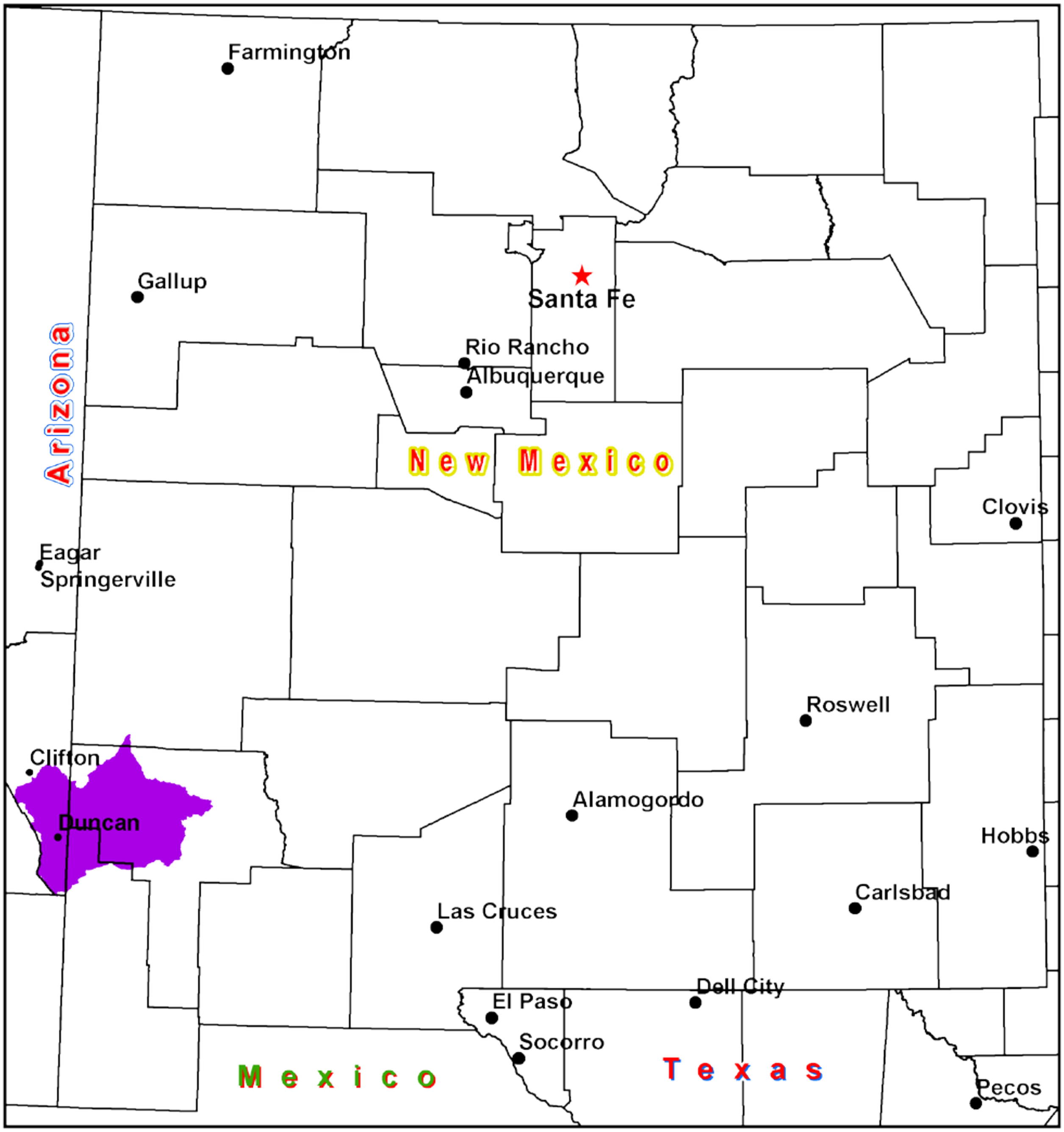
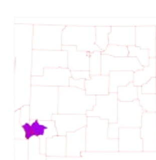



# Rapid Watershed Assessment
# Upper Gila-Mangas Watershed



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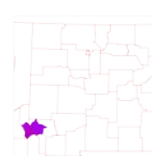

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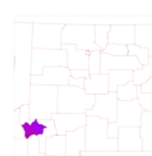


# Overview

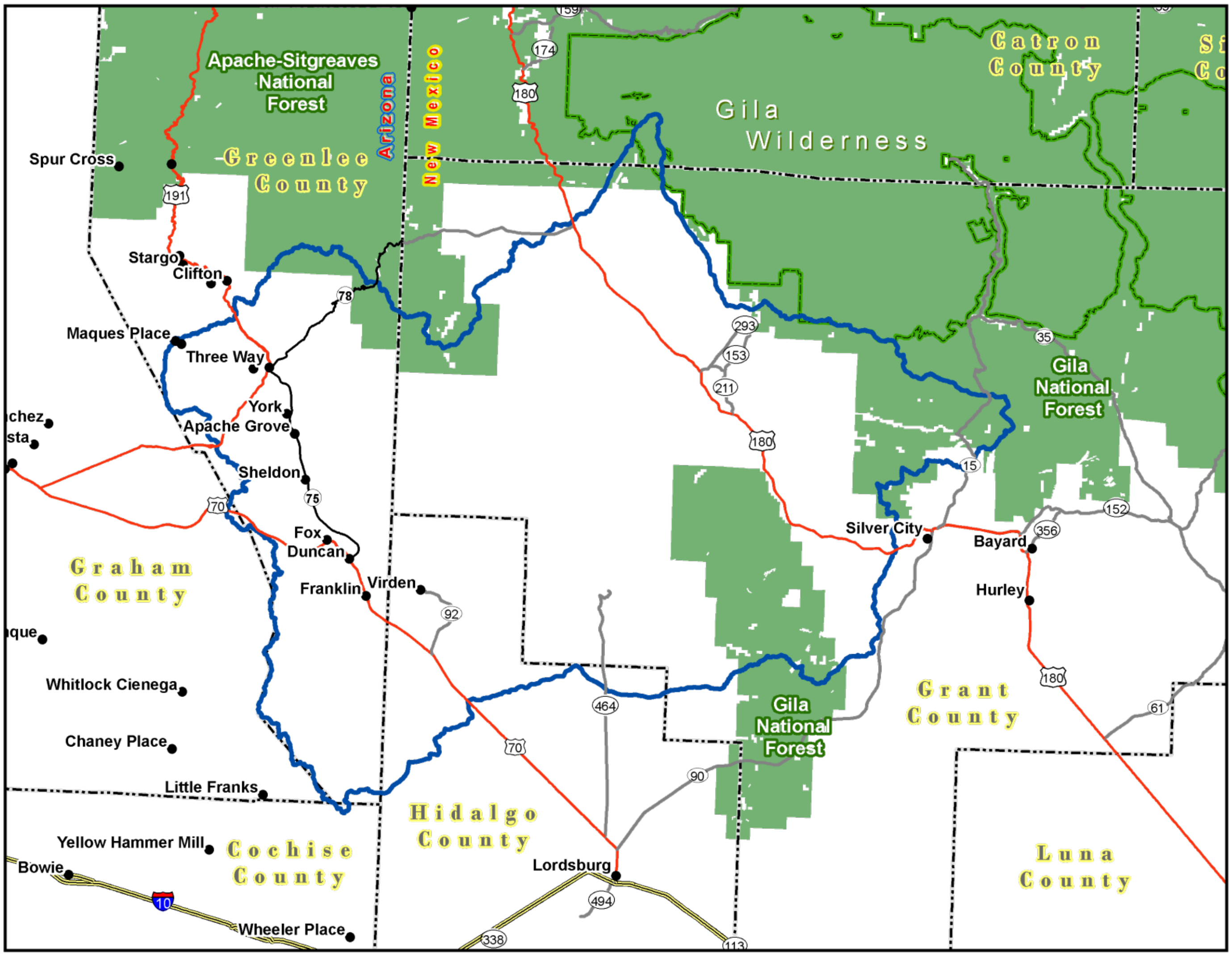
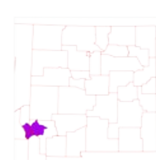



**Figure 1. Upper Gila-Mangas Watershed Overview.**



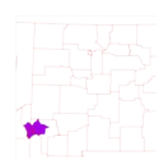


# Overview

The Upper Gila-Mangas Watershed is located in southwestern New Mexico and southeastern Arizona. It covers 1,314,074 total acres (5,318 sq. km). Portions of the Upper Gila-Mangas watershed are Catron, Grant, and Hidalgo counties in New Mexico and Cochise, Graham and Greenlee counties in Arizona. Table 1 summarizes the distribution of the Upper Gila-Mangas Watershed.

| County | County Acres Total | Acres in HUC | % of HUC in County | % of County in HUC |
|---|---|---|---|---|
| **Catron, NM** | **4,442,108** | **6,423** | **<1%** | **<1%** |
| **Grant, NM** | **2,543,536** | **821,185** | **62%** | **32%** |
| **Hidalgo, NM** | **2,210,400** | **143,929** | **11%** | **7%** |
| **Cochise, AZ** | **3,978,378** | **412** | **<1%** | **<1%** |
| **Graham, AZ** | **2,968,819** | **1,712** | **<1%** | **<1%** |
| **Greenlee, AZ** | **1,182,841** | **340,159** | **26%** | **29%** |
| **Sum (∑)** | **--** | **1,314,074** | **100** | **--** |

**Table 1. Upper Gila-Mangas Watershed acreage distribution.**



## Physical Setting

**Geology:** The watershed is in the Transition Zone between the Colorado Plateau and Basin and Range physiographic provinces. The Colorado Plateau physiographic province consists of flat-lying, undeformed sedimentary rocks. The Basin and Range physiographic province is dominated by faulting, volcanism, magma intrusion, erosion and sedimentation. This produces elongated valleys filled with sediment and rock debris with north to north-west trending fault-block or volcanic highlands.

Resource concerns are high sediment erosion with destruction of the adjacent river terraces through a rapid shift in flow direction of the main channel potentially causing loss of wildlife habitat. In addition the lowering of valleys by river incision is a continuing process. Rivers respond by aggrading during climates that promote large sediment yield and large, stable discharges; and incise during climates that produce flashy flows and reduce the sediment supply. Groundwater quality and quantity is a concern. Depth to groundwater is a concern if the shallow unconfined aquifer does not produce enough water for the resource or increased population demands are 'mining' the water. Groundwater quality ranges from good to fair for livestock or crops.

**Soils:** Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the Upper Gila-Mangas Watershed are assigned to four groups (A, B, C, and D).

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.



Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

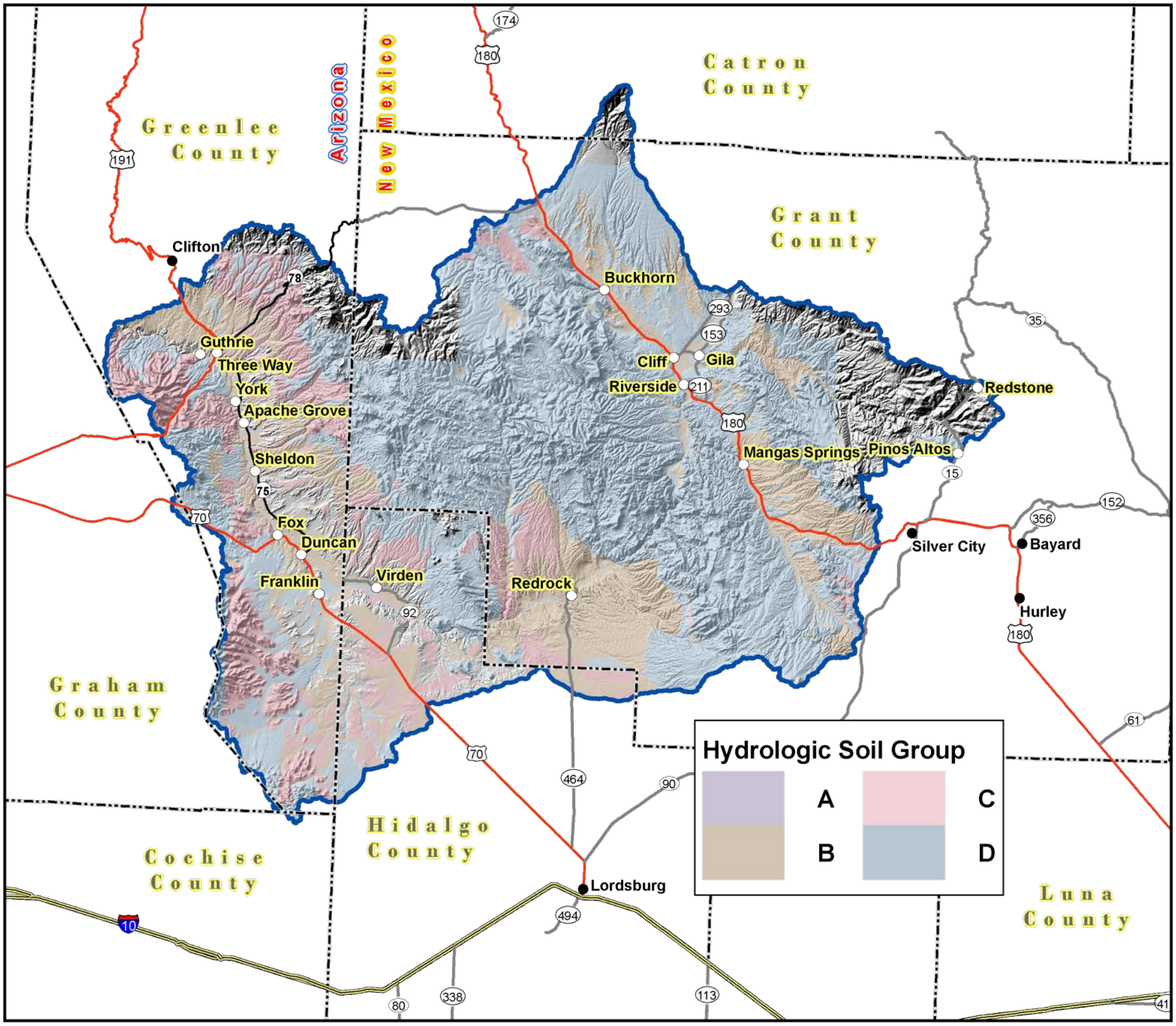
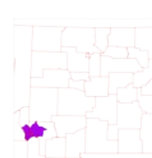



**Figure 2. Upper Gila-Mangas Watershed Hydrologic Soil Group.**



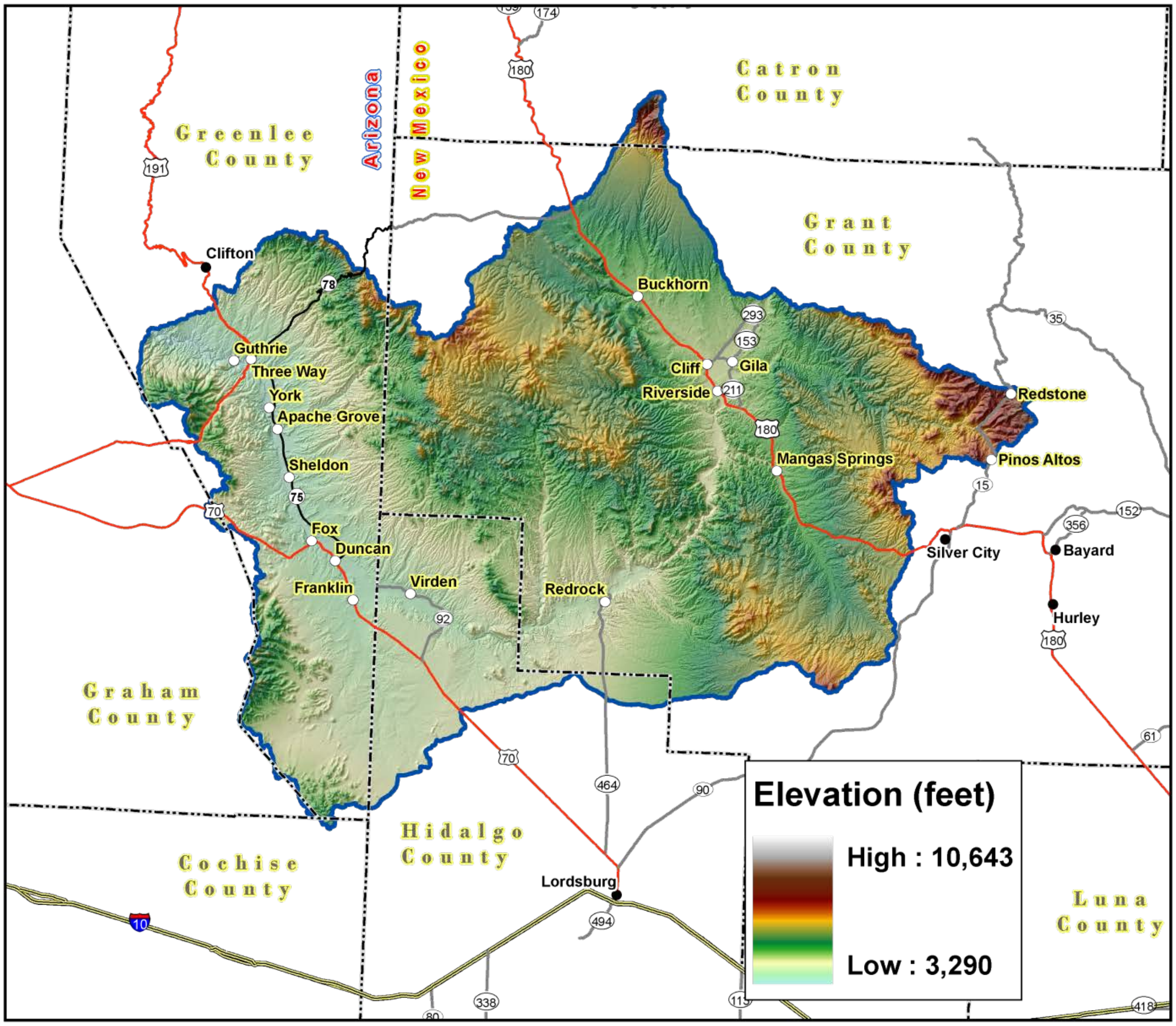



**Figure 3. Upper Gila-Mangas Watershed Shaded Relief.**

# Precipitation [1]

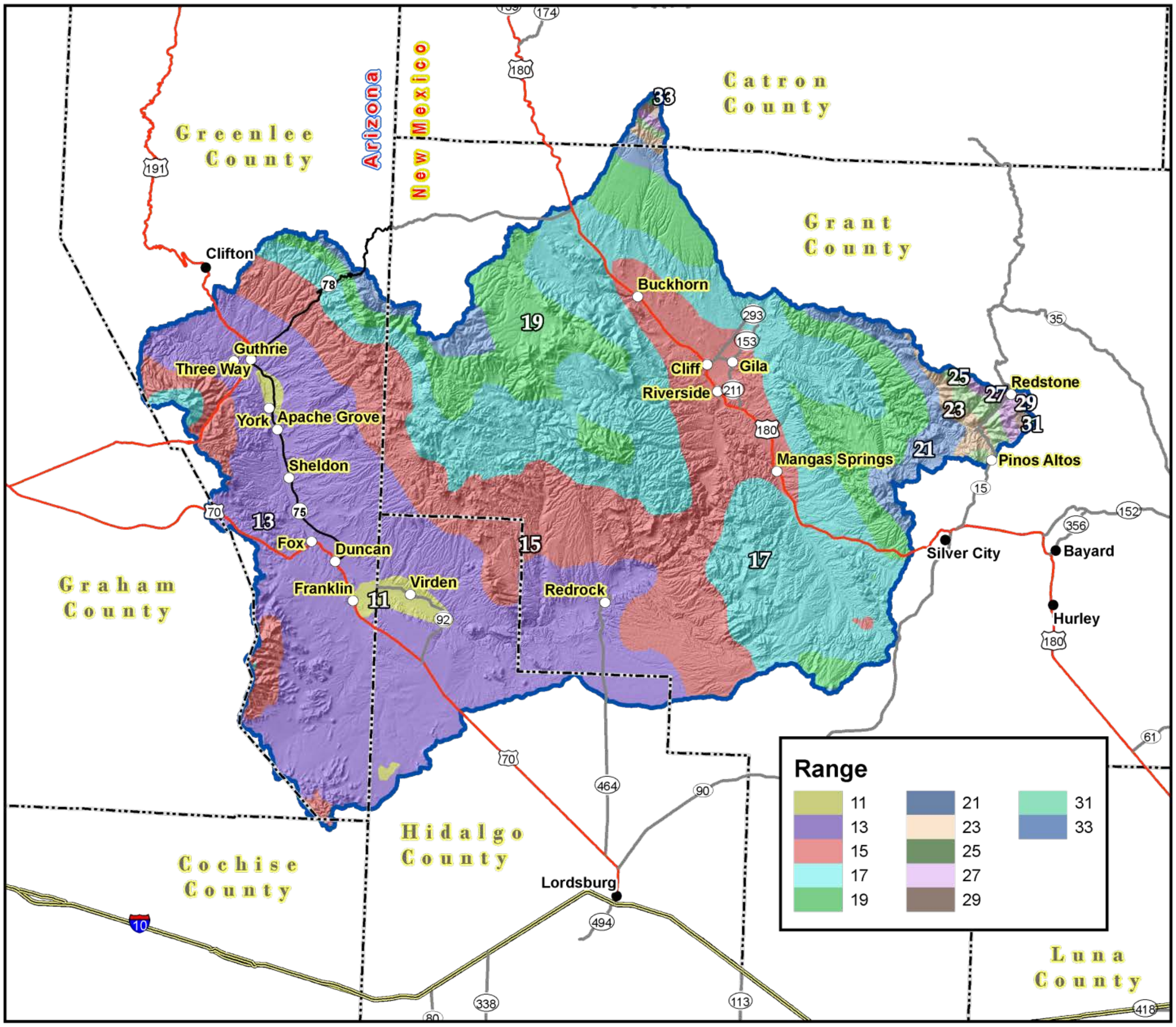
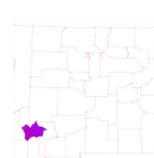



**Figure 4. Upper Gila-Mangas Watershed Annual Precipitation.**



# Land Ownership [2,3]

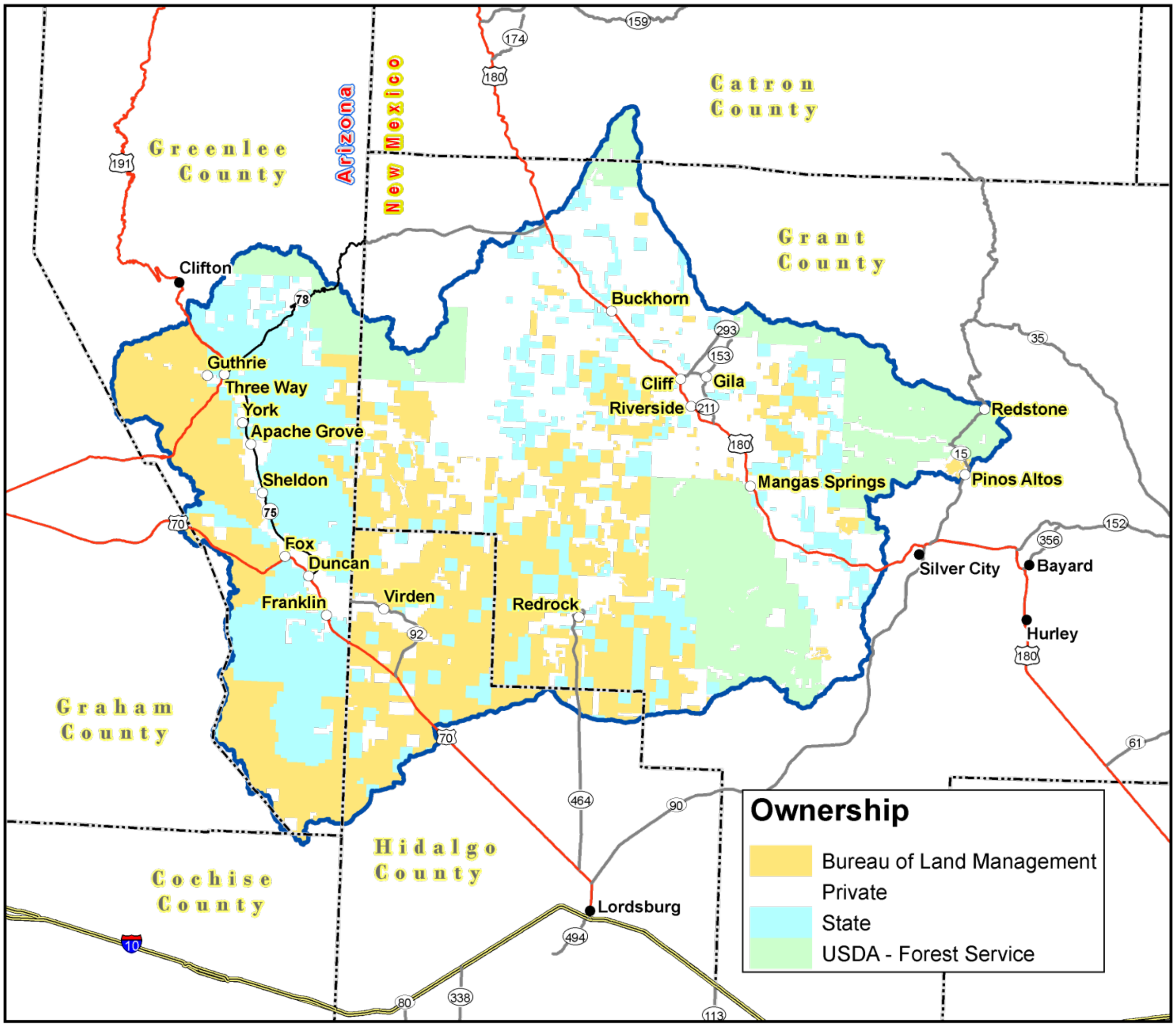
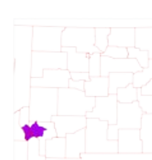



**Figure 5. Upper Gila-Mangas Watershed Land Ownership.**



# Land Ownership

| COUNTY | BLM | Private | State-AZ | State - NM | USDA Forest Service |
|---|---|---|---|---|---|
| Catron, NM | | 226 | | | 6,196 |
| Grant, NM | 161,782 | 355,575 | | 111,504 | 192,324 |
| Hidalgo, NM | 103,581 | 23,262 | | 17,086 | |
| Cochise, AZ | 412 | | | | |
| Graham, AZ | 1,296 | 117 | 299 | | |
| Greenlee, AZ | 121,764 | 40,762 | 157,441 | | 20,192 |
| Watershed (∑) | 388,835 | 419,942 | 157,740 | 128,590 | 218,712 |
| % Watershed | 30% | 32% | 12% | 10% | 17% |

**Table 2. Land Ownership in the Upper Gila-Mangas Watershed.**



# Land Use / Land Cover [4,5]

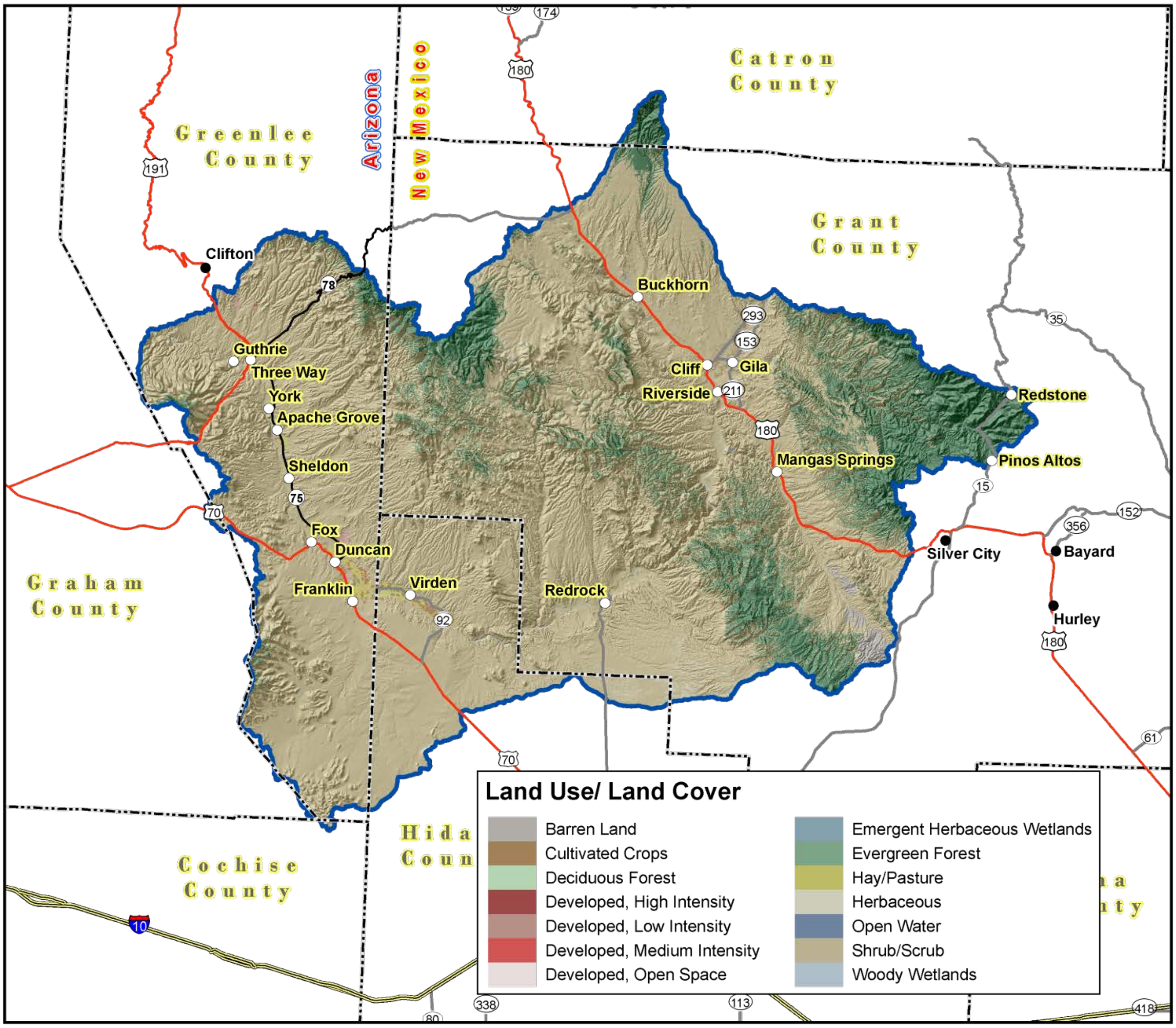
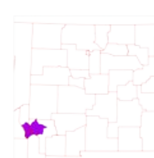



**Figure 6. Subset of the National Land Cover Dataset in the Upper Gila-Mangas Watershed**.



## Land Use / Land Cover

The U.S. Geological Survey (USGS) produced the National Land Cover Dataset (NLCD) as part of a cooperative project between the USGS and the U.S. Environmental Protection Agency (USEPA). The goal of this project was to produce a consistent land cover data layer for the conterminous United States. The Multiresolution Land Characterization (MRLC) Consortium collected the data used to compile the NLCD. The MRLC Consortium is a partnership of Federal agencies that produce or use land cover data; partners include the UNITED STATES GEOLOGICAL SURVEY (National Mapping, Biological Resources, and Water Resources Divisions), USEPA, the U.S. Forest Service, and the National Oceanic and Atmospheric Administration.

| Land Use/ Land Cover | Acres | % of Watershed |
|---|---|---|
| Shrub/Scrub | 1,081,417 | 82% |
| Evergreen Forest | 198,244 | 15% |
| Barren Land | 7,825 | 1% |
| Herbaceous | 7,675 | 1% |
| Hay/Pasture | 4,391 | < 1% |
| Developed, Low Intensity | 4,154 | < 1% |
| Developed, Open Space | 4,103 | < 1% |
| Cultivated Crops | 3,499 | < 1% |
| Woody Wetlands | 1,634 | < 1% |
| Emergent Herbaceous Wetlands | 677 | < 1% |
| Developed, Medium Intensity | 283 | < 1% |
| Deciduous Forest | 93 | < 1% |
| Open Water | 58 | < 1% |
| Developed, High Intensity | 4 | < 1% |

**Table 3. Extent of NLCD classes in the Upper Gila-Mangas Watershed.**



# Land Use / Land Cover

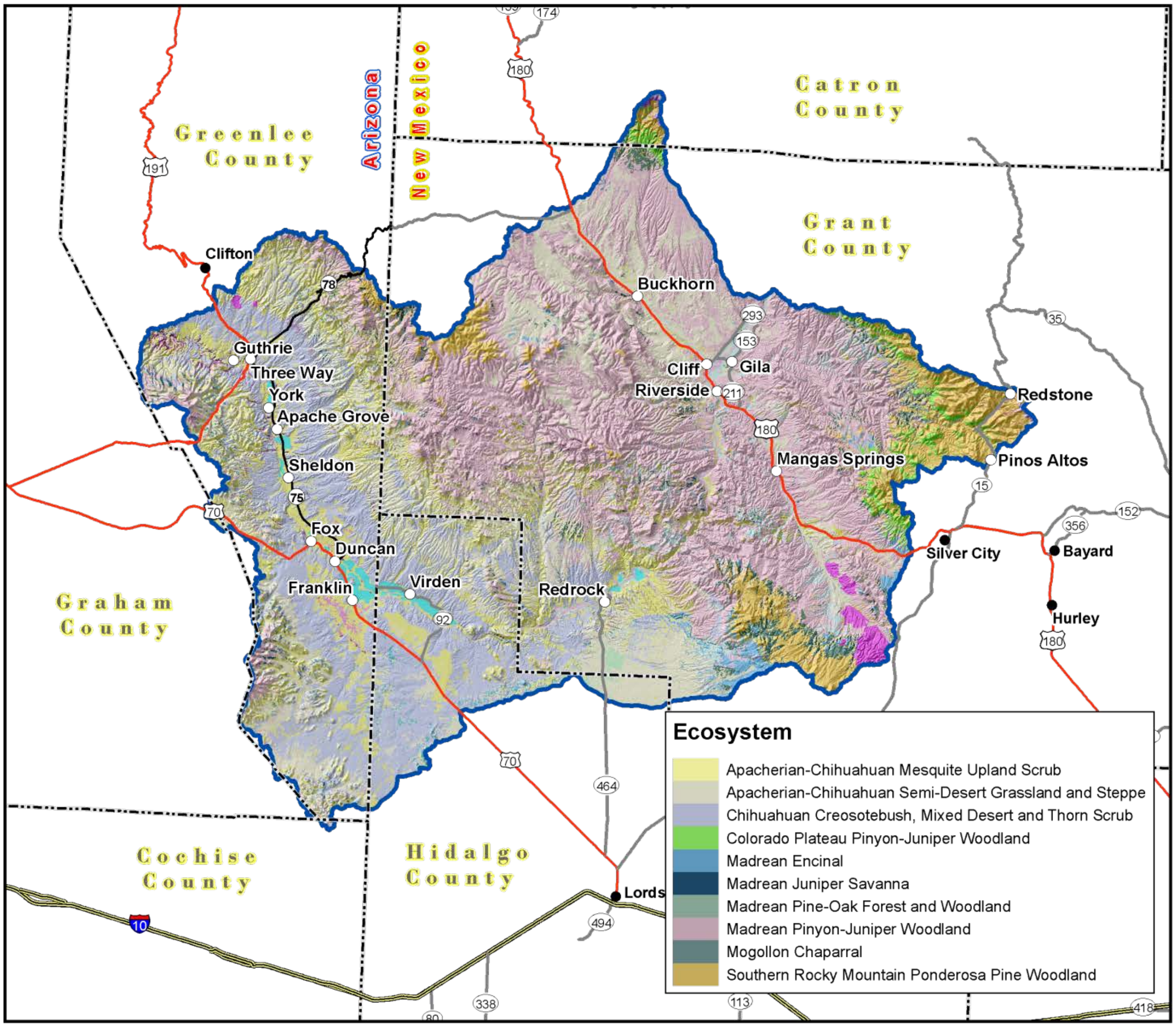



**Figure 7. Subset of the SWREGAP over the Upper Gila-Mangas Watershed. The 10 dominant ecosystems are displayed in the legend.**

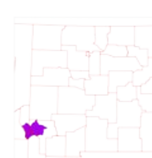
## Land Use / Land Cover

The land cover mapping effort for the Southwest Region Gap Analysis Project was a coordinated multi-institution endeavor. This dataset was created for regional terrestrial biodiversity assessment. Additional objectives were to establish a coordinated mapping approach to create detailed, seamless maps of land cover, all native terrestrial vertebrate species, land stewardship, and management status, and to analyze this information to identify those biotic elements that are underrepresented on lands managed for their long term conservation.

| ECOSYSTEM | Acres | % of Watershed |
|---|---|---|
| Madrean Pinyon-Juniper Woodland | 421,994 | 32% |
| Apacherian-Chihuahuan Semi-Desert Grassland and Steppe | 249,153 | 19% |
| Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub | 229,670 | 17% |
| Apacherian-Chihuahuan Mesquite Upland Scrub | 175,511 | 13% |
| Southern Rocky Mountain Ponderosa Pine Woodland | 83,052 | 6% |
| Mogollon Chaparral | 46,429 | 4% |
| Madrean Pine-Oak Forest and Woodland | 22,935 | 2% |
| Colorado Plateau Pinyon-Juniper Woodland | 14,717 | 1% |
| Madrean Juniper Savanna | 11,913 | 1% |
| Madrean Encinal | 10,935 | 1% |

**Table 4. SW Region Gap analysis ecosystem acreages.**





# Hydrology [6,7,8,9,10,11,12]

The National Hydrography Dataset (NHD) is a comprehensive set of data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities. The NHD identifies 5,270 miles (8,481 km) of water courses in the Upper Gila-Mangas Watershed. The majority of these courses typically flow intermittently in summer months during periods associated with high intensity convective thunderstorms.

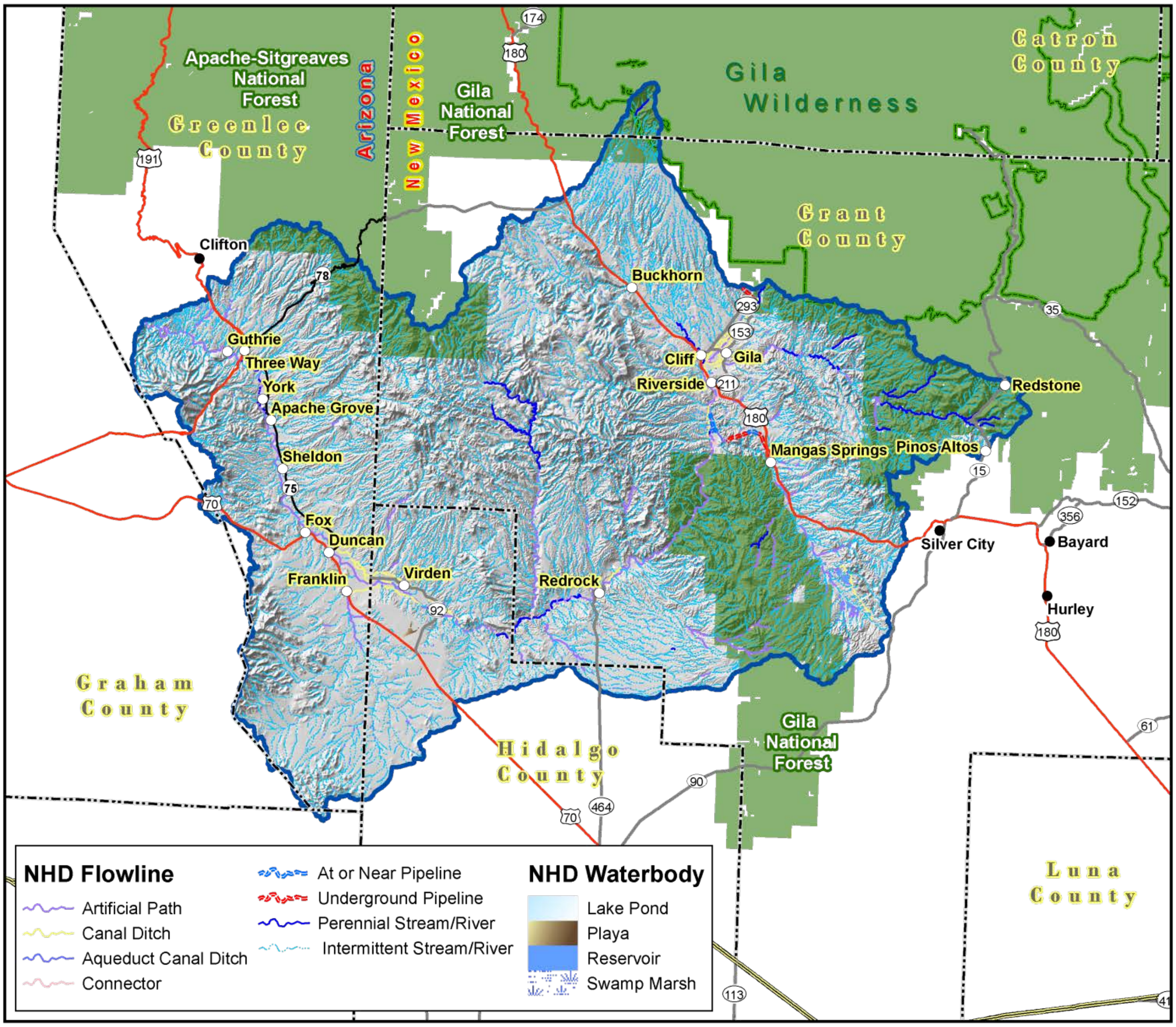
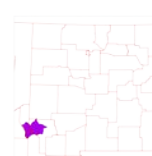
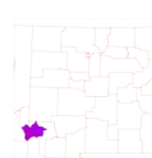



**Figure 8. National Hydrologic Dataset (NHD) of the Upper Gila-Mangas Watershed.**



| Water Course Type | Miles |
|---|---|
| Aqueduct Canal Ditch | 1 |
| Artificial Path | 238 |
| At or Near Pipeline | 3 |
| Canal / Ditch | 71 |
| Connector | 3 |
| Intermittent Stream / River | 4,869 |
| Perennial Stream / River | 78 |
| Underground Pipeline | 6 |
| Sum (∑) | 5,270 |

**Table 5. NHD Water Course Type and Extents.**



## Gauging Stations:

There are 25 dams and water gauging stations in the watershed. USGS Site 09432000 is located near the southern boundary of the watershed on the Gila River below Blue Creek, near Virden, NM. During the period 1927 – 2012, this site has had mean annual discharge of 210 cubic feet per second ranging from 43.1 (1956) to 745.7 (1993) cubic feet per second.

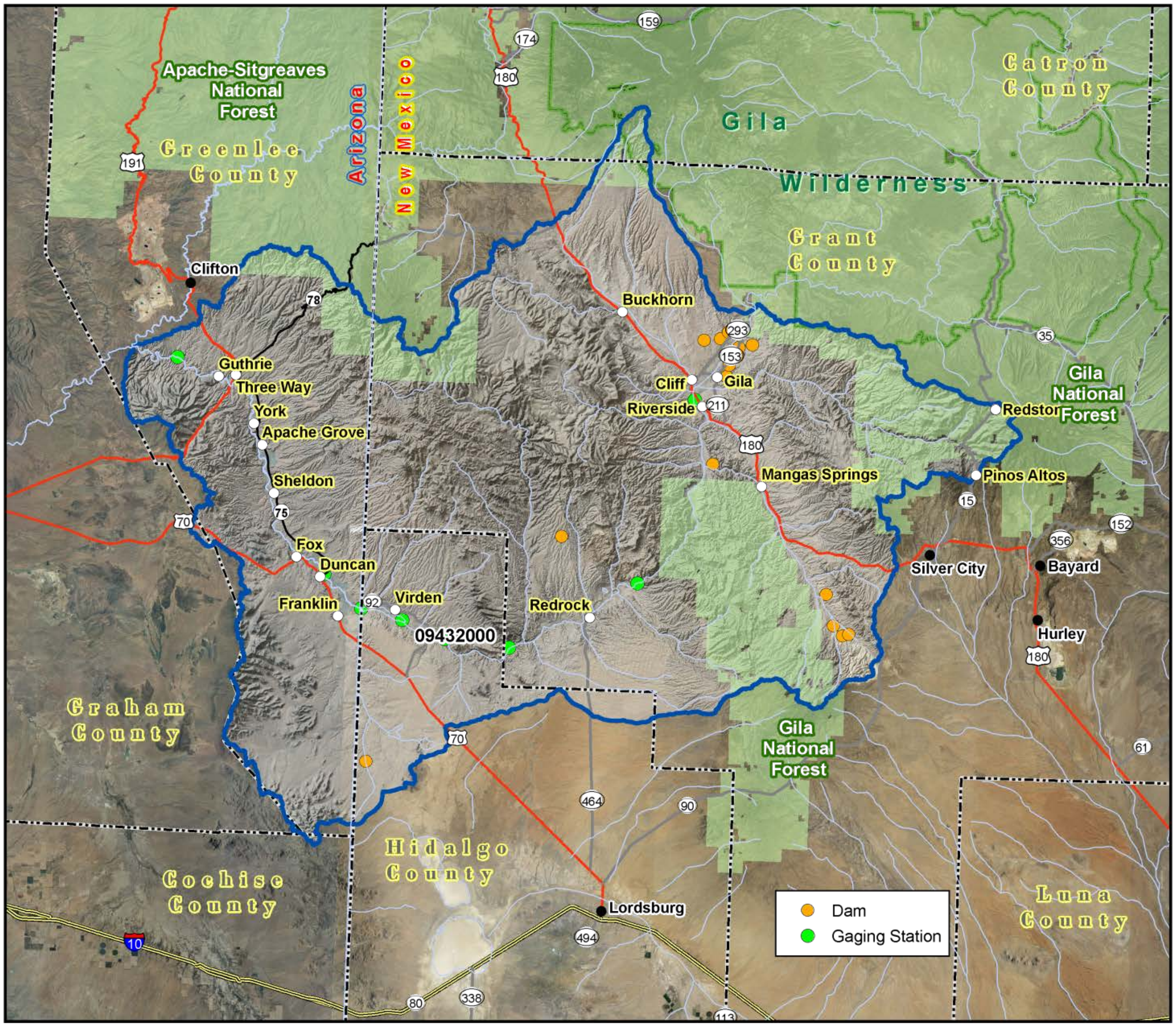
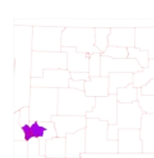



**Figure 9. Gauging Stations in the Upper Gila-Mangas Watershed.**



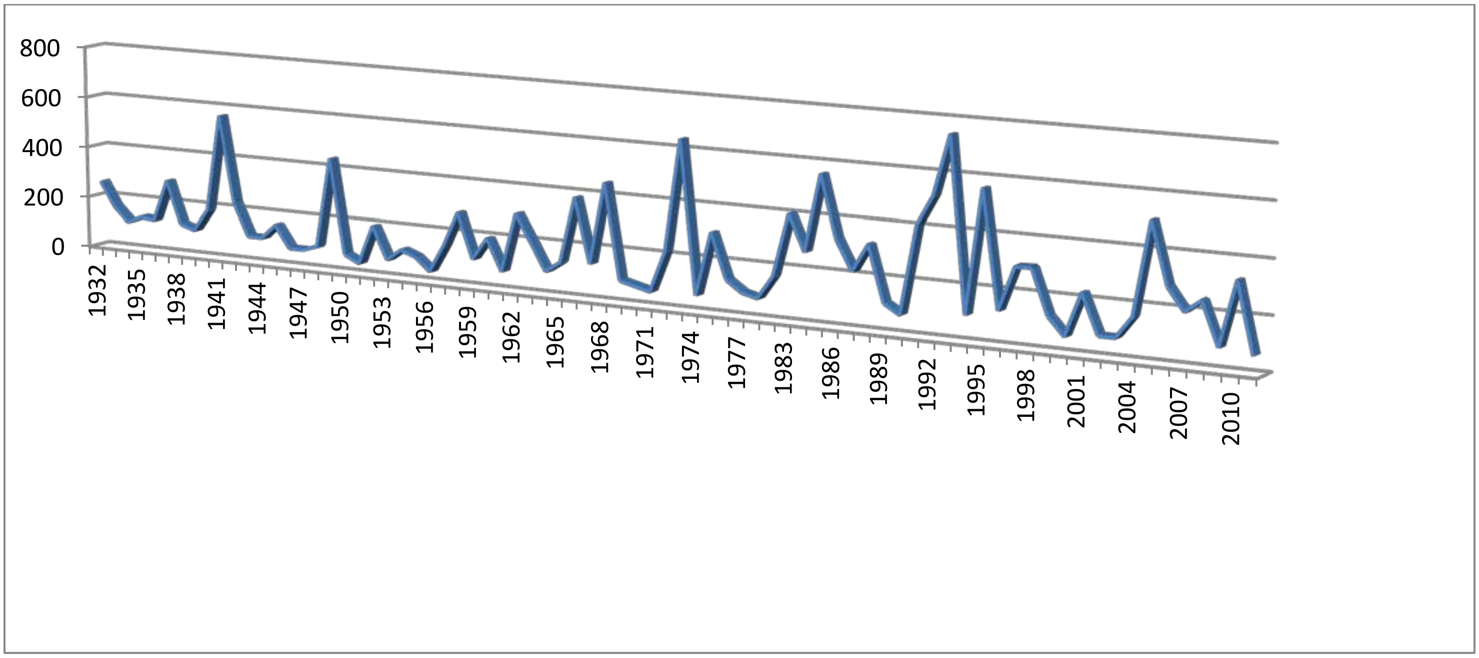



**Figure 10. Annual average of Mean Daily Flow on the Upper Gila-Mangas watershed on the Gila River Below Blue Creek near Virden, NM. Period of observation: 1927-2012.**

# Hydrology

## New Mexico Water Quality Control Commission (NMWQCC):

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes, are required to develop lists of impaired waters. These are waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by states. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs), for these waters. A TMDL is a calculation of the maximum amount of a pollutant a water body can receive and still safely meet water quality standards.

The Upper Gila-Mangas Watershed has the following reaches and water bodies listed as 303 (d) Impaired Surface Waters:

1. Bill Evans Lake
2. Gila River (AZ border to Red Rock)
3. Gila River (Mangas Creek to Mogollon Creek)
4. Gila River (Red Rock to Mangas Creek)
5. Mangas Creek (Gila River to Mangas Springs)

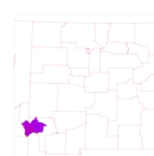
The river and stream reaches total 68 miles (110 km) and the listed water body covers 70 acres (0.3 sq. km).

| Use | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Industrial Water Supply | | x | x | x | x |
| Irrigation | | | x | x | x |
| Livestock Watering | x | x | x | x | x |
| Marginal Coldwater Aquatic Life | NS | | NS | NS | NS |
| Marginal Warmwater Aquatic Life | | NS | | | |
| Primary Contact | x | x | x | x | x |
| Warmwater Aquatic Life | x | | NS | NS | NS |
| Wildlife Habitat | x | x | x | x | x |

**Table 6. Listed Uses. NS = Not Supporting, NA = not assessed, x = Fully Supporting**

| Probable Causes of Impairment | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Nutrient/Eutrophication Biological Indicators | | | | x | x |
| Temperature, water | x | x | x | x | x |

**Table 7. Possible Causes of Impairment in New Mexico.**



## Hydrology

## Arizona Department of Environmental Quality (ADEQ):

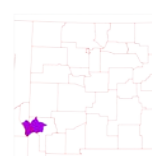
Arizona's Integrated 305(b) Assessment and 303(d) Listing Report describes the status of surface water in Arizona in relation to state water quality standards. The report contains a 303(d) list of Arizona's impaired surface waters requiring the development of a Total Maximum Daily Load (TMDL) and fulfills requirements of the federal Clean Water Act sections 305(b) (assessments), 303(d) (impaired water identification), and 314 (status of lake water quality).

6. **Skully Creek – San Francisco River**
7. **Apache Creek – Skully Creek**
8. **New Mexico border – Bitter Creek**

The river and stream reaches total 39 miles (62 km).

| Probable Causes of Impairment | 6 | 7 | 8 |
|---|---|---|---|
| **Suspended Sediment Concentration (SSC) (2006)** | | | × |
| ***E. coli* and suspended sediment concentration (2006)** | × | × | × |

**Table 8. Possible Causes of Impairment in Arizona.**



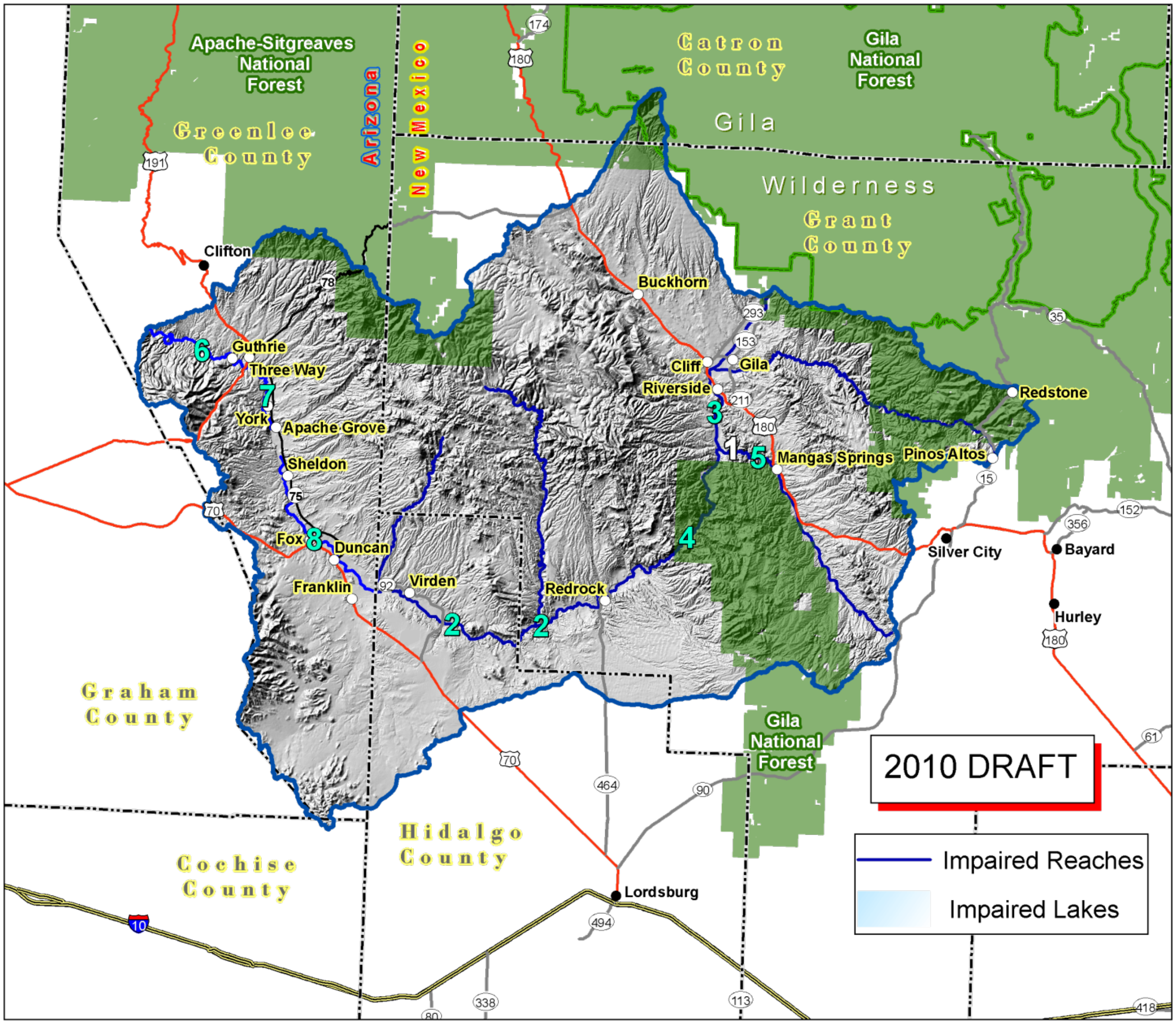



**Figure 11. 303(d) Impaired Waters. Draft Status (2010) in Arizona.**

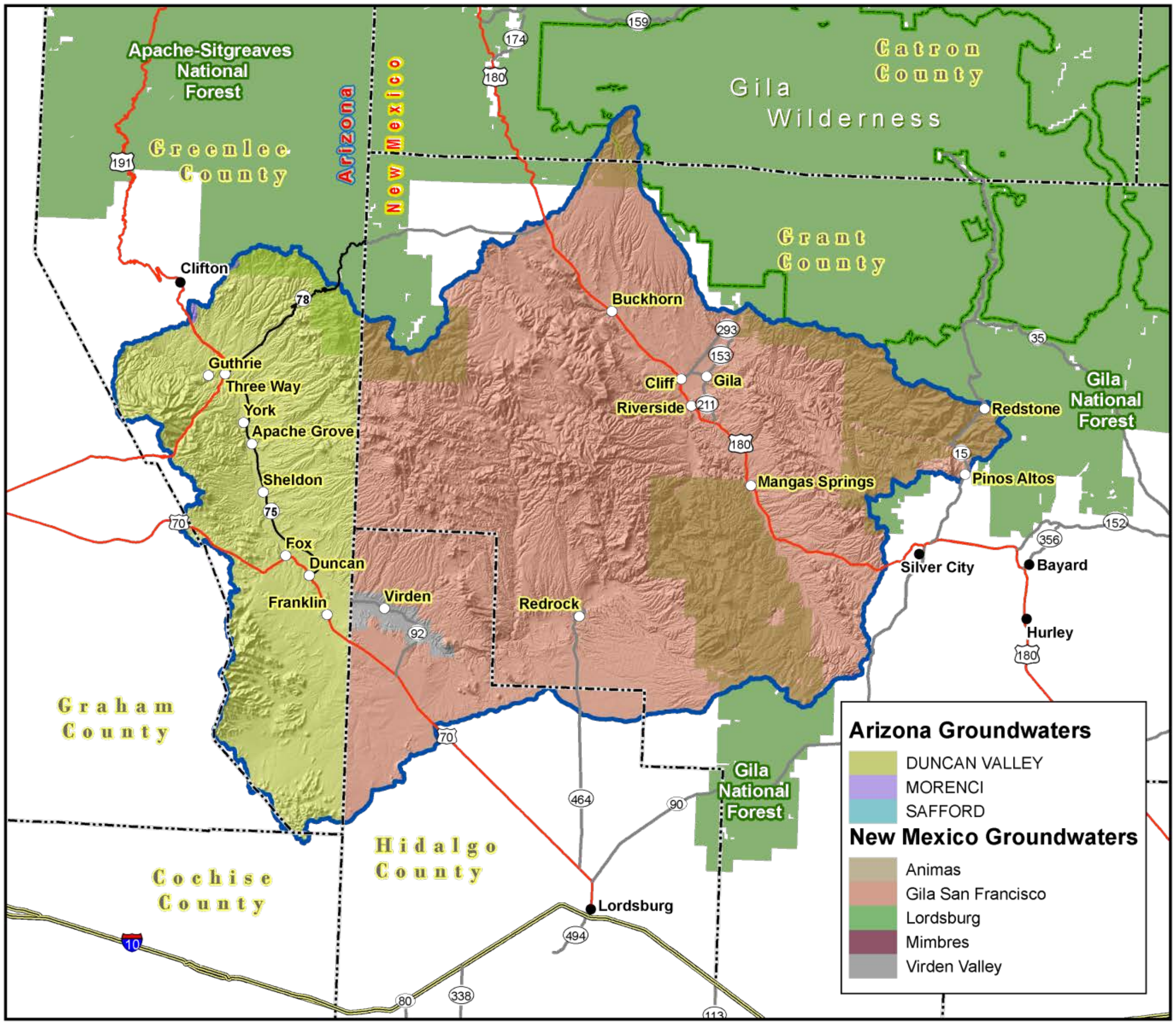
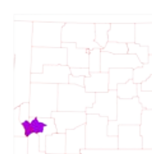



**Figure 12. Declared Groundwater Basins of the Upper Gila-Mangas.**

A declared groundwater basin is an area of the state proclaimed by the State Engineer to be underlain by a groundwater source having reasonably ascertainable boundaries. By such proclamation, the State Engineer assumes jurisdiction over the appropriation and use of groundwater from the source. There are 8 declared groundwater basins in the Upper Gila-Mangas Watershed: Animas, Gila San Francisco, Lordsburg, Mimbres, and Virden Valley Underground Water Basin in New Mexico, and Duncan Valley, Morenci and Safford in Arizona.



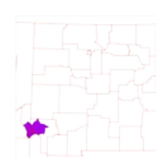
## Threatened and Endangered Species [13,14]

Endangered species are those that are at risk of extinction throughout all or a significant portion of its native range. A threatened species is one that is likely to become endangered in the foreseeable future. The New Mexico Natural Heritage and the Arizona Game and Fish Department program track the status of threatened and endangered species which are listed on both federal and state lists. Tables 9 and 10 show the species that are currently listed and tracked in the Upper Gila-Mangas Watershed.

LT/LE = Listed Threatened /Listed Endangered
T/E = Threatened/Endangered

| Common Name | Scientific Name | Tax Class | Family | Federal Status | State Status |
|---|---|---|---|---|---|
| Bald Eagle | Haliaeetus leucocephalus | Aves | Accipitridae | | T |
| Chiricahua Leopard Frog | Rana chiricahuensis | Amphibia | Ranidae | LT | |
| Common Black-Hawk | Buteogallus anthracinus | Aves | Accipitridae | | T |
| Common Ground-Dove | Columbina passerina | Aves | Columbidae | | E |
| Duncan's Corycactus | Escobaria dasyacantha var. duncanii | Dicotyledoneae | Cactaceae | | E |
| Gray Redhorse | Scartomyzon congestus | Actinopterygii | Catostomidae | | E |
| Mexican Spotted Owl | Strix occidentalis lucida | Aves | Strigidae | LT | |
| Mineral Creek Mountainsnail | Oreohelix pilsbryi | | | | T |

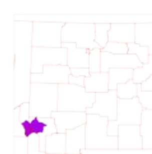
**Table 9. Threatened and Endangered Plant and Animal Species for New Mexico.**



SC=Species of Concern
WSC=Wildlife of Special Concern in Arizona
SR=Salvage Restricted: collection only with permit **(**Plants - NPL Arizona Native Plant Law 2008)

| Common Name | Scientific Name | Federal Status | State |
|---|---|---|---|
| **Lowland Leopard Frog** | **Rana yavapaiensis** | **SC** | **WSC** |
| **Golden Eagle** | **Aquila chrysaetos** | | |
| **Common Black-Hawk** | **Buteogallus anthracinus** | | **WSC** |
| **Southwestern Willow Flycatcher** | **Empidonax traillii extimus** | **LE** | **WSC** |
| **Gila Longfin Dace** | **Agosia chrysogaster chrysogaster** | **SC** | |
| **Desert Sucker** | **Catostomus clarkii** | **SC** | |
| **Sonora Sucker** | **Catostomus insignis** | **SC** | |
| **Bigelow Onion** | **Allium bigelovii** | | **SR** |
| **Magenta-flower Hedgehog-cactus** | **Echinocereus fasciculatus** | | **SR** |
| **San Carlos Wild-buckwheat** | **Eriogonum capillare** | **SC** | **SR** |
| **Texas Horned Lizard** | **Phrynosoma cornutum** | **SC** | |

**Table 10. Threatened and Endangered Plant and Animal Species for Arizona.**

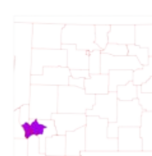


# Invasive Species [15]

Invasive species are those which have been introduced into a region or ecosystem and have the ability to out-compete native species for resources (i.e. water, nutrients, sunlight, etc.) The Southwest Exotic Plant Mapping Program (SWEMP) is a collaborative effort between the United States Geological Survey and federal, tribal, state, county and non-government organization partners in the southwest which maintains ongoing efforts to compile and distribute regional data on the occurrence of non-native invasive plants in the southwestern United States. Within the Upper Gila-Mangas Watershed, the SWEMP has identified 8 species of invasive plants (Table 11). Each of these species is defined as non-native by the USDA PLANTS database.

| Scientific Name | Common Name |
|---|---|
| *Zygophyllaceae (Caltrop Family)* | African Rue |
| *Scrophulariaceae (Figwort Family)* | Dalmatian Toadflax |
| *Brassicaceae (Mustard Family)* | Hoary Cress (Whitetop) |
| *Euphorbiaceae (Spurge Family)* | Leafy Spurge |
| *Asteraceae (Sunflower Family)* | Musk Thistle |
| *Lythraceae (Loosestrife Family)* | *Purple Loosestrife* |
| *Asteraceae (Sunflower Family)* | Russian Knapweed |
| *Asteraceae (Sunflower Family)* | *Yellow Starthistle* |

**Table 11. Invasive Species Recognized by the SWEMP.**



# Common Resource Areas[16]

A Common Resource Area (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) designation. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area. Each Common Resource Area will have multiple Conservation System Guides associated with it. A Conservation System Guide associates, for a given CRA and land use, different components of Resource Management Systems and their individual effect on conserving soil and water resources.

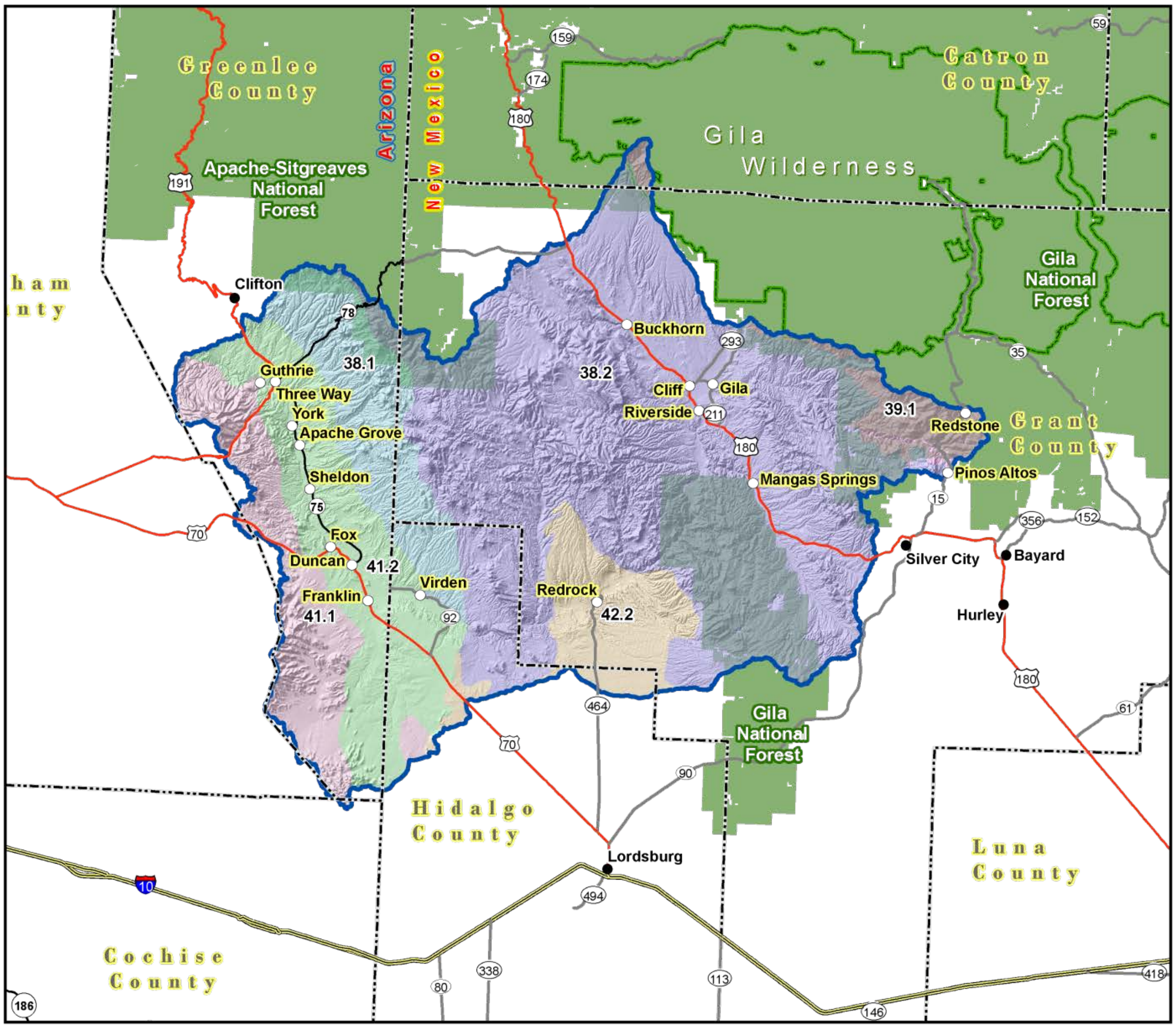



Figure 13. Common Resource Areas of the Upper Gila-Mangas Watershed.

# Common Resource Areas

## 38 .2 - Lower Interior Chaparral

This unit occurs within the Transition Zone Physiographic Province and is characterized by canyons and structural troughs or valleys. Igneous, metamorphic and sedimentary rock occurs on rough mountainous terrain. Elevations range from 3000 to 4500 feet. Precipitation averages 12 to 16 inches per year. The soil temperature regime is thermic. The soil moisture regime is ustic aridic. Vegetation includes canotia, juniper, mesquite, shrubby buckwheat, squirreltail, gramas, and desert needlegrass.

## 38. 2 - Interior Chaparral - Woodlands

This unit occurs within the Transition Zone Physiographic Province and is characterized by canyons and structural troughs or valleys. Igneous, metamorphic and sedimentary rock occurs on rough mountainous terrain. Elevations range from 4000 to 5500 feet. Precipitation averages 16 to 20 inches per year. The soil temperature regime ranges from thermic to mesic. The soil moisture regime is aridic ustic. Vegetation includes turbinella oak, silktassel, juniper, pinyon, sugar sumac, and bullgrass.

## 39. 1 - Mogollon Plateau Coniferous Forests

This unit occurs within the Colorado Plateau Physiographic Province and is characterized by volcanic fields and gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Elevations range from 7000 to 12500 feet. Precipitation averages 20 to 35 inches per year. The soil temperature regime ranges from mesic to frigid. The soil moisture regime ranges from typic ustic to udic ustic. Vegetation includes ponderosa pine, Gambel oak, Arizona walnut, sycamore, and Douglas fir.

## 41.1- Mexican Oak-Pine Forest and Oak Savannah

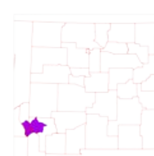
This unit occurs within the Colorado Plateau Physiographic Province and is characterized by volcanic fields and gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Elevations range from 7000 to 12500 feet. Precipitation averages 20 to 35 inches per year. The soil temperature regime ranges from mesic to frigid. The soil moisture regime ranges from typic ustic to udic ustic. Vegetation includes ponderosa pine, Gambel oak, Arizona walnut, sycamore, and Douglas fir.

## 41.2 - Chihuahuan – Sonoran Desert Shrubs

This unit occurs within the Basin and Range Physiographic Province and is characterized by valley plains, alluvial fans, and mountains. Sediments are from fluvial, lacustrine, colluvial and alluvial deposits. Igneous and metamorphic rock dominate the mountain ranges. Elevations range from 2600 to 4000 feet. Precipitation ranges from 8 to 12 inches per year. The soil temperature regime is thermic and the soil moisture regime is typic aridic. Vegetation includes mesquite, catclaw acacia, whitethorn, bush muhly and threeawns.

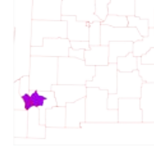
## 42. 2 - Chihuahuan Desert Shrubs

This unit occurs within the Basin and Range Physiographic Province and is characterized by valley plains, alluvial fans, and mountains. Sediments are from fluvial, lacustrine, colluvial and alluvial deposits. Igneous and metamorphic rock dominate the mountain ranges. Elevations range from 3800 to 5200 feet. Precipitation ranges from 8 to 10 inches per year. The soil temperature regime is thermic. The soil moisture regime is typic aridic. Vegetation includes Creosote, tarbush, soaptree yucca, torrey yucca, tobosa, and alkali sacaton.



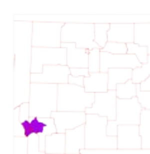
# Conservation [17]

The USDA-Natural Resources Conservation Service (NRCS) focuses on the development and delivery of high quality products and services that enable people to be good stewards of our Nation's soil, water, and related natural related resources on non-Federal lands. The Natural Resources Conservation Service's conservation programs aid agricultural producers in their efforts to reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters. Public benefits include enhanced natural resources that help sustain agricultural productivity and environmental quality while supporting continued economic development, recreation, and scenic beauty.



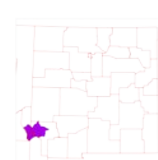
| Conservation Practice | 2007 | | 2008 | | 2009 | | 2010 | | 2011 | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | Acres | # | Acres | # | Acres | # | Acres | # | Acres | # | Acres |
| **Brush Management** | | | 3 | 29,716 | 1 | 4,058 | | | 1 | 28 | 5 | 33,802 |
| **Conservation Crop Rotation** | 2 | 356 | 3 | 194 | 2 | 184 | 2 | 269 | 1 | 44 | 10 | 1,046 |
| **Cover Crop** | | | | | 1 | 37 | | | | | 1 | 37 |
| **Forage and Biomass Planting** | | | | | 1 | 1,242 | | | | | 1 | 1,242 |
| **Integrated Pest Management (IPM)** | 3 | 405 | 4 | 139 | 2 | 124 | 4 | 325 | 2 | 40 | 15 | 1,033 |
| **Irrigation Land Leveling** | 2 | 85 | 4 | 170 | 3 | 60 | 2 | 61 | 2 | 32 | 13 | 407 |
| **Irrigation System, Sprinkler** | 2 | 405 | | | 1 | 9 | | | | | 3 | 414 |
| **Irrigation System, Surface and Subsurface** | 3 | 535 | 3 | 115 | 4 | 225 | 2 | 237 | | | 12 | 1,113 |
| **Irrigation Water Management** | 4 | 977 | 2 | 208 | 3 | 480 | 4 | 615 | 2 | 84 | 15 | 2,364 |
| **Nutrient Management** | 3 | 255 | 3 | 125 | 2 | 336 | 2 | 268 | | | 10 | 984 |
| **Prescribed Grazing** | 3 | 72,105 | 7 | 51,707 | 4 | 52,263 | 5 | 59,161 | 3 | 73,648 | 22 | 308,884 |
| **Residue and Tillage Management, No-Till/Strip Till/Direct Seed** | | | 1 | 63 | | | | | | | 1 | 63 |
| **Residue Management, Seasonal** | 1 | 28 | 2 | 627 | 2 | 127 | 2 | 320 | 1 | 2 | 8 | 1,104 |
| **Riparian Forest Buffer** | | | 1 | 2 | | | | | | | 1 | 2 |
| **Upland Wildlife Habitat Management** | 3 | 75,373 | 3 | 7,883 | 3 | 48,963 | 3 | 46,899 | | | 12 | 179,119 |
| **Waste Recycling** | | | 1 | 48 | | | | | | | 1 | 48 |
| **SUM (∑)** | 26 | 150,524 | 37 | 90,999 | 29 | 108,107 | 26 | 108,152 | 12 | 73,879 | 130 | 531,662 |

**Table 12 . 5 year Trends in Applied Conservation Practices. Reported in Acres.**



| Conservation Practice | 2007 | | 2008 | | 2009 | | 2010 | | 20111 | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | Feet | # | Feet | # | Feet | # | Feet | # | Feet | # | Feet |
| **Above Ground, Multi-Outlet Pipeline** | 1 | 150 | 2 | 41 | 2 | 226 | 1 | 14 | | | 6 | 431 |
| **Fence** | 2 | 4,642 | 3 | 15,484 | 3 | 13,612 | 3 | 223 | 1 | 6,705 | 12 | 40,666 |
| **Irrigation Water Conveyance, Corrugated Metal Pipeline** | | | | | 1 | 33 | | | | | 1 | 33 |
| **Irrigation Water Conveyance, Corrugated, Ribbed or Profile wall thermal pipeline** | | | | | 1 | 180 | 1 | 33 | | | 2 | 213 |
| **Irrigation Water Conveyance, Ditch and Canal Lining, Plain Concrete** | 1 | 17 | 1 | 16 | 1 | 87 | | | | | 3 | 120 |
| **Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic** | 2 | 136 | 3 | 256 | 2 | 161 | 2 | 29 | | | 9 | 583 |
| **Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic** | 2 | 43 | 3 | 109 | 2 | 150 | 2 | 23 | | | 9 | 325 |
| **Irrigation Water Conveyance, Pipeline, Rigid Gated Pipeline** | 2 | 7 | 1 | 9 | 1 | 10 | 1 | 18 | | | 5 | 43 |
| **Irrigation Water Conveyance, Pipeline, Steel** | 1 | 9 | 2 | 96 | 1 | 259 | 1 | 18 | | | 5 | 382 |
| **Pipeline** | 1 | 4,635 | 2 | 20,104 | 2 | 19,485 | 2 | 1,487 | 1 | 3,300 | 8 | 49,011 |
| **Streambank and Shoreline Protection** | 1 | 125 | | | 1 | 83 | | | | | 2 | 208 |
| **SUM (∑)** | 13 | 9,764 | 17 | 36,115 | 17 | 34,284 | 13 | 1,846 | 2 | 10,005 | 62 | 92,013 |

**Table 13. 5 Year Trends in Location Specific Applied Conservation Practices. Reported in Feet if Linear (i.e. Fence)**



## Soil Resource Inventory[18]

The Upper Gila-Mangas Watershed has a number of certified National Cooperative Soil Survey (NCSS) inventories. The National Forests are not covered, but have soils information available through their Terrestrial Ecosystem Unit Inventories. These will be integrated with the National Cooperative Soil Survey (NCSS) Inventories in the next few years. Soils data is available from the NRCS Soil Data Mart at http://soildatamart.nrcs.usda.gov/ and/or the NRCS Geospatial Data Gateway at http://datagateway.nrcs.usda.gov .

### National Cooperative Soil Survey:

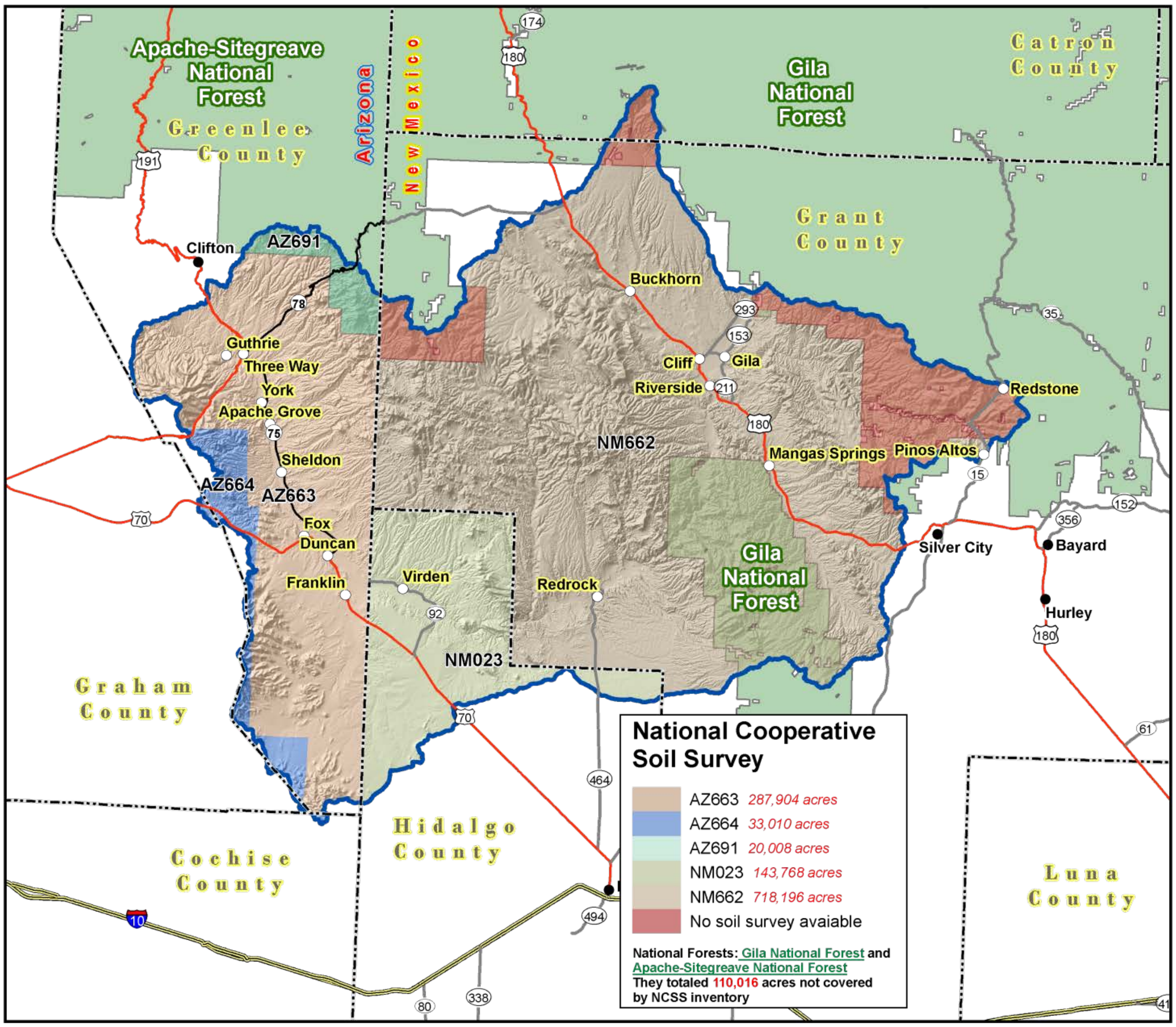
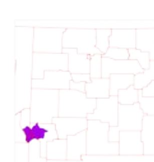



**Figure 14. National Cooperative Soil Survey coverage of the Upper Gila-Mangas Watershed.**



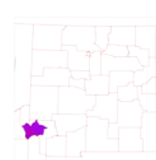
## Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Upper Gila-Mangas Watershed, a model was developed using Soil Survey Geographic Database (SSURGO) information. The soil properties saturated hydraulic conductivity, soil loss tolerance, and wind erodibility group were used in conjunction with slope to assess soil map unit potential for erosion. Saturated hydraulic conductivity and slope are reported in SSURGO databases as interval/ratio data whereas wind erodibility and soil loss tolerance are ordinal data. Data transformations for the model are listed -

| SSURGO Value | Nominal Description | Model Rank |
|---|---|---|
| **Saturated Hydraulic Conductivity** | | |
| µm / s | | |
| 705.0 - 100.0 | Very High | 0 |
| 99.9 - 10.0 | High | 1 |
| 9.9 - 1.0 | Moderately High | 2 |
| 0.9 - 0.1 | Moderately Low | 3 |
| 0.09 - 0.01 | Low | 4 |
| **Slope %** | | |
| 0 - 5 | | 0 |
| 6 - 10 | | 1 |
| 11 - 15 | | 2 |
| 16 - 25 | | 3 |
| > 25 | | 4 |
| **Soil Loss Tolerance** | | |
| 5 | High Tolerance For loss | 0 |
| 4 | ↓ | 1 |
| 3 | ↓ | 2 |
| 2 | ↓ | 3 |
| 1 | Low Tolerance For Loss | 4 |
| **Wind Erodibility Group** | | |
| 1 | Very High | 4 |
| 2 | Very High | 4 |
| 3 | High | 3 |
| 4 | High | 3 |
| 4L | High | 3 |
| 5 | Moderate | 2 |
| 6 | Moderate | 2 |
| 7 | Moderate | 1 |
| 8 | Slight | 0 |

**Table 14. Criteria Used for Soil Erosion Susceptibility Model.**





## Soil Resource Inventory

For each soil map unit (discrete delineation), the soil properties (named above) of the dominant soil type was used as the condition to be evaluated in the susceptibility to erosion model. Miscellaneous areas such as gravel pits, water, riverwash, etc. were excluded from evaluation. Possible range of values for each map unit are 0 – 16. Increasing values represent a higher susceptibility to soil erosion. Forest Service Soils are not able to be included in the model at his time.

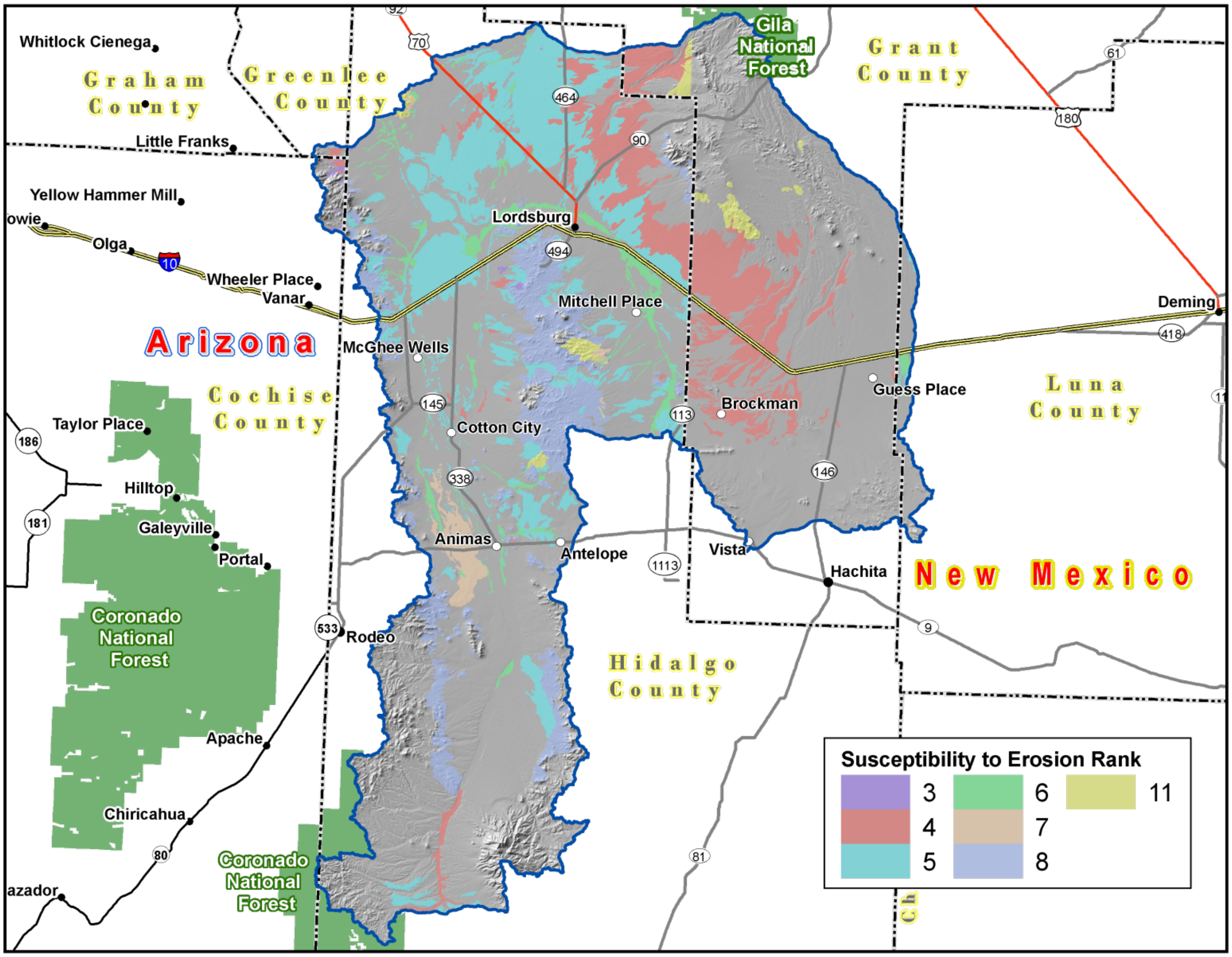
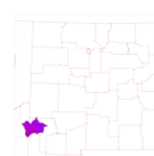



**Figure 15. Upper Gila-Mangas Watershed Erosion Potential.**



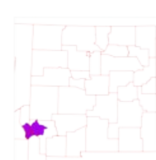


## Soil Resource Inventory

| Rank | Acres |
|---|---|
| 2 | 1,799 |
| 3 | 3,487 |
| 4 | 245,801 |
| 5 | 107,828 |
| 6 | 17,030 |
| 7 | 30,294 |
| 8 | 42,490 |
| 9 | 172,183 |
| 10 | 112,914 |
| 11 | 32,807 |
| 12 | 6,726 |
| Sum( ∑) | 773,360 |

**Table 15. Soil Erosion Potential Model Results. A greater rank indicates greater potential for erosion.**





## Socioeconomic Data (2010) [19]

| COUNTY | Total population: Total | Total population: Hispanic or Latino | Total population: White alone | Total population: Black or African American alone | Total population: American Indian and Alaska Native alone | Total population: Asian alone | Total population: Native Hawaiian and Other Pacific Islander alone | Total population: Some other race alone | Total population: Two or more races | Families: Median family income adj. 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| Grant, NM | 29,514 | 14,252 | 25,058 | 255 | 400 | 123 | 22 | 2,837 | 819 | 44,360 |
| Hidalgo, NM | 4,894 | 2,769 | 4,177 | 29 | 41 | 23 | 2 | 536 | 86 | 41,594 |
| Luna, NM | 25,095 | 15,423 | 19,511 | 288 | 317 | 119 | 19 | 4,176 | 665 | 33,312 |
| Cochise, AZ | 131,346 | 42,543 | 103,085 | 5,465 | 1,589 | 2,525 | 418 | 12,,989 | 5,275 | 53,077 |
| Greenlee, AZ | 8,437 | 4,040 | 6,517 | 89 | 195 | 46 | 5 | 1,268 | 320 | 51,729 |

**Table 16. Socioeconomic Data of the Counties in the Watershed (2010).**



## References

1. Parameter-elevation Regressions on Independent Slopes Model (PRISM).PRISM is a unique knowledge-based system that uses point measurements of precipitation, temperature, and other climatic factors to produce continuous, digital grid estimates of monthly, yearly, and event-based climatic parameters. http://www.prism.oregonstate.edu/

2. Bureau of Land Management – New Mexico State Office - http://www.blm.gov/nm/st/en/prog/more/geographic_sciences/spatial_data_metadata.html

3. Bureau of Land Management – Arizona State Office – http://www.blm.gov/az/st/en/prog/maps/gis_files.html

4. UNITED STATES GEOLOGICAL SURVEY - National Land Cover Dataset. http://landcover.United States Geological Survey.gov/

5. Southwest Regional Gap Analysis Project (SWReGAP). http://earth.gis.usu.edu/swgap/

6. UNITED STATES GEOLOGICAL SURVEY – National Hydrography Dataset. http://nhd.United States Geological Survey.gov/

7. UNITED STATES GEOLOGICAL SURVEY - http://waterdata.usgs.gov/nwis/rt

8. State of New Mexico Environment Department - ftp://ftp.nmenv.state.nm.us/www/swqb/303d-305b/2010/USEPA-Approved303dList.pdf

9. Arizona Department of Environmental Quality (ADEQ) - http://www.azdeq.gov/

10. United States Environmental Protection Agency - http://cfpub.epa.gov/surf/huc.cfm?huc_code=15040002

11. New Mexico - Office of the State Engineer- http://www.ose.state.nm.us/water_info_data.html

12. Arizona Department of Water Resources- http://www.azwater.gov/azdwr/default.aspx

13. New Mexico Natural Heritage Program - http://nhnm.unm.edu/

14. Arizona Game and Fish Department - http://www.azgfd.gov/

15. Southwest Exotic Plant Mapping Program - http://www.invasiveweeds.com/mapping/welcome.html

16. Natural Resources Conservation Service – National Coordinated Common Resource Area (CRA) Geographic Database http://soils.usda.gov/survey/geography/cra.html

17. Natural Resources Conservation Service – Performance Results System http://ias.sc.egov.usda.gov/PRSHOME/



18. Natural Resources Conservation Service – Soil Data Mart
http://soildatamart.nrcs.usda.gov/

19. United States Census Bureau - http://www.census.gov/