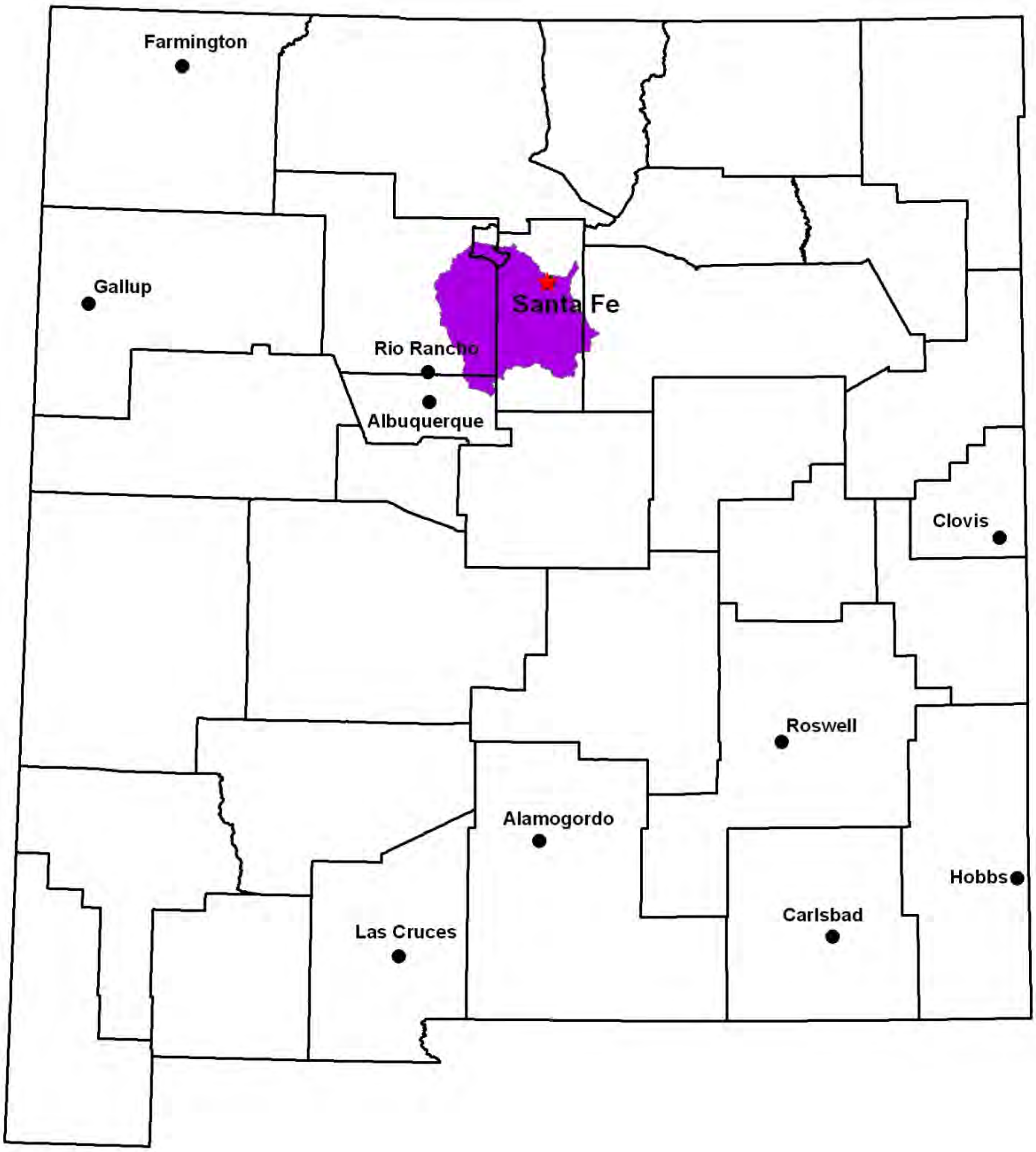
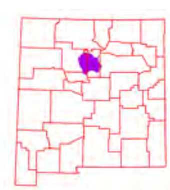
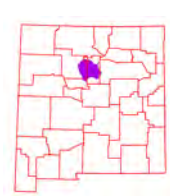


Rapid **W**atershed **A**ssessment
Rio Grande-Santa Fe Watershed





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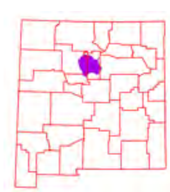

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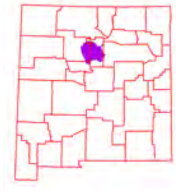


Overview

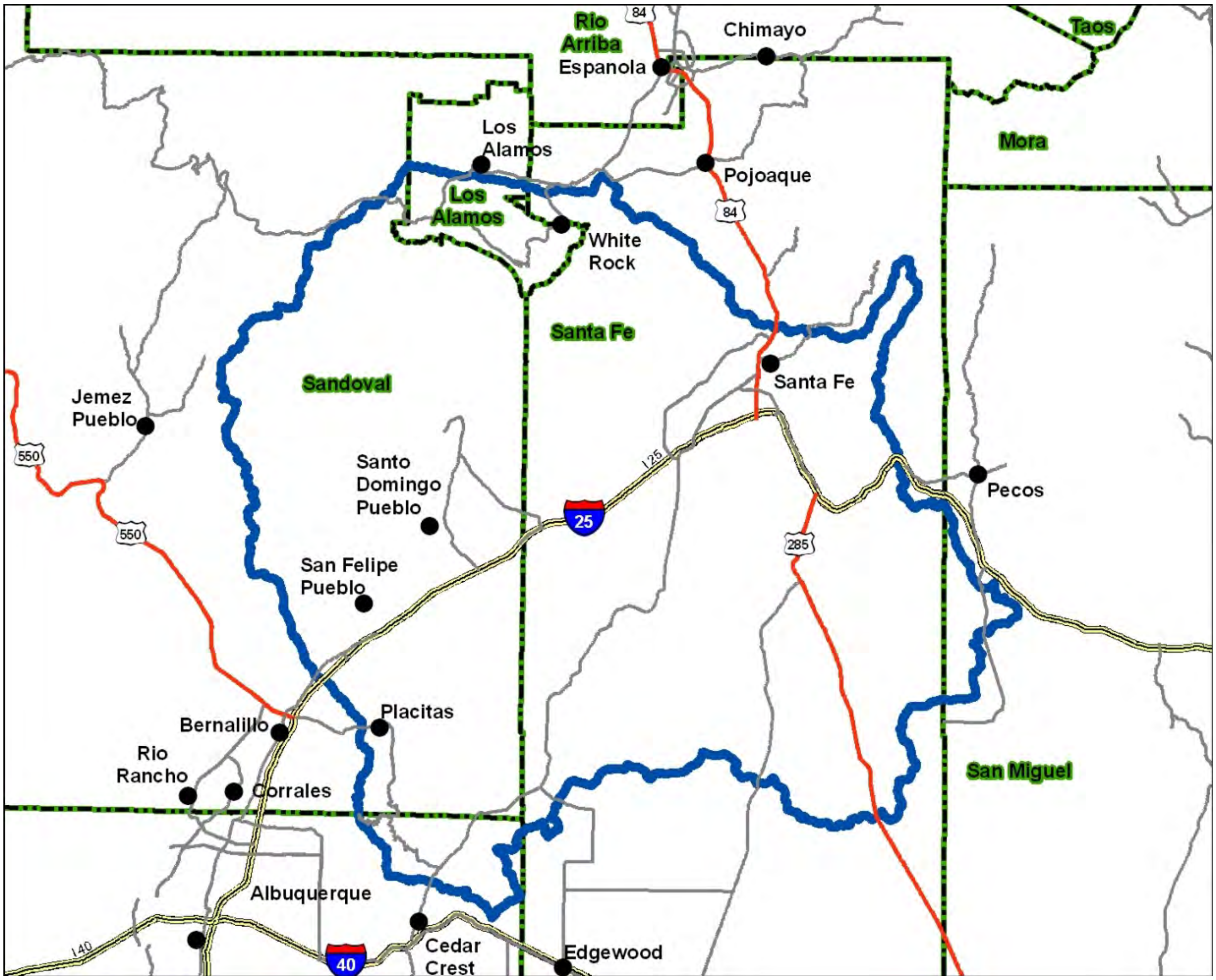
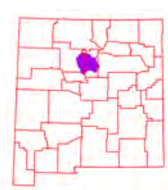


Figure 1. Rio Grande-Santa Fe Watershed Overview.

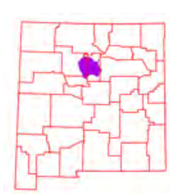


Overview

The Rio Grande-Santa Fe Watershed is located in north central New Mexico. It covers 2,081,253 total acres (8,423 sq. km). Portions of the Rio Grande-Santa Fe watershed extend into Bernalillo, Los Alamos, San Miguel, Sandoval, and Santa Fe counties. Table 1 summarizes the distribution of the Rio Grande-Santa Fe watershed.

Table 1. Rio Grande-Santa Fe watershed acreage distribution.

	County Acres Total	Acres in HUC	% of HUC in County	% of County in HUC
Bernalillo	747,774	32,676	3	4
Los Alamos	69,949	38,393	3	55
San Miguel	3,028,627	20,256	2	1
Sandoval	2,377,011	447,280	37	19
Santa Fe	1,222,180	658,629	55	54
Sum (∑)	--	1,197,234	100	--



Physical Setting

Geology: [1]

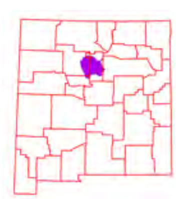
The hydrologic unit begins at Otowi, west of Pojoaque, New Mexico in the Upper Rio Grande Valley. Further downstream, the river enters Cochiti Lake, which marks the northern boundary of the Middle Rio Grande Valley. The hydrologic unit continues downstream to the confluence with the Jemez River.

The mountain ranges consist of Paleoproterozoic Eon aged granitic plutons or quartzite; Tertiary Period aged volcanic (basalt, basaltic-andesite or rhyolite) and pyroclastic flow breccias from the Valles Caldera of the Jemez Mountains; and Paleoproterozoic Eon aged or earlier volcanic or metamorphic rocks. Pennsylvanian limestone, shale and sandstone occur in a few outcrops on the west side of the pre-Cambrian massif. The valley floors consist of Tertiary Period partly compacted sands and gravels of the Santa Fe group or Quaternary Period alluvium. The Santa Fe Group consists of alluvial fans, river channel deposits and inter-bedded volcanic rocks preserved in a complex of depressed fault blocks within the Rio Grande depression.

The ancestral Middle Rio Grande developed into a single river system about 5 million years ago (Crawford et al. 1993). Incision of the Middle Rio Grande Valley has been cyclic, and has produced gravel, sand, and silt terraces 9 to 53 meters (m) (30 to 175 feet (ft)) above the current floodplain. The Rio Grande is thought to have reached maximum entrenchment between 10,000 and 20,000 years ago, at a depth 18 to 40 m (60 to 130 ft) below the current valley floor. Since that time, sediment influx from tributaries has resulted in a gradual aggradation of the river bed. Historically, this process led to frequent avulsions of the river channel. The historic river channel was braided and sinuous with a shifting sand substrate that freely migrated across the floodplain, limited only by valley terraces and bedrock outcroppings (Crawford et al. 1993).

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. This can be exasperated by the mining of sand and gravel from the river channels.

Groundwater quality and quantity is a concern. Groundwater occurs to a greater or lesser extent in all of these geologic units. The most significant aquifer is the Santa Fe Group, particularly its lower member, the Tesuque Formation. The upper member, the Ancha, is typically more conductive than the Tesuque but occurs above the water table in much of the Santa Fe watershed. Deeper groundwater is nearly continuous in the Tesuque Formation throughout the watershed area, to depths of 2000 feet or greater in some areas. This deep groundwater dates from the Ice Age and is recharged little if at all by present-day rainfall and snowmelt. Precipitation in the high mountains and flow in the Santa Fe River and its tributary arroyos seeps into and recharges shallow groundwater, which in some areas may be continuous with deeper groundwater.



Volcanics often serve as a "floor" or channel to concentrate percolating groundwater and cause it to emerge as spring flow.

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 igneous rocks and volcanics 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:

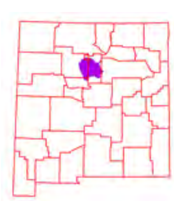
Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.
The soils in the Rio Grande-Albuquerque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



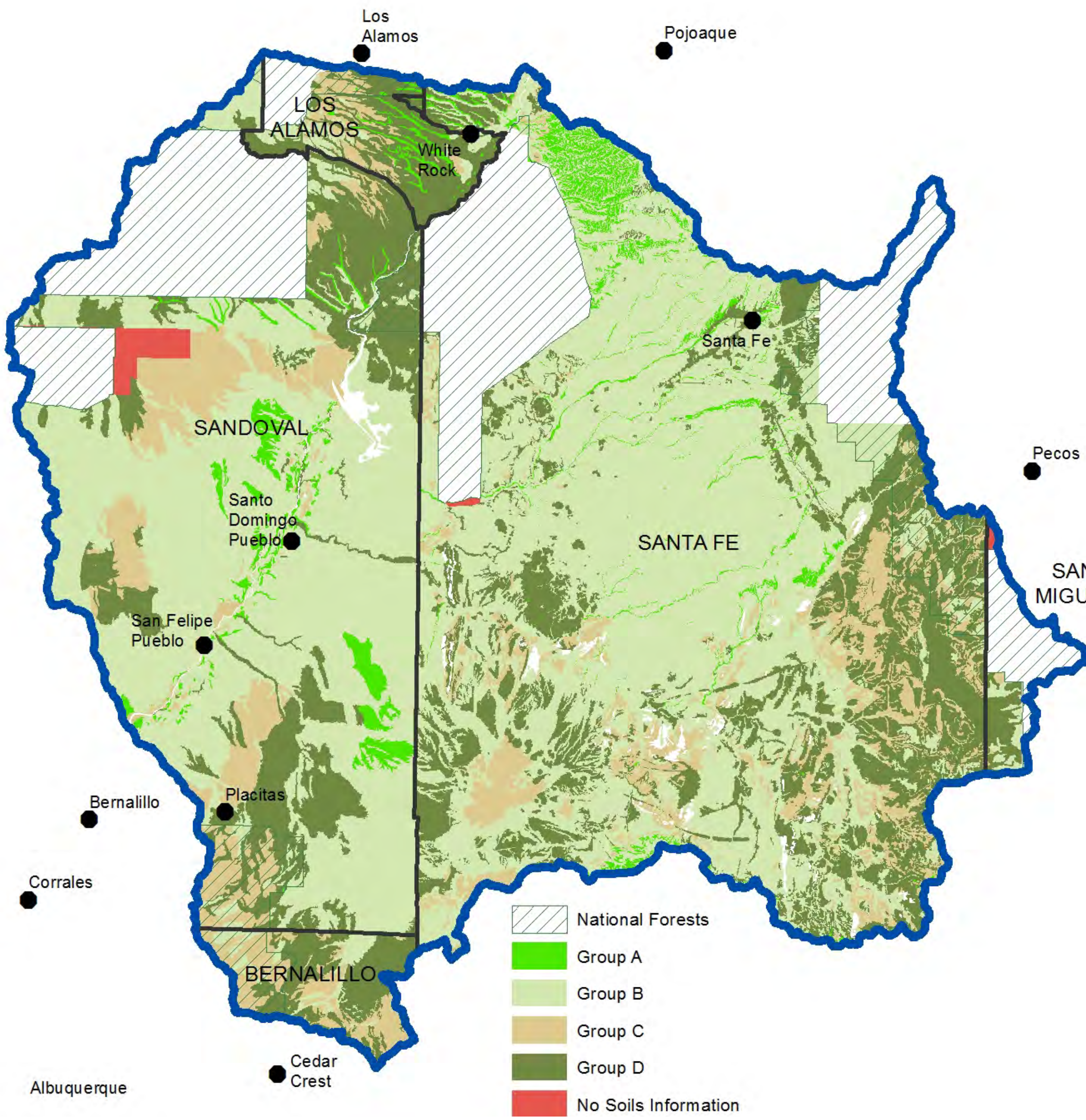
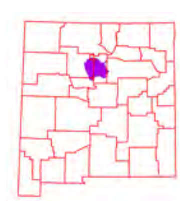


Figure 2. Hydrologic Soil Group



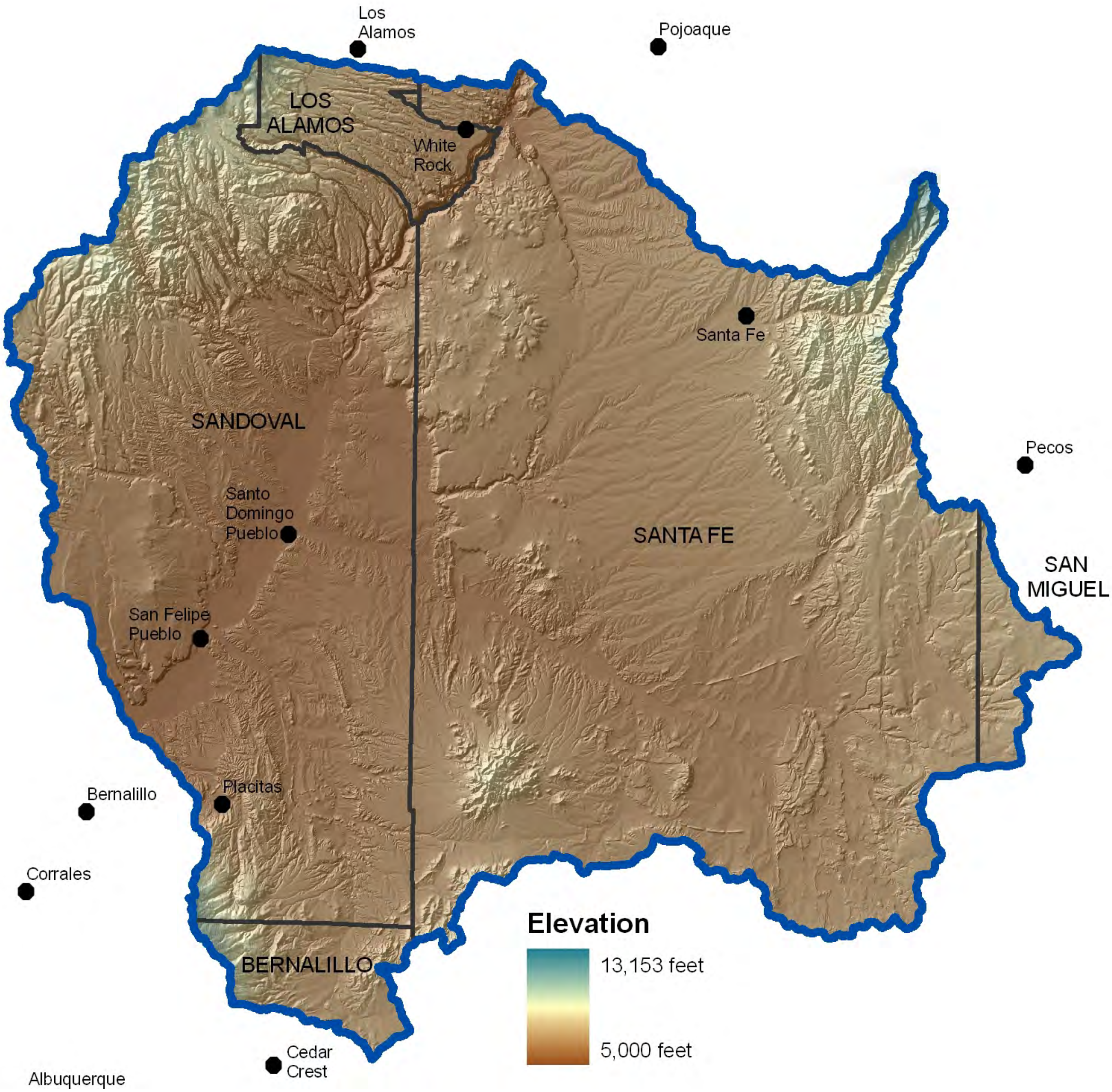
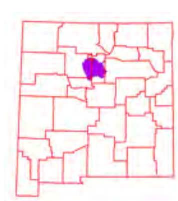


Figure 3. Rio Grande-Santa Fe Watershed Shaded Relief



Precipitation [2]

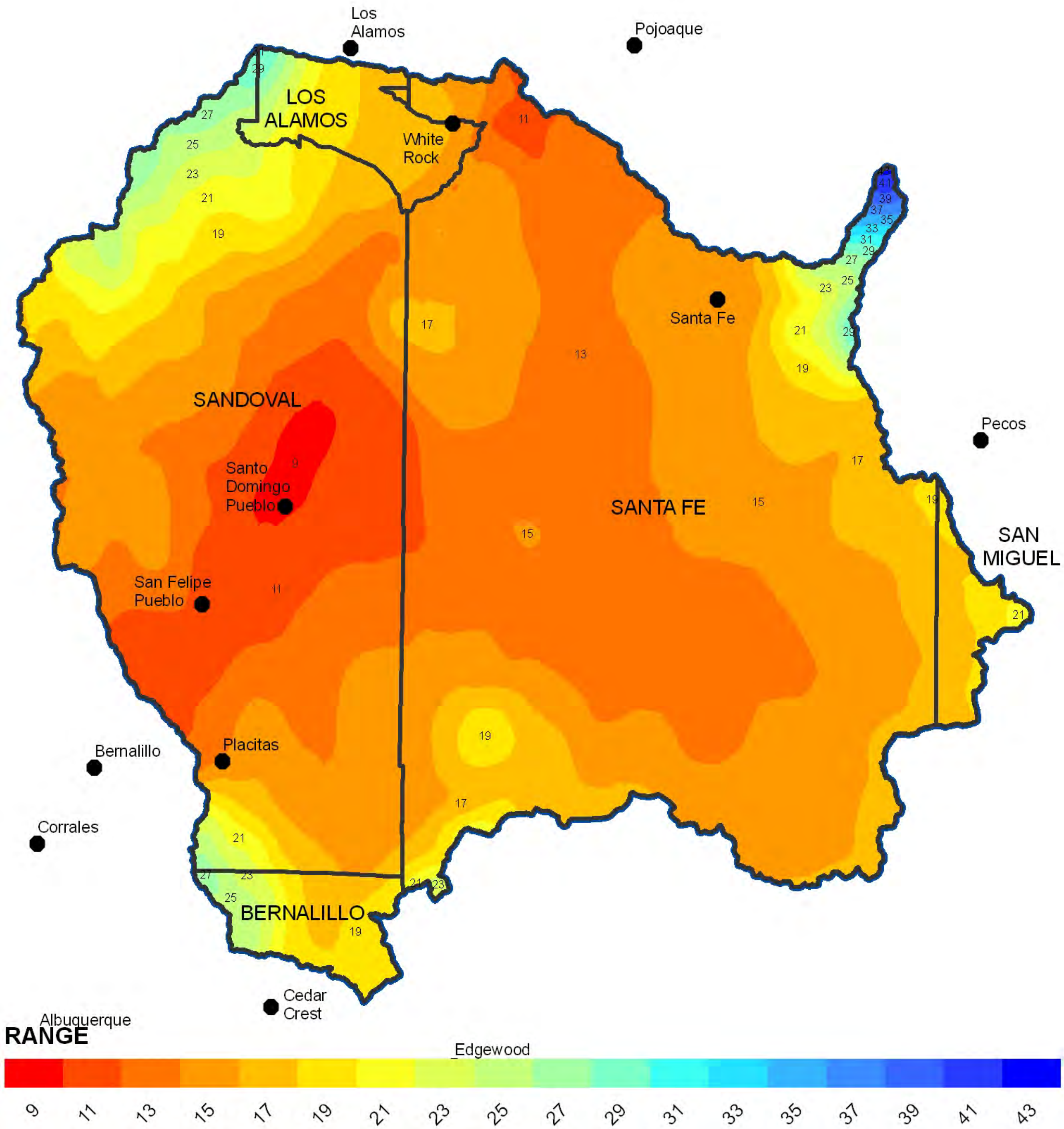
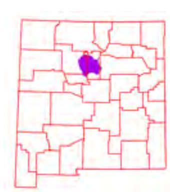


Figure 4. Rio Grande-Santa Fe Watershed Annual Precipitation.



Land Ownership [3]

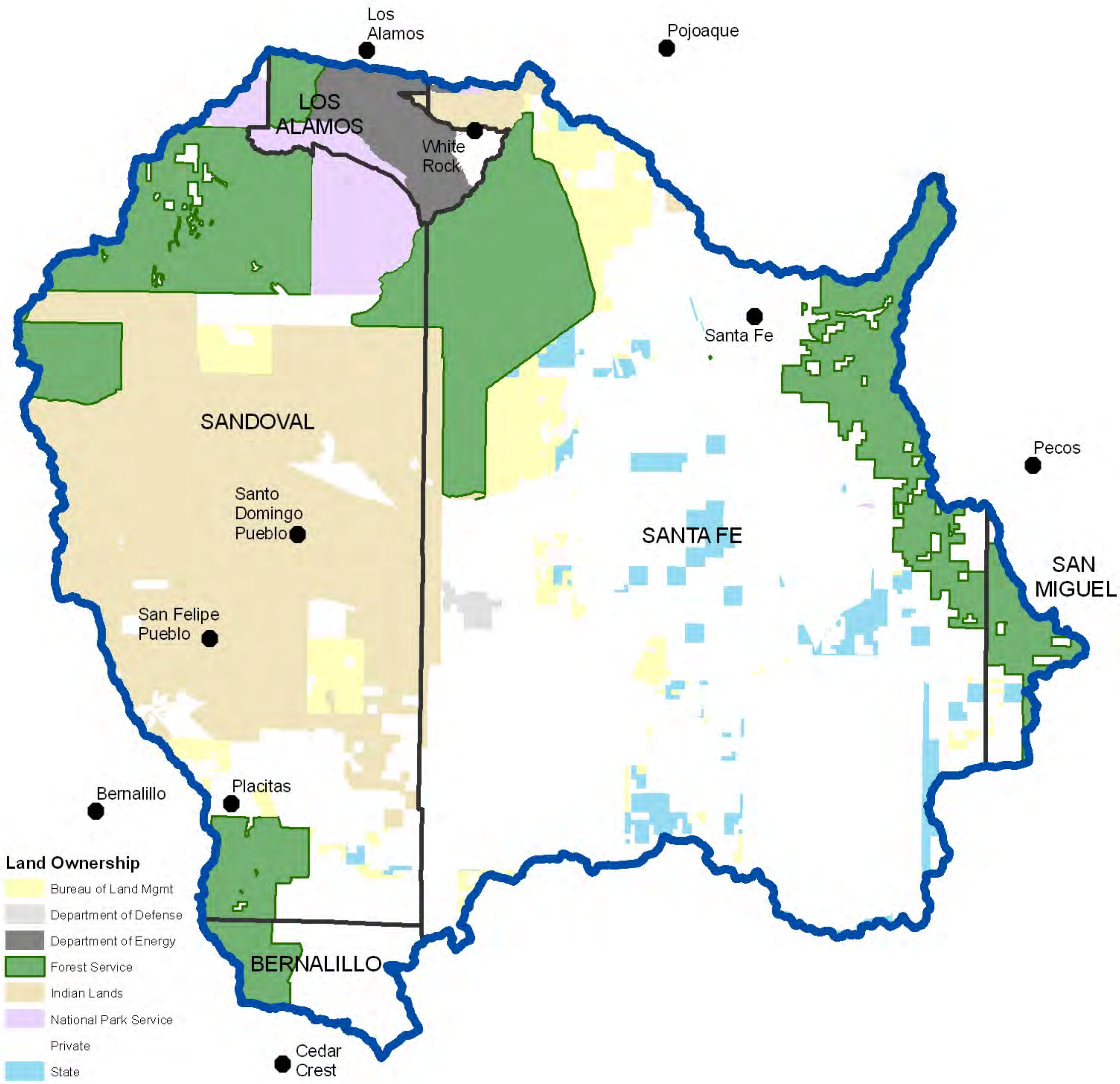
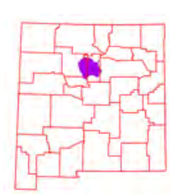


Figure 5. Rio Grande-Santa Fe Watershed Land Ownership.

Land Ownership

COUNTY	BLM	DoD	DoE	FS	Indian Lands	NPS	Private	State
Bernalillo				9,286			23,404	
Los Alamos			22,311	5,907	20	6,664	3,509	
San Miguel	539			12,341			6,747	644
Sandoval	17,781		19	88,739	238,066	26,258	75,148	771
Santa Fe	41,106	2,755	428	107,428	20,880	655	455,043	30,722
Watershed (∑)	59,426	2,755	22,758	223,701	258,966	33,577	563,851	32,137
% Watershed	5	<1	2	19	22	3	47	3

Table 2. Land ownership in the Rio Grande-Santa Fe watershed.



Las Conchas Fire[4]

Date Started: June 26, 2011

Cause: Human

Size: 156,593 acres total, 86,315 in the Rio Grande-Santa Fe watershed
Residences: 63 destroyed
Outbuildings: 49 destroyed; **2** damaged
Location: On Santa Fe National Forest in Sandoval, Los Alamos, and Rio Arriba Counties; Santa Clara Pueblo; Jemez Pueblo; Cochiti Pueblo; Santo Domingo Pueblo; Bandelier National Monument; Valles Caldera National Preserve; and state and private in-holdings.

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.

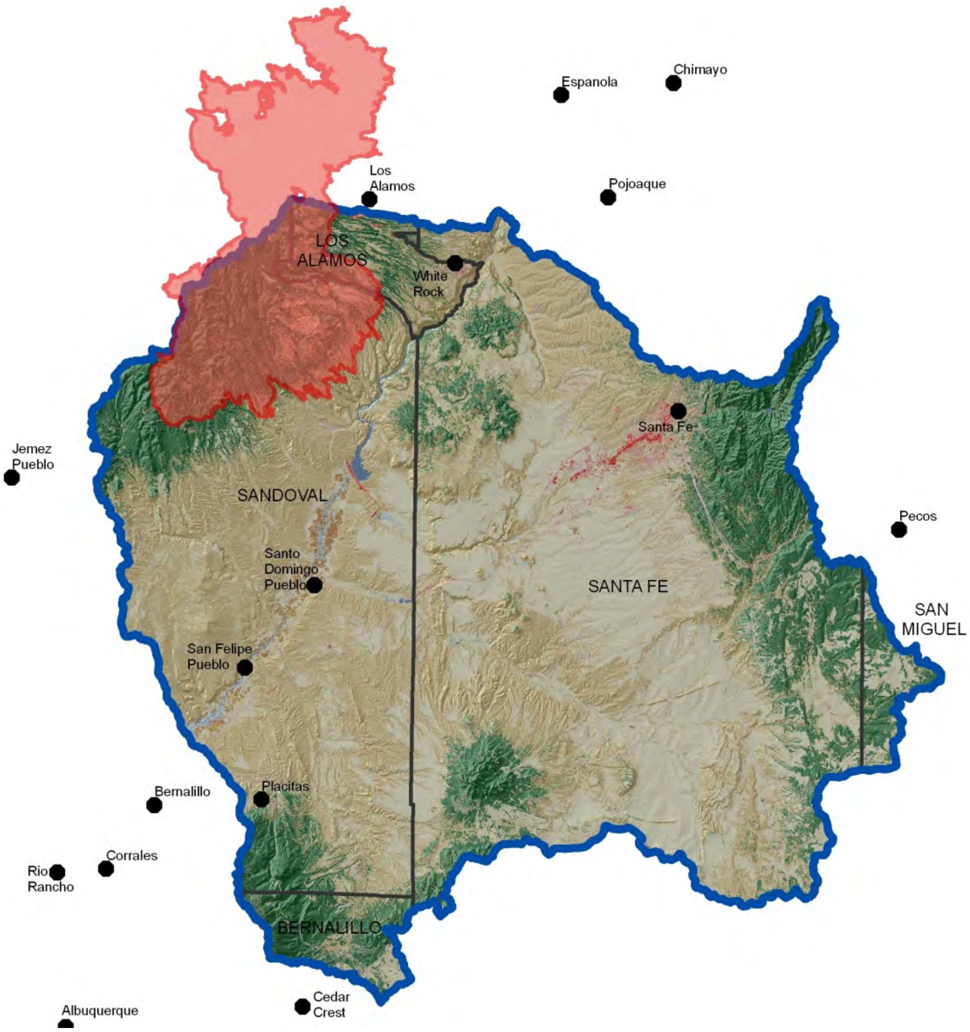
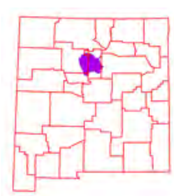


Figure 6: Las Conchas Fire, Summer 2011



Land Use / Land Cover [5, 6]

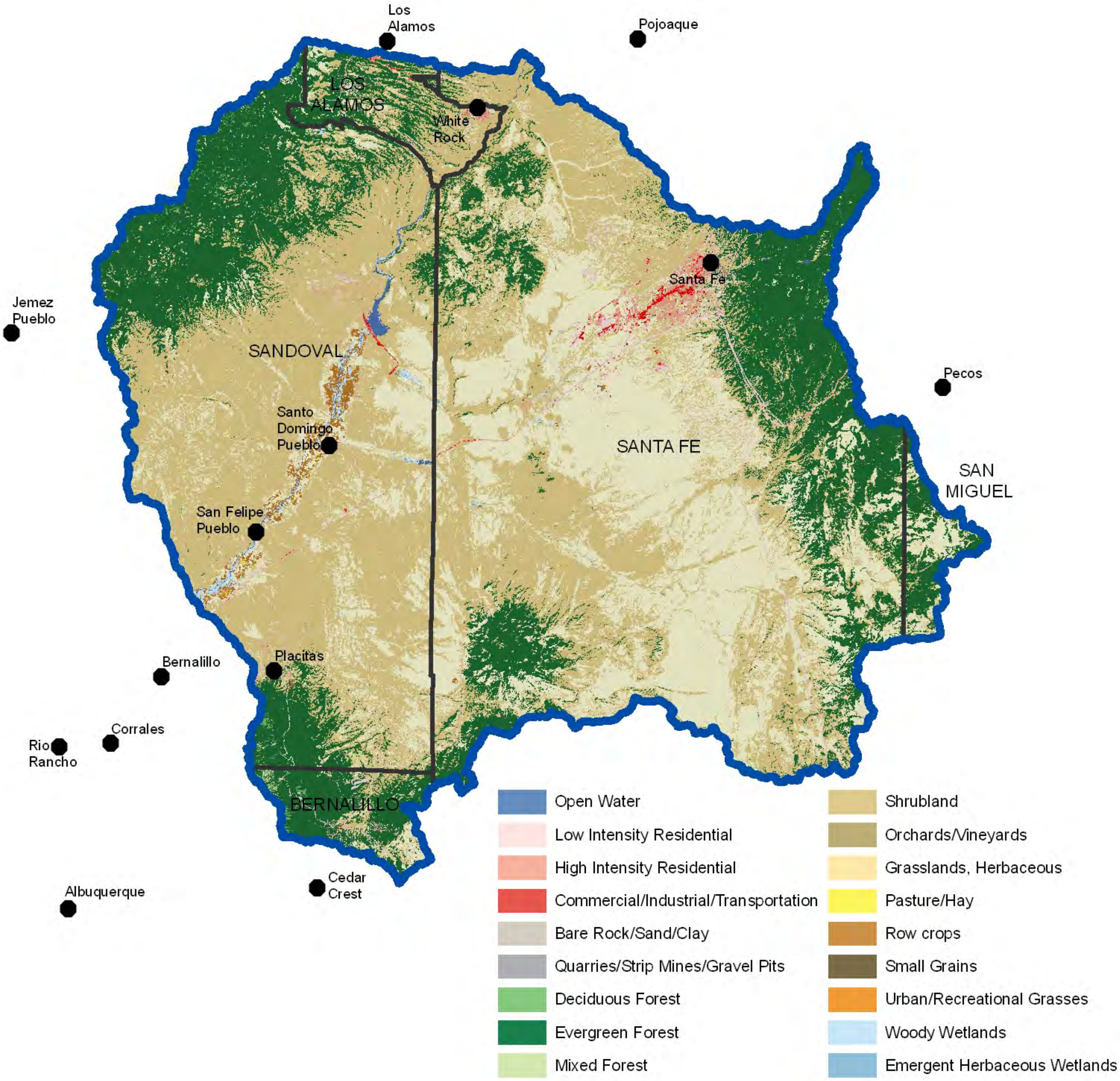
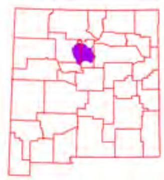


Figure 7. Subset of the National Land Cover Dataset over the Rio Grande-Santa Fe Watershed.

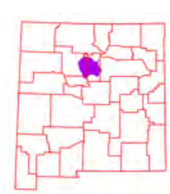


Land Use / Land Cover

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 Multi Resolution 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
Shrubland	521,268	44
Grasslands, Herbaceous	334,437	28
Evergreen Forest	296,243	25
Low Intensity Residential	17,487	1
High Intensity Residential	8,617	1
Row crops	6,381	1
Woody Wetlands	4,421	< 1
Deciduous forest	2,787	< 1
Open Water	2,587	< 1
Commercial/Industrial/Transportation	1,891	< 1
Mixed Forest	709	< 1
Pasture/hay	444	< 1

Table 3. Extent of NLCD classes in the Rio Grande-Santa Fe watershed.



Land Use / Land Cover

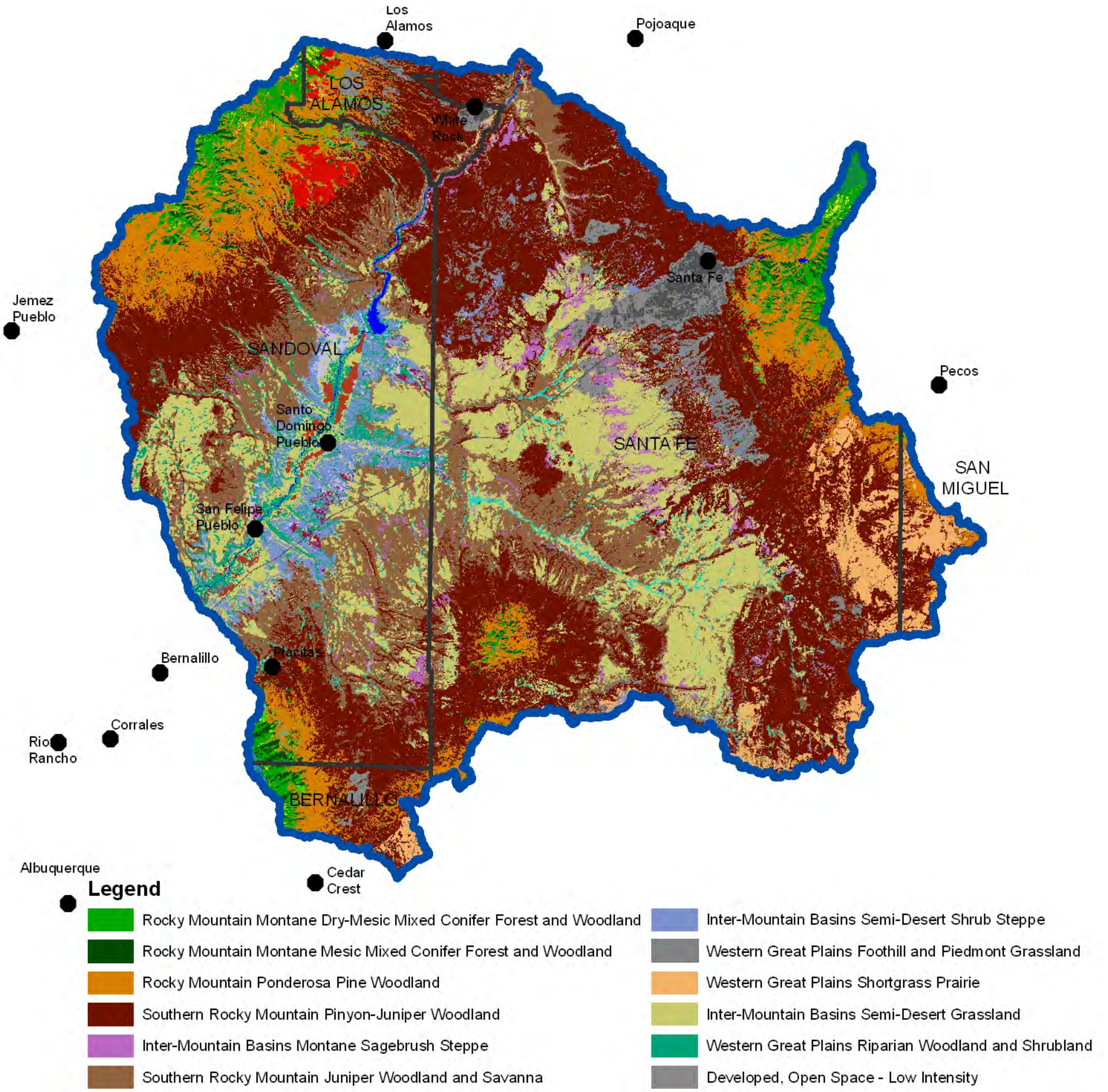
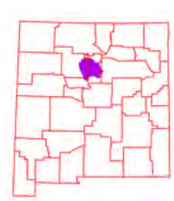


Figure 8. Subset of the SWREGAP over the Rio Grande-Santa Fe Watershed. The 12 dominant ecosystems are displayed in the legend.

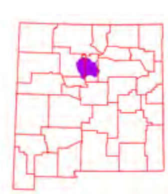


Land Use / Land Cover

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.

Ecosystem	Acres	% of Watershed
Southern Rocky Mountain Pinyon-Juniper Woodland	422,104	35
Southern Rocky Mountain Juniper Woodland and Savanna	193,205	16
Inter-Mountain Basins Semi-Desert Grassland	187,598	16
Rocky Mountain Ponderosa Pine Woodland	118,061	10
Western Great Plains Shortgrass Prairie	38,101	3
Inter-Mountain Basins Semi-Desert Shrub Steppe	33,130	3
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	30,724	3
Western Great Plains Riparian Woodland and Shrubland	27,205	2
Inter-Mountain Basins Montane Sagebrush Steppe	25,347	2
Western Great Plains Foothill and Piedmont Grassland	24,209	2
Developed, Open Space - Low Intensity	18,337	2
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	13,755	1
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	13,238	1
Developed, Medium - High Intensity	12,794	1
Recently Burned	7,671	1
Rocky Mountain Cliff and Canyon	7,176	1
Apacherian-Chihuahuan Mesquite Upland Scrub	4,267	< 1
Southern Rocky Mountain Montane-Subalpine Grassland	3,959	< 1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	3,710	< 1
Agriculture	3,597	< 1
Inter-Mountain Basins Active and Stabilized Dune	3,477	< 1
Open Water	2,729	< 1
Inter-Mountain Basins Mixed Salt Desert Scrub	2,498	< 1
Rocky Mountain Aspen Forest and Woodland	2,158	< 1

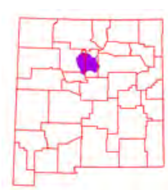
Table 4. SW Region Gap analysis ecosystem acreages.



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

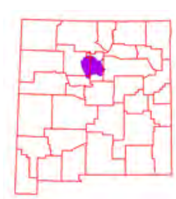
The National Hydrography Dataset (NHD) is a comprehensive set of data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities. The NHD identifies 4,249 miles (6,838 km) of water courses in the Rio Grande-Santa Fe River 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 Rio Grande-Santa Fe.



Water Course Type	Miles
Artificial path	368
Connector	20
Canal / Ditch	126
Intermittent Stream / River	3,480
Perennial Stream / River	217
Sum (∑)	4,249

Table 5. NHD Water Course Type and Extents



There are 28 water gauging stations in the watershed. USGS Site 08319000 is near the West sideof the watershed on the Rio Grande at San Felipe, NM. During the period 1974 – 2010, this site has had mean annual discharge of 1,438 cubic feet per second ranging from 547 (1977) to 2,493 (1987) cubic feet per second.

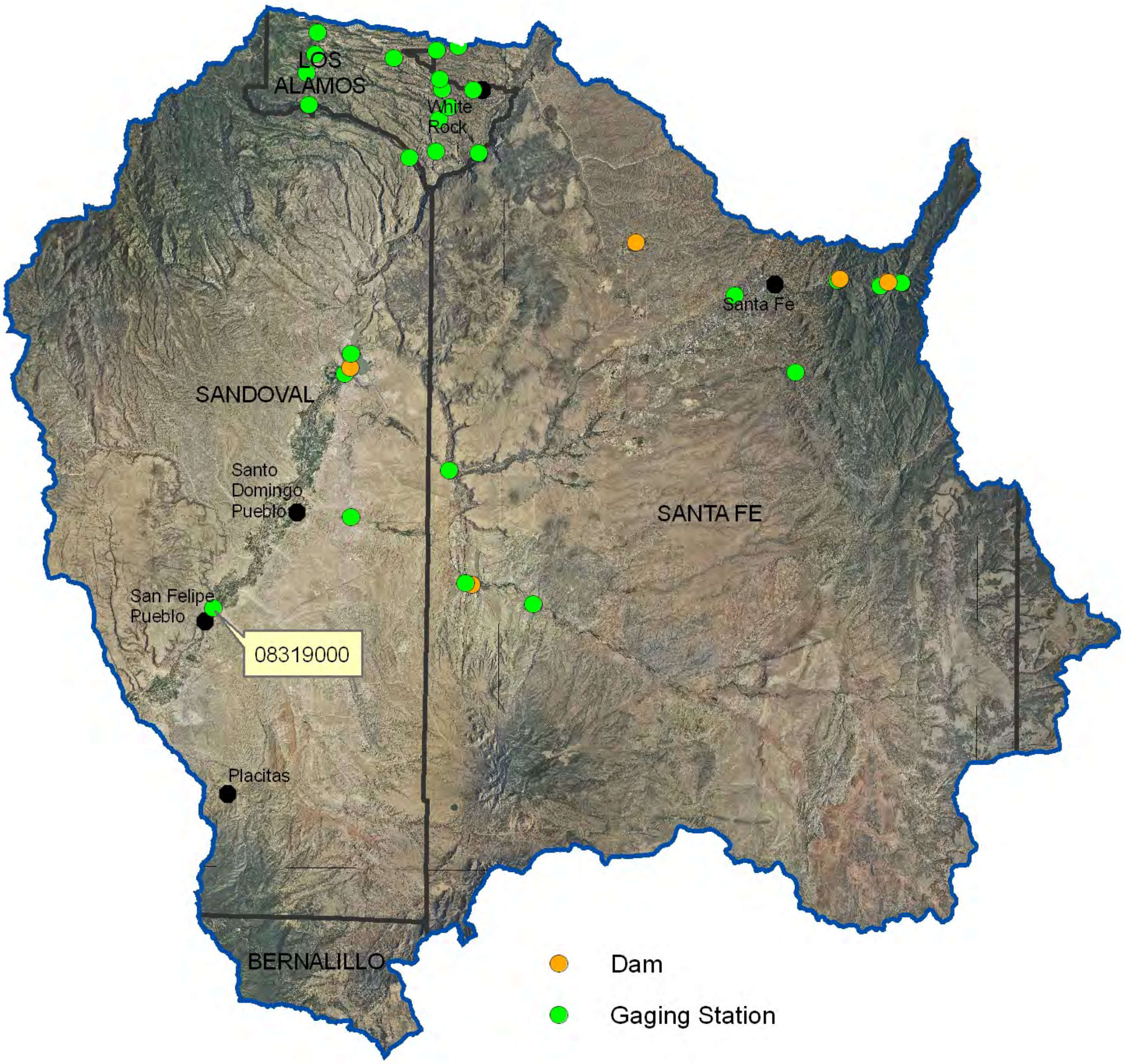
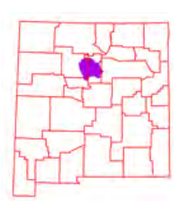


Figure 10. Gaging Stations in the Rio Grande-Santa Fe Watershed



Hydrology

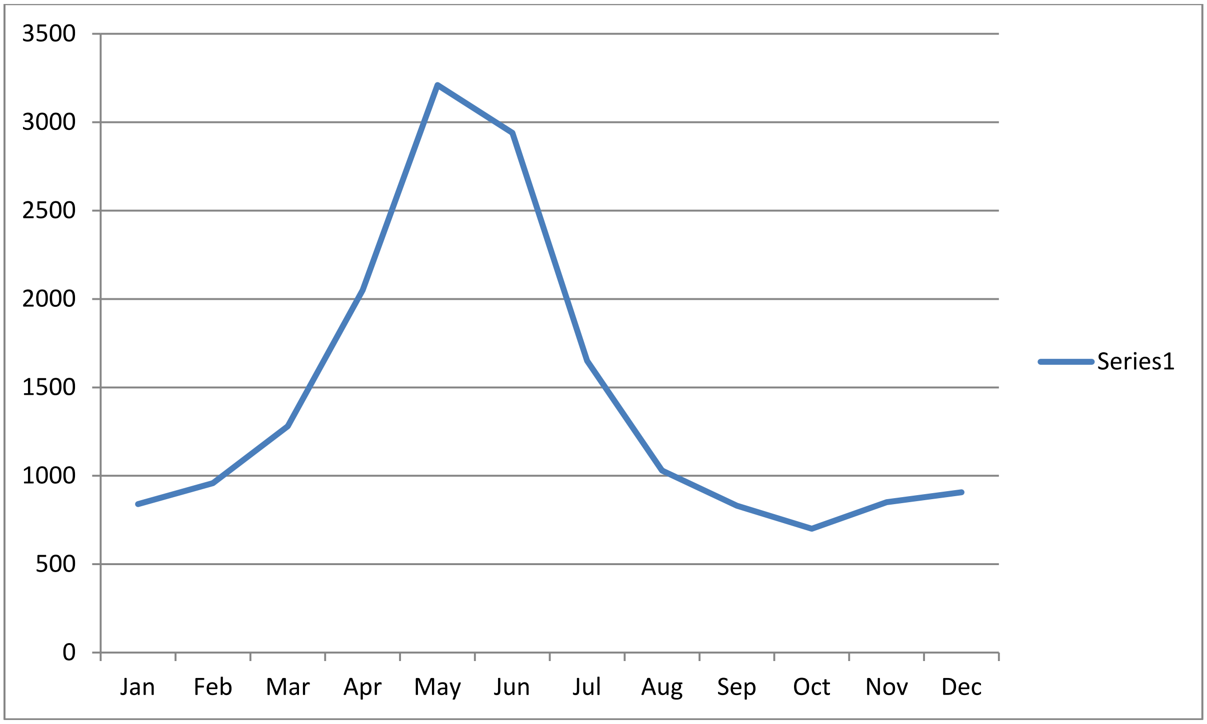
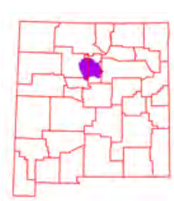


Figure 11. Monthly Average of Mean Daily Flow on the Rio Grande at San Felipe, NM. Period of Observation: 1973-2010.

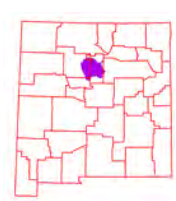


The New Mexico Water Quality Control Commission (NMWQCC) is the issuing agency of water quality standards for interstate and intrastate waters in New Mexico. The NMWQCC has defined the Rio Grande-Santa Fe watershed as part of the Rio Grande River Basin.

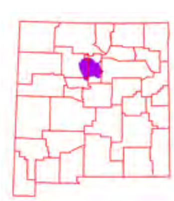
Within the Rio Grande-Santa Fe Watershed, there are no bodies of water that are listed as impaired as of the 2010-12 listing cycle. The river and stream reaches total 208.26 miles (335.17 km).

The Rio Grande-Santa Fe watershed has the following reaches listed as 303 (d) Impaired Surface Waters:

1. Ancho Canyon (North Fork to headwaters)
2. Ancho Canyon (Rio Grande to North Fork Ancho)
3. Arroyo de la Delfe (Pajarito Canyon to headwaters)
4. Canada del Buey (within LANL)
5. Canon de Valle (below LANL gage E256)
6. Canon de Valle (LANL gage E256 to Burning Ground Spring
7. Canon de Valle (upper LANL boundary to headwaters)
8. Galisteo Creek (perennial reaches above Kewa Pueblo boundary)
9. Las Huertas Creek (perennial part Santa Ana Pueblo boundary to headwaters)
10. Mortandad Canyon (within LANL)
11. North Fork Ancho Canyon (Ancho Canyon to headwaters)
12. Pajarito Canyon (Arroyo de la Delfe to Starmers Spring)
13. Pajarito Canyon (Upper LANL boundary to headwaters)
14. Pajarito Canyon (within LANL above Starmers Gulch)
15. Pajarito Canyon (within LANL below Arroyo de la Delfe)
16. Potrillo Canyon (above Water Canyon)
17. Rio Grande (Cochiti Reservoir to San Ildefonso boundary)
18. Rito de los Frijoles (Rio Grande to Upper Crossing)
19. Rito de los Frijoles (Upper Crossing to headwaters)
20. San Pedro Creek (San Felipe boundary to headwaters)
21. Sandia Canyon (Sigma Canyon to NPDES outfall 001)
22. Sandia Canyon (within LANL below Sigma Canyon)
23. Santa Fe River (non-Pueblo Cochiti Reservoir to Paseo del Canon)
24. Santa Fe River (Paseo del Canon to Santa Fe WWTP)
25. Santa Fe River (Santa Fe WWTP to Nichols Reservoir)



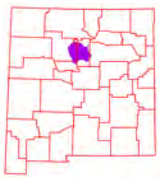
26. Ten Site Canyon (Mortandad Canyon to headwaters)
27. Three Mile Canyon (Pajarito Canyon to headwaters)
28. Two Mile Canyon (Pajarito to headwaters)
29. Water Canyon (Area–A Canyon to NM501
30. Water Canyon (Upper LANL boundary to headwaters)
31. Water Canyon (within LANL below Area–A Canyon)



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

Use	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
high quality coldwater aquatic life								NS	NS						
marginal coldwater aquatic life						NS						NS			
Irrigation/irrigation storage								X	X						
domestic water supply								X							
livestock watering	NA	NS	NS	NS	NS	NS	NS	X	X	NS	NS	NS	NS	NS	NS
wildlife habitat	X	X	NS	NA	X	NS	X	X	X	X	NS	X	NS	X	NS
marginal warmwater aquatic life							NS						NS		
Primary Contact							NA	NA			NA		NA		
Secondary Contact	NA	NA	NA	NA	NA	NA		NA	X	NA		NA		NA	NA
Fish culture															
Limited Aquatic Life	NS	NS	NS	NS	NS					NS	NS			NS	NS
Industrial Water Supply								X							
Municipal Water Supply								X							

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



Use	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
high quality coldwater aquatic life			NS	NS												
Marginal coldwater aquatic life		NS			NS	NS		NS	NS					NS		
Irrigation/irrigation storage		X	X	X	X			X	X							
domestic water supply			X	X												
livestock watering	NS	X	X	X	X	NS	NS	X	X	X	NS	NS	NS	X	X	NS
wildlife habitat	X	X	X	X	X	NS	NS	X	X	NS	NS	X	NS	X	X	NS
marginal warmwater aquatic life		NS						X	X	NS					NS	
primary contact		NA	X	NA						NS				NA	NA	
secondary contact	NA		X	NA	X	NA	NA	X	X		NA	NA	NA			NA
Fish culture																
Industrial Water Supply			X	X												
Municipal Water Supply			X	X												
Limited Aquatic Life	NS						NS				NS	NS	NS			NS

Table 7 continued. Listed Uses. NS = Not Supporting, NA = not assessed, x = Fully Supporting

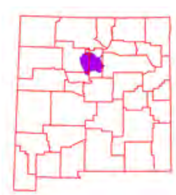
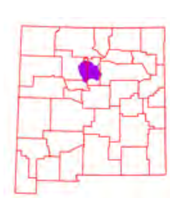


Figure 12. 303(d) Impaired waters (numbers reference Table 6 Stream Reaches)



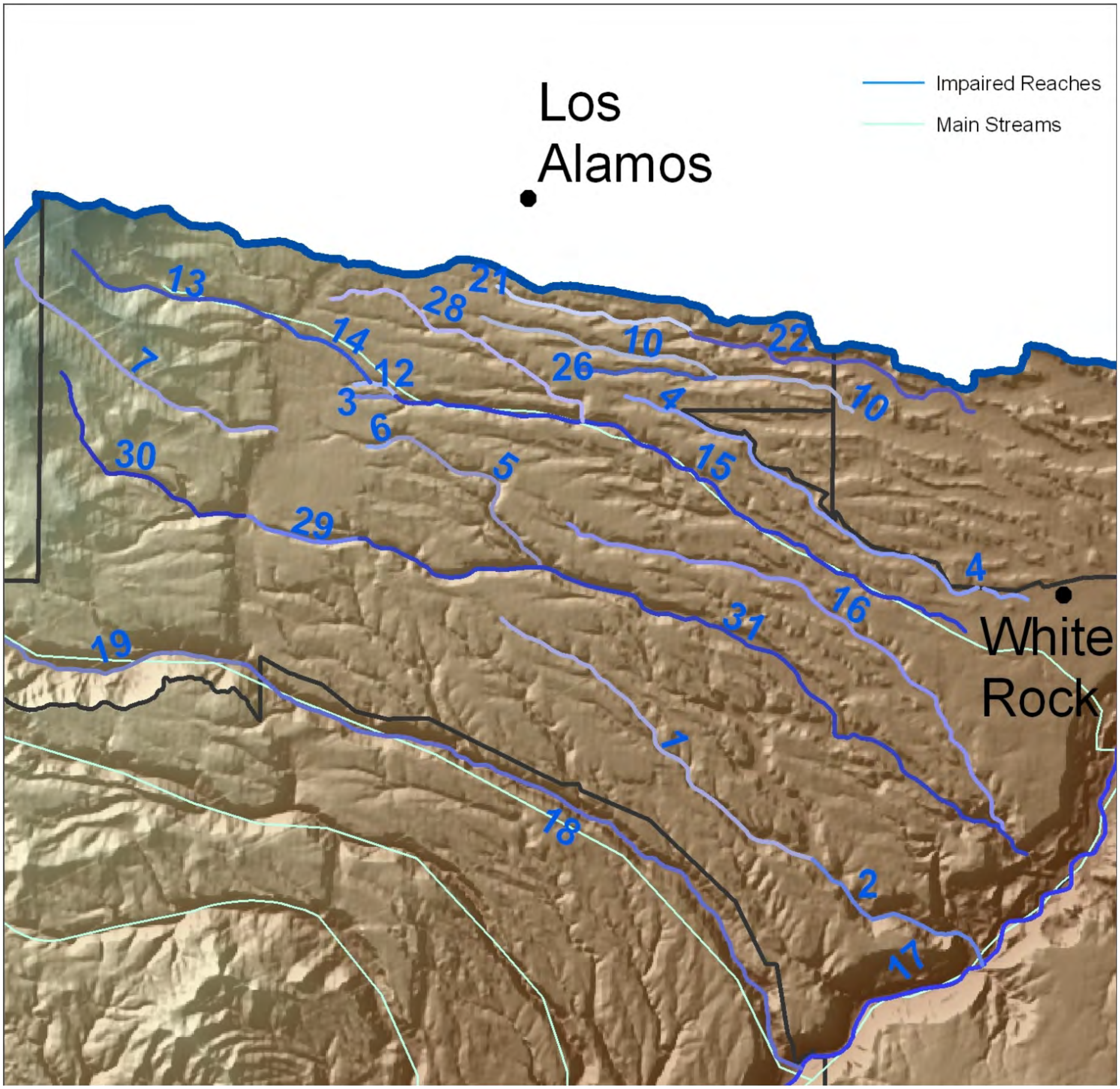
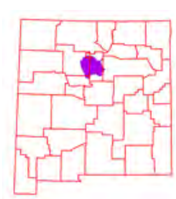


Figure 13. Impaired Reaches around Los Alamos.

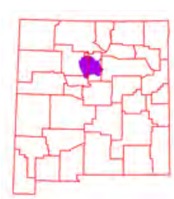


Hydrology

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 Rio Grande-Santa Fe Watershed, there are no bodies of water that are listed as impaired as of the 2010-12 listing cycle. The river and stream reaches total 208.26 miles (335.17 km).

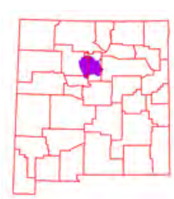
Probable Causes of Impairment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Aluminum		X	X	X	X	X	X			X		X	X	X	X	X
Copper						X				X			X		X	
Gross Alpha - Adjusted		X	X	X	X	X	X			X	X	X	X	X	X	X
Mercury			X													
Nutrient/Eutrophication									X							
PCB’s	X			X		X	X				X		X		X	
Specific Conductance								X								
Temperature								X								
Turbidity									X							

Table 7. Possible Causes of Impairment



Probable Causes of Impairment	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Aluminum		X	X		X	X			X	X	X	X	X	X	X
Benthic-Macroinvertebrate Bioassessments				X											
Copper					X	X				X	X				
E. Coli									X						
Gross Alpha - Adjusted					X	X				X	X	X			X
Nutrient/Eutrophication							X	X							
Mercury					X	X									
Oxygen, Dissolved							X	X							
PCB's					X	X			X	X		X			X
PCB's in fish tissue	X														
DDT in fish tissue		X													
Sedimentation/Siltation															
Turbidity	X						X								
Zinc										X					
Arsenic										X					
Silver										X					

Table 7-Continued. Possible Causes of Impairment



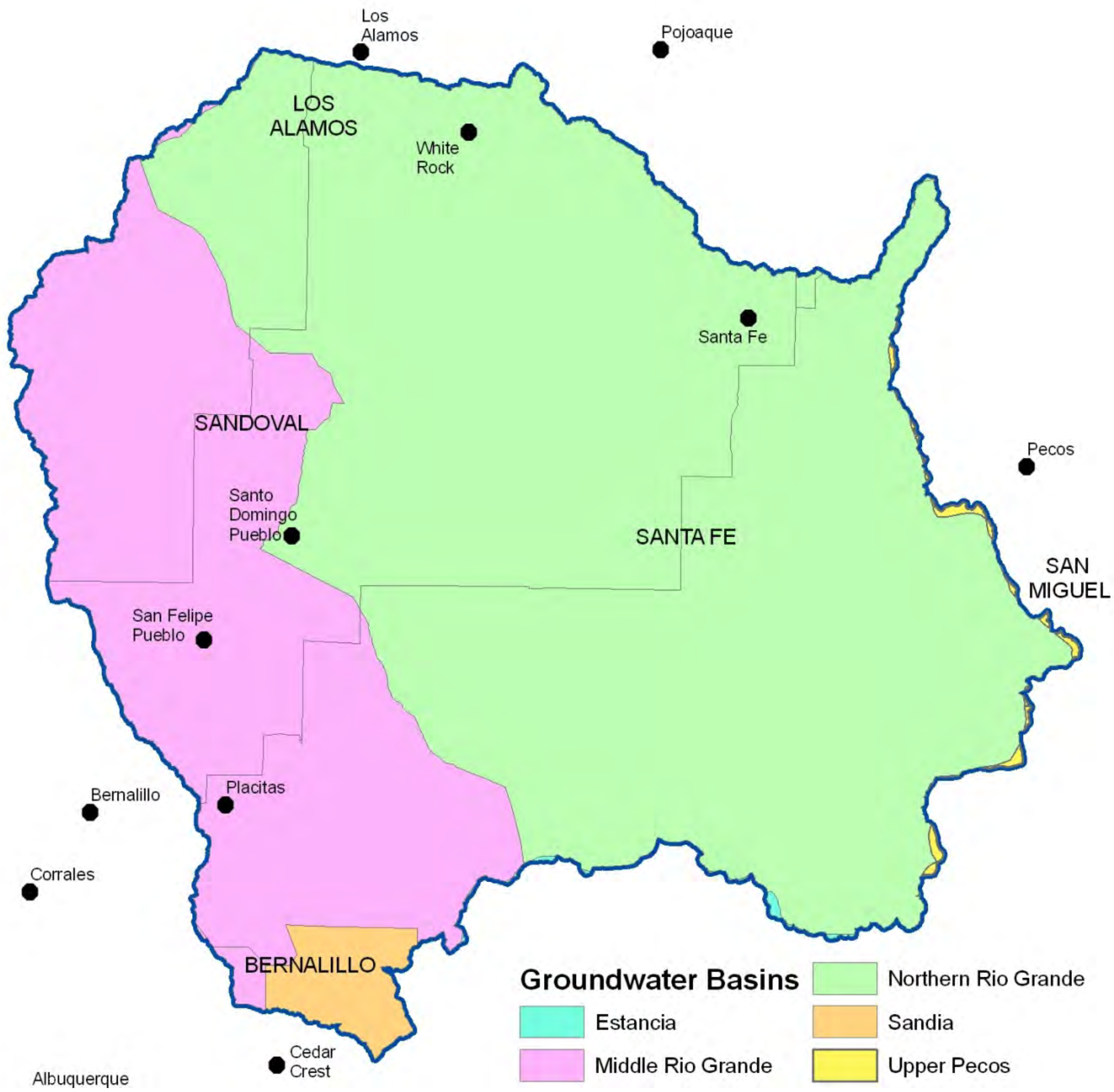
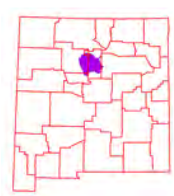


Figure 14. Declared Groundwater Basins of the Rio Grande-Santa Fe.

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 Rio Grande-Santa Fe watershed is mainly within the Northern Rio Grande Underground Water Basin (827,131 acres), but also the Estancia (884 acres), Middle Rio Grande (342,140 acres), Sandia (23,440 acres), and Upper Pecos (3,629 acres) Underground Water Basins.

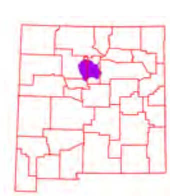


Threatened and Endangered Species [12]

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 Rio Grande-Santa Fe River Watershed.

Common Name	Scientific Name	Tax.Class	Family	Fed Status	State Status
Rio Grande Silvery Minnow	*Hybognathus amarus*	Actinopterygii	Cyprinidae	LE	E
Rio Grande Cutthroat Trout	*Oncorhynchus clarkii virginalis*	Actinopterygii	Salmonidae	C	
Jemez Mountains Salamander	*Plethodon neomexicanus*	Amphibia	Plethodontidae		E
Boreal Owl	*Aegolius funereus*	Aves	Strigidae		T
Mexican Spotted Owl	*Strix occidentalis lucida*	Aves	Strigidae	LT	
Gray Vireo	*Vireo vicinior*	Aves	Vireonidae		T
	Opuntia viridiflora	Dicotyledoneae	Cactaceae		E
American Marten	*Martes americana*	Mammalia	Mustelidae		T
Wood Lily	*Lilium philadelphicum var. andinum*	Monocotyledoneae	Liliaceae		E
Large Yellow Lady's-slipper	*Cypripedium parviflorum var. pubescens*	Monocotyledoneae	Orchidaceae		E

Table 8. Threatened and Endangered Plant and Animal Species.

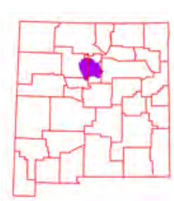


Invasive Species [13]

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 Rio Grande-Santa Fe 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.

Scientific Name	Common Name
Fabaceae **(Pea Family)**	**Camelthorn**
Scrophylariaceae **(Figwort Family)**	**Dalmatian Toadflax**
Brassicaceae (**Mustard Family)**	**Hoary Cress (Whitetop)**
Asteraceae **(Sunflower Family)**	**Musk Thistle**
Brassicaceae (**Mustard Family)**	**Perennial Pepperweed (Tall Whitetop)**
Lythraceae **(Loosestrife Family)**	**Purple Loosestrife**
Asteraceae **(Sunflower Family)**	**Russian Knapweed**

Table 9. Invasive Species Recognized by the SWEMP.



Common Resource Areas[14]

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..

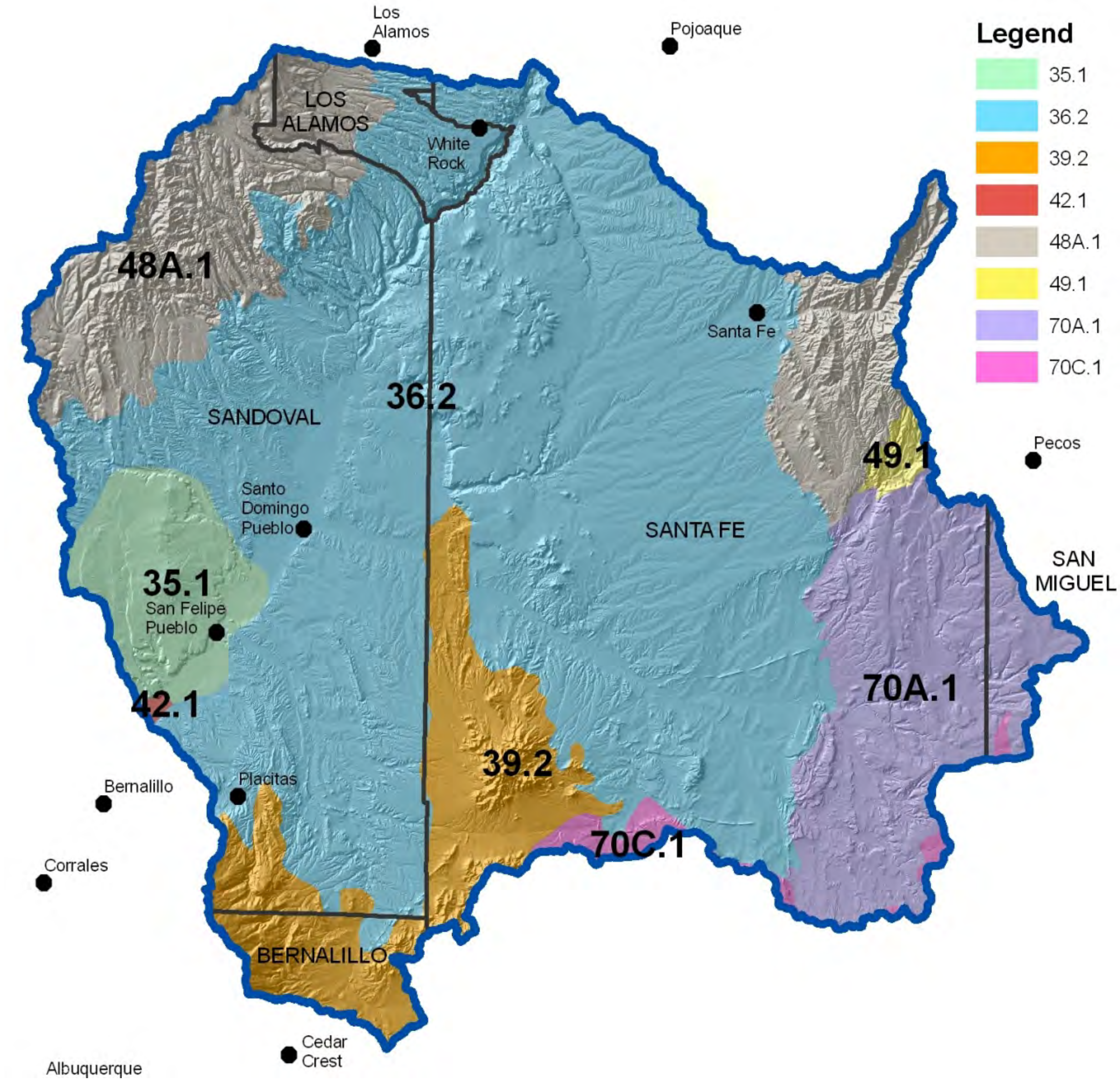
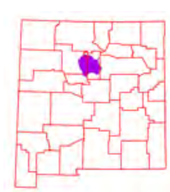


Figure 15. Common Resource Areas of the Rio Grande-Santa Fe



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.

36.2 – Southwest Plateaus, Mesas, and Foothills – Warm Semiarid Mesas and Plateaus
This area encompasses the lower elevation mesas and plateaus. The temperature regime is mesic and the moisture regime is transitional from ustic to aridic. Vegetation is typically twoneedle pinyon, Utah juniper, and big sagebrush. Cropland is a significant land use in parts of this area, particularly on soils formed in thick deposits of eolian material. Precipitation ranges from 10 to about 16 inches. Elevations range from about 6,000 to 7.000 feet.

39.2 – Central New Mexico Mountains
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 12000 feet. Precipitation ranges 17 to 25 inches per year. The soil temperature regime ranges from mesic to frigid. Vegetation includes corkbark, Douglas and white fir, Englemann spruce, pinyon and southwestern white pine, and aspen. Grasslands include tufted hairgrass, sedges, and Arizona and Thurber fescue.

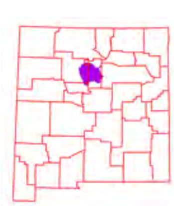
42.1 – Upper Rio Grande Rift Valley
This unit occurs within the Basin and Range Physiographic Province and contains the upper Rio Grande Rift Valley. Elevations range from 4500 to 5500 feet. Precipitation ranges from 8 to 11 inches per year. The soil temperature regime ranges thermic to mesic. The soil moisture regime is typic aridic. Indian ricegrass, New Mexico feathergrass, galleta, blue grama and bottlebrush squirreltail characterize vegetation in the cooler portions. Warmer portions include black grama and tobosa. Alkali sacaton, dropseed and threeawns are common.

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.

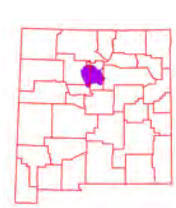
70A.1 – Northern New Mexico Highlands
This unit is characterized by broad, rolling plains broken by closed basins and drainageways that have smooth-shaped valley floors. Rugged breaks are common in the northern part of the area. Native vegetation is mid- to short-grass prairie species in the lowlands, 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.

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)



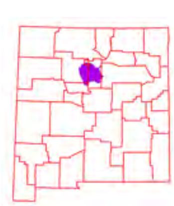
Conservation [15]

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.



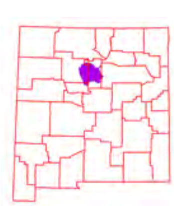
Conservation Practice	2006		2007		2008		2009		2010		TOTAL	
	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres
Brush Management	1	1	1	7	1	318	2	50	2	17	7	393
Conservation Crop Rotation			8	59	8	32			14	181	30	272
Critical Area Planting	1	100									1	100
Forage and Biomass Planting			1	13	6	32	1	11			8	56
Forage Harvest Management			4	15	6	37	2	7	3	22	15	81
Integrated Pest Management			7	48	14	60	1	20	5	27	27	155
Irrigation Land Leveling	7	66	8	38	6	36	5	32	16	198	42	370
Irrigation System, Microirrigation							1	2			1	2
Irrigation System, Sprinkler							1	2			1	2
Irrigation Water Management	3	73	20	103	19	84	8	40	16	193	66	493
Nutrient Management			7	47	15	70	1	20	6	38	29	175
Prescribed Grazing	1	2,273	4	5,957	14	5,569	11	3,842	4	6,208	34	23,849
Residue Management, Seasonal			8	59	8	32			3	16	19	107
Stormwater Runoff Control	1	600									1	600
Tree/Shrub Establishment			1	7	3	23	2	20			6	50
Upland Wildlife Habitat Management			5	5,975	12	9,578	6	5,589	4	13,698	27	34,840
Wetland Enhancement			2	27	2	15	2	20			6	62
SUM (∑)	14	3,113	76	12,355	114	15,886	43	9,655	73	20,598	320	61,607

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



Conservation Practice	2006		2007		2008		2009		2010		TOTAL	
	#	Feet	#	Feet	#	Feet	#	Feet	#	Feet	#	Feet
Above-Ground, Multi-Outlet Pipeline							1	300	2	600	3	900
Conservation Completion Incentive First Year			3								3	NA
Fence	1	9,584			5	33,373			2	20,064	8	63,021
Grade Stabilization Structure							9		7		16	NA
Irrigation Field Ditch			1	900							1	900
Irrigation Water Conveyance, Ditch and Canal Lining, plain concrete									5	2,379	5	2,379
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	1	40	7	4,558	7	560	6	7,740	11	6,334	32	19,232
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	10	5,706	11	5,950	8	6,566	2	567	4	3,802	35	22,591
Irrigation Water Conveyance, Pipeline, Steel			2	41			4	154			6	195
Pipeline	2	7,383									2	7,383
Pond									3		3	NA
Pumping Plant	1		1		1		2		3		8	NA
Structure for Water Control	4		11		5		7		12		39	NA
Water Well	1										1	NA
Watering Facility	2				3		1		2		8	NA
SUM (∑)	22	NA	36	NA	29	NA	32	NA	51	NA	170	NA

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



Soil Resource Inventory [16]

The Rio Grande-Santa Fe Watershed has a number of certified National Cooperative Soil Survey (NCSS) inventories. The National Forests in New Mexico mostly 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.

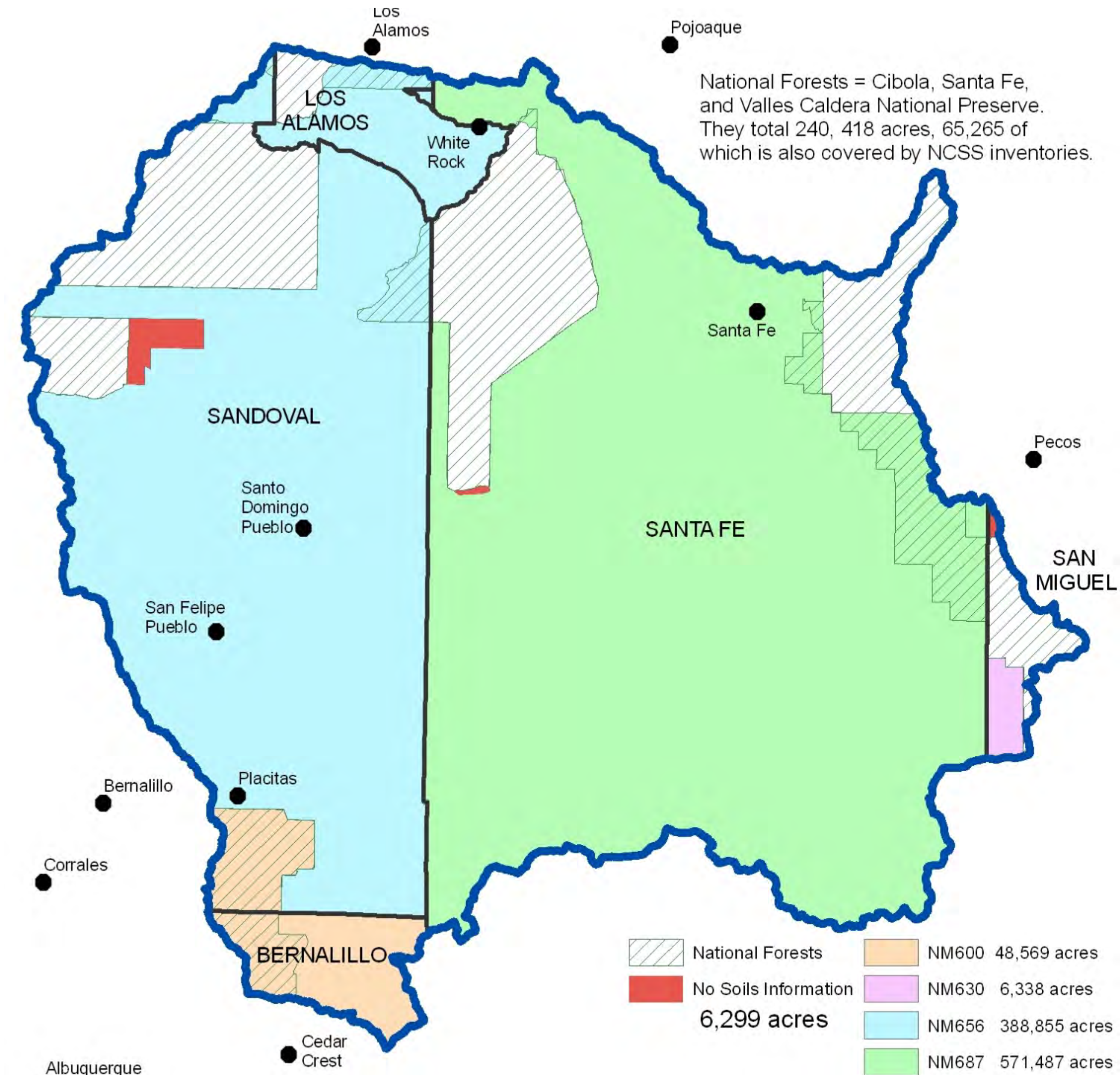
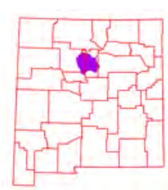


Figure 16. National Cooperative Soil Survey coverage of the Rio Grande-Santa Fe Watershed

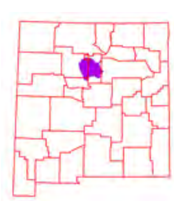


Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Rio Grande-Santa Fe 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 -

SSURGO Value	Nominal Description	Model Rank
Saturated Hydraulic Conductivity		
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
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 this time.

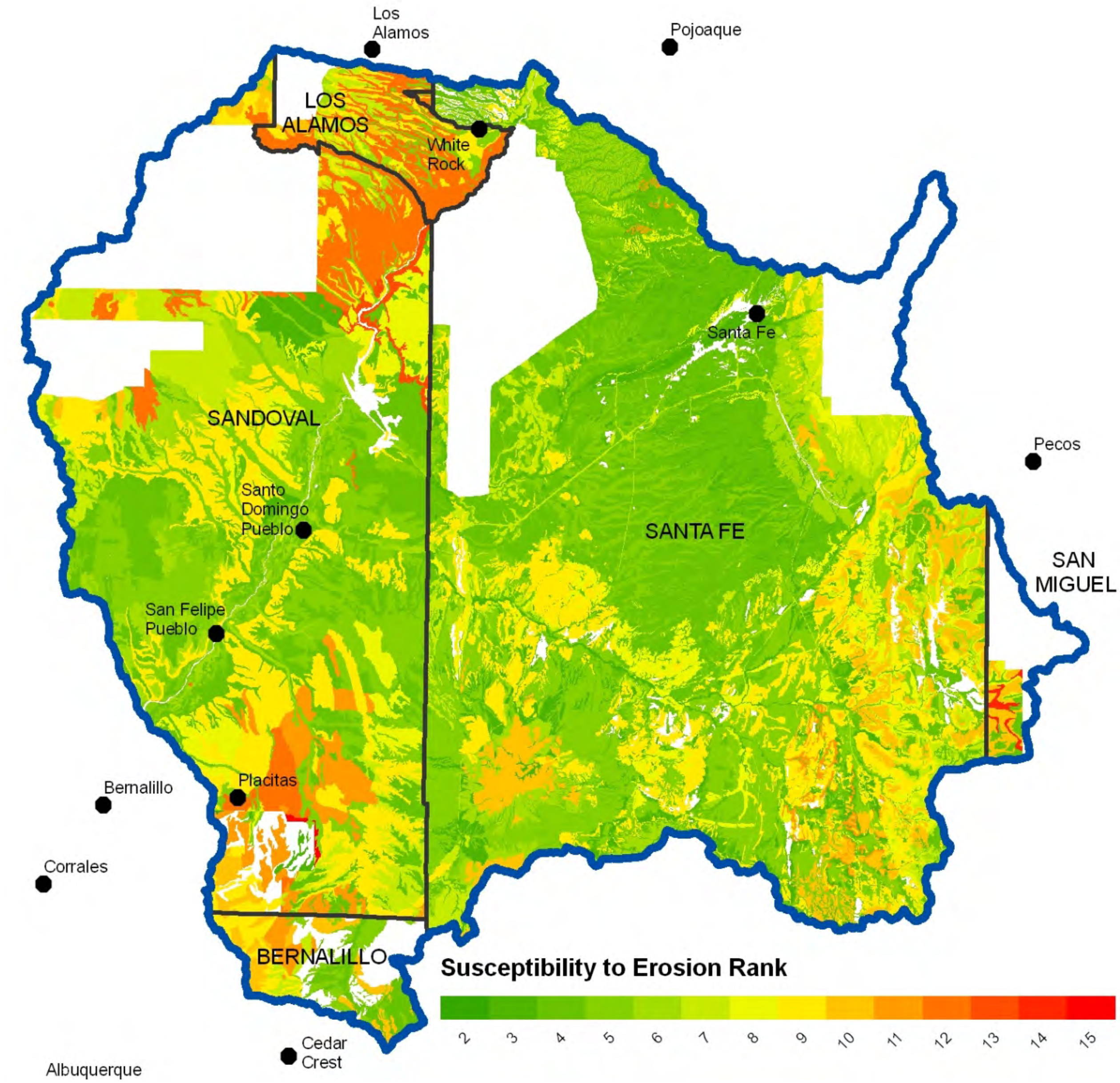
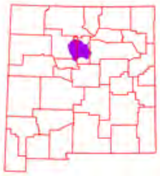


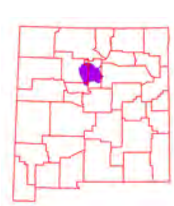
Figure 17. Rio Grande-Santa Fe Watershed Erosion Potential



Soil Resource Inventory

Rank	Acres
2	67
3	46,687
4	245,852
5	206,426
6	73,066
7	71,669
8	64,678
9	152,635
10	49,860
11	22,433
12	42,786
13	3,732
14	944
15	428
Sum(∑)	1,015,250

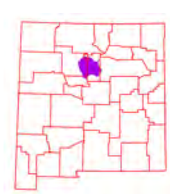
Table 13. Soil Erosion Potential Model Results. A greater rank indicates greater potential for erosion.



Socioeconomic Data [17]

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. 2009
Bernalillo	662,564	317,089	459,660	19,652	31,744	15,525	695	105,847	29,441	58,314
Los Alamos	17,950	2,646	15,765	102	142	1,071	10	393	467	117,453
San Miguel	29,393	22,583	19,583	412	508	228	37	7,478	1,147	41,096
Sandoval	131,561	46,129	89,482	2,800	16,945	1,922	169	15,139	5,104	65,693
Santa Fe	144,170	73,015	109,800	1,239	4,486	1,672	108	21,730	5,135	64,499

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



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

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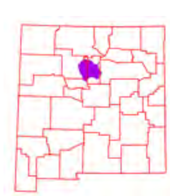
11. New Mexico - Office of the State Engineer- http://www.ose.state.nm.us/water_info_data.html

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

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

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

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



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

17. United States Census Bureau - http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml