Manzano Mountains State park and Abo and Quarai of the Salinas Pueblo Missions National Monument

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Manzano Mountains State Park and Abó and Quarai units of the Salinas Pueblo Missions National Monument

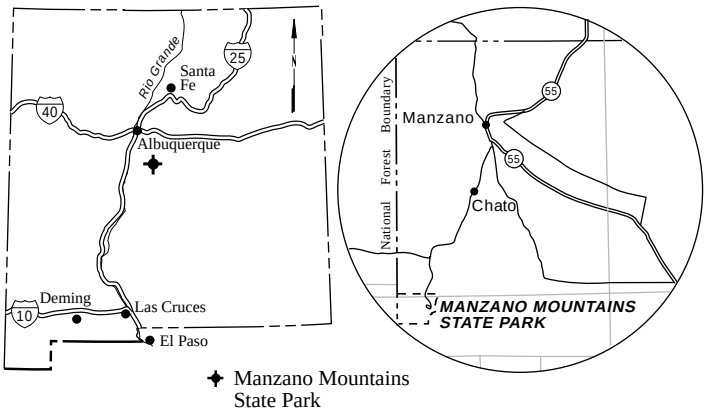

FIGURE 1—Location of Manzano Mountains State Park.

Introduction

Eighteen miles northwest of Mountainair in the foothills of the Manzano Mountains and south of the village of Manzano, lies Manzano Mountains State Park (Fig. 1), established in 1973. "Manzano" is Spanish for apple and refers to old apple orchards found in the town of Manzano. The apple trees were planted after 1800 as determined by tree ring growth, although local legends claim that the apple trees were planted in the 17th century by Spanish missionaries traveling to the nearby Indian pueblos (Stanley, 1962; Julyan, 1996; Laine and Laine, 1998). The few remaining trees are probably the oldest apple trees in the United States. There are no apple trees at Manzano Mountains State Park, but Gambel oak, Emory oak, piñon, ponderosa pine, and alligator juniper trees are abundant. The alligator juniper is named for the checkered pattern on the bark of older trees, which resembles an alligator's hide. Nearby, Tajique, Torreon, and 4th of July Canyons in the Manzano Mountains contain some of the largest stands of Rocky Mountain and big-toothed maple trees in the Southwest; spectacular fall colors attract visitors from throughout the area. The Manzano Mountains also play an important role as a raptor flyway during spring and fall migrations. Some species of birds may fly 200 mi in a day and several thousand miles in a season. The park has a field checklist available to visitors who enjoy bird watching.

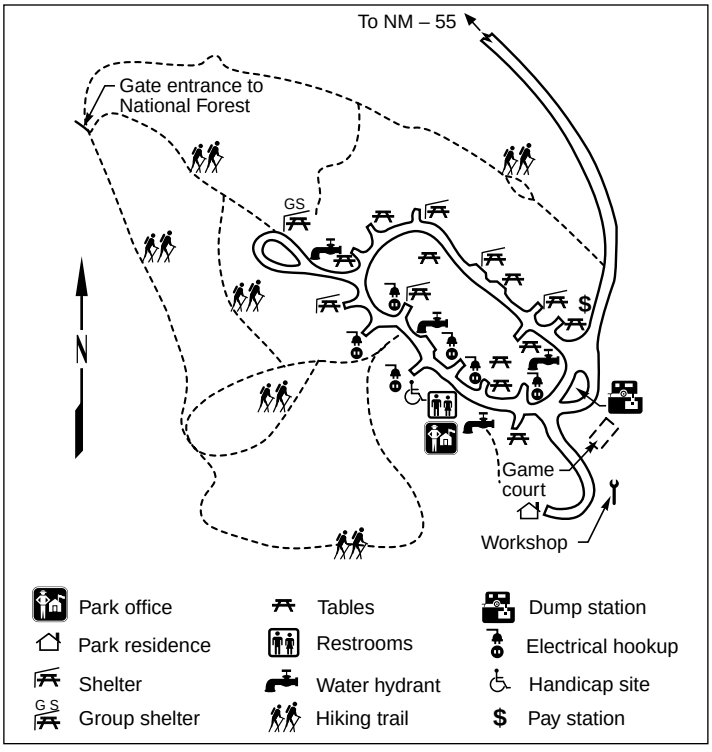

FIGURE 2—Facilities map of Manzano Mountains State Park.

FIGURE 3—View of Manzano Mountains from a trail in Manzano Mountains State Park.

The 160-acre state park, at an elevation of 7,300 ft, is reached via a well-graded gravel road off NM–55 near Manzano. This same road continues on to Red Canyon and the Manzano Mountains Wilderness area, established in 1978. The 36,970-acre Manzano Mountains Wilderness ranges from juniper woodland at approximately 5,000 ft to pine and aspen at approximately 10,000 ft. It is administered by the Cibola National Forest.

Popular activities at the state park include camping, bird watching, photography, hiking, horseback riding, mountain biking, and cross-country skiing. Horseshoe pits are also available. The park has restrooms (no showers), electrical hookups, RV dump station, 17 campsites (Fig. 2), and a large group pavilion. A ½-mi nature trail wanders throughout much of the park grounds; other park trails connect to trails in the Cibola National Forest via a gate at the forest boundary. One of the forest trails reaches the crest of the Manzano Mountains at an elevation of 10,098 ft. The Manzano Mountains lie in the background to the west (Figs. 3, 4), and the Estancia Basin lies to the east. The state park is open from mid-April through October.

The main Visitor Center for the Salinas Pueblo Missions National Monument is headquartered in Mountainair. The monument, established in 1980, consists of three pueblo sites and Spanish missions: Abò, Quarai (Fig. 5), and Gran Quivira. The Quarai site, also on NM–55, is a few miles southeast of the Manzano Mountains State Park, south of Punta de Aqua. "Salinas" is Spanish for salt or salt marshes. There are no camping

FIGURE 4—Manzano Mountains form the skyline beyond Manzano Mountains State Park.

FIGURE 5—Quarai ruins.

facilities at the national monument. In 1995, the Salt Missions Trail was established and forms a loop connecting Tijeras, Manzano Mountains State Park, Quarai, Mountainair, Gran Quivira, Willard, Estancia, and Moriarty (Fig. 6).

History

Prehistoric people traveled and hunted in the Estancia Basin from about 12,000 to 10,000 yrs before present (B.P.; Lyons and Ebert, 1982; Lang, 1993). Hunters of the Sandia, Clovis, Folsom, and Plano cultures (Paleo-Indian people) established camping sites throughout the basin from about 8,000 to 12,000 yrs B.P. (Lyons and Ebert, 1982; Lang, 1993). About 600 A.D. agriculture and a more sedentary village lifestyle became a part of prehistoric life. Pithouses began to appear in the Estancia Basin, similar to those of the Mogollon culture.

Between 900 and 1,500 A.D. the Estancia Basin was one of the more populous areas of New Mexico. The Pueblo Indians mined salt from the playa lakes and established trade routes with the Plains Indians to the east, other Pueblo Indians along the Rio Grande to the west, and the Jumanos Indians to the southwest (Kraemer, 1976). The Pueblo Indians settled along the western edge of the Estancia Basin; raised corn, squash, beans, and cotton; and built villages at the Salina Pueblos called Abò, Quarai, and Gran Quivira (Murphy, 1993). They established other smaller settlements in the basin. Salt, piñon nuts, local crops, and hides of animals hunted in the Manzano Mountains were traded for other needed commodities. Quarai (Fig. 5) lies in the juniper forest, a setting similar to the state park. Quarai had the advantage of natural springs and the forest to provide shade and construction materials for building. Abò lies south of Quarai and was on the trade route connecting the salt lakes to the Rio Grande. Gran Quivira, the largest of the ruins, is farther south on Chupadera Mesa and was nearest the Plains Indians to the east (Fig. 6).

Don Juan de Oñate was one of the first of the Spanish explorers to visit the pueblo communities in the Estancia Basin in 1598 (Murphy, 1993). Soon Catholic missionaries came and built large churches within the existing pueblo complexes. Ultimately six churches were built in the basin; ruins remain at Abò, Quarai, and Gran Quivira. Local stone was used along with clay to make adobe bricks and walls. As early as 1660 the Spanish coerced the Indians to mine salt, which was shipped 700 mi to Parral and Chihuahua, Mexico, for processing silver that was being mined there (Northrop, 1959). The Spanish used the smelting method called the patio process. They mixed silver sulfide with salt and mercury, ground the mixture to a powder in arrastras (large donkey-driven rock millstones used to grind other rocks and grain), and then spread it on patios to be heated by the sun. The salt combined with the silver to form silver chloride, which was then reduced to pure silver by the sunlight. Estancia Basin salt was also used by the Spanish to cure leather and was needed for raising animals (Kraemer, 1976).

As time passed, the Indians had to give more and more of their crops to the church and to the colonial government in Santa Fe; there was not enough time and man power to both grow crops and mine salt. The pueblo way of life was further hampered by changes in climate as drought hit the basin in the 1660s. Famine and pestilence followed, and raids by Apache Indians increased (Kraemer, 1976). Finally, the great missions were abandoned, Gran Quivira in 1671, Abò in 1673, and Quarai in 1677 (Murphy, 1993). By the time of the Pueblo Revolt in 1680, no one lived permanently in the basin, although the nomadic Apache, Comanche, and Navajo Indians hunted in the area. The sandstone and adobe walls at Abò and Quarai and the limestone walls at Gran Quivira began to crumble and collapse. Don Diego de Vargas led the Reconquest of New Mexico in 1692–1693, but the Estancia Basin was not settled again until the 1700s. The Spanish would attempt to mine salt once or twice a year under heavily armed escorts (Kraemer, 1976).

Hispanic sheepherders began grazing their flocks in the Manzano area about 1703. Hispanic settlers from Tomè, northeast of Belen, established Manzano village in 1824, and in 1829 the settlers were granted the Manzano Land Grant (Stanley, 1962; Julyan, 1996). The state park is part of the original land grant. Manzano Lake, southeast of the village, was once the site of a gristmill. Navajo, Comanche, and Apache Indians continued raiding the settlements until the 1860s. Hispanic settlers raised cattle and sheep and grew chile, onions, beans, corn, and alfalfa. A U.S. Post Office was established at Manzano in 1871 (at that time spelled Manzana). In 1876, the post office changed the spelling to Manzano, but in 1918, the post office closed. Immigrants from Texas and Arkansas homesteaded much of the Estancia Basin in the early 1900s.

The arrival of the railroad to the region brought homesteaders and a boost in the economy. John W. Corbett, a newspaperman from Kansas, heard that the proposed Belen cutoff of the Atchinson, Topeka, and Santa Fe Railroad would go through Abo Pass. Corbett and Col. E. C. Manning located a townsite at the highest point in the pass in 1901, and they called the town Mountainair because of mountain breezes in the summer. The cutoff was completed in 1908. A U.S. Post Office was established in 1903.

Exploitation of salt continued into the 20th century, when in

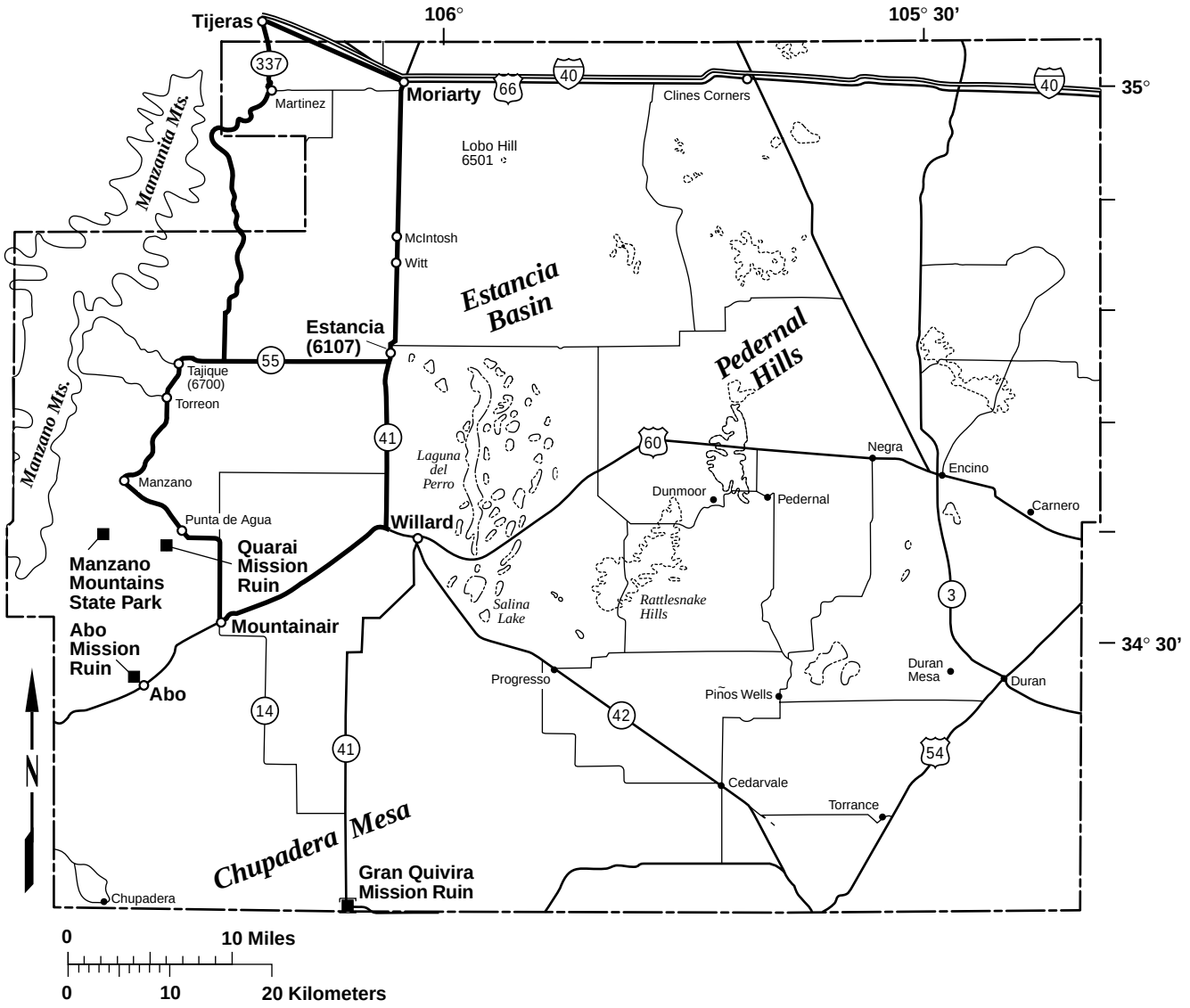

FIGURE 6—The Salt Missions Trail in the Estancia Basin forms a loop connecting Tijeras, Manzano Mountains State Park, Quarai, Mountainair, Gran Quivira, Willard, Estancia, and Moriarty.

1915, Julius Meyer began producing salt commercially. From 1915 to 1933 several companies mined salt; approximately 1,050 tons was produced in 1932–1933 (Talmage and Wootton, 1937; McLemore, 1984). When the Carlsbad potash mines opened and began producing salt as a by-product, operations in the Estancia Basin were abandoned. Total production of salt from the Estancia Basin is unknown.

Homesteaders raised pinto beans, and Mountainair was known as the "Pinto Bean Capital of the World" until drought once again hit the area in the 1950s. Today, Mountainair is a small ranching community that attracts tourists, railroad workers, and travelers passing through on US–60.

Geology

The Manzano Mountains are a north-south elongate, east-tilted fault block that formed as part of the eastern flank of the Rio Grande rift during Miocene time, about 20–15 m.y. ago. The oldest rocks exposed in the highest peaks of the Manzano Mountains are Proterozoic quartzites, mica schists, metasiltstones, phyllites, metarhyolite, amphibolite, and basic schist (Fig. 7; Bauer, 1982, 1983; Cavin et al., 1982). These rocks were subsequently metamorphosed (Marcoline et al., 2000) and then intruded locally by granitic rocks of the Ojita, Monte Largo, and Priest plutons. The Ojita pluton is 1,527 m.y. old, the Monte Largo pluton is 1,656 m.y. old and the Priest pluton is 1,427 m.y. old (Bauer et al., 1993). The metamorphic rocks are clearly older than the 1,656 m.y.-old Monte Largo pluton and may be as old as 1,700 m.y. (Bolton, 1976; Bowring et al., 1983). Boulders of these metamorphic rocks are scattered throughout the state park.

Regional uplift occurred, and several thousand feet of erosion followed forming a regional erosional surface that records no deposition in the Manzano Mountains until Late Mississippian, a gap in the geologic record of about 1.1 m.y. The contact between the substantially older Proterozoic rocks and younger Mississippian rocks is called an "unconformity." This particular unconformity was recognized in the Grand Canyon area and was called the Great Unconformity by John Wesley Powell.

Marine seas began to cover New Mexico during late Paleozoic time and deposited Mississippian- and Pennsylvanian-age sediment unconformably on the Proterozoic rocks (Myers, 1982). The Mississippian Caloso Formation of Myers (1982) and the Pennsylvanian Sandia Formation represent the first stage of marine deposition and consist of a mixture of thin nonmarine limestones, siltstones, sandstones, and conglomerates and marine limestones and shales (Myers, 1982). The Caloso Formation is poorly exposed,

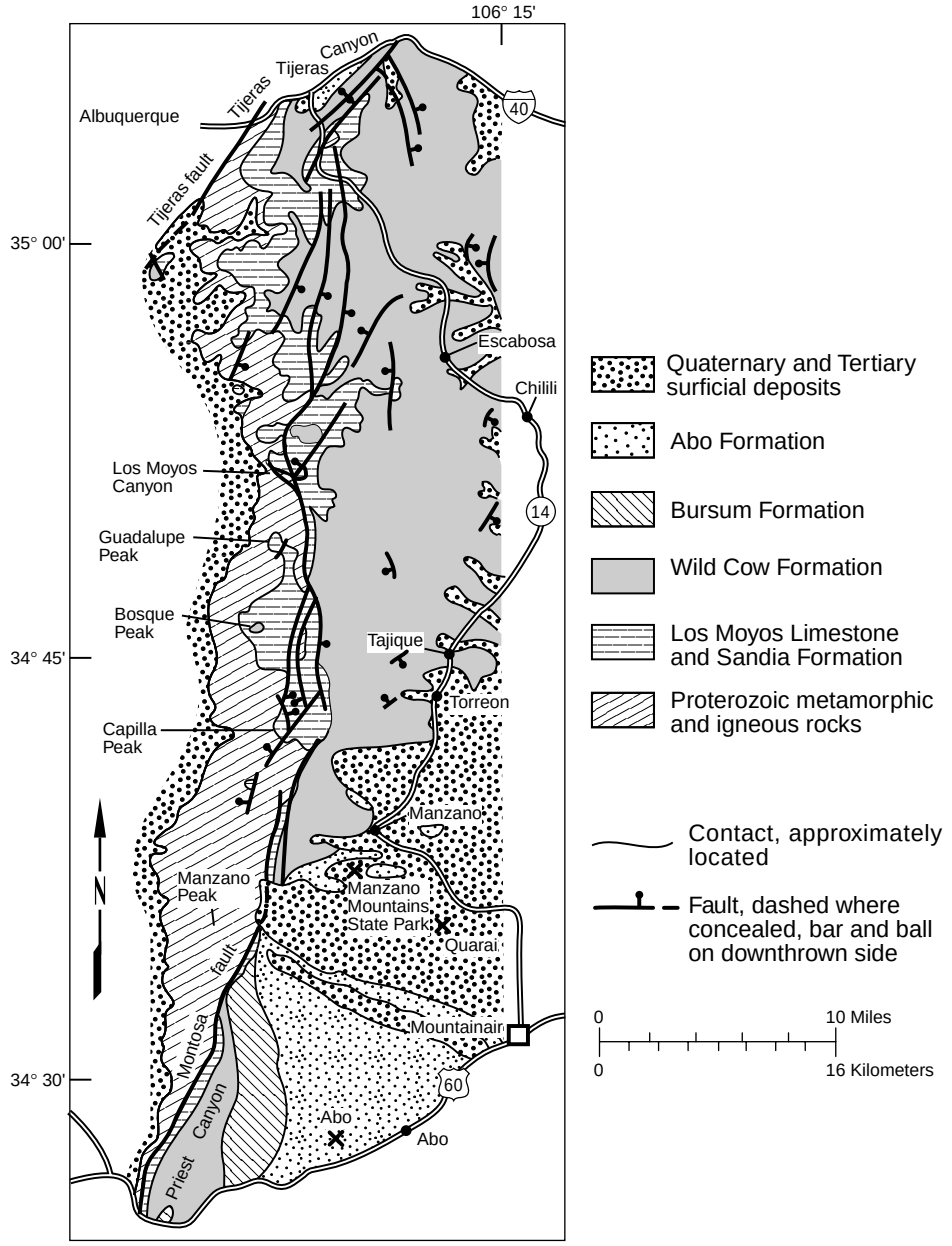

FIGURE 7—Geologic map of Manzano Mountains and vicinity, including Manzano Mountains State Park (modified by V. T. McLemore from Myers, 1966, 1967, 1969, 1977, 1982; Myers and McKay, 1970, 1971, 1972, 1974).

consists of local, thin (less than 22 ft thick), nonfossiliferous limestones, and is probably part of the Arroyo Peñasco Group (Broadhead, 1997). The Sandia Formation is approximately 90–320 ft thick, and most of the sediment was probably derived from the Pedernal uplift, which forms the eastern edge of the Estancia Basin (Figs. 6, 7). These rocks were probably deposited about 320 m.y. ago, based on fossil evidence (Myers, 1982), and are exposed along the western foothills of the Manzano Mountains (Fig. 7).

The Madera Group overlies the Sandia Formation and represents the major marine sequence of the Pennsylvanian and Early Permian. The Madera Group is 1,200–1,270 ft thick and consists of the Los Moyos Limestone (oldest), Wild Cow Formation, and Bursum Formation (Broadhead, 1997). Many of the limestone boulders found in the state park belong to these formations. The Los Moyos Limestone and Wild Cow Formation consist of marine limestones with interbedded siltstones, shales, sandstones, and conglomerates. The Bursum Formation is the last phase (Early Permian) of marine deposition during the Pennsylvanian–Permian and consists of alternating sequences of red arkosic sandstones, red and green shales and siltstones, and greenish-gray marine limestones. Carbon dioxide (CO_2) was discovered in the Pennsylvanian rocks near Estancia in 1925 (McLemore, 1984). Carbon dioxide was produced from 1932 to 1942 and was converted into dry ice.

The brick red sandstones, shales, and mudstones of the Permian Abo Formation were deposited on top of the Madera Group after the Pennsylvanian seas retreated about 250 m.y. ago. The lower units of the Abo Formation were deposited in high-energy alluvial-fan and pediment environments, and the upper units were deposited in low-energy fluvial floodplain and shallow-water lake environments (Hatchell et al., 1982). Abo sandstones were used at Abò and Quarai by the Pueblo Indians to build their homes and later the churches. The area of the state park has been stripped of younger rocks by erosion and is underlain by the Abo Formation (Fig. 7). Rocks eroding from the Manzano Mountains form a thin veneer on top of the Abo and other Permian and Pennsylvanian rocks in the surrounding Manzano area. The younger Yeso Formation, at one time overlying the Abo Formation, also has been eroded in the Manzano area and is only exposed to the east in the Estancia Basin.

The state park lies on the western edge of a closed basin, called the Estancia Basin (Fig. 6), which initially formed as a depositional basin during the Early Pennsylvanian with the deposition of the Sandia Formation and Madera Group. The present structural basin formed when the Sandia, Manzano, Manzanita, and Los Pinos Mountains were uplifted during formation of the Rio Grande rift about 20–15 m.y. ago (McLemore, 1999; Bauer et al., in press). The Sandia, Manzano, Manzanita, and Los Pinos Mountains form the western boundary, the Pedernal Hills form the eastern boundary, Chupadera Mesa forms the southern boundary, and Lobo Hill separates the Estancia Basin from the Española Basin to the north (Broadhead, 1997).

During the last ice age between 24,000 and 12,000 yrs B.P., a large pluvial lake filled the basin (Bachhuber, 1982; Smith and Anderson, 1982; Allen and Anderson, 2000). The maximum extent of the lake was approximately 40 mi long, 23 mi wide, and it would have covered the towns of Estancia and Willard with nearly 100 ft of water (Allen, 1994). Shore features, cliffs, terraces, beach ridges, and other lake features, preserved in the Estancia Basin east of the state park, record a series of changing water levels in the lake from 24,000 to 12,000 yrs B.P. caused by rapid shifts in climate. Lake Estancia gradually dried up after about 12,000 yrs B.P., and the floor became exposed (Allen and Anderson, 1993, 2000). A return to wetter conditions resulted in the filling of the basin again by a younger lake (called Lake Willard by some geologists) at about 10,000 yrs B.P. (Bachhuber, 1982; Allen and Anderson, 2000). These lakes did not have any outlets to the Rio Grande or anywhere else, and the water became saline over time, in part as a result of evaporation and also as a result of contributions from underlying Yeso evaporites.

Today, a complex of playa lakes and surrounding gypsum and

clay dunes remain following excavation or deflation of the ancient lake bottom since about 8,000 yrs B.P. by southwesterly wind. An overall rise in the water table and return to a slightly wetter climate have reversed the trend from deflation to sediment filling of the lakes (Allen, 1994). As saline water in some of the playas evaporated, a residue of halite (salt) and minor sodium sulfates and magnesium sulfates precipitated. The deposits of halite became valuable commodities to the Pueblo Indians that settled at Abò, Quarai, and Gran Quivira and later to the Spanish and Anglo settlers. Today, the playa lakes in Estancia Basin range in size from a few acres to more than 12 mi long (Fig. 6; Meinzer, 1911; Talmage and Wootton, 1937).

Summary

Manzano Mountains State Park lies in the foothills of the Manzano Mountains and on the edge of the Estancia Basin. Park visitors enjoy camping, bird watching, photography, hiking, horseback riding, mountain biking, and cross-country skiing. The Quarai unit of the Salinas Pueblo Missions National Monument lies southeast of the state park and is a tribute to early settlement of the basin. The geologic evolution of the Estancia Basin influenced human occupation in the area. Playa lakes that formed in the area contained salts, which led to early settlement and mining of the salt (halite) in the basin by Pueblo Indians. These Indians established trade routes with the Plains Indians to the east and with other Pueblo Indians along the Rio Grande. Drought, pestilence, over taxing by the Spanish government, and raiding by Apache Indians ended the pueblo way of life in the basin by 1677. Hispanic homesteaders settled in the basin, starting in 1703, and ranching and farming continues today. Manzano Mountains State Park and Salinas Pueblo Missions National Monument are worth visiting as scenic reminders of the relationships between geologic past and human history.

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