

Rapid Watershed Assessment Upper Pecos-Long Arroyo Watershed



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Overview

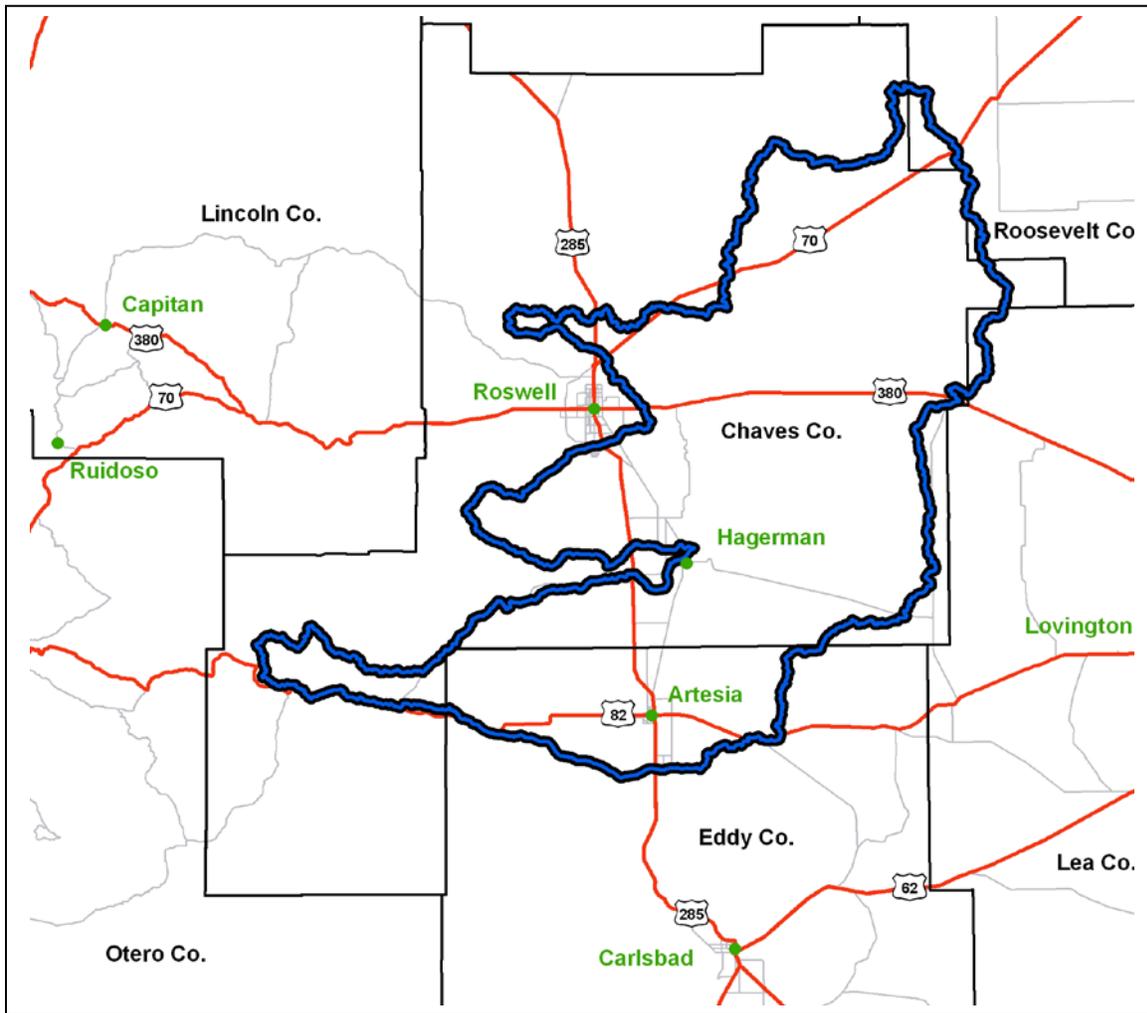


Figure 1. Upper Pecos - Long Arroyo watershed overview.



Overview

The Upper Pecos – Long Arroyo watershed, in southeast New Mexico, lies within the Rio Grande hydrologic region. The watershed covers approximately 2 million acres (8,100 sq. km.) with portions of the watershed extending into Eddy, Lea, Roosevelt, and Chaves counties. The distribution of the watershed is provided in Table 1.

County	Co. Acres Total	Acres in UPLA	% UPLA in Co.	% Co. in UPLA
Eddy	2,684,668	341,289	16.7	12.7
Lea	2,811,518	15,003	1	0.5
Roosevelt	1,570,664	31,960	1.6	2.0
Chaves	3,885,365	1,659,249	81	42.7
UPLA total	---	2,047,500	100	---

Table 1. Upper Pecos - Long Arroyo acreage distribution.



General History of the area:

Castano de Sosa's Route In 1590-91 Gaspar Castano de Sosa, a Portuguese by birth, took an expedition up the Pecos River in an attempt to establish a colony in New Mexico in 1590. His venture was a failure, but it led to a permanent settlement under Don Juan de Onate in 1598. He pushed north along the Pecos River, the group passed along this route in the vicinity of present-day Artesia and Roswell.

Colonel José Francisco Chaves a military leader during the U.S. Civil War, and delegate-elect to Congress in 1865, serving three terms, and as speaker of the Lower House of the New Mexico Territorial Legislature representing southeastern New Mexico.

John Chisum's cattle drives along the Pecos River started in 1866. Mr. Chisum's cowboys often used the springs at Artesia to water their cattle. In the 1890's, a former Union soldier, John F. Truitt, homesteaded along the Chisum Trail, just a few blocks from what is today Artesia's business district. John Chisum's niece, Sally Chisum Robert, also filed a homestead claim in the area and lived on her property for many years. A stage stop, "Blake's Spring" was established in 1894. When the Pecos Valley Railroad built a siding, they named it "Miller's Siding".

In 1889, Captain Joseph Lea, for whom Lea County is named, successfully persuaded the New Mexico legislature to create a new county from Lincoln County lands. Captain Lea insisted that the new county be named for his close friend and political ally Colonel José Francisco Chaves.

The town of Hagerman, in Chaves County was first laid out to be on the new PV&NE railroad (Pecos Valley and Northeastern) in 1894. Initially, it was known as *Felix* for the River Felix, which enters the Pecos River just north of the town. The name was changed to honor J. J. Hagerman, builder of the railroad. Though Hagerman's railroad was later acquired by the AT&SF railroad, his name remains on the town. Mr. Hagerman later bought the Old Chisum Ranch which, after his death, was sold to Cornell University. Hagerman is on NM 2 about 17 miles southeast of Roswell. It's a tranquil farming town now.

A man named *Stegman*, a land promoter, married Sally Chisum Robert. He established the first post office 1899 as the *Stegman Post Office*. In 1903, the *Artesia Home Site Co.* was formed to promote real estate in the expanding community. A special feature was the many artesian wells that were supplying water. "Stegman" finally became "Artesia". Oil was discovered in 1924 and added a profitable income to the area's ranching and farming businesses.



Physical Setting

Geology:

The Upper Pecos – Long Arroyo watershed falls within the Pecos Section of the Great Plains Province and is expressed as a long trough situated between the High Plains to the east and the Basin and Range Province to the west. Its boundaries are marked by steep slopes 500 to 800 feet in height. Within these limits, the topography varies from flat plains to rocky canyons. The section is consistent in that it has been uniformly eroded below the once continuous level of the High Plains. The Llano Estacado, whose most prominent feature is the Caprock Escarpment, is surfaced with outwash gravels and sands from the western mountains and once was a continuous surface to the east before erosion incised the Pecos River valley. The Pecos Valley is limited to the west by the dip-slope of the Sacramento Mountains. To the east, the valley is bounded by the High Plains, or Llano Estacado.

A combination of three geologic processes formed the Pecos River valley. The first process was the dissolution of underlying rocks. Groundwater slowly dissolved the gypsum, halite and limestone bedrock forming caves. These voids may collapse over time due to the weight of the overlying strata. The collapsed areas are known as sinkholes and cenotes. Downcutting and lateral erosion due to regional uplift has also shaped the current valley. Secondly, the Permian aged formations have been uplifted, beveled, and displaced by Tertiary-Quaternary aged strike slip faults. Regional uplift has increased the gradient of the Pecos River to the north, allowing a deeper incision of the river into the underlying bedrock. Finally, climate change has increased the amount of erosion to the structurally disturbed rock formations and the subsequent sorting and deposition of the alluvial materials. Periods of cooler and wetter events and warmer and drier times have provided both erosive and depositional episodes.

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 Pecos-Long Arroyo 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.



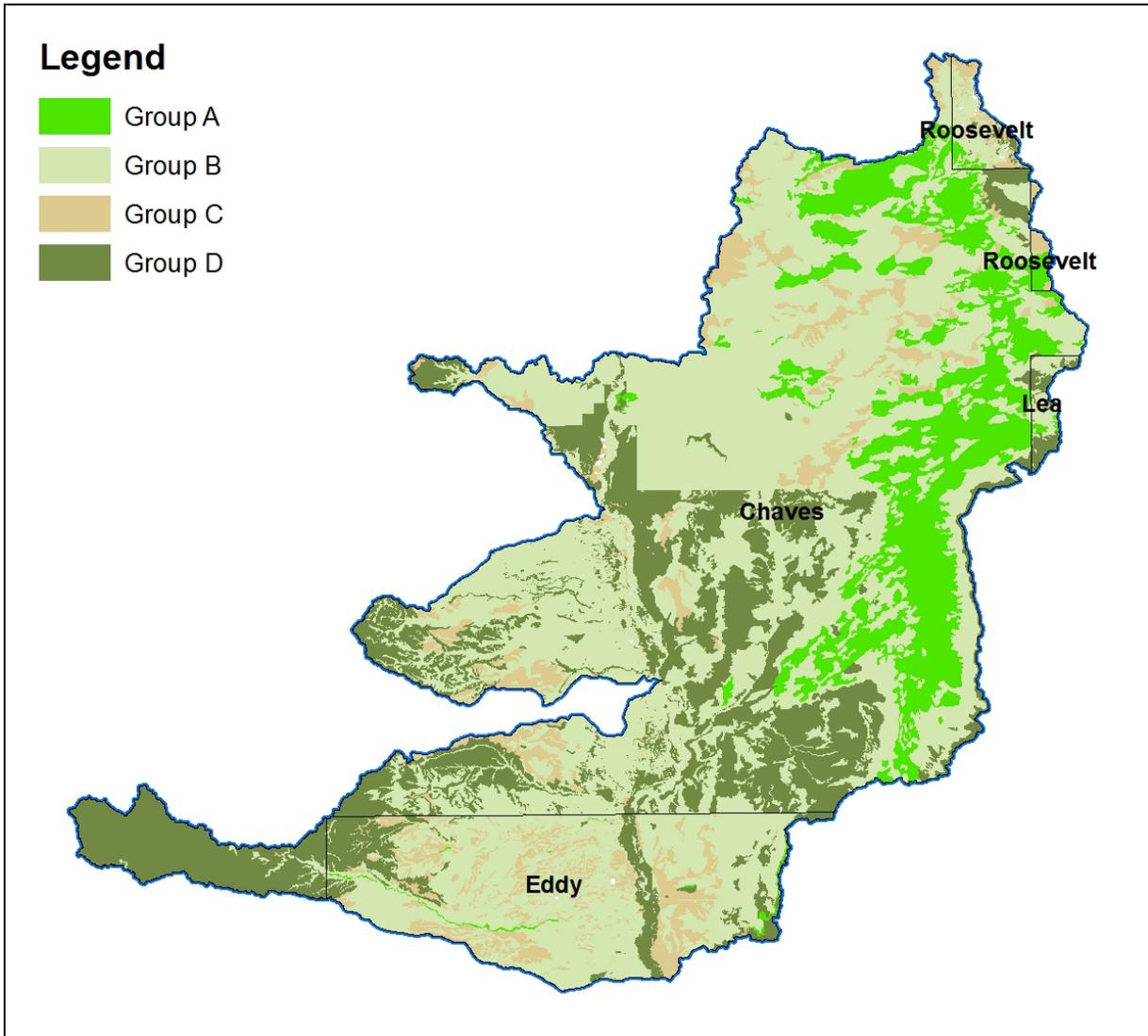


Figure 2. Hydrologic Soil Group



Physical Setting

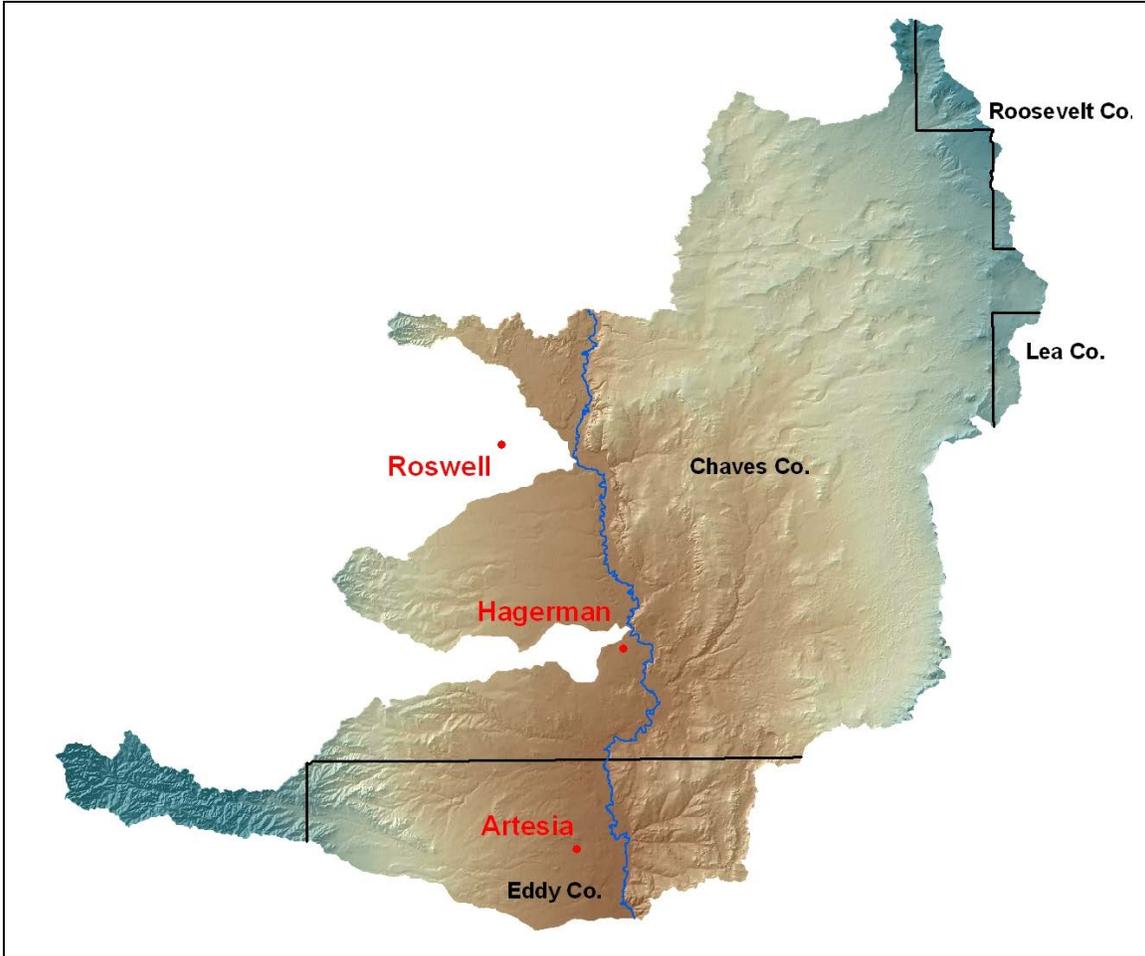


Figure 3. Shaded relief graphic of the Upper Pecos – Long Arroyo watershed.



Precipitation ¹

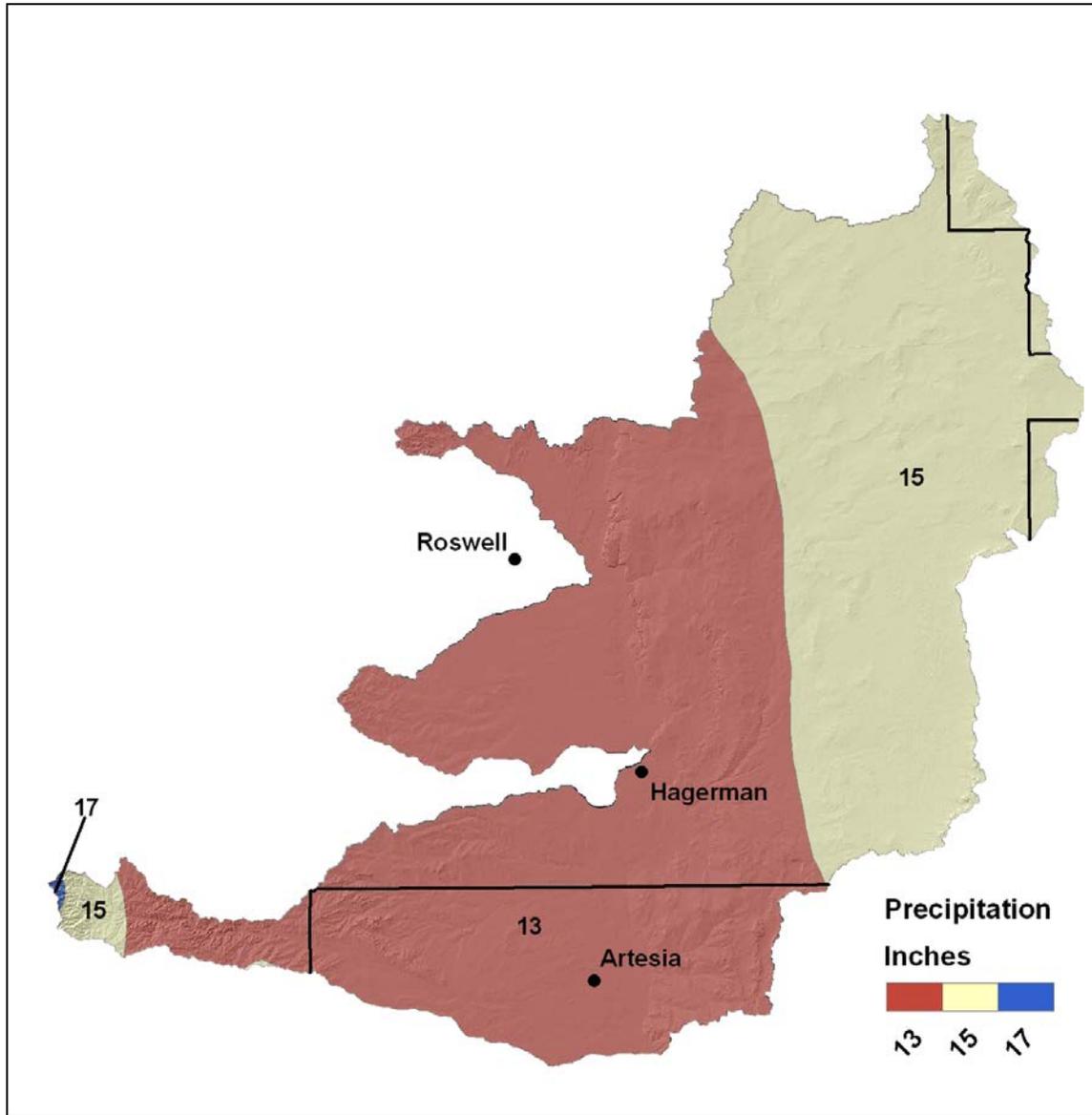


Figure 4. Annual precipitation of the Upper Pecos – Long Arroyo watershed.



Land Ownership²

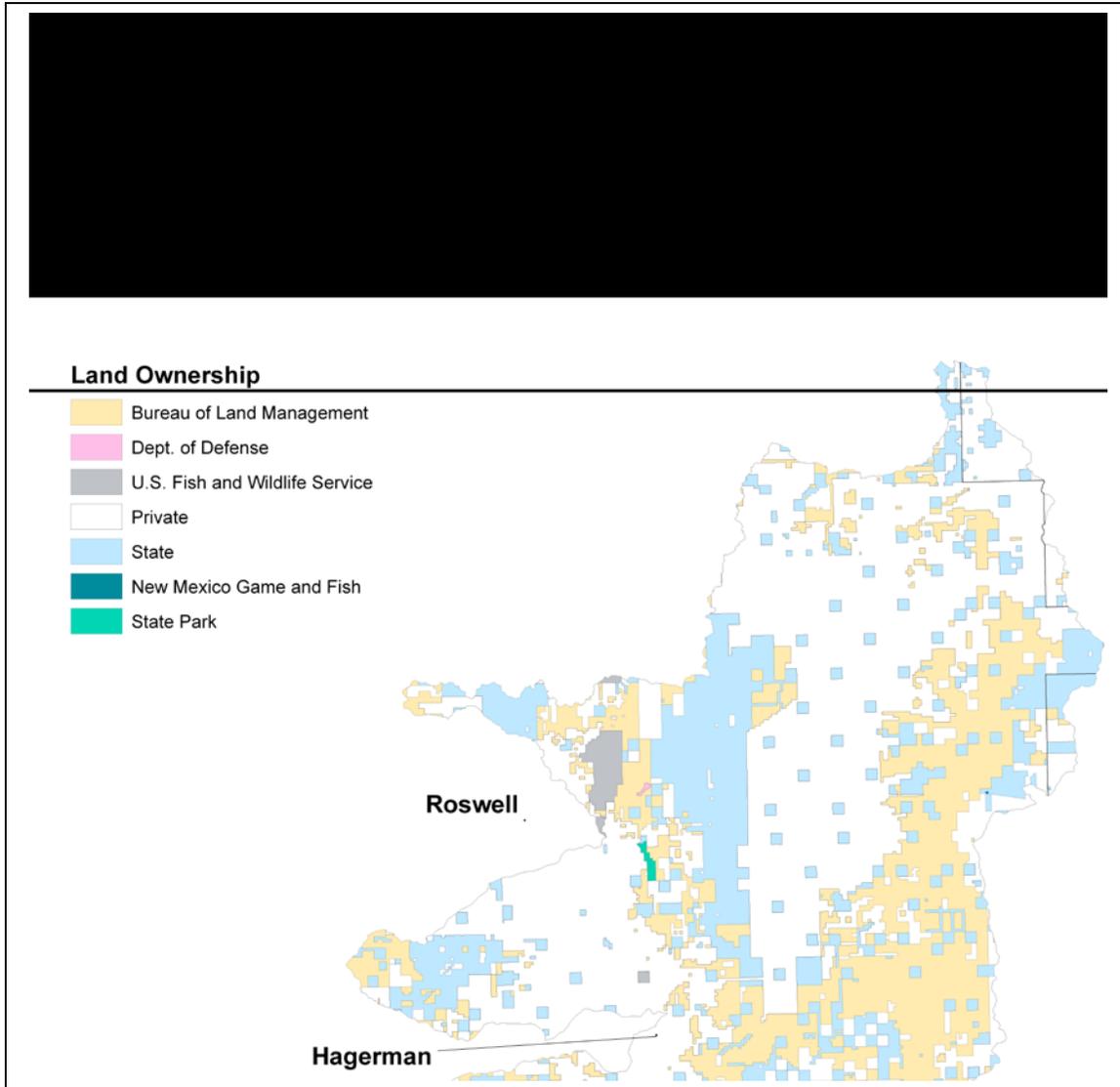


Figure 5. Land ownership within the Upper Pecos – Long Arroyo watershed.



Land Ownership

There are 6 land managing entities in the Upper Pecos – Long Arroyo watershed with over 99% of the area under the management of just three. Privately owned lands are the majority with more than half of the area under private management. Table 2 summarizes land ownership within the watershed.

	Private	BLM	State	NM Game & Fish	U.S. Fish & Wildlife	DoD	State Park
Chaves Co.	846,300	449,900	348,100		13,200	300	1,500
Eddy Co.	166,900	109,300	62,000	3,200			
Roosevelt Co.	26,500	300	5,200				
Lea Co.	6,500	900	7,600				
Watershed (Σ)	1,046,100	560,400	422,800	3,200	13,200	300	1,500
Watershed (%)	51.1	27.4	20.6	< 1	< 1	< 1	< 1

Table 2. Land ownership in the Upper Pecos – Long Arroyo watershed. Reported to the nearest hundred acres.



Land Use / Land Cover ^{3,4}

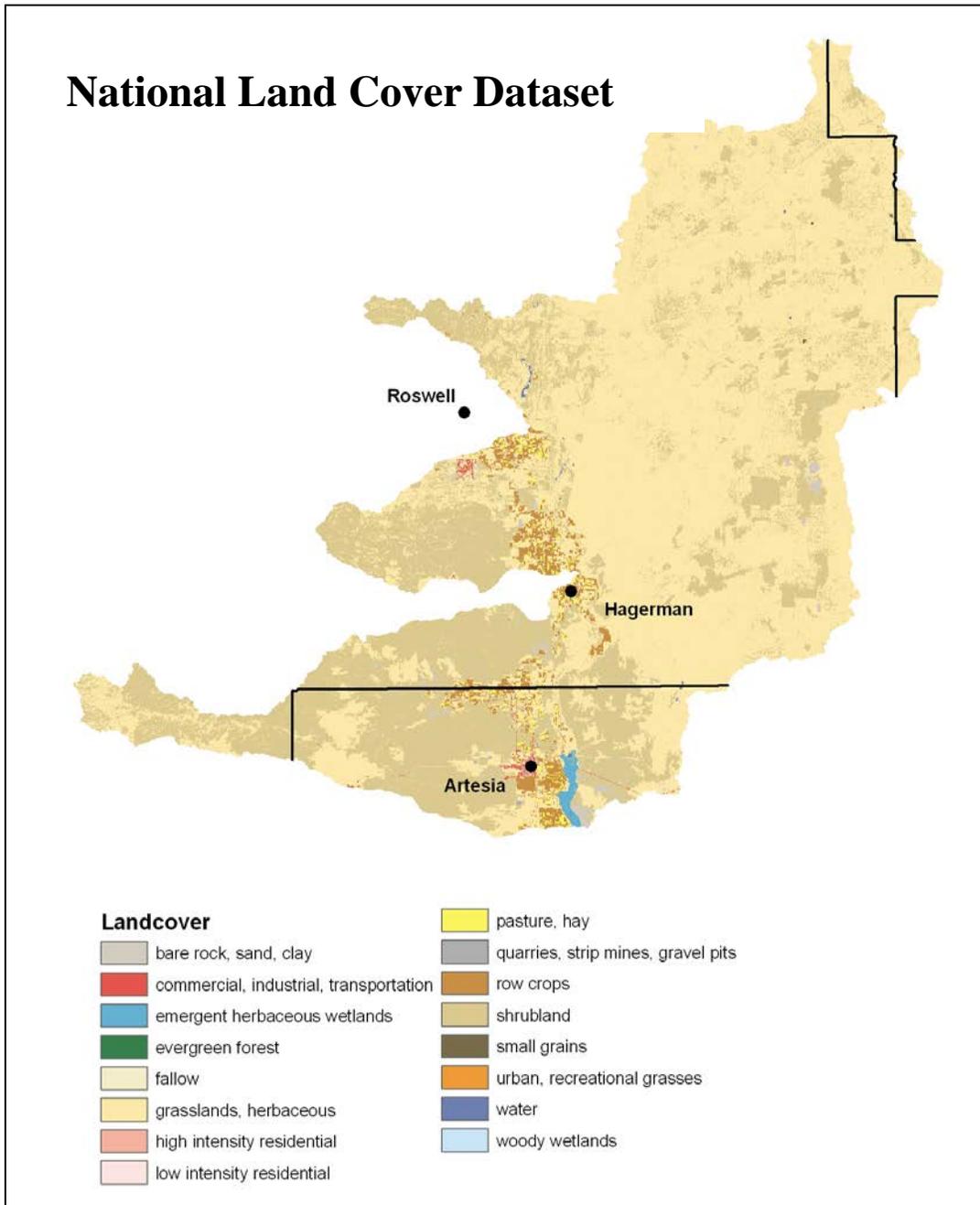


Figure 6. National Land Cover Dataset subset of the Upper Pecos – Long Arroyo watershed.



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. The land cover distributions within the Upper Pecos – Long Arroyo watershed are presented below.

Land Cover	Acres	% of Watershed
grasslands, herbaceous	1,289,200	62.9
shrubland	669,800	32.7
row crops	45,900	2.2
bare rock, sand, clay	18,900	< 1
pasture, hay	12,000	< 1
emergent herbaceous wetlands	5,900	< 1
commercial, industrial, transportation	4,500	< 1
water	1,400	< 1
low intensity residential	1,000	< 1
quarries, strip mines, gravel pits	600	< 1
small grains	300	< 1
fallow	300	< 1
urban, recreational grasses	200	< 1
woody wetlands	100	< 1

Table 3. Extent of NLCD classes. Reported to the nearest hundred acres.



Land Use \ Land Cover

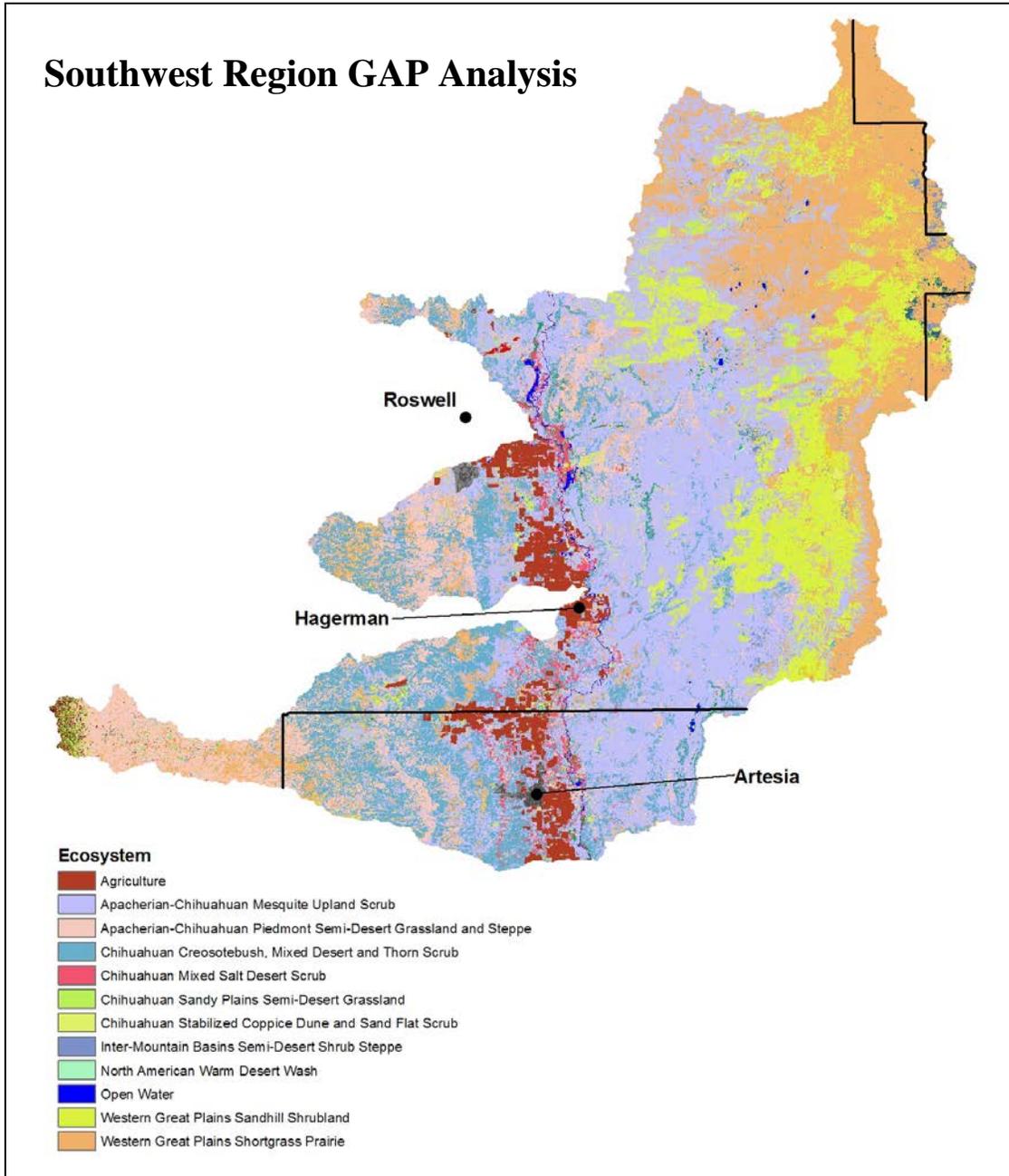


Figure 7. Subset of the SW ReGAP. The 12 dominant ecosystems are listed in the legend.



Land Use \ Land Cover

The land cover mapping effort for the Southwest Region Gap Analysis Project was a coordinated multi-institution endeavor. This dataset was created for regional terrestrial biodiversity assessment. Additional objectives were to establish a coordinated mapping approach to create detailed, seamless maps of land cover, all native terrestrial vertebrate species, land stewardship, and management status, and to analyze this information to identify those biotic elements that are underrepresented on lands managed for their long term conservation.

Ecosystem	Acres	% of Watershed
Apacherian-Chihuahuan Mesquite Upland Scrub	711,000	35
Western Great Plains Shortgrass Prairie	434,100	21
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	263,000	13
Western Great Plains Sandhill Shrubland	249,600	12
Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	204,900	10
Agriculture	74,600	4
Chihuahuan Mixed Salt Desert Scrub	32,900	2
Inter-Mountain Basins Semi-Desert Shrub Steppe	15,200	< 1
Chihuahuan Sandy Plains Semi-Desert Grassland	8,700	< 1
Open Water	6,700	< 1
Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	6,100	< 1
North American Warm Desert Wash	5,300	< 1
Developed, Medium - High Intensity	4,800	< 1
Developed, Open Space - Low Intensity	4,400	< 1
North American Arid West Emergent Marsh	3,200	< 1
North American Warm Desert Active and Stabilized Dune	3,100	< 1
Western Great Plains Mesquite Woodland and Shrubland	3,000	< 1
Southern Rocky Mountain Juniper Woodland and Savanna	2,900	< 1
North American Warm Desert Riparian Woodland and Shrubland	2,600	< 1
Madrean Juniper Savanna	2,500	< 1
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	2,300	< 1
Southern Rocky Mountain Pinyon-Juniper Woodland	1,900	< 1
Madrean Pinyon-Juniper Woodland	1,300	< 1
Western Great Plains Cliff and Outcrop	1,200	< 1

Table 4. Extent of SW ReGAP ecosystem acreages. Reported to the nearest hundred acres.



Land Use / Land Cover

Ecosystem	Acres	% of Watershed
North American Warm Desert Playa	1,000	< 1
Western Great Plains Riparian Woodland and Shrubland	900	< 1
Rocky Mountain Lower Montane-Foothill Shrubland	800	< 1
Recently Burned	800	< 1
Madrean Encinal	500	< 1
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	300	< 1
Western Great Plains Saline Depression Wetland	200	< 1
North American Warm Desert Bedrock Cliff and Outcrop	200	< 1
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	100	< 1
Chihuahuan Gypsophilous Grassland and Steppe	100	< 1

Table 4 cont'd. Extent of SW ReGAP 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 approximately 2,600 miles (4,200 km) of water courses within the Upper Pecos–Long Arroyo watershed. Additionally, the NHD identifies the principal drainage, the Pecos River, travelling approximately 95 miles in the watershed. Statistics from the United States Geological Survey gauging station near Artesia, NM are provided in Table 5 and Figure 7.

Date	Description	Discharge (cfs)
1941	Maximum mean annual discharge	1378
1964	Minimum mean annual discharge	65
Sept. 25, 1941	Maximum daily discharge	44,300
*Several days (1946, 1947, 1953, 1954, 1964, 1965)	Minimum daily discharge	0

* Typically occurring between June and October.

Table 5. USGS streamflow data.

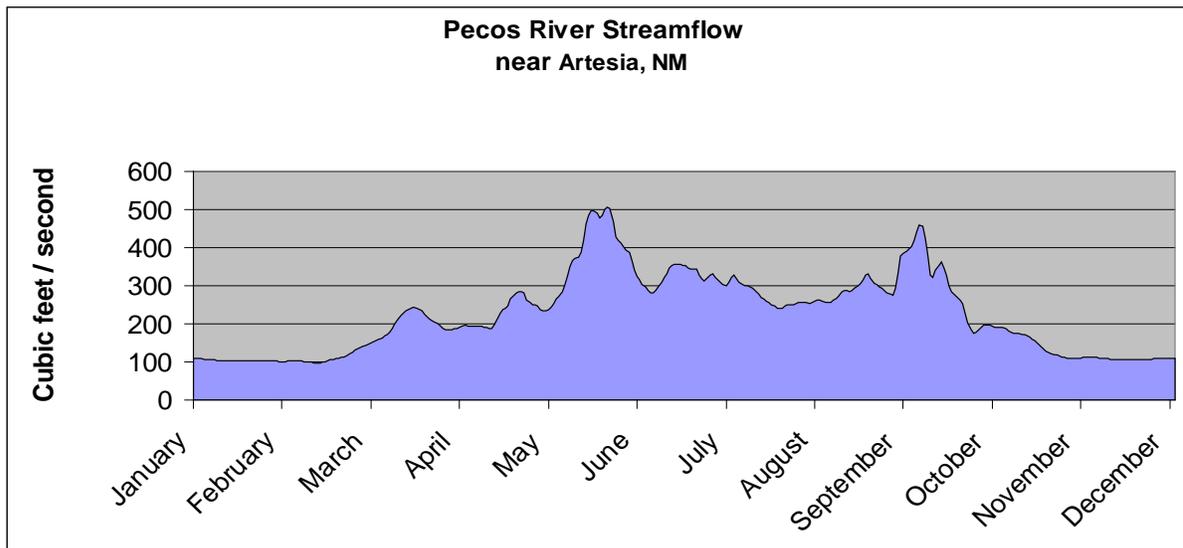


Figure 8. Pecos River 10 day running mean of mean daily discharge.



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.

The New Mexico Water Quality Control Commission (NMWQCC) is the issuing agency of water quality standards for interstate and intrastate waters. In this role, it is the responsibility of the NMWQCC to assess the waters in New Mexico for compliance with the Clean Water Act. The NMWQCC has subdivided the Upper Pecos – Long Arroyo watershed into 10 reaches. These reaches are listed in Table 6.

Reach	Designated Uses					
	Livestock Watering	Wildlife Habitat	Marginal Cold Water Fishery	Secondary Contact	Irrigation	Warm Water Fishery
Bitter Lake	x	x				
Cottonwood Lake	x	x				
Devils Inkwell	x	x				
Eagle Creek	x	x				
Figure Eight Lake	x	x	x	x		
Lake Van	x	x				
Lea Lake	x	x	x	x		
Mirror Lake	x	x				
Pasture Lake	x	x				
Pecos River (Rio Peñasco to Salt Creek)	x	x		x	x	x

Table 6. Listed uses of water bodies.



Hydrology

Within the 2004-2006 New Mexico Integrated Clean Water Act Report, 3 of the 10 listed reaches of the Upper Pecos-Long Arroyo watershed were evaluated for compliance with Section 303(d) of the Clean Water Act. These were Figure Eight Lake, Eagle Creek, and the Pecos River reaches. These reaches (Figure 8) were found to not have any impairments.

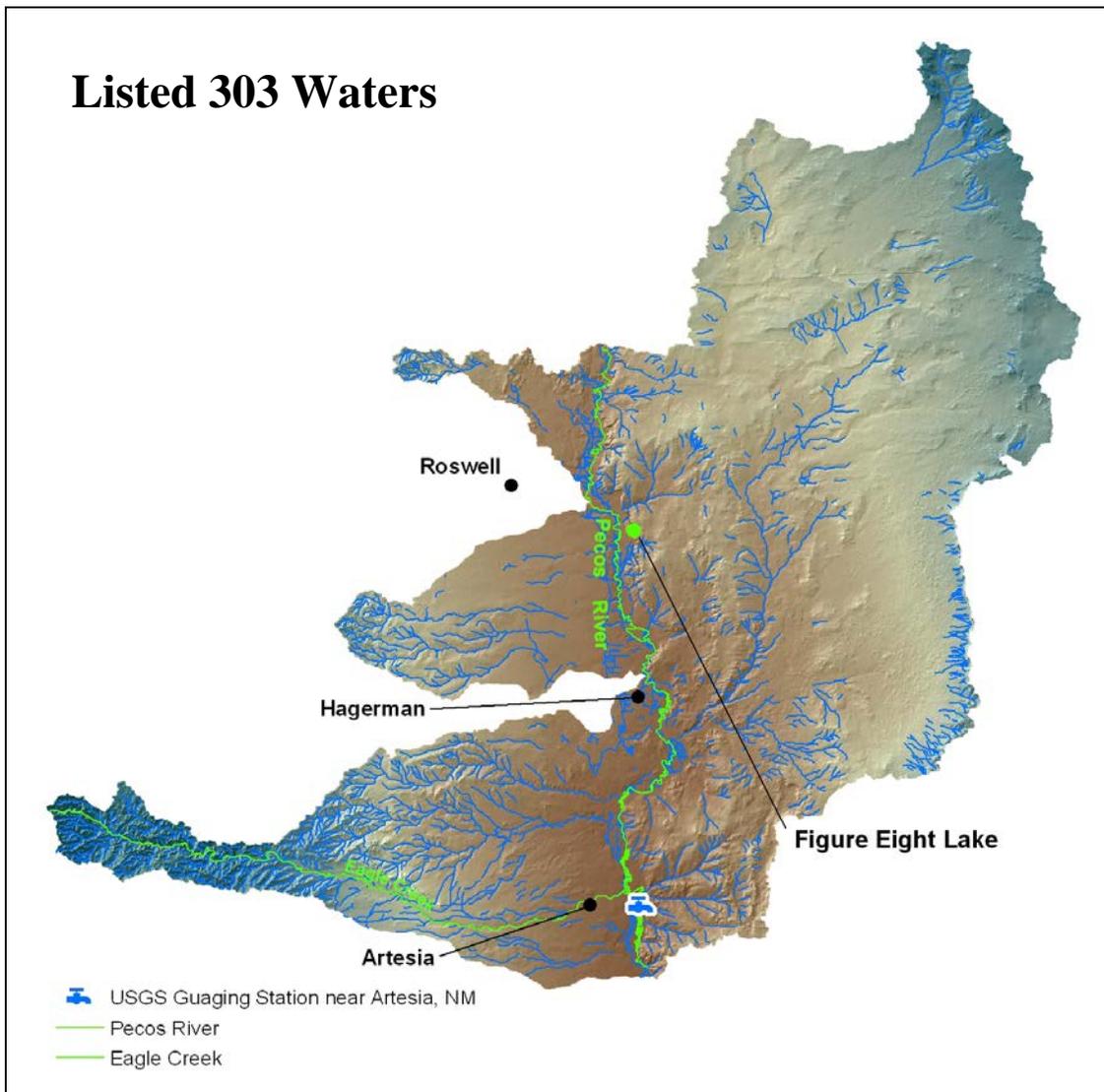


Figure 9. Aassed waters of the Upper Pecos – Long Arroyo watershed.



Hydrology

There are four declared groundwater basins within the Upper Pecos – Long Arroyo watershed. A declared groundwater basin is an area of the state proclaimed by the State Engineer to be underlain by a groundwater source having reasonably ascertainable boundaries. By such proclamation the State Engineer assumes jurisdiction over the appropriation and use of groundwater from the source. The Roswell ground water basin covers almost 99% of the area in the watershed with the remaining 1% falling in the Fort Sumner, Lea County, and Peñasco basins.



Threatened and Endangered Species ^{10, 11, 12, 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 (NMNH), a division of the Museum of Southwestern Biology, collects data on the biology, status and location of the New Mexico's biological resources. In addition, NMNH keeps track of any legal or informal status applied to biological resources with respect to rarity or conservation priority by both governmental and non-governmental agencies. As such, NMNH maintains a tracking list of about 600 Threatened, Endangered and Sensitive (TES) animal and plant species of particular concern or sensitivity in New Mexico. Table 7 lists those species which are currently listed and tracked in the Upper Pecos – Long Arroyo Watershed.

Common Name	Scientific Name	Taxonomic Class	Family	Fed Status	State Status	Global Rank
Gray Redhorse	Scartomyzon congestus	Actinopterygii	Catostomidae		E	G4
Mexican Tetra	Astyanax mexicanus	Actinopterygii	Characidae		T	G5
Arkansas River Shiner	Notropis girardi	Actinopterygii	Cyprinidae		E	G2
Arkansas River Shiner	Notropis girardi	Actinopterygii	Cyprinidae		E	G2
Pecos Bluntnose Shiner	Notropis simus pecosensis	Actinopterygii	Cyprinidae	LT	E	G2T2
Plains Minnow	Hybognathus placitus	Actinopterygii	Cyprinidae			G4
Rio Grande Shiner	Notropis jemezianus	Actinopterygii	Cyprinidae			G3
Rio Grande Silvery Minnow	Hybognathus amarus	Actinopterygii	Cyprinidae	LE	E	G1
Roundnose Minnow	Dionda episcopa	Actinopterygii	Cyprinidae			G5
Texas Shiner	Notropis amabilis	Actinopterygii	Cyprinidae			G4
Pecos Pupfish	Cyprinodon pecosensis	Actinopterygii	Cyprinodontidae		T	G1
Rainwater Killifish	Lucania parva	Actinopterygii	Fundulidae			G5
Black Bullhead	Ameiurus melas	Actinopterygii	Ictaluridae			G5
Channel Catfish	Ictalurus punctatus	Actinopterygii	Ictaluridae			G5
Flathead Catfish	Pylodictis olivaris	Actinopterygii	Ictaluridae			G5
Longnose Gar	Lepisosteus osseus	Actinopterygii	Lepisosteidae			G5
Bigscale Logperch	Percina macrolepida	Actinopterygii	Percidae		T	G5
Greenthroat Darter	Etheostoma lepidum	Actinopterygii	Percidae		T	G3G4
Pecos Gambusia	Gambusia nobilis	Actinopterygii	Pociliidae	LE	E	G2
	Acarospora clauzadeana	Ascomycetes	Acarosporaceae			G1G2
Mississippi Kite	Ictinia mississippiensis	Aves	Accipitridae			G5

Table 7. Threatened and endangered species in the watershed. L= listed, P = potential, E = endangered, T = threatened, C = Candidate (See Appendix A).



Threatened and Endangered Species

Common Name	Scientific Name	Taxonomic Class	Family	Fed Status	State Status	Global Rank
Ring-necked Duck	<i>Aythya collaris</i>	Aves	Anatidae			G5
Least Bittern	<i>Ixobrychus exilis</i>	Aves	Ardeidae			G5
Piping Plover	<i>Charadrius melodus</i>	Aves	Charadriidae	LE, LT	T	G3
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	Aves	Charadriidae			G4T3
Forster's Tern	<i>Sterna forsteri</i>	Aves	Laridae			G5
Interior Least Tern	<i>Sterna antillarum athalassos</i>	Aves	Laridae		E	G4T2Q
Brown Pelican	<i>Pelecanus occidentalis</i>	Aves	Pelecanidae		E	G4
Lesser Prairie-chicken	<i>Tympanuchus pallidicinctus</i>	Aves	Phasianidae	C		G3
Tharp's Blue-star	<i>Amsonia tharpii</i>	Dicotyledoneae	Apocynaceae		E	G1
Pecos Sunflower	<i>Helianthus paradoxus</i>	Dicotyledoneae	Asteraceae	LT	E	G2
Wright's Marsh Thistle	<i>Cirsium wrightii</i>	Dicotyledoneae	Asteraceae			G2
Kuenzler's Hedgehog Cactus	<i>Echinocereus fendleri</i> var. <i>kuenzleri</i>	Dicotyledoneae	Cactaceae	LE	E	G4G5T1
Great Sage	<i>Salvia summa</i>	Dicotyledoneae	Lamiaceae			G3?
Gypsogenus Ringstem	<i>Anulocaulis gypsogenus</i>	Dicotyledoneae	Nyctaginaceae			G4
Pecos Assiminea	<i>Assiminea pecos</i>	Gastropoda	Assimineidae	PE	E	G2
Koster's Springsnail	<i>Juturnia kosteri</i>	Gastropoda	Hydrobiidae	PE	E	G2
Roswell Springsnail	<i>Pyrgulopsis roswellensis</i>	Gastropoda	Hydrobiidae	PE	E	G2
Common Green Darner	<i>Anax junius</i>	Insecta	Aeshnidae			G5
Swift Fox	<i>Vulpes velox</i>	Mammalia	Canidae			G3
Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	Mammalia	Sciuridae			G3G4
Mexican Ground Squirrel	<i>Spermophilus mexicanus</i>	Mammalia	Sciuridae			G5
Least Shrew	<i>Cryptotis parva</i>	Mammalia	Soricidae		T	G5
Gypsum Gramma	<i>Bouteloua breviseta</i>	Monocotyledoneae	Poaceae			G5
Sand Dune Lizard	<i>Sceloporus arenicolus</i>	Reptilia	Phrynosomatidae	C	E	G2

Table 8 cont'd. Threatened and endangered species in the watershed. L= listed, P = potential, E = endangered, T = threatened, C = Candidate (See Appendix A).



Threatened and Endangered Species

Of the many plant and animal species currently on the NMNH tracking list, two species in the Upper Pecos – Long Arroyo watershed have received significant attention in recent years. These species are the lesser-prairie chicken (*Tympanuchus pallidicinctus*) and the sand dune lizard (*Sceloporus arenicolus*). As indicated in Table 8, both of these species have a federal 'Candidate' status for protection under the Endangered Species Act of 1973.

The lesser-prairie chicken is second only to the Gunnison sage-grouse (*Centrocercus minimus*) with respect to the smallest habitat area and population size of North American Grouse species. Prime lesser-prairie chicken environments are found within habitats dominated by sand sagebrush (*Artemisia filifolia*) and shin-oak (*Quercus havardii*). The lesser-prairie chicken prefers to nest under these shrubs, particularly when there are adjacent tall bunchgrasses serving as protective cover from predation. The native range of the lesser-prairie chicken is believed to have declined over 90% since the settlement of the western United States began in the 19th century. Causes believed to have contributed to their decline include drought, improper grazing management, rangeland conversion to cropland, and chemical control of sand sagebrush and shin-oak. Combinations of these land management practices and conditions have led to a highly fragmented habitat in which the lesser-prairie chicken struggles to maintain sustaining populations.

The sand dune lizard, native to New Mexico and Texas, is endemic to the sand-shinnery-oak ecosystem. Unlike other lizards that share this habitat, the sand dune lizard can't survive outside this ecosystem. The sand dune lizard requires the wind-eroded blowouts of the shin-oak dunes where they forage and burrow within deep sand. Similar to the lesser-prairie chicken, shrub eradication, cropland conversion, and poor grazing management have contributed to a declining population of the lizard.

Painter and Pierce (2000) made a rough delineation of the contiguous areas thought to be the best suitable habitat for the sand dune lizard (Figure 9). This area covered approximately 590,000 acres (2,380 sq. km) including lands in both New Mexico and Texas. Of this area, 242,000 acres (1000 sq. km) are found within the Upper Pecos – Long Arroyo watershed. This suggests 41% of the area best meeting sand dune lizard habitat is found within this watershed. Additionally, the New Mexico Department of Game and Fish has inventoried known and probable sand dune lizard occurrences in order to fulfill the mission of protecting New Mexico's biological diversity (Figure 9). A total of 643 occurrences have been cataloged and 249 (39%) are located within the boundaries of the Upper Pecos – Long Arroyo watershed.



Threatened and Endangered Species

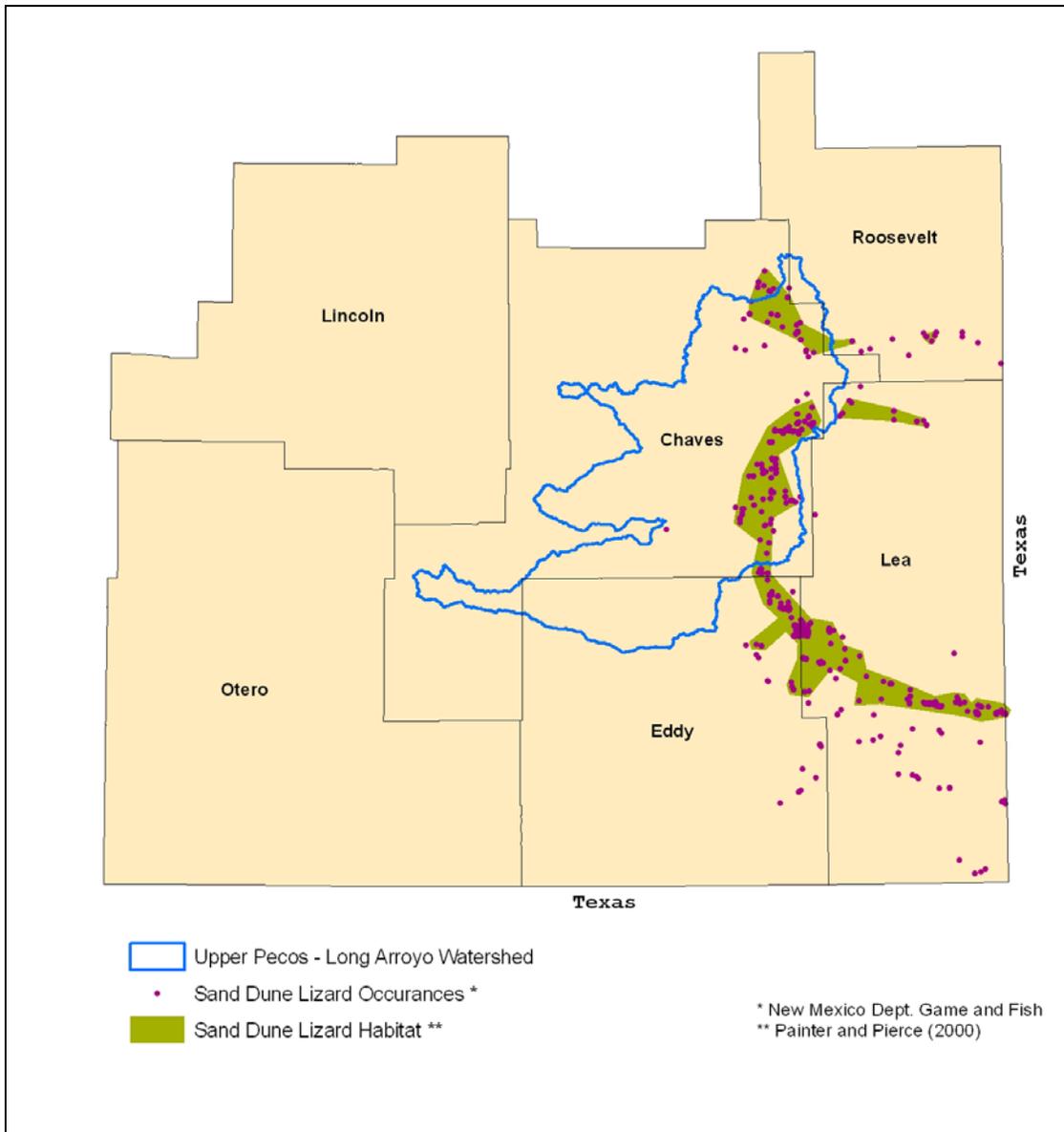


Figure 10. Sand Dune Lizard habitat in NM and TX



Threatened and Endangered Species

A 2005 NMNH study of the lesser-prairie chicken habitat in southeastern New Mexico sought to identify primary habitat areas across the existing range. The study covered ~ 2,239,000 acres (9,100 sq. km) in parts of Roosevelt, Lea, Chaves, and Eddy counties. Table 8 lists the habitat types that were identified in this study. These units were further aggregated into landscape units for the purposes of conservation planning, population assessment, and restoration. These designations are identified as A, B, C, and B-C. Group A units are considered occupied or suitable habitat and are indicate areas where shin-oak or sand sagebrush are dominant, with minor to no honey mesquite. Areas in Group B are considered to be seasonal-use to transitional areas and are dominated by mid- or tall-grasses or grasslands with minor shin-oak components. Extensive areas of relatively homogeneous grasslands in Group B suggest that shrubs have been removed either mechanically or chemically. Areas in Group C and B-C are classified as potential restoration habitat. They contain altered vegetation types that were originally suitable habitat and areas that have been impacted by invasive species but still contain enough suitable vegetation for restoration. All other map units are considered unsuitable habitat.

Vegetation Community	Group	Acres Study Area	% Study Area	UPLA Acres	% UPLA Study Area
Shin-Oak/Mixed Mid-Grass & Tall-Grass Duneland	A	212,961	10	89,550	15
Shin-Oak/Sparse Duneland	A	189,063	8	73,412	13
Shin-Oak/Mixed Mid-Grass & Tall-Grass Shrubland	A	65,258	3	23,041	4
Shin-Oak/Mixed Mid-Grass & Short-Grass Shrubland	A	353,372	16	65,294	11
Shin-Oak/Sparse Shrubland	A	52,429	2	19,920	3
Honey Mesquite-Shin-Oak/Short-Grass Shrubland	C	88,542	4	6,609	1
Sand Sagebrush Shrubland	A	22,681	1	8,552	1
Honey Mesquite Shrubland		137,771	6	41,374	7
Escarpment-Footslope Shrubland		6,266	0	1,910	0
Tall-Grass Grassland	B-C	13,776	1	11,883	2
Honey Mesquite/Sparse Shrubland		138,325	6	36,386	6
Shin-Oak-Sand Sagebrush Shrubland	A	7,287	0	343	0
Short-Grass Grassland		365,964	16	89,808	15
CRP Fields		40,215	2	0	0
Agricultural Fields		72,956	3	1	0
Mid-Grass Grassland	B-C	54,194	2	21,664	4
Mixed Grasses/Shin-Oak Grassland	B-C	63,433	3	8,511	1
Short-Grass/Honey Mesquite Grassland		152,785	7	46,749	8
Playa Lakebed		5,638	0	993	0
Barren/Sparsely Vegetated/Manmade Disturbance		195,615	9	37,587	6

Table 9. Lesser-prairie chicken vegetation communities identified by the NMNH.



Threatened and Endangered Species

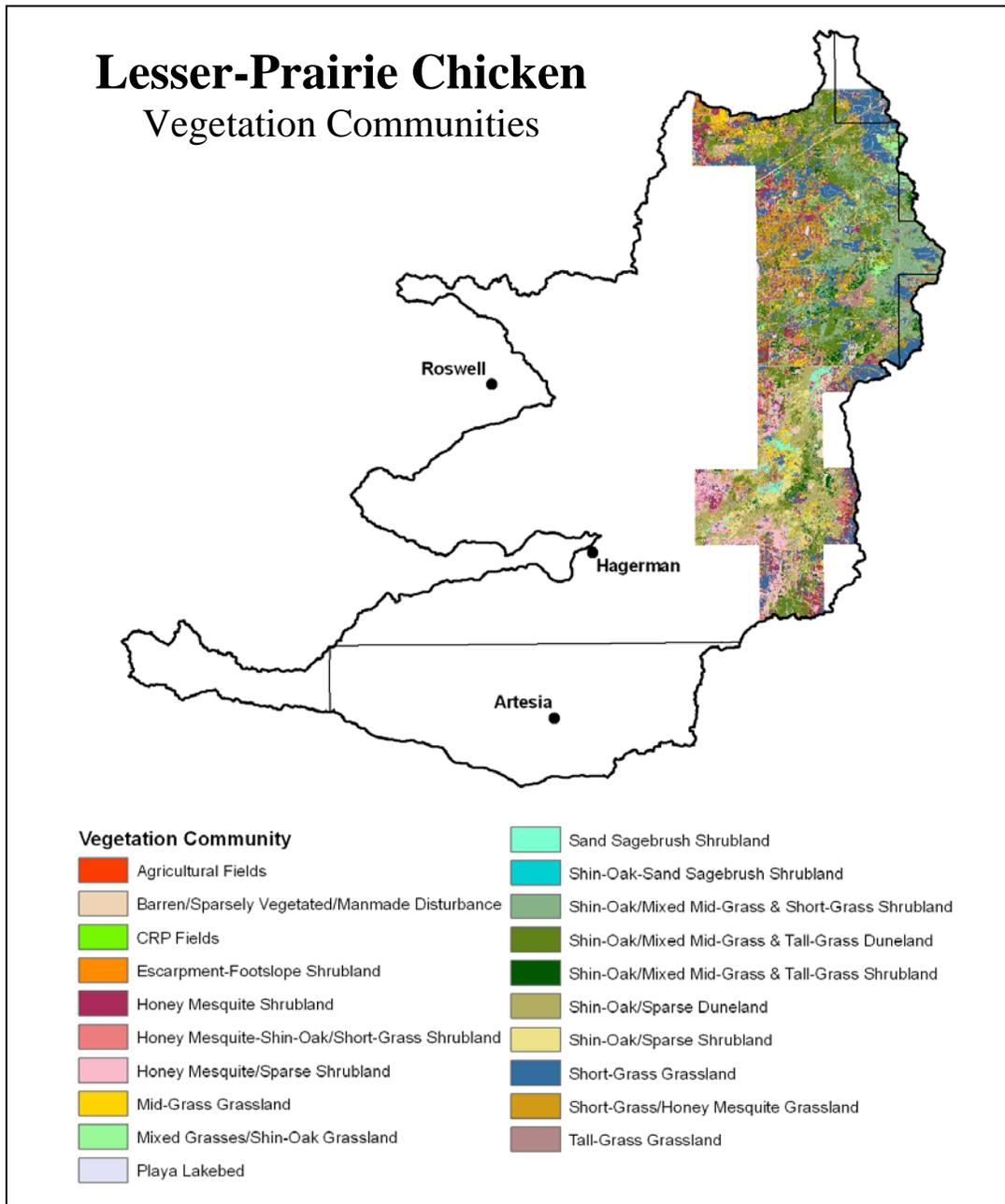


Figure 11. Lesser-Prairie chicken study habitat types within the Upper Pecos – Long Arroyo watershed.



Threatened and Endangered Species

The NMNH study covered ~ 584, 000 acres in the Upper Pecos – Long Arroyo watershed, representing 29% of the total study area. Of the area in the Upper Pecos – Long Arroyo watershed, almost half is designated as group A, areas with exceptional habitat for the lesser-prairie chicken. Table 9 summarizes the results of this study as applied to the watershed.

Group	Acres	% Study Area in UPLA
A	280,112	48
B-C	42,059	7
C	6,609	1
Unsuitable	254,808	44
Sum (Σ)	583,588	

Table 10. Extent of suitable lesser-prairie chicken habitat

Research has suggested both 8,000 and 18,000 contiguous acres as minimum areas to maintain healthy populations of the lesser-prairie chicken. These areas represent distances over which the species will travel for reproduction. The NMNH study considered group A vegetation communities as those suited to meet these area / distance requirements. Within the Upper Pecos – Long Arroyo watershed seven of these areas exist (Figure 11).

Additionally the study identified areas where restoration was an option. Areas from Group C and B-C were chosen as they contain altered vegetation types that were originally lesser-prairie chicken habitat and areas that have been impacted by invasive species but still contain enough suitable vegetation for restoration. Figure 12 displays areas within the watershed suitable for potential restoration. Approximately 49,000 acres exist within the watershed that are well suited for habitat restoration.



Threatened and Endangered Species

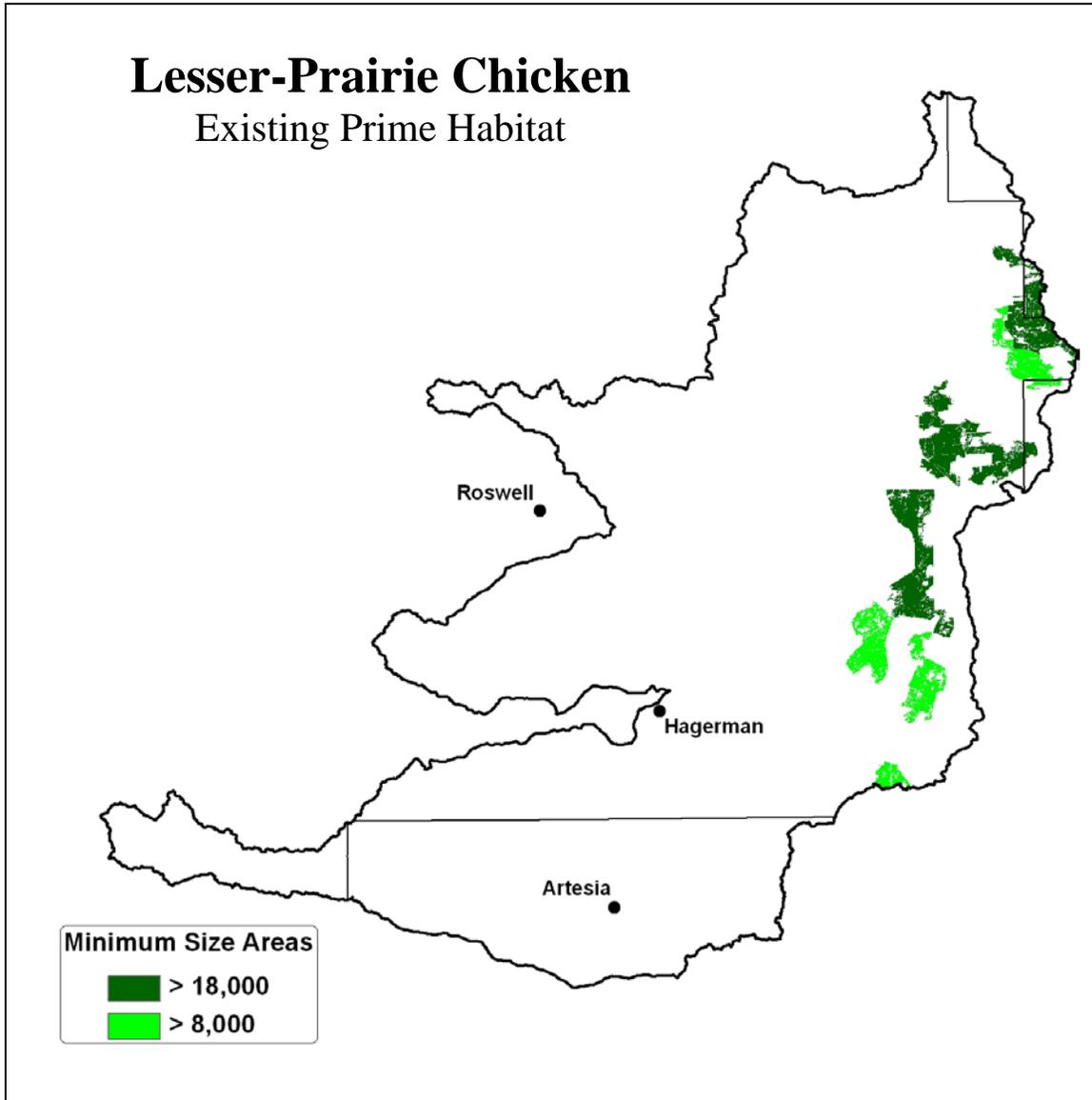


Figure 12. Prime lesser-praire chicken habitat.



Threatened and Endangered Species

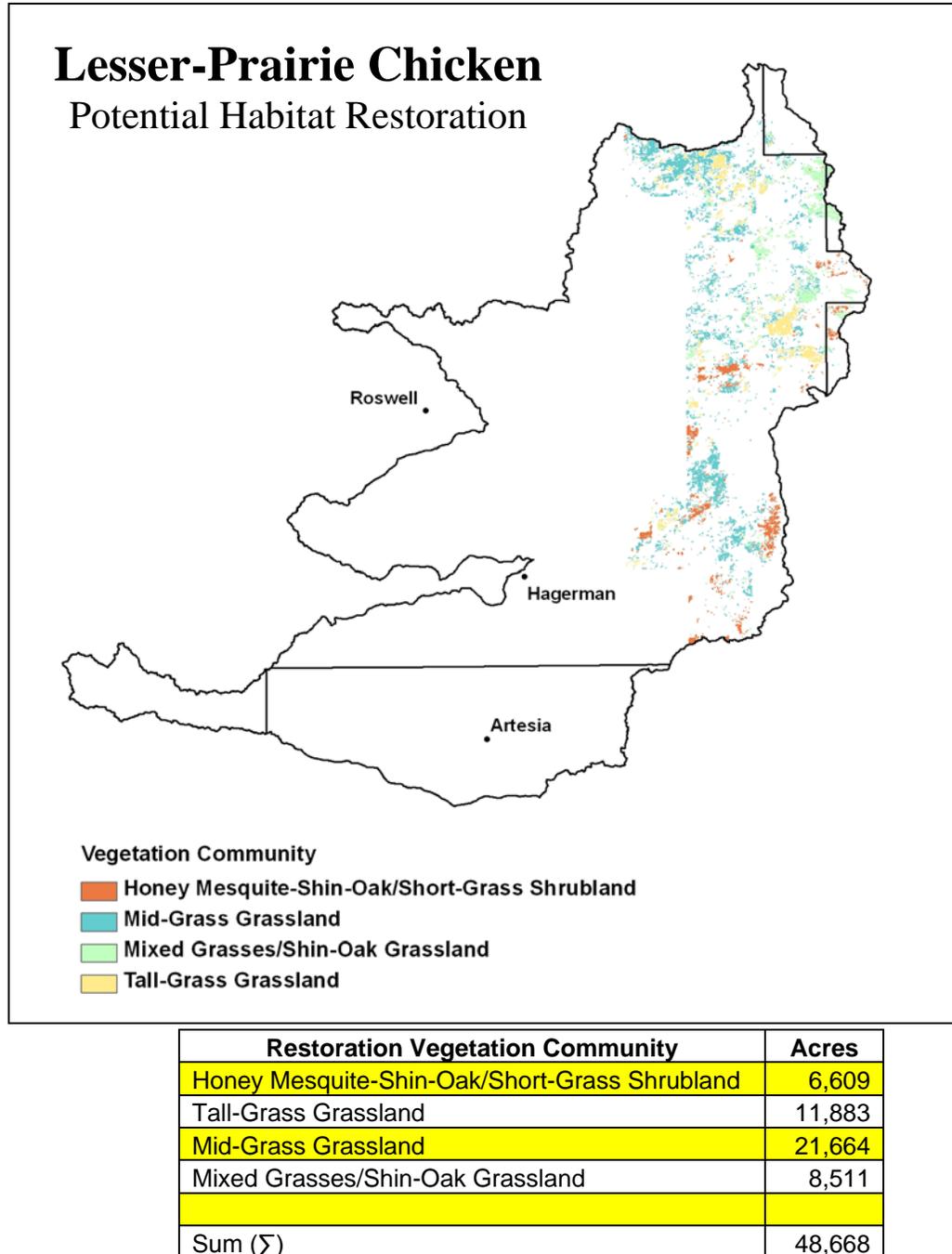


Figure 13. Potential lesser-prairie chicken habitat restoration.



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 Pecos–Long Arroyo watershed, the SWEMP has identified and cataloged the presence of 2 species of invasive plants (Table 10). These species are defined as non-native by the USDA-PLANTS database.

Scientific Name	Common Name
<i>Acroptilon repens</i>	hardheads
<i>Tamarix species</i>	tamarisk

Table 11. Invasive species of the Upper Pecos – Long Arroyo watershed.



Common Resource Areas

A Common Resource Area (CRA) is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) designation. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area.

Each Common Resource Area will have multiple Conservation System Guides associated with it. A Conservation System Guide associates, for a given CRA and land use, different components of Resource Management Systems and their individual effect on conserving soil and water resources.

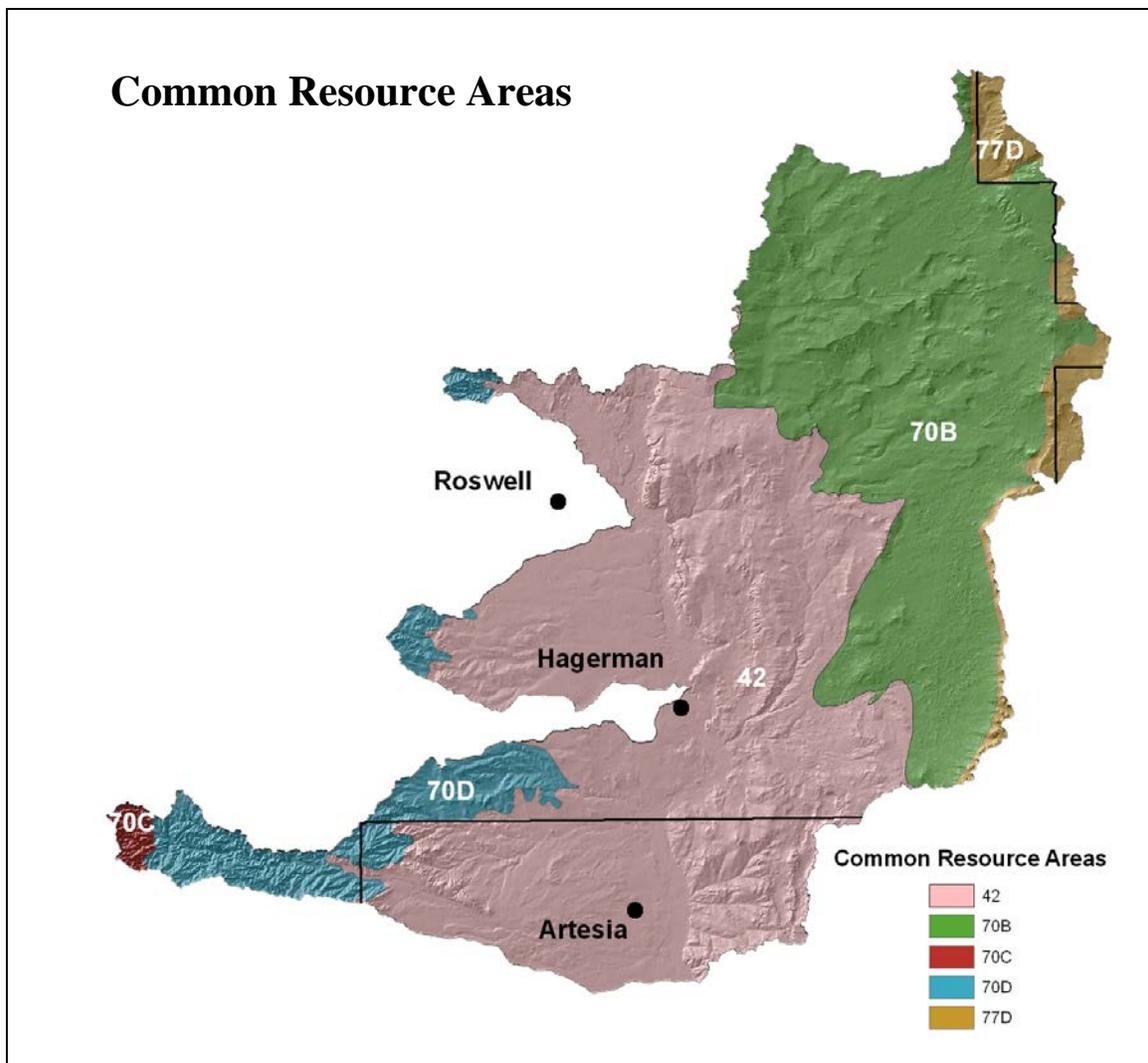


Figure 14. Common Resource Areas of the Upper Pecos – Long Arroyo watershed.



Common Resource Areas

42 - 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.

70B - 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 - 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.

70D - Southern New Mexico Foothills

This unit is characterized by nearly level to steep limestone hills with steep, narrow drainageways. Elevation ranges from 4,000 to 7,000 feet and average annual precipitation is 13 to 18 inches. Native vegetation is sparse and consists of pinyon, juniper, algerita, agave, yucca and cacti. Grasses include blue and black grama, little bluestem, and muhly species. Shrubs include catclaw, ocotillo, sotol and fourwing saltbush. Much of the area is federally owned. Federal and private lands are used for grazing, wildlife habitat, and military training.

77D - 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

The USDA-Natural Resources Conservation Service (NRCS) focuses on the development and delivery of high quality products and services that enable agricultural producers to be good stewards of our Nation’s soil, water, and related natural resources on non-Federal lands. The Natural Resources Conservation Service’s conservation programs aid 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. In fiscal year 2008, 280 planned conservation practices addressed resource concerns on more than 900,000 acres in the Upper Pecos – Long arroyo watershed. These programs were administered from the Roswell and Portales USDA-NRCS Service Centers. Tables 11 and 12 summarize these practices.

Conservation Practice	Chaves Count	Chaves Acres	Eddy Count	Eddy Acres	Watershed Count	Watershed Acres
Brush Management	8	22,750	8	835	16	23,585
Conservation Crop Rotation	10	1,081	4	267	14	1,348
Irrigation System, Sprinkler	10	891	4	1,148	14	2,039
Irrigation Water Management	10	1,081	3	142	13	1,223
Nutrient Management	10	1,081	4	267	14	1,348
Pest Management	10	1,081	4	267	14	1,348
Prescribed Grazing	57	368,397	13	76,818	70	445,215
Residue Management, Seasonal	11	1,196	4	267	15	1,463
Upland Wildlife Habitat Management	58	368,451	13	76,818	71	445,269
Sum (Σ)	184	766,008	57	156,829	241	922,837

Table 12. 2008 planned conservation practices in the Upper Pecos - Long Arroyo watershed. Reported in acres.



Conservation

Conservation Practice	Chaves	Eddy
Comprehensive Nutrient Management Plan	2	---
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	13	4
Manure Transfer	5	---
Structure for Water Control	6	---
Waste Storage Facility	3	---
Watering Facility	6	---
Watershed Total	35	4

Table 13. 2008 location specific planned conservation.



Soil Resource Inventory

All of the approximately 2 million acres in the Upper Pecos – Long Arroyo Watershed have a certified Soil Survey Geographic Database - National Cooperative Soil Survey inventory. Soil resource inventories have been conducted on 5 distinct areas including lands managed by the Bureau of Land Management and the State of New Mexico, as well as those that are privately held.

National Cooperative Soil Survey

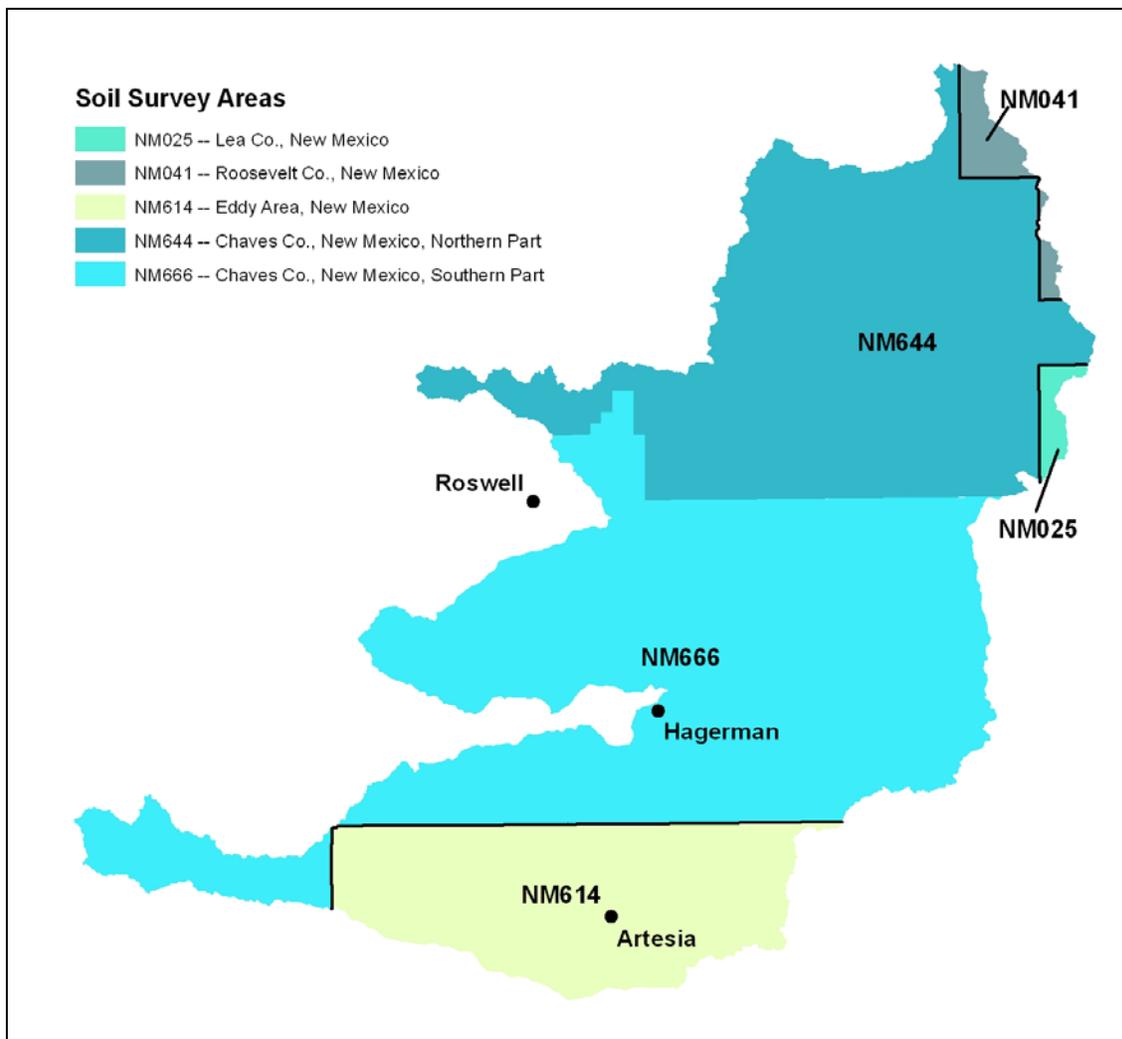


Figure 15. National Cooperative Soil Survey coverage of the Upper Pecos – Long Arroyo watershed.





Soil Resource Inventory

In order to evaluate the susceptibility of erosion within the Upper Pecos - Long Arroyo watershed, a model was developed using Soil Survey Geographic Database (SSURGO) information. The soil properties saturated hydraulic conductivity, soil loss tolerance, and wind erodibility group were used in conjunction with slope to assess soil map unit potential for erosion. Saturated hydraulic conductivity and slope are reported in SSURGO databases as interval/ratio data whereas wind erodibility and soil loss tolerance are ordinal data. Data transformations for the model are listed -

<u>SSURGO Value</u>	<u>Nominal Description</u>	<u>Model Rank</u>
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
5 - 10		1
10 - 15		2
15 - 25		3
> 25		4
Soil Loss Tolerance		
5	High Tolerance For loss	0
4	↓	1
3	↓	2
2	↓	3
1	Low Tolerance For Loss	4
Wind Erodibility Group		
1	Very High	4
2	Very High	4
3	High	3
4	High	3
4L	High	3
5	Moderate	2
6	Moderate	2
7	Moderate	1
8	Slight	0

Table 14. Soil erosion model criteria



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. The possible range of values for each map unit are 0 – 16. Increasing values represent a higher susceptibility to soil erosion.

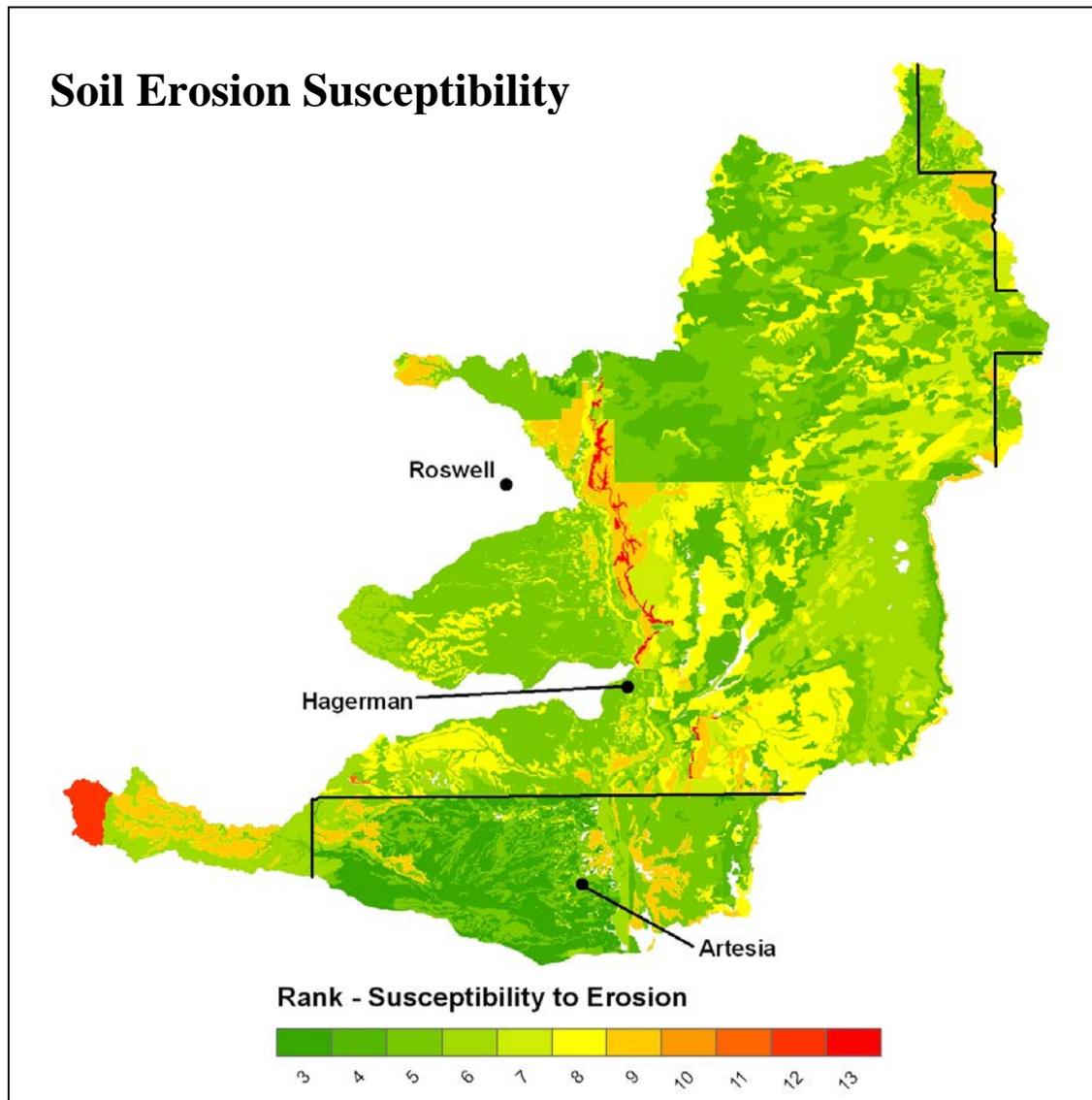


Figure 16. Soil erosion model results.



Soil Resource Inventory

Rank	Acres	% Watershed
3	130,652	7
4	294,422	14
5	703,629	35
6	263,343	13
7	175,596	9
8	296,622	15
9	128,742	6
10	2	< 1
11	379	< 1
12	11,313	1
13	8,134	< 1
Sum (Σ)	2,012,832	100

Table 14. Soil erosion model results.



Socioeconomic ¹⁵

	Total population: Total	Total population: Urban	Total population: Rural	Total population: Rural; Farm	Total population: 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 in 1999
Chaves	61382	47158	14224	1044	13180	27016	44175	1226	621	387	50	12810	2113	32532
Eddy	51658	38980	12678	675	12003	20130	39407	959	396	218	26	9248	1404	36789
Lea	55511	43665	11846	377	11469	21973	37284	2440	536	217	19	13359	1656	34665
Roosevelt	18018	11524	6494	1050	5444	6057	13384	347	146	79	9	3535	518	31813

Table 15. Socioeconomic data of counties which are found in the watershed.



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

3. United States Geological Survey – National Land Cover Dataset

<http://landcover.United States Geological Survey.gov/>

4. Southwest Region Gap Analysis Project (SWReGAP).

<http://earth.gis.usu.edu/swgap/>

5. United States Geological Survey

<http://waterdata.usgs.gov/nwis/rt>

6. United States Geological Survey - National Hydrography Dataset

<http://nhd.United States Geological Survey.gov/>

7. United States Environmental Protection Agency

<http://www.epa.gov/owow/tmdl/>

8. New Mexico Environment Department – Water Quality Control Commission

<http://www.nmenv.state.nm.us/wqcc/index.html>

9. New Mexico Office of the State Engineer

<http://www.ose.state.nm.us/index.html>

10. New Mexico Natural Heritage

<http://nhnm.unm.edu/>

11. Neville, P., T. Neville, and K. Johnson. 2007. Map of a portion of potential sand dune lizard habitat in southeastern New Mexico. Natural Heritage New Mexico Publ. No. 07-GTR-318. Natural Heritage New Mexico, University of New Mexico, Albuquerque, NM. 71 p.

12. Neville, P., T. Neville, and K. Johnson. 2005. Lesser prairie-chicken habitat map for portions of Eastern New Mexico. Publication No. 05-GTR-285. Natural Heritage New Mexico, Museum of Southwestern Biology, University of New Mexico. 77 p.



13. Painter, C. W. and L. J. S. Pierce. 2000. Proposed distributions for the amphibians and reptiles of New Mexico. New Mexico Department of Game and Fish unpublished report to New Mexico State Land Office (Geographic Information Systems data).

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

15. United States Census Bureau -
http://factfinder.census.gov/home/saff/main.html?_lang=en



Appendix A

BASIC FEDERAL STATUS DESIGNATIONS

LE = Listed Endangered

Species for which a final rule has been published in the Federal Register to list the species as endangered. Species is legally protected by the Endangered Species Act.

LT = Listed Threatened

Species for which a final rule has been published in the Federal Register to list the species as threatened. Species is legally protected by the Endangered Species Act.

PE = Proposed Endangered

Species for which a proposed rule has been published in the Federal Register to list the species as endangered

PT = Proposed Threatened

Species for which a proposed rule has been published in the Federal Register to list the species as threatened.

C or CN = Candidate for Listing

Substantial information exists in U.S. Fish and Wildlife Service files on biological vulnerability to support proposals to list as endangered or threatened.

SC = Species of Concern

The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife Service, but neither term has official status (currently all former C2 species).

PDL = Proposal for delisting

Species for which a final rule has been published in the Federal Register to delist the species.

XN = Non-essential Experimental Population

Species for which a population has been artificially established in the wild which is not essential to the survival of the species in the wild.

T(S/A) = Listed as Threatened Due to Similarity of Appearance



Appendix A

STATE STATUS DESIGNATIONS FOR ANIMALS

E = Endangered

Any species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

T = Threatened

Any species or subspecies that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico.

STATE STATUS DESIGNATIONS FOR PLANTS

E = Endangered - The taxon is listed as threatened or endangered under the provisions of the Federal Endangered Species Act (16 U.S.C. Sections 1531 et seq.), or is considered proposed under the tenets of the act [10-29-85,]; or the taxon is a rare plant across its range within the state, and of such limited distribution and population size that unregulated taking could adversely impact it and jeopardize its survival in New Mexico. [10-29-85, 8-31-95]

SoC = Species of Concern - A New Mexico plant species, which should be protected from land use impacts when possible because it is a unique and limited component of the regional flora.



Appendix A

BASIC GLOBAL RANKS

GX = Presumed Extinct

Believed to be extinct throughout its range. Not located despite intensive searches and virtually no likelihood that it will be rediscovered.

GH = Possibly Extinct

Known only from historical occurrences. Still some hope of rediscovery.

G1 = Critically Imperiled

Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).

G2 = Imperiled

Imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).

G3 = Vulnerable

Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations) , or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals

G4 = Apparently Secure

Uncommon but not rare, and usually widespread. Possibly cause for longterm concern. Typically more than 100 occurrences globally or more than 10,000 individuals.

G5 = Secure

Common, typically widespread and abundant.



Appendix A

BASIC STATE RANKS

SX = Presumed Extirpated

Believed to be extirpated. Not located despite intensive searches and virtually no likelihood that it will be rediscovered.

SH = Possibly Extirpated

Known only from historical occurrences. Still some hope of rediscovery.

S1 = Critically Imperiled

Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 5 or fewer occurrences or very few remaining individuals (<1,000).

S2 = Imperiled

Imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000).

S3 = Vulnerable

Vulnerable in the state either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations) , or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals

S4 = Apparently Secure

Uncommon but not rare, and usually widespread. Possibly cause for longterm concern. Typically more than 100 occurrences in the state or more than 10,000 individuals.

S5 = Secure

Common, typically widespread and abundant.

VARIANT STATE RANKS

S#S# = Range Rank

A numeric range rank (e.g., S2S3) is used to indicate uncertainty about the exact status of a taxon.

SA = Accidental

Accidental or casual in NM. In other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location.



Appendix A

SE = Exotic

An exotic established in state; may be native elsewhere in North America; includes fish native to NM but introduced into watersheds where the species is non-native. An exotic established in NM may be assigned a numeric rank (e.g. SE2) to indicate its status, as defined for S1 through S5.

SU = Unrankable

Currently unrankable due to lack of available information about status or trends.

HYB = Hybrid

SRF = False Report

Element reported in NM but the report is known to be invalid.

SNR = Not Ranked

State conservation status not yet assessed.

S? = Unranked

Rank not yet assessed.

RANK QUALIFIERS

? = Inexact numeric rank

Denotes inexact numeric rank.

Q = Questionable taxonomy

Taxonomic status is questionable; numeric rank may change with taxonomy.

C = Captive or cultivated only

Taxon at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.

B = Breeding

The associated rank refers to breeding occurrences of mobile animals.

N = Non-breeding

The associated rank refers to non-breeding occurrences of mobile animals.

Z = Moving

Occurs in the state, but as a diffuse, usually moving population; difficult or impossible to map static occurrences.

