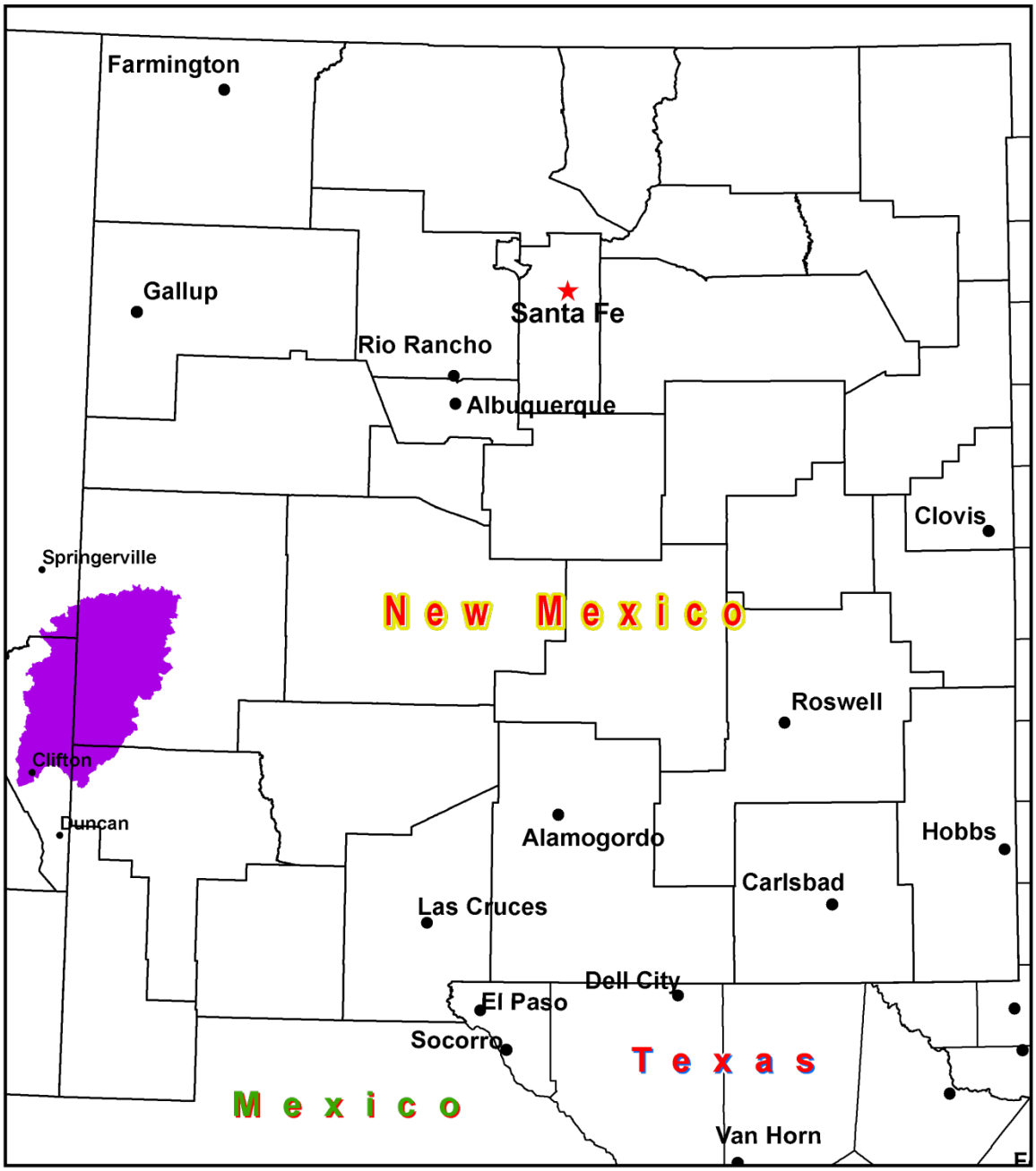
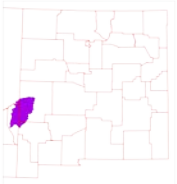


Rapid Watershed Assessment
San Francisco Watershed



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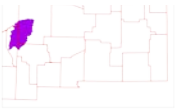

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Overview

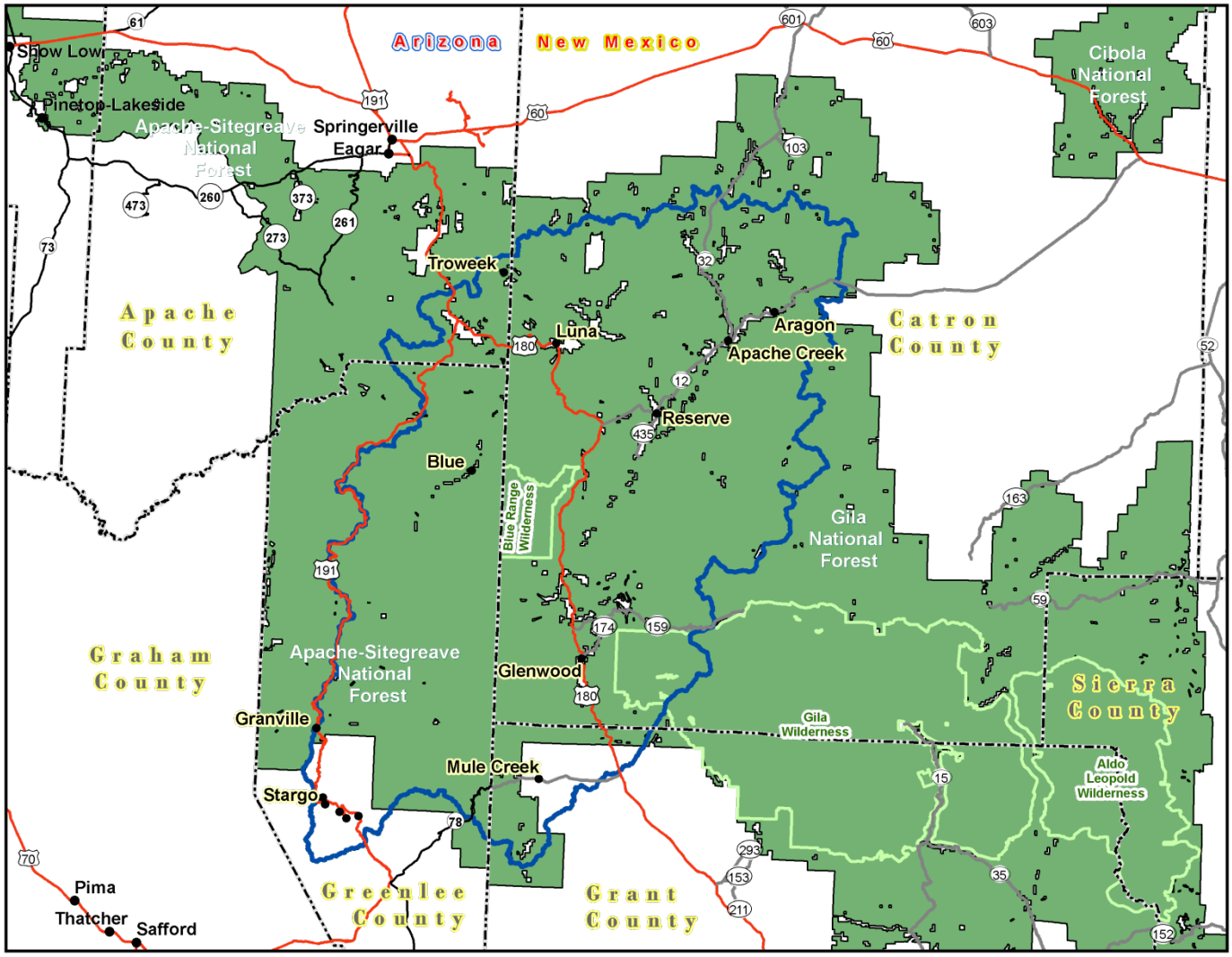
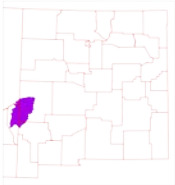


Figure 1. San Francisco Watershed Overview.



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Overview

The San Francisco Watershed is located in southwestern New Mexico and in southeastern Arizona. It covers 1,797,788 total acres (7,275 sq. km). Portions of the San Francisco Watershed are in Catron, and Grant counties in New Mexico, and Apache and Greenlee counties in Arizona. Table 1 summarizes the distribution of the San Francisco Watershed.

County	County Acres Total	Acres in HUC	% of HUC in County	% of County in HUC
Catron, NM	4,442,108	1,093,682	61%	25%
Grant, NM	2,543,536	101,356	6%	4%
Apache, AZ	7,177,492	61,642	3%	1%
Greenlee, AZ	1,182,841	540,399	30%	46%
Sum (∑)	--	1,797,788	100	--

Table 1. San Francisco 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.

Much of the river, in the upper watershed, is bedrock controlled. 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 San Francisco 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.

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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.

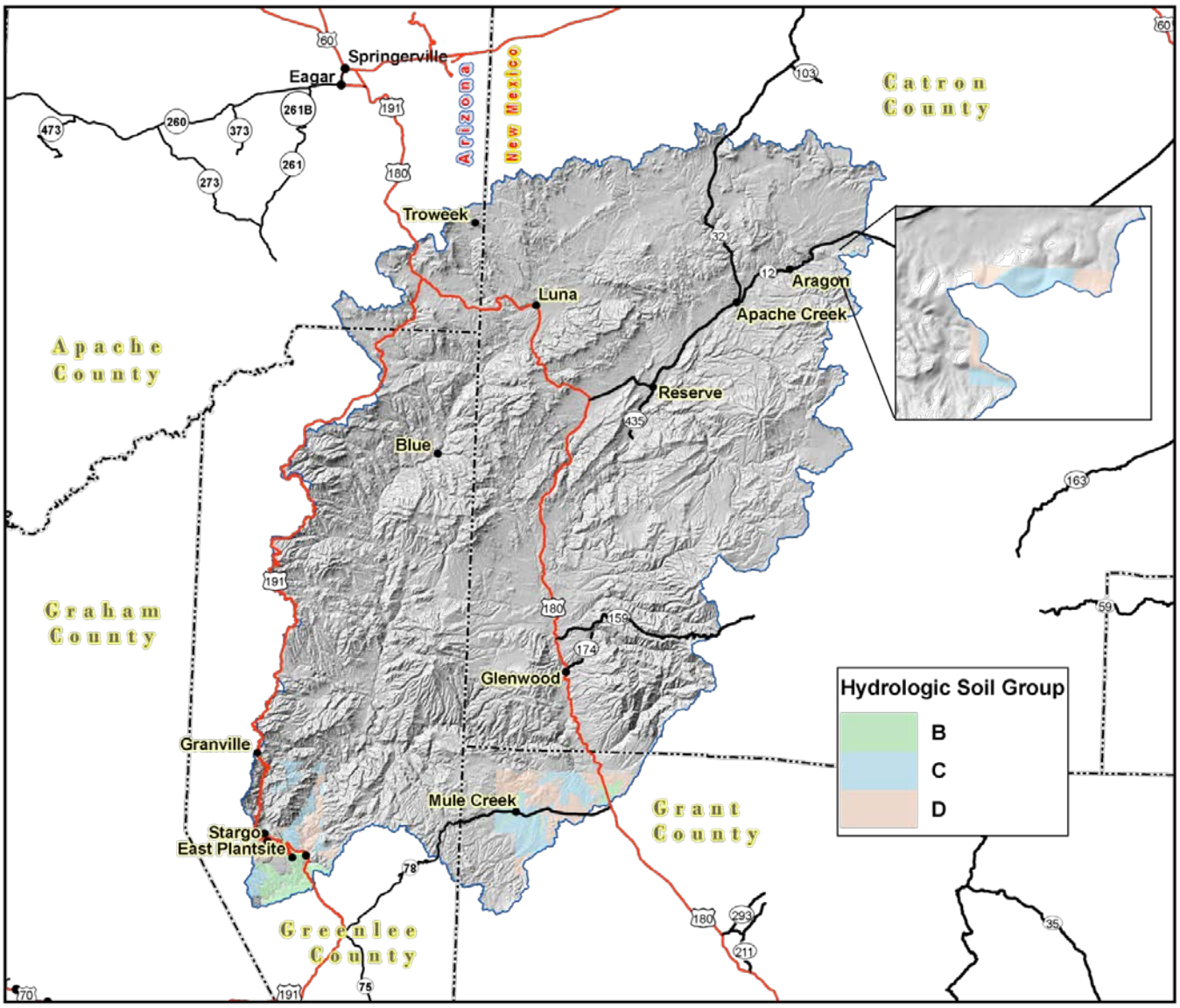


Figure 2. San Francisco Watershed Hydrologic Soil Group

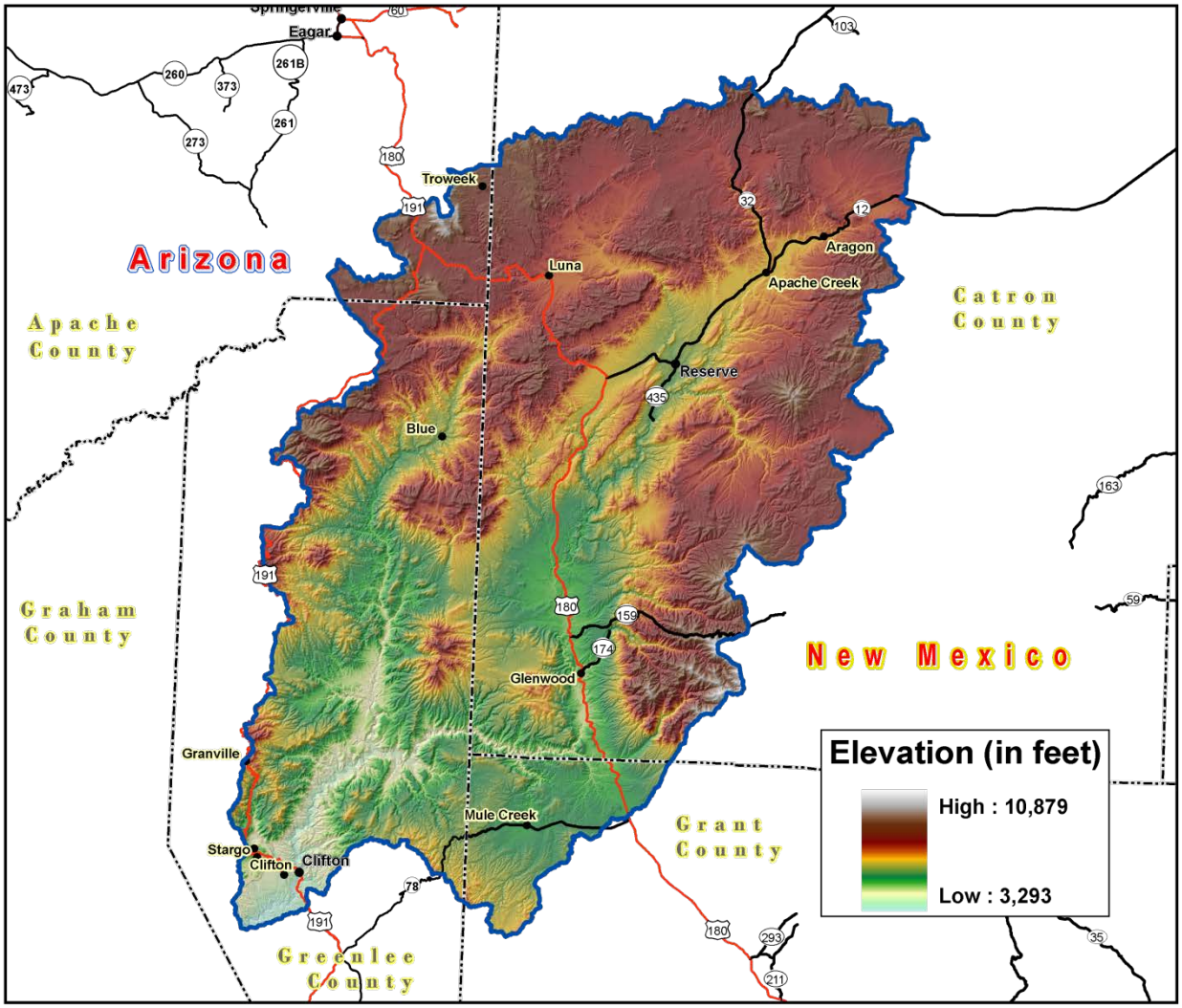


Figure 3. San Francisco Watershed Shaded Relief.

Precipitation [1]

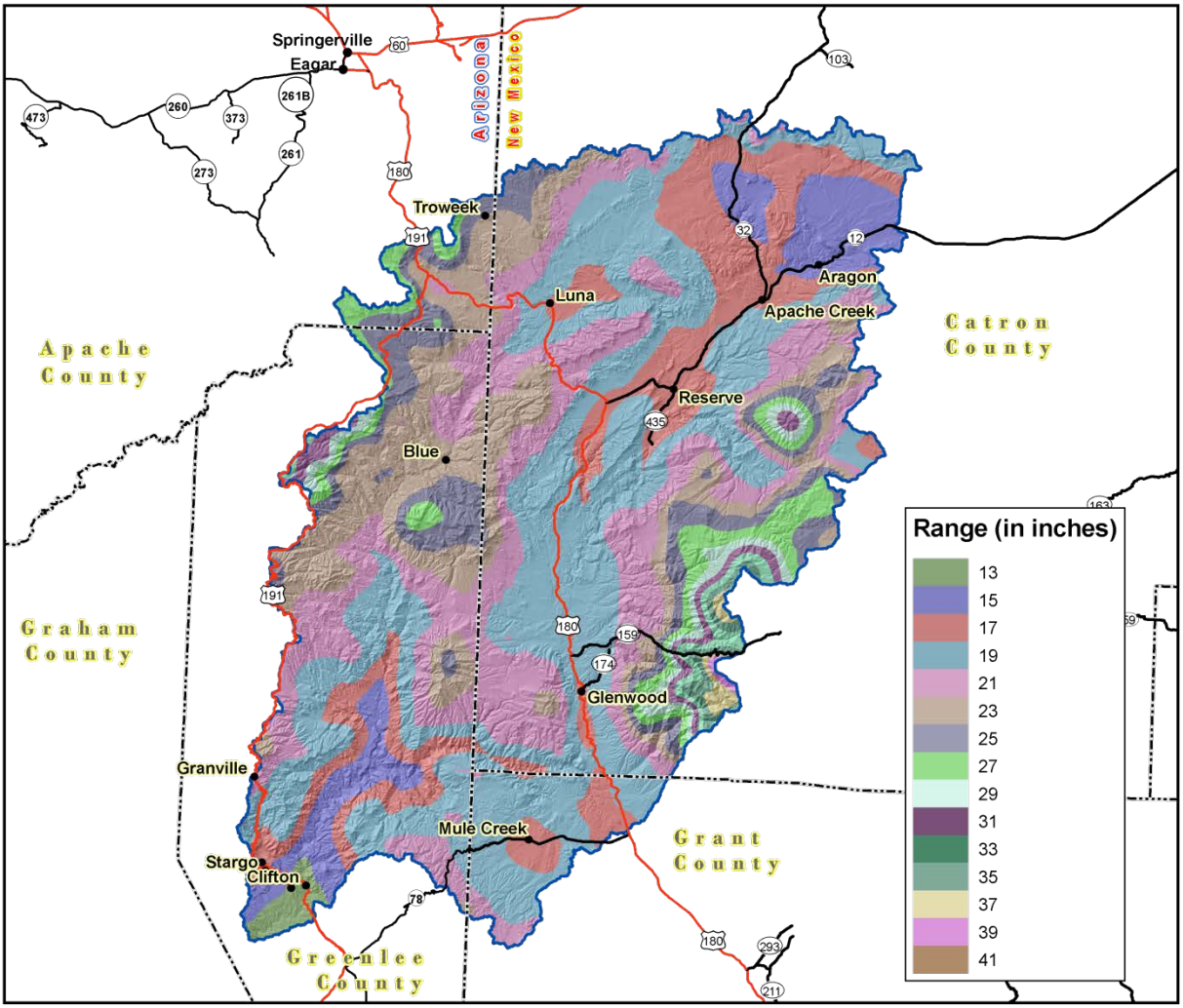


Figure 4. San Francisco Watershed Annual Precipitation.

Land Ownership [2,3]

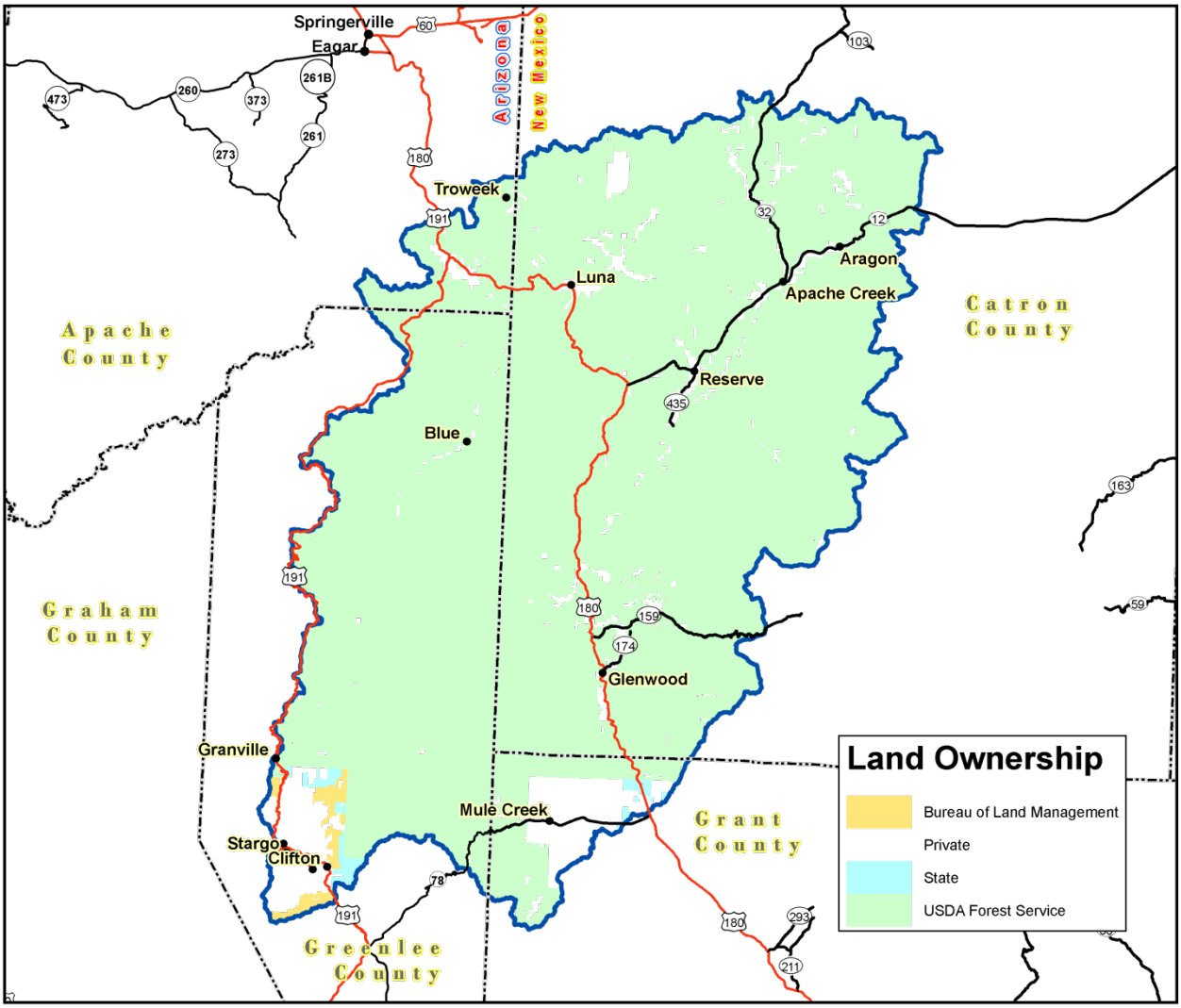
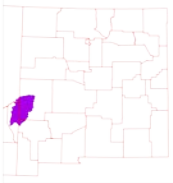


Figure 5. San Francisco Watershed Land Ownership.

Land Ownership

COUNTY	BLM	Private	State-AZ	State - NM	USDA Forest Service
Catron, NM	403	49,256			1,044,023
Grant, NM		42,795		3,260	55,301
Apache, AZ		5,248			56,395
Greenlee, AZ	11,552	41,188	7,443		480,216
Watershed (∑)	11,955	138,487	7,443	3,260	1,635,935
% Watershed	1%	8%	<1%	<1%	91%

Table 2. Land Ownership in the San Francisco Watershed.



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Fires [4]

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

111,379 acres in the San Francisco 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.

Wallow Fire

Date Started: May 29, 2011, closed out July 8, 2011

Cause: Human

Size: **538,049** acres total, largest fire in Arizona history

156,678 acres in the San Francisco watershed

Buildings: 4403 threatened, 6 damaged, 72 destroyed

Personnel: 4,734

The fire started as an unattended camp fire that got whipped up by heavy winds.

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.

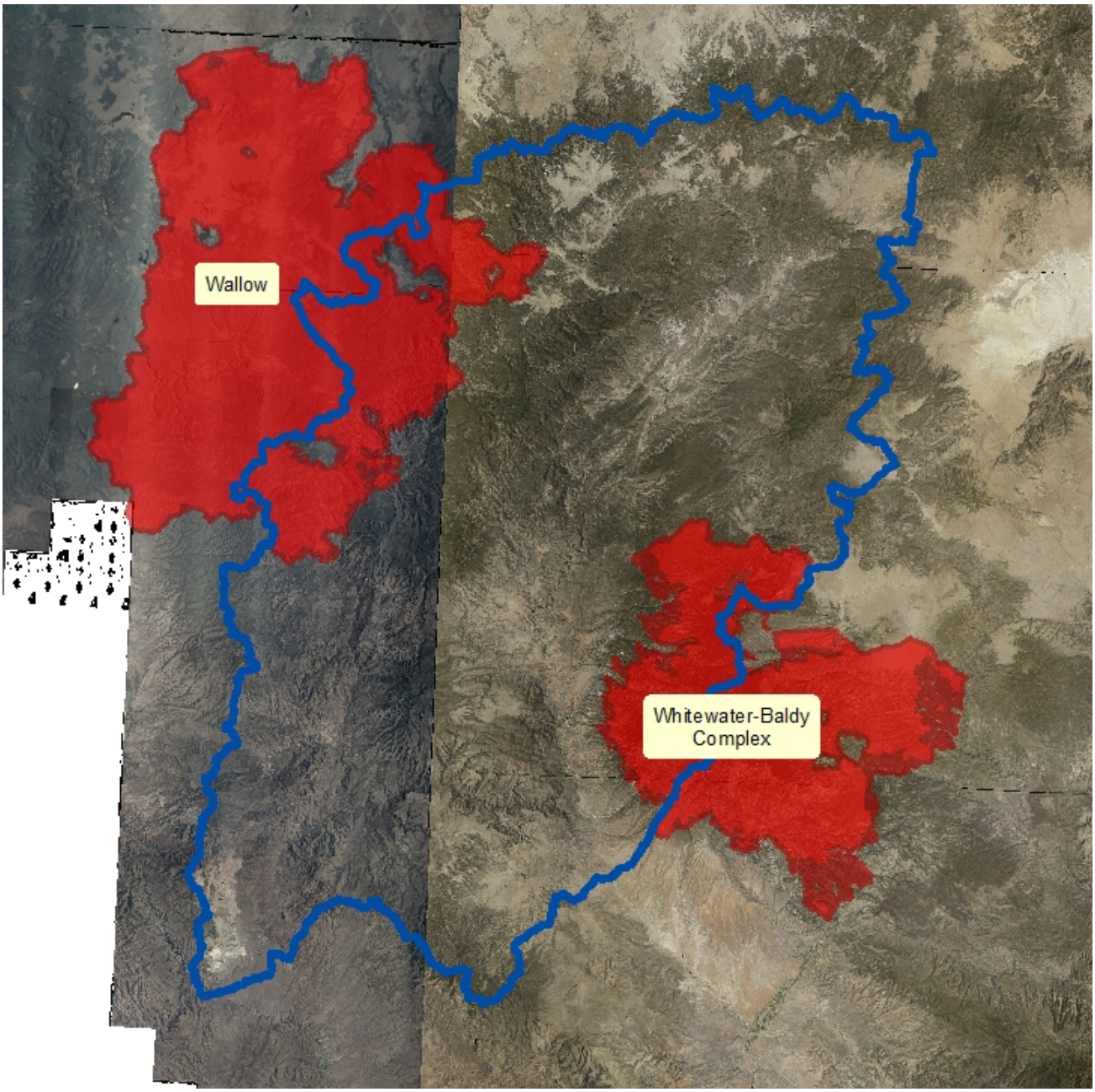

Figure 6. Wallow and Whitewater-Baldy Fires.

Land Use / Land Cover [5,6]

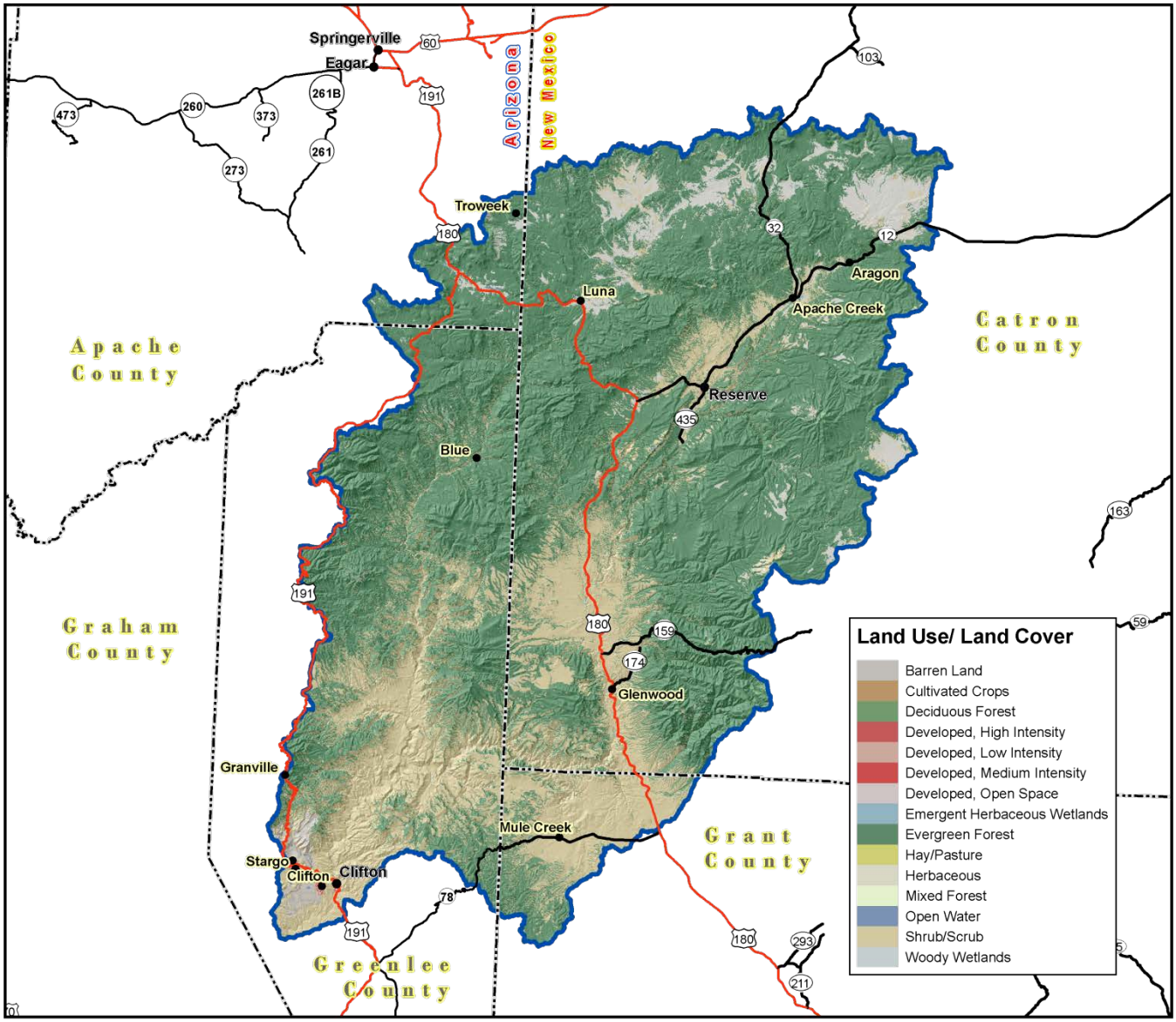

Figure 7. Subset of the National Land Cover Dataset in the San Francisco Watershed.

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	1,258,734	70%
Shrub/Scrub	441,978	25%
Herbaceous	77,710	4%
Barren Land	11,635	1%
Developed, Open Space	6,891	< 1%
Deciduous Forest	2,562	< 1%
Developed, Low Intensity	2,257	< 1%
Emergent Herbaceous Wetlands	1,256	< 1%
Woody Wetlands	634	< 1%
Open Water	541	< 1%
Developed, Medium Intensity	336	< 1%
Cultivated Crops	201	< 1%
Hay/Pasture	104	< 1%
Developed, High Intensity	22	< 1%
Mixed Forest	0	< 1%

Table 3. Extent of NLCD classes in the San Francisco Watershed.

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Land Use / Land Cover

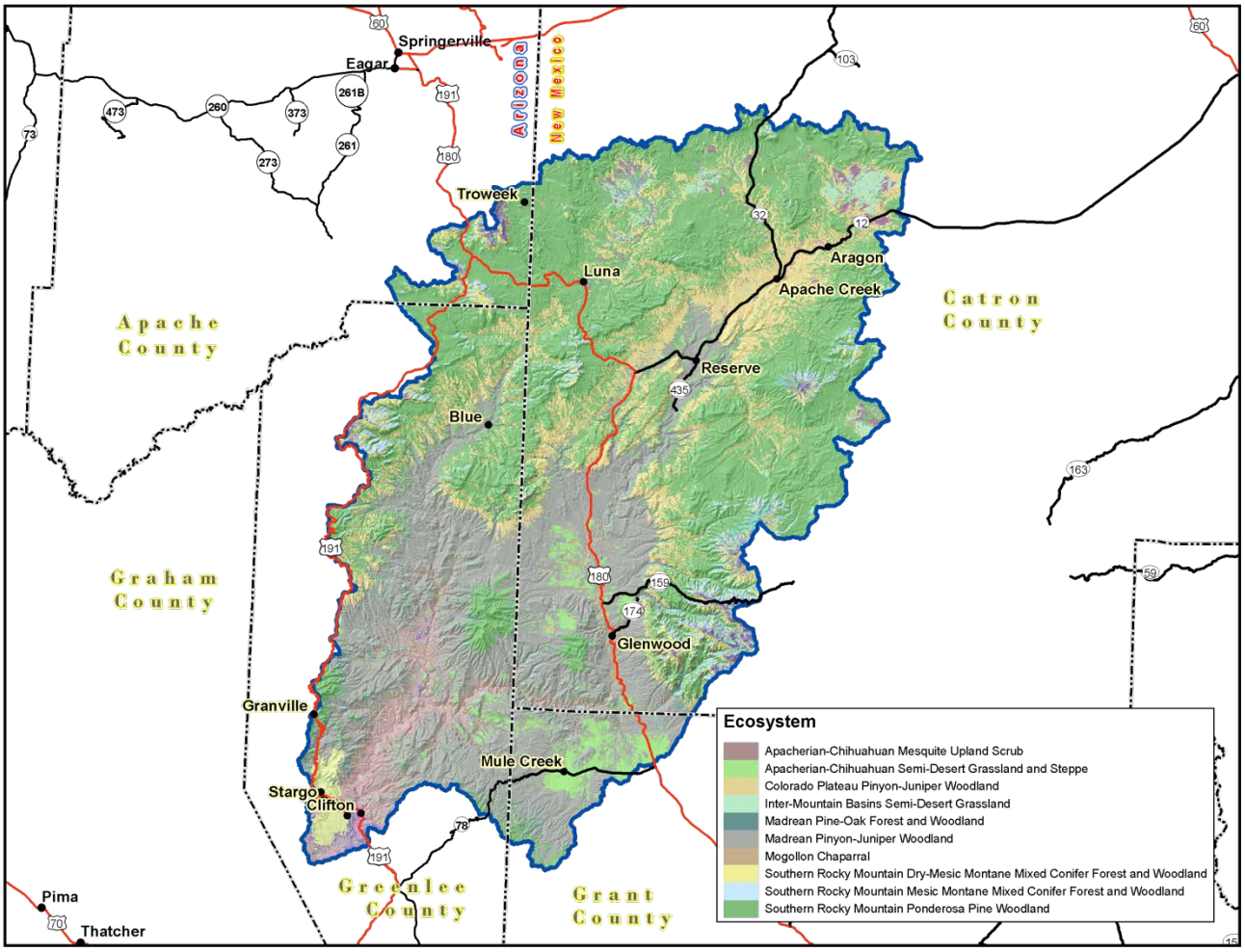


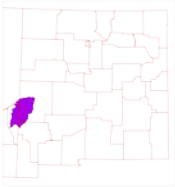
Figure 8. Subset of the SWREGAP over the San Francisco Watershed. The 10 dominant ecosystems are displayed in the legend.

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	748,510	42%
Madrean Pinyon-Juniper Woodland	457,637	25%
Colorado Plateau Pinyon-Juniper Woodland	218,889	12%
Apacherian-Chihuahuan Semi-Desert Grassland and Steppe	61,731	3%
Apacherian-Chihuahuan Mesquite Upland Scrub	60,317	3%
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	49,805	3%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	36,440	2%
Mogollon Chaparral	23,710	1%
Inter-Mountain Basins Semi-Desert Grassland	23,310	1%
Madrean Pine-Oak Forest and Woodland	20,258	1%

Table 4. SW Region Gap analysis ecosystem acreages.



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Hydrology [7,8,9,10,11,12,13]

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 7,910 miles (12,730 km) of water courses in the San Francisco Watershed. The majority of these courses typically flow intermittently in summer months during periods associated with high intensity convective thunderstorms.

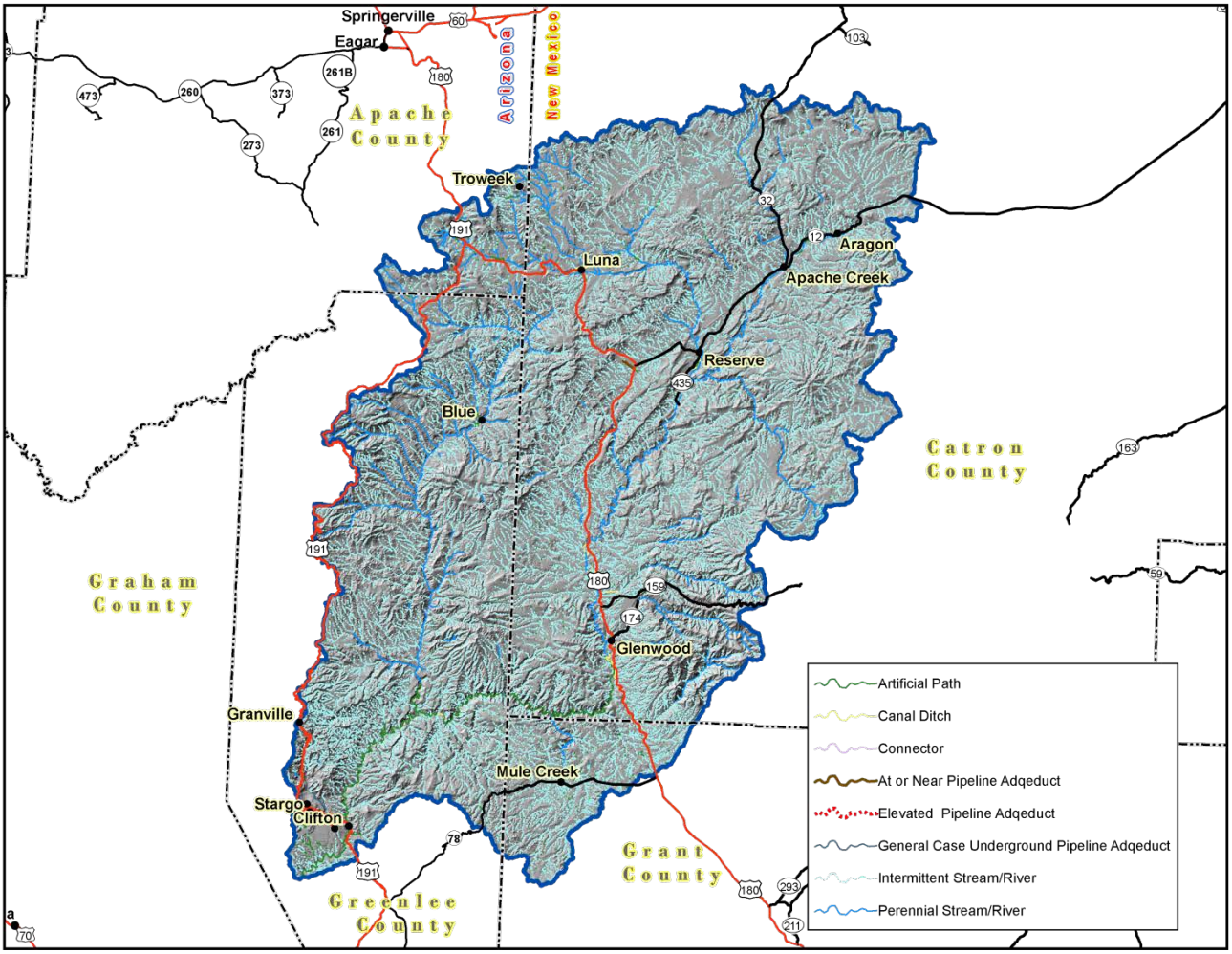
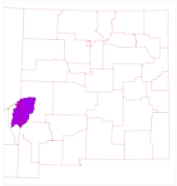


Figure 9. National Hydrologic Dataset (NHD) of the San Francisco Watershed.



Water Course Type	Miles
Artificial Path	**135**
Canal / Ditch	**16**
Connector	**2**
Intermittent Stream / River	**7,107**
Perennial Stream / River	**646**
General Case Underground Pipeline	**3**
At or Near Surface Aqueduct Underground Pipeline	**1**
Underground Pipeline	**0**
Sum (∑)	**7,910**

Table 5. NHD Water Course Type and Extents

Gauging Stations:

There are 13 dams and water gauging stations in the watershed. USGS Site 09444000 is located at the southeast corner of the watershed at San Francisco River near Glenwood, NM. During the period from 1928 to 2011 this site has had mean annual discharge of 87 cubic feet per second ranging from 13.9 (1956) to 351.1 (1979) cubic feet per second.

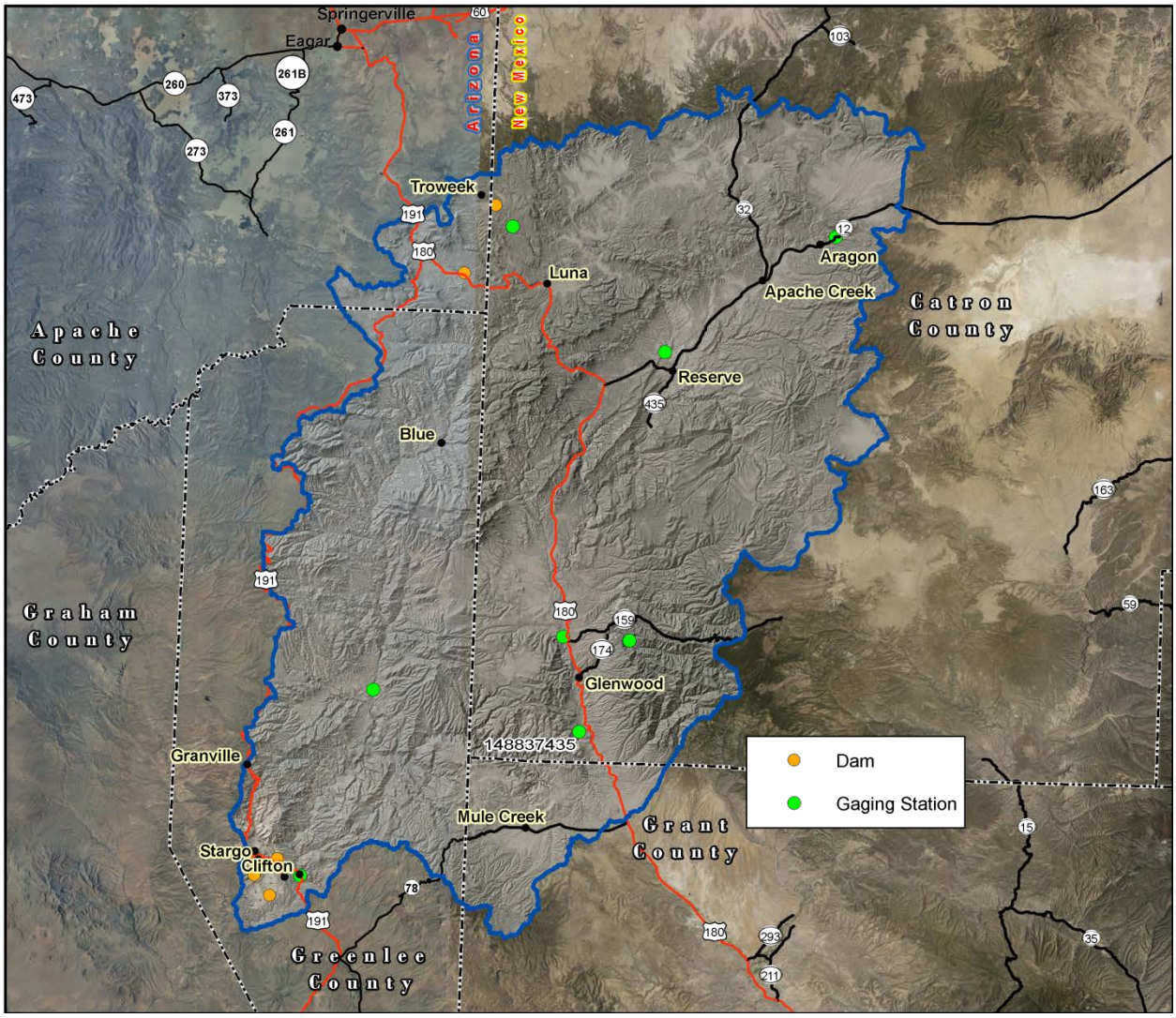


Figure 9. Gauging Stations in the San Francisco Watershed.

Hydrology

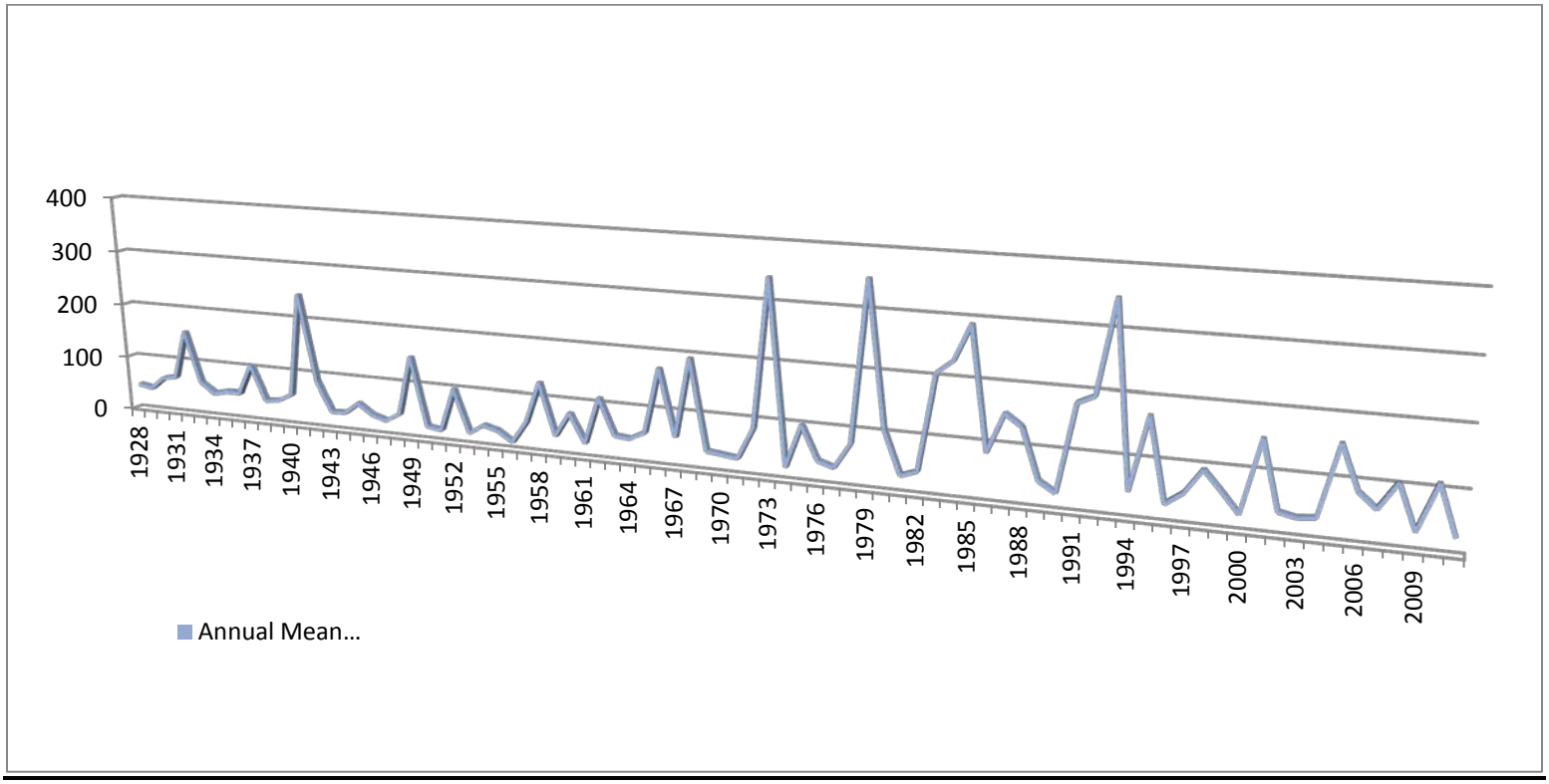


Figure 11. Monthly Average of Mean Daily Flow on the San Francisco River near Glenwood, NM. Period of Observation: 1928 – 2011.

Hydrology

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 NMWQCC has defined the San Francisco Watershed as part of the Gila-San Francisco Basin.

The New Mexico portion of the San Francisco Watershed has the following reaches listed as 303 (d) Impaired Surface Waters:

1. Centerfire Creek (San Francisco R to headwaters)
2. Negrito Creek (Tularosa River to conflu of N and S forks)
3. San Francisco River (Dry Creek to Whitewater Creek)

The designated uses for these reaches have been listed in Table 6.

Listed Use	1	2	3
Domestic Water Supply	x	x	
Fish Culture	x	x	
High Quality Coldwater Aquatic Life	NS	NS	
Irrigation	x	x	x
Livestock Watering	NA	x	x
Marginal Coldwater Aquatic Life			NS
Marginal Warmwater Aquatic Life			NS
Secondary Contact	NA	NA	x
Wildlife Habitat	NA	x	x

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

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.

There are no designated water bodies for the new Mexico portion of the San Francisco Watershed.

The river and streams reaches total 37 miles (60 km)

Probable Causes of Impairment	1	2	3
Benthic-Macroinvertebrate Bioassessments (Streams)			x
Nutrient/Eutrophication Biological Indicators	x		
pH	x		
Specific Conductance	x		
Temperature, water	x	x	

Table 7. NMWQCC Possible Causes of Impairment.

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). This report is currently Draft 2010 status and is unknown when it will be released the final.

6. **Strayhorse Creek – San Francisco River**
7. **Skully Creek – San Francisco River**
8. **San Francisco River – Limestone Gulch**
9. **Blue River – Limestone Gulch**

The Impaired river reaches in Arizona total 57 miles (91 km).

Probable Causes of Impairment	6	7	8	9
E. coli	x	x	x	x

Table 8. ADEQ Possible Causes of Impairment.

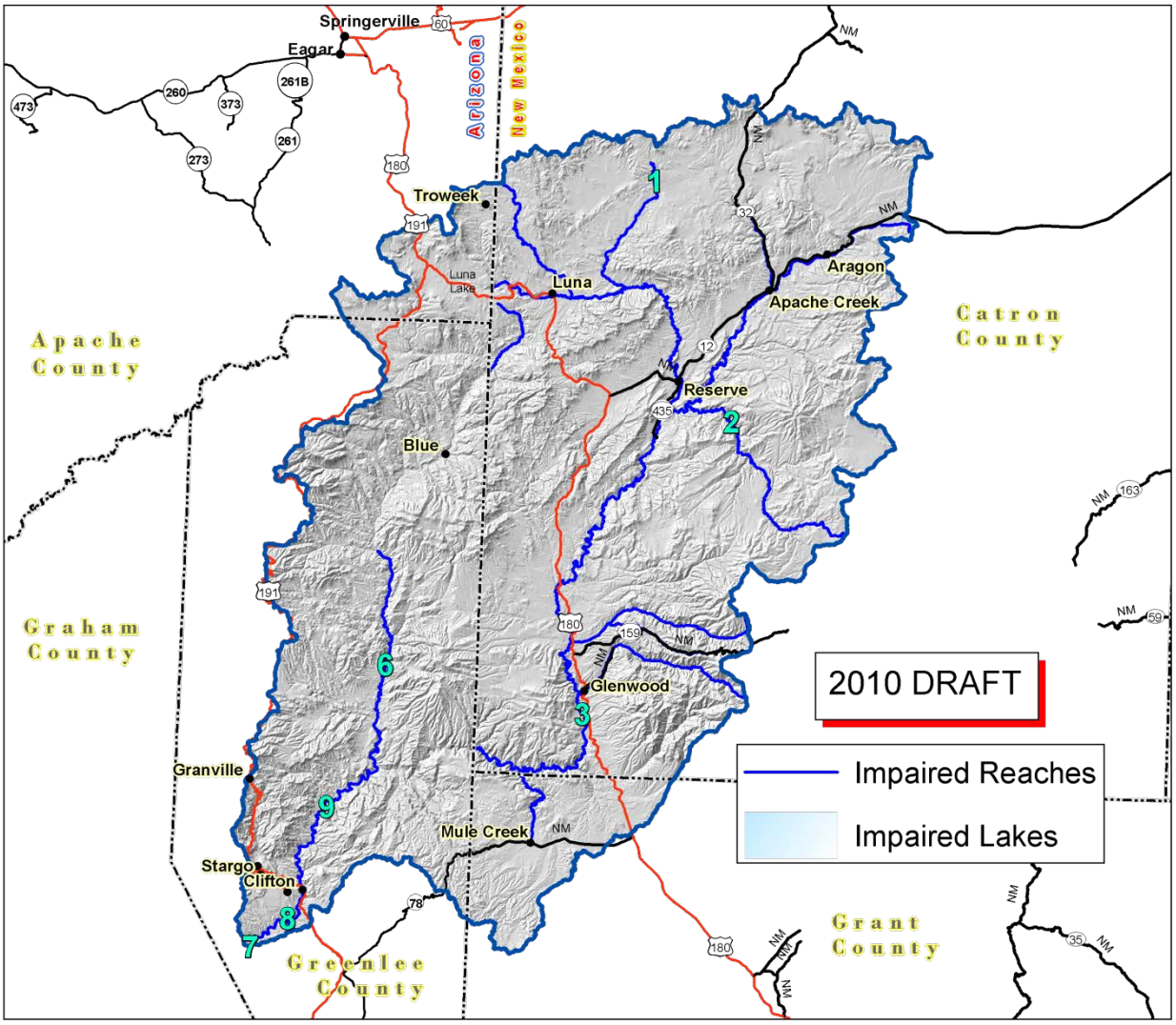


Figure 12. 303(d) Impaired Waters.

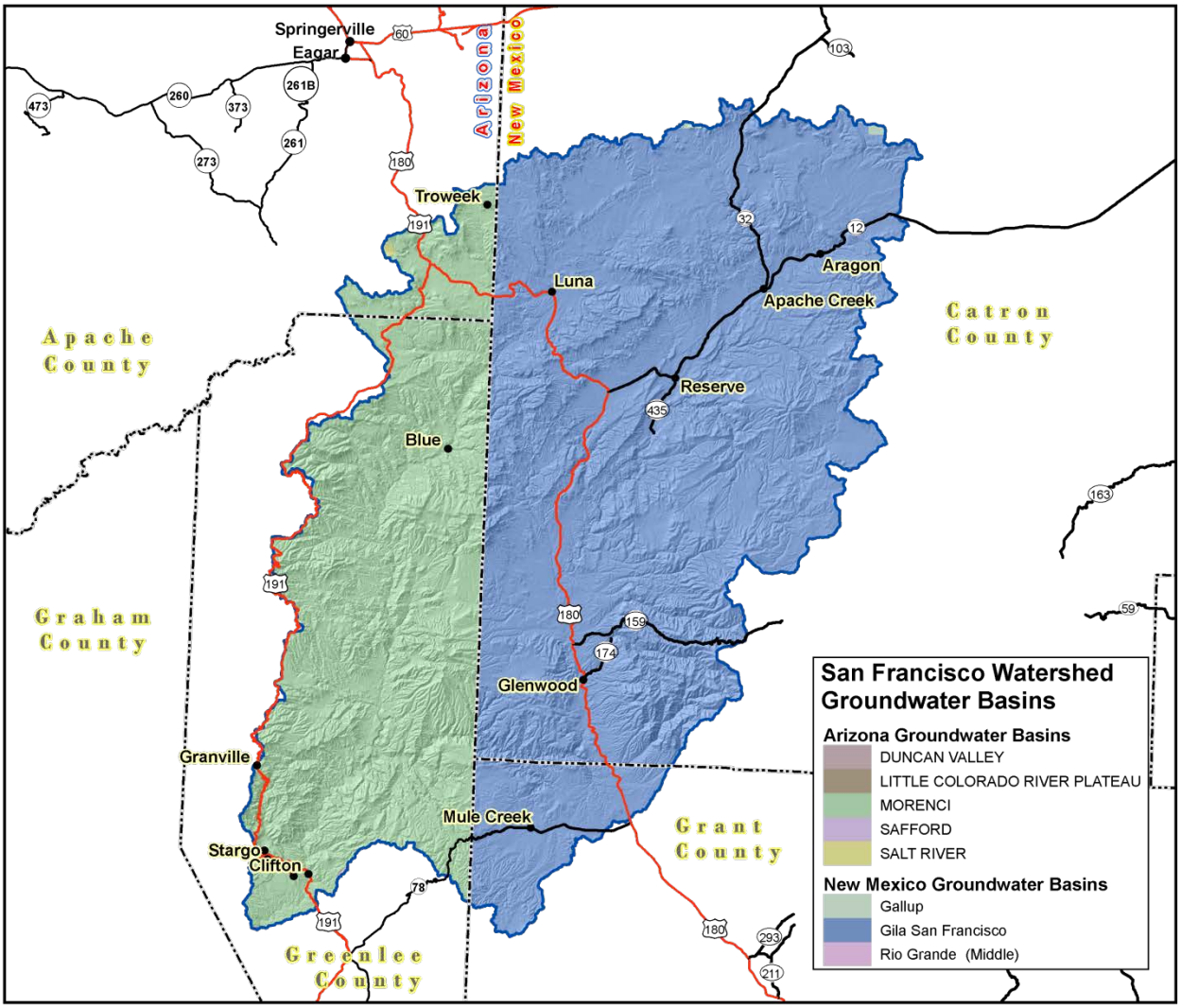


Figure 13. Declared Groundwater Basins of the San Francisco Watershed.

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 eight declared groundwaters in the San Francisco Watershed: Gallup, Gila San Francisco, and Rio Grande (Middle) Underground Water Basin, and while in Arizona portions are in the Duncan Valley, Little Colorado River Plateau, Morenci, Safford and Salt River.

Threatened and Endangered Species [14,15]

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. Table 9 lists those species which are currently listed and tracked in the San Francisco Watershed in New Mexico and Table 10 in Arizona.

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	Dicotyledonae	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 the watershed in New Mexico.

ARIZONA:
C = Candidate. Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.
HS = Highly Safeguarded: no collection allowed
PS: C = Partial Status: listed Endangered or Threatened, but not in entire range. Candidate. Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.
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 Status
Chiricahua Leopard Frog	Lithobates chiricahuensis	LT	WSC
Northern Leopard Frog	Rana pipiens		WSC
Lowland Leopard Frog	Rana yavapaiensis	SC	WSC
Northern Goshawk	Accipiter gentilis	SC	WSC
Common Black-Hawk	Buteogallus anthracinus		WSC
Yellow-billed Cuckoo (Western U.S. DPS)	Coccyzus americanus	PS:C	WSC
Gray Catbird	Dumetella carolinensis		WSC
Southwestern Willow Flycatcher	Empidonax traillii extimus	LE	WSC
American Peregrine Falcon	Falco peregrinus anatum	SC	WSC
Bald Eagle	Haliaeetus leucocephalus	SC	WSC
Bald Eagle - Winter Population	Haliaeetus leucocephalus (wintering pop.)	SC	WSC
Mexican Spotted Owl	Strix occidentalis lucida	LT	WSC
Gila Chub	Gila intermedia	LE	WSC
Roundtail Chub	Gila robusta	C	WSC
Apache Trout	Oncorhynchus apache	LT	WSC
Gila Trout	Oncorhynchus gilae	LT	WSC
Loach Minnow	Tiaroga cobitis	LE	WSC
Razorback Sucker	Xyrauchen texanus	LE	WSC
Allen's Lappet-browed Bat	Idionycteris phyllotis	SC	
Arizona Myotis	Myotis occultus	SC	
Long-legged Myotis	Myotis volans	SC	
New Mexico meadow jumping mouse	Zapus hudsonius luteus	C	WSC
Goodding Onion	Allium gooddingii	SC	HS
Western Fairy Slipper	Calypso bulbosa		SR
Mexican Hemlock Parsley	Conioselinum mexicanum	SC	
Yellow Lady's-slipper	Cypripedium parviflorum var. pubescens		HS
San Carlos Wild-buckwheat	Eriogonum capillare	SC	SR
Purple Adder's Mouth	Malaxis porphyrea		SR
Maguire's Penstemon	Penstemon linarioides ssp. maguirei		SR
Blumer's Dock	Rumex orthoneurus	SC	HS
Gila Groundsel	Senecio quaerens	SC	SR
White Mountains Clover	Trifolium neurophyllum	SC	

Table 10. Threatened and Endangered Plant and Animal Species for the watershed in Arizona.

Invasive Species [16]

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 San Francisco Watershed, the SWEMP has identified 5 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**
Asteraceae (Sunflower Family)	**Musk Thistle**
Lythraceae (Loosestrife Family)	***Purple Loosestrife***
Asteraceae (Sunflower Family)	***Yellow Starthistle***

Table 11. Invasive Species Recognized by the SWEMP.

Common Resource Areas[17]

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.

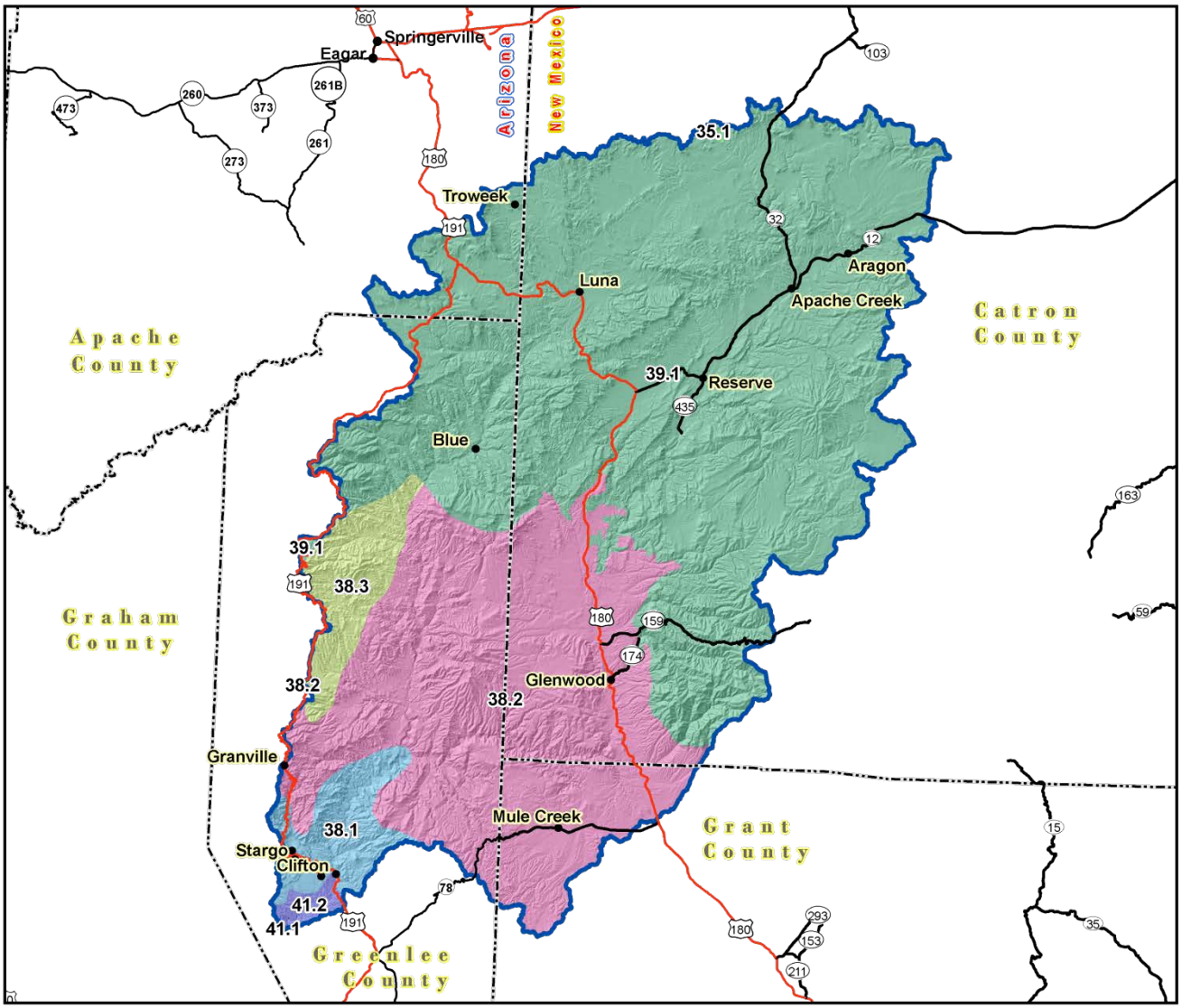


Figure 14. Common Resource Areas of the San Francisco Watershed.

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.

38.1 Lower Interior Chaparral

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.

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.

38.3 Interior Chaparral Forests

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 5100 to 7000 feet. Precipitation averages 20 to 27 inches per year. The soil temperature regime is mesic. The soil moisture regime is typic ustic. Vegetation includes Gambel oak, Arizona white oak, Emory oak, pinyon, juniper, Arizona cypress, and ponderosa pine.

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 [18]

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					2	118	1	1,716	2	4,132	5	5,966
Forage and Biomass Planting					1	74			2	28	3	102
Forage Harvest Management	1	64			2	44	1	5	1	54	5	166
Forest Stand Improvement									1	14,167	1	14,167
Integrated Pest Management (IPM)			1	16					3	115	4	131
Irrigation System, Sprinkler					1	28	1	3	1	4	3	35
Irrigation Water Management	1	64			2	39	1	11	2	77	6	191
Land Smoothing									1	21	1	21
Nutrient Management							1	17	2	145	3	162
Prescribed Grazing	1	154	1	33,402	3	14,128	2	3,284	4	31,498	11	82,466
Upland Wildlife Habitat Management	3	660					2	3,284	3	27,519	8	31,463
Wetland Restoration									1	421	1	421
SUM (∑)	6	942	2	33,418	11	14,431	9	8,320	23	78,179	51	135,289

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	4					1	4
Fence	1	33,402			1	4,876	2	10,394	1	54,352	5	103,024
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	1	21					1	9			2	30
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	2	216			1	63	2	89	1	45	6	412
Irrigation Water Conveyance, Pipeline, Steel							2	51			2	51
Pipeline			1	28,212	3	28,297	1	4,210	1	28,212	6	88,932
Streambank and Shoreline Protection					1	310					1	310
SUM (∑)	4	33,639	1	28,212	7	33,550	8	14,753	3	82,610	23	192,763

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

Soil Resource Inventory[19]

The San Francisco Watershed has a number of certified National Cooperative Soil Survey (NCSS) inventories. The Apache-Sitgreaves and Gila National Forests are not covered, but have soils information being collected 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:

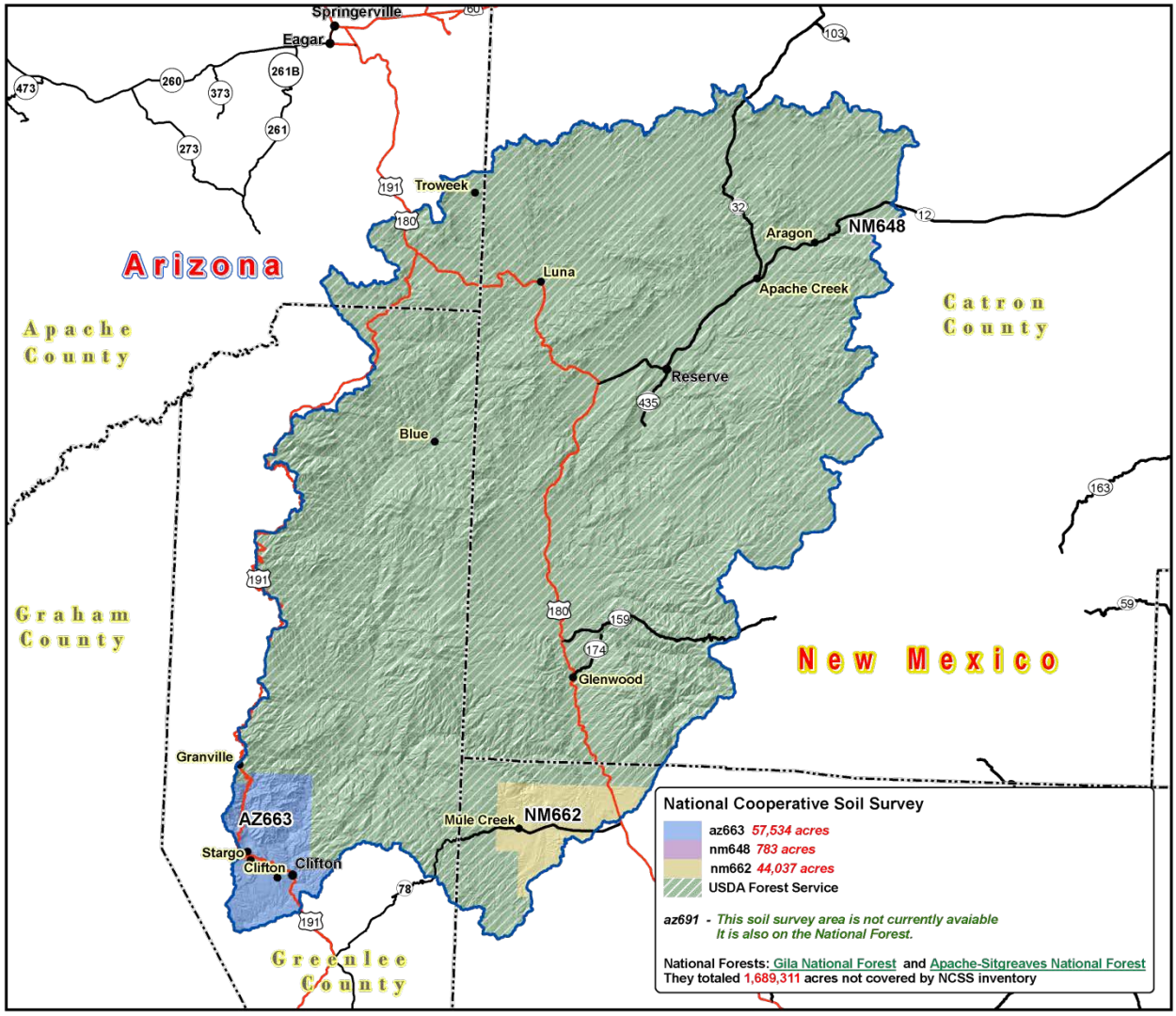


Figure 15. National Cooperative Soil Survey coverage of the San Francisco Watershed.

Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the San Francisco 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.

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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.

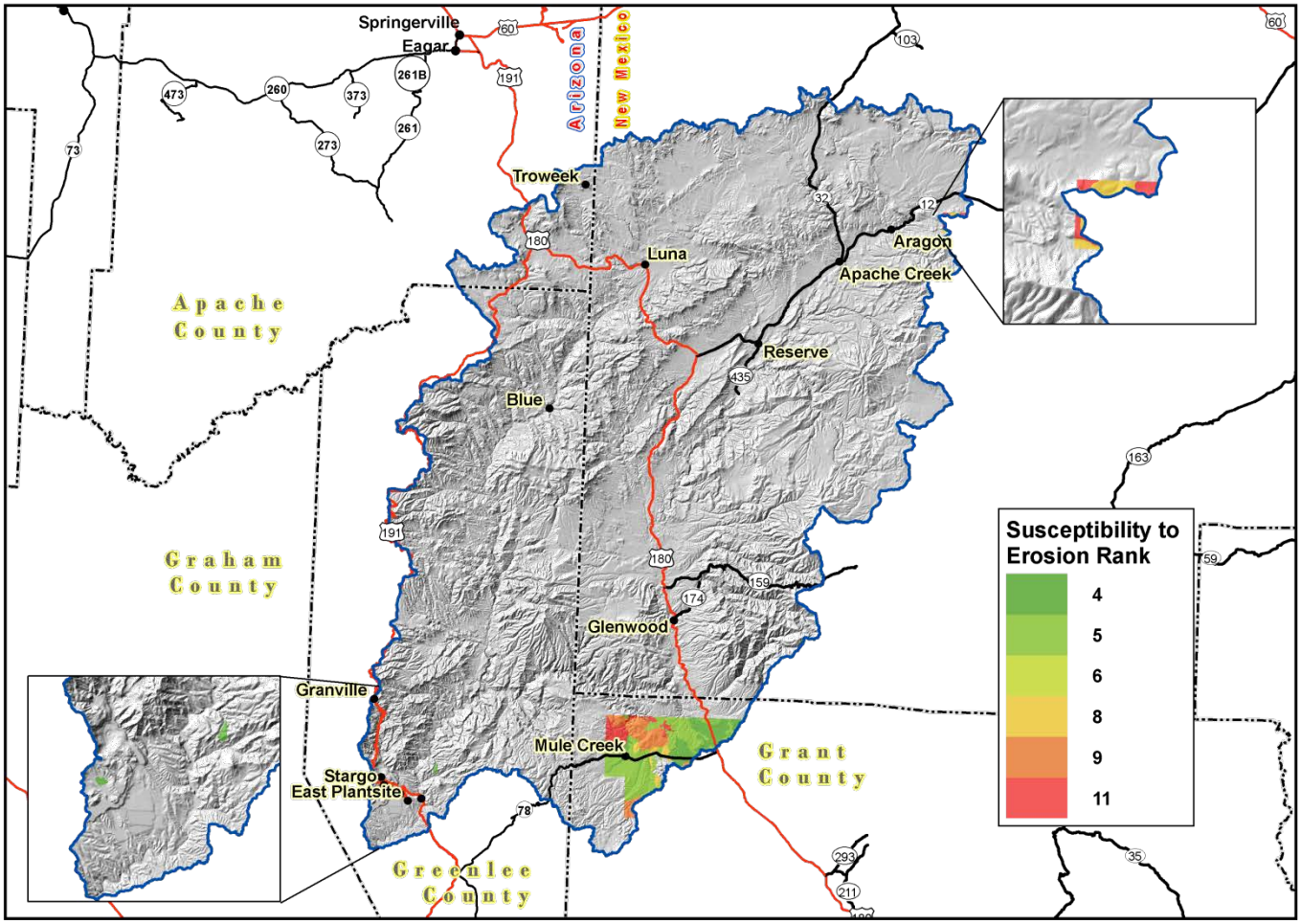
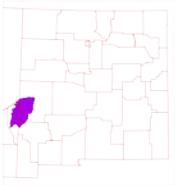


Figure 16. San Francisco Watershed Erosion Potential.



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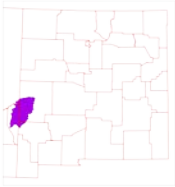
Soil Resource Inventory

Rank	Acres
4	10,049
5	19,316
6	18
8	2,155
9	7,409
11	4,426
Sum(∑)	43,372

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



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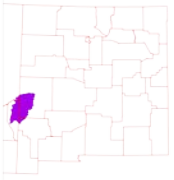
Socioeconomic Data (2010)[20]

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
Catron, NM	3,725	709	3,344	16	99	7	0	142	117	40,906
Apache, AZ	71,518	4,113	16,634	175	52,154	203	26	904	1,422	36,915
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).



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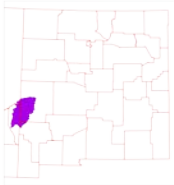

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