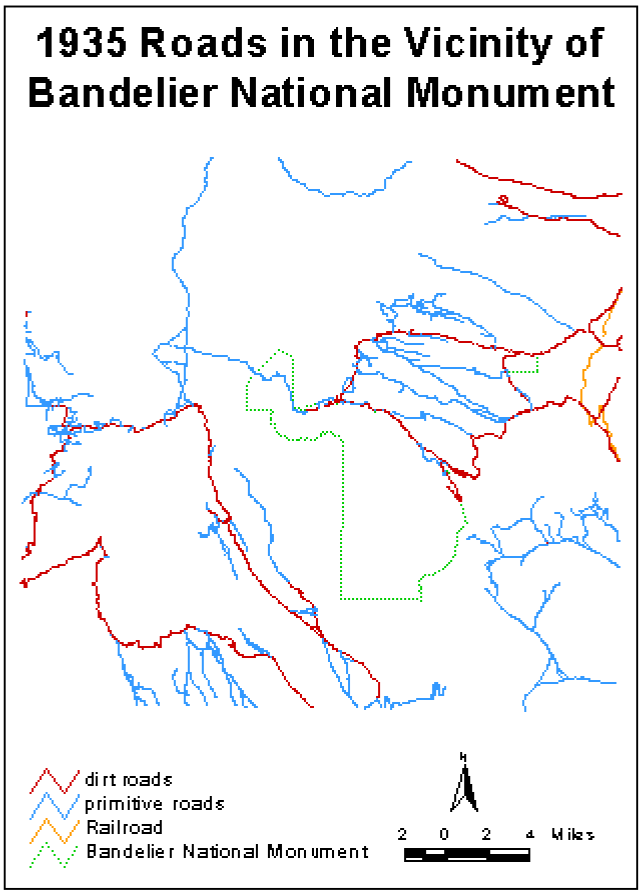
APPENDIX 12. 5 - LAND USE

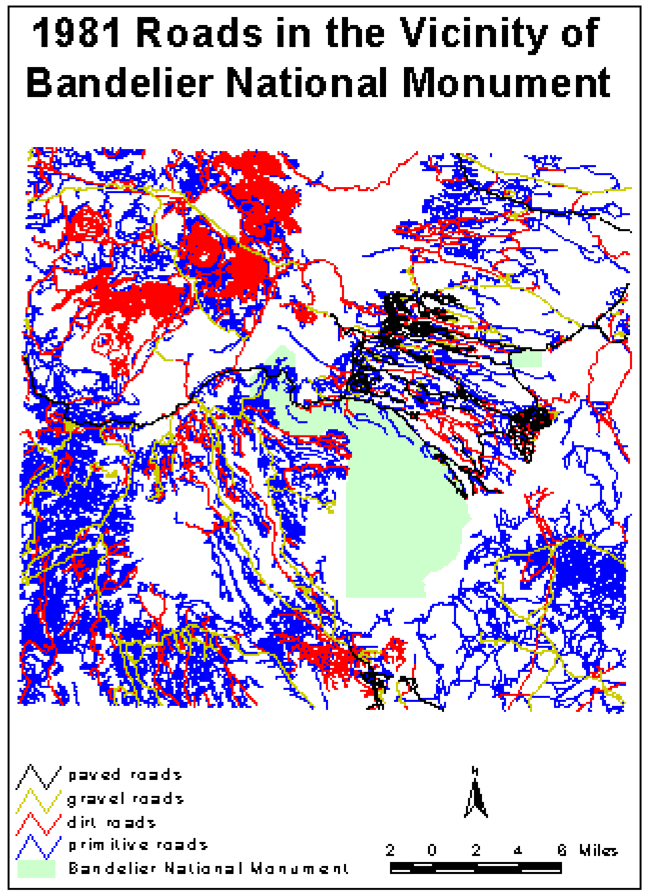
Land Use History of North America - (LUHNA): Repeat Photography By: **Craig D. Allen,** *U.S. Geological Survey, Midcontinent Ecological Science Center;* **Julio L. Betancourt,** *U.S. Geological Survey, Desert Laborator;y* **Thomas W. Swetnam,** *University of Arizona, Laboratory of Tree-Ring Research*

Changes in road networks through time reflect land use history, as illustrated in this Jemez Mountains example. Total road density in 1935 (Fig. 23) was greatest on the homesteaded lands just north of Bandelier National Monument, where dirt and primitive roads provided access to agricultural fields, dwellings, and timber and fuelwood resources. West of Bandelier roads provided access to ranches, mines, and some timber operations. Large portions of the Jemez area remained roadless.

http://geochange.er.usgs.gov/sw/impacts/biology/photo_pairs/#fig22

Figures 23 & 24





(Left image) Map of all roads visible in 1935 aerial photographs across 187,858 hectares around Bandelier National Monument, in the Jemez Mountains, New Mexico. The current Monument boundaries are shown.

By 1981 (Fig. 24) the length of mapped roads increased nearly 12-fold, from 719 km in 1935 to 8433 km 1981.

The great increase in road networks observed since 1935 in the Jemez Mountains suggests the possibility of significant, landscape-wide, ecological impacts (Allen 1989). Roads can have many ecological effects, ranging from habitat fragmentation (Reed et al. 1996), reduced landscape productivity through the direct conversion of roadways into compacted and little vegetated surfaces (McGurk and Fong 1995), provision of routes for the spread of non-native weeds (Tyser and Worley 1992), accelerated erosion rates, and increased stream sediment loads (Eaglin and Hubert 1993). Roads act as fire breaks and facilitate extensive access to formerly remote areas for fire suppression. Roads also allow increased human access for recreational and consumptive purposes, resulting in widespread habitat modifications (e.g., cutting of snags for fuelwood) and disturbances to wildlife (e.g., through vehicle traffic and hunting) that alter biotic communities (Reijnen et al. 1995, McLellan and Shackleton 1988). Overall, road networks often provide distinctive landscape signatures of the histories and ecological effects of human land uses.

http://geochange.er.usgs.gov/sw/impacts/biology/photo_pairs/#fig22

Land Use History of North America - (LUHNA):
Repeat Photography

By:
Craig D. Allen
U.S. Geological Survey, Midcontinent Ecological Science Center
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University of Arizona, Laboratory of Tree-Ring Research

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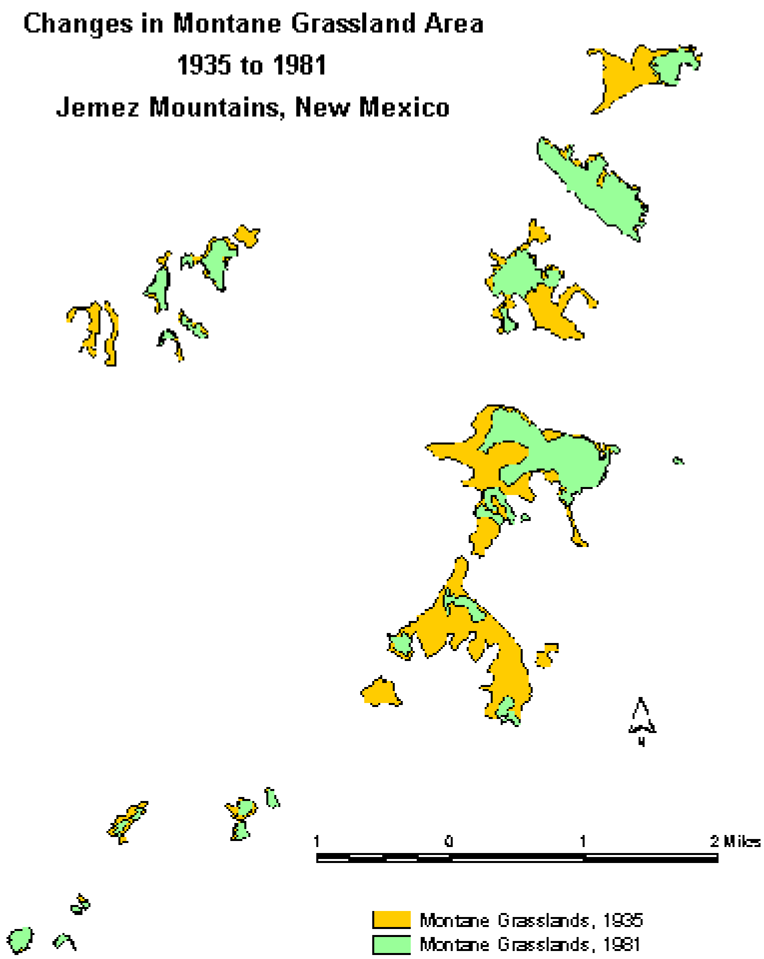
Figure 22 - Map of changes in montane grassland area between 1935 and 1981 in the southeastern Jemez Mountains, New Mexico. Area of open grassland (with less than 10% tree canopy cover) determined from aerial photographs.

Land Use History of North America - (LUHNA): Repeat Photography By: **Craig D. Allen,** *U.S. Geological Survey, Midcontinent Ecological Science Center;* **Julio L. Betancourt,** *U.S. Geological Survey, Desert Laborator;y* **Thomas W. Swetnam,** *University of Arizona, Laboratory of Tree-Ring Research*

Area of open grassland (with less than 10% tree canopy cover) determined from aerial photographs.
Figure 22 –
Aerial photographs confirm these observations and reveal the extensiveness of the tree invasion (Fig. 22), which reduced the area of open montane grasslands by 55% between 1935 and 1941 in the mapped area. The tree invasion is tied to changes in land use history, primarily livestock grazing and fire suppression (Allen 1989).

Changes in road networks through time reflect land use history, as illustrated in this Jemez Mountains example. Total road density in 1935 (Fig. 23) was greatest on the homesteaded lands just north of Bandelier National Monument, where dirt and primitive roads provided access to agricultural fields, dwellings, and timber and fuelwood resources. West of Bandelier roads provided access to ranches, mines, and some timber operations. Large portions of the Jemez area remained roadless.


Changes in Montane Grassland Area
1935 to 1981
Jemez Mountains, New Mexico
1
0
1
2 Miles
Montane Grasslands, 1935
Montane Grasslands, 1981

3. Middle Rio Grande Project

http://rmmcweb.cr.usgs.gov/public/mrgb/ofr97-116.html

U.S. Geological Survey Middle Rio Grande Basin Study--Proceedings of the First Annual Workshop, Denver, Colorado, November 12-14, 1996
By James R. Bartolino, editor

U.S. GEOLOGICAL SURVEY
Open-File Report 97-116
Albuquerque, New Mexico
1997

THE MIDDLE RIO GRANDE BASIN PROJECT OF THE U.S. GEOLOGICAL SURVEY AND THE NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES

By David A. Sawyer[(2)] , Ren A. Thompson[(3)], and Charles E. Chapin[(4)]

The Middle Rio Grande Project is a 5-year effort to develop state-of-the art digital geologic map datasets to address critical societal problems in the middle Rio Grande region of New Mexico. Centered on the Albuquerque Basin of the Rio Grande Rift, the map area also includes the Sandia and Manzano Uplifts bordering the basin; the southern Española Basin, Jemez Mountains, Valles Caldera, and Nacimiento Mountains to the north; and the east flank of the San Juan Basin to the west. Rapid urban growth in the Albuquerque and Santa Fe metropolitan areas has created a need for earth-science information to better manage land and water resources to meet the requirements of a burgeoning population. The presence of numerous Pueblo Indian reservations adjoining the areas of rapid growth necessitates that the effects of growth be minimized on traditional users of land and water. For these reasons, the USGS Geologic Division (GD) and the New Mexico Bureau of Mines and Mineral Resources (NMBMMR) have embarked upon this project funded largely by the USGS National Cooperative Geologic Mapping Program, including its STATEMAP component.

The principal resource in limited supply is ground water, the source for virtually all drinking water for urban areas in the region. A USGS interdivisional effort (GD, Water Resources Division, and National Mapping Division), in cooperation with the NMBMMR, is addressing changing land use, the hydrogeologic framework of the Albuquerque Basin, and constraints on ground-water availability. Evaluation of current land use/land cover from aerial photography, Digital Line Graph revision, interpretation of satellite imagery, and comparison with historical data in a GIS system will provide the basis for trend analysis of land-use change. Delineation by geology and geophysics of subsurface extents of axial-channel gravel and sand in the upper and middle Santa Fe Group will be the basis for an improved hydrogeologic framework. Investigations of surface-water/ground-water interactions in the Holocene to Recent Rio Grande fluvial system, recharge into the basin from marginal mountain areas and by basin underflow, and ground-water quality, especially factors relating to arsenic distribution, will lead to a better understanding of ground-water availability.

2 U.S. Geological Survey, Denver, Colorado back

3 U.S. Geological Survey, Denver, Colorado back

4New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico back

From the Rio to the Sierra: **An Environmental History of the Middle Rio Grande Basin**

Dan Scurlock

United States Department of Agriculture
Forest Service
Rocky Mountain Research Station
Fort Collins, Colorado 80526
General Technical Report
RMRS-GTR-5
1998.

IMPACTS AND CHANGES IN THE RIO PUERCO, 1846–1980: A CASE STUDY

The best documented environmental impacts and changes of a Middle Basin tributary from the mid 1800s to present are for the Rio Puerco. A history of intensive grazing and erodible soils, combined with periodic droughts and intensive rains, has led to the use of the term “abused basin” to describe the Puerco. In the recent past (1920s to 1960s), a number of environmental studies have been conducted. Today several federal agencies, including the U.S. Forest Service and Bureau of Land Management, are continuing to study runoff, erosion, vegetation change, and other aspects. Because of the these factors, the Puerco has been selected as a case study in this report.

In the mid 1800s the upper Rio Puerco valley, from Guadalupe to its headwaters above Cuba, was a “grassy wilderness” with “swampy vegas,” “clear water,” and “willow-lined banks” (Maes and Fisher 1937: 10). The river channel at this time was discontinuous. During the dry seasons (late September to early December), the river was dry at its mouth, as it is now. The entire channel was dry during extended droughts. In mid October 1846, west of Atrisco, Lt. Abert (1962: 74–78) described the valley as “wide, flat, overgrown with varieties of artemisias and coarse grass” and the river banks as “10 or 12 feet high” and “a few cottonwood trees” in the river bed, which was dry. To the north, near the abandoned town of Poblazon, the banks were 30 feet high (Table 57).

In 1849, Lt. J.H. Simpson (McNitt 1964: 29) estimated the river bank to be 20 to 30 feet high and the width of the river at about 100 feet. Four years later, the Puerco near present Interstate 40 was described as 100 feet wide and its streambed 18 feet deep with scattered pools of water (Foreman 1941: 119). The channel was about 18 feet deep (Rittenhouse 1965: 27–28). About this time, the channel was about 8 feet deep at La Ventana (Dortignac 1962: 588).

By 1862, with cessation of Navajo raids in the area, Hispanics and Anglos began to intensively graze the upper Puerco (Maes and Fisher 1937: 10–15). In the 1870s the Rio Puerco channel in the Cabezon area was still relatively shallow, with a wagon road crossing marked by large logs laid in the streambed. There were “large groves of cottonwood trees, high grass, and weeds.” The channel at La Ventana was about 8 feet deep (Dortignac 1963: 507). By 1877 there were “high banks marked by recent cave-ins and falling trees” (Bryan 1928a: 268, 273). Native grasses were being cut and sold as hay (deBuys 1985: 217; Rittenhouse 1965: 64). A major flood, which undoubtedly eroded banks and downcut the river channel more, occurred in the area in 1880 (USGS 1994).

During the 1880s the number of sheep in the area increased to over 100,000, and there were about 9,000 cattle (Scurlock 1990a: 18). By the turn of the century sheep numbers had increased to several hundred thousand. Harvests of corn and other irrigated crops were good during this period, probably due to better, moister conditions from above-normal precipitation (Maes and Fisher 1937: 11–12, 14). About 10,000 acres were under irrigation in the upper Rio Puerco valley at this time (deBuys 1985: 217).

Intensive grazing continued into the early decades of the next century; in 1937 there were relatively large numbers of livestock on 75,284 acres of public lands in the Upper Basin. Droughts and intensive floods, probably caused in part by exposed rangeland soils, contributed to severe erosion during this period (Calkins 1937b: 6; Maes and Fisher 1937: 15– 19, 34). Continued entrenchment of the Puerco became a problem for irrigation farmers in the Cabezon area (Bryan 1928a: 274). Irrigated lands in the same area dropped to 3,000 acres, a decrease of 70 percent in less than 3 decades (Harper et al. 1943: 52). Some farmers may have shifted their operations to the Puerco valley above Cuba, where there were 5,500 acres under irrigation in 1939 (Dortignac 1960: 48).

A surveyor referred to a "new channel" for the river at Cabezon in 1899; it was 198 feet wide. Seven years later the channel at the same location had widened to 244 feet, with a depth of 20 feet. At nearby San Luis the depth of the Puerco channel was the same (Bryan 1928a: 271–273; Tuan 1966: 589). To the north, at La Ventana, the river channel was 15 feet deep in 1913 (Dortignac 1962: 58; Fig. 73a and b). By 1925 environmental problems in the Rio Puerco basin were becoming increasingly serious. Continued excessive grazing, coupled with periods of drought followed by intensive rains, was causing severe erosion, including rapid downcutting of the river channel. Channel depth at La Ventana was about 40 feet, at San Luis about 22 feet, and south of the Santa Fe rail line about 40 feet (Bryan 1928a: 275, 277; Tuan 1966: 589). Diversion dams were destroyed, and the water table generally lowered. Irrigated land in the basin declined to 3,000 acres.

Table 57—Rio Puerco–of–the–East: historical conditions and channel changes, 1846–1964.

Date	**Channel depth**	**Channel width**	**Date**	**Channel depth**	**Channel width**
1846	10–12 feet (lower reach)		1906	20 feet (near San Luis-Cabezon)	244.4 feet (Cabezon)
1846	30 feet (at Poblazon)				405.9 feet (near Guadalupe)
1849	20–30 feet (near San Luis)	100 feet			
1850s (early)	8 feet (at La Ventana)				
1853	18 feet (at Interstate 40 W)				
1855	20 feet (lower reach)		1913	15 feet (at La Ventana)	
1860s	"Shallow" (at Cabezon)		1927	40–41 feet (at La Ventana)	
1874	8 feet (at La Ventana)		1927	22 feet (at San Luis)	
1875	"Shallow" (at San Luis)		1927	40 feet (lower reach)	
1876–1880	"Shallow" (at Cabezon)		1928	40–41 feet (at Cabezon)	
1877		26.4–29.2 feet	1940	26 feet (lower reach)	
1870s	"Shallow" (at Cabezon)		1959	50 feet (at La Ventana)	
1881	"Deepening" (lower reach)		1964	55 feet (at La Ventana)	
1887	3 feet (at Guadalupe)	30 feet	1964	36 feet at (San Luis)	

1890	"Deepening" (at Cabezon)	1964	30 feet (at Poblazon)
1899	198 feet (at Cabezon)	1964	36 feet (at San Ignacio, lower)

Sources: Abert 1962; Bryan 1928; Dortignac 1962; Lopez 1980; Love and Young 1983; Maes and Fisher 1937; McNitt 1964; Rittenhouse 1965; Tuan 1966.

The high sediment load of the river continued to increase (Harper et al. 1943: 52). As a result, the Rio Grande floodway, just below the mouth of the Puerco, aggraded 4 to 5 feet from 1927 to 1936 (Happ 1937: i, 3). Alluviation on the lower reach of the river, below the Santa Fe rail line, raised the channel 14 feet (Tuan 1966: 593). The ongoing erosion in the Rio Puerco valley between La Ventana and Cuba was so severe that the railroad had to be abandoned (Cooperrider and Hendricks 1937: 11– 12). The eroding, downcutting action of the stream caused most of the residents from the Middle Valley to move upstream, where irrigation agriculture was still relatively reliable in the mid 1930s. A few years later there were more than 5,500 acres of irrigated farmland with 17 ditch systems in the drainage above Cuba (Calkins 1937b: 18–19; Dortignac 1960: 48). By the 1940s virtually all of the irrigated lands below Cuba were abandoned due to the flood damage of water control structures and the downcutting of the river (deBuys 1985: 217–218). Populations of towns such as Cabezon, Guadalupe, and Casa Salazar declined rapidly.

The San Luis Dam was destroyed by a flood in 1926 or 1927 (Widdison 1959: 276–277), and area roads and bridges were frequently washed out in the late 1920s and 1930s (Cooperrider and Hendricks 1937: 20). A new San Luis irrigation dam was constructed a mile above the old site by the Soil Conservation Service in 1936 (Widdison 1959: 277). Unlike that of Cabezon, San Luis' population did not decrease dramatically during this period. There were 44 families living in the town in 1939, but all but two were government employed or aided by government welfare programs (Widdison 1959: 281).

During the drought year of 1934 the U.S. Government purchased the "badly overgrazed and eroded" Ojo del Espiritu Santo land grant and initiated a resource management program (Varney 1987: 35). There were some 14,500 cattle-units in the upper Puerco Basin in 1936, almost four times the estimated grazing capacity (Maes and Fisher 1937: 34). In 1937 there were 56,240 acres of public domain, 19,044 acres of national forest land, and 75,431 acres of private land being grazed in the valley from Regina-Cuba to Casa Salazar (Calkins 1937b: 6). By 1940 the U.S. Forest Service and Bureau of Land Management began to fence federal land in the valley and on Mesa Prieta (Garcia 1992: 23).

A resurvey of the Puerco channel in 1939 determined that the sediment volume between Cuba and the mouth of the river was 267,000 acre-feet, an increase of 250,000

Figure 73a—View north of the town of Cabezon (center) and entrenched Rio Puerco (lower center,) 1917. Note four cottonwoods.
Photo by W.T. Lee, courtesty US Geological Survey Photo Archives, Denver.

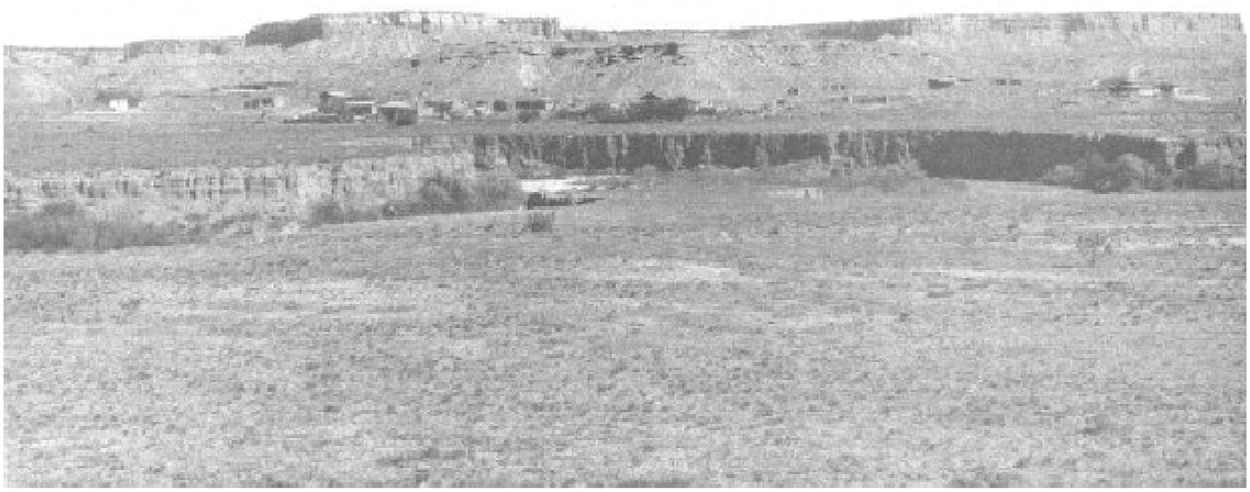


Figure 73b—Repeat photograph of Figure 73a, 1995. Note deeper and wider river channel and salt cedar. Photo by author.

acre-feet since 1884. The mean annual suspended sediment load in the Puerco basin was 41 percent (Dortignac 1956: 49). In an attempt to arrest erosion in the watershed, the Grazing Service began reducing the number of livestock in the Puerco valley between 1941 and 1943. Each family in the area could have no more than 15 head. This number, however, was below the minimum needed for subsistence (Forrest 1989: 157–159), resulting in the abandonment of more ranches and farms. Most of Cabezon's population had moved away from the village by 1941. A few stayed on, raising livestock and operating a trading post, but they were all gone by 1950 (Varney 1987: 35).

By the mid 1950s the sediment load of the Rio Puerco began to decrease, primarily due to improved land management and climatic patterns (Crawford et al. 1993: 54). The river continued to downcut. Its channel at La Ventana was about 50 feet deep in 1956 (Dortignac 1960: 47), and 3 years later it was about 55 feet (Dortignac 1962: 588). Downstream, channel depths were 36 feet at San Luis, 43 feet at Poblazon, and 36 feet at San Ignacio (Tuan 1966: 589). Although sediment concentrations have decreased steadily since the mid 1950s, in recent years the Rio Puerco has contributed about one-half the sediment load (2.6 million tons per year) carried from its mouth to Elephant Butte Reservoir by the Rio Grande (Crawford et al. 1993: 54).[1]

IMPACTS AND CHANGES IN UPLAND GRASSLANDS, WOODLANDS, AND FORESTS

Prior to the arrival of Europeans in the Southwest, grasslands supported few woody shrubs or forbs, and woodlands and forests were probably less dense (more open or savannalike) than stands of recent times. Also, grasslands, pinyon-juniper and ponderosa woodlands, and montane meadows in New Mexico probably had a higher carrying capacity for livestock grazing in the mid 1820s and 1830s than in this century. The main concentration of sheep was along the Rio Puerco-of-the-East and in the valleys and uplands along both sides west of the Middle Rio Grande Valley from the Santa Fe-Galisteo area to the Belen area.

The sheep numbers in these areas, as well as in the Jemez Mountains-Pajarito Plateau and Sangre de Cristo Mountains, were high until the early 1900s. This intensive grazing, reoccurring droughts, and periodic, high-intensity rainfall appear to have been significant interrelated ecological factors in triggering the beginning of a severe erosional period beginning in the late 1870s-early 1880s (Denevan 1967: 699–702). Changes in composition of species and density have resulted from the previously discussed human uses (burning, grazing, cutting, etc.), wild fires, and fire suppression, as well as climate. Each of these phenomena obviously brought changes to the area over the short term, but these factors have interacted over a longer period to cause changes observed in recent decades (West 1984: 1301, 1311–1313).

A recent study of vegetative change (Bahre 1991: 180– 187) in southeastern Arizona demonstrated that historical alteration has resulted from removal of native plant cover by various Euro-American settlement activities, introduction of exotic plants, and suppression of fires. These factors have resulted in five directional changes: (1) an overall decline in native grasses, (2) an expansion of exotic grasses and other plants, (3) an increase in woody plants, notably in the grasslands and lower elevations of the woodlands, (4) an increase in protected stands of oak, juniper, and ponderosa pine, and (5) a general degradation of vegetative cover. The spread of various *Juniperus* species into grasslands in northern Arizona has also been well documented (Johnsen 1962; Lowe 1964: 58).

Gross and Dick-Peddie (1979) reconstructed the "primeval" vegetation in New Mexico below the ponderosa pine zone using territorial survey records (see Fig. 52). The most significant historic changes in vegetation have occurred in the grassland-woodland and savannadesert shrubland types. In many areas, woodland savannah has apparently replaced the upper elevation grasslands. Grover and Musich (n.d.: 10) presented evidence of shrubland encroachment in desert grasslands in the southern part of the region, leading to local and regional climatic changes due to increased surface temperatures. These plant community changes might have significant impacts on albedo and sensible heat flux.

[1] Note: Indications are that the lower Puerco is now aggrading. (communiqué with Mike Chavez, RPMC, May 10, 2003)

Additionally, physiological and phenological differences between grasses and shrubs can influence rates of evapotranspiration.

Grass growth and decomposition and mineralization processes needed for nutrient cycling are inhibited by chemical compounds in the needle litter of pinyon and juniper. This has led to an increase in density of these two species (Grover and Musick n.d.: 10).

One investigator (Dittmer 1951: 351) concluded that pinyon-juniper woodlands in the Southwest, with their understory of *grama* species and other nutritious bunch grasses, were overgrazed in the late 19th and early 20th centuries, decimating these grasses. Another valuable understory plant, *Krascheninnikovia lanata* (Soil Conservation Service 1994), which also occurs in the upper grassland grassland elevations, has been severely depleted over the last 150 years.

Gross (1973) found that large portions of northwestern and north-central New Mexico experienced near complete replacement of the late 19th century vegetation communities. The historic pinyon-juniper-sagebrush (*Artemisia tridentata*) association has been replaced by sagebrushgrassland. The lower grassland community has also become a secondary successional stage of sagebrushgrassland association. The replacement of the pinyonjuniper communities by sagebrush was probably due to fire, as pinyon-juniper does not survive conflagration well. Other large stands of pinyon-juniper were cleared by homesteaders for use in dryland farming, grazing, fence posts, and fuelwood (Gross 1973: 10, 43 44).

Southwest of Cuba most of the historic pinyon-juniper communities have disappeared; only a few isolated, relict stands have survived. These, too, have changed to sagebrush-grassland. On the 9,389-acre Chijuilla community grazing allotment located in T21N, R23, early sheep grazing and later homesteaders impacted the pinyon-juniper community as indicated above. In 1963, 321 acres of pinyon-juniper were chained, and 673 acres of “brush” were cut in sections 19, 20, and 30 in an effort to increase the production of grazing forbs and grasses. About a quarter of a century later, 20 study plots of pinyon-juniper were identified by the Bureau of Land Management. Ten plots were thinned on the allotment, while the other ten were not thinned. Grasses and forbs on the plots were clipped and weighed in September 1990 to determine production. The thinned plots produced 2,174 pounds green weight per acre, but the untreated plots yielded only 520 pounds per acre (Bodine 1990; Gross 1973: 16; Levine et al. 1980: 4, 44–47, 50, 131, 136).

Watson (1912: 205–207) noted that *Juniperus monosperma* in the Estancia Valley of central New Mexico was invading into the lower grassland from the “Cedar Formation.” *Gutierrezia sarothrae*, *Yucca glauca*, and *Opuntia imbricata* were “abundant.” In the pinyon-juniper zone, common plant associates in the area included *Yucca baccata*, *Cercocarpus montanus*, *Philadelphus microphyllus*, *Tragia nepetifolia*, and *Lesquerella* spp.

Covington and Moore (1994: 39) wrote about impacts and change in ponderosa pine forests: Heavy grazing, logging, and fire exclusion, in conjunction with climatic oscillations and elevated atmospheric CO2, have led to many more younger and smaller trees; fewer older and larger trees; accumulation of heavy forest floor fuel loads; reduced herbaceous production; and associated shifts in ecosystem structure, fire hazard, and wildlife habitat.

Prior to Euro American settlement these forests were much more open and parklike, with scattered stands varying in age, and crown cover usually not exceeding 25 percent. Crown fires were rare (Covington and Moore 1994: 39–41). In the upper Pecos River drainage *Pinus ponderosa*, *P. edulis*, and *Juniperus monosperma* were harvested intensively for use as lumber, posts, and fuelwood in the 19th century. There were 500 sheep grazing in the area of Rowe at this time. In the early 1900s all of the trees north and east of Rowe were clear-cut to create pasture for cattle. Some relatively recent chaining of pinyon-juniper was carried out between the present Interstate 25 and the town (Meszaros 1989: 13–14, 52–55).

4. La Jara Geographical Priority Area (GPA) Proposal FY2003.

Date: May 22, 2002

B. Provide a Narrative Description of the GPA Boundaries.

The La Jara GPA is bounded on the west by the Jicarilla Apache Reservation, and Highway 550; on the east by the ridgeline of the Nacimiento Mountains; on the south by the ridgeline separation with the Los Pinos watershed; and on the north by the ridgeline separation with the Naranjo Creek watershed (Attachment "2").

C. Provide a brief narrative of the GPA setting

The La Jara GPA is within the Rio Puerco and Rio Grande Basins. It would consist of both private and federally owned lands (portions of the Santa Fe National Forest & BLM parcels).

Type of terrain (mountainous, river valley, high plains, low desert, etc.):

La Jara Creek is a perennial stream arising along the west slope of the Sierra Nacimiento. The Creek flows through a steep, narrow canyon in a generally southwesterly direction, then through the foothills into a gradually widening valley with reduced gradient. It empties into the Arroyo San Jose, a tributary of the Rio Puerco that is just east of and parallel to the boundary of the Jicarilla Apache Reservation, approximately one mile west of the village. Several ridges form narrow canyons and open valleys adjacent to the main La Jara valley. The Sierra Nacimiento is composed chiefly of coarse-grained granites and basalt dykes. On the lower slopes highly erodible limestone, sandstone, and shale overlie the granite core.

General vegetative types:

The mountainous area supports spruce, pine, balsam, quaking aspen, kindred trees, and various grasses and herbaceous plants. Ridges and mesas, which surround the valleys, support some agriculture, and pinon, juniper, pine, and oak woodlands. The valleys support willow, cottonwood, alfalfa, grasses and cash crops. Sagebrush predominates in many areas especially on formerly irrigated but presently fallow lands.

Land use (rangeland, cropland, forestland, etc.):

Agriculture, gazing, wildlife habitat, hunting, fuel wood gathering, and recreation are the predominant land uses. Generally: irrigated areas are found in the La Jara valley and several narrow valleys that parallel it; the surrounding wooded ridges and mesas support grazing; the timbered mountainous region supports hunting, fuel wood gathering and recreation. Wildlife habitat is found throughout the area. Ungulates and other herbivores, coexist with carnivores such as bear, lion and coyote. Trout inhabit the upper parts of the watershed. Birds of prey coexist with waterfowl in an ecosystem benefited by the agrarian practices. Aquatic ecosystems, including La Jara Creek, ephemeral streams, constructed wetlands and natural springs, also support complex plant and animal communities.

Ranges in elevation:

The La Jara watershed and adjacent areas lie between elevations of 7,108 on the west and 10,500 feet on the east.

Precipitation, temperature, etc:

La Jara can experience heavy snowfalls and extremely low temperatures during the winters, frequent showers and moderately warm temperatures during the summer, while spring and autumn are fairly cool and can receive considerable precipitation. The mean annual precipitation is near 15.8 inches and the growing season averages about 110 days.

III. SIZE AND SCOPE

A. Acres in the GPA

Total area of proposal:	16,000
Total area of Federal portion:	6560
Total area of state portion:	0
Total area of tribal portion:	0
Total area of private portion:	9,440

B. Acres Requiring Treatment by Land User and Land Owner

LAND USE	FEDERAL	STATE	TRIBAL	PRIVATE
1. Cultivated Cropland	0	0	0	1610
2. Non-cultivated Cropland	0	0	0	2850
3. Forest Land (Timber)	0	0	0	0
4. Forest Land (grazed)	5240	0	0	1380
5. Pasture Land	0	0	0	500
6. Range Land	1280	0	0	3000
7. Riparian Area	40	0	0	100
8. Urban Land	0	0	0	0
9. Other	0	0	0	0

IV. ENVIRONMENTAL BENEFITS
Natural Resource Concerns, Solutions, Objectives

A. SOIL RESOURCE CONCERNS:

Soil Resource Concern No. I- Rangeland Soil Erosion:

Surface water runoff on grazed lands causes sheet and rill erosion resulting in formation or progression of head cuts, gullies, and arroyos. Overgrazing, and the development and increasing use of unpaved roads are contributing factors to this problem. Increasing incision of arroyos lowers the water table resulting in disappearance of springs and seeps. Erosion of rangeland causes loss of soil, reduces soil nutrients, prevents establishment of grasses, and results in general deterioration of the land, its uses, value and other benefits.

Proposed Solutions:
* Educate landowners and ranchers about erosion factors, methods to reduce or prevent it, and improved methods of livestock handling.
* Construct grade stabilization structures such as: net wire diversions, rock and brush dams, and other similar applications.

* Improve grazing management through methods such as: fencing, pasturing, rotational grazing and other methods.

Planned Objectives:
* Reduce formation of, and stabilize head cuts, gullies and arroyos.
* Increase benefit to landowners and producers.

Soil Resource Concern No. 2- Cropland Soil Erosion:

Croplands within the community receive water through an extensive and intricate system of large unlined dirt ditches while smaller, unlined lateral ditches distribute water to family fields where flood irrigation methods are practiced. Increased cutting of the ditches has caused channelization in some places and made application of water to fields difficult or impossible. Blown out culverts and broken flumes add to soil erosion when water bypasses them to reach the grade beyond. Topography of hundreds of acres of potentially productive and productive land prevents efficient application of water, and enhances sheet and rill erosion. Erosion within irrigated cropland causes loss of topsoil and seed, reduces soil nutrients and irrigation efficiency, and results in general deterioration of the land, its uses, value and other benefits.

Proposed Solutions:
* Laser-level croplands.
* Educate landowners and farmers about erosion factors, methods to reduce or prevent it, and improved methods of agriculture.
* Re-contour segments of the ditch that have become channelized where it traverses private land.
* Repair deeply eroded cuts with heavy equipment, and smaller cuts with grade stabilization structures, weirs, and other similar methods.
* Line the ditch system, or segments most prone to erosion, with concrete or PVC pipe, repair and improve culverts and flumes, and repair or construct structures for water control.
* Apply soil conservation techniques such as installation of field borders, and conservation or no-till methods.

Planned Objectives:
* Reduce erosion.
* Increase benefit to landowners and producers.

Soil Resource Concern No. 3-Riparian Soil Erosion:

During periods of heavy precipitation un-vegetated banks along La Jara Creek and ephemeral waterways are subject to high-energy flooding which causes soil erosion, and channelization.

Proposed Solutions:
* Educate landowners and ranchers about erosion factors, methods to reduce or prevent it, improved methods of livestock handling, and importance of riparian areas.
* Plant willow and cottonwood trees at unstable banks and along non-vegetated segments.
* Construct fencing to protect riparian areas and plantings from livestock.
* Construct grade stabilization structures such as: net wire diversions, rock and brush darns, and other similar applications.
* Stabilize channel banks by installing J-Hooks and other similar structures.

Planned Objectives:
* Reduce erosion to retain and improve riparian lands of private landowners.
* Improve riparian habitat of La Jara Creek and other waterways.

IV. ENVIRONMENTAL BENEFIT

B. WATER RESOURCE CONCERNS

Water Resource Concern No. I- Watershed Yield:

The upper reach of La Jara Creek flows through forests that have become overgrown with small diameter trees and brush. Conditions have developed which promote occurrence of catastrophic wildland fires, and reduce the amount of surface water runoff to the Creek. La Jara Creek is both the direct and indirect source of all the community's water. Unlined irrigation ditches promote growth of weedy species which further reduces the water supply. The water supply has always been erratic; during normal years it is strained and in drought years becomes inadequate. Further, unlined ditches, flood irrigation methods, unleveled fields, and inefficient distribution results in waste of irrigation water. The community's water supply and irrigation delivery system affects both agricultural and non-agricultural water users. Overall, the watershed needs to be protected, and the community's water supply and irrigation delivery system needs to be improved. Additionally, the 1932 La Jara Hydrographic Survey notes proposed locations for several irrigation reservoirs.

Proposed Solutions:

* Line the ditch system and laterals with concrete or PVC pipe.
* Construct a water storage reservoir (preferable) or other storage facility.
* Work with relevant agencies where necessary to implement projects to reduce the number of stems per acre on the National Forest.
* Work with relevant agencies where necessary to implement projects to reduce the number of stems per acre on private lands.
* Work with relevant agencies where necessary to implement controlled burn projects on the National Forest and along the irrigation ditch on private lands.

Planned Objectives:

* Protect and increase both domestic and irrigation water supplies.
* Provide a consistent and sustainable source of water.

Water Resource Concern No. 2- Drinking Water Quality:

As noted above, La Jara receives its drinking water from surface runoff to La Jara Creek. Catastrophic fire in the watershed would greatly affect water quality. Presently, during spring snowmelt and summer monsoons the quality of domestic water is diminished due to suspended sediment, and boiling is generally required. Water storage would help to reduce the amount of sediment entering the drinking water system.

Proposed Solutions:

* Construct a water storage reservoir (preferable) or other storage facility.
* Work with relevant agencies where necessary to implement thinning of trees on the National Forest.
* Work with relevant agencies where necessary to implement controlled burn projects on the National Forest.

Planned Objectives:

Protect and improve domestic water quality.

Water Resource Concern No. 3- Rangeland Water Availability:

During periods of low precipitation there is insufficient water for livestock and wildlife. A limited water supply can concentrate livestock and wildlife into restricted geographical areas causing competition, overgrazing, and a reduction in size and productivity. Adequate distribution of water can be used to achieve a balanced utilization pattern across the landscape. Studies show a close link between detrimental impacts to the local ecology and economic losses of local producers. Additionally, the 1932 La Jara Hydrographic Survey notes the geologic structure in the area is favorable for production of water from shallow wells.

Proposed Solutions:
* Drill wells for development of alternative upland water sources.
* Install improved well pump technology on existing wells.
* Install water pipelines and drinking troughs.

Planned Objectives:
* Improved water availability and distribution to reduce grazing impacts and improve livestock productivity.
* Improve water resource conditions for local wildlife populations.

C. AIR RESOURCES CONCEN
Not a concern

IV. ENVIRONMENTAL BENEFIT
Natural Resource Concerns, Solutions, Objectives

D. PLANT RESOURCE CONCERNS

<u>Plant Resource Concern No. 1- Fallow Cropland</u>

About 45% of irrigated cropland acres are lying fallow. Causes include: an inadequate supply and distribution of irrigation water, absentee or aging landowners, and the financial obligation of getting land into production along with pessimism that costs can be recouped through crop production. Primarily, the inadequacy of the irrigation system's infrastructure reduces the small farmer's ability to farm. As the amount of cropland taken out of production increases the hardship on remaining producers also increases. With fewer irrigators remaining to finance and repair the ditch the system quickly looses efficiency. As the system's efficiency decreases it provides fewer producers with water resulting in withdrawal of more producers. Soon the agrarian lifestyle is in a downward spiral.

Proposed Solutions:
* Educate landowners and producers about relevant contemporary farming technologies and practices, and expanding crop markets.
* Develop a local agricultural cooperative to promote agriculture, an interest in native and traditional crops, contemporary crops, and new and emerging crop markets.
* Implement new farming technologies that will promote new crop production, promote native vegetation and crop diversity, and increase production.
* Work with local banks and Acequia de La Jara (Community Ditch Association) where necessary to help our agricultural producers who lack financial resources.
* Work with local schools to involve children and young adults in agriculture.
* Laser-level croplands.
* Improve and repair the ditch and lateral system.
* Construct a water storage reservoir or facility.

Planned Objective:
Develop an agricultural cooperative that will promote and sustain agriculture through education, financial support, improved farming methods, crop diversity, shared use of equipment and teaching the community's children about the importance and benefit of agriculture and good agricultural conservation methods.

It is anticipated that a cooperative should be able to get 50% of the fallow croplands back into production within 10 years, and 75% within 15 years.

It is anticipated that overall yields of a diversity of native, traditional, contemporary and economically important crops should increase by 50% in 10 years, and 75% in 15 years.

Bringing fallow lands back into production and increasing yields, however, is intricately dependent on a consistent and sustained supply of water.

Plant Resource Concern No. 2- Sagebrush, and Juniper Tree Encroachment:

E. ANIMAL RESOURCE CONCERNS

Animal Resource Concern No. 2- Competition for Forage:
Animal Resource Concern No. 3- Competition for Water:

SANDOVAL COUNTY SUBDIVISIONS BY TOWNSHIP

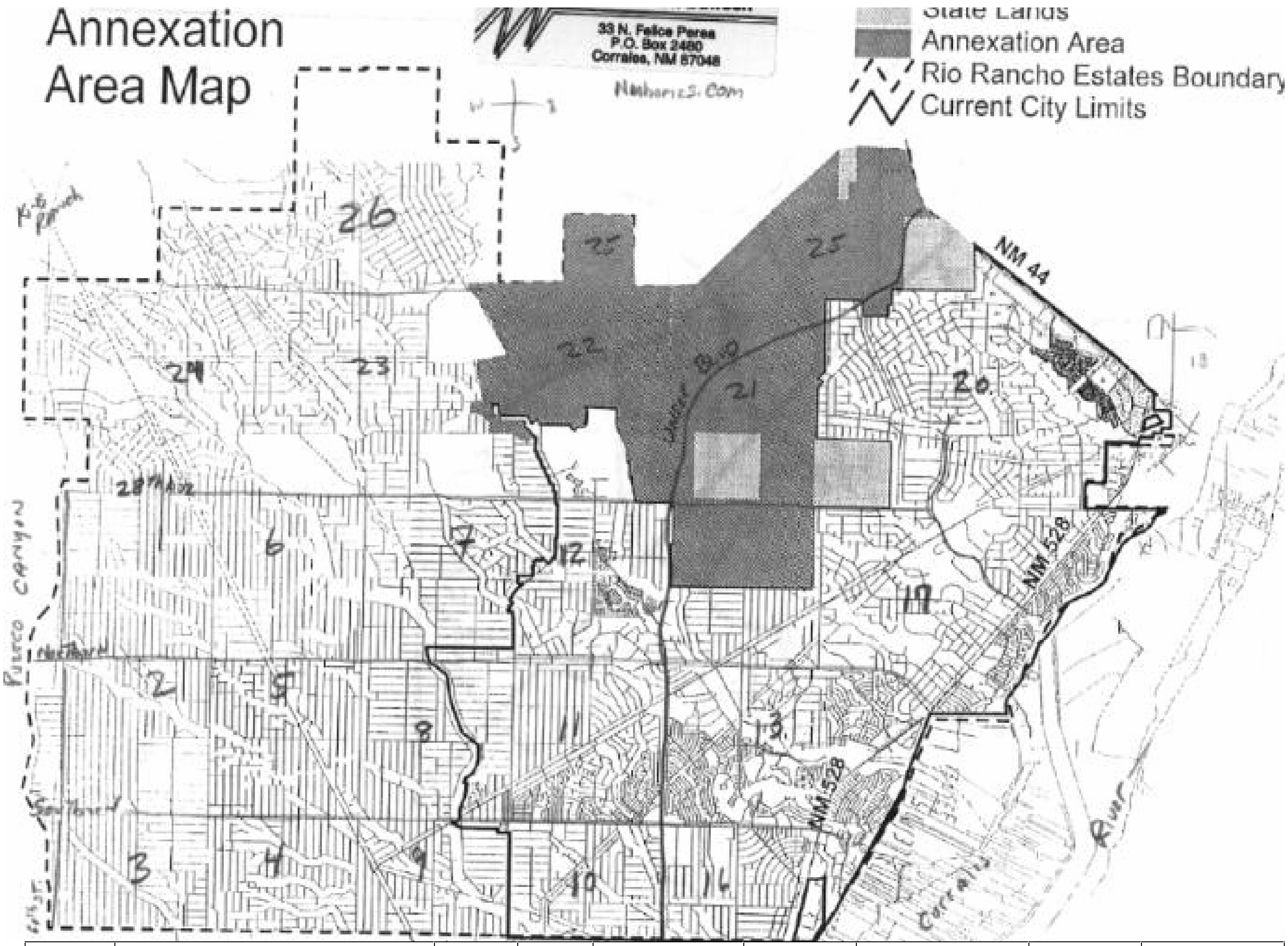
KEY

OnWeb: Details on County Webpage
Name: Subdivision Name
Twn:Township
Rng: Range
Sec: Section
Area - SD: Location - School District
In/Out: Within Incorporated Area or Not
Date: Date Subdivided

On Web	NAME	Twn	Rng	Sec	#LOTS	AREA - SD	In/Out	DATE
	La Ventana	?N			12	Cuba- 20	Out	
	La Madera Verde	?N	?			La Madera- 1	?	3/26/92
	Alamo Ranch	12N 12N	1W 1E	2-6 5-8		Jemez- 31	Out	
	Loma De Verano	12N	3E	21, 22, 27	47	Cuba- 20	In	11/30/83
X	Canon Alegre	12N	5E	35	18	La Madera- 1	Out	3/16/79
	El Rancho de Los Parientas	12N	5E	36	4	La Madera- 1	Out	12/2/92
	Kings Meadow	12N	5E	25, 36	10	La Madera- 1	Out	8/29/89
	La Madera Heights	12N	5E	36	729	La Madera- 1	Out	
	La Vista Grande	12N	5E	36	6	La Madera- 1	Out	5/1/73
	Madera Heights	12N	5E	36	130	La Madera- 1	Out	8/18/66
	Misty Meadows	12N	5E	25, 36	2	La Madera- 1	Out	5/25/95
X	Mountain View Acres	12N	5E	35	16	La Madera- 1	Out	72, 76, 79
	Paloma Park Estates	12N	5E	33	80	La Madera- 1	Out	
	Pinon Park Estate #1	12N	5E	25, 26	32	La Madera- 1	Out	6/30/55
	Pinon Park Estate #2	12N	5E	24, 25	48	La Madera- 1	Out	1/10/57
	Pinon Park Estate #3	12N	5E	24	30	La Madera- 1	Out	10/18/94
	Pinon Park Estate #4	12N 12N	5E 6E	24 19, 30	58	La Madera- 1	Out	11/24/59
	Pinon Park Estate #5	12N 12N	5E 6E	25 30	6	La Madera- 1	Out	
	Sandia Mountain Eastward	12N	5E	26	24	La Madera- 1	Out	9/24/79
X	Sky Mountain	12N	5E	26	10	La Madera- 1	Out	10/13/77
	Townsite of La Madera- 1 (Folder)	12N	5E	36		La Madera- 1	Out	8/5/68
X?	San Pedro Creek Estates	12N	6E	33	102	La Madera- 1	Out	2/22/95
?	San Pedro Creek Estates II	12N	6E	33	98	Plac	Out	10/1/96
?	San Pedro Creek Estates III	12N	6E	19, 21, 29, 30, 31	175	La Madera- 1	Out	10/1/96
	Sandoval Mountain Spring Ranch	12N	6E	21-36	1	La Madera- 1	Out	9/11/00
X	King Ranch	13N 12N	1E, 2E, 3E, 1W 1W			Jemez- 31	Out	
	San Antonio De Las Huertas	13N	5E	28, 33		La Madera- 1	Out	6/24/74
	Zia Los Posos Ranch	14N	1W	?		Jemez- 31	Out	3/19/01
	The Pueblo of Zia	14N	2W	1	1	Cuba- 20	Out	10/15/01
	Townsite of Monterrey	15N	1E	12	620	Jemez- 31	Out	11/15/78
	Manuel Miera	15N	2E	6		Jemez- 31	Out	
	Romeros Acre	15N	2E	6	6	Jemez- 31	Out	12/6/85
X	Happy Hollow	16N 17N	2E 2E	4, 3 33, 34	24	Jemez- 31	Out	5/18/78
	Martinez, Robert & Mary Frances	16N	2E	31	12	Jemez- 31	Out	10/11/77
	Mesita Blanca #1	16N	2E	2, 3	24	Jemez- 31	Out	4/9/74
	Tachias Ranch	16N	4W	12		Cuba- 20	Out	5/26/87

On Web	NAME	Twn	Rng	Sec	#LOTS	AREA - SD	In/Out	DATE
	Eagle	16N	6E	32		Jemez- 31	Out	
	Gilman Millsite	17N	23-	5, 8		Jemez- 31	Out	5/9/85
	Blind Canyon	17N	2E	22, 27	4	Jemez- 31	Out	11/29/96
	Canon Del Sol	17N	2E	33	5	Jemez- 31	Out	9/11/80
	Carmelita Garcia Family Transfer	17N	2E	29	2	Canon- 31	Out	2/5/02
	De Colores	17N	2E	27, 28, 33, 34	23	Jemez- 31	Out	11/14/75
X	Guadalupe River Estates	17N	2E	17, 20, 29		Jemez- 31	Out	5/18/82
	Jemez Canon Estates #1, #2	17N	2E	21, 22, 27	79	Jemez- 31	Out	4/16/70
	Jemez Canon Parcels A, B, C	17N	2E	21	3	Jemez- 31	Out	
	Jemez Corridor Unit 2	17N	2E	3	24	Jemez- 31	Out	8/10/73
	Jemez Corridor Unit 7	17N	2E	3		Jemez- 31	Out	8/10/73
	Jemez Corridor Unit 8	17N 18N	2E 2E	3 34	34	Jemez- 31	Out	8/10/73
	Jesus Maria Montoya, Estate of	17N	2E	29	10	Jemez- 31	Out	3/24/76
	Manuel Montoya Family Transfer	17N	2E	29	8	Jemez- 31	Out	2/27/01
	Mesita Blanca #2	17N	2E	26, 27, 34, 36	7	Jemez- 31	Out	74, 79
?	Canon de San Diego Grant	17N	2E?	?		Jemez- 31	Out	5/9/85
	Garcia, Ernest and Rita	17N	3E	31	2	Jemez- 31	Out	12/19/96
	La Petacca	17N	3E	31	25	Jemez- 31	Out	1/5/73
	Trujillo, Candido Estate of	17N	3E	31	10	Jemez- 31	Out	3/26/01
	Anna Block Estates	18N	2E	12, 13	11	Jemez- 31	Out	3/18/91
	Bells Jemez Homesites	18N	2E	23	18	Jemez- 31	Out	2/14/64
	Brown	18N	2E	23		Jemez- 31	Out	8/10/77
	Casa Angelica Foundation	18N	2E	12	3	Jemez- 31	Out	
	Cool Pines	18N	2E	1, 12	55	Jemez- 31	Out	6/28/79
	Eagle Heights	18N	2E	12		Jemez- 31	Out	1/23/92
	Ernest Saiz	18N	2E	26	5	Jemez- 31	In	1966
	Indian Mesa Tract	18N	2E	13	5	Jemez- 31	Out	5/5/95
X	Jemez Vista Estates	18N	2E	26, 27	5	Jemez- 31	Out	6/20/96
	Madera Hermosa	18N 18N	2E 3E	12 7	74	Jemez- 31	Out	8/18/66
	Madera Verde #1	18N	2E	11, 12, 13, 14	2	Jemez- 31	Out	10/5/79
X	Quinn Haven	18N 18N	2E 3E	1 6	24	Jemez- 31	Out	6/22/78
	Rosey's Ranch	18N	2E	26	2	Jemez- 31	Out	2/16/88
	Servants of the Paraclete	18N	2E	6	21	Jemez- 31	Out	7/21/66
	Soda Dam	18N	2E	13	22	Jemez- 31	Out	54, 81
X	Indian Mesa, The Anna Block Estate	18N	2E	12, 13		Jemez- 31	Out	6/25/96
	Whitland Addition	18N	2E	14		Jemez- 31	Out	8/25/78
	Revised Gallagher Tract	18N	3E	6	6	Jemez- 31	Out	1995
	Jemez Music Camp	18N	3E	6	3	Jemez- 31	Out	
	Rivera Ranch	18N	3E	26	5	Ponderosa	Out	8/12/02
	Sierra Los Pinos Unit 10	18N	3E	12	6	Jemez- 31	Out	1/9/80
X	Sierra Los Pinos Unit 4	18N	3E	11	18	Jemez- 31	Out	1/9/80
	Sierra Los Pinos Unit 5	18N	3E	11, 12	13	Jemez- 31	Out	1/9/80
	Sierra Los Pinos Unit 6	18N	3E	12	15	Jemez- 31	Out	1/9/80

On Web	NAME	Twn	Rng	Sec	#LOTS	AREA - SD	In/Out	DATE
	Sierra Los Pinos Unit 7	18N	3E	12	22	Jemez- 31	Out	1/9/80
	Sierra Los Pinos Unit 8	18N	3E	11	13	Jemez- 31	Out	1/9/80
	Sierra Los Pinos Unit 9	18N	3E	12	18	Jemez- 31	Out	1/9/80
	Sierra Los Pinos #1, #2, #3	18N	3E	11	90	Jemez- 31	Out	72-78
	Tract B	18N	3E	2	6	Jemez- 31	Out	9/4/87
	Vallecitos De Los Indios	18N	3E	11	16	Jemez- 31	Out	
	Vallecitos Pinos	18N	3E	11		Jemez- 31	Out	10/30/62
?	Canon Del Norte	18N	4E	13	9	Jemez- 31	Out	8/29/96
?	Canon Del Norte Estates	18N	4E	11	20	Jemez- 31	Out	3/27/74
	Cox Real Estate, Rodger Cox	18N	4E	8	5	Jemez- 31	Out	1/21/97
	Pine Creek Meadows East Portion	18N	5E	17, 18, 19, 20	28	Jemez- 31	Out	7/20/66
	Pine Creek Meadows North Portion	18N	5E	20	18	Jemez- 31	Out	10/14/65
	Pine Creek Meadows South Portion	18N	5E	20	12	Jemez- 31	Out	10/15/65
	Pine Creek Meadows West Portion	18N	5E	18	20	Jemez- 31	Out	7/8/70
	Rest-A-While	19N	2E	3	59	Jemez- 31	Out	4/12/71
	Cielo Vista Estates	19N	3E	19	41	Jemez- 31	Out	0/0/97
X	Cielo Vista Estates #1	19N	3E	18, 19	24	Jemez- 31	Out	12/26/78
	Cielo Vista Estates #2	19N	3E	19, 20	16	Jemez- 31	Out	12/4/80
	Cielo Vista Inc	19N	3E	20	2	Jemez- 31	Out	11/4/85
X	Elk Valley	19N	3E	9	24	Jemez- 31	Out	7/18/90
	Forest Hill	19N	3E	17	15	Jemez- 31	Out	6/19/72
	Hidden Valley Estates	19N	3E	17, 20	60	Jemez- 31	Out	7/12/71
	Hofheins Homeplace	19N	3E	33	33	Jemez- 31	Out	9/16/71
	Horseshoe Summer Home	19N	3E	52	52	Jemez- 31	Out	
	JM Shields Estates	19N	3E	8	31	Jemez- 31	Out	6/6/83
	La Cueva Hermosa	19N	3E	20	73	Jemez- 31	Out	7/16/70
	Lake Sheen Estates	19N	3E	17	5	La Cueva	Out	9/30/02
	Marcel Thomas Addition	19N	3E	17	25	Jemez- 31	Out	12/8/93
	Rancho Lucero	19N	3E	16	128	Jemez- 31	Out	4/30/70
	Sky High Enterprises, Inc	19N	3E	20	6	Jemez- 31	Out	7/6/95
	Thompson Ridge Estates	19N	3E	5	200	Jemez- 31	Out	6/11/71
X	Elk Meadows	19N	5E	31, 32	8	Jemez- 31	Out	4/21/97
	Deer Lake Estates	20N	1E	4, 5	181	Cuba- 20- 20	Out	7/14/67
	Edelweiss	20N	1E	1	49	Cuba- 20	Out	12/18/93
	Rio De Las Vacas	20N	1E	13	34	Cuba- 20	Out	2/17/82
	Will Miller	20N	1E	1		Cuba- 20	Out	10/22/64
	Merville	20N	1W	28	10	Cuba- 20	Out	8/15/84
	Manzanal Fenton Day School	20N	2E	34	17	Jemez- 31	Out	12/26/95
	Baca Location	20N	3E, 3E, 5E	23, 31, 32, 34, 35	20	Jemez- 31	Out	10/7/97
	Cuba- 20-Gallina Schools	21N	1W	29, 32		Cuba- 20	Out	6/28/96
	Eichwald-Valdez	21N	1W	29	76	Cuba- 20	Out	3/26/57
	Eugene Atencio	21N	1W	28	14	Cuba- 20	In	11/26/58
	Loma Alta Addition	21N	1W	28, 28	55	Cuba- 20	In	9/5/72
	Loma Alta Estates	21N	1W	28, 28	79	Cuba- 20	In	8/18/71
	Luis Salazar #2	21N	1W	29, 32	59	Cuba- 20	In	3/19/73
	Meeks	21N	1W	20	1	Cuba- 20	Out	9/7/88



On Web	NAME	Twn	Rng	Sec	#LOTS	AREA - SD	In/Out	DATE
	Rio Puerco Estates	21N	1W	31	44	Cuba- 20	Out	9/17/63
	Village of Cuba- 20 Housing Project	21N	1W	29		Cuba- 20	In	10/3/85
	V-S (Virginia Sandoval)	21N	1W	28	89	Cuba- 20	In	7/9/73
	Arrowhead Lakes Estate (Bear Paw)	23N	1W	33, 34	80	Regina- 20	Out	11/6/70
	Caldwell, Helen J	23N	1W	27		Regina- 20	Out	12/31/97
?	San Pedro Estates	23N	1W	28	882	Cuba- 20	Out	2/3/71

Forest Guardians

River Preserves

Puerco Preserve
Map of the Rio Puerco Preserve, from Forest Guardians GIS
Size: 1,200 acres

Description: Like most parcels of state land with perennial water, this site is severely overgrazed. The cottonwood/willow forest, which once dominated this site, has been completely eliminated as a result of 250 years or more of livestock grazing. Beaver no longer occur on this site and would likely starve if reintroduced with the habitat in its current condition. If restoration efforts are successful, we intend to reintroduce beaver within 5 years.

The Rio Puerco is one of the most severely overgrazed watersheds in the West. The area, which was once considered "The Breadbasket of Northern New Mexico", today contributes over 70% of the sediment to the Rio Grande and less than 10% of the water. In addition to approximately 3 miles of this perennial stream, the site includes 500 + acres of a sagebrush/ grassland ecosystem. We acquired the parcel in October 1996 and will initiate restoration efforts including cottonwood and willow pole plantings in the Spring of 1997. Within 5 years we expect to have a young and thriving streamside forest that provides habitat for neotropical migratory songbirds, native fish and reduces sediment loads in the river.

Directions: From Bernalillo go north and west on U.S. Highway 550 for about 60 miles. The parcel is 7 miles south of Cuba and is within a 1/4 of a mile of Highway 550. The best access is on a dirt road on the western side of the Highway, which is just before mile marker 57. [see map]

Cost: The cost of leasing the parcel is $770 per year which is approximately $1.38 per acre. We have established an endowment in order to be able to perpetually lease these critical sites. Our endowment goal is $100,000 and we greatly appreciate any contributions.

Visitor Status: If you are a member of Forest Guardians and interested in visiting this site please call us at (505) 988-9126.

Rio Puerco Restoration in the News:
7th Annual Rio Puerco Restoration Weekend -- Saturday & Sunday, April 26-27, 2003
Forest Guardians Wins New Mexico State Land Lease—Rio Puerco Preserve Grows to 1,200 Acres, 3 Miles of Riverside Habitat, Frontline 11-7-02
Forest Guardians win land lease, Santa Fe New Mexican 11-10-02
Ground-Level Activism - Forest Guardians, Southwest Environmental Center team up to bring life back to stretch of Rio Puerco, Albuquerque Journal 3-25-98

FOREST GUARDIANS WINS NEW MEXICO STATE LAND LEASE—RIO PUERCO PRESERVE GROWS TO 1,200 ACRES, 3 MILES OF RIVERSIDE HABITAT

More than three miles of currently degraded but potentially biologically rich riverside habitats and over one-thousand acres of sagebrush grasslands just s outh of Cuba, NM will be protected for native fish and wildlife as a result of Forest Guardians' recent acquisition of a lease to state school trust lands. The New Mexico State Land Office awarded the grazing lease to Forest Guardians on 10-1-02 after the group outbid the rancher who formerly held the lease by offering more than four times the annual rental amount. The newly acquired lease is adjacent to a parcel already leased by Forest Guardians, on which the group has previously planted thousands of trees to help restore the cottonwood-willow bosque ecosystem, considered one of the most endangered in North America, due in large part to ongoing and historic cattle grazing. A map of the Rio Puerco Preserve is available here.

The combined parcels contain almost three miles of the Rio Puerco, a stream whose watershed is one of the most severely overgrazed in the West. The Rio Puerco valley, which was once considered "The Breadbasket of Northern New Mexico", today contributes over 70% of the sediment to the Rio Grande and less than 6% of the water. Forest Guardians' state land leasing efforts focus on streams and wetlands because of their critical endangerment throughout the region and because they provide habitat for 80% of all fish and wildlife species in the Southwest. Despite the requirement in the New Mexico Constitution that the state maximize revenues from state land leases in order to benefit public schools, very few leases experience any competition, due to an antiquated leasing system that strongly favors current lease-holders. For example, although there were more than 500 leases up for renewal this year, Forest Guardians application represented the only competition for leases.

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Ground-Level Activism

Forest Guardians, Southwest Environmental Center team up to bring life back to stretch of Rio Puerco

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By Nancy Harbert

The Albuquerque Journal, 3/25/98

It was a muddy proposition, but about 20 hardy environmentalists accepted it, spending a recent chilly Saturday sloshing up and down a stretch of the Rio Puerco just south of Cuba, planting small cottonwoods and willows.

The event was the second annual Rio Puerco Restoration Day, sponsored by the Forest Guardians and the Southwest Environmental Center, who two years ago jointly signed a grazing lease for 550 acres of state trust land bisected by the river.

"As far as we know, we were the first non-livestock group to successfully bid on a state grazing lease," said Kevin Bixby, with the Southwest Environmental Center in Las Cruces.

The groups banned all cattle and erected fencing across the river to prevent neighboring cows from trespassing. Next, they set about improving the streamside environment through an inaugural Rio Puerco Restoration Day in 1997. A total of 3,000 willows and 200 cottonwoods were planted.

"This makes me feel as good as the river is going to feel," said Retta Johnston of Santa Fe, who, despite a threatening sky and dropping temperatures, cheerily stuck a metal pole into soft mud, pulled it out and replaced it with a tiny cottonwood shoot. She then stamped the oozing mud hard with the heel of her boot to snuff out excess air. "Planting trees is a first step toward a vision of this as a healthy environment."

Johnston, bundled up in thick fleece and a ballcap, remembered a trip through the area 10 years ago with officials from the Bureau of Land Management, which manages nearby sections. "They said this was one of the most degraded rivers in the state."

In fact, the New Mexico Environment Department has designated the Rio Puerco an impaired watershed. It drains 7,350 square miles in west-central New Mexico.

Although a 1996 Bureau of Reclamation study indicated soil erosion from the watershed has decreased during the past 50 years, the Rio Puerco still contributes 78 percent of the sediment that reaches the Rio Grande at San Marcial, said Allen Gellis, a geomorphologist with the United States Geological Survey, who has been examining the geologic evolution of the river.

Across the shallow river, Tony Minero and Rebecca Weatherford, both of Albuquerque, laughed as Minero attempted to walk in his mud-caked shoes. They were planting baby narrow-leaved cottonwoods using the same method as Johnston.

"I wanted to do this because I hope to have kids some day, and I want them to be able to breathe clean air and enjoy this kind of environment," said Minero, 21. "This will benefit everyone in the long run."

For John Horning, who alternated between operating a gasoline-powered auger and supervising the volunteers, the weekend planting effort was a welcome change from his environmental activist job with Forest Guardians.

"So much of our work is fighting with the (state and federal) agencies, and it's really gratifying to come out and be part of the work of trying to heal a damaged river," he said.

Forest Guardians, like the Southwest Environmental Center, is a nonprofit environmental advocacy organization.

Forest Guardians also has separate leases for two miles along the Santa Fe River, more than 2,000 acres along the Rio Embudo and is hoping to obtain a lease on the Rio Grande.

Horning and Bixby were pleased to see healthy coyote willows protruding from the river's edge, the result of last year's planting. Volunteers lopped off the shrubs' tops and planted them as well, hoping to extend the developing willow forest. Some cottonwoods fared well, but others had succumbed to the antler rubbings of elk, which enjoy the soft bark of cottonwoods just before they shed their antlers.

Horning admits it could be 20 years or more before the rewards from the volunteer planting effort will be displayed.

"Nonetheless, the benefit is that people get a firsthand understanding of the degradation of our rivers," he said. About 2,000 willows, 450 cottonwood trees and a smattering of New Mexico olive, chokecherry and locust trees were planted during the recent effort.

Outfitted in knee-high rubber boots, Gary Simpson of Albuquerque trudged up and down the shallow, silt-laden river, helping out wherever he was needed, including carrying an ill-prepared reporter across the river.

"I'm a hopeless idealist," he said. "We need to help stabilize the erosion, and through this demonstration project, I want to show that it can come back."

http://www.nmenv.state.nm.us/swqb/Watershed_Protection/Clearing_The_Waters/ctwfall03web.pdf

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CLEAN WATER ACT SECTION 401/404 CASE STUDY: Correcting a Violation on the Rio Puerco near Cabezón, New Mexico

By Michael Coleman and Daniel Guevara

The Rio Puerco Watershed is characterized by high sediment load, flash floods, and erosive vertical banks. In December 2001, a rancher recognized how sediment and erosion was impacting his land along the Rio Puerco and decided to take matters into his own hands. He was concerned how the river was eroding the banks and threatening an adjacent stock pond, which is the primary source of water for his cattle. He decided to divert the flow away from his pond by straightening the channel using a backhoe to dig a straight diversion ditch. He then went on to extend the ditch over a mile, cutting off flow to several very large meanders. In the process, riparian plants were damaged and destroyed and large quantities of excavated soil were deposited in the meandering channel bottom. This work resulted in a major modification of the channel geometry of the Rio Puerco and threatened to cause more major erosion problems.

By straightening the channel, the rancher was unknowingly increasing the channel gradient and flow velocity and thus the power of the river to further incise and undermine an already deeply incised channel.

A concerned citizen noticed what was going on and contacted the Bureau of Land Management (BLM) Albuquerque Field Office. The BLM manages much of the channel and the land on one side of the river, while the rancher grazes cattle on private and BLM-leased land on the other side. When BLM was informed of this activity, they contacted the Army Corps of Engineers and the New Mexico Environment Department Surface Water Quality Bureau (SWQB), which are the two agencies that regulate dredge and fill activities in the waters of New Mexico. They found that the landowner had conducted dredge and fill activities without a permit, in violation of Section 404 of the Clean Water Act (CWA), which regulates work within the ordinary high water mark of "Waters of the United States".

Normally, a person seeking authorization to work in a waterway would apply for a 404 permit from the U.S. Army Corps of Engineers. In addition, Section 401 of the Clean Water Act requires that the State review the 404 permit to ensure water quality degradation will not occur as a result of the permitted activity. Typically, the 404 and 401 permits are requested before work begins in a stream. However, on occasion the public is apparently unaware of this permit requirement and work begins in the stream without the necessary authorization. In this case the rancher was contacted by the US Army Corps of Engineers and instructed to halt further work in the Rio Puerco. The SWQB provided a letter stating the consequences of straightening of the channel on the Rio Puerco and what needed to be done to ensure further problems would not occur. Cutting the straight diversion ditches would ultimately lead to increased local and downstream erosion. The area where this construction was performed was showing an upward trend towards stability and reduced erosion. The flourishing riparian vegetation, natural sinuosity and towards stability and reduced erosion. The flourishing riparian vegetation, natural sinuosity and stable gradient were keeping flow velocities in check. When the channel was cut down and straightened the gradient was increased and it could be expected that flow velocity would increase markedly. The dredged sediments would be incorporated in the flows, the missing vegetation could no longer assist in stabilizing this stream reach, and increased erosion and sediment loading would be expected to further degrade the Rio Puerco. Furthermore, the new, straightened channel cuts could potentially advance upstream, impacting the work underway by the Rio Puerco Management Committee (RPMC) to prevent erosion and redevelop stream and riparian habitat above La Ventana (see *CTW* Vol. 8 No. 2 for more information about watershed restoration underway in the Rio Puerco Watershed).

Together, the SWQB, BLM and COE determined that the rancher needed to backfill the trenches and plant new vegetation to make up for what was lost. By July 2002, the rancher had backfilled the trenches and the agencies verified that the restoration work had been completed and declared that the rancher was no longer in violation of the Clean Water Act.

The BLM agreed to monitor the site for five years, after which the rancher will need to seed or replant if vegetation has not returned. The Rio Puerco's problems are region-wide and any impact to the river can affect other sections of the main channel and other tributaries as well. Acting on his own, this rancher did not fully realize the problems that could occur as a result of his dredging and filling activities. However, collaborating with actively involved organizations, the situation was corrected before serious damage could occur. With the rancher's continued cooperation and participation, the possibility now exists that future in-channel work can be developed to solve problems and to halt further degradation of the Rio Puerco.