

### Geology

The Carrizo Creek Watershed is on the down-dropped edge of the Mogollon Rim escarpment, the southern boundary of the Colorado Plateau Uplands physiographic province in the northeastern corner of the state. This province covers the northern 2/5 of the state of Arizona and is characterized by

mostly level, horizontally stratified sedimentary rocks that have been eroded into canyons and plateaus, and by some high volcanic mountains.

The edge of the Mogollon Rim exposes a sequence, nearly 3,000 feet thick, of Paleozoic sedimentary rocks that are capped by Tertiary volcanic rocks (Parker and Flynn, 2000). The overall vertical displacement of the Rim varies, but in some multiple fault zones near the Verde River it is estimated at approximately 6,000 feet (Feth, et.al. 1954). Continued subsidence along several fault zones eventually formed the Carrizo Creek Watershed, with the headwaters of Carrizo Creek entrenched within one of the numerous northwest – southeast trending vertical faults forming the Rim escarpment.

Compared with the rest of Arizona geology, the Plateau Uplands seems easy to understand, the rocks are flat-lying sedimentary strata set in sequences of oldest (bottom) to youngest (top). The Carrizo Creek Canyon (formed by both vertical faulting and creek down cutting) exposes the layered Paleozoic (245 million years old and older) sedimentary rocks (rocks formed by sediment, e.g., rock fragments or particles of various sizes), which include: sandstone, shale, and limestone. These rocks are visible as orange to reddish ledgy outcrops cliffs across the watershed.

Quaternary and Tertiary aged (65 million years and younger) lava flows along the margins of the Mogollon Rim and the White Mountains have spilled over into the Carrizo Creek Watershed and filled paleovalleys, protecting them from erosion that wore away surrounding

unprotected paleoridges, so that now what was a valley has become a ridge, and what were ridges have become eroded valleys. Along Corduroy Creek runs a long, narrow ridge of basalt capping Snake Ridge to the west. Forced from an older bed by the Snake Ridge lava flow, Corduroy Creek moved over and develop a new channel beside it.

Shaly siltstones, mudstone, conglomerates, and the Kaibab limestone overlay the Permian age Coconino Sandstone, and the older red siltstone and fine sandstone rocks of the Supai Formation are exposed in the deep canyon. About 12 miles south of Carrizo red mudstone and siltstone can be observed (Chronic, 1983) as part of the Mississippian age (320 to 355 million years before present) Redwall Limestone. These ancient marine and coastal deposits include a wide range of rock types – limestone, claystone, mudstone, sandstone, and conglomerate. Between the towns of Carrizo and Show Low are outcrops of yellow-white Coconino Sandstone and thin, buff-colored layers of sandy limestone, both normally cliff-formers marking the edge of the Mogollon Rim and the southern edge of the Colorado Plateau. Figure 2-1 shows the geology of the Carrizo Creek Watershed.

### Soils

Soils within the Carrizo Creek Watershed are diverse and formed as the result of differences in climate, vegetation, geology, and physiography. Detailed soils information for the watershed is available from the Natural Resources Conservation Service (NRCS). Lands within this watershed

are covered by the “Soil Survey of Fort Apache Indian Reservation, AZ, Parts of Apache, Gila and Navajo Counties.” Soils data and maps from this Soil Survey can be accessed through the NRCS Web Soil Survey website: <http://websoilsurvey.nrcs.usda.gov>.

### Common Resource Areas

The USDA, Natural Resources Conservation Service (NRCS) defines a Common Resource Area (CRA) as a geographical area where resource concerns, problems, or treatment needs are similar (NRCS 2006). 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 Carrizo Creek Watershed is comprised of two Common Resource Areas (Figure 2-2 and Table 2-1).

The lower portion of the watershed is comprised of CRA 38.2 “Interior Chaparral - Woodlands” which occurs at elevations ranging from 4000 to 5500 feet. Precipitation averages 16 to 20 inches per year. Vegetation includes turbinella oak, hollyleaf buckthorn, desert buckbrush, one-seed juniper, alligator juniper, pinyon, sugar sumac, blue grama, curly mesquite, bottlebrush squirreltail, muttongrass, plains lovegrass and bullgrass. The soils in this area have a mesic soil temperature regime and an aridic ustic to typic ustic soil moisture regime. The dominant soil orders are Alfisols and Mollisols. Deep, gravelly, medium and fine-textured soils occur on dissected uplands. Shallow to

moderately deep, gravelly and cobbly, medium and fine-textured soils occur on hills and mountains.

This CRA 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.

The upper watershed is comprised of CRA 39.1 “Mogollon Plateau Coniferous Forests” which occurs at elevations ranging from 7000 to 12,500 feet. Precipitation averages 20 to 35 inches per year. Vegetation includes ponderosa pine, Gambel oak, Arizona walnut, sycamore, Douglas fir, blue spruce, Arizona fescue, mountain muhly, muttongrass, pine dropseed, and

dryland sedges. The soils in this area have a mesic to frigid soil temperature regime and a typical ustic to udic ustic soil moisture regime. The dominant soil orders are Entisols, Alfisols and Mollisols. Shallow to deep, gravelly and cobbly, moderately coarse and fine-textured, soils occur on mountains and hills. Moderately deep and deep, medium and moderately fine-textured soils occur on mountains.

This CRA occurs within the Colorado Plateau Physiographic Province and is characterized by a sequence of flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Sedimentary rock classes dominate the plateau with volcanic fields occurring for the most part near its margin.

*Table 2-1: Carrizo Creek Watershed - Common Resource Areas*

Common Resource Area Type	Area (sq. miles)	Percent of Watershed
38.2 Interior Chaparral – Woodlands	318	45%
39.1 Mogollon Plateau Coniferous Forest	391	55%

Data Sources: GIS map layer “cra”. Arizona Land Information System (ALRIS 2004). Natural Resource Conservation Service (NRCS 2006)

### Slope Classifications

Slope, as well as soil characteristics and topography, are important when assessing the vulnerability of a watershed to erosion. Approximately 64.2% of the Carrizo Creek Watershed has a slope greater than 15%, while about 11.8% of the watershed has a slope less than 5%. Carrizo Creek (Local Drainage) is comparatively flat, with only 54% of its area over 15%

slope, and 16.5% less than 5% slope. The Cedar Creek and Corduroy Creek watersheds are relatively steeper, with 63.7% and 71.2% of the area greater than 15% slope, respectively (Table 2-2 and Figure 2-3).

**Table 2-2: Carrizo Creek Watershed Slope Classifications**

	Area (sq. miles)	Percent		
		0-5%	5-15%	>15%
Carrizo Creek (Local Drainage) 1506010403	212	16.5%	29.5%	54.0%
Cedar Creek 1506010402	176	11.1%	25.3%	63.7%
Corduroy Creek 1506010401	321	9.1%	19.8%	71.2%
Carrizo Creek Watershed	709	11.8%	24.1%	64.2%

*Data Sources: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006), U.S. Census Bureau TIGER 2000, USGS DLG 1988. USGS National Elevation Dataset 2004 10-meter.*

### Streams, Lakes and Gaging Stations

The locations of active and inactive gaging stations, and their respective annual mean stream flow, are found in Table 2-3.1A. Corduroy Creek, near Mouth and Show Low, has the largest active stream flow with 24.53 cfs. Cibecue One, a tributary of Carrizo Creek, near Show Low has the lowest active stream flow with .01 cfs. Carrizo Creek near Show Low has the highest Peak Flow recorded at 23,000 CFS (Table 2-3.1B).

Figure 2-4 and Table 2.3.2 identify major lakes and reservoirs in the Carrizo Creek Watershed, as well as their watershed position, surface area, elevation and dam name. Cooley Lake and Bootleg Lake are the largest surface waters with areas of 475 and 360 acres respectively. The next largest water body is Forestdale Canyon Tank which covers 195 acres. Figure 2-4 and Table 2-3.3 list the major streams and their lengths. Stream lengths range from 63 miles for Carrizo Creek to 2.0 miles for Salt River.

*Table 2-3.1A: Carrizo Creek Watershed USGS Stream Gages and Annual Mean Stream Flow*

USGS Gage ID Number	Site Name	Begin Date	End Date	Annual Mean Stream Flow (cfs)
09496700	Cibecue Two, Tributary of Carrizo Creek, Near Show Low	10/1/1959	9/30/1971	0.01
09494300	Carrizo Creek, Above Corduroy Creek, Near Show Low	10/1/1954	9/30/1966	11.91
09494500	Corduroy Creek, Above Forestdale Creek, Near Show Low	10/1/1953	9/30/1960	3.96
09495500	Forestdale Creek, Near Show Low	10/1/1953	9/30/1960	3.03
09496000	Corduroy Creek, Near Mouth, Near Show Low	10/1/1952	9/30/2005	24.53
09496600	Cibecue One Tributary of Carrizo Creek, Near Show Low	10/1/1959	9/30/1971	0.01

Data Source: USGS Water Data for the Nation <http://waterdata.usgs.gov/nwis/>

*Table 2-3.1B: Carrizo Creek Watershed USGS Stream Gages and Reported Peak Flow*

USGS Gage ID Number	Site Name	Years Observed	Peak Flow Observation Date	Peak Flow (cfs)
09496500	Carrizo Creek, Near Show Low	1951-2006	Dec. 30, 1965	23,000
09495800	Corduroy Creek, Near Show Low	2004-2006	Jul. 15, 2004	3,500
09494200	Carrizo Creek, Near Cibecue	2004-2005	Dec. 29, 2005	3,340
09495000	Forestdale Creek, Diverted from Show Low Creek, Near Show Low	No data	No data	No data

Data Source: USGS <http://waterdata.usgs.gov/nwis/peak> Retrieved on 2007-03-15 19:13:45 EDT. No data available for Gage 09495000.

**Table 2-3.2. Carrizo Creek Major Lakes and Reservoirs**

Lake Name	Watershed	Surface Area (acres)	Elevation (feet)	Dam Name (if known)
Forestdale Canyon Tank	Corduroy Creek	195	1,956	Unknown
Bootleg Lake	Corduroy Creek	360	2,082	Unknown
Cooley Lake	Corduroy Creek	475	2,153	Cooley Dam
Wild Steer Tank	Carrizo Creek – Local Drainage	180	1,642	Unknown

Data Sources: GIS data layer “Lakes”, Arizona State Land Department, Arizona Land Resource Information System (ALRIS), February 7, 2003, <http://www.land.state.az.us/alris/index.html>

**Table 2-3.3: Carrizo Creek Watershed Major Streams and Lengths**

Stream Name	Watershed	Stream Length (miles)
Carrizo Creek	Carrizo Creek	63
Corduroy Creek	Corduroy Creek, Carrizo Creek	37
East Cedar Creek	Cedar Creek	19
Turkey Canyon	Carrizo Creek	16
Cedar Creek	Cedar Creek, Carrizo Creek	14
Middle Cedar Creek	Cedar Creek	14
West Cedar Creek	Cedar Creek	14
Jumpoff Canyon	Carrizo Creek	12
Mud Creek	Carrizo Creek	12
Deer Springs Canyon	Carrizo Creek	11

Data Sources: GIS data layer “Streams”, Arizona State Land Department, Arizona Land Resource Information System (ALRI S2004). <http://www.land.state.az.us/alris/index.html>

### Riparian Vegetation

There is no significant riparian vegetation for Carrizo Creek Watershed (Figure 2-5 and Table 2-4), according to data from the Arizona Land Department, Arizona Land Resource Information System (ARLIS).

**Table 2-4: Carrizo Creek Watershed Riparian Vegetation (acres) by 10-digit Watershed.**

Watershed	
1506010403	No data
1506010402	No data
1506010401	No data

### Land Cover

The Riparian Vegetation map (Figure 2-5) and Land Cover map (Figure 2-6) were created from the Southwest Regional Gap Analysis Project land cover map (Lowry et. al, 2005). Within the Carrizo watershed, Table 2-6 identifies the Rocky Mountain Ponderosa Pine Woodland as the most common land cover type over the entire watershed, encompassing 47.64% of the watershed. The next most common types are Mandrean Pinyon-Juniper Woodland (42.84%), Mogollon Chaparral (3.46%), and Colorado Plateau Pinyon-Juniper Woodland (3.08%).

Note: There are a total of 26 GAP vegetation categories present within the Carrizo Creek Watershed boundary. Some of these categories occur only in small concentrations, and are not visible at the small scale in which the maps are displayed. Some of the vegetation

categories were re-grouped in order to increase the legibility of the map. In collaboration with NRCS, staff was able to create a total of 8 grouped GAP vegetation categories, as shown in Table 2-5, below.

*Table 2-5: Carrizo Creek Watershed Southwest Regional GAP Analysis Project Land Cover, Percent of 10-digit Watershed*

Landcover	Carrizo Creek (Local Drainage) 1506010403	Cedar Creek 1506010402	Corduroy Creek 1506010401	Percent of Total
Agriculture	-	-	-	-
Apacherian-Chihuahuan Grassland and Mesquite Scrub	2.23%	1.96%	0.09%	1.52%
Colorado Plateau Mixed Bedrock Canyon and Tableland	1.10%	1.07%	0.26%	0.84%
Colorado Plateau Pinyon-Juniper Woodland	1.88%	0.58%	6.96%	3.08%
Madrean Pinyon- Juniper Woodland	44.17%	56.82%	29.24%	42.84%
Mogollon Chaparral	5.27%	3.05%	1.05%	3.46%
Open Water	<0.01%	-	-	<0.01%
Rocky Mountain Ponderosa Pine Woodland	44.47%	36.16%	61.96%	47.64%
Area (sq. mile)	321	176	212	709

*Data Sources: GIS data layer "Arizona Gap Analysis Project Vegetation Map", University of Arizona, Southern Arizona Data Services Program, 2004  
<http://sdrsnet.smr.arizona.edu/index.php> Originated by Arizona Game & Fish Department, Habitat Branch, 1993. This dataset was digitized from Brown & Lowe, 1980.*

### Meteorological Stations, Precipitation and Temperature

For the years 1948-1971, the average annual precipitation for the Carrizo Creek Watershed was 25 inches (Table 2-6). The Corduroy Creek watershed received the most rainfall with 24.60 inches of rain in an average year, while

the Cedar Creek and Carrizo Creek watersheds typically received 21.67 and 20.25 inches respectively. No temperature data was available for the Carrizo Creek watershed. The only meteorological station in the watershed is located at Forestdale, on Corduroy Creek (Figure 2-7).

*Table 2-6: Carrizo Creek Watershed Meteorological Stations, Temperature (°F) and Precipitation (in/yr) with Recent Long-term Records.*

Watershed Name	Meteorological Stations and Station ID	Average Temperature(°F)			Precipitation (in/yr)		
		Min.	Max.	Weighted Average	Min.	Max	Weighted Average
Carrizo Creek (Local Drainage) 1506010403	None	-	-	-	17	33	20.25
Cedar Creek 1506010402	None	-	-	-	17	25	21.67
Corduroy Creek 1506010401	Forestdale 023082-2	30.1	66.7	48.4	19	31	24.60
Carrizo Creek Watershed	-	-	-	-	17	33	25.00

Source: Temperature: Western Regional Climate Center (WRCC), Temperature data. Forestdale Period of record: 7/1/1948 to 5/31/1971 <http://www.wrcc.dri.edu/summary/climsmaz.html>. Precipitation: GIS data layer "car\_wash\_precip" Arizona Land Information System (ALRIS 2004). <http://www.land.state.az.us/alris/index.html>.

### Land Ownership/Management

In the Carrizo Creek Watershed, there are 3 different land ownership/management entities (Figure 2-8 and Table 2-7). The White

Mountain Apache Tribe is the largest land owners, representing over 99% of the watershed. The Forest Service and Private lands are minimal, each with less than 1% of the watershed.

*Table 2-7: Carrizo Creek Land Ownership/Management (Percent of each 10-digit Watershed)*

Land Owner	Carrizo Creek (Local Drainage) 1506010403	Cedar Creek 1506010402	Corduroy Creek 1506010401	Carrizo Creek Watershed TOTAL
White Mountain Apache Tribe	98.12%	100%	99.97%	99.16%
Private	-	-	0.05%	0.02%
US Forest Service	1.92%	-	0.07%	0.89%
Area (sq. miles)	321	176	212	709

Data Sources: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006), U.S. Census Bureau TIGER 2000, USGS DLG 1988. National Climate Data Center PRISM.

## Land Use

The Land Use map was created from the Southwest Regional GAP Analysis Project land cover map (Lowry et. al, 2005).

The land cover condition during the early 1990's was determined using the National Land Cover Dataset (NLCD). The NLCD classification contains 21 different land cover categories; however, these categories have been consolidated into five land cover types (Figure 2-9 and Table 2-8). The five groupings for the land cover categories are:

- Crop, which includes confined feeding operations; cropland and pasture; orchards, groves, vineyards, nurseries and ornamental horticulture; other agricultural land.
- Forest, includes areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy

accounts for 25-100 percent of the cover.

- Water, identifies all areas of surface water, generally with less than 25% cover of vegetation/land cover.
- Range, which includes herbaceous rangeland; mixed range; shrub and brush rangeland.
- Urban, which includes residential areas; commercial and services; industrial and commercial complexes; mixed urban or built-up land; other urban or built-up land; strip mines quarries and gravel pits; transportation, communication and utilities.

The most common land cover type is Forest which makes up 65.33% of the watershed. Range land is the next most common type with 34.70% of the total area (USGS, NLD Land Cover Class Definitions).

*Table 2-8: Carrizo Creek Watershed Land Use, Percent of 10-digit Watershed*

Land Cover/Location	Crop	Forest	Urban	Range	Water	Area (sq miles)
Carrizo Creek (Local Drainage) 1506010403	-	61.47%	-	38.57%	<0.01%	321
Cedar Creek 1506010402	-	50.27%	-	49.84%	-	176
Corduoy Creek 1506010401	-	83.68%	0.13%	16.27%	0.01%	212
Percent of Carrizo Creek Watershed	-	65.33%	0.04%	34.70%	<0.01%	709

Data Sources: GIS data layer "car\_gapveg21", Arizona State Land Department, Arizona Land Resource Information System (ALRIS 2004) <http://www.land.state.az.us/alris/index.html>

## Mines – Primary Ores

Figure 2-10 and Table 2-9 identify 10 mineral extraction mines listed for the Carrizo Creek Watershed. The types of ores mined are gypsum, pumice, clay and sand and gravel.

*Table 2-9: Carrizo Creek Watershed Mines – Primary Ores*

Ore Type	Total Number of Mines
Gypsum	4
Pumice	3
Clay	2
Sand and Gravel	1

*Note: If a mine contains more than one ore, only the major ore is noted.  
Data Source: Natural Resource Conservation Service (NRCS).*

## **Section 3: Resource Concerns**

### Introduction

Conservation Districts and other local leaders, along with NRCS and other resource management agencies, have identified priority natural resource concerns for this watershed. These concerns can be grouped under the broad resource categories of Soil, Water, Air, Plants, or Animals (SWAPA). Refer to Table 3-1 for a listing of priority resource concerns by land use within the Carrizo Creek Watershed.

### Soil 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 rangeland in areas of shallow soils and 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 is locally significant where adequate vegetative cover is not maintained.

Conservation practices applied to address this resource concern 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, prescribed grazing, range planting, stream channel stabilization, tree and shrub establishment, water and sediment

control basins, water spreading, windbreak establishment, and wildlife upland habitat management.

### Water Quality

Water pollution from suspended sediment and turbidity is a resource concern whenever accelerated soil erosion contributes excessive sediment to perennial waters that support aquatic fauna. Grazing, farming, recreation and other activities in or near perennial waters can cause sediment and turbidity problems. Maintaining adequate vegetative cover on critically eroding sites and installing vegetative filter strips adjacent to these sites can help capture sediments before entering the stream or other body of water.

Conservation practices used to address this resource concern are generally those that improve vegetative cover and reduce upland and stream bank erosion. Practices may include critical area planting, filter strips, heavy use area protection, prescribed grazing, range planting, riparian forest buffers, sediment basins, stream bank protection, upland wildlife habitat management, and windbreak or shelterbelt establishment.

Table 3-1: Carrizo Creek Watershed Priority Resource Concerns by Land Use

Resource Category	Cropland Concerns	Rangeland Concerns	Forest Concerns	Urban Concerns
Soil Erosion		Sheet & Rill Erosion	Sheet & Rill Erosion	Roads & Construction Sites
Water Quality		Excessive Suspended Sediment in Surface Water	Excessive Suspended Sediment in Surface Water	
Water Quantity				
Air Quality				
Plant Condition		Plant Productivity, Health & Vigor	Plant Productivity, Health & Vigor	
Noxious & Invasive Plants		Noxious & Invasive Plants	Noxious & Invasive Plants	
Domestic Animals		Inadequate Quantities & Quality of Feed & Forage & Water	Inadequate Quantities & Quality of Feed & Forage & Water	
Species of Concern		T&E Species & Declining Species & Species of Concern	T&E Species & Declining Species & Species of Concern	

(NRCS, 2007)

### Water Quantity

Water resources in the Carrizo Creek Watershed are similar to those along the Mogollon Rim of the Little Colorado Watershed. In the Carrizo Watershed, the D & N aquifers have been removed by erosion, and any water bearing geology is from the Coconino Sandstone.

The Carrizo Creek Watershed has two predominant stream types: perennial and ephemeral/intermittent. The main drainage, Carrizo Creek, is perennial for the first 32 miles, or for

approximately 52% of the length. Two other tributaries are also perennial for a portion of their length: Corduroy Creek for approximately 12 miles, or 33% of the total length, and Turkey Canyon near the first 4 miles of the headwaters, or 29% of the total length. The remaining streams are intermittent and/or ephemeral. The definitions for the three different stream types are below:

- Perennial surface water means surface water that flows continuously throughout the year, with baseflow maintained by ground water discharged into the channel.

- Intermittent surface water means a stream or reach of a stream that flows continuously only at certain times of the year; such as when it receives water from a seasonal rainfall, a spring, or from another source, such as melting spring snow.
- Ephemeral streams are at all times above the elevation of the ground water table, has no base flow, and flows only in direct response to precipitation.

Most streams in Arizona are intermittent or ephemeral. Some of the stream channels in the region are dry for years at a time, but are subject to flash flooding during high-intensity storms (Gordon et al., 1992).

#### Air Quality

This area is entirely on Indian Reservation and not assessed by ADEQ. There are no known air quality concerns in the watershed (Figure 3-2).

#### Plant Condition

Plant condition is a resource concern whenever plants do not manufacture sufficient food to continue the growth cycle or to reproduce. Plant condition is frequently a concern on rangeland where proper grazing management is not being applied.

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, forest stand

improvement, herbaceous wind barriers, nutrient management, pest management, prescribed grazing, prescribed burning, range planting, recreation area improvement, riparian forest buffers, tree and shrub establishment, wetland development or restoration, wildlife upland habitat management, wildlife watering facility, wildlife wetland habitat management, and windbreak establishment.

#### Noxious and Invasive Plants

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, control of wildfires in the higher elevations, 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.

#### Bark Beetle, Drought and Wildfire

Over the past several years, Arizona has experienced increased piñon and ponderosa pine mortality due to outbreaks of several species of bark beetles. The Ips beetle and western

pine beetle are the two most common groups of bark beetles responsible for the outbreaks in Arizona (USDA 2007; USDA 2004). Low tree vigor caused by several years of drought and excessively dense stands of trees have combined to allow beetle populations to reach outbreak levels. These insects are native to ponderosa pine forests and piñon-juniper woodlands of the Southwest, and normally only attack a small number of diseased or weakened trees. Healthy trees are usually not susceptible to these beetles.

The vegetation communities in the Carrizo Watershed are mostly Ponderosa Pine, Pinyon-Juniper, and Pine-Oak woodland. Based on an analysis of the Forest Service GIS data for bark beetle occurrence, approximately 206 acres of lands in the Carrizo have been affected by bark beetles, or only about 0.14 percent. The land cover types where bark beetles occur in the Carrizo Watershed are Colorado Plateau Mixed Bedrock Canyon and Tableland, Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland, Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland, Madrean Pine-Oak Forest and Woodland, Rocky Mountain Ponderosa Pine Woodland, Southern Rocky Mountain Pinyon-Juniper Woodland, Colorado Plateau Pinyon-Juniper Woodland, Mogollon Chaparral, Madrean Pinyon-Juniper Woodland, Developed Medium-High Intensity, and Recently Burned.

The upper portion of the Carrizo Creek Watershed is comprised primarily of the Rocky Mountain ponderosa pine woodland vegetation type. Most of this area was moderately to severely burned

during the massive Rodeo-Chediski wildfire of 2002. This event killed many of the pine trees along with most of the ground vegetation, thereby leaving the soils within much of the upper watershed unprotected and subject to runoff and erosion.

The Climate Assessment for the Southwest (CLIMAS) website ([www.ispe.arizona.edu/climas](http://www.ispe.arizona.edu/climas)) provides information on Arizona's drought status. Recent precipitation events have placed the area of Arizona that encompasses the Carrizo Creek Watershed in moderate drought status. However, the watershed remains abnormally dry, and the long term drought status remains moderate.

The Southwest Coordination Center ([gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm](http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm)) places the Carrizo Creek Watershed in the Normal category for significant wildland fire activity potential due to favorably moist conditions.

### Domestic Animal Concerns

Domestic animal concerns occur whenever the quantity and quality of food are not adequate to meet the nutritional requirements of animals, or adequate quantity and quality of water is not provided. This is frequently a concern on rangeland where changes in species composition resulting from poor grazing management and drought can reduce the availability of suitable forage.

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.

### Species of Concern

There are 55 threatened and endangered species listed for Arizona. (U. S. Fish and Wildlife Service website). In 1990 Arizona voters created the Heritage Fund, designating up to \$10 million per year from lottery ticket sales for the conservation and protection of the state's wildlife and natural areas. The Heritage Fund allowed for the creation of the Heritage Data Management System (HDMS) which identifies elements of concern in Arizona and consolidates information about their status and distribution throughout the state. (Arizona Game & Fish website, 2006)

The Carrizo Creek Watershed contains only one of the 55 threatened or endangered species listed for Arizona (Table 3-2). The species found in the Carrizo Creek watershed is the Nutrioso Milk-vetch (U.S. Fish & Wildlife Service, 2004). The Nutrioso Milk-vetch is listed as a Species of Concern by the U.S. Fish and Wildlife Service. The State of Arizona lists the species as Salvage Restricted, meaning that it can only be collected with a permit.

### Resource Concern Summary

Local leaders have identified watershed health as a priority concern for the Carrizo Creek Watershed. This includes both the upland areas of the watershed and the riparian or stream course areas. The condition of the upland areas is integral to the hydrologic function, such that when precipitation falls on the land its disposition is affected by the soil and vegetation, which in turn are affected by land uses, both historical and current. The amount of the precipitation which immediately runs off the land surface, and that which infiltrates into the soil to either be used for plant growth or to recharge groundwater, is dependent on this critical interface.

Most of the watershed lies within the White Mountain Apache Indian Reservation and is not facing many of the pressures related to population growth observed in other watersheds in Arizona. The two dominate land use activities are livestock grazing and forestry. The upper portion of the watershed has been intensely logged and there is an extensive road system to support the logging and grazing activities. However, the most important current watershed issue is the residual impacts from the 2002 Rodeo-Chediski Fire. The Rodeo-Chediski Fire burned most of the upper portion of the watershed. The fire severity was high for much of the burned area in the watershed resulting in high rates of vegetation mortality and bare soil, increasing the flood and erosion hazards. There has been extensive rehabilitation within the watershed since 2002.

**Table 3-2: Carrizo Creek Watershed Species of Concern Classifications and Observation<sup>(1)</sup>**

Name	Common Name	USESA (2)	USFS (3)	BLM (4)	STATE (5)	Last Observation
<i>Astragalus nutriosensis</i>	Nutrioso Milk- vetch	SC			SR	1994-05-14

Data Sources: Arizona Land Information System (ALRIS), Natural Resource Conservation Service (NRCS).

Note: Status Definitions as Listed by Arizona Game and Fish Department, November 26, 2006  
[http://www.gf.state.az.us/w\\_c/edits/hdms\\_status\\_definitions.shtml](http://www.gf.state.az.us/w_c/edits/hdms_status_definitions.shtml)

**(2) Listed:**

SC Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife Service, but neither term has official status (currently all former C2 species).

**(5) State Status**

NPL Arizona Native Plant Law (1993)  
[Arizona Department of Agriculture](http://www.azagriculture.gov)

SR Salvage Restricted: collection only with permit.

Conservation Progress/Status

Conservation progress for the previous five years in the Carrizo Creek Watershed has focused on addressing the following primary resource concerns:

- ✓ Soil Erosion – Sheet and Rill Erosion
- ✓ Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water

- ✓ Plant Condition – Productivity, Health and Vigor
- ✓ Domestic Animals – Inadequate Quantities and Quality of Feed and Forage

The following table presents conservation accomplishments in this watershed during fiscal years (FY) 2002 through 2006, according to the NRCS Progress Reporting System (Table 3-3).

**Table 3-3: San Simon River Watershed Conservation Treatment Applied**

Carrizo Creek Watershed (15060104)		FY02-06
Conservation Treatment Applied		TOTAL
Fence (feet)		196,437
Prescribed Grazing (acres)		1,455,013

(NRCS, 2007)

## **Section 4: Census, Social and Agricultural Data**

This section discusses the human component of the watershed and the pressure on natural resources caused by humans and by population change.

### Population Density, 1990

Census block statistics for 1990 were compiled from information prepared by Geo-Lytics (Geo-Lytics, 1998). These data were linked with census block data and used to create a density map (Figure 4-1) through a normalization process using a grid of 7 km squares. This process involves calculating density per census block and intersecting it with the grid, which is then used to calculate the number of people and thus density per grid square.

Table 4-1 shows the tabulated minimum, maximum and mean number of people per square mile in 1990 for each watershed. In 1990, the mean population density for the entire watershed was about 19 people per square mile. Corduroy Creek had the highest population mean with about 52 people per square mile, and a maximum of 9,334 people per square mile. Carrizo Creek Watershed (Local Drainage) had the lowest density with an average of only about 2 people per square mile.

### Population Density, 2000

The Census Block 2000 statistics data were downloaded from the Environmental Systems Research Institute (ESRI) website (ESRI Data Products, 2003) and are shown in Table 4-2.

A population density map (Figure 4-2) was created from these data. The mean population density in 2000 was about 55 people per square mile. Corduroy Creek and Cedar Creek had the highest mean population density with approximately 140 and 33 people per square mile, respectively. Corduroy Creek had the highest maximum density of 21,323 people per square mile.

### Population Density Change, 1990-2000

The 1990 and 2000 population density maps were used to create a population density change map. The resulting map and table (Figure 4-3 and Table 4-3) show population increase or decrease over the ten year time frame. Overall, mean population density increased by about 36 people per square mile during this ten year time period. Corduroy Creek and Cedar Creek had the largest increases in mean population at about 88 and 29, respectively.

### Housing Density, 2000 and 2030

The Watershed Housing Density Map for the years 2000 and 2030 were created with data developed by David M. Theobald (Theobald, 2005). Theobald developed a nationwide housing density model that incorporates a thorough way to account for land-use change beyond the “urban fringe.”

Exurban regions are the “urban fringe”, or areas outside suburban areas, having population densities greater than 0.68 – 16.18 ha (1.68 – 40 acres) per unit. Theobald stresses that exurban areas are increasing at a much faster rate than urban sprawl, are consuming much more land, and are having a greater

impact on ecological health, habitat fragmentation and other resource concerns.

Theobald estimates that the exurban density class has increased at a much faster rate than the urban/suburban density classes. Theobald’s model forecasts that this trend will continue and may even accelerate by 2030. This indicates that development patterns are shifting more towards exurban, lower density, housing units, and are thereby consuming more land. He suggests that exurban development has more overall effect on natural resources because of

the larger footprint and disturbance zone, a higher percent of impervious surfaces, and higher pollution because of more vehicle miles traveled to work and shopping.

Figure 4-4 and Table 4-4, Carrizo Creek Watershed Housing Density for 2000, identifies that 94% of housing is located in “undeveloped private” areas, while 5.7% is located in “rural” areas. Figure 4-5 and Table 4-5, Carrizo Creek Watershed Housing Density for 2030, projects “undeveloped private” areas being reduced to 93% and “rural” increasing to 6.5%.

*Table 4-1: Carrizo Creek Watershed 1990 Population Density (people/square mile)*

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Carrizo Creek (Local Drainage) 1506010403	321	0	593.72	2.29
Cedar Creek 1506010402	176	0	473.73	3.58
Corduroy Creek 1506010401	212	0	9334.05	51.92
Total Carrizo Creek Watershed	709	0	9334.05	18.92

*Data Sources: Census block statistics for 1990 were compiled from a CD prepared by Geo-Lytics (GeoLytics, Inc. 1998. Census 1990. Census CD + Maps. Release 3.0.)*

*Table 4-2: Carrizo Creek Watershed 2000 Population Density (people/square mile)*

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Carrizo Creek (Local Drainage) 1506010403	321	0	101.03	0.52
Cedar Creek 1506010402	176	0	7347.46	32.66
Corduroy Creek 1506010401	212	0	21323.35	139.66
Total Carrizo Creek Watershed	709	0	21323.35	54.82

*Data Sources: ESRI Data Products, Census 2000, October 17, 2003.*  
<http://www.esri.com/data/>

*Table 4-3: Carrizo Creek Watershed 1990 to 2000 Population Density Change (people/square mile)*

10-digit Watershed Name	Area (sq. miles)	Population Density (people/sq.mi.)		
		Min	Max	Mean
Carrizo Creek (Local Drainage) 1506010403	321	0	-593.72	0.51
Cedar Creek 1506010402	176	0	6873.74	29.08
Corduroy Creek 1506010401	212	0	11989.30	87.74
Total Carrizo Creek Watershed	709	0	11989.30	35.90

*Data Sources: Derived from data from the GIS data used for tables 4-1 and 4-2.*

*Table 4-4: Carrizo Creek Watershed Housing Density 2000 (Percent of Watershed)\**

Housing Density	Carrizo Creek (Local Drainage) 1506010403	Cedar Creek 1506010402	Corduroy Creek 1506010401	Carrizo Watershed Percent of Total
Undeveloped Private	100.00%	86.73%	91.12%	94.01%
Rural	-	12.76%	8.33%	5.72%
Exurban	0.05%	0.50%	0.43%	0.28%
Suburban	-	-	0.09%	0.03%
Urban	-	-	0.03%	0.01%
Area (sq. mile)	314	176	212	702

Source: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006) and Theobald (2005).

\*All calculations are based on GIS data layer "housing density (Theobald, 2005)." The data layer does not include an area of approximately 7 sq. miles in the northern portion of the Carrizo Creek (Local Drainage) 1506010403 watershed (see map).

*Table 4-5: Carrizo Creek Watershed Housing Density 2030  
(Percent of Watershed)\**

Housing Density	Carrizo Creek (Local Drainage) 1506010403	Cedar Creek 1506010402	Corduroy Creek 1506010401	Carrizo Watershed Percent of Total
Undeveloped Private	99.71%	86.05%	88.57%	92.93%
Rural	0.23%	13.42%	9.95%	6.47%
Exurban	0.06%	0.53%	1.30%	0.55%
Suburban	-	-	0.15%	0.04%
Urban	-	-	0.03%	0.01%
Area (sq. mile)	314	176	212	702

Source: Arizona Land Information System (ALRIS 2004), Natural Resource Conservation Service (NRCS 2006) and Theobald (2005).

\*All calculations are based on GIS data layer "housing density (Theobald, 2005)." The data layer does not include an area of approximately 7 sq. miles in the northern portion of the Carrizo Creek (Local Drainage) 1506010403 watershed (see map).

### Carrizo Creek Watershed Agricultural Statistics

Arizona is known as one of the most productive and efficient agricultural regions in the world, with beauty that also provides the food and fiber to sustain life in the desert. Arizona is also one of the most diverse agricultural producing states in the nation, producing more than 160 varieties of vegetables, livestock, field crops and nursery stock. The climate, natural resources, agribusiness infrastructure and farm heritage help make agriculture a \$9.2 billion dollar industry employing more than 72,000 individuals.

According to the United States Department of Agriculture's, 2002 Census, there are more than 7,000 farms and ranches, seventy-eight percent of which are owned by individuals or families. The total

farmland in Arizona is comprised of more than 26,000,000 acres with irrigated crops on 1,280,000 acres and pasture for animals on 23,680,000.

Agriculture in general on the Carrizo Creek Watershed is comprised of livestock grazing. Of the 25 farms that have pasture and rangeland, 40% have 100 or more acres. Eighty-nine percent of all farms in the watershed are less than 1,000 acres in size. Of the 17 farms that harvest crops, 88% are 49 acres or less in size.

The NASS (National Agricultural Statistics Service, United States Department of Agriculture) has farm data by zip code. We used the U.S. Census Bureau ZIP Census Tabulation Areas (ZCTA) to generate maps. A typical 5-digit ZCTA (there are 3-digit ZCTAs as well) is typically nearly identical to a 5-digit U.S. Postal Service

ZIP code, but there are some distinctions. Unlike ZIP codes, ZCTA areas are spatially complete and they are easier to map. The Bureau created special `XX ZCTAs (ZCTAs with a valid 3-digit ZIP but with "XX" as last two characters of the code) which represent large unpopulated areas where it made no sense to assign a census block to an actual ZIP code. Similarly, HH ZCTAs represent large bodies of water within a 3-digit zip area. There is typically no population in either an XX or HH ZCTA.

Data is withheld by NASS for categories with one to four farms. This is to protect the identity of individual farmers. Farm counts for these zip codes are included in the "State Total" category. Some categories only contained stars instead of numbers. Each star was counted as one farm. But because each star could represent as many as 4 farms, each

number on the tables are actually greater than or equal to the number listed. In some cases this results in percentages that add up to more or less than 100 percent.

Tables Include data from zip codes both contained within the watershed and zip codes crossing watershed boundaries.

Four of the zip codes that lie within Carrizo Watershed contained no information from NASS databases. NASS assumed that no information for those areas meant that there was no agricultural activity taking place within that zip code area. In addition, 13 zip code areas were listed as XX ( 4 ) or HH ( 9 ), meaning that these are new zip code areas formerly were covered by water or were uninhabited, respectively.

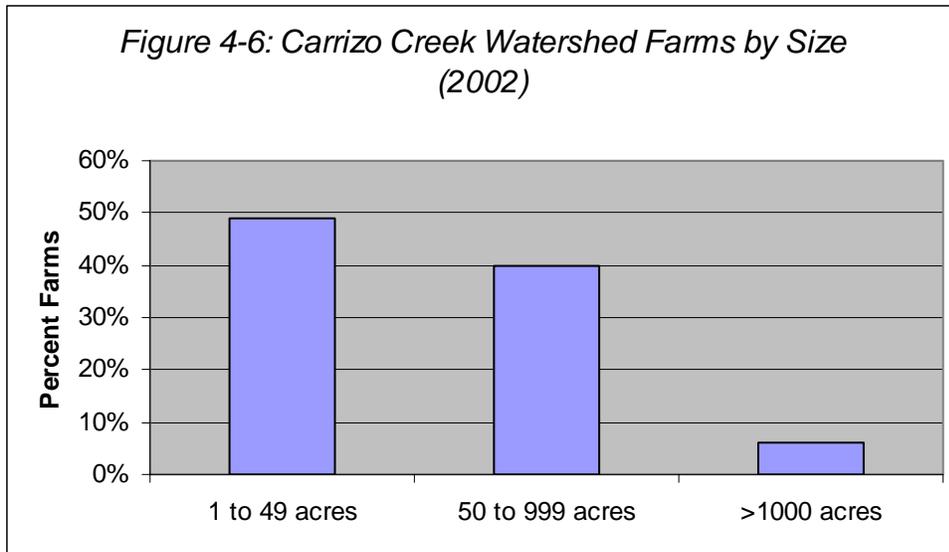
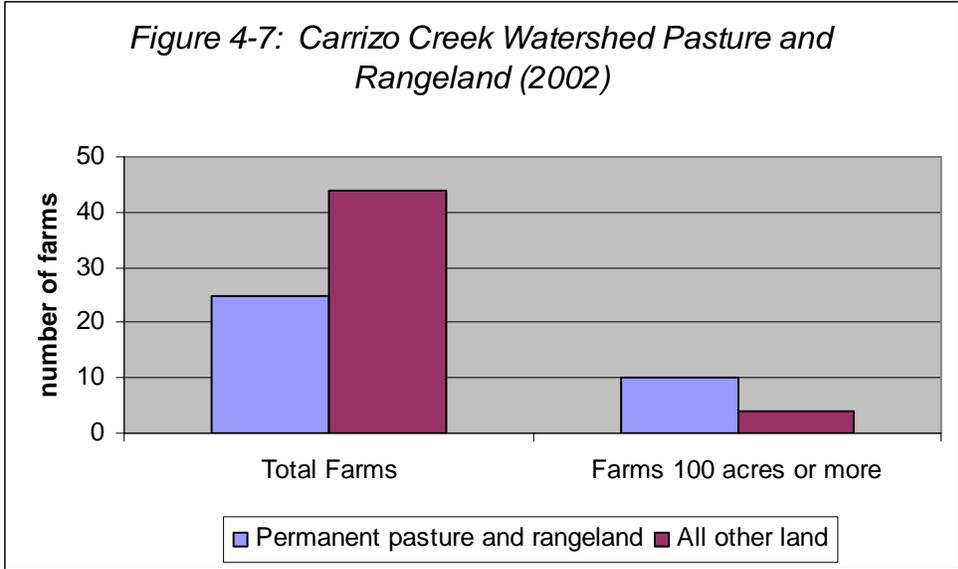


Table 4-6: Carrizo Creek Watershed Farms by Size (2002)

All farms	1 to 49 acres	50 to 999 acres	>1000 acres
70	49%	40%	6%

Percents rounded.

Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)

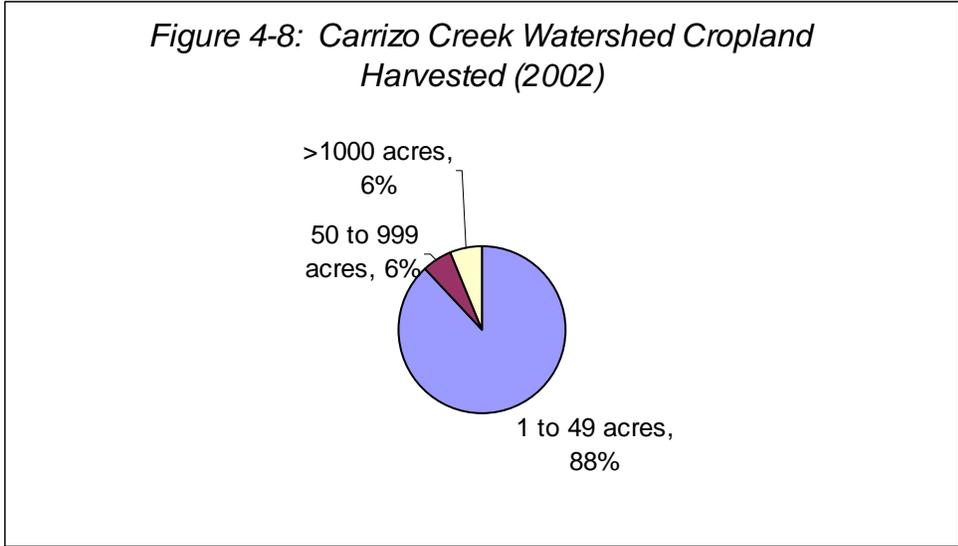


**Table 4-7: Carrizo Creek Watershed Pasture and Rangeland (2002)**

Category	Total farms	Farms 100 acres or more
Permanent pasture and rangeland	25	40%
All other land	44	10%

*Percents rounded.*

*Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*



**Table 4-8: Carrizo Creek Watershed Cropland Harvested (2002)**

Total farms	1 to 49 acres	50 to 999 acres	>1000 acres
17	88%	6%	6%

*Percents rounded.*

*Data source: NASS (National Agricultural Statistics Service, United States Department of Agriculture)*

## Section 5: Resource Assessment Tables

The following Resource Assessment Tables summarize current and desired future natural resource conditions for the Carrizo Creek Watershed. The tables present information on benchmark and future conservation systems and practices, qualitative effects on primary resource concerns, and estimated costs for conservation implementation. Conservation District board members, NRCS conservationists, and other people familiar with conservation work in the watershed were consulted for estimating current and future natural resource conditions. To contribute additional or updated information for this watershed, visit the NRCS Arizona website: [www.az.nrcs.usda.gov/programs](http://www.az.nrcs.usda.gov/programs).

The tables show three levels of conservation treatment (Baseline, Progressive, Resource Management System) for each of the major land uses (range and forest) within the watershed. **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 watershed. **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) resource concerns typically seen for this land use in this watershed.

For each land use, the results of the assessment are presented in two parts. Part 1 (Assessment Information) summarizes the conservation practices at each treatment level and the quantities of practices for current benchmark conditions and projected future conditions. Part 1 also displays the four primary resource concerns, along with individual practice effects and an overall Systems Rating (ranging from a low of 1 to a high of 5) indicating the effectiveness of the conservation system used at each treatment level. Part 2 (Conservation Cost Table) summarizes the installation, management, and related costs by conservation practice and treatment level for the projected future conditions by federal and private share of the costs. Part 2 also displays the benchmark and future conservation conditions status bars.

Credit goes to NRCS in Oregon for development of the template for these Resource Assessment Tables.

NOTE: the numbers in the first column of each table represent NRCS conservation practice codes.

WATERSHED NAME & CODE		CARRIZO CREEK - 15060104				LANDUSE ACRES		154,530	
LANDUSE TYPE		RANGE				TYPICAL UNIT SIZE ACRES		50,000	
ASSESSMENT INFORMATION		BENCHMARK CONDITIONS				CALCULATED PARTICIPATION		36%	
Conservation Systems by Treatment Level	Benchmark Conditions	Future Conditions			RESOURCE CONCERNS				
		Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water	Plant Condition – Productivity, Health and Vigor	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage
<b>Baseline</b>		<b>System Rating -&gt;</b>							<b>0</b>
Fence (ft.) 382	10,044	5,022	0	5,022	0	1	3	0	1
Pipeline (ft.) 516	10,044	5,022	0	5,022	3	3	3	0	0
Watering Facility (no.) 614	20	10	0	10	0	4	4	1	0
<b>Total Acreage at Baseline</b>	<b>100,445</b>	<b>50,222</b>	<b>0</b>	<b>50,222</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>4</b>
<b>Progressive</b>		<b>System Rating -&gt;</b>							<b>4</b>
Fence (ft.) 382	27,043	28,356	16,071	44,427	0	1	1	1	1
Pipeline (ft.) 516	27,043	28,356	16,071	44,427	3	3	3	0	0
Prescribed Burning (ac.) 338	5,409	4,868	4,018	8,885	1	1	1	4	4
Prescribed Grazing (ac.) 528	54,086	48,677	40,178	88,855	5	3	3	5	5
Watering Facility (no.) 614	22	28	8	36	0	4	4	1	0
<b>Total Acreage at Progressive Level</b>	<b>54,086</b>	<b>48,677</b>	<b>40,178</b>	<b>88,855</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>
<b>RMS</b>		<b>System Rating -&gt;</b>							<b>4</b>
Brush Management (ac.) 314	0	0	1,545	1,545	4	4	4	5	3
Fence (ft.) 382	0	3,709	11,744	15,453	0	1	1	1	1
Pipeline (ft.) 516	0	3,709	11,744	15,453	3	3	3	0	0
Prescribed Burning (ac.) 338	0	541	1,004	1,545	1	1	1	4	4
Prescribed Grazing (ac.) 528	0	5,409	10,044	15,453	5	3	3	5	5
Range Planting (ac.) 550	0	0	1,545	1,545	4	2	2	5	5
Upland Wildlife Habitat Management (ac.) 645	0	0	15,453	15,453	0	0	0	4	1
Watering Facility (no.) 614	0	4	11	15	0	4	4	1	0
Wildlife Watering Facility (no.) 648	0	0	3	3	0	4	4	1	0
<b>Total Acreage at RMS Level</b>	<b>0</b>	<b>0</b>	<b>15,453</b>	<b>15,453</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>

WATERSHED NAME & CODE		CARRIZO CREEK - 15060104		LANDUSE ACRES		154,530			
LANDUSE TYPE		RANGE		TYPICAL UNIT SIZE ACRES		50,000			
CONSERVATION COST TABLE									
		FUTURE		FEDERAL		PRIVATE			
Conservation Systems by Treatment Level		New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
<b>Progressive</b>									
Fence (ft.) 382		16,071	\$24,107	\$0	\$4,821	\$28,928	\$24,107	\$964	\$28,169
Pipeline (ft.) 516		16,071	\$64,284	\$0	\$12,857	\$77,141	\$64,284	\$2,571	\$75,116
Prescribed Burning (ac.) 338		4,018	\$100,445	\$0	\$20,089	\$120,533	\$100,445	\$2,009	\$108,907
Prescribed Grazing (ac.) 528		40,178	\$30,133	\$0	\$6,027	\$36,160	\$30,133	\$0	\$30,133
Watering Facility (no.) 614		8	\$4,018	\$0	\$804	\$4,821	\$4,018	\$241	\$5,033
<b>Subtotal</b>		<b>40,178</b>	<b>\$222,987</b>	<b>\$0</b>	<b>\$44,597</b>	<b>\$267,584</b>	<b>\$222,987</b>	<b>\$5,786</b>	<b>\$247,358</b>
<b>RMS</b>									
Brush Management (ac.) 314		1,545	\$92,718	\$0	\$18,544	\$111,262	\$92,718	\$1,854	\$100,529
Fence (ft.) 382		11,744	\$17,616	\$0	\$3,523	\$21,140	\$17,616	\$705	\$20,585
Pipeline (ft.) 516		11,744	\$46,977	\$0	\$9,395	\$56,373	\$46,977	\$1,879	\$54,893
Prescribed Burning (ac.) 338		1,004	\$25,111	\$0	\$5,022	\$30,133	\$25,111	\$502	\$27,227
Prescribed Grazing (ac.) 528		10,044	\$7,533	\$0	\$1,507	\$9,040	\$7,533	\$0	\$7,533
Range Planting (ac.) 550		1,545	\$46,359	\$0	\$9,272	\$55,631	\$46,359	\$927	\$50,265
Upland Wildlife Habitat Management (ac.) 645		15,453	\$0	\$60,267	\$12,053	\$66,751	\$0	\$20,089	\$30,924
Watering Facility (no.) 614		11	\$5,640	\$0	\$1,128	\$6,768	\$5,640	\$338	\$7,066
Wildlife Watering Facility (no.) 648		3	\$1,545	\$0	\$309	\$1,854	\$1,545	\$31	\$1,675
<b>Subtotal</b>		<b>15,453</b>	<b>\$243,501</b>	<b>\$60,267</b>	<b>\$60,753</b>	<b>\$357,952</b>	<b>\$243,501</b>	<b>\$26,326</b>	<b>\$300,696</b>
<b>Grand Total</b>		<b>55,631</b>	<b>\$466,487</b>	<b>\$60,267</b>	<b>\$105,351</b>	<b>\$625,536</b>	<b>\$466,487</b>	<b>\$32,111</b>	<b>\$548,054</b>

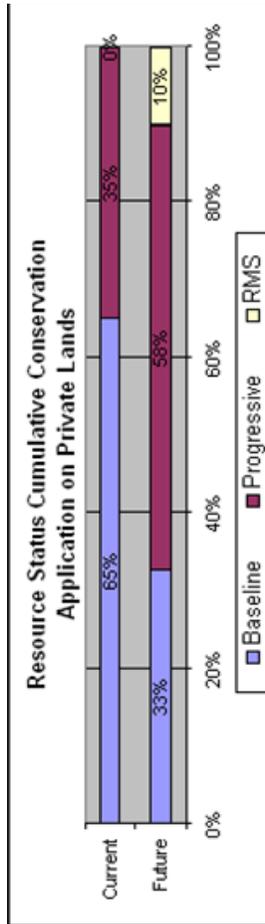


Chart Refers To	
Landuse Type	RANGE
Calculated Participation Rate	36%

Average PV Costs per Ac		
System	Federal	Private
Prog	\$6.66	\$6.16
RMS	\$23.16	\$19.46

WATERSHED NAME & CODE		CARRIZO CREEK - 15060104			LANDUSE ACRES		299,354	
LANDUSE TYPE		FOREST			TYPICAL UNIT SIZE ACRES		50,000	
ASSESSMENT INFORMATION					CALCULATED PARTICIPATION		36%	
Conservation Systems by Treatment Level	Benchmark Conditions		Future Conditions		RESOURCE CONCERNS			
	Total Units	Existing Unchanged Units	New Treatment Units	Total Units	Soil Erosion – Sheet and Rill	Water Quality – Excessive Suspended Sediment and Turbidity in Surface Water	Plant Condition – Productivity, Health and Vigor	Domestic Animals – Inadequate Quantities and Quality of Feed and Forage
<b>Baseline</b>					<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>
Fence (ft.) 382	19,458	9,729	0	9,729	0	1	1	1
Pipeline (ft.) 516	19,458	9,729	0	9,729	3	3	0	0
<b>Total Acreage at Baseline</b>	<b>194,580</b>	<b>97,290</b>	<b>0</b>	<b>97,290</b>				
<b>Progressive</b>					<b>4</b>	<b>2</b>	<b>4</b>	<b>4</b>
Fence (ft.) 382	52,387	54,931	31,133	86,064	0	1	1	1
Pipeline (ft.) 516	52,387	54,931	31,133	86,064	3	3	0	0
Prescribed Burning (ac.) 338	10,477	9,430	7,783	17,213	1	1	4	4
Prescribed Grazing (ac.) 528	104,774	94,297	77,832	172,129	5	3	5	5
<b>Total Acreage at Progressive Level</b>	<b>104,774</b>	<b>94,297</b>	<b>77,832</b>	<b>172,129</b>				
<b>RMS</b>					<b>5</b>	<b>4</b>	<b>5</b>	<b>3</b>
Brush Management (ac.) 314	0	0	2,994	2,994	4	4	5	3
Fence (ft.) 382	0	7,184	22,751	29,935	0	1	1	1
Pipeline (ft.) 516	0	7,184	22,751	29,935	3	3	0	0
Prescribed Burning (ac.) 338	0	1,048	1,946	2,994	1	1	4	4
Prescribed Grazing (ac.) 528	0	10,477	19,458	29,935	5	3	5	5
Tree/Shrub Establishment (ac.) 612	0	0	2,994	2,994	5	1	4	-3
Upland Wildlife Habitat Management (ac.) 645	0	0	29,935	29,935	0	0	4	1
Watering Facility (no.) 614	0	0	30	30	0	4	1	0
Wildlife Watering Facility (no.) 648	0	0	6	6	0	0	0	0
<b>Total Acreage at RMS Level</b>	<b>0</b>	<b>0</b>	<b>29,935</b>	<b>29,935</b>				



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## GLOSSARY

<b>Cubic Foot Per Second (C.F.S.)</b>	A unit expressing the rate of discharge of water. One cubic foot per second is equal to the discharge through a rectangular cross section, one foot wide and one foot long, flowing at an average velocity of one foot per second. One cubic foot per second equals 448.8 gallons per minute, and 1.98 acre-feet per day. It is a rate of water movement in volume per time unit.
<b>Drainage Basin</b>	A region or area bounded by a topographic divide and occupied by a drainage system, also known as a watershed.
<b>Drought</b>	There is no universally accepted quantitative definition of drought. Generally, the term is applied to periods of less than average precipitation over a certain period of time; nature's failure to fulfill the water wants and needs of man.
<b>Flood</b>	A flood is an overflow or inundation that comes from a river or other body of water and causes or threatens damage. It can be any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream. It is also a relatively high flow as measured by either gage height or discharge quantity.
<b>Ground Water</b>	The supply of fresh and saline water found beneath the Earth's surface which is often used for supplying wells and springs. Because ground water is a major source of drinking water, there is a growing concern over areas where leaching agricultural or industrial pollutants are contaminating ground water.
<b>Soil Moisture Regimes</b>	<p><b>Aridic</b> is a soil moisture regime that has no water available for plants for more than half the cumulative time that the soil temperature at 50 cm (20 in.) below the surface is <math>&gt;5^{\circ}\text{C}</math> (<math>41^{\circ}\text{F}</math>.), and has no period as long as 90 consecutive days when there is water for plants while the soil temperature at 50 cm (20 in.) is continuously <math>&gt;8^{\circ}\text{C}</math> (<math>46^{\circ}\text{F}</math>.).</p> <p><b>Udic</b> is a soil moisture regime that is neither dry for as long as 90 cumulative days nor for as long as 60 consecutive days in the 90 days following the summer solstice at periods when the soil temperature at 50 cm (20 in.) below the surface is above <math>5^{\circ}\text{C}</math> (<math>41^{\circ}\text{F}</math>.).</p> <p><b>Ustic</b> is a soil moisture regime that is intermediate between the aridic and udic regimes and common in temperate subhumid or semiarid regions, or in tropical and subtropical regions with a monsoon climate. A limited amount of water is available for plants but occurs at times when the soil temperature is optimum for plant growth.</p>

<b>Soil Orders</b>	A soil order is a group of soils in the broadest category. In the current USDA classification scheme there are 12 orders, differentiated by the presence or absence of diagnostic horizons.
<b>Soil Temperature Regimes</b>	<p><b>Hyperthermic</b> is a soil temperature regime that has mean annual soil temperatures of 22°C (72°F.) or more and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p> <p><b>Thermic</b> is a soil temperature regime that has mean annual soil temperatures of 15°C (59°F.) or more but &lt;22°C (72°F.), and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p> <p><b>Mesic</b> A soil temperature regime that has mean annual soil temperatures of 8°C (46°F.) or more but &lt;15°C (59°F.), and &gt;5°C (41° F.) difference between mean summer and mean winter soil temperatures at 50 cm (20 in.) below the surface.</p>
<b>Surface Water</b>	Water on the earth's surface. Lakes, bays, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, wetlands, marshes, inlets, canals, and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, navigable or non-navigable, and including the beds and banks of all watercourses and bodies of surface water, that are wholly or partially inside or bordering the state or subject to the jurisdiction of the state; except that waters in treatment systems which are authorized by state or federal law, regulation, or permit, and which are created for the purpose of waste treatment.
<b>Watershed</b>	The area of land that contributes surface run-off to a given point in a drainage system and delineated by topographic divides.

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