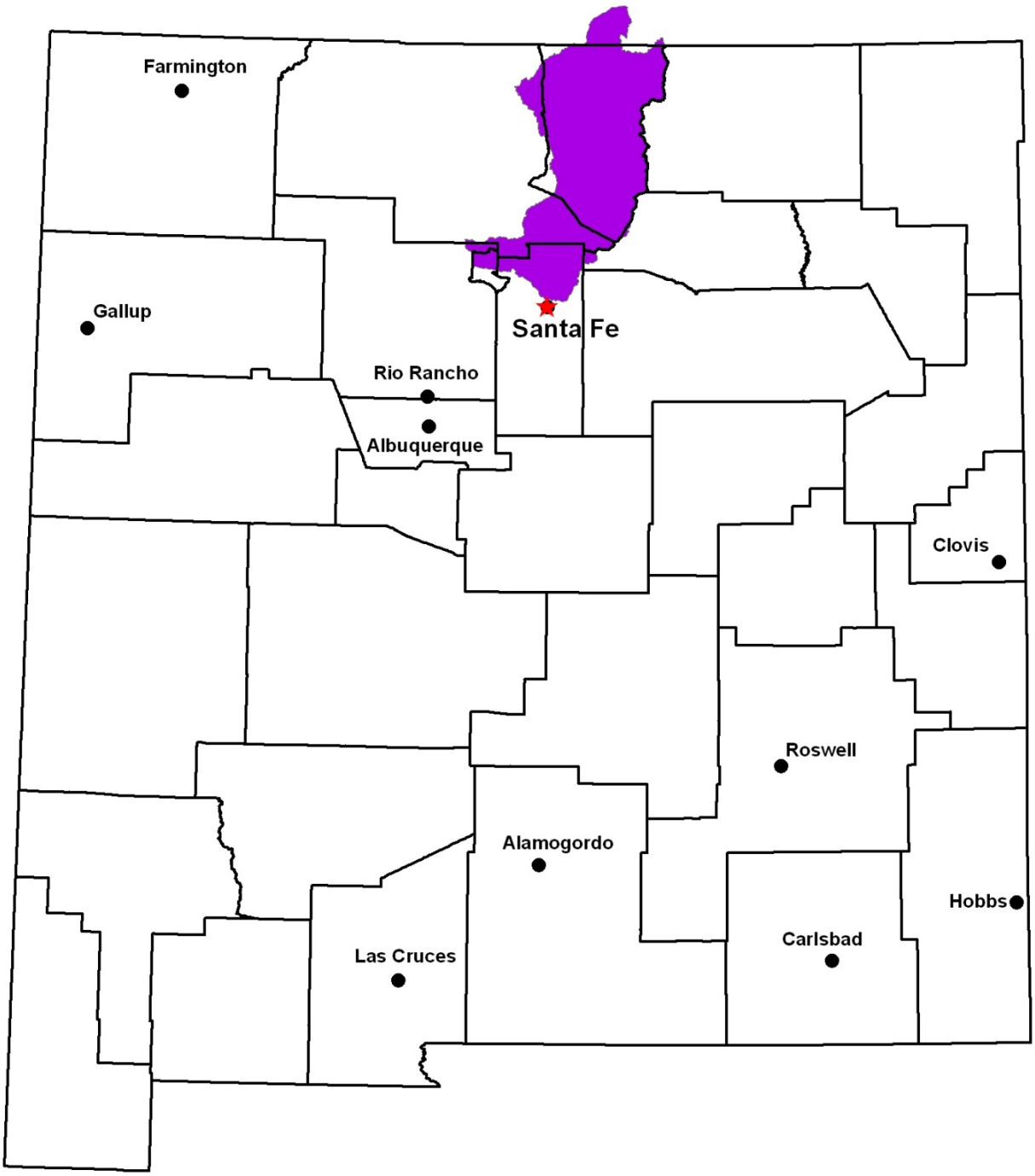
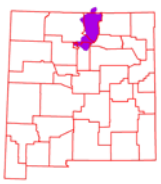


Rapid **W**atershed **A**ssessment
Upper Rio Grande Watershed



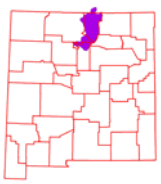
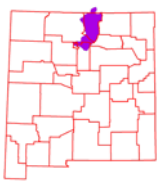
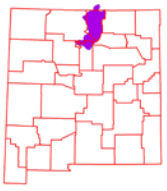


Table of Contents

List of Tables



List of Figures



Overview

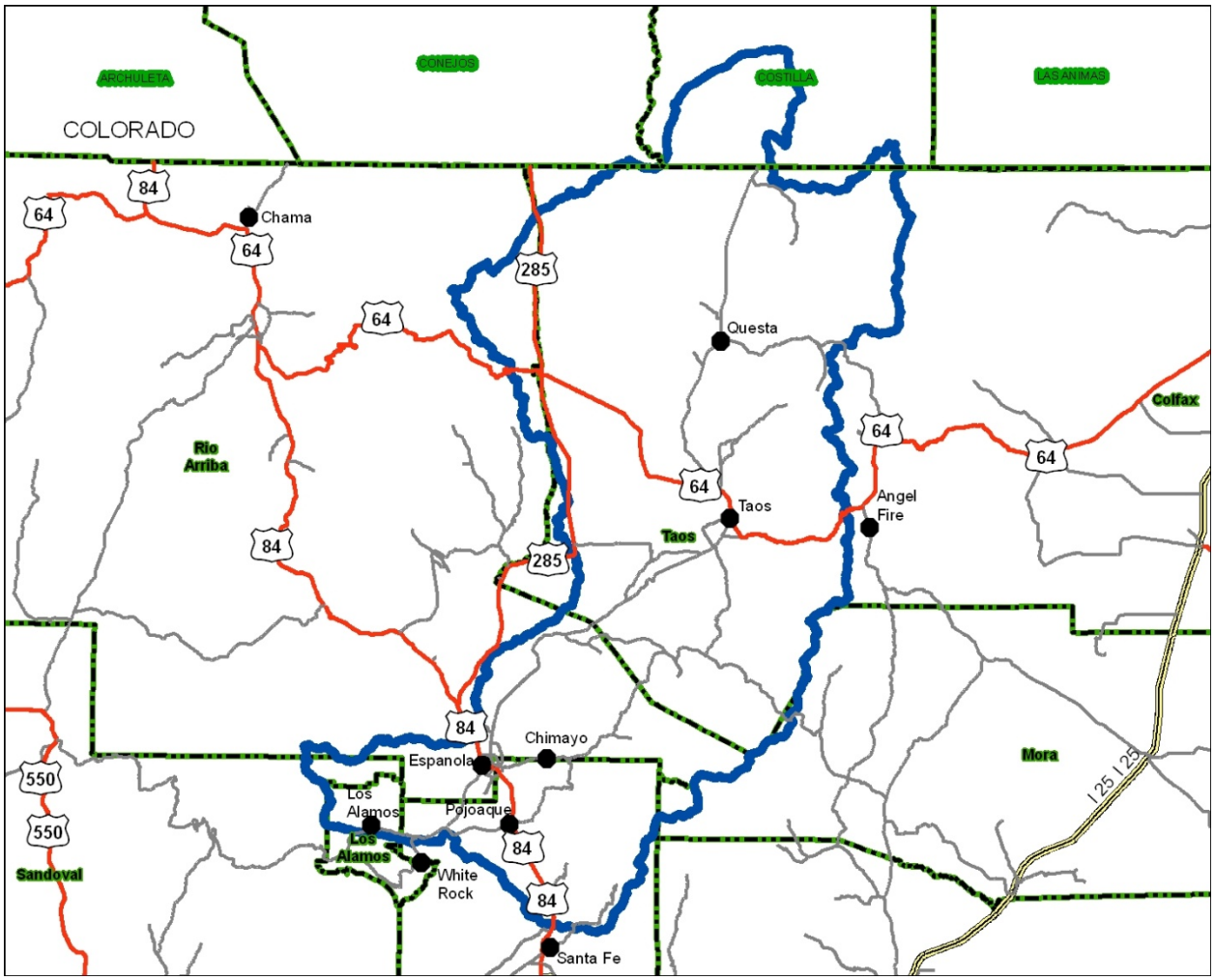
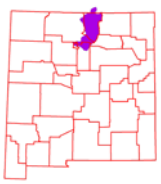


Figure 1. Upper Rio Grande Watershed Overview

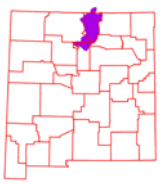


Overview

The Upper Rio Grande Watershed is located in southern Colorado and north central New Mexico. It covers 2,081,253 total acres (8,423 sq. km). Portions of the Upper Rio Grande watershed extend into southern Colorado (Costilla and Conejos counties), and Colfax, Los Alamos, Mora, Rio Arriba, Sandoval, Santa Fe, and Taos counties. Table 1 summarizes the distribution of the Upper Rio Grande watershed.

Table 1. Upper Rio Grande watershed acreage distribution.

	County Acres Total	Acres in HUC	% of HUC in County	% of County in HUC
Colfax	2,409,767	190	<1	<1
Los Alamos	69,949	31,240	2	45
Mora	1,236,472	14,704	<1	1
Rio Arriba	3,772,816	337,697	16	9
Sandoval	2,377,011	19,621	<1	<1
Santa Fe	1,222,180	237,970	11	19
Taos	1,409,948	1,336,437	64	95
CO-Conejos	825,586	541	<1	<1
CO-Costilla	785,605	102,401	5	13
Sum (∑)	--	2,081,253	100	--



Physical Setting

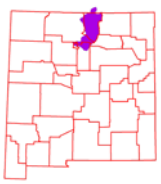
Geology: [1]
The Rio Grande originates in the San Juan Mountains of southwestern Colorado in the Southern Rocky Mountains physiographic province. In northern New Mexico, the river descends through the Rio Grande Gorge into the Española Valley, where it is joined from the northwest by the Rio Chama, its largest tributary. The hydrologic unit ends at Otowi, west of Pojoaque, New Mexico. Further downstream, the river enters Cochiti Lake, which marks the northern boundary of the Middle Rio Grande Valley.

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. 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 Rio Grande Rift is a graben that was dropped down between two North-South trending fault zones. The rift separates the Rocky Mountain physiographic province into two segments, the Sangre de Cristo range and the Tusa and Brazos mountains to the west. The Rio Grande currently flows within the rift. The Rio Grande Gorge, north of Velarde, was formed when the resistant basalt beds of the Taos volcanic field only allowed the Rio Grande to flow through a narrow valley up to 650 feet deep. Downstream of Valerde, the valley widens out.

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 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:

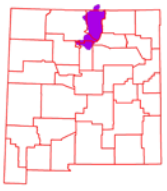
Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.
The soils in the Upper Rio Grande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



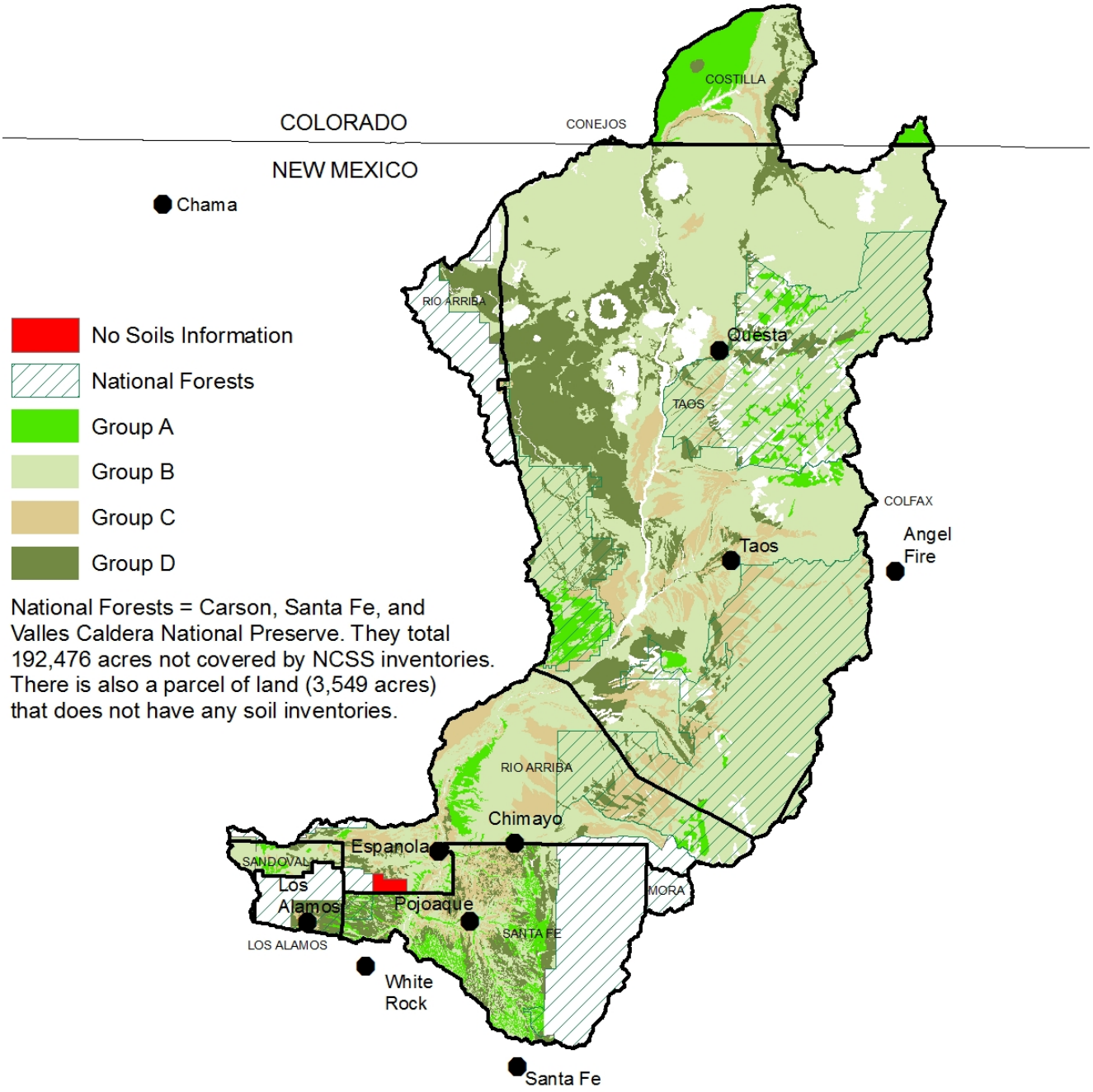
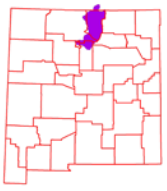


Figure 2. Hydrologic Soil Group



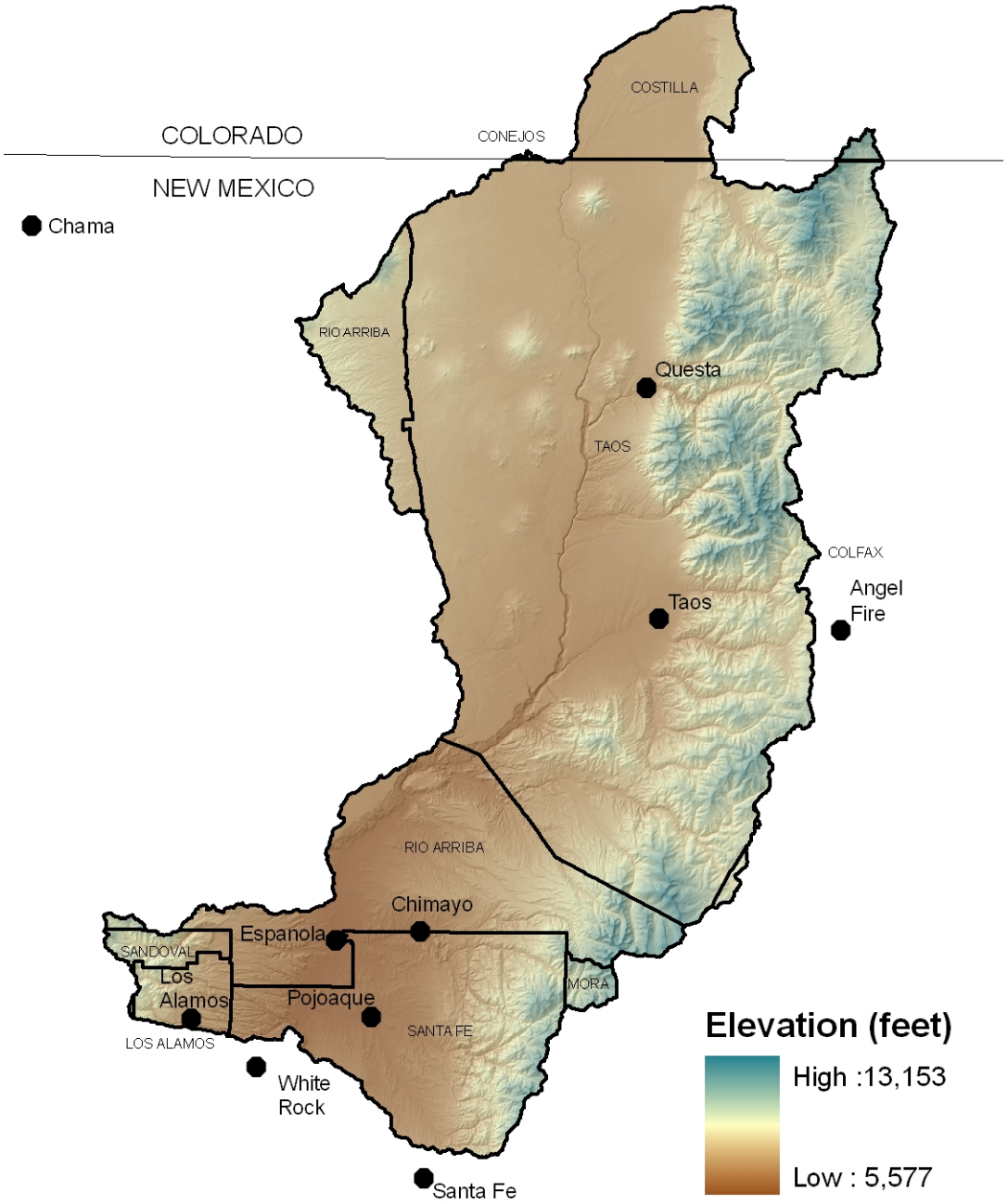
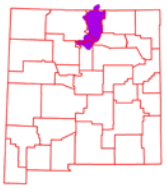


Figure 3. Upper Rio Grande Watershed Shaded Relief



Precipitation [2]

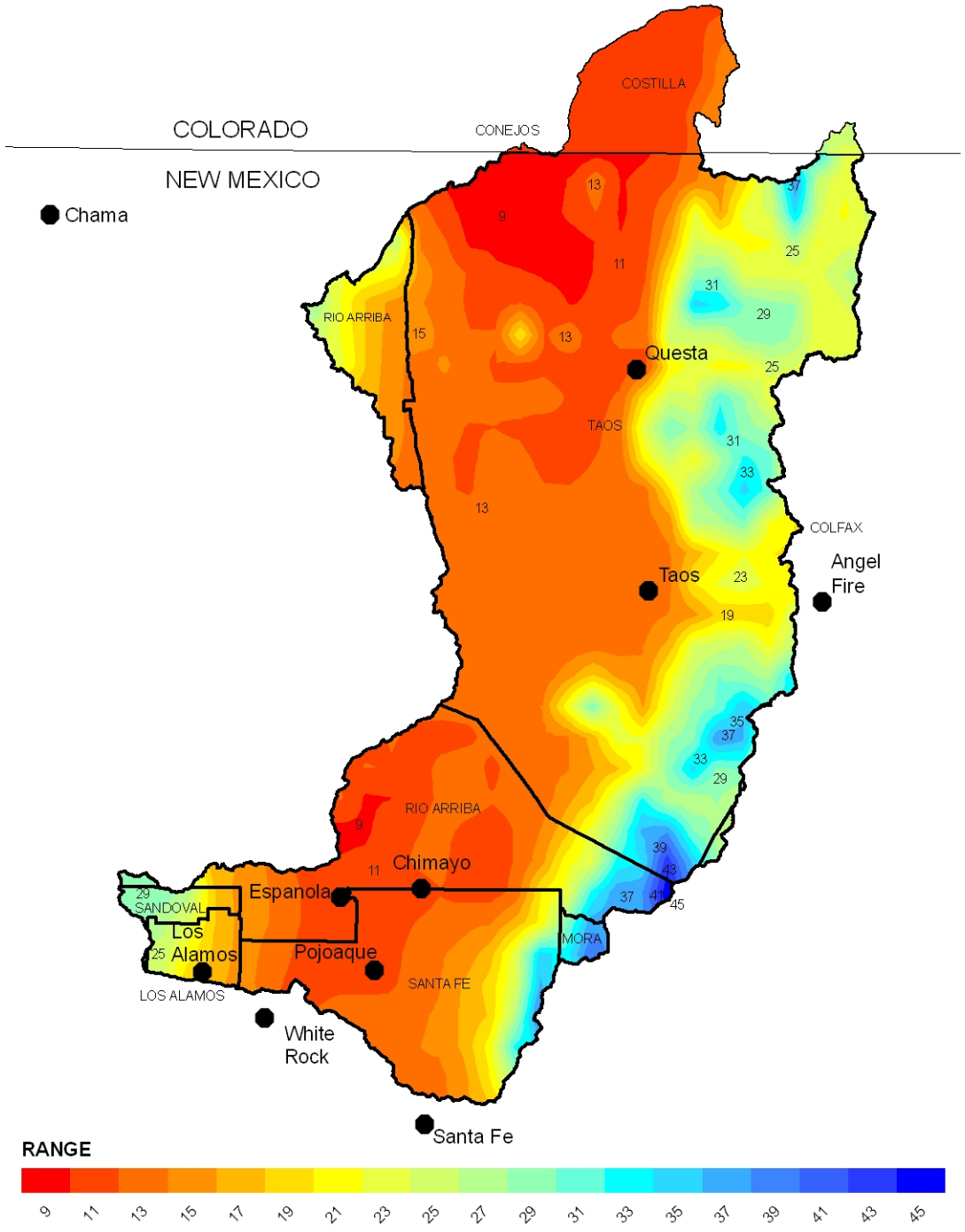
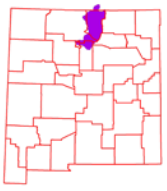


Figure 4. Upper Rio Grande Watershed Annual Precipitation.



Land Ownership [3,4]

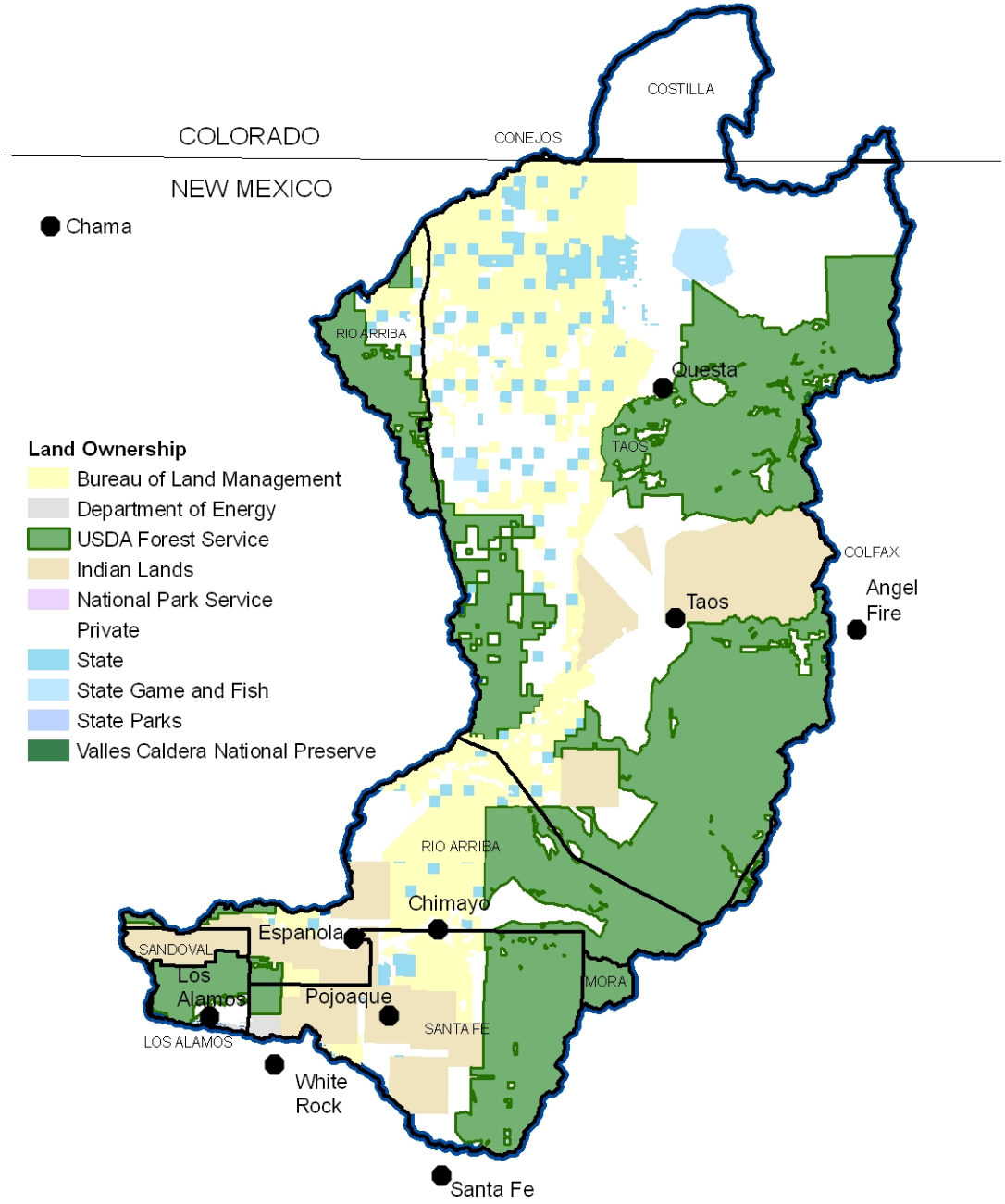
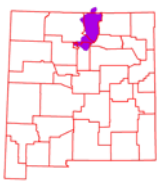


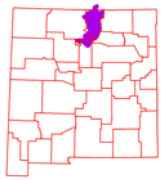
Figure 5. Upper Rio Grande Watershed Land Ownership.



Land Ownership

COUNTY	BLM	DoE	FS	Indian Lands	NPS	Private	State	State G&F	State Parks	VCNP
Colfax			81	20		90				
Los Alamos		2,232	22,759	12		6,236				
Mora			14,085			619				
Rio Arriba	92,493		128,575	40,612		65,822	10,195			
Sandoval		--	36	19,125		158	--	--	--	303
Santa Fe	25,712	3,364	96,964	73,103	264	34,316	3,890		356	
Taos	228,276	--	487,485	116,819		428,757	58,533	16,548	--	
Conejos (CO)	539	--	--	--		--	--	--	--	
Costilla (CO)	8	--	--	--		102,393	--	--	--	
Watershed (∑)	347,028	5,596	749,985	249,691	264	72,618	16,548	16,548	356	303
% Watershed	17	<1	36	12	<1	31	3	1	<1	<1

Table 2. Land ownership in the Upper Rio Grande watershed.



Las Conchas Fire [5]

Date Started: June 26, 2011

Cause: Human

Size: 156,593 acres total, 28,419 in the Upper Rio Grande 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.

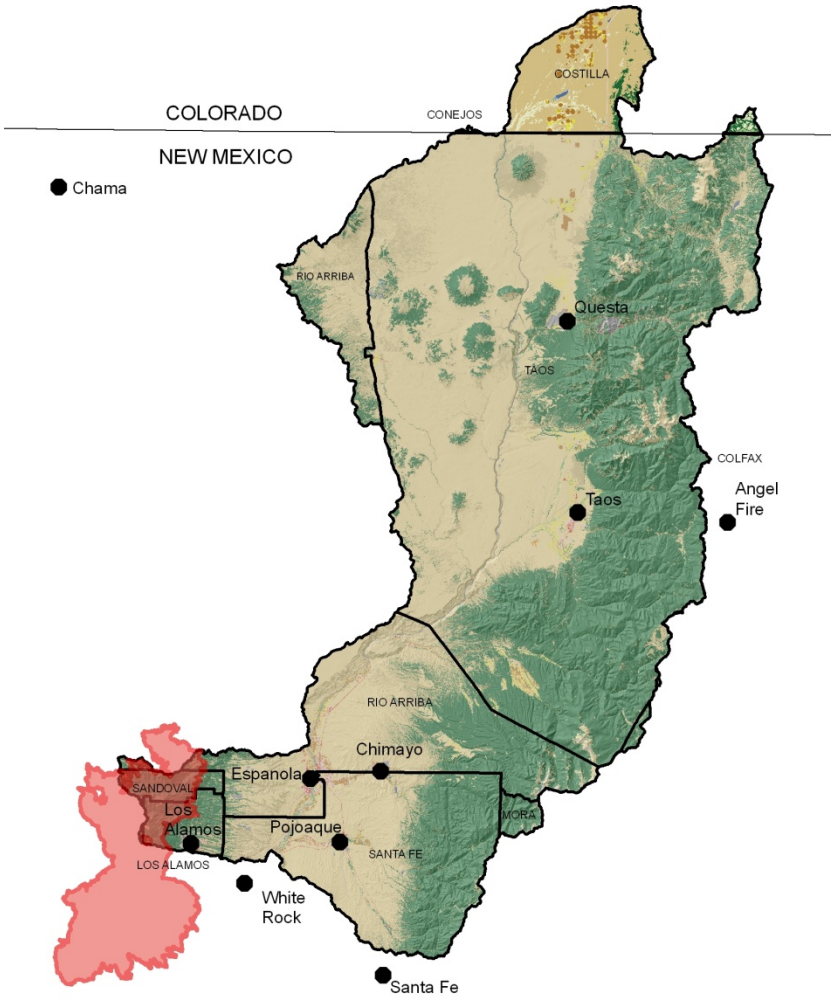
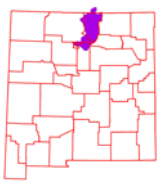


Figure 6. Las Conchas Fire, Summer 2011



Land Use / Land Cover [6,7]

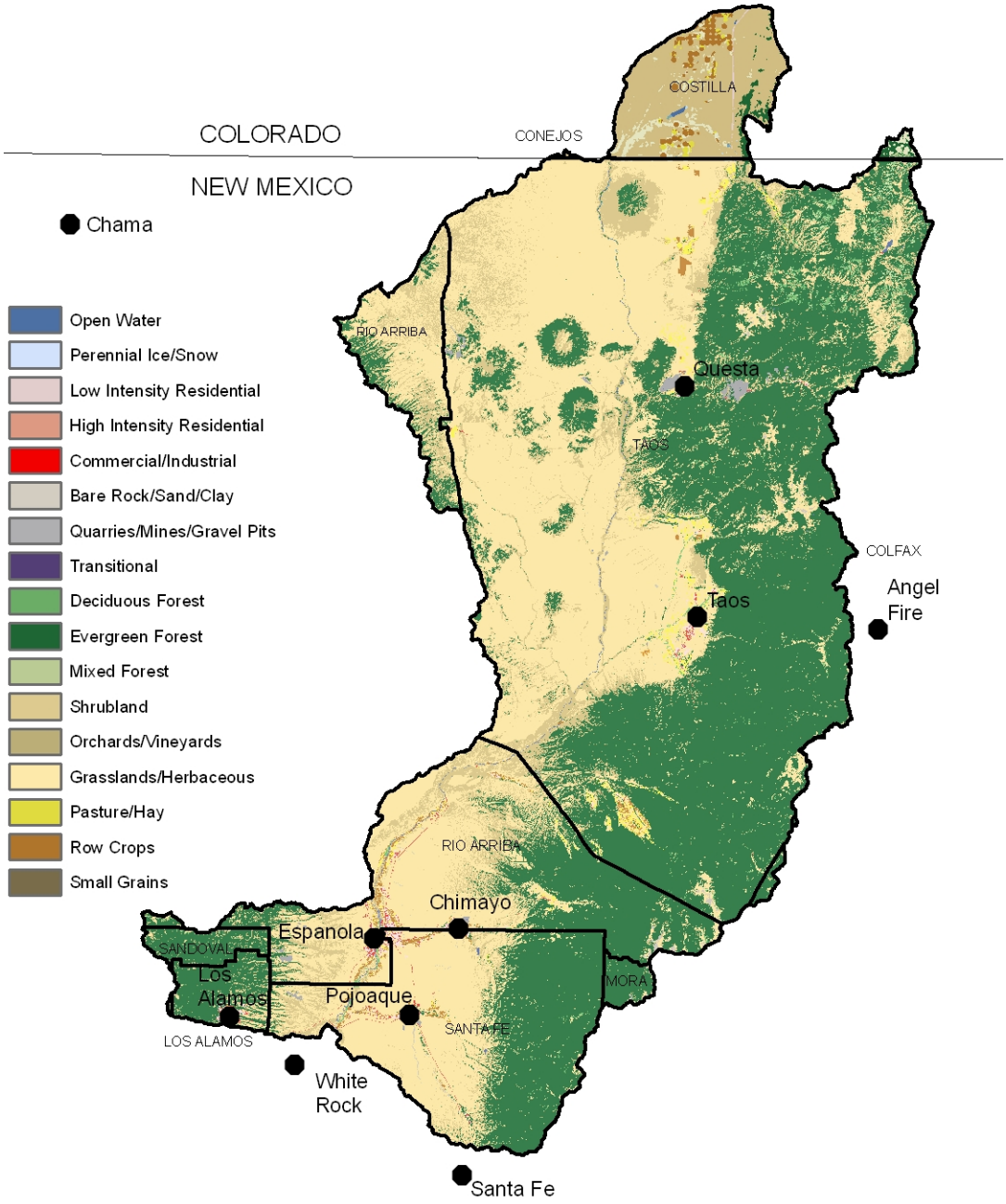
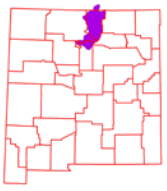


Figure 7. Subset of the National Land Cover Dataset over the Upper Rio Grande Watershed.

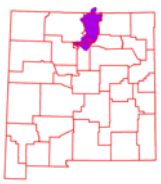


Land Use / Land Cover

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	878,609	42%
grasslands, herbaceous	822,518	40%
shrubland	316,266	15%
Row crops	14,887	1%
Pasture/hay	14,671	1%
Deciduous forest	12,672	1%
Low Intensity Residential	7,364	< 1%
Quarries/Strip Mines/Gravel Pits	5,256	< 1%
Commercial/Industrial/Transportation	4,653	< 1%
Mixed Forest	3,323	< 1%
Open Water	3,067	< 1%
Bare Rock/Sand/Clay	3,035	< 1%

Table 3. Extent of NLCD classes in the Upper Rio Grande watershed.



Land Use / Land Cover

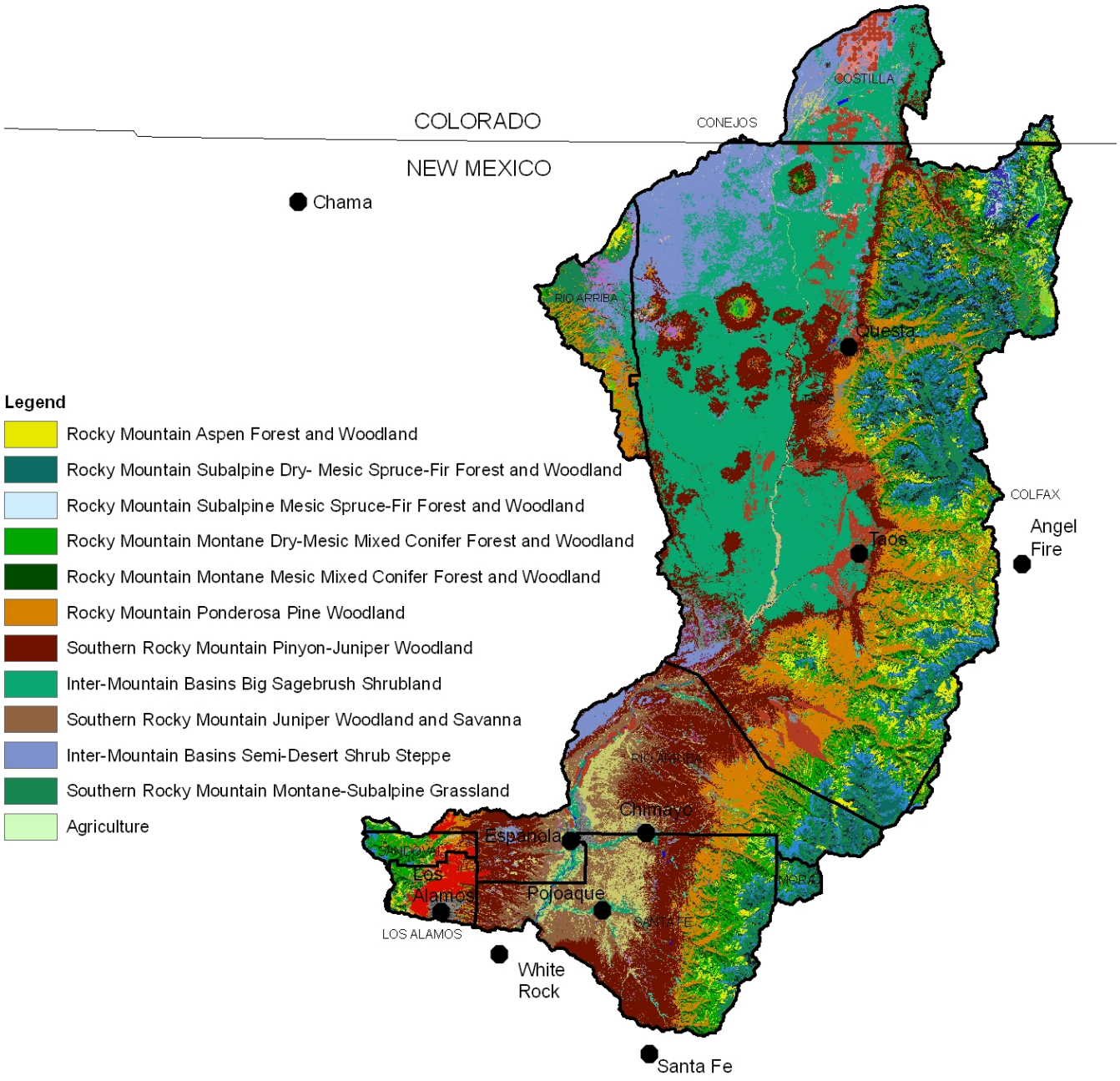
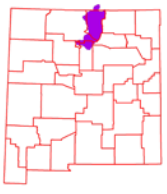


Figure 8. Subset of the SWREGAP over the Upper Rio Grande Watershed. The 12 dominant ecosystems are displayed in the legend.

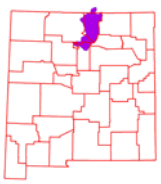


Land Use / Land Cover

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
Inter-Mountain Basins Big Sagebrush Shrubland	418,800	20
Southern Rocky Mountain Pinyon-Juniper Woodland	332,000	16
Rocky Mountain Ponderosa Pine Woodland	243,500	12
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	159,900	8
Inter-Mountain Basins Semi-Desert Shrub Steppe	156,200	8
Rocky Mountain Subalpine Dry- Mesic Spruce-Fir Forest and Woodland	102,100	5
Southern Rocky Mountain Montane-Subalpine Grassland	84,500	4
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	82,800	4
Southern Rocky Mountain Juniper Woodland and Savanna	78,200	4
Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	67,600	3
Rocky Mountain Aspen Forest and Woodland	66,000	3
Agriculture	62,400	3
Inter-Mountain Basins Semi-Desert Grassland	49,200	2
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	27,800	2
Rocky Mountain Cliff and Canyon	18,400	1
Western Great Plains Foothill and Piedmont Grassland	14,700	1
Recently Burned	14,500	1
Western Great Plains Riparian Woodland and Shrubland	11,700	1
Inter-Mountain Basins Montane Sagebrush Steppe	10,200	< 1
Developed, Open Space - Low Intensity	9,800	< 1
Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex	9,200	< 1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	8,100	< 1
Rocky Mountain Alpine-Montane Wet Meadow	5,300	< 1
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	5,000	< 1

Table 4. SW Region Gap analysis ecosystem acreages. Reported to the nearest hundred acres



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

The National Hydrography Dataset (NHD) is a comprehensive set of data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities. The NHD identifies 7,971 miles (12,828 km) of water courses in the Upper Rio Grande River Watershed. The majority of these courses typically flow intermittently in summer months during periods associated with high intensity convective thunderstorms.

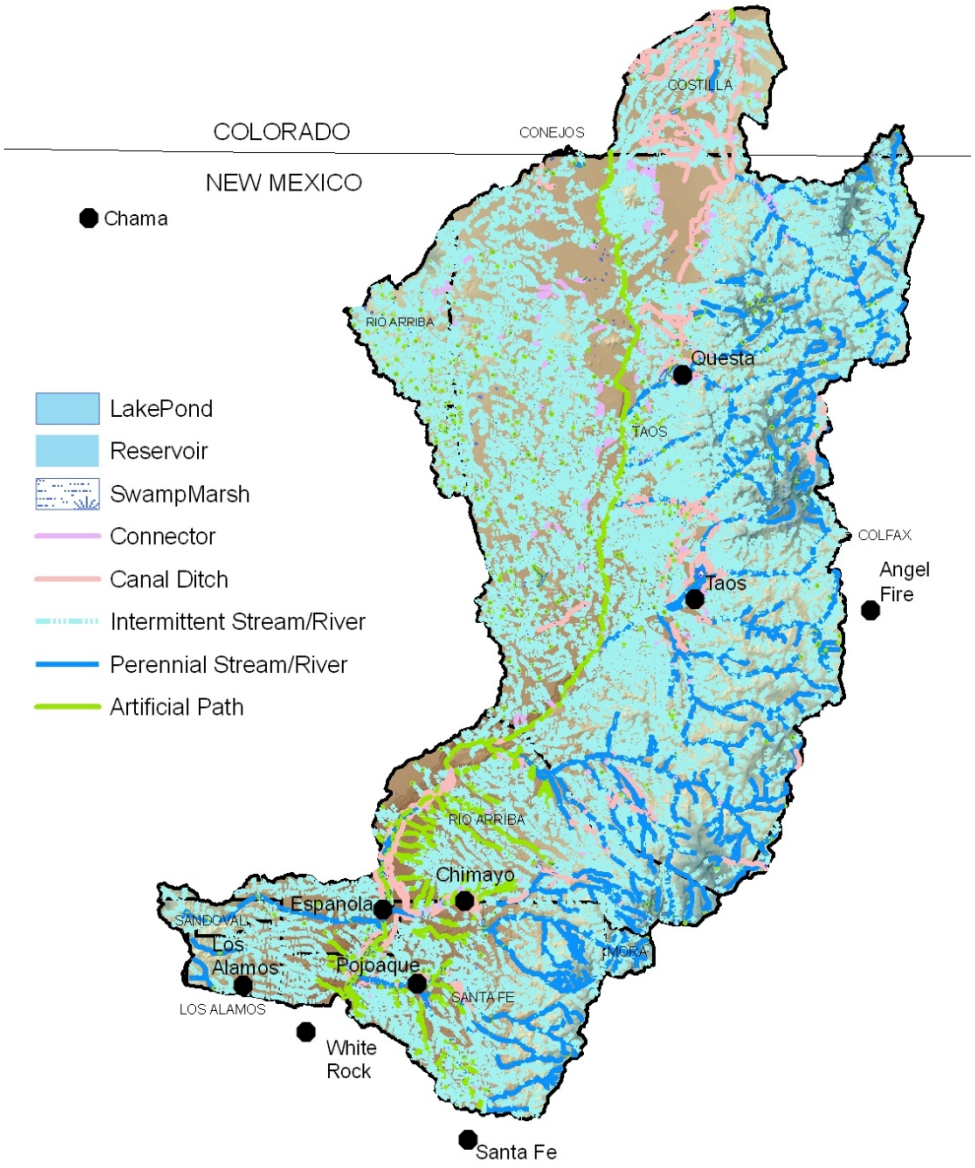
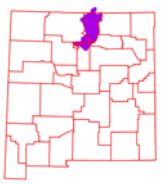
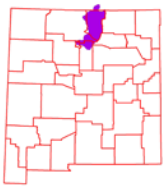


Figure 9. National Hydrologic Dataset (NHD) of the Upper Rio Grande.



Water Course Type	Miles
Artificial path	334
Connector	78
Canal / Ditch	495
Intermittent Stream / River	6,091
Perennial Stream / River	973
Sum (∑)	7,971

Table 5. NHD Water Course Type and Extents



There are 22 water gauging stations in the watershed. USGS Site 08313000 is near the Sw corner of the watershed on the Rio Grande at Otowi Bridge, NM. During the period 1971 – 2009, this site has had mean annual discharge of 808 cubic feet per second ranging from 602 (1977) to 2,764 (1987) cubic feet per second.

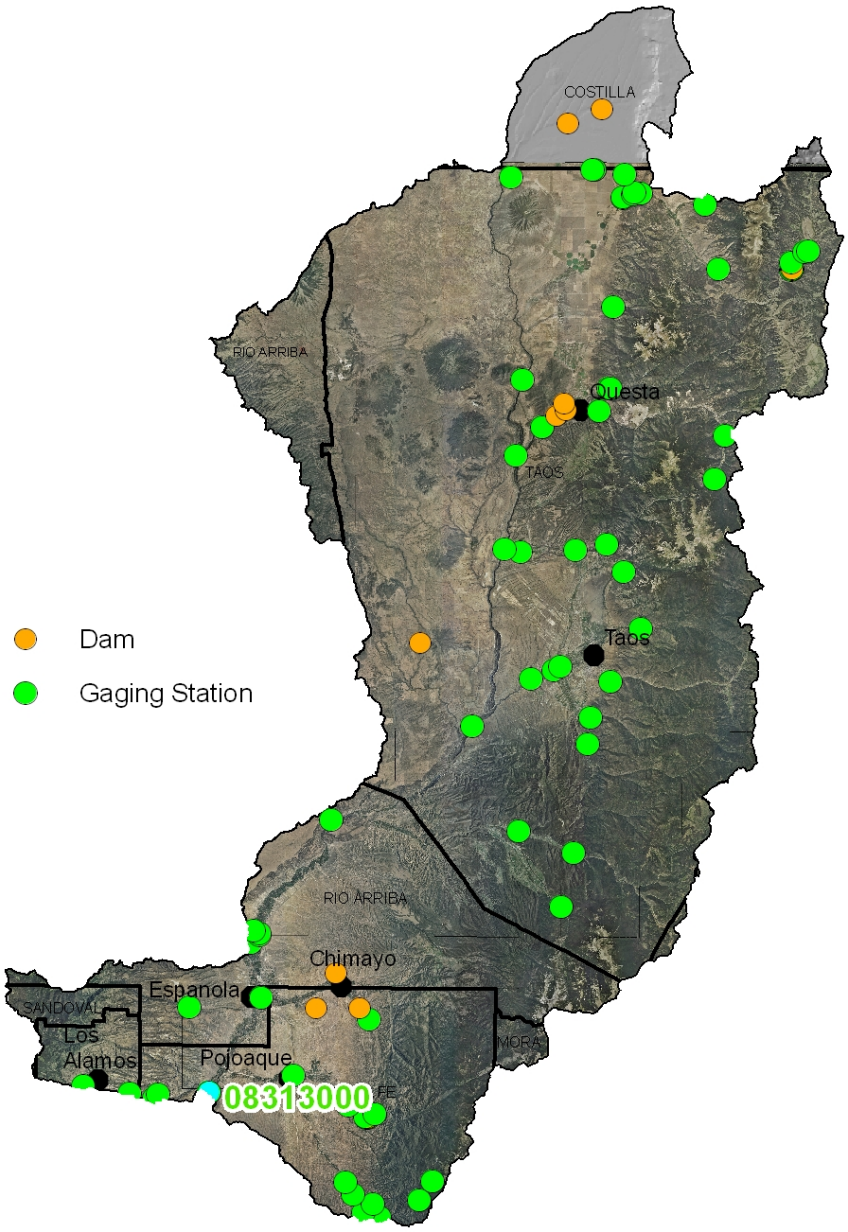
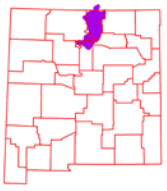


Figure 10. Gauging Stations in the Upper Rio Grande Watershed



Hydrology

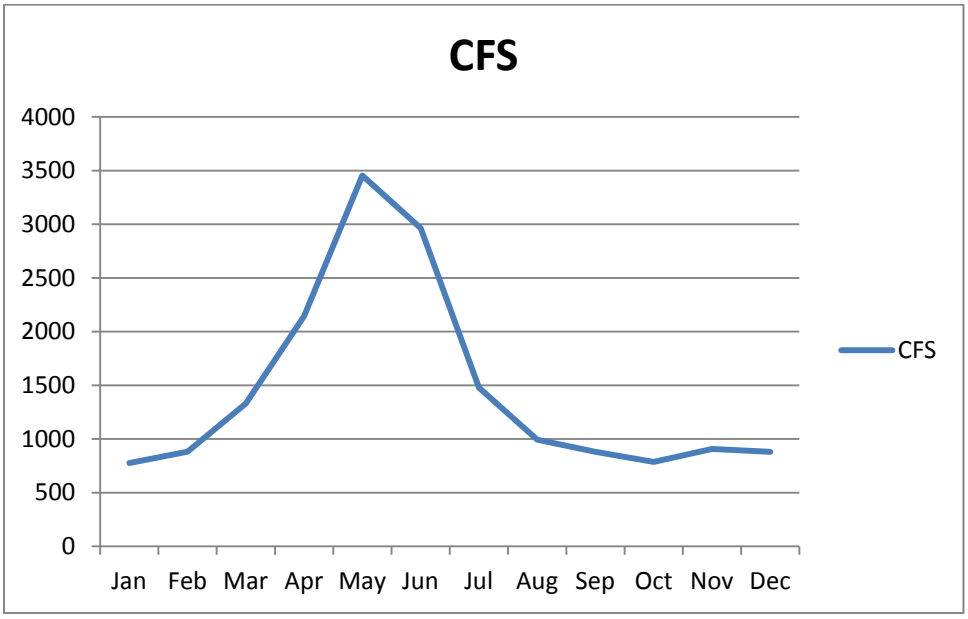
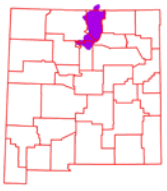


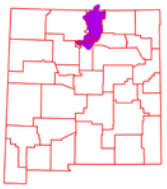
Figure 9. Monthly Average of Mean Daily Flow on the Rio Grande at Otowi Bridge, NM. Period of observation: 1970-2009.



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 Upper Rio Grande watershed as part of the Rio Grande River Basin.

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

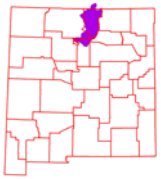
1. Acid Canyon (Pueblo to headwaters)
2. Apache Canyon (Rio Fernando de Taos to headwaters)
3. DP Canyon (Los Alamos Canyon to LANL boundary)
4. Embudo Creek)Canada do Ojo Sarco to Picuris Pueblo boundary)
5. Gold Creek (Comanche Creek to headwaters)
6. Goose Lake
7. Graduation Canyon (Pueblo Canyon to headwaters)
8. Grassy Creek (Comanche Creek to headwaters)
9. Guaje Canyon (San Ildefonso boundary to headwaters)
10. Holman Creek (Comanche Creek to headwaters)
11. LaBelle Creek (Comanche Creek to headwaters)
12. Los Alamos Canyon (DP Canyon to LANL boundary)
13. Los Alamos Canyon (NM-4 to DP Canyon)
14. Pueblo Canyon (Acid Canyon to headwaters)
15. Pueblo Canyon (Bayo WWTP to Acid Canyon)
16. Pueblo Canyon (Los Alamos Canyon to Bayo WWTP)
17. Red River (Placer Creek to headwaters)
18. Rio Chiquito (Picuris Pueblo boundary to headwaters)
19. Rio Chupadero (USFS boundary to headwaters)
20. Rio Fernando de Taos (Tienditas Creek to headwaters)
21. Rio Grande (Ohkay Owingeh boundary to Embudo Creek)
22. Rio Grande (Red River to Colorado border)
23. Rio Grande (Santa Clara Pueblo to Ohkay Owingeh boundary)
24. Rio Pueblo (Picuris Pueblo boundary to headwaters)
25. Rio Pueblo de Taos (Rio Grande del Rancho to Taos Pueblo boundary)
26. Rio Sana Barbara (non-Pueblo Embudo Creek to USFS boundary)
27. Santa Cruz River (Santa Clara Pueblo boundary to Santa Cruz dam)
28. Walnut Canyon (Pueblo Canyon to headwaters)



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

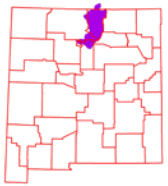
Use	1	2	3	4	5	6	7	8	9	10	11	12	13	14
high quality coldwater aquatic life					NS	NS		NS		NS	NS			
marginal coldwater aquatic life				NS										
Irrigation/irrigation storage				X	X	X		X		X	X			
domestic water supply					X	X		X		X	X			
livestock watering	NS	NA	NS	X	X	NA	X	X	NS	X	X	NS	NS	NS
wildlife habitat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

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



Use	15	16	17	18	19	20	21	22	23	24	25	26	27	28
high quality coldwater aquatic life			NS	NS	NS					NS	NS	NS		
Marginal coldwater aquatic life							NS	NS	NS				NS	
Irrigation/irrigation storage			X	X	X		X	X	X	X	X	X	X	
domestic water supply			X	X	X					X	X	X		
livestock watering	NS	NS	NA	NA	X	NA	X	X	X	X	NA	NA	NA	X
wildlife habitat	NS	NS	X	X	X	NA	X	X	X	X	X	X	X	X
marginal warmwater aquatic life	NS	NS				NA	NS		NS				NS	NS
primary contact	NA	NA			NA	NS	X	NA	X				NA	NA
secondary contact			NA	NA	NA					NA	X	NA		
Fish culture			X	X				X		X	X	X		
Industrial Water Supply					X									
Municipal Water Supply					X									

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



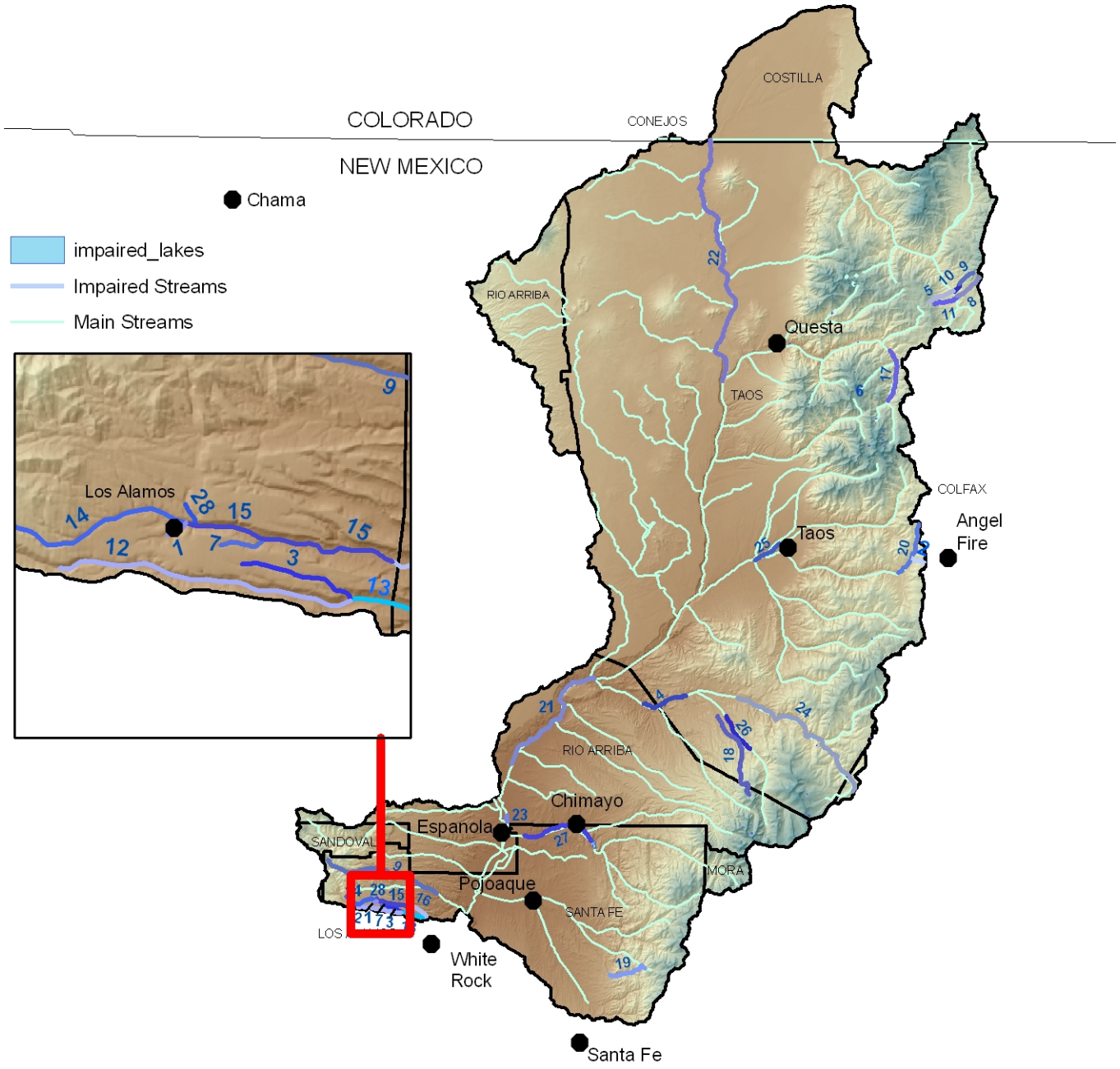
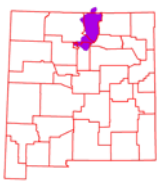


Figure 11. 303(d) Impaired Waters (numbers reference Table 6 stream reaches).



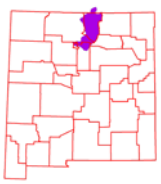
Hydrology

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes, are required to develop lists of impaired waters. These are waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by states. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs), for these waters. A TMDL is a calculation of the maximum amount of a pollutant a water body can receive and still safely meet water quality standards. Within the Upper Rio Grande Watershed, there is one body of water that is listed as impaired as of the 2010-12 listing cycle (Goose Lake).

The river and stream reaches total 153.26 miles (246.65 km) and the listed water body covers 5.95 ac (.002 sq. km).

	Impairment													
Probable Causes of Impairment	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Aluminum	X		X		X		X		X			X	X	X
Benthic-Macroinvertebrate Bioassessments				X										
Copper	X		X				X					X	X	
Dissolved Oxygen														
Total Fecal and Coliform		X												
Gross Alpha - Adjusted	X		X						X			X	X	X
Mercury	X											X	X	
Nutrient/Eutrophication						X								
PCB's	X		X				X					X	X	X
Sedimentation/Siltation						X								
Specific Conductance														
Temperature					X					X	X			
Turbidity								X						
Zinc	X												X	

Table 7. Possible Causes of Impairment



	Impairment													
Probable Causes of Impairment	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Aluminum		X	X		X									
Benthic-Macroinvertebrate Bioassessments										X		X		
Copper		X												
Dissolved Oxygen														
Total Fecal and Coliform						X								
Gross Alpha - Adjusted	X	X												
Mercury														
PCB's	X	X					X		X					X
pH								X						
Sedimentation/Siltation													X	
Specific Conductance											X			
Temperature								X			X			
Turbidity				X			X		X			X		
Zinc		X												

Table 7-Continued. Possible Causes of Impairment

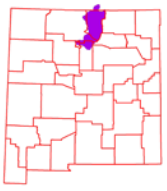
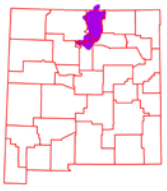


Figure 12. Declared Groundwater Basins of the Upper Rio Grande.

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 New Mexico portion of the Upper Rio Grande watershed is completely within the Northern Rio Grande Underground Water Basin. The surface watershed in New Mexico covers 1,977,859 of the approximately 4.97 million acres of the underground water basin in New Mexico.

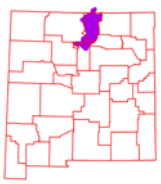


Threatened and Endangered Species [13]

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 Upper Rio Grande River Watershed.

Common Name	Scientific Name	Tax.Class	Family	Fed Status	State Status
Lilljeborg Peaclam	*Pisidium lilljeborgi*				T
Sangre de Cristo Peaclam	*Pisidium sanguinichristi*				T
Rio Grande Silvery Minnow	*Hybognathus amarus*	Actinopterygii	Cyprinidae	LE	E
Jemez Mountains Salamander	*Plethodon neomexicanus*	Amphibia	Plethodontidae		E
American Peregrine Falcon	*Falco peregrinus anatum*	Aves	Falconidae		T
White-tailed Ptarmigan	*Lagopus leucura*	Aves	Phasianidae		E
Boreal Owl	*Aegolius funereus*	Aves	Strigidae		T
Mexican spotted owl	*Strix occidentalis lucida*	Aves	Strigidae	LT	
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Aves	Tyrannidae	LE	E
	Opuntia viridiflora	Dicotyledoneae	Cactaceae		E
New Mexican Jumping Mouse	*Zapus hudsonius luteus*	Mammalia	Dipodidae		E
American Marten	*Martes americana*	Mammalia	Mustelidae		T
Wood Lily	*Lilium philadelphicum var. andinum*	Monocotyledoneae	Liliaceae		E
Great Plains Ladies'-tresses	*Spiranthes magnicamporum*	Monocotyledoneae	Orchidaceae		E

Table 8. Threatened and Endangered Plant and Animal Species.

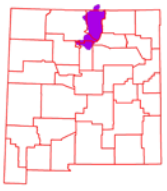


Invasive Species [14]

Invasive species are those which have been introduced into a region or ecosystem and have the ability to out-compete native species for resources (i.e. water, nutrients, sunlight, etc.) The Southwest Exotic Plant Mapping Program (SWEMP) is a collaborative effort between the United States Geological Survey and federal, tribal, state, county and non-government organization partners in the southwest which maintains ongoing efforts to compile and distribute regional data on the occurrence of non-native invasive plants in the southwestern United States. Within the Upper Rio Grande 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
Scrophylariaceae **(Figwort Family)**	**Dalmatian Toadflax**
Brassicaceae (**Mustard Family)**	**Hoary Cress (Whitetop)**
Euphorbiaceae **(Spurge Family)**	**Leafy Spurge**
Asteraceae **(Sunflower Family)**	**Musk Thistle**
Brassicaceae (**Mustard Family)**	**Perennial Pepperweed (Tall Whitetop)**
Asteraceae **(Sunflower Family)**	**Russian Knapweed**
Asteraceae **(Sunflower Family)**	**Spotted Knapweed**

Table 9. Invasive Species Recognized by the SWEMP.



Common Resource Areas[15]

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

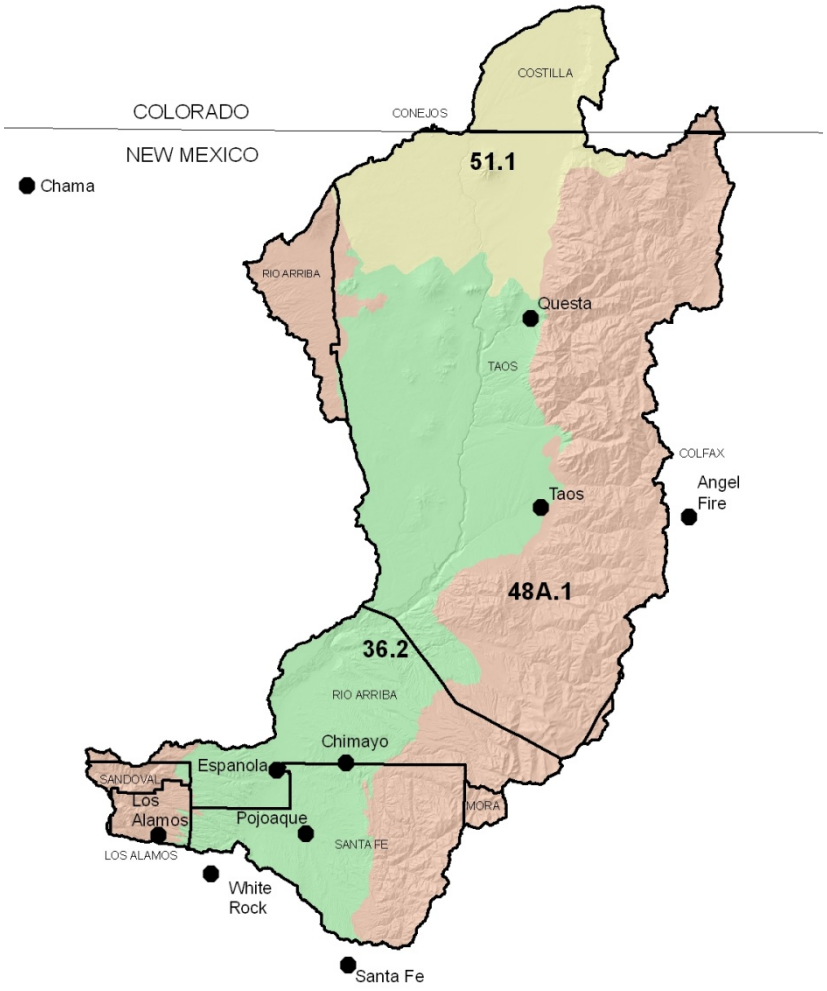


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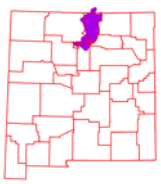
Figure 13. Common Resource Areas of the Upper Rio Grande.



Common Resource Areas

36.2 – Southwest Plateaus, Mesas, and Foothills – Warm Semiarid Mesas and Plateaus

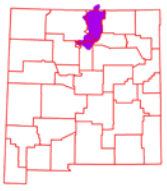
This area encompasses the lower elevation mesas and plateaus. The temperature regime is mesic and the moisture regime is transitional from ustic to aridic. Vegetation is typically twoneedle pinyon, Utah juniper, and big sagebrush. Cropland is a significant land use in parts of this area, particularly 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.

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.

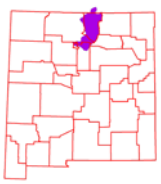
51.1 – High Intermountain Valleys

This is an area of low relief composed of valley fill sediments from the surrounding mountains. The temperature regime is mainly frigid but includes mesic in the southern part. The moisture regime is aridic. Characteristic native vegetation is greasewood, fourwing saltbush, and alkali sacaton.



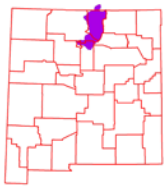
Conservation [16]

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.



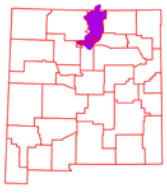
Conservation Practice	2006		2007		2008		2009		2010		TOTAL	
	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres	#	Acres
Brush Management	2	282	8	606	15	520			7	739	32	2147
Conservation Crop Rotation	1	3	7	211	15	1379	7	461	10	1187	40	3241
Cover Crop					9	15			1	0	10	15
Critical Area Planting	1	2									1	2
Forage and Biomass Planting	3	18	6	29	6	172	2	25	2	62	19	306
Forage Harvest Management	8	61	15	207	16	123	4	7	20	427	63	825
Forest Slash Treatment									3	42	3	42
Forest Stand Improvement									4	72	4	72
Integrated Pest Management			9	12					2	136	11	148
Irrigation Land Leveling					1	5	1	24	3	5	5	34
Irrigation System, Microirrigation			2	1	2	3			1	1	5	5
Irrigation System, Sprinkler			4	110	3	103	1	117	2	82	10	412
Irrigation System, Surface and Subsurface					2	10	4	5	4	6	10	21
Irrigation Water Management	11	77	36	1484	32	3222	13	287	38	2378	130	7448
Land Smoothing	1	5	1	9	1	2			3	62	6	78
Nutrient Management			8	9	2	8			3	298	13	315
Prescribed Grazing	36	10532	18	1876	46	31409	3	39	30	7401	133	51257
Range Planting	1	7	3	147	14	449	2	31	5	490	25	1124
Residue Management			3	3							3	3
Residue Management, Seasonal	1	4	4	51	5	310			13	1458	23	1823
Surface Roughening									2	239	2	239
Tree/Shrub Establishment									1	1	1	1
Upland Wildlife Habitat Management	8	9501	9	41381	31	22170	8	5235	23	10766	79	89053
Wetland Restoration	2	10									2	10
Wetland Wildlife Habitat Management	2	10									2	10
SUM (∑)	77	20512	133	46136	200	59900	45	6231	177	25852	632	158631

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	150	5	5400	16	3,405	22	8955
Conservation Completion Incentive First Year			4		2						6	NA
Dam-Diversion			2		1				1		4	NA
Diversion					1	10			1	20	2	30
Fence	4	5,388	1	873	15	33,158	1	1,935	3	9,075	24	50429
Fishpond Management	1										1	NA
Grade Stabilization Structure							1				1	NA
Irrigation Field Ditch	1	300					1	150			2	450
Irrigation Water Conveyance, Ditch and Canal Lining, plain concrete					1	4			1	750	2	754
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	1	760	8	10,163	10	6,605	14	11,997	17	16,901	50	46426
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	7	9,352	9	3,992	13	12,900	9	1,755	8	3,256	46	31255
Irrigation Water Conveyance, Pipeline, Rigid Gated Pipeline	5	1,980	3	650	12	3,510	6	1,160	1	180	27	7480
Irrigation Water Conveyance, Pipeline, Steel	1	10	3	20	6	142	2	45	1	70	13	287
Pipeline	1	300	3	710	7	18,335					11	19345
Pond							2				2	NA
Pond Sealing or Lining					5				1		6	NA
Pumping Plant	1		8		7		3		4		23	NA
Streambank and Shoreline Protection	1	150									1	150
Structure for Water Control	12		25		41		33		101		212	NA
Water Well	2		3		5		1		1		12	NA
Watering Facility	5		11		19		2		8		45	NA
Wildlife Watering Facility			1		1						2	NA
Windbreak/Shelterbelt Establishment	2	253									2	253
SUM (∑)	48	NA	81	NA	147	NA	80	NA	164	NA	516	NA

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



Soil Resource Inventory [17]

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.

National Cooperative Soil Survey

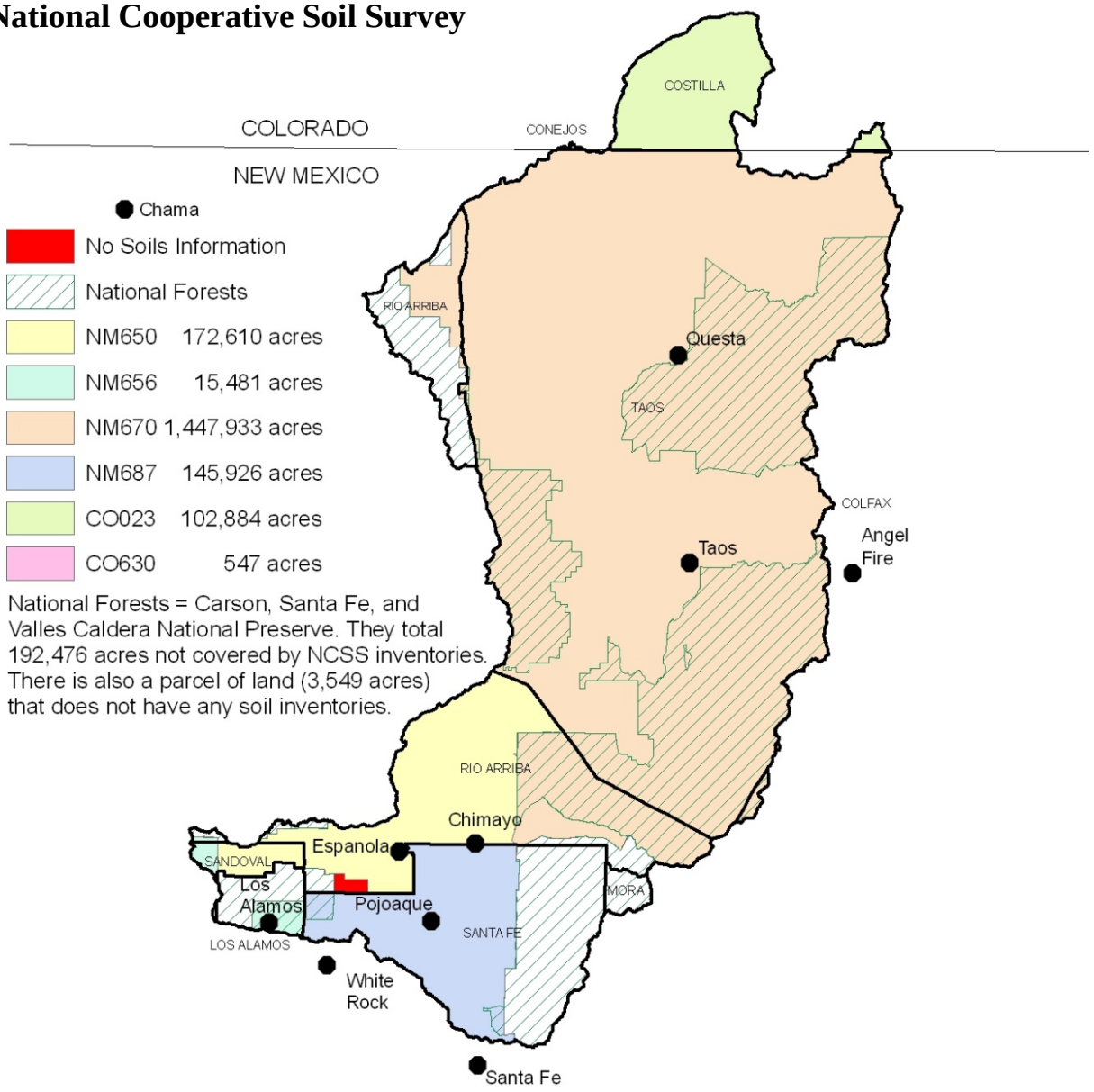
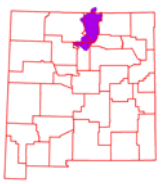


Figure 14. National Cooperative Soil Survey coverage of the Upper Rio Grande Watershed.

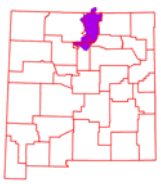


Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Upper Rio Grande 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.

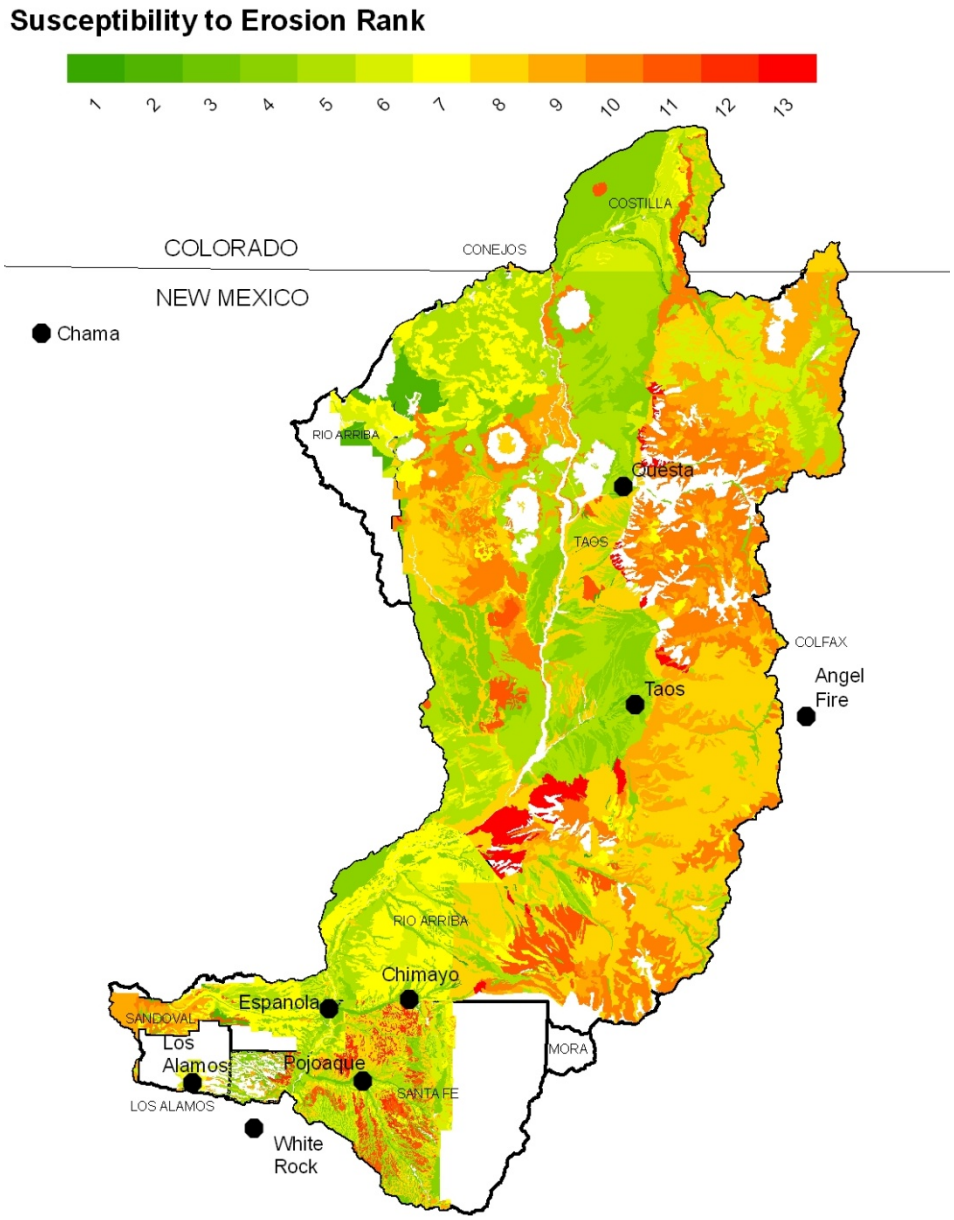
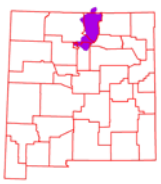


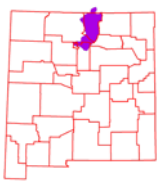
Figure 15. Upper Rio Grande Watershed Erosion Potential.



Soil Resource Inventory

Rank	Acres
1	2,698
2	17,668
3	10,392
4	228,298
5	353,265
6	120,449
7	174,698
8	383,218
9	179,547
10	199,014
11	51,282
12	11,693
13	25,439
Sum(∑)	1,424,660

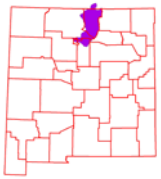
Table 13. Soil Erosion Potential Model Results. A greater rank indicates greater potential for erosion.



Socioeconomic Data [18]

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. 2008
Colfax	14,189	6,789	7,400	320	7,080	6,739	11,564	45	209	45	1	1,816	509	$36,827
Los Alamos	18,343	16,215	2,128	0	2,128	2,155	16,556	67	107	694	6	495	418	$90,032
Mora	5,180	0	5,180	296	4,884	4,229	3,050	5	59	6	0	1,915	145	$27,648
Rio Arriba	41,190	17,678	23,512	544	22,968	30,025	23,320	143	5,717	56	47	10,554	1,353	$41,387
Sandoval	89,908	68,906	21,002	161	20,841	26,437	58,512	1,535	14,634	894	98	11,118	3,117	$56,479
Santa Fe	129,292	97,465	31,827	643	31,184	63,405	95,053	826	3,982	1,133	94	22,936	5,268	$50,000
Taos	29,979	12,171	17,808	291	17,517	17,370	19,118	105	1,975	114	35	7,447	1,185	$37,778
Conejos (CO)	8,400	0	8,400	547	7,853	4,949	6,112	18	142	13	6	1,806	303	$29,066
Costilla (CO)	3,663	0	3,663	147	3,516	2,476	2,231	29	91	37	5	1,079	191	$25,509

Table 14. Socioeconomic Data of the Counties in the Watershed (2000).



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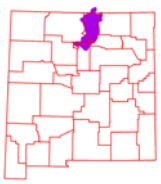

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