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The Rio Grande Bosque: Ever Changing

DAN SCURLOCK

Throughout the Spanish-speaking world, a bosque refers to a woodland, usually fringing a body of water. Here in New Mexico we have come to know it as a relatively dense stand of deciduous trees—primarily mature valley cottonwood (*Populus fremontii* var. *wislizenii*) with associated species such as willow (*Salix* spp.), Russian olive (*Elaeagnus angustifolia*), and salt cedar or tamarisk (*Tamarix pentandra*)—growing on the flood plain of the Rio Grande. This bosque, which actually extends from southern Colorado to southern Texas, is the most extensive cottonwood woodland in the American Southwest.¹

But has this bosque always existed? Has it always had the botanical composition described above? The answer is no. Yet surprisingly, a cottonwood bosque probably has existed along the Rio Grande for over a million years, or back to the colder times of the early Pleistocene.² What this riparian forest looked like compared to the bosque seen by the earliest humans in the valley about 11,000 years ago is unknown.

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1. Valerie C. Hink and Robert D. Ohmart, *Middle Rio Grande Biological Survey* (Tempe: Center for Environmental Studies, Arizona State University, 1984), 1.

2. Donald Peterson, "Life in the Rio Grande Bosque," *New Mexico Magazine*, 64 (June 1986), 28–33.

Arriving at the end of the last Ice Age, these Paleo-Indians probably found stands of cottonwood and willow interspersed with extensive marshes and swamps dominated by sedge (*Carex* species), bulrush (*Scirpus acutus*), cattail (*Typha latifolia*), and salt grass (*Distichlis spicata*).

These Native Americans were nomadic hunters and gatherers who moved in small bands up and down the valley and across the adjacent grasslands and foothills in search of food animals and useful plants. They may have burned portions of the bosque intentionally to drive game into the open. Some plant species were collected for food and medicinal purposes; others were used in construction of shelter, tools, weapons, and baskets. Because these small bands moved over such a large territory, exploitation of a given location was relatively minimal, and fauna and flora presumably recovered rapidly.

The first significant human impact on the bosque probably came with clearing of valley woodland for agriculture between 1,500 and 2,000 years ago by the predecessors of the historic Pueblo Indians.³ By the time the first Europeans arrived in central New Mexico in 1540, many large Native American farming villages extended along the valley from present San Marcial to White Rock Canyon. Nearing present Albuquerque, one of Don Francisco Vásquez de Coronado's chroniclers described the setting in the earliest written description of the valley: "This river of Nuestra Senora flows through a broad valley planted with fields of maize and dotted with cottonwood groves. There are twelve pueblos, whose houses are built of mud and are two storeys high."⁴ Following Spanish colonization begun in 1598, more land was cleared and more water was diverted from the Rio Grande for farming by the growing European settlements along the river. Within two centuries an estimated 100,000 acres, mostly in the Rio Grande valley, were in cultivation.⁵

Beginning in the early nineteenth century, increasingly detailed descriptions of the bosque environs were published. Pedro Bautista Pino wrote in 1812: "This imposing Nile is, so to speak, the heart of the territory, for the richest settlements are located on its banks, which are truly picturesque. The variety of its luxuriant groves, the beautiful forests that embellish it, the diverse perspectives presented by its vegas,

3. Richard B. Woodbury and Ezra B. W. Zubrow, "Agricultural Beginnings, 2000 B.C.-A.D. 500," in Alfonso Ortiz, ed., *Handbook of North American Indians: Southwest* (Washington, D.C.: Smithsonian Institution, 1979), 49-50.

4. Herbert Eugene Bolton, *Coronado: Knight of Pueblos and Plains* (Albuquerque: University of New Mexico Press, 1964), 184.

5. Allan G. Harper, Andrew R. Cordova, and Kalervo Oberg, *Man and Resources in the Middle Rio Grande Valley* (Albuquerque: University of New Mexico Press, 1943), 52.

which are cultivated by a multitude of laboring men, the infinite herds that quench their thirst in its current, and the thousands of valuable birds that live there . . . make New Mexico, from the point of view of an observer, a place of true delight."⁶ In 1839, explorer and trader Josiah Gregg commented less favorably on the condition of the bosque: "On the water-courses there is little timber to be found except cottonwood, scantily scattered along their banks. Those of the Rio del Norte are now nearly bare throughout the whole range of the settlements, and the inhabitants are forced to resort to the distant mountains for most of their fuel."⁷

Frederick Adolphus Wislizenus, a German physician and naturalist, made what were perhaps the most detailed environmental observations of New Mexico in the mid-nineteenth century. Proceeding downriver from Santa Fe in July 1846, Wislizenus found sagebrush (*Artemisia*) and other shrubs but apparently little or no grass on the sandy llano east of Albuquerque. Grasses here probably had already been decimated by sheep. Moving back to the Rio Grande, he found only a few cottonwoods from Albuquerque to Isleta Pueblo. Some five miles below the pueblo, he mentioned "a fine grove of cotton trees, called bosque. . . ." On the east side of the Rio Grande, a few miles below Casa Colorado, Wislizenus commented on the improved condition of the grasslands. Near La Joya he collected a creosotebush specimen, and between Sabino and Parida he encountered mesquite and soapweed yucca for the first time.⁸

With the Anglo-American invasion of New Mexico in August 1846 came a number of military contingents, which explored the Rio Grande from Santa Fe downriver to Mexico. In September of that year Lieutenant W. H. Emory of the U.S. Topographical Engineers noted impressive stands of cottonwood along the Rio Grande beginning at Isleta Pueblo and extending southward beyond the Bosque del Apache.⁹ The following October Lieutenant J. W. Abert of the same military unit did not mention cottonwood in his journals until he was below Isleta.

6. H. Bailey Carroll and J. V. Haggard, eds. and trans., *Three New Mexico Chronicles: the Exposition of Don Pedro Bautista Pino, 1812; the Ojeada of Lic. Antonio Barreiro, 1832; and Don Agustin de Escudero, 1849* (Albuquerque: Quivira Society, 1942), 21.

7. Josiah Gregg, *Commerce of the Prairies*, (2 vols., New Canaan, Connecticut: Readex Microprint Corporation, 1966), 1: 159.

8. F. A. Wislizenus, *Memoir of a Tour to Northern Mexico Connected with Col. Doniphan's Expedition in 1846 and 1847* (Glorieta, New Mexico: Rio Grande Press, 1969), 34-36.

9. Ross Calvin, ed., *Lieutenant Emory Reports* (Albuquerque: University of New Mexico Press, 1968), 81-88.



The Bosque was abundant when a ferry plied the Rio Grande at the turn of the century near present-day Elephant Butte Reservoir. Photograph taken by Henry A. Schmidt. Courtesy Special Collections, Zimmerman Library, University of New Mexico.

"From Joya we observed quite a change in the appearance of the country. The river banks are now heavily timbered with cotton wood," he wrote. In the vicinity of Valverde he recorded cocklebur (*Xanthium strumarium*), a plant introduced by the Spanish, and carrizo (*Phragmites communis*), a tall reed-like grass that grew commonly along waterways in the valley before extensive modifications of the flood plain in the twentieth century.¹⁰ Also in 1846, Henry Smith Turner noted the depletion of cottonwood and the efforts to preserve this species in the bosque south of Albuquerque: "There is great difficulty in obtaining sufficient fuel for cooking purposes—the men have to go to the distance of several miles to obtain a handful of wood. . . . We occasionally see a grove of cottonwood which is preserved with great care, as it furnishes the only material with which casts for the whole country are made. These groves are always private property."¹¹

The next year, 1847, George Rutledge Gibson, traveling upriver, found no firewood and very little grass for livestock from La Joya to

10. J. W. Abert, *Abert's New Mexico Report, 1846–47* (Albuquerque: Horn and Wallace, 1962), 100, 119–20, 127.

11. Marc Simmons, *Albuquerque: A Narrative History* (Albuquerque: University of New Mexico Press, 1982), 18–19.

above Peralta.¹² W. W. H. Davis described the valley below Isleta in 1855: "About a mile below Doctor Connelly's we passed what is known as the bosque, a large tract of fine timber, mostly cottonwood, something very rare in New Mexico. Wood is exceedingly scarce all over the country. The valleys are generally bare of it. . . . The country is said to have been well wooded when the Spaniards first settled it, but in many parts it has been entirely cut off, and in some instances without leaving even a tree for shade."¹³

William Bell, in 1867, also noted that trees were scarce on the Rio Grande flood plain from Albuquerque to Fort Craig. He attributed the situation not only to human activity, but also, astutely, to meandering of the river, which frequently changed course, resulting in cyclic destruction and regeneration of cottonwood stands. Albuquerque writer Harvey Fergusson described the same phenomenon in the early twentieth century.¹⁴ In those areas of the flood plain not altered extensively, cottonwood-willow woodlands, small lakes (*charcos*) with associated aquatic vegetation such as cattail and bulrush, and marshes (*ciénegas*) with associated semi-aquatic vegetation such as rush (*Juncus balticus*), sedge, salt grass, and yerba mansa (*Anemopsis californica*) dominated the valley vegetation. Relatively wide (up to a mile), the Rio Grande was a meandering, shallow river with numerous islands and sandbars. Late spring or summer floods were frequent, some inundating the entire flood plain. In part, periodic flooding maintained the riparian communities. One obvious benefit of flooding on riparian vegetation, especially the shallow-rooted cottonwood, is an increase in available moisture. Another benefit is the deposition of rich, silt alluvium as a prime habitat for the establishment of seedlings of pioneer tree species.¹⁵

J. R. Watson published the first detailed botanical description of the central Rio Grande in 1912. For the flood plain he described two major floristic associations: (1) nearly pure stands of valley cottonwood

12. Robert W. Frazer, ed., *Over the Chihuahua and Santa Fe Trails 1847-1848: George Rutledge Gibson's Journal* (Albuquerque: University of New Mexico Press, 1981), 35-36.

13. W. W. H. Davis, *El Gringo: or New Mexico and Her People* (New York: Harper & Brothers, 1857), 356.

14. William A. Bell, *New Tracks in North America: A Journal of Travel and Adventure Whilst Engaged in the Survey for a Southern Railroad to the Pacific Ocean During 1867-8* (Albuquerque: Horn and Wallace Publishers, 1965), 241-42; Hink and Ohmart, *Middle Rio Grande Biological Survey*, 33-34, 66-67; Harvey Fergusson, *Rio Grande* (New York: Alfred A. Knopf, 1931), 8.

15. Hink and Ohmart, *Biological Survey*, 33-34, 66-67; Marjorie Van Cleave, "Vegetative Changes in the Middle Rio Grande Conservancy District" (master's thesis, University of New Mexico, Albuquerque, 1935), 1, 6-11, 21, 23-24.

with a scattering of willows, *Baccharis*, *Senna*, and sedge; and (2) a wet meadowlike community of sedge, yerba mansa, *Baccharis*, common sunflower (*Helianthus annuus*) and cañagire (*Rumex* species). Watson did not mention salt cedar or Russian olive as components of the bosque, but noted that salt cedar was being planted in Albuquerque as an ornamental.¹⁶

Irrigated lands along the Rio Grande had increased to about 125,000 acres by 1880 with the arrival of Anglo farmers. Within a decade, this acreage began to decrease sharply as the flood plain became waterlogged from extensive irrigation, recurring floods, and an aggrading (building up) riverbed. This latter phenomenon was caused by an increasing sediment load derived from overgrazed and intensively farmed areas upstream being carried by a decreased flow in the Rio Grande. The reduced flow resulted from an increased use of water for irrigation. Thus, the channel of the Rio Grande began to aggrade rather than downcut. As the bed of the river rose in elevation above the farmlands on the flood plain, the associated water table rose to the surface in many locations. Increased alkalinity of the soil, a condition which commonly develops in the Southwest as a result of intensive irrigation, also had become a serious problem by the late 1800s. By 1896 cultivated acreage had decreased to 50,000 acres, and in 1925 to 40,000 acres.¹⁷ By the end of World War I, approximately two-thirds of the valley was classified as alkaline, marsh, or sand hills dominated by sagebrush.¹⁸

To alleviate these problems, the Middle Rio Grande Conservancy District, which extended from present Cochiti Dam downriver to the northern boundary of the Bosque del Apache National Wildlife Refuge, was established in 1923. The district encompasses 277,760 acres, of which 128,787 acres are irrigable.¹⁹ Construction of flood control structures, drainage canals, levees, and a more complex irrigation system was soon begun in the district, which mitigated major flooding, drainage problems, and soil alkalinity. But other environmental problems

16. J. R. Watson, "Plant Geography of North-Central New Mexico," *Botanical Gazette*, 54 (July–December 1912), 199–200.

17. C. L. Forsling, "The Rio Grande Valley in New Mexico—Its Present and Future," *Journal of Forestry* 48 (September 1950), 439–41; Vincent C. Kelley, *Albuquerque: Its Mountains, Valley, Water and Volcanoes* (Socorro: New Mexico Bureau of Mines & Mineral Resources, 1982), 18–19.

18. Mary P. Davis, "Farming along the American Nile," *Century Magazine*, 2 (December 1982), 9–13.

19. Middle Rio Grande Conservancy District, *Development Statement for the Middle Rio Grande Conservancy District* (Albuquerque: Middle Rio Grande Council of Governments of New Mexico, 1980), I-1, I-3.



This view along the Rio Grande below Rincon was captured by an illustrator for *Harper's New Monthly Magazine* for an article on the Southwest in 1884.

resulted from changes in the hydrologic dynamics of the region. One notable impact was vegetative changes caused by a lowering of the high water table in the Rio Grande valley. A lower water table resulted from drainage projects undertaken by the conservancy district. All five types of flood plain plant communities identified by Marjorie Van Cleave experienced varying degrees of environmental changes between 1923 and 1935. Two of these communities, lakes and swamps, virtually disappeared, but remnant components survived along ditches and drainage canals. Another association, wet meadows, was drying up. Cottonwood and willow in the bosque and "fringing woodlands" (along the edge of the river) were decreasing, while the recently introduced salt cedar and Russian olive were increasing, especially in the southern portion of the conservancy district. These two species, exotic phreatophytes, have deeper root systems and can tolerate higher soil alkalinity than cottonwood and willow. Increased alkalinity resulted as dams and channelization ended periodic flooding, which had flushed the alkali from river valley soils.²⁰ Native cottonwood, which requires

20. Van Cleave, "Vegetative Changes," 4-31, 42-44.

a fairly high water table and periodic flooding for survival, began to decrease.

Meanwhile, a number of introduced species invaded the bosque. Nurserymen introduced salt cedar (tamarisk) from Eurasia into the eastern United States in the early 1800s. The U.S. Department of Agriculture began cultivating salt cedar in the mid-nineteenth century and by 1868 listed six species that had been established at the arboretum in Washington, D.C. By this time, nurseries in California offered salt cedar for sale, and it escaped from cultivation in the 1870s.²¹ The earliest report of salt cedar growth in New Mexico was in 1910 near Mesilla Park. A few seedlings were reported growing on the delta of Lake McMillan on the Pecos River. Some salt cedars were included in a shipment of exotic plants which the City of Albuquerque and the U.S. Forest Service purchased from the Stark Brothers Nursery in Missouri in 1919. Within a few years seedlings were growing along the city's irrigation ditches, and by the early 1930s, salt cedar invaded the bosque.²² Thriving on increasing salinity and a continuing high silt load of the Rio Grande and helped by planting along stream banks for erosion control, the salt cedar spread dramatically. By 1947, it dominated 60,640 acres of the Rio Grande Valley and consumed an estimated 238,700 acre-feet of water.²³ In recent years salt cedar has become the dominant species on portions of the Rio Grande flood plain, especially south of Bernardo.

Russian olive was introduced at Mesilla about 1903. Within a decade this species was being planted at several locations in the state. Seedlings were reported growing on the flood plain in 1929 and by 1935, Russian olive had become an important component of the bosque. Since 1960 Russian olive has been a major understory component of the valley woodlands from Corrales to Belen. Salt cedar, which is shade intolerant, does not appear to be increasing in the Albuquerque area except where cottonwoods are cleared. On the other hand, Russian olive continues to increase on the Rio Grande flood plain throughout the middle Rio Grande valley.²⁴

21. T. W. Robinson, "Introduction, Spread, and Areal Extent of Salt Cedar (*Tamarix*) in the Western States," *Geological Survey Professional Paper 491-A* (Washington, D.C.: U.S. Geological Survey, 1965), A3-4.

22. Marcus Walton, "The Trees We Love to Hate: Elms," *Albuquerque Journal, Impact*, 7 (April 10, 1984), 4-9; Robinson, "Introduction, Spread, and Areal Extent," A5-7.

23. John Hay, "Upper Rio Grande: Embattled River," in C. Hodge and P. C. Duisberg, eds., *Aridity and Man* (Washington, D.C.: American Association for the Advancement of Science, 1963), 491-98.

24. Michael D. Freehling, *Riparian Woodlands of the Middle Rio Grande Valley*, New

Another introduced species which has spread and invaded portions of the flood plain and uplands from plantings in regional towns and cities is the Siberian elm (*Ulmus pumila*). In Albuquerque, the Chamber of Commerce, the U.S. Forest Service, and the city purchased several hundred exotic trees—among them American elms—to plant in residential areas and public parks in 1919. Championed by Mayor Clyde Tingley, the first Siberian elms soon followed in the late 1920s. This species quickly escaped and became a prominent part of Albuquerque's treescape.²⁵

Spreading in disturbed areas in the bosque, but with less severe ecological-economic consequences than salt cedar and Russian olive, is the tree of heaven (*Ailanthus altissima*). When it was introduced into New Mexico has not been documented, but this native of China was brought to Philadelphia in 1784 and to New York City in the early 1800s.²⁶ Spreading from both seeds and root suckers, the tree of heaven is a rapid grower and is common around older homesites, on abandoned farmland, and along irrigation ditches.

Some might suggest that introducing exotics and other environmental and botanical changes caused by human activity in the prehistoric and historic periods are part of the natural evolution of the bosque. These changes have included clearing of much of the woodland, diminished flooding, a lower water table, increased soil alkalinity, and introduction of highly adaptive, exotic plant species. As a result of these impacts, the valley cottonwood and associated flood plain vegetation, such as willow, cattail, bulrush, salt grass, sedge, and carrizo, have decreased in density or, in some areas, have disappeared. In contrast, two of the exotics introduced in the early twentieth century, salt cedar and Russian olive, have increased dramatically and in some areas have become the dominant species or have replaced the native species completely.

With continued incursion of these exotics, continued development on and along the flood plain and increased recreational use, what is the future of the bosque in New Mexico? In recent years a growing government and public concern over this riparian greenbelt, especially in and around Albuquerque, has resulted in establishment of the Rio

Mexico: A Study of Bird Populations and Vegetation with Special Reference to Russian-olive (*Elaeagnus angustifolia*) (Albuquerque: U.S. Fish and Wildlife Service, 1982), 10; Hink and Ohmart, *Middle Rio Grande Biological Survey*, 71.

25. Walton, "The Trees We Love to Hate," 6-8.

26. Edmund Newton, "Arboreal Riffraff or Ultimate Tree?" *Audubon*, 88 (July 1986), 12, 14, 16, 18-19.

Grande Valley State Park, the Rio Grande Nature Center, and the Corrales Bosque Preserve. This is a good beginning, but how should these and other areas of the bosque be managed, especially the vegetation? Should the planting of exotics like Russian olive, which has been the recent policy at the Rio Grande Nature Center, be continued? Or should the exotics be removed and the indigenous species such as valley cottonwood and willow be proliferated by planting seedlings? Irrigation flooding of these young plants probably would insure survival and rapid growth.

Whatever management decisions are made now will determine future changes in the constituent species of the bosque. Two results seem likely. One, if no direct alteration of the bosque is attempted, then the historical increase in the density and dominance of salt cedar and Russian olive will continue until they become the climax vegetation for the entire bosque. Or, second, valley cottonwood and willow species will be restored to their former dominance, an ecological condition that has existed along the Rio Grande for at least a million years.