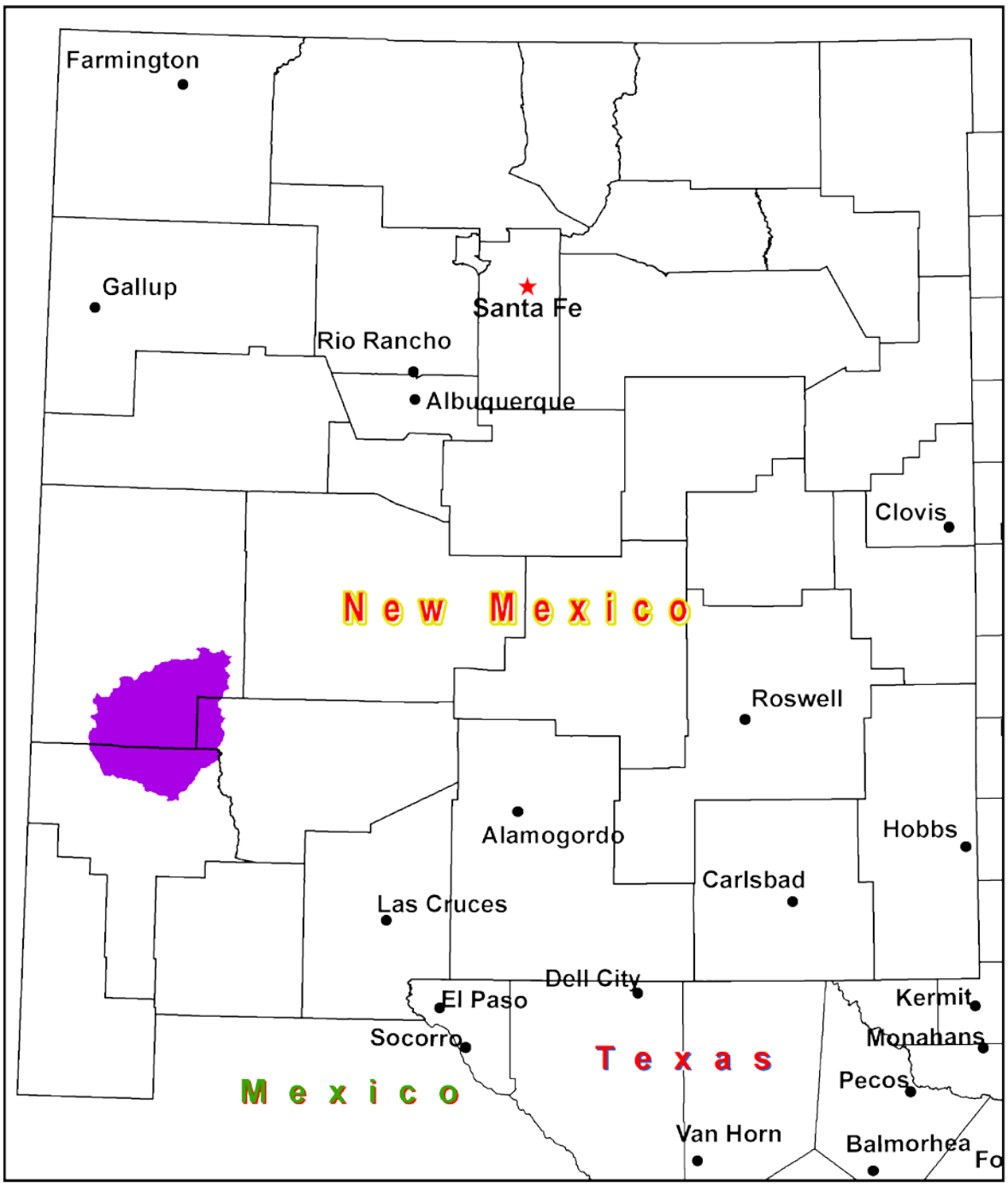
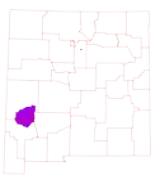


Rapid Watershed Assessment
Upper Gila Watershed



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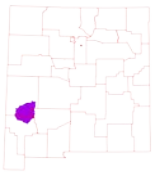

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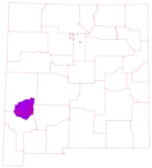
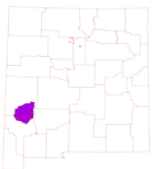




Overview

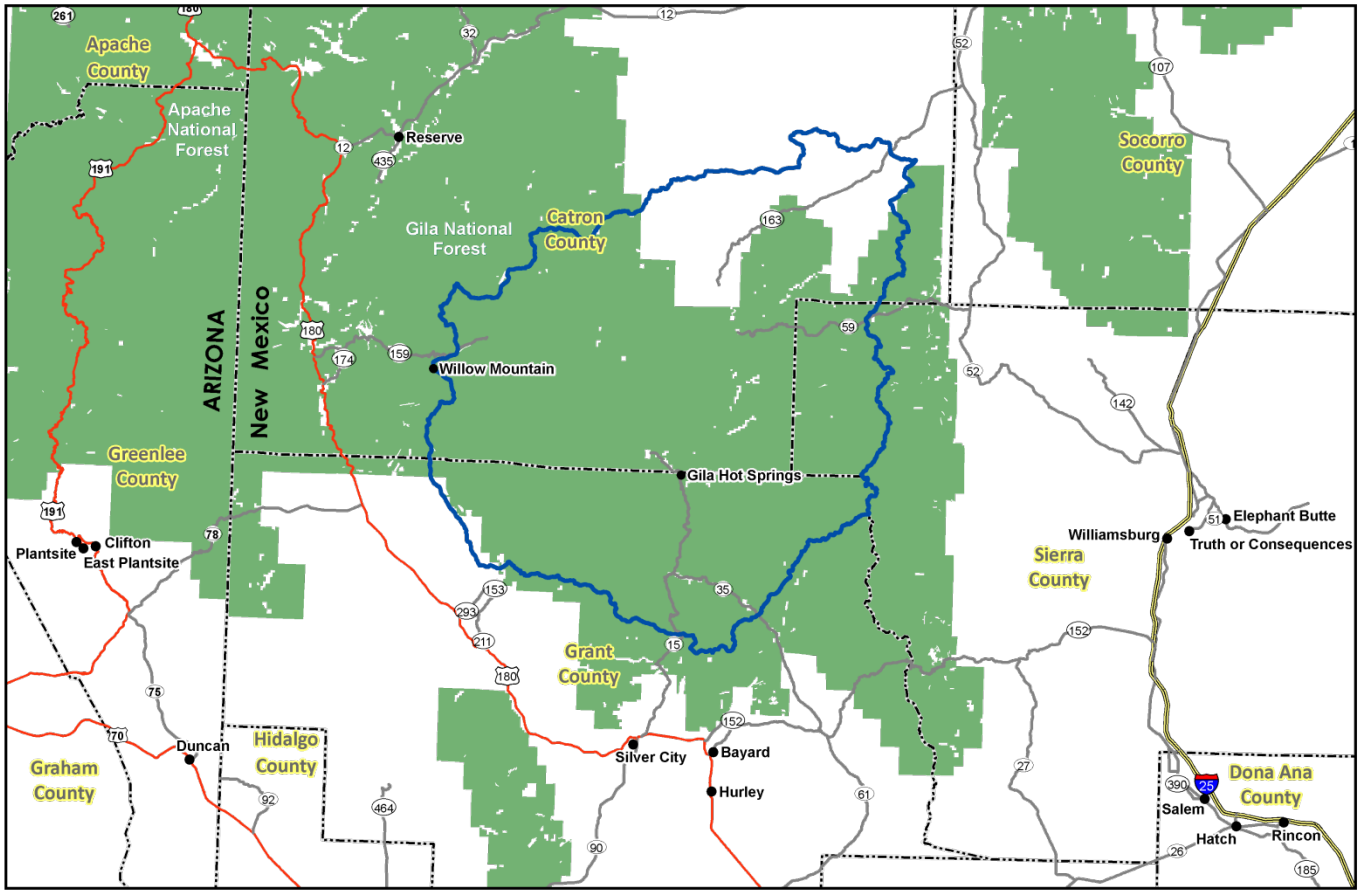
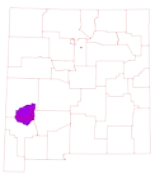


Figure 1. Upper Gila Watershed Overview.

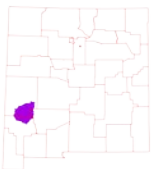


Overview

The Upper Gila Watershed is located in southwestern-central New Mexico and it covers 1,270,253 total acres (5,141 sq. km). Portions of the Upper Gila Watershed are in Catron, Grant, and Sierra counties. Table 1 summarizes the distribution of the Upper Gila Watershed.

County	County Acres Total	Acres in HUC	% of HUC in County	% of County in HUC
Catron	4,442,108	787,200	62	18
Grant	2,543,536	372,307	29	15
Sierra	2,711,883	110,746	9	4
Sum (∑)	--	1,270,253	100	--

Table 1. Upper Gila 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. Most of the watershed is designated a wilderness area.

Much of the river, in this reach, is bedrock controlled. 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:

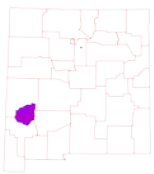
Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the Upper Gila 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 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.

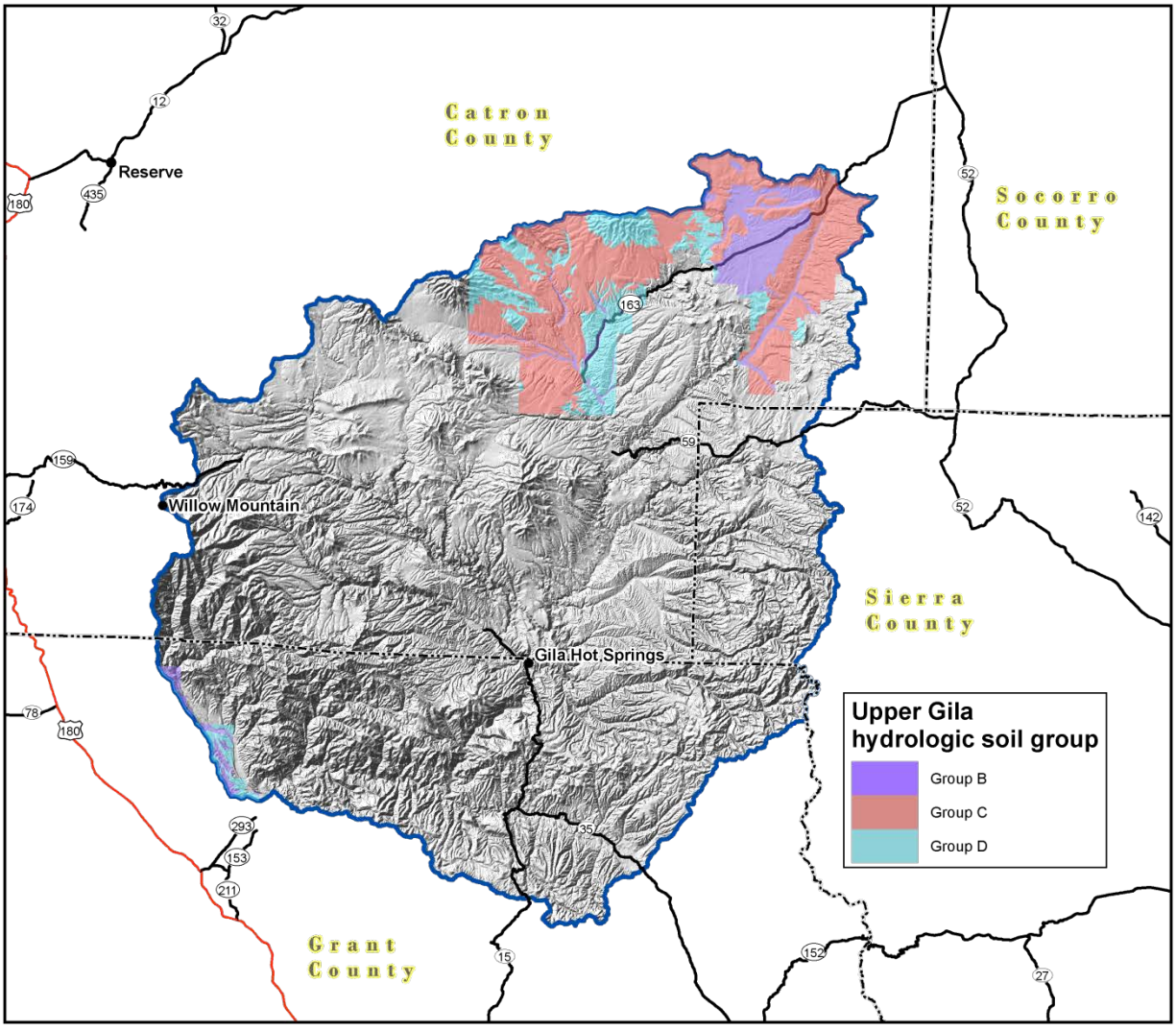


Figure 2. Upper Gila Watershed Hydrologic Soil Group.

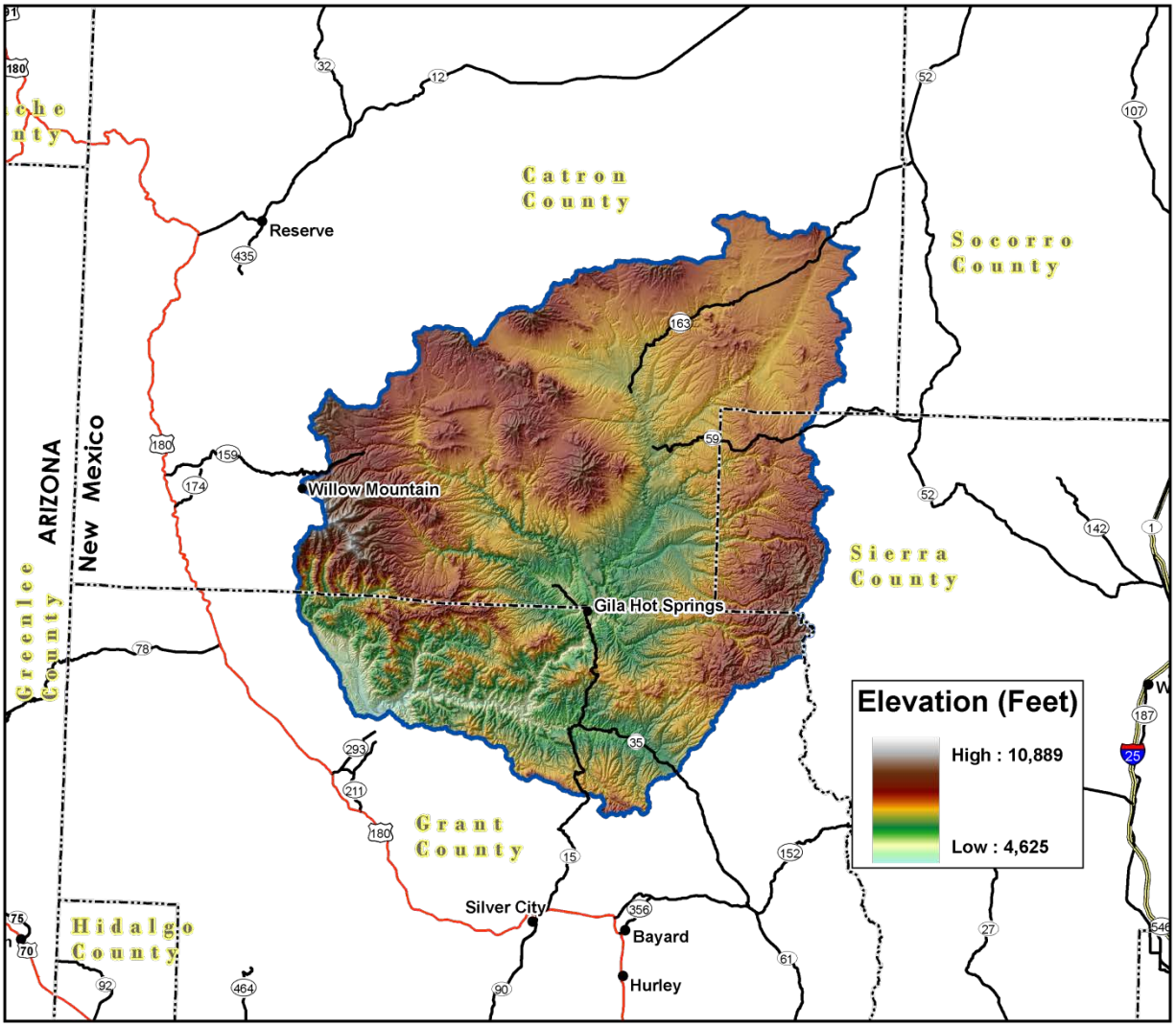


Figure 3. Upper Gila Watershed Shaded Relief.

Precipitation [1]

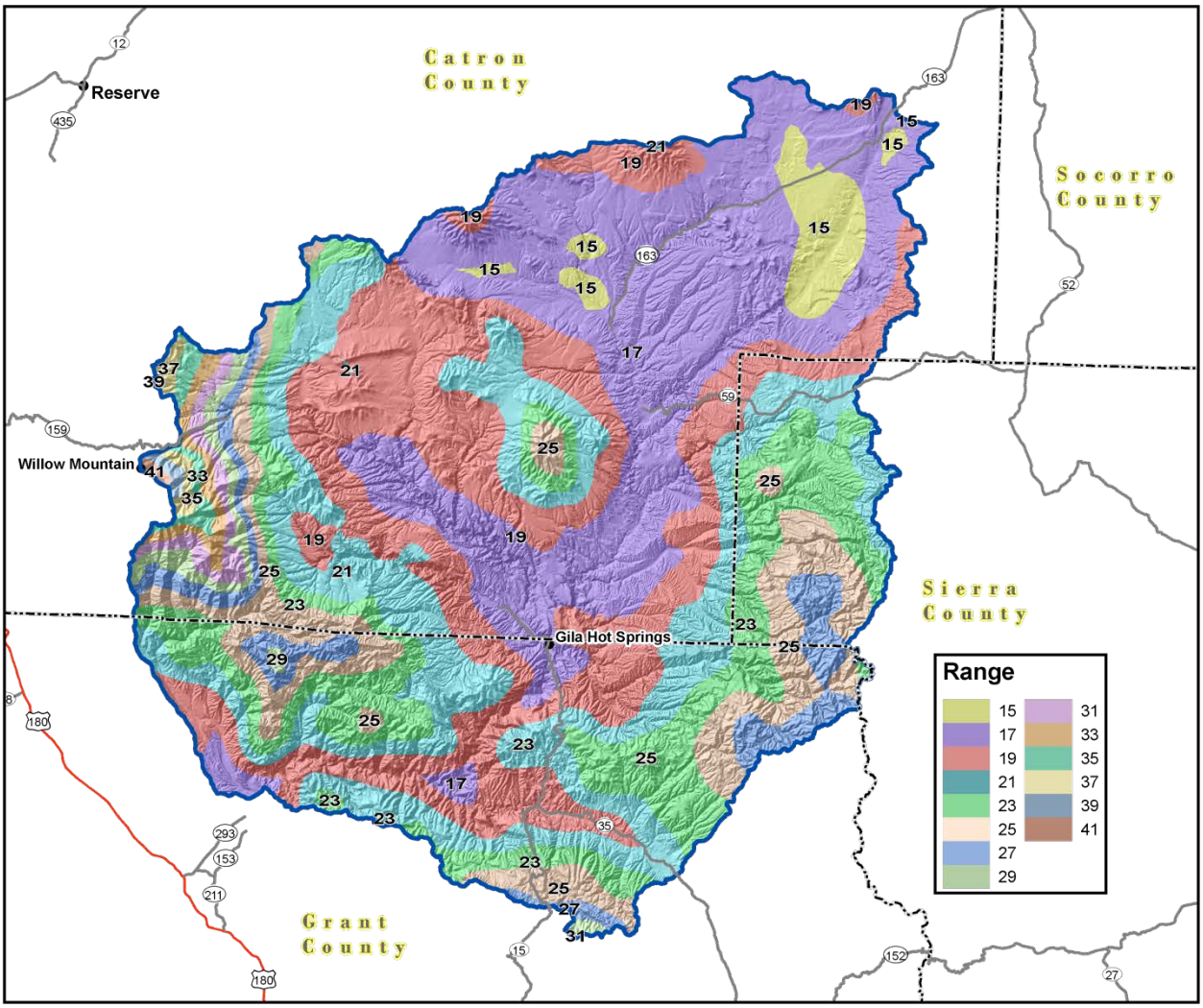


Figure 4. Upper Gila Watershed Annual Precipitation.

Land Ownership [2]

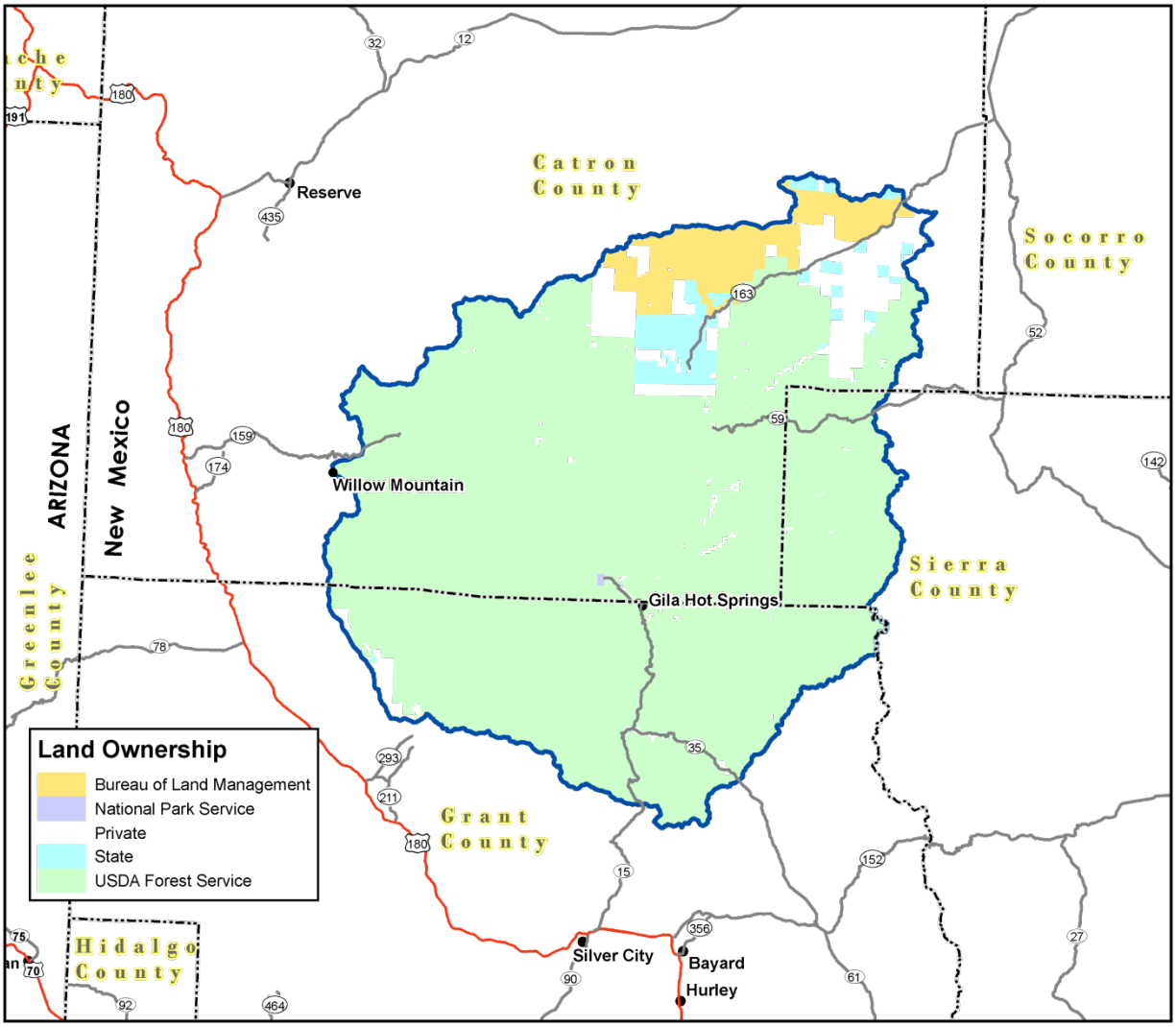
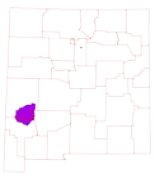


Figure 5. Upper Gila Watershed Land Ownership.

Land Ownership

COUNTY	BLM	NPS	Private	State	USDA Forest Service
Catron	70,187	406	82,187	36,607	596,679
Grant			10,487	243	361,023
Sierra			406		110,227
Watershed (∑)	70,187	406	93,080	36,850	1,067,929
% Watershed	6	<1	7	3	84

Table 2. Land Ownership in the Upper Gila Watershed.



Fires [3]

Whitewater-Baldy Complex

Date Started: May 16, 2012, closed out July 19, 2012

Cause: Lightning

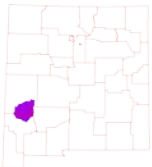
Size: **297,845** acres total, largest fire in New Mexico history

171,069 acres in the Upper Gila watershed

Buildings: 20 destroyed, cost $23,000,000

The fire started as two separate fires, the Whitewater Fire which was detected on May 16th and the smaller Baldy Fire that started earlier on May 9, both from lightning strikes.

Safety and Health: Flash floods on and near burn scars can be life threatening. Monitor forecasts and prepare to take action or evacuate should flash flood warnings be issued. Thunderstorms can form, and subsequently produce lightning and heavy rainfall within 30 minutes.



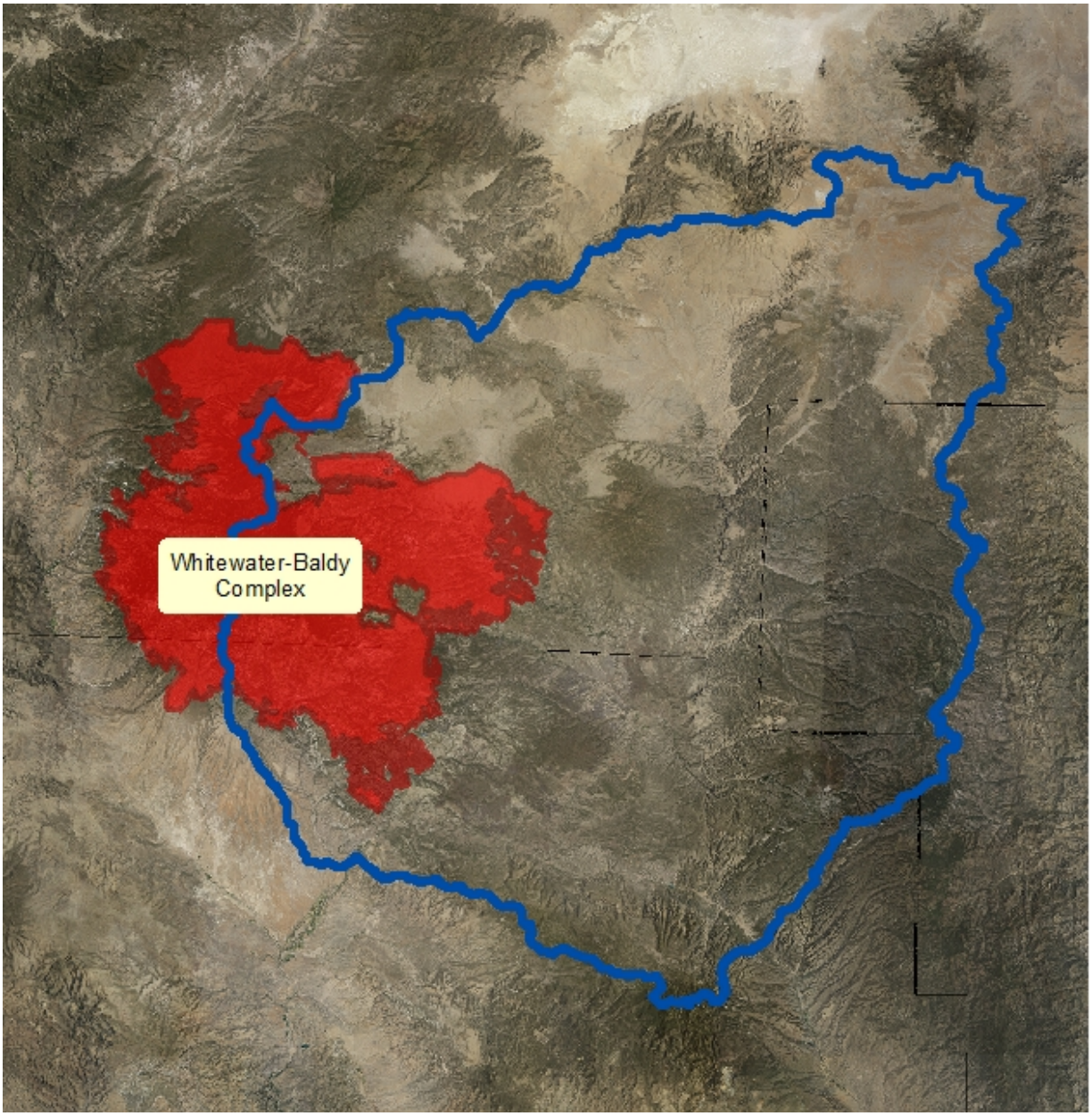
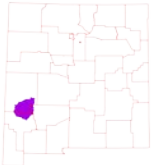


Figure 6. Whitewater-Baldy Complex extent in the Upper Gila Watershed.



Land Use / Land Cover [4,5]

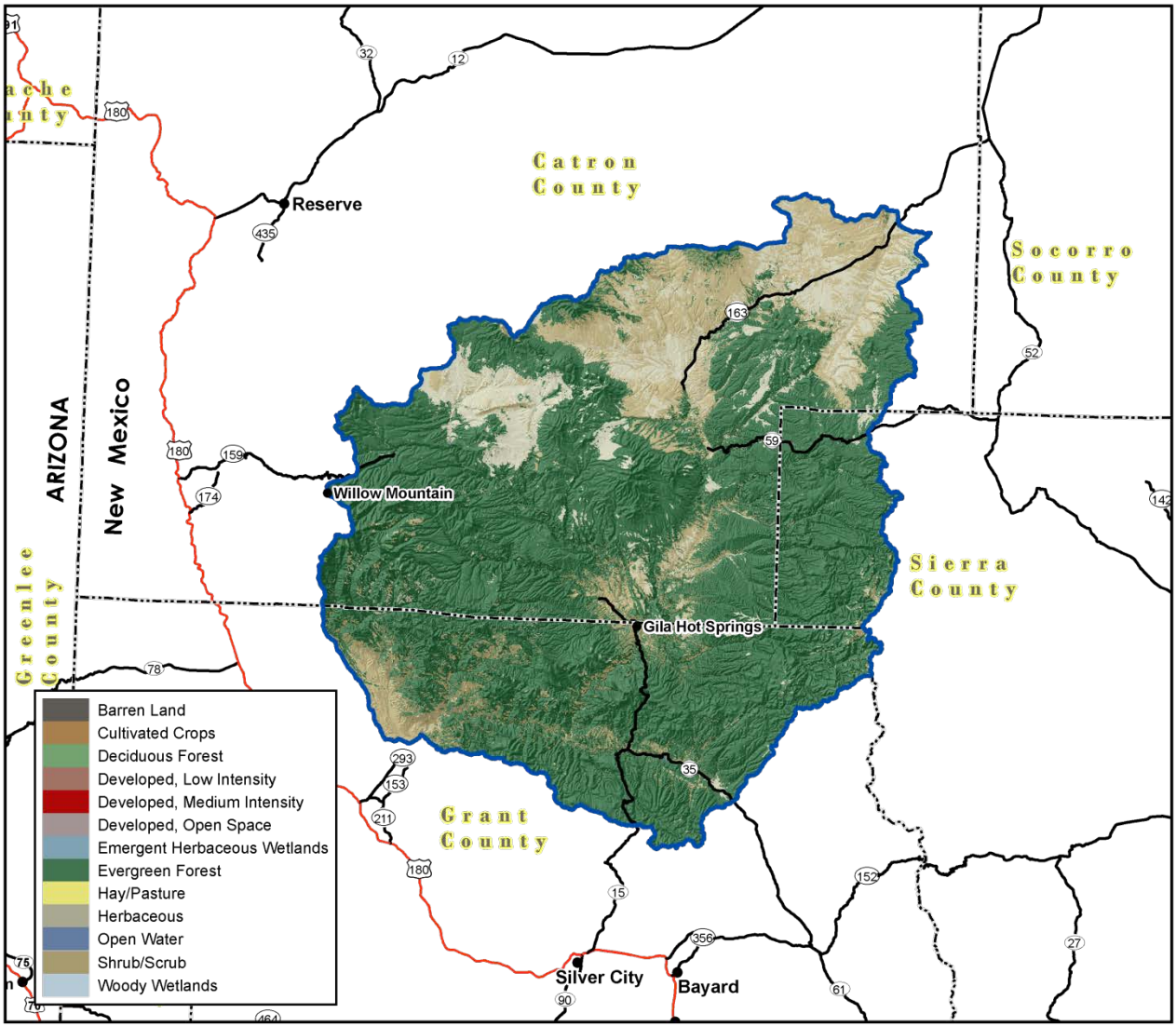
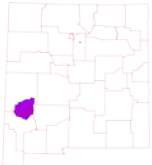


Figure 7. Subset of the National Land Cover Dataset in the Upper Gila Watershed.

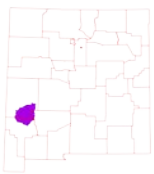


Land Use / Land Cover

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
Evergreen Forest	901,033	71
Shrub/Scrub	214,874	17
Herbaceuous	147,159	12
Deciduous Forest	2,372	0
Developed, Open Space	1,942	0
Barren Land	1,449	0
Woody Wetlands	774	0
Emergent Herbaceuous Wetlands	337	0
Developed, Low Intensity	160	0
Open Water	91	0
Hay/Pasture	20	0
Developed, Medium Intensity	8	0
Cultivated Crops	5	0

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



Land Use / Land Cover

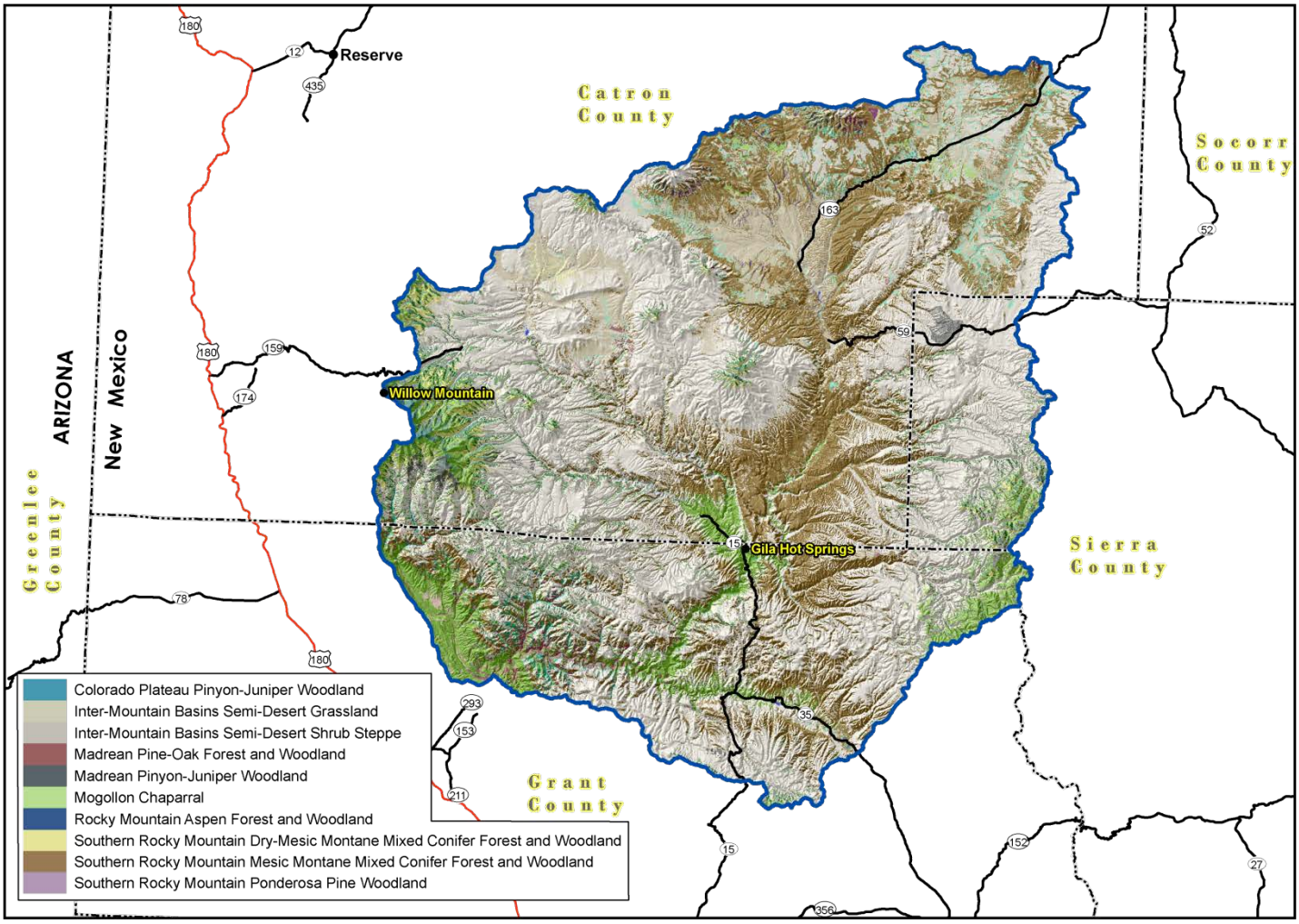
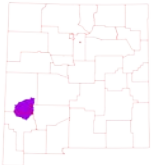


Figure 8. Subset of the SWREGAP over the Upper Gila Watershed. The 10 dominant ecosystems are displayed in the legend.

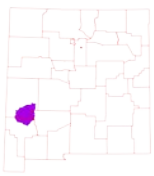


Land Use / Land Cover

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
Southern Rocky Mountain Ponderosa Pine Woodland	692,664	55%
Colorado Plateau Pinyon-Juniper Woodland	272,274	21%
Inter-Mountain Basins Semi-Desert Grassland	80,037	6%
Madrean Pinyon-Juniper Woodland	54,520	4%
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	31,736	2%
Rocky Mountain Aspen Forest and Woodland	30,027	2%
Inter-Mountain Basins Semi-Desert Shrub Steppe	25,882	2%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	19,457	2%
Mogollon Chaparral	11,415	1%
Madrean Pine-Oak Forest and Woodland	8,306	1%

Table 4. SW Region Gap analysis ecosystem acreages.



Hydrology [6,7,8,9,10]

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 5,532 miles (8,903 km) of water courses in the Upper Gila Watershed. The majority of these courses typically flow intermittently in summer months during periods associated with high intensity convective thunderstorms.

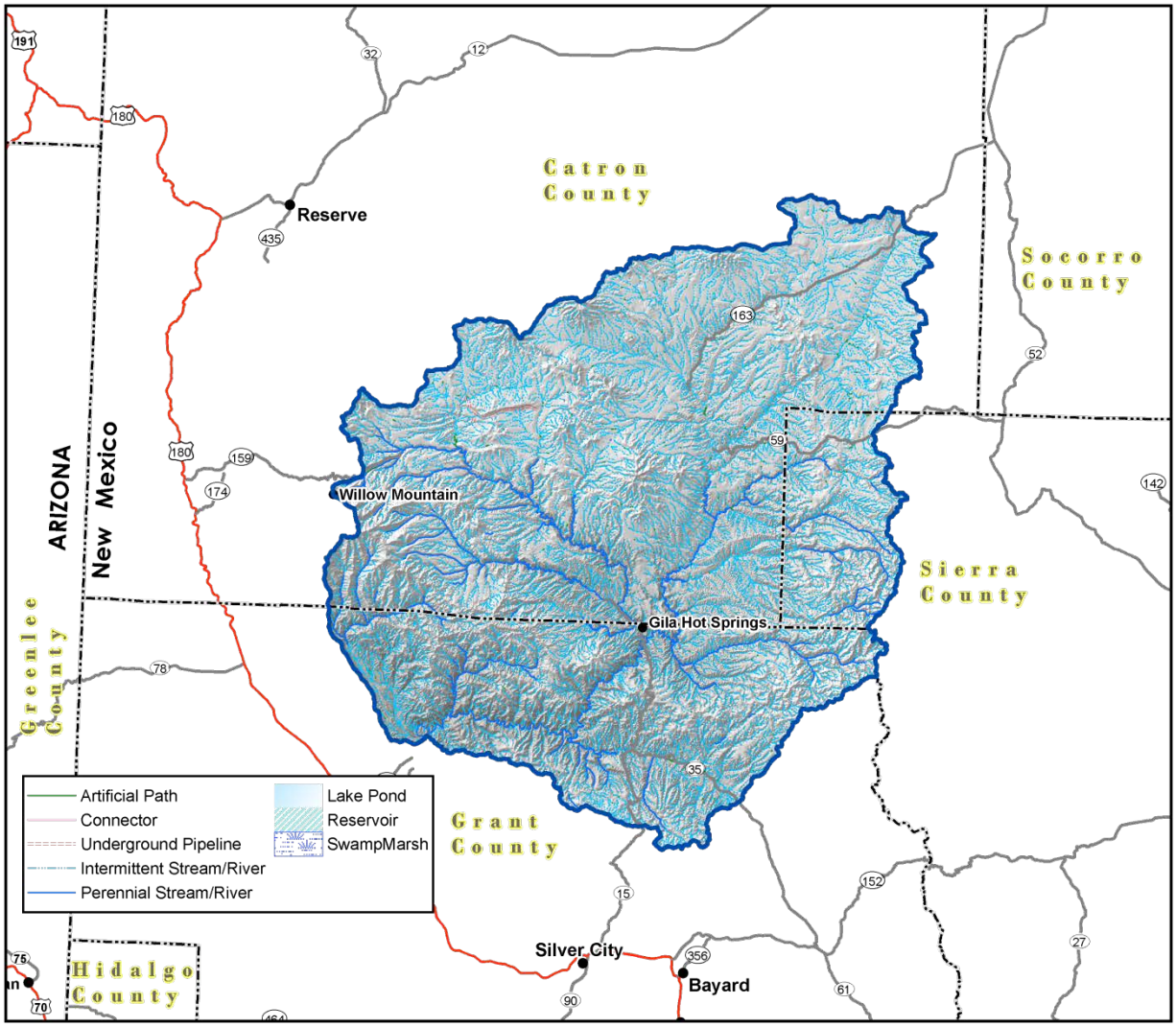
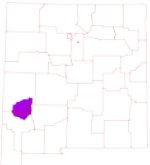
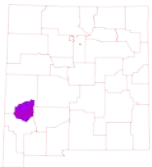


Figure 9. National Hydrologic Dataset (NHD) of the Upper Gila Watershed.



Water Course Type	Miles
Artificial Path	24
Connector	1
Intermittent Stream / River	5,079
Perennial Stream / River	419
Underground Pipeline	9
Sum (∑)	5,532

Table 5. NHD Water Course Type and Extents



Gauging Stations:

There are seven dams and water gauging stations in the watershed. USGS Site 09430500 is located at the southwest corner of the watershed at Gila River near Gila, NM. During the period from 1927 to 2011 this site has had mean annual discharge of 156.446 cubic feet per second ranging from 19.2 (2002) to 2,028 (2005) cubic feet per second.

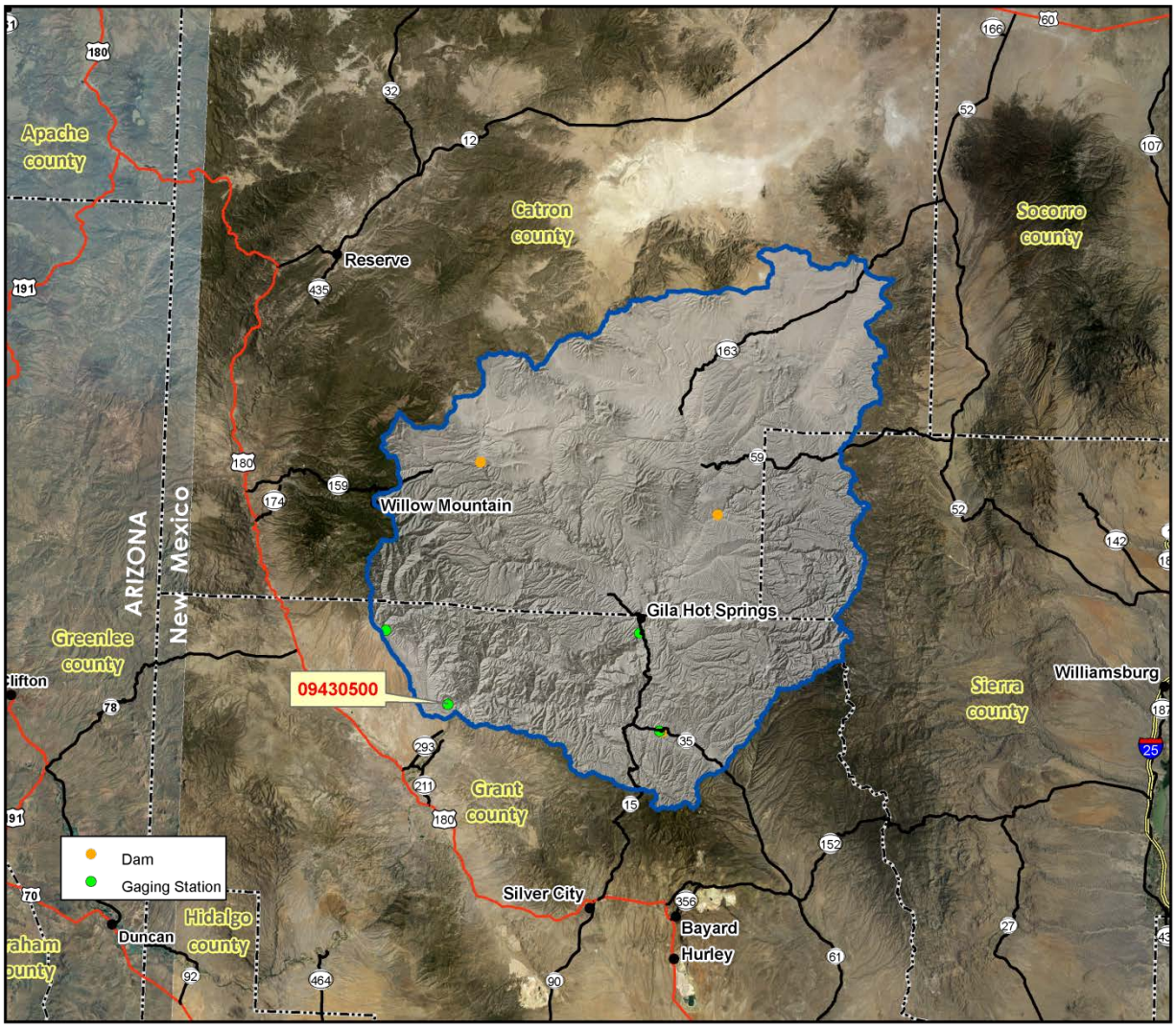


Figure 10. Gauging Stations in the Upper Gila Watershed.

Hydrology

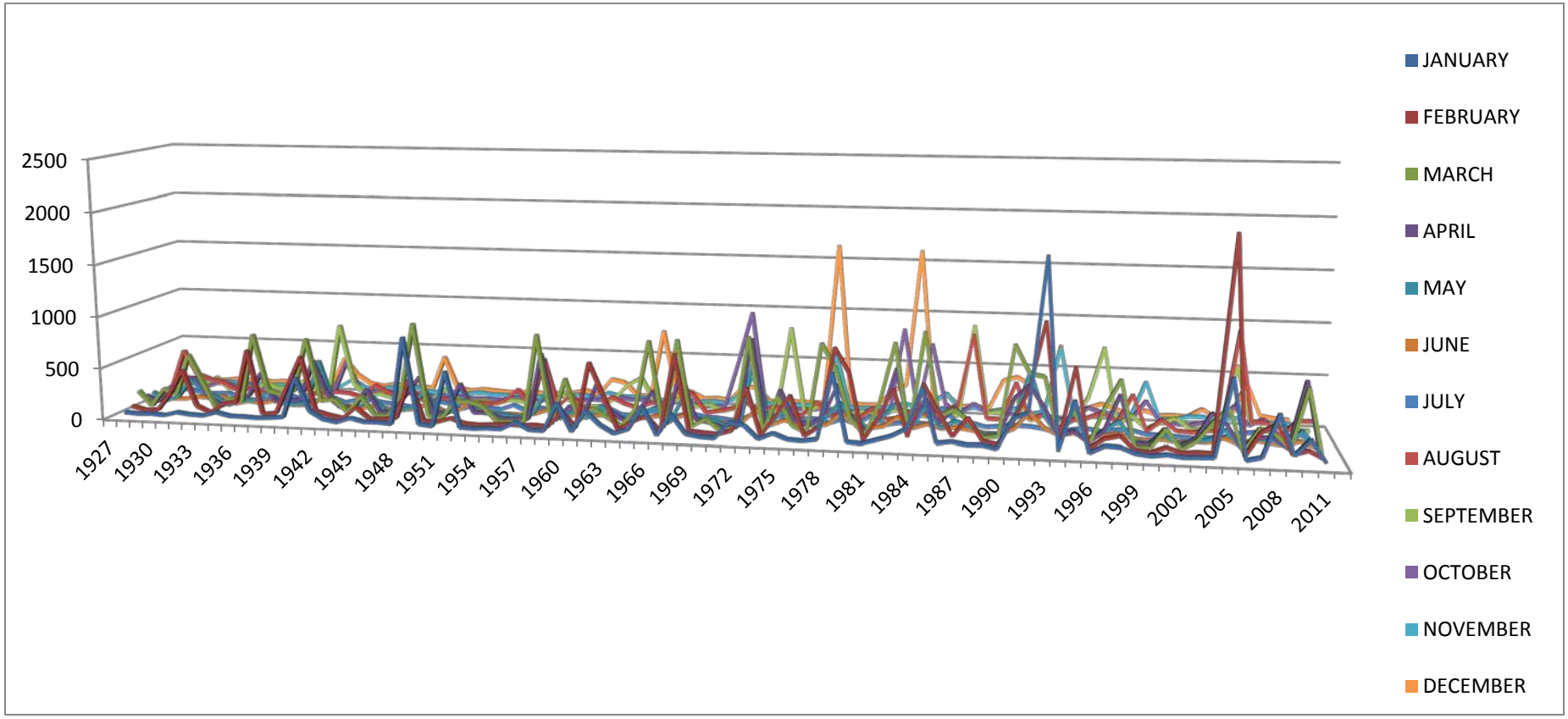
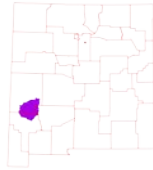


Figure 11. Monthly Average of Mean Daily Flow on the Upper Gila watershed at Gila River near Gila, NM. Period of observation: 1927-2011.



Helping People Help the Land

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New Mexico Water Quality Control Commission (NMWQCC):

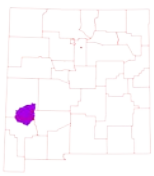
The New Mexico Water Quality Control Commission (NMWQCC) is the issuing agency of water quality standards for interstate and intrastate waters in New Mexico.

The Upper Gila Watershed has the following reaches listed as 303 (d) Impaired Surface Waters:

1. East Fork Gila River (Gila River to headwaters)
2. Gila River (Mogollon Creek to Gila Hot Springs)
3. Gilita Creek (Middle Fork Gila R to Willow Creek)
4. Lake Roberts
5. Middle Fork Gila River (Gila River to headwaters)
6. Taylor Creek (Beaver Creek to Wall Lake)
7. Taylor Creek (Perennial reaches abv Wall Lake)
8. Turkey Creek (Gila River to headwaters)
9. West Fork Gila R (Cliff Dweller Cyn to headwaters)
10. West Fork Gila R (East Fork to Middle Fork)

Use	1	2	3	4	5	6	7	8	9	10
Domestic Water Supply	x		x	x	x	x	x	x	x	x
High Quality Coldwater Aquatic Life	NS		NS	x	NS	NS	NS	NS	NS	NS
Industrial Water Supply		x								
Irrigation	x	x	x	x	x	x	x	x	x	x
Livestock Watering	x	x	x	NA	x	x	x	NA	x	NA
Marginal Coldwater Aquatic Life		NS								
Primary Contact		x								
Secondary Contact	x		NA	NA	x	NA	NA	NA	x	NA
Warmwater Aquatic Life		x								
Wildlife Habitat	x	x	x	NA	x	x	x	NA	x	NA

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



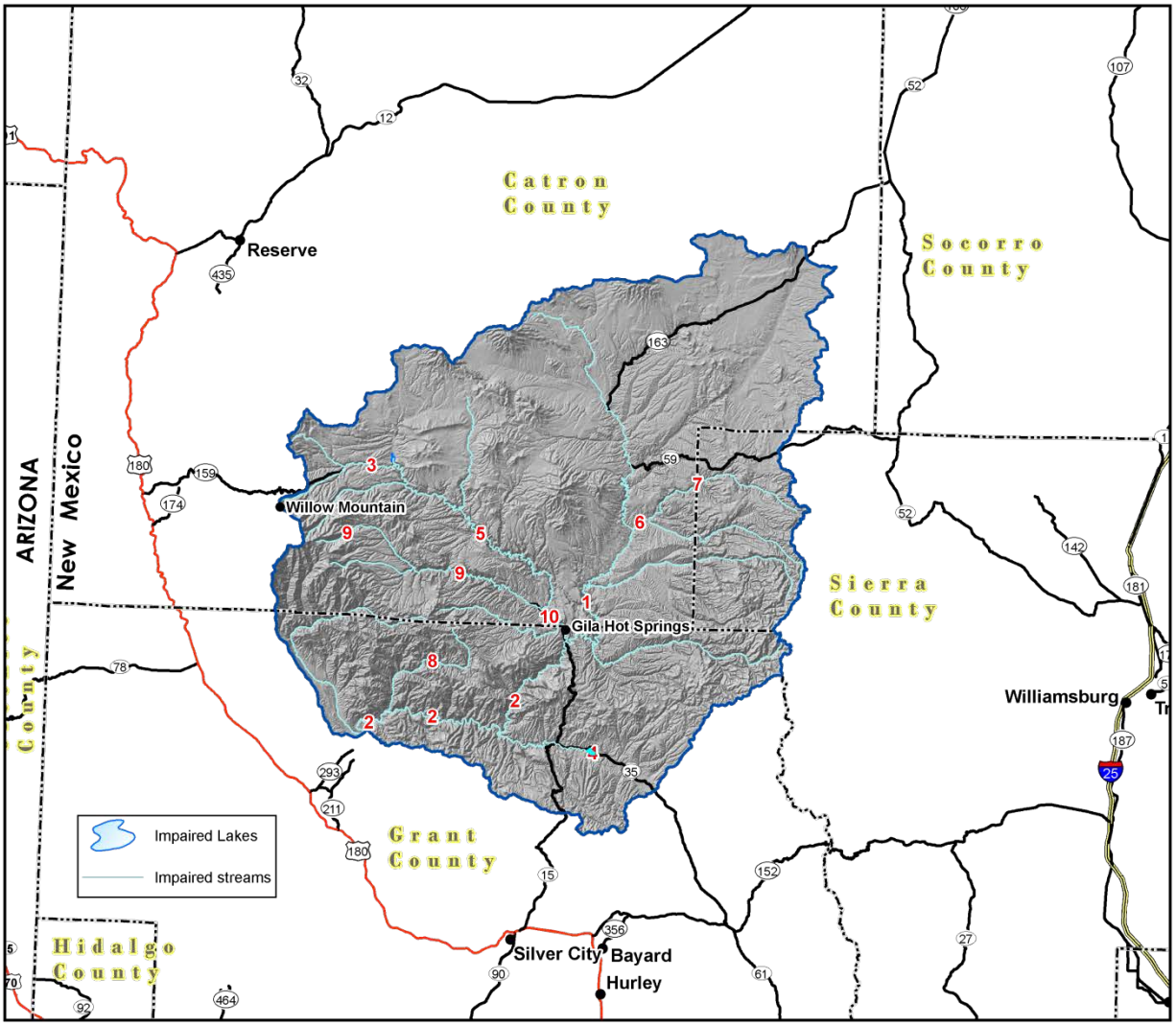
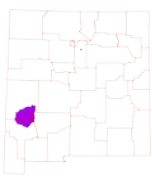


Figure 12. 303(d) Impaired Waters.



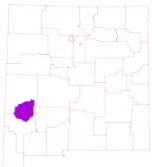
Hydrology

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. Within the Upper Gila Watershed, there is one water body listed as impaired as of the 2010-12 listing cycle: Lake Roberts (#4).

The river and stream reaches total 186 miles (299 km) and the listed water body covers 2,944 acres (0.28 sq. km).

Use	1	2	3	4	5	6	7	8	9	10
Aluminum	×		×		×	×	×			
Benthic-Macroinvertebrate Bioassessments (Streams)	×									
Nutrient/Eutrophication Biological Indicators				×						
Oxygen, Dissolved								×		
pH				×						
Temperature water		×	×	×	×	×	×	×	×	×
Turbidity					×	×	×			

Table 7. Possible Causes of Impairment.



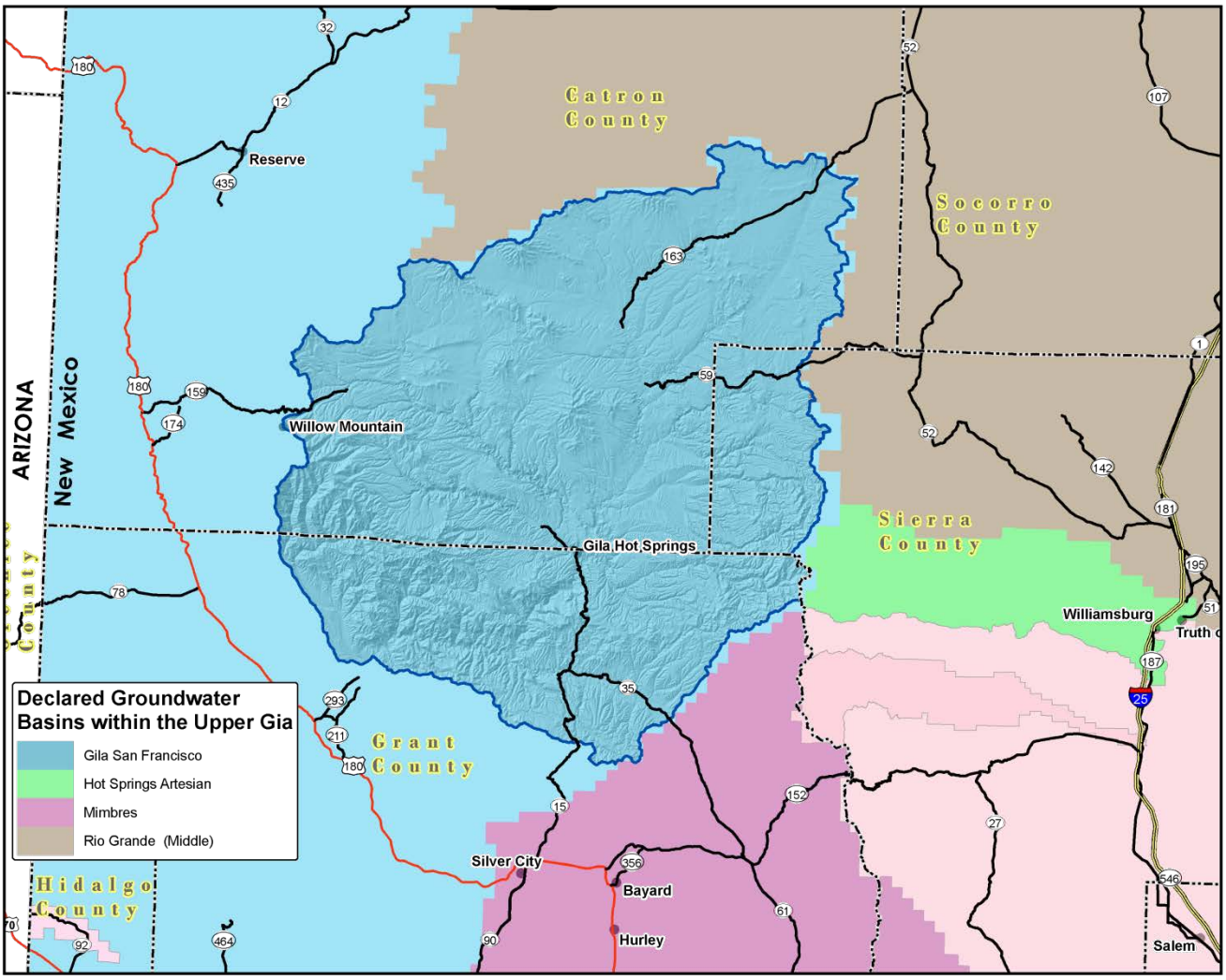
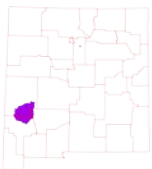


Figure 13. Declared Groundwater Basins of the Upper Gila.

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. The Upper Gila Watershed is completely within Gila San Francisco, Hot Springs Artesian, Mimbres, and Rio Grande (Middle) Underground Water Basins. The surface watershed in New Mexico covers 794,222 of the approximately 5,528,715 million acres of the underground water basin in New Mexico.

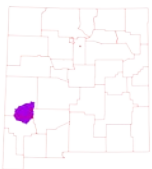


Threatened and Endangered Species [11]

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 Department program tracks the status of threatened and endangered species which are listed on both federal and state lists. Table 8 lists those species which are currently listed and tracked in the Upper Gila Watershed.

Common Name	Scientific Name	Tax Class	Family	Federal Status	State Status
Chiricahua Leopard Frog	Rana chiricahuensis	Amphibia	Ranidae	LT	
Common Black-Hawk	Buteogallus anthracinus	Aves	Accipitridae		T
Gila Chub	Gila intermedia	Actinopterygii	Cyprinidae	PE	E
Gila Springsnail	Pyrgulopsis gilae			C	T
Gila Trout	Oncorhynchus gilae gilae	Actinopterygii	Salmonidae	LE	T
Goodding's Onion	Allium gooddingii	Monocotyledoneae	Liliaceae		E
Headwater Chub	Gila nigra	Actinopterygii	Cyprinidae		E
Hess' Fleabane	Erigeron hessii	Dicotyledoneae	Asteraceae		E
Large Yellow Lady's-slipper	Cypripedium parviflorum var. pubescens	Monocotyledoneae	Orchidaceae		E
Loach Minnow	Rhinichthys cobitis	Actinopterygii	Cyprinidae	LT	T
Mexican Spotted Owl	Strix occidentalis lucida	Aves	Strigidae	LT	
Mexican Wolf	Canis lupus baileyi	Mammalia	Canidae		E
New Mexico Hot Springsnail	Pyrgulopsis thermalis			C	T
Roundtail Chub	Gila robusta	Actinopterygii	Cyprinidae		E
Spikedace	Meda fulgida	Actinopterygii	Cyprinidae	LT	E
Spotted Bat	Euderma maculatum	Mammalia	Vespertilionidae		T

Table 8. Threatened and Endangered Plant and Animal Species.

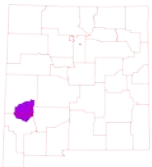


Invasive Species [12]

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 Watershed, the SWEMP has identified 6 species of invasive plants (Table 9). 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**
Asteraceae (Sunflower Family)	**Musk Thistle**
Lythraceae (Loosestrife Family)	***Purple Loosestrife***
Asteraceae (Sunflower Family)	***Russian Knapweed***
Asteraceae (Sunflower Family)	***Yellow Starthistle***

Table 9. Invasive Species Recognized by the SWEMP.



Common Resource Areas[13]

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.

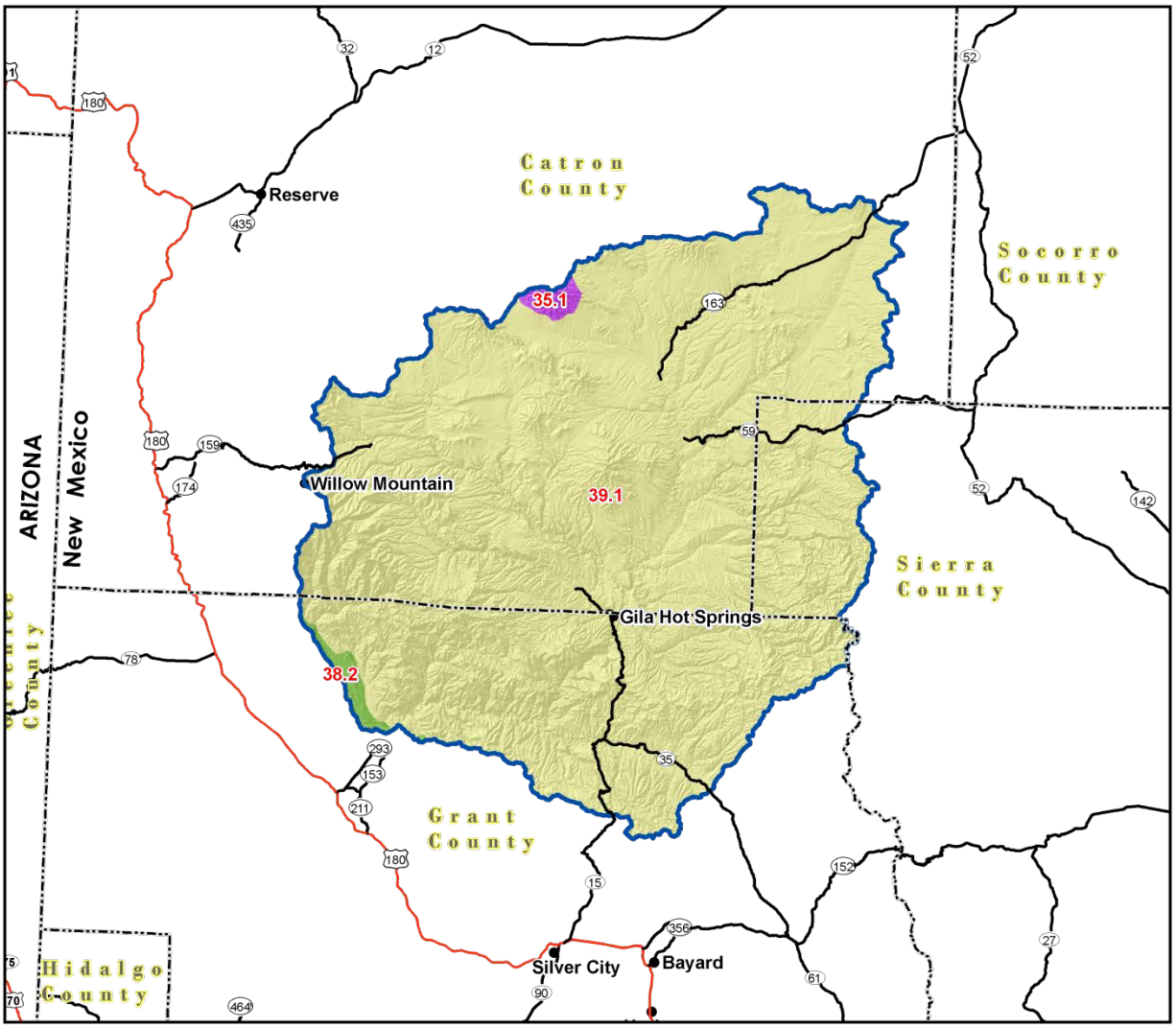


Figure 14. Common Resource Areas of the Upper Gila Watershed.

Common Resource Areas

35.1 - Colorado Plateau Mixed Grass Plains

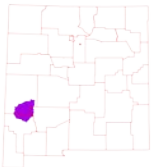
This unit occurs within the Colorado Plateau Physiographic Province and is characterized by flat to gently dipping sedimentary rocks eroded into plateaus, valleys and deep canyons. Volcanic fields occur in places. Elevations range from 5100 to 6000 feet. Precipitation averages 10 to 14 inches per year. The soil temperature regime is mesic. The soil moisture regime is ustic aridic. Vegetation includes Stipa, Indian ricegrass, galleta, blue grama, fourwing saltbush, and scattered juniper.

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.



Conservation [14]

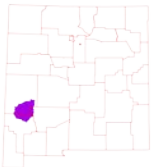
The USDA-Natural Resources Conservation Service (NRCS) focuses on the development and delivery of high quality products and services that enable people to be good stewards of our Nation's soil, water, and related natural related resources on non-Federal lands. The Natural Resources Conservation Service's 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
Prescribed Grazing					1	1,410			1	1,710	2	3,120
Upland Wildlife Habitat Management					1	3,120						3,120
SUM (∑)					2	4,530			1	1,710		6,240

Table 10. 5 year Trends in Applied Conservation Practices. Reported in Acres.

Conservation Practice	2007		2008		2009		2010		2011		TOTAL	
	#	Feet	#	Feet	#	Feet	#	Feet	#	Feet	#	Feet
Fence							1	6,846	1		1	6,846
Pipeline			1	1,710	1	13,317	1	12,648	1	12,492	4	40,167
SUM (∑)			1	1,170	1	13,317	2	19,493	2	12,492	5	47,012

Table 11. 5 Year Trends in Location Specific Applied Conservation Practices. Reported in Feet if Linear (i.e. Fence)



Soil Resource Inventory [15]

The Upper Gila Watershed has a number of certified National Cooperative Soil Survey (NCSS) inventories. The National Forests in New Mexico 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:

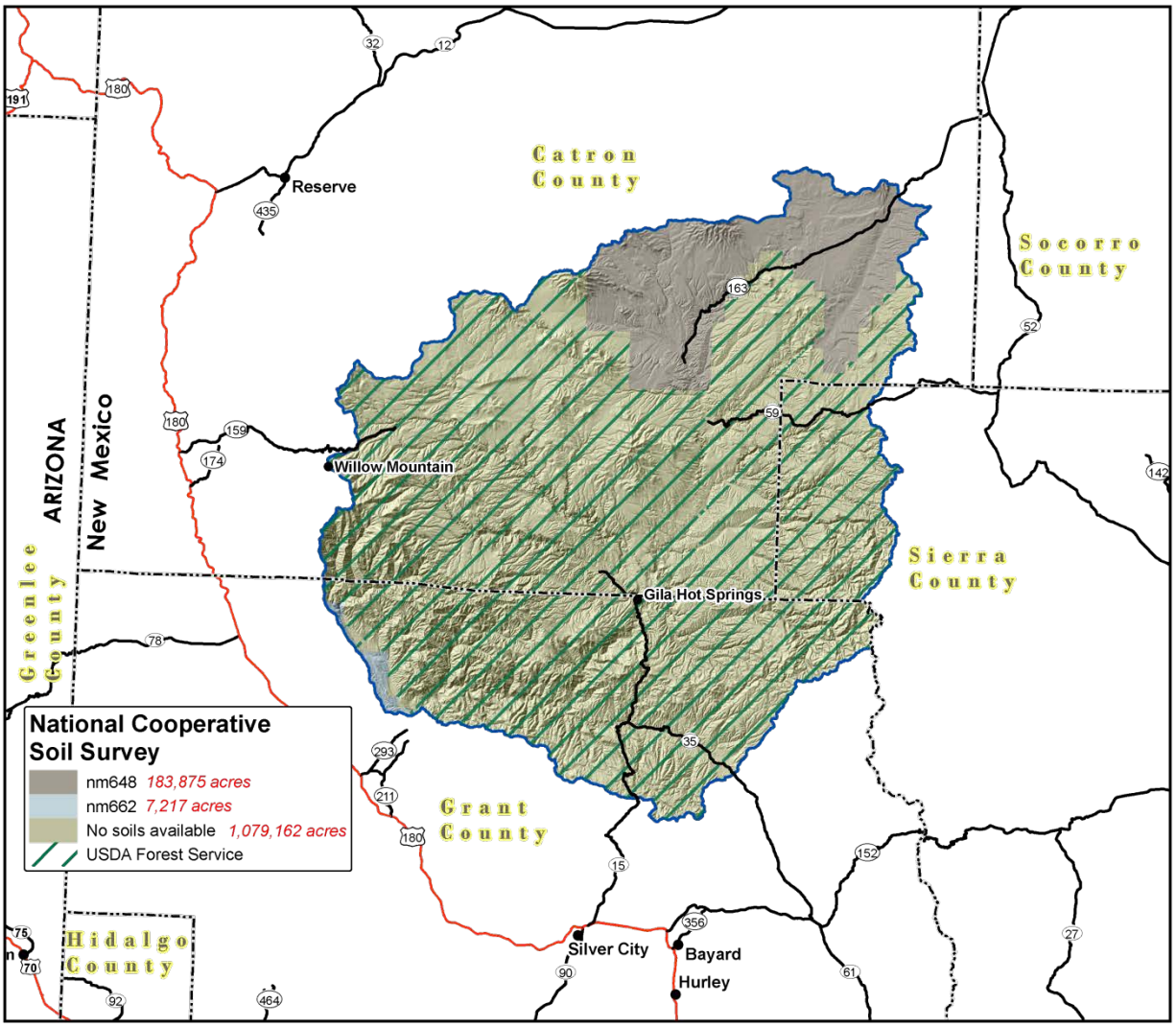
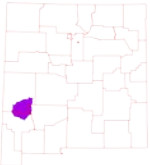


Figure 15. National Cooperative Soil Survey coverage of the Upper Gila Watershed.

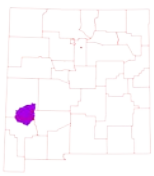


Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Upper Gila 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 12. 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.

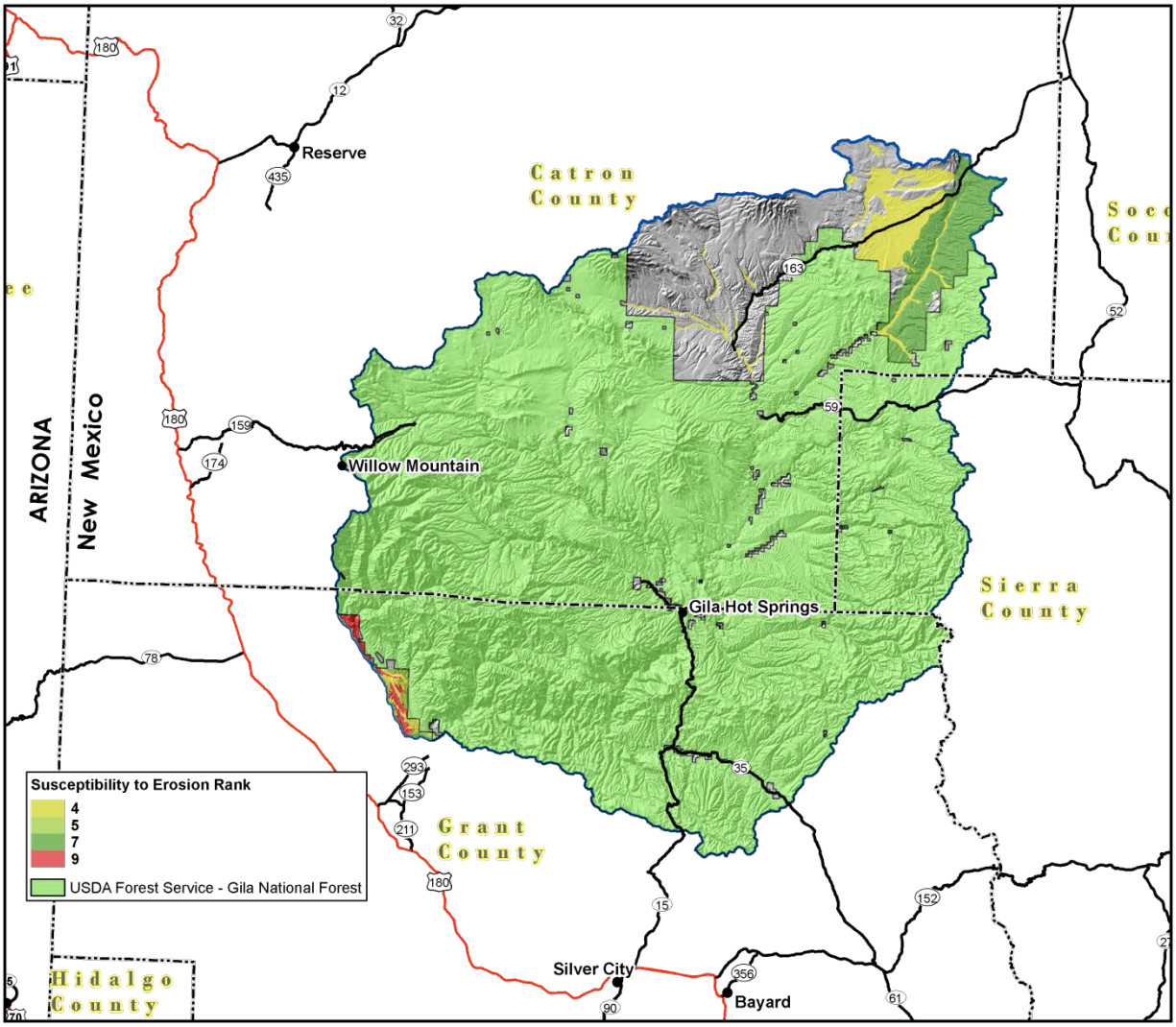
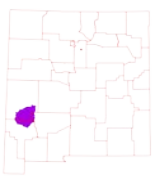


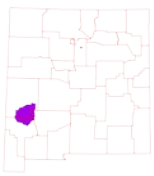
Figure 16. Upper Gila Watershed Erosion Potential.



Soil Resource Inventory

Rank	Acres
4	31,006
5	1,423
7	33,794
9	3,218
Sum(∑)	69,440

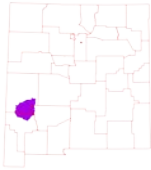
Table 13. Soil Erosion Potential Model Results. A greater rank indicates greater potential for erosion.



Socioeconomic Data (2010) [18]

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
Catron	3,725	709	3,344	16	99	7	0	142	117	40,906
Grant	29,514	14,252	25,058	255	400	123	22	2,837	819	44,360
Sierra	11,988	3,352	10,265	49	199	49	3	1,032	391	38,641

Table 14. Socioeconomic Data of the Counties in the Watershed (2010).



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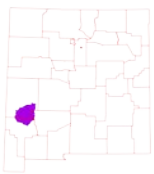
13. Natural Resources Conservation Service – National Coordinated Common Resource Area (CRA) Geographic Database http://soils.usda.gov/survey/geography/cra.html

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

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



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