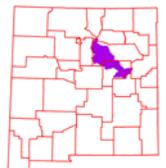
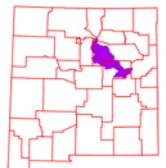


## Rapid Watershed Assessment Pecos Headwaters Watershed



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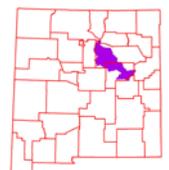


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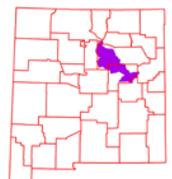
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## Overview

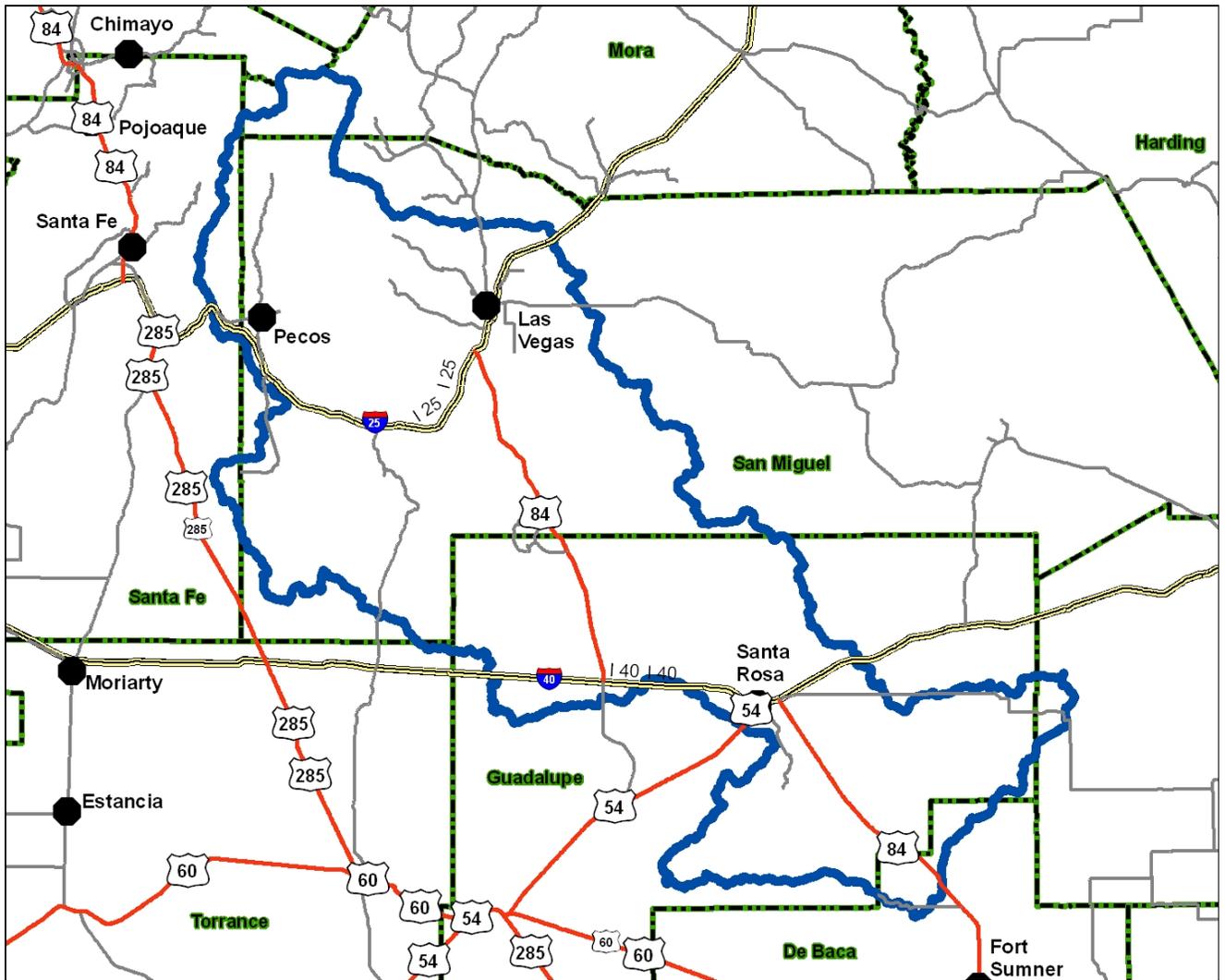
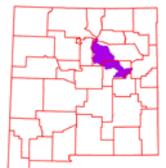


Figure 1. Pecos Headwaters Watershed Overview

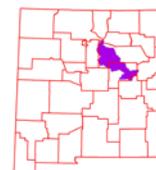


## Overview

The Pecos Headwaters Watershed is located northeast of central New Mexico. It covers 2,226,271 total acres (8,423 sq. km). Portions of the Pecos Headwaters watershed extend into Colfax, Los Alamos, Mora, Rio Arriba, Sandoval, Santa Fe, and Taos counties. Table 1 summarizes the distribution of the Pecos Headwaters watershed.

**Table 1. Pecos Headwaters watershed acreage distribution.**

	County Acres Total	Acres in HUC	% of HUC in County	% of County in HUC
<b>DeBaca</b>	<b>1,492,600</b>	<b>43,324</b>	<b>3</b>	<b>2</b>
<b>Guadalupe</b>	<b>1,938,748</b>	<b>880,980</b>	<b>45</b>	<b>40</b>
<b>Mora</b>	<b>1,236,472</b>	<b>42,594</b>	<b>3</b>	<b>2</b>
<b>Quay</b>	<b>1,843,723</b>	<b>14,976</b>	<b>1</b>	<b>1</b>
<b>Rio Arriba</b>	<b>3,772,816</b>	<b>5</b>	<b>&lt;1</b>	<b>&lt;1</b>
<b>San Miguel</b>	<b>3,028,627</b>	<b>1,188,584</b>	<b>39</b>	<b>53</b>
<b>Santa Fe</b>	<b>1,222,180</b>	<b>54,074</b>	<b>4</b>	<b>2</b>
<b>Torrance</b>	<b>2,139,990</b>	<b>1,732</b>	<b>&lt;1</b>	<b>&lt;1</b>
<b>Sum (Σ)</b>		<b>2,226,271</b>		<b>100</b>



## **Physical Setting**

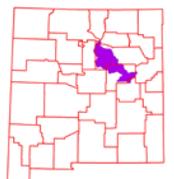
### **Geology:**

The Pecos River Headwaters hydrologic unit starts on the east side of the Sangre de Cristo Mountains and ends at Sumner Lake. The hydrologic unit starts in the Southern Rocky Mountain physiographic province, proceeds to the Basin and Range physiographic province and ends up in the Great Plains physiographic province.

The east side of the Sangre de Cristos Mountains contains Permian and Pennsylvanian Period shales and limestones. The Permian rocks contain a large amount of salt and gypsum, which along with the limestone cause sinkholes and karst topography when dissolved. Upon entering the valley floor, the Pecos River flows over Cretaceous sandstones and shales. Near Romeroville, the colorful sandstones and siltstones of the Triassic Period include the Chinle formation and the Santa Rosa sandstone. Near Santa Rosa the river snakes through collapsed caverns. Also on the valley floors are Quaternary period alluvial and eolian deposits of sands, silts, gravels and clays.

Resource concerns are high sediment erosion and water runoff as the result of forest fires. In addition the lowering of valleys by river incision is a continuing process. Many valleys are flanked by terraces. 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 in the limestones is usually along fracture zones which are hard to intercept with water wells. Groundwater quality ranges from good to poor 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 Rio Grande-Albuquerque 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.



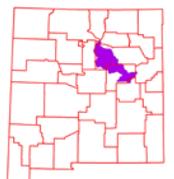
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.



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.



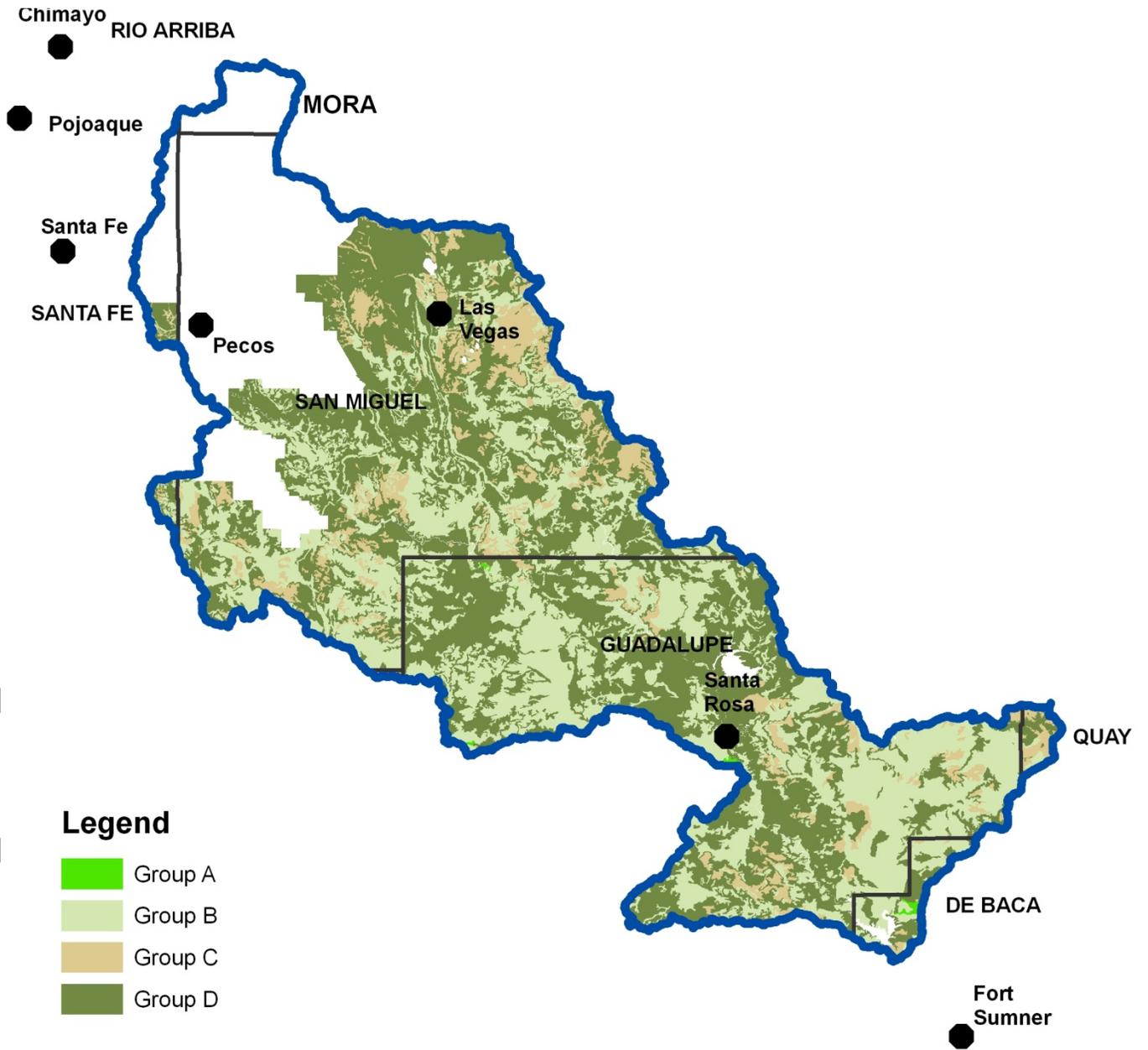
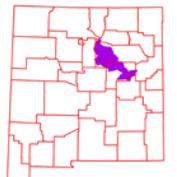


Figure 2. Hydrologic Soil Groups



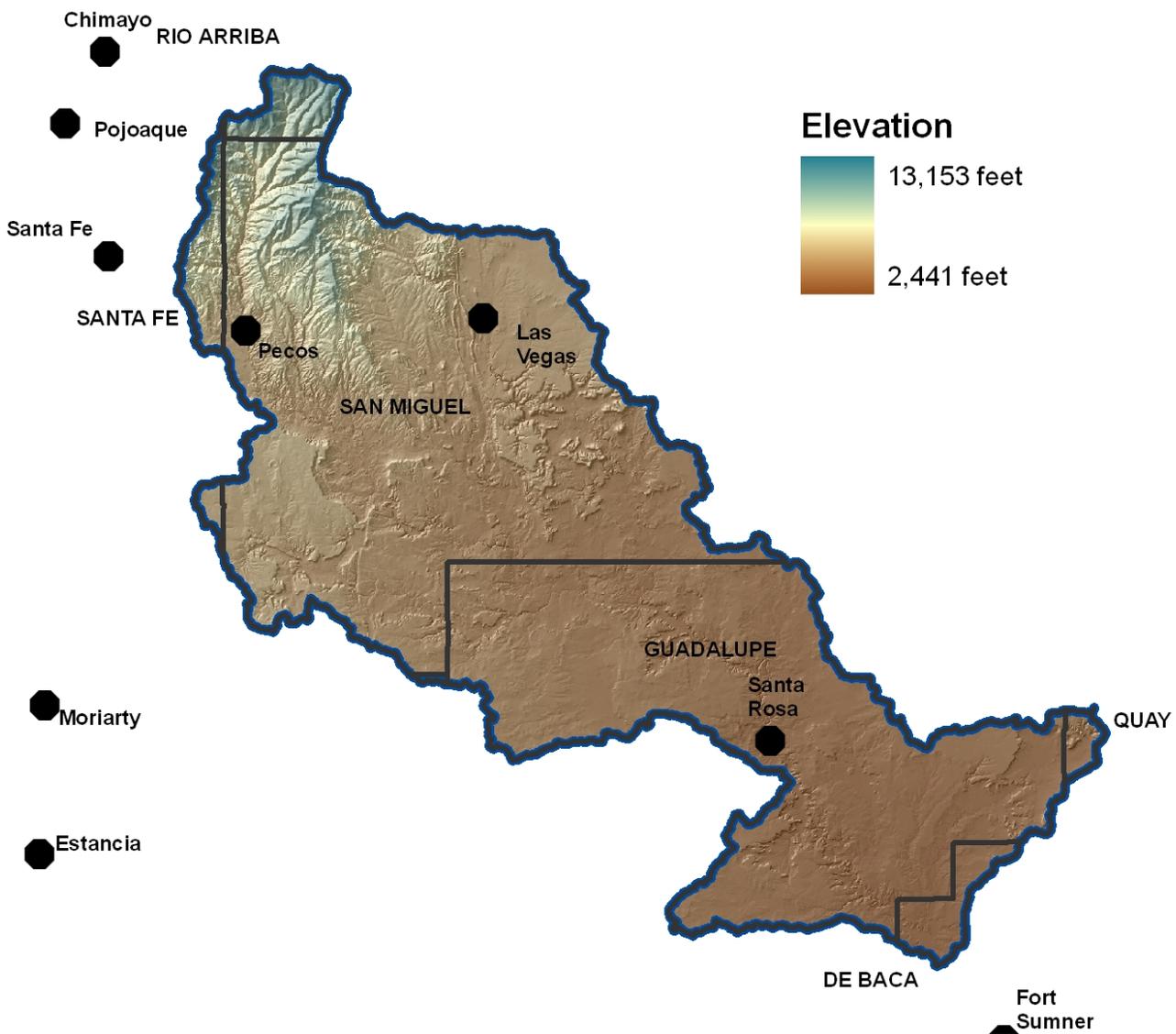
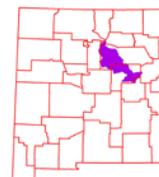


Figure 3. Pecos Headwaters Watershed Shaded Relief



**Precipitation**

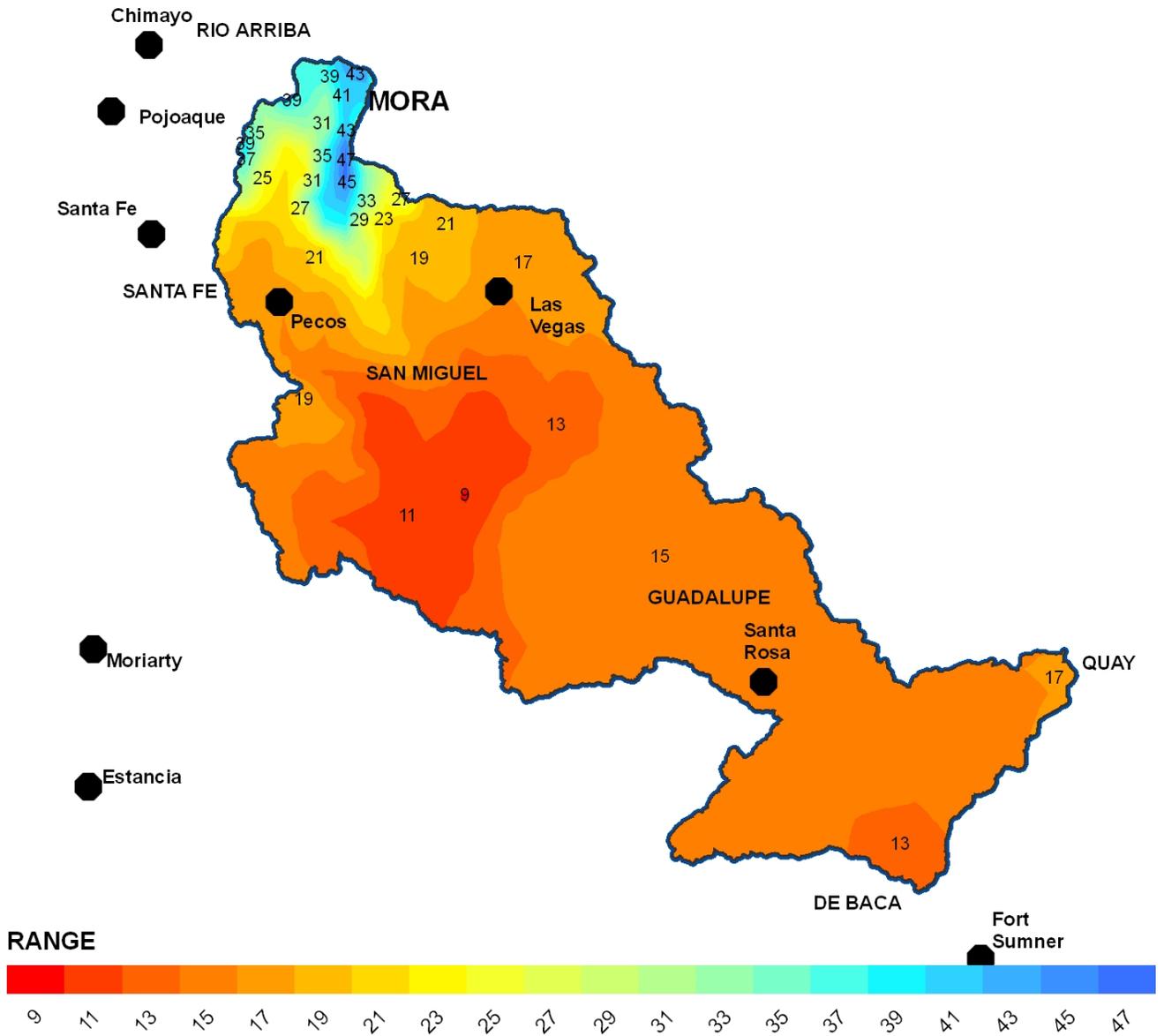
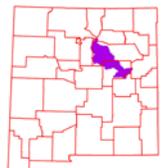


Figure 4. Pecos Headwaters Watershed Annual Precipitation.



**Land Ownership <sup>2</sup>**

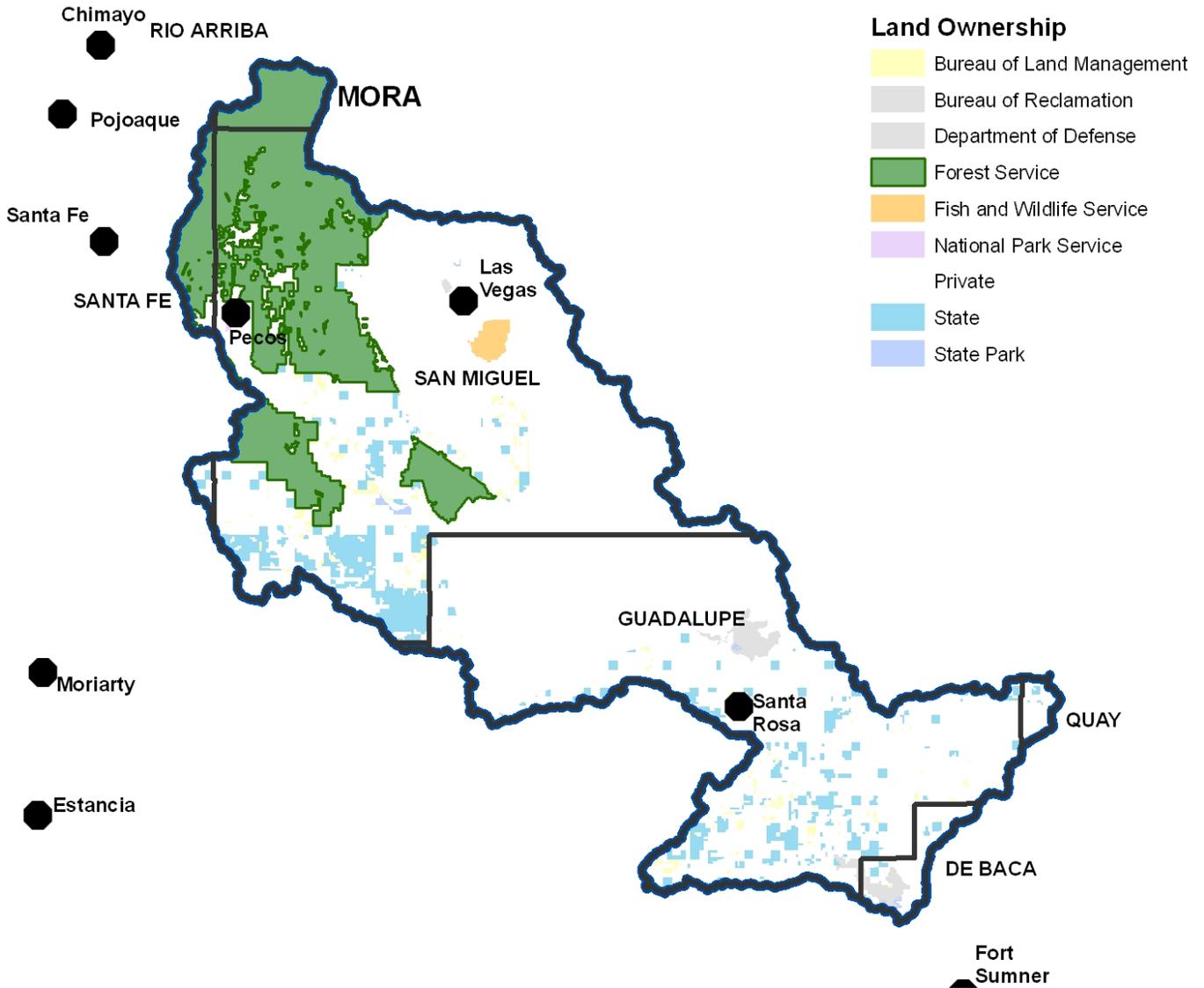
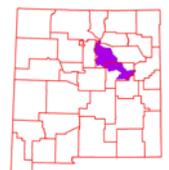


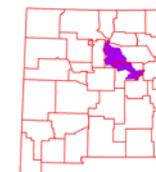
Figure 5. Pecos Headwaters Watershed Land Ownership.



### Land Ownership

<u>COUNTY</u>	<u>BLM</u>	<u>BoR</u>	<u>DoD</u>	<u>FS</u>	<u>FWS</u>	<u>NPS</u>	<u>Private</u>	<u>State</u>	<u>State Parks</u>
DeBaca	242	7,820					31,632	2,819	842
Guadalupe	8,295	2,391	11,818				799,957	59,191	364
Mora				42,625					
Quay	3						14,140	842	
Rio Arriba				5					
San Miguel	13,292		802	303,377	9,325	329	784,338	76,274	1,758
Santa Fe				40,876		312	11,014	1,910	
Torrance							1,332	402	
<b>Watershed (Σ)</b>	<b>21,832</b>	<b>10,211</b>	<b>12,620</b>	<b>386,883</b>	<b>9,325</b>	<b>641</b>	<b>1,642,413</b>	<b>141,438</b>	<b>2,964</b>
<b>% Watershed</b>	<b>1</b>	<b>&lt;1</b>	<b>1</b>	<b>17</b>	<b>&lt;1</b>	<b>&lt;1</b>	<b>74</b>	<b>6</b>	<b>&lt;1</b>

Table 2. Land ownership in the Pecos Headwaters watershed.



**Land Use / Land Cover** <sup>3, 4</sup>

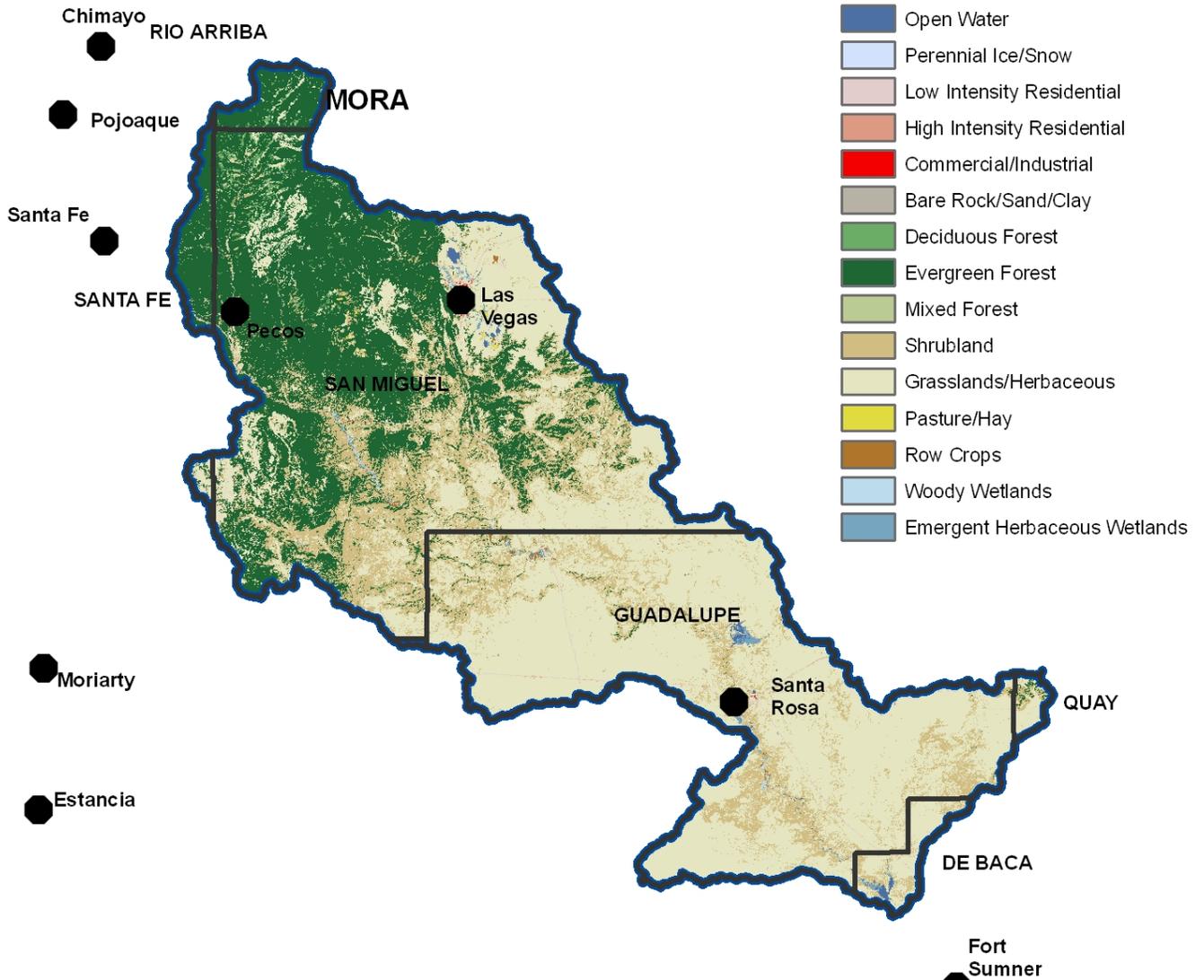
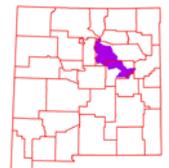


Figure 6. Subset of the National Land Cover Dataset over the Pecos Headwaters Watershed.

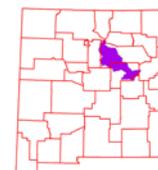


## Land Use / Land Cover

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.

<u>Land use / Land cover</u>	<u>Acres</u>	<u>% of Watershed</u>
grasslands, herbaceous	1,124,842	51%
evergreen forest	621,199	28%
shrubland	428,052	19%
Low Intensity Residential	12,796	1%
Deciduous forest	11,868	1%
Emergent Herbaceous Wetlands	7,952	< 1%
Open Water	5,602	< 1%
Woody Wetlands	3,549	< 1%
High Intensity Residential	3,117	< 1%
Mixed Forest	2,458	< 1%
Row Crops	2,386	< 1%
Bare Rock/Sand/Clay	1,581	< 1%

Table 3. Extent of NLCD classes in the Pecos Headwaters watershed.



## Land Use / Land Cover

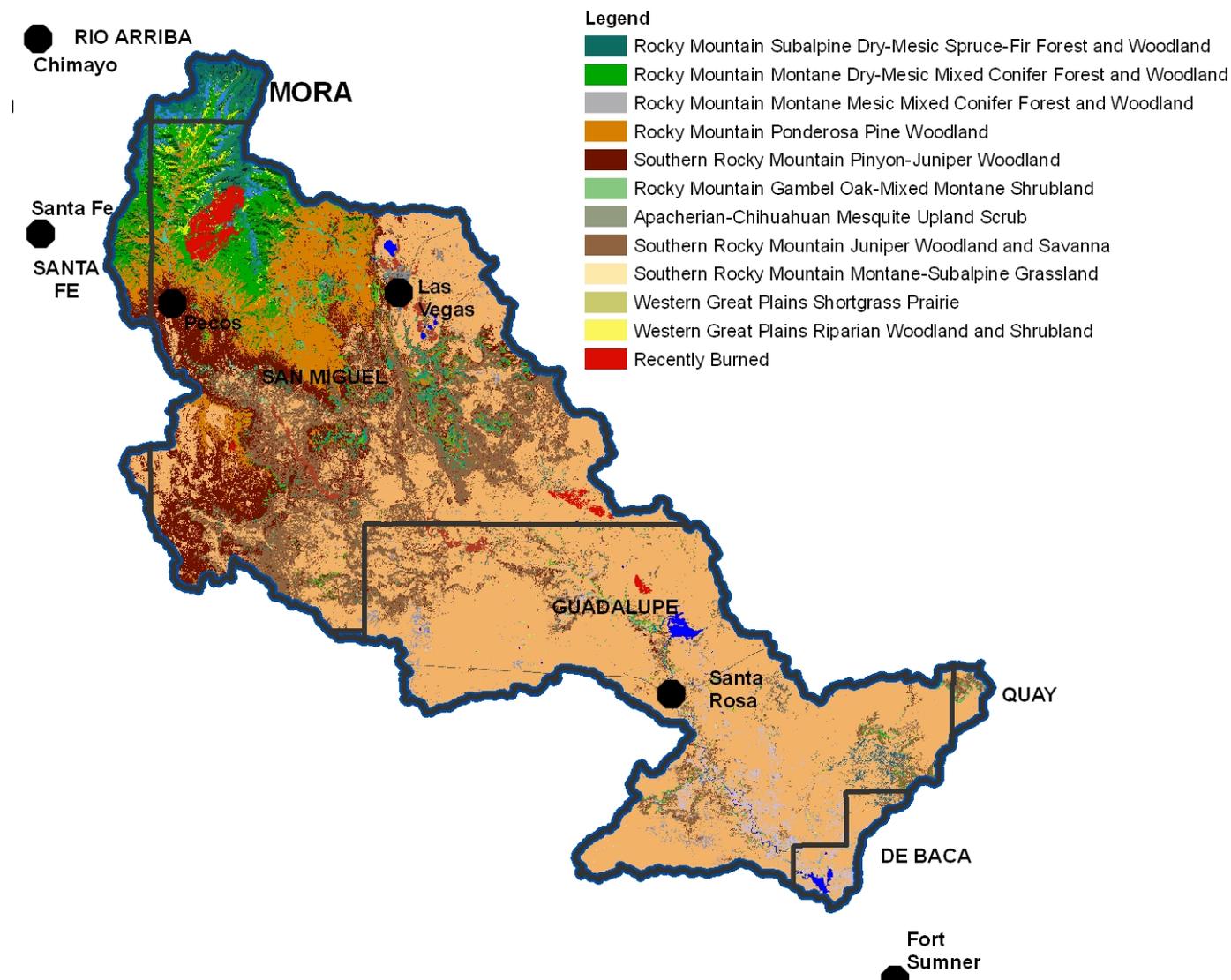
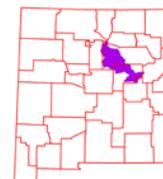


Figure 7. Subset of the SWREGAP over the Pecos Headwaters Watershed. The 12 dominant ecosystems are displayed in the legend.

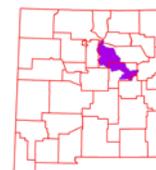


## Land Use / Land Cover

The landcover 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.

<u>Ecosystem</u>	<u>Acres</u>	<u>% of Watershed</u>
Western Great Plains Shortgrass Prairie	1,146,797	52
Southern Rocky Mountain Juniper Woodland and Savanna	315,718	14
Southern Rocky Mountain Pinyon-Juniper Woodland	213,113	10
Rocky Mountain Ponderosa Pine Woodland	185,563	8
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	89,256	4
Southern Rocky Mountain Montane-Subalpine Grassland	26,966	1
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	26,058	1
Western Great Plains Riparian Woodland and Shrubland	24,031	1
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	24,004	1
Recently Burned	23,212	1
Apacherian-Chihuahuan Mesquite Upland Scrub	21,655	1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	17,578	1
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	17,002	1
Rocky Mountain Aspen Forest and Woodland	12,213	1
Agriculture	10,965	< 1
Inter-Mountain Basins Semi-Desert Shrub Steppe	10,714	< 1
Western Great Plains Mesquite Woodland and Shrubland	10,630	< 1
Open Water	9,842	< 1
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	6,175	< 1
Developed, Medium - High Intensity	5,931	< 1

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



**Hydrology** 5, 6, 7, 8, 9

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 7,184 miles (11,562 km) of water courses in the Pecos Headwaters River Watershed. The majority of these courses typically flow intermittently in summer months during periods associated with high intensity convective thunderstorms.

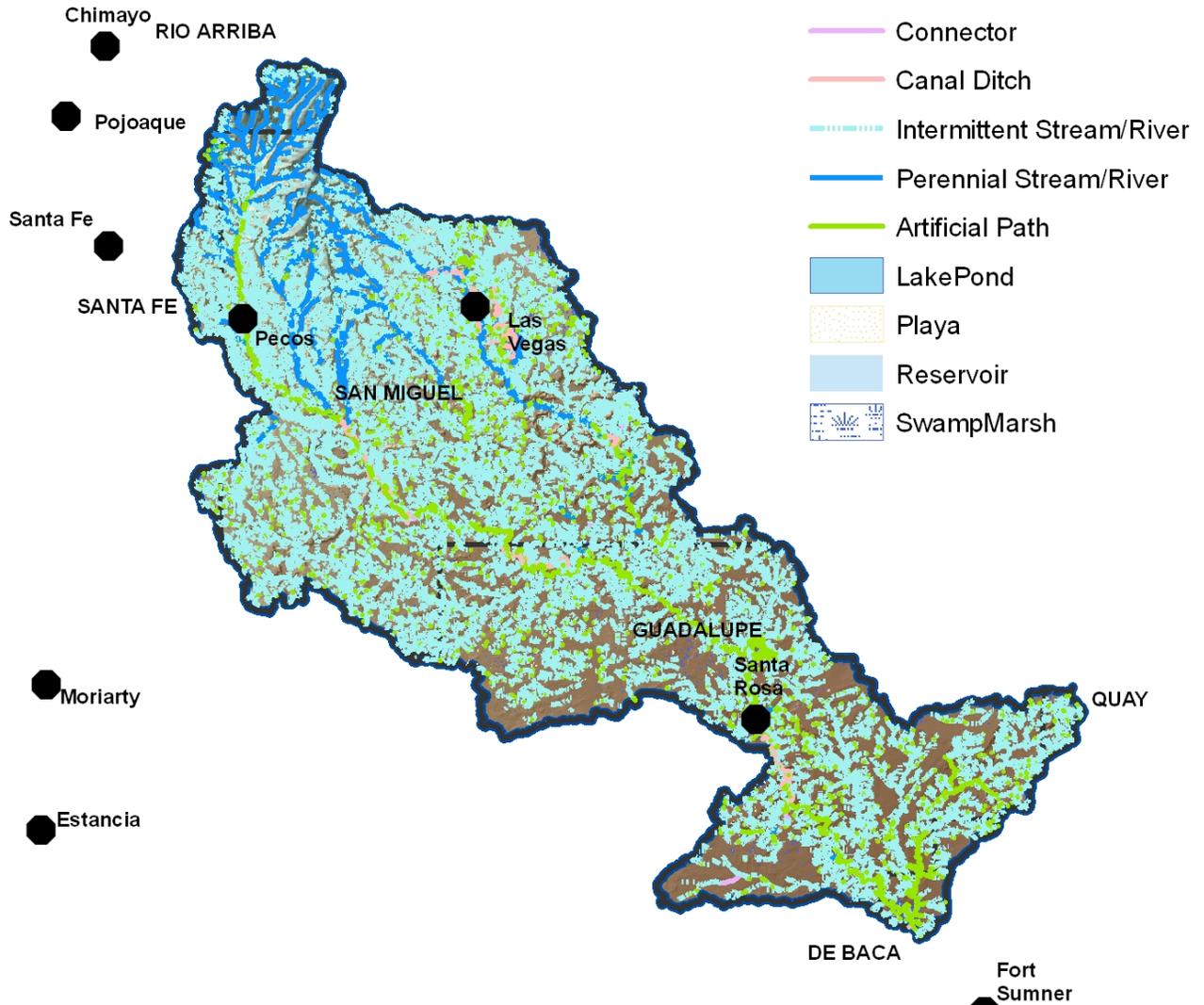
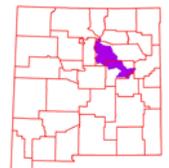
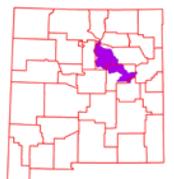


Figure 8. National Hydrologic Dataset (NHD) of the Pecos Headwaters.



<b>Water Course Type</b>	<b>Miles</b>
Artificial path	394
Connector	4
Canal / Ditch	104
Intermittent Stream / River	6,218
Perennial Stream / River	464
Sum ( $\Sigma$ )	7,184

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



There are 22 water gauging stations in the watershed. USGS Site 08384500 is at the southern end of the watershed on the Pecos River below Summer Dam, NM. During the period 1937 – 2010, this site has had mean annual discharge of 193 cubic feet per second ranging from 91.9 (1954) to 710.1 (1941) cubic feet per second.

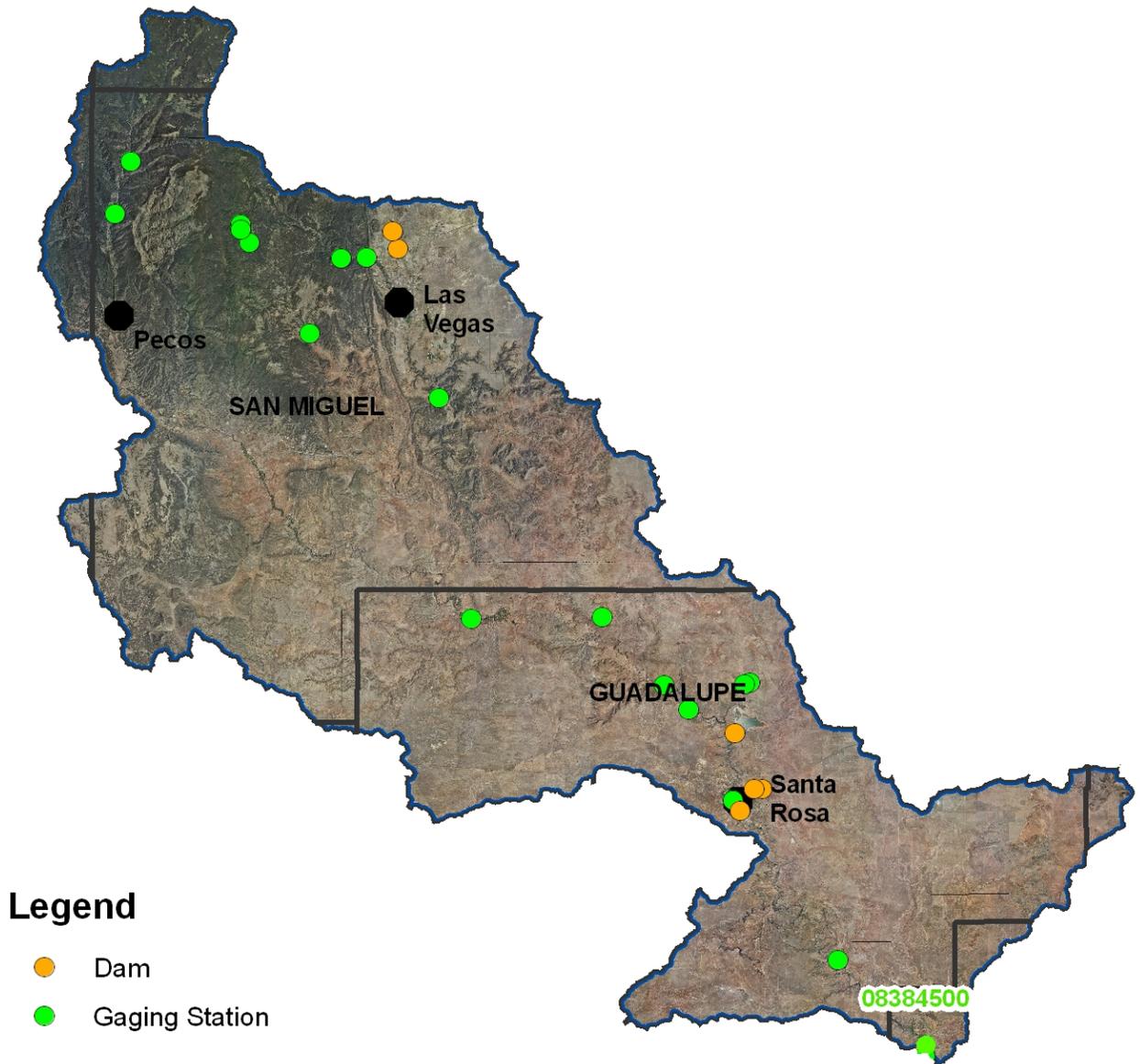
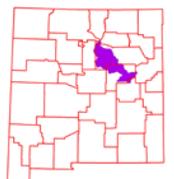
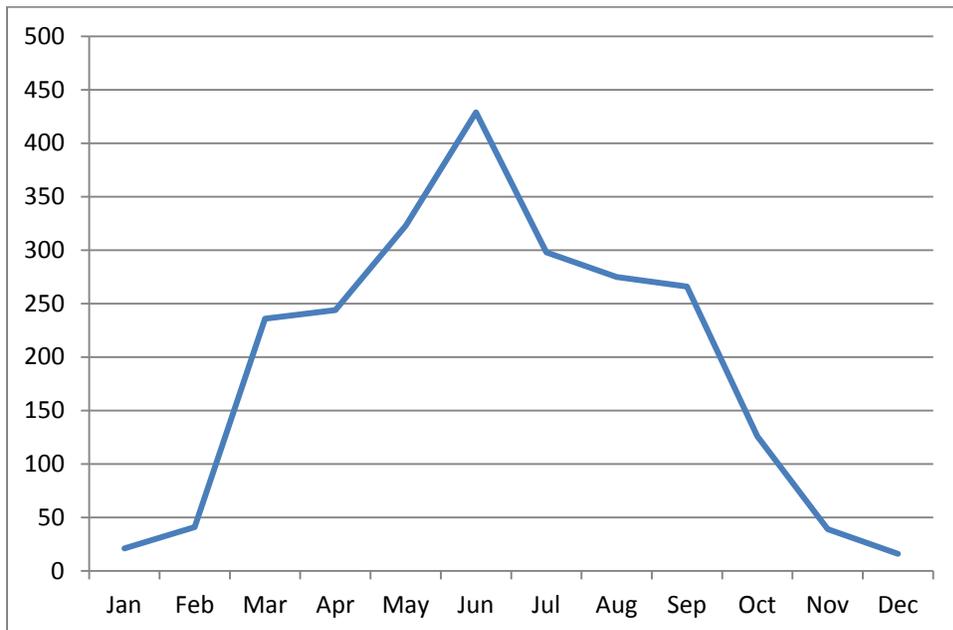


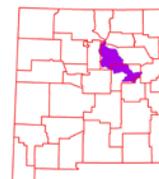
Figure 9. Gauging Stations in the Pecos Headwaters Watershed



## Hydrology



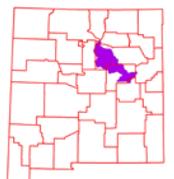
**Figure 10. Monthly Average of Mean Daily Flow on the Pecos River below Sumner Dam, NM. Period of observation: 1937-2010.**



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 Pecos Headwaters watershed as part of the Rio Grande River Basin.

The Pecos Headwaters watershed has the following reaches listed as 303 (d) Impaired Surface Waters:

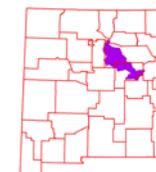
1. El Porvenir Creek (Gallinas River to SFNF boundary)
2. Gallinas River (San Augustin to Las Vegas Diversion)
3. Glorieta Creek (Pecos River to headwaters)
4. McAllister Lake
5. Pecos Arroyo (Gallinas River to headwaters)
6. Pecos River (Alamitos Canyon to Willow Creek)
7. Pecos River (Canon de Manzanita to Alamitos Canyon)
8. Pecos River (Jack's Creek to headwaters)
9. Pecos River (Santa Rosa Reservoir to Tecolote Creek)
10. Pecos River (Sumner Reservoir to Santa Rosa Reservoir)
11. Pecos River (Tecolote Creek to Canon de Manzanita)
12. Pecos River (Willow Creek to Jack's Creek)
13. Santa Rosa Reservoir
14. Storrie Lake
15. Sumner Reservoir
16. Tecolote Creek (I-25 to Blue Creek)
17. Tres Lagunas (Northeast)
18. Willow Creek (Pecos River to fish barrier above reclamation)



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

<b>Use</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>high quality coldwater aquatic life</b>	NS		NS			NS	NS	NS	
<b>marginal coldwater aquatic life</b>		NS		NS					
<b>Irrigation/irrigation storage</b>	X	X	X			X	X	X	X
<b>domestic water supply</b>	X		NS			X	X	X	
<b>livestock watering</b>	X	X	NA	X	X	X	NA	X	X
<b>wildlife habitat</b>	X	X	X	X	X	X	X	X	X
<b>marginal warmwater aquatic life</b>					X				NS
<b>Primary contact</b>		X			NS				
<b>secondary contact</b>	NA		X	X		NA	X	NA	NA
<b>Fish culture</b>			X			X	X	X	X
<b>Limited Aquatic Life</b>									
<b>Industrial Water Supply</b>	X								
<b>Municipal Water Supply</b>	X								

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



<b>Use</b>	10	11	12	13	14	15	16	17	18
high quality coldwater aquatic life			NS				NS		NS
Marginal coldwater aquatic life		NS			NS			NS	
Irrigation/irrigation storage	X	X	X	X	X	X	X	X	X
domestic water supply			X				X		X
livestock watering	X	X	X	X	X	X	X	X	X
wildlife habitat	X	X	X	X	X	X	X	X	X
marginal warmwater aquatic life	NS			NS	NS	NS			
primary contact		NA			NA	X		X	
secondary contact	X		NA	X			NA		NA
Fish culture	X		X	X					X
Industrial Water Supply							X		
Municipal Water Supply					X		X		

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

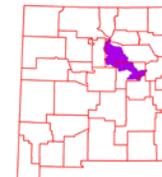
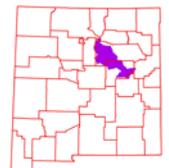




Figure 11. 303 (d) Impaired Waters (numbers reference stream reaches on Page 21).



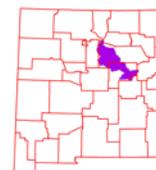
## Hydrology

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 Pecos Headwaters Watershed, there are five bodies of water that are listed as impaired as of the 2010-12 listing cycle.

The river and stream reaches total 272.54 miles (438.51 km) and the listed water bodies cover 10,393 acres (42 sq. km).

<b>Probable Causes of Impairment</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>Aluminum</b>									
<b>Benthic-Macroinvertebrate Bioassessments</b>		X							
<b>Copper</b>									
<b>Dissolved Oxygen</b>			X						
<b>Total Fecal and Coliform</b>					X				
<b>Gross Alpha - Adjusted</b>									
<b>Mercury</b>						X	X	X	
<b>Nutrient/Eutrophication</b>		X							
<b>PCB's</b>									
<b>Sedimentation/Siltation</b>									X
<b>Specific Conductance</b>			X						
<b>Temperature</b>	X		X				X		
<b>Turbidity</b>			X			X	X		
<b>Zinc</b>									
<b>Ammonia (Un-ionized)</b>			X						
<b>Nitrogen, Nitrate</b>			X						
<b>Arsenic</b>				X					

Table 7. Possible Causes of Impairment



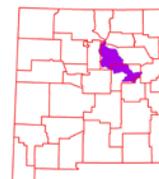
<b>Probable Causes of Impairment</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>
<b>Aluminum</b>									
<b>Benthic-Macroinvertebrate Bioassessments</b>									
<b>Cadmium</b>									X
<b>Dissolved Oxygen</b>									
<b>Total Fecal and Coliform</b>									
<b>Gross Alpha - Adjusted</b>									
<b>Mercury</b>			X	X	X	X			
<b>PCB's</b>									
<b>pH</b>								X	
<b>Sedimentation/Siltation</b>	X	X							X
<b>Specific Conductance</b>							X		X
<b>Temperature</b>							X		
<b>Turbidity</b>									
<b>Zinc</b>									X

Table 7-Continued. Possible Causes of Impairment

### Hydrology - Declared Groundwater Basins

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 Pecos Headwaters watershed is within three Underground Water Basins: the Canadian River, the Upper Pecos, and the Fort Sumner. Three percent of the watershed is not in a declared groundwater basin.

<b>Groundwater Basin</b>	<b>Acres in Basin</b>	<b>Watershed Acres</b>	<b>% of Declared Basin</b>
Canadian River	3,714,061	15,675	0.42
Fort Sumner	2,487,352	438,499	17.63
Upper Pecos	2,425,228	1,715,010	70.72



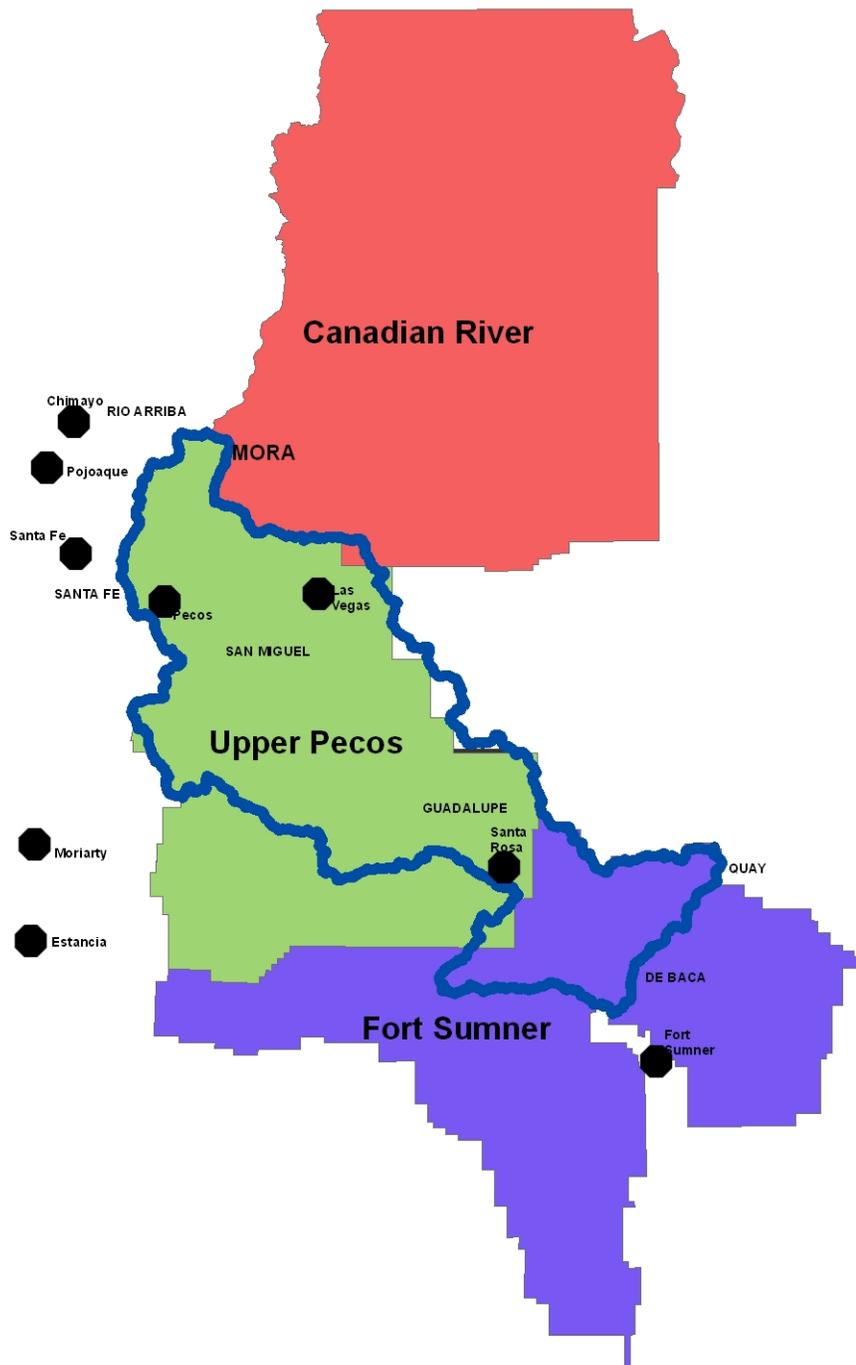
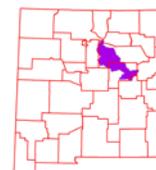


Figure 12. Declared Groundwater Basins of the Pecos Headwaters.

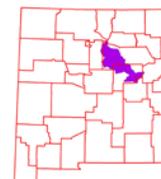


## Threatened and Endangered Species <sup>10</sup>

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 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 Pecos Headwaters River Watershed.

<u>Common Name</u>	<u>Scientific Name</u>	<u>Tax.Class</u>	<u>Family</u>	<u>Fed Status</u>	<u>State Status</u>
<u>Mexican Tetra</u>	<u><i>Astyanax mexicanus</i></u>	Actinopterygii	Characidae		T
<u>Chihuahua Chub</u>	<u><i>Gila nigrescens</i></u>	Actinopterygii	Cyprinidae	LT	E
<u>Pecos Bluntnose Shiner</u>	<u><i>Notropis simus pecosensis</i></u>	Actinopterygii	Cyprinidae	LE	E
<u>Rio Grande Silvery Minnow</u>	<u><i>Hybognathus amarus</i></u>	Actinopterygii	Cyprinidae	LE	E
<u>Suckermouth Minnow</u>	<u><i>Phenacobius mirabilis</i></u>	Actinopterygii	Cyprinidae		T
<u>Bigscale Logperch</u>	<u><i>Percina macrolepida</i></u>	Actinopterygii	Percidae		T
<u>Piping Plover</u>	<u><i>Charadrius melodus</i></u>	Aves	Charadriidae	LE, LT	T
<u>Brown Pelican</u>	<u><i>Pelecanus occidentalis</i></u>	Aves	Pelecanidae		E
White-tailed Ptarmigan	<i>Lagopus leucura</i>	Aves	Phasianidae		E
Boreal Owl	<i>Aegolius funereus</i>	Aves	Strigidae		T
Mexican spotted owl	<i>Strix occidentalis lucida</i>	Aves	Strigidae	LT	
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Aves	Tyrannidae	LE	E
<u>Gray Vireo</u>	<u><i>Vireo vicinior</i></u>	Aves	Vireonidae		T
<u>Pecos Sunflower</u>	<u><i>Helianthus paradoxus</i></u>	Dicotyledoneae	Asteraceae	LT	E
<u>Holy Ghost Ipomopsis</u>	<u><i>Ipomopsis sancti-spiritus</i></u>	Dicotyledoneae	Polemoniaceae	LE	E
<u>Least Shrew</u>	<u><i>Cryptotis parva</i></u>	Mammalia	Soricidae		T
Wood Lily	<i>Lilium philadelphicum var. andinum</i>	Monocotyledoneae	Liliaceae		E
<u>Large Yellow Lady's-slipper</u>	<u><i>Cypripedium parviflorum var. pubescens</i></u>	Monocotyledoneae	Orchidaceae		E

**Table 8. Threatened and Endangered Plant and Animal Species.**

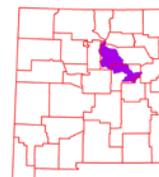


## Invasive Species <sup>11</sup>

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 Pecos Headwaters watershed, the SWEMP has identified 7 species of invasive plants (Table 9). Each of these species is defined as non-native by the USDA PLANTS database.

<b><u>Scientific Name</u></b>	<b><u>Common Name</u></b>
<i>Fabaceae</i> (Pea Family)	Camelthorn
<i>Scrophylariaceae</i> (Figwort Family)	Dalmatian Toadflax
<i>Brassicaceae</i> (Mustard Family)	Hoary Cress (Whitetop)
<i>Asteraceae</i> (Sunflower Family)	Musk Thistle
<i>Asteraceae</i> (Sunflower Family)	Russian Knapweed
<i>Asteraceae</i> (Sunflower Family)	Spotted Knapweed
<i>Asteraceae</i> (Sunflower Family)	Yellow Starthistle

Table 9. Invasive Species Recognized by the SWEMP.



## Common Resource Areas<sup>12</sup>

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..

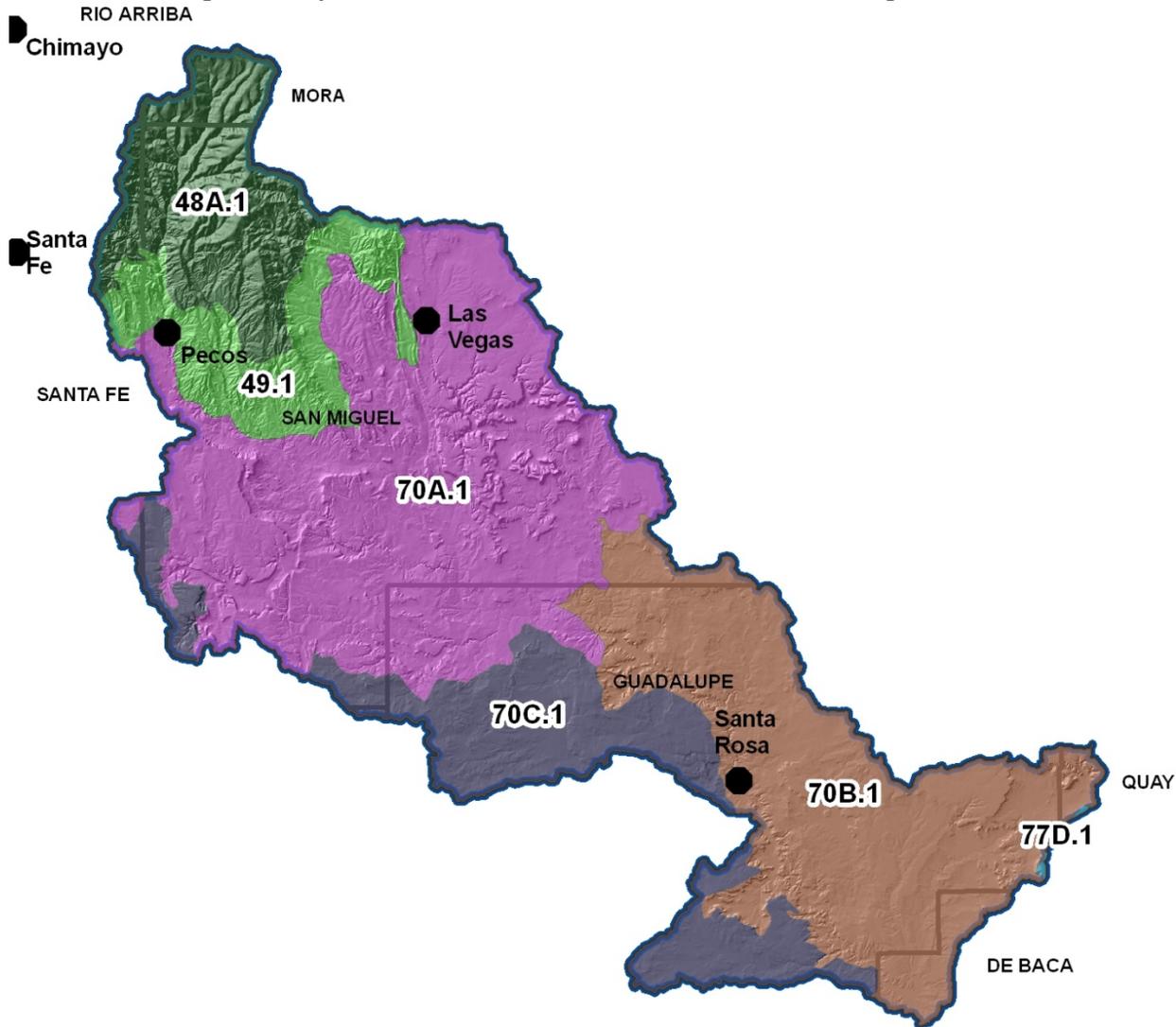
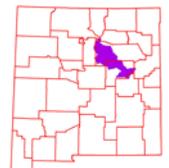


Figure 13. Common Resource Areas of the Pecos Watershed



#### 48.1 – Southern Rocky Mountains – High Mountains and Valleys

This area is best characterized by steep, high mountain ranges and associated mountain valleys. The temperature regimes are mostly frigid and cryic; moisture regimes are mainly ustic and udic. Vegetation is sagebrush-grass at low elevations, and with increasing elevation ranges from coniferous forest to alpine tundra. Elevations range from 6,500 to 14,400 feet.

#### 49.1 – Southern Rocky Mountain Foothills

This area is generally a transition between the Great Plains and the Southern Rocky Mountains. The temperature regime is mesic or frigid, and moisture regime is ustic. Characteristic native vegetation ranges from grasslands and shrubs to ponderosa pine and Rocky Mountain Douglas fir forest.

#### 70A.1 – Northern New Mexico Highlands

This unit is characterized by broad, rolling plains broken by closed basins and drainageways that have smooth-shaped valley floors. Rugged breaks are common in the northern part of the area. Native vegetation is mid- to short-grass prairie species in the lowlands, with pinyon and juniper in the higher elevations and on the breaks. The soils are formed in weathered sedimentary rocks of Cretaceous age and igneous rocks of Tertiary and Quaternary age.

#### 70B.1 - Central Pecos Valleys and Plains

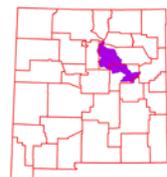
This unit is characterized by broad, rolling piedmonts, plains, and tablelands broken by drainageways and tributaries of the Pecos River. Native vegetation is mid- to short-grass prairie species in the lowlands, with pinyon and juniper in the higher elevations and on steeper north-facing slopes. Current land use is predominantly livestock grazing. The soils formed in material weathered from sedimentary rocks of Cretaceous age.

#### 70C.1 - Central New Mexico Highlands

Tablelands and mesas separated by broad plains and small terraces characterize this area. Elevation is 5,000 to 7,200 feet and precipitation is 12 to 17 inches. The soil moisture regime is aridic to ustic and the soil temperature regime is mesic. Pinyon-juniper savannah and pinyon juniper woodlands at higher elevations, and broad mid- to short-grass prairies and basins at lower elevations dominate the area. Current land use is livestock grazing. The soils formed in Quaternary alluvium, eolian sands, and sedimentary rocks of Permian age. (Old CP-3)

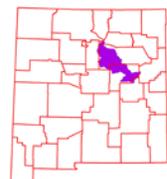
#### 77D.1 - High Plains, Southwestern Part

This area is characterized by nearly level to gently undulating plains with scattered playa depressions. Soil temperature regime is thermic and soil moisture regime is aridic bordering on ustic. Sandy and loamy soils are generally well drained and range from shallow to deep and medium- to coarse-textured. Native vegetation is short- to mid-grasses and sandy sites support tall-grasses with sand shin oak and mesquite. Current land use is mainly rangeland, although irrigated cropland is expanding.



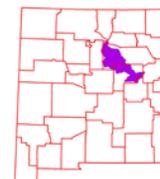
## Conservation <sup>13</sup>

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.



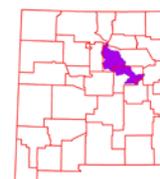
Conservation Practice	2006		2007		2008		2009		2010		TOTAL	
	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres
Access Control									1	239	1	239
Brush Management	7	395	17	2,821	12	4,377	21	3,211	21	4,067	78	14,871
Conservation Crop Rotation	1	7							5	11	6	18
Cover Crop									6	34	6	34
Critical Area Planting	7	45	1	6					3	17	11	68
Enhancement – Grazing Management	1	480									1	480
Forage Harvest Mgmt									1	12	1	12
Forage and Biomass Planting	4	43	3	18	5	32	1	2	7	39	20	134
Forage Slash Treatment									8	50	8	50
Forest Trails and Landings							1	194			1	194
Forest Stand Improvement	4	51	5	45	4	32	1	7	12	77	26	212
Heavy Use Area Protection			1	417							1	417
Integrated Pest Management	11	10,995	7	749			1	194			19	11,938
Irrigation Land Leveling	2	9	1	3	3	13	3	17			9	42
Irrigation System, Microirrigation	1	2	2	2	1	3			6	10	10	17
Irrigation System, Sprinkler							1	170	5	1,519	6	1,689
Irrigation Water Management	2	14	1	8							3	22
Land Smoothing			2	16	2	22	2	9			6	47
Prescribed Burning					2	1,896					2	1,896
Prescribed Grazing	19	11,059	8	4,988			11	7,845	16	17,946	54	41,838
Range Planting					1	6	2	87			3	93
Residue Management	1	7									1	7
Tree/Shrub Establishment			2	8	1	13	2	199	2	38	7	258
Upland Wildlife Habitat Management	8	64	7	4,830	3	6,206	26	15,733	17	20,337	61	47,170
<b>SUM (Σ)</b>	<b>68</b>	<b>23,171</b>	<b>57</b>	<b>13,911</b>	<b>34</b>	<b>12,600</b>	<b>72</b>	<b>27,668</b>	<b>110</b>	<b>44,396</b>	<b>341</b>	<b>121746</b>

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



Conservation Practice	2006		2007		2008		2009		2010		TOTAL	
	#	Feet	#	Feet								
Above-Ground, Multi-Outlet Pipeline					1	210	6	1,420	6	1,750	13	3380
Conservation Completion Incentive First Year			1		1						2	
Dike									1	300	1	300
Diversion							5	23,078			5	23078
Fence	4	14,632	4	11,016	2	12,812	16	88,905	10	34,146	36	161511
Grade Stabilization Structure	4						2				6	
Irrigation Water Conveyance, Ditch and Canal Lining, plain concrete	1	1									1	1
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	1	4	2	1,160			2	2,500	11	13,327	16	16991
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	25	10,556	5	852	7	12,181	8	3,635	8	15,207	53	42431
Irrigation Water Conveyance, Pipeline, Rigid Gated Pipeline	7	1,290	2	450	2	390					11	2130
Irrigation Field Ditch									1	81	1	81
Pipeline	2	3,168	2	17,247	7	14,351	7	42,409	7	46,325	25	123500
Pond							2		1		3	
Pond Sealing or Lining	1								1		2	
Pumping Plant	2		4		4		2		8		20	
Structure for Water Control	25		10		14		20		63		132	
Water Well	3		3		3		3		4		16	
Watering Facility	6		8		10		21		13		58	
Water Harvesting Catchment									1		1	
Wildlife Watering Facility							1				1	
Windbreak/Shelterbelt Establishment							1	587			1	587
<b>SUM (Σ)</b>	81	NA	41	NA	51	NA	96	NA	135	NA		NA

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



## Soil Resource Inventory <sup>14</sup>

The Rio Chama 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.

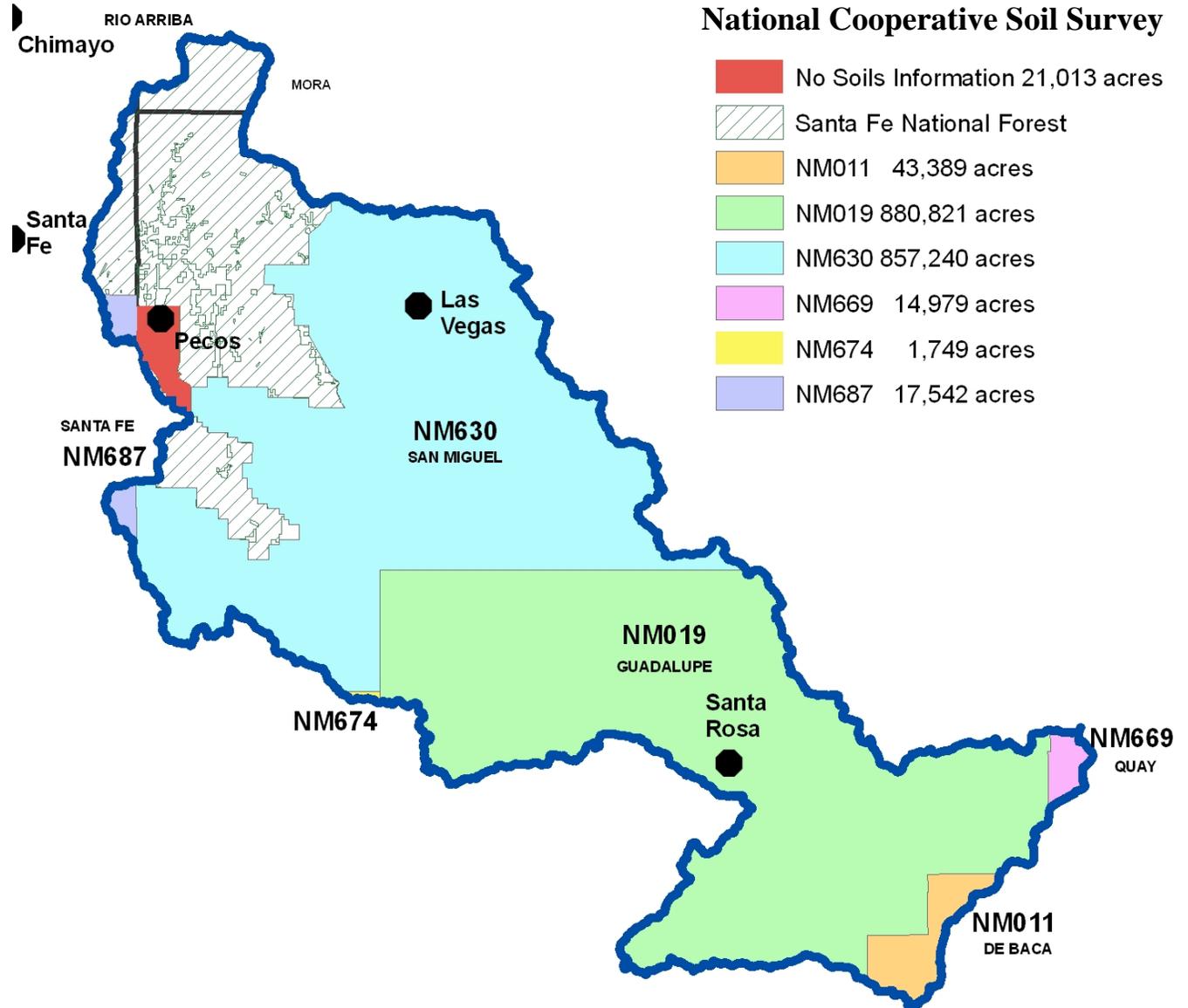
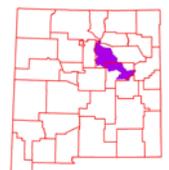


Figure 14. National Cooperative Soil Survey of Pecos Headwaters

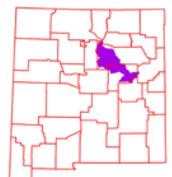


## Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Pecos Headwaters 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 mapunit 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 -

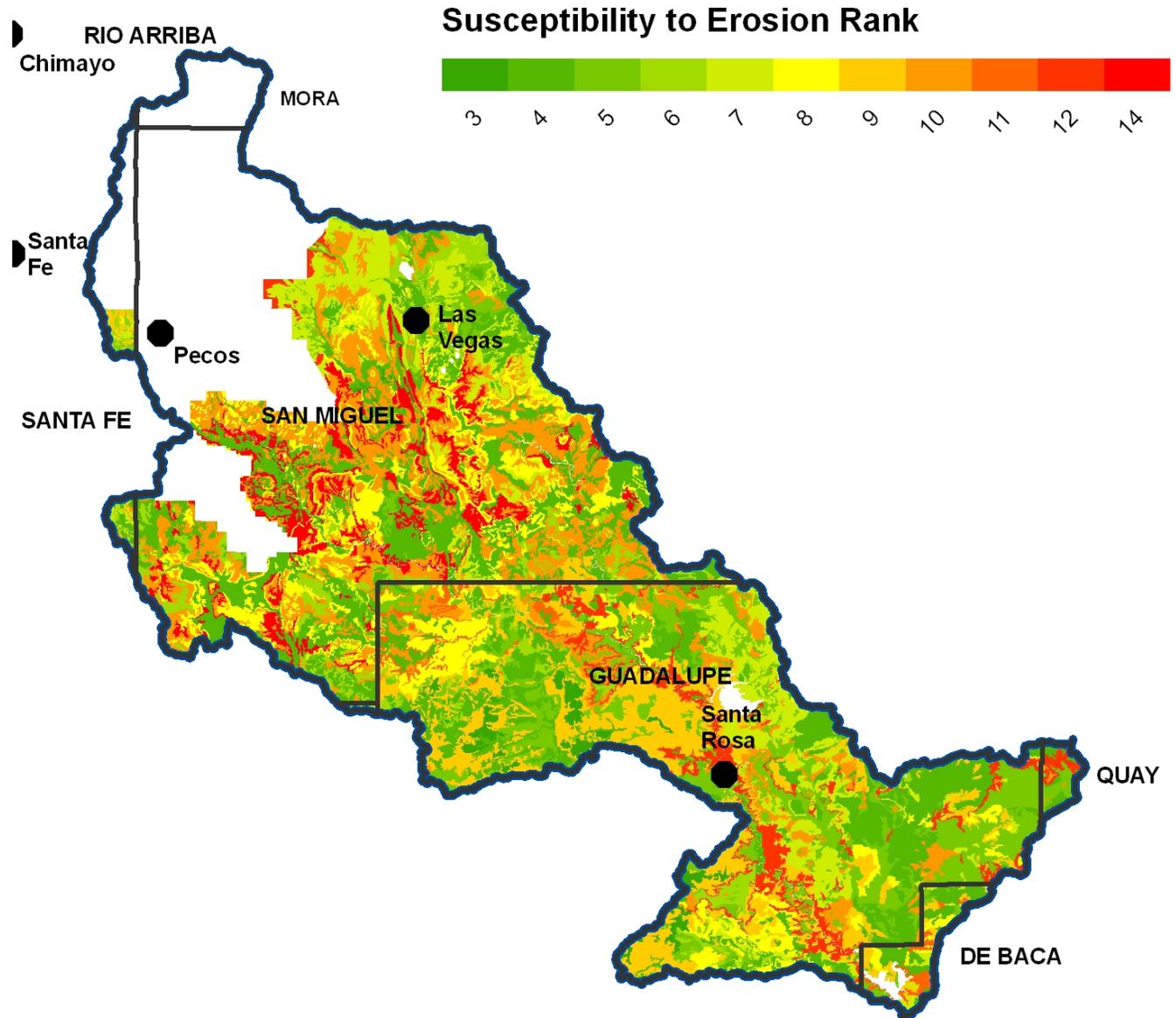
<u>SSURGO Value</u>	<u>Nominal Description</u>	<u>Model Rank</u>
<b>Saturated Hydraulic Conductivity</b>		
µm / s		
705.0 - 100.0	Very High	0
100.0 - 10.0	High	1
10.0 - 1.0	Moderately High	2
1.0 - 0.1	Moderately Low	3
0.1 - 0.01	Low	4
<b>Slope %</b>		
0 - 5		0
6 - 10		1
11 - 15		2
16 - 25		3
> 25		4
<b>Soil Loss Tolerance</b>		
5	High Tolerance For loss	0
4	↓	1
3	↓	2
2	↓	3
1	Low Tolerance For Loss	4
<b>Wind Erodibility Group</b>		
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.**

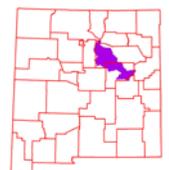


## Soil Resource Inventory

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 this time.



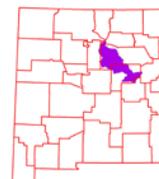
**Figure 15. Erosion Potential of Pecos Headwaters Watershed**



## Soil Resource Inventory

<u>Rank</u>	<u>Acres</u>
1	0
2	0
3	25,150
4	434,568
5	217,029
6	78,537
7	185,882
8	193,157
9	198,863
10	288,897
11	17,925
12	73,531
13	0
14	86,533
Sum( $\Sigma$ )	1,815,720

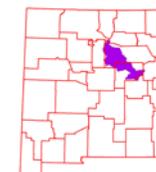
Table 13. Soil Erosion Potential Model Results. A greater rank indicates greater potential for erosion.



## Socioeconomic Data <sup>15</sup>

COUNTY	Total population: Total	Total population: Urban	Total population: Rural	Total Pop.: Rural Farm	Total Pop.: Rural Nonfarm	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. 2009
De Baca	2,022	0	2,240	306	1,934	779	1,766	3	13	1	0	160	79	\$34,648
Guadalupe	4,687	2,530	2,150	269	1,881	3,730	3,298	79	90	62	0	1,004	154	36,279
Mora	4,881	0	5,180	296	4,884	3,953	3,462	32	64	13	1	1,149	160	38,715
Quay	9,041	5,911	4,244	781	3,463	3,834	7,781	103	113	88	4	648	304	42,978
Rio Arriba	40,246	7,152	10,864	217	10,647	28,703	20,778	204	6,447	170	13	11,288	1,346	48,306
San Miguel	29,393	7,447	6,807	157	6,650	22,583	19,583	412	508	228	37	7,478	1,147	41,096
Santa Fe	144,170	43,508	14,193	231	13,962	83,015	109,800	1,239	4,486	1,672	108	5,135	4,822	64,499

Table 14. Socioeconomic Data of the Counties in the Watershed (2010) except for green cells, not available yet from 2010 census so are 2000.



## 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](http://www.blm.gov/nm/st/en/prog/more/geographic_sciences/spatial_data_metadata.html)
3. UNITED STATES GEOLOGICAL SURVEY - National Land Cover Dataset. <http://landcover.United States Geological Survey.gov/>
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