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CHAPTER 12

Rumblings in Rio Arriba: Landscape Changes in the Southern Rocky Mountains of Northern New Mexico

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This chapter focuses on human effects on the landscape ecology of the southernmost realm of the Rocky Mountains, the Rio Arriba region of northern New Mexico. Here the Rocky Mountains end with the Sangre de Cristo and Jemez Mountains, which flank the eastern and western sides, respectively, of the Rio Grande valley (plate 6). I define the Rio Arriba (Upper River) area to be the mountainous region astride the Rio Grande from the Colorado border south to the mouth of the Jemez River at Santa Ana Pueblo. Large upland portions of Rio Arriba are contained in Santa Fe National Forest and Carson National Forest, which together constitute about 1.6 million hectares (ha), or 4 million acres.

Human Societies and Land Use History of Rio Arriba

The landscapes of Rio Arriba bear the imprint of a long history of human activity. Paleo-Indian presence extends back approximately 11,000 years, and these hunters very likely contributed to the extinctions of many large mammal species during that time (Stuart and Gauthier 1988, Alroy 2001). Resident hunting and gathering peoples had only modest effects on the regional landscape because of their small numbers and high mobility, their level of technology, and the ubiquity of natural fire ignitions in this region (Allen 2002). Over the past 3,000 years, the ancestors of modern Puebloan peoples, the Anasazi, adopted

an agricultural lifestyle. By 1200 B.P., Rio Arriba was a major zone of settlement for ancestral Puebloans, as documented by the extremely high densities of archaeological sites found today (see, e.g., Powers and Orcutt 1999). These agricultural peoples developed large populations and affected their environment through clearing of woodlands, agriculture, and hunting (Betancourt and Van Devender 1981, Periman 1996, Allen 1996). By the time of Spanish contact in the sixteenth century, the Puebloans of Rio Arriba had moved from upland mesas to adjoining river valleys, except in the vicinity of modern Jemez Springs. Today, fourteen long-settled Puebloan communities are still found along the major valley steams in Rio Arriba; all these sites have been occupied for 400 to 800 years. These long-enduring people see Western civilization as unsustainable and are planning to outlast it (Stuart 2000).

Spaniards colonized Rio Arriba in 1598 B.P., establishing missions among the Puebloans. The Spanish introduced additional food crops, new technologies and cultural practices, and domestic livestock. Hispanic settlements and land uses were focused on the lowlands and valleys of Rio Arriba, where there was suitable agricultural land, water, and communal protection from the attacks of nomadic Navajos, Utes, Apaches, and Comanches. These dangerous tribes used the uplands until the 1860s, constraining use of the mountains by the more settled Indo-Hispanic peoples of the valleys (deBuys 1985). Northern New Mexico remained a remote peripheral territory of first New Spain and later Mexico, after Mexican independence in 1821.

Anglo-American penetration of the region in the 1820s eventually led to the Mexican War and annexation by the United States. With the Treaty of Guadalupe Hidalgo in 1848, which ended the war, Rio Arriba became part of the United States. Large portions of communal land grants awarded during Spanish and Mexican governance were lost to Hispanic villages and eventually ended up in Santa Fe and Carson National Forests, where controversy persists between rural Hispanic communities and others over control and management of these lands (deBuys 1985, Atencio 2001).

The arrival of railroads in Rio Arriba in 1880 reduced the economic isolation of the region, leading to intensification of commercial livestock grazing and logging activities (deBuys 1985, Rothman 1992). Communities such as Española sprang up at railheads. New Mexico became the forty-seventh state in 1912. A modest tourism industry developed. Until World War II, the Land of Enchantment remained a sparsely populated, relatively unknown state with an impoverished agricultural economy.

The successful creation of the first atomic bomb in 1945 by the secret Manhattan Project at Los Alamos transformed the economy of this region, leading to broad landscape changes (Rothman 1992). Los Alamos became the nation's

preeminent nuclear weapons laboratory. By importing highly educated scientific personnel from throughout the country, "the Lab" created an affluenr island of external cultural values amid the traditional agrarian cultures of Rio Arriba.

The development of Santa Fe as a major arts center and tourist destination has further fueled economic and population growth in Rio Arriba. New Mexico in general, and Rio Arriba in particular, have experienced rapid population and economic growth in recent decades (figure 1.1). New Mexico's population increased by 78.9% from 1970 to 2000, growing from 1.0 million to 1.8 million people. With a 20.1% growth rate during the 1990s, it ranked twelfth nationwide, ahead of Montana and Wyoming but lagging behind the extraordinary growth of the other Rocky Mountain states. The five New Mexico counties that constitute the bulk of Rio Arriba all experienced rapid population growth after 1990, with the exception of tiny, landlocked Los Alamos County, where a shortage of privately owned land constrains population expansion.

Increasing affluence and changing lifestyles regionally and nationally have driven substantial land use changes in Rio Arriba, teflected in the growing prominence of year-round recreation and tourism attractions. Northern New Mexico has become a magnet for a variety of visitors. The Jemez Mountains attract outdoor enthusiasts to Santa Fe National Forest, Bandelier National Monument, a state park, three designated wilderness areas, a wild and scenic river, Jemez National Recreation Area, and the newly established Valles Caldera National Preserve. Seven ski areas attract winter use. Native Americans are cashing in on tourism too, with four pueblos developing golf courses and resort centers. Casinos have sprouted across Rio Arriba on seven pueblos and on Jicarilla Apache land. This leads to such ironies as the Cities of Gold Casino at Pojoaque Pueblo, where Native Americans have found an easy way to collect money from the descendants of European conquistadores and colonists.

Rio Arriba is no longer an isolated economic and cultural backwater of the United States; it is a desirable and trendy place to live, like many other portions of the Rocky Mountains. With population growth and increased incomes has come substantial conversion of agricultural lands to residential use, with a proliferation of both house trailers and trophy homes. Substantial upgrades of highway networks contribute to the accelerating sprawl by reducing driving time from outlying areas. With increased use of flexible work schedules, the emergence of telecommuting, affluent retirees, and the demand for vacation homes, no place is too remote to develop anymore.

This has brought substantial changes in the landscape around Los Alamos, as an example (Allen 1989). Human-dominated cover accounted for only 0.9% of the 86,000 ha, or 212,000 acre, landscape in 1935, primarily as dry-farmed fields. By 1981, humanized patches covered 6.3% of the landscape as farms

were replaced by Los Alamos National Laboratory and the townsites of Los Alamos, White Rock, and Cochiti Lake. Other new cultural features by 1981 included two golf courses, a ski area, Cochiti Dam and Reservoir, and multiple pumice mines and stock ponds. Such developments increasingly fragment the montane wildlands of the southern Rockies.

With the arrival of well-to-do immigrants, property values in Rio Arriba have skyrocketed, putting increased economic (and cultural) pressure on natives. Santa Fe, the City Different, is turning into a wealthy pseudo-adobe caricature of itself, where many natives can no longer afford to live. Pockets of poverty and affluence often occur in close proximity, highlighting trends of increasing disparity. Yet the winter pall of wood smoke increasingly hangs over all Rio Arriba communities alike, whether from subsistence heating and cooking stoves in rural Las Trampas or from decorative fireplaces in the upscale Las Campañas development near Santa Fe. Regional quality of life increasingly depends on communal appreciation and thoughtful management of the shared environment.

In the sections that follow, I amplify two particular land use topics: (1) human alteration of upland forests and grasslands and (2) development and degradation of water resources in Rio Arriba.

Anthropogenic Alteration of Upland Forests and Grasslands

Forests in the southern Rockies have been extensively exploited for timber production for more than a century (deBuys 1985, Rothman 1992). Historical forest harvest practices include targeted removal of most old-growth trees and the construction of extensive road networks to support timber extraction (see, e.g., Allen, Betancourt, and Swetnam 1998). However, the most pervasive human effects on Rio Arriba forests have been indirectly caused by the combination of historical livestock grazing and fire suppression.

There were 5.4 million sheep and 1.4 million cattle present in New Mexico by the mid- to late 1880s (chapter 5; Wooton 1908). Consumption of herbaceous plants and trampling contributed significantly to accelerated erosion rates and arroyo development (Cooperider and Hendricks 1937, Davenport et al. 1998). Cattle numbers remained fairly constant and sheep numbers dropped tenfold in the twentieth century (Bogan et al. 1998), yet the consequences of grazing remain an ecological and social problem in parts of Rio Arriba, particularly in riparian areas, where cattle tend to congregate. Elk, reintroduced into Rio Arriba in the 1900s, also cause substantial ecological effects through herbivory of herbaceous and woody plants (Allen 1996).

A major consequence of intensive landscape-wide grazing was inadvertent suppression of surface fires from many forests and grasslands as livestock ate

the herbaceous fuels that had previously allowed low-intensity fires to spread (Swetnam, Allen, and Betancourt 1999). Active fire suppression then became institutionalized as policy by the federal government after severe fires in 1910 (chapter 7). Regional vegetation changes caused by both grazing and fire suppression include invasion of grasslands by trees and shrubs, increased density of woody species and accelerated erosion rates in piñon-juniper woodlands, and conversion of many open ponderosa pine and mixed conifer forests into thickets dominated by young trees (chapters 10, 11).

Consider the decline of montane grasslands in the Jemez Mountains. Montane grasslands are found on the upper south-facing slopes of nearly all the larger summits and ridge crests. Deep prairie-type soils indicate that grasslands have persisted on these sites for thousands of years, yet a tidal wave of young ponderosa pine, Douglas-fir, and aspen have been invading since the 1920s (Allen 1989; Swetnam, Allen, and Betancourt 1999). Between 1935 and 1981, tree invasion reduced the area of open montane grasslands by 55% across the southeastern Jemez Mountains (Allen 1989; Allen, Betancourt, and Swetnam 1998). Similar tree and shrub invasions are also observed in many other open vegetation types throughout northern New Mexico, including blue spruce encroachment on moist meadows in Valles Caldera National Preserve, Engelmann spruce invasion of subalpine parks in the Pecos Wilderness and San Pedro Parks Wilderness, and the spread of juniper, sagebrush, and snakeweed into valley grasslands (Bogan et al. 1998).

The regional land use history of overgrazing and fire suppression has altered many piñon-juniper woodlands, which were formerly more open and had well-developed herbaceous ground covers. Since the late 1800s, fire-sensitive piñon and juniper trees became established in higher densities, competing with the remaining grasses for water and nutrients. Thus, a positive feedback cycle was initiated that favors tree invasion and decreased herbaceous ground cover in these semi-arid woodlands, where intense thunderstorms on exposed soil generate substantial runoff and accelerated erosion.

Woodland soils in Bandelier National Monument are eroding at rates of about 1 centimeter (cm), or 0.4 inch (in.), per decade (Davenport et al. 1998; Sydoriak, Allen, and Jacobs 2000). Given soil depths averaging only 30–60 cm (12–24 in.) in many areas, these erosion rates are clearly unsustainable and will result in the loss of entire soil bodies across extensive areas. Accelerated runoff and erosion has damaged more than 90% of inventoried archaeological sites at Bandelier (Sydoriak, Allen, and Jacobs 2000). In this park, my colleagues and I have found as many as 1,040 cultural artifacts (mostly potsherds) moved by a single thunderstorm into a sediment trap draining only 0.1 ha, or about 11,000 square feet (ft.^{2}), of gentle hillslope. The park's biological productivity and cultural resources are

literally washing away. Similar histories and high erosion rates characterize many piñon-juniper woodlands, resulting in considerable transport of sediment through watersheds, with associated effects on water quality (Bogan et al. 1998). Without management intervention, this human-induced episode of accelerated soil erosion appears to be irreversible (Sydoriak, Allen, and Jacobs 2000).

Tree densities have burgeoned approximately tenfold in many ponderosa pine and mixed conifer forests over pre-1900 norms as the result of a century of fire suppression (Bogan et al. 1998; Swetnam, Allen, and Betancourt 1999). Relatively open forests dominated by older trees and with herbaceous ground cover have been converted into thickets of young trees with heavy fuel loadings of needles and logs on the forest floor. Fire-sensitive and shade-tolerant species such as white fir and Engelmann spruce now dominate, increasing the potential for widespread outbreaks of western spruce budworm (Swetnam and Lynch 1993). Montane forests in Rio Arriba are increasingly experiencing stand-replacing crown fires, such as the 1977 La Mesa Fire, the 1996 Dome and Hondo Fires, the 1998 Oso Fire, and the 2000 Cerro Grande and Viveash Fires (plate 6, figure 12.1). Extensive crown fires are not natural in lower-elevation forests in this region (Allen 2002) and cause many undesirable ecological and social effects. The Cerro Grande Fire killed nearly every tree in a 39 square kilometer (km^2), or 15 $mi.^2$, patch adjoining Los Alamos that included key habitat for the endemic Jemez Mountains salamander and threatened Mexican spotted owl (figure 12.1). The fire triggered downstream flooding that has affected the infrastructure of the townsite and national laboratory because such fires increase peak flows approximately a hundredfold (Veenhuis 2002). The Cerro Grande Fire was the first fire in American history in which postfire watershed rehabilitation cost more than the fire suppression efforts, reflecting the regional trends of increased fire severity and human values at risk.

Trees in overcrowded forests and woodlands are subject to more water stress in dry years. When multi-year drought returns to this region, as occurs every few decades, extensive forest dieback and enormous wildfires are likely (Allen and Breshears 1998, Swetnam and Betancourt 1998). Global climate change will quite likely increase the frequency and magnitude of extreme climatic events such as drought, along with associated dieback and fires (Breshears and Allen 2002).

Agua es Vida: Development and Degradation of Water Resources

Agua es vida is a familiar slogan in Rio Arriba, meaning "Water is life." Water availability has long limited human societies in this region because conditions are dry in the lowlands, where people cultivate food crops. People here have

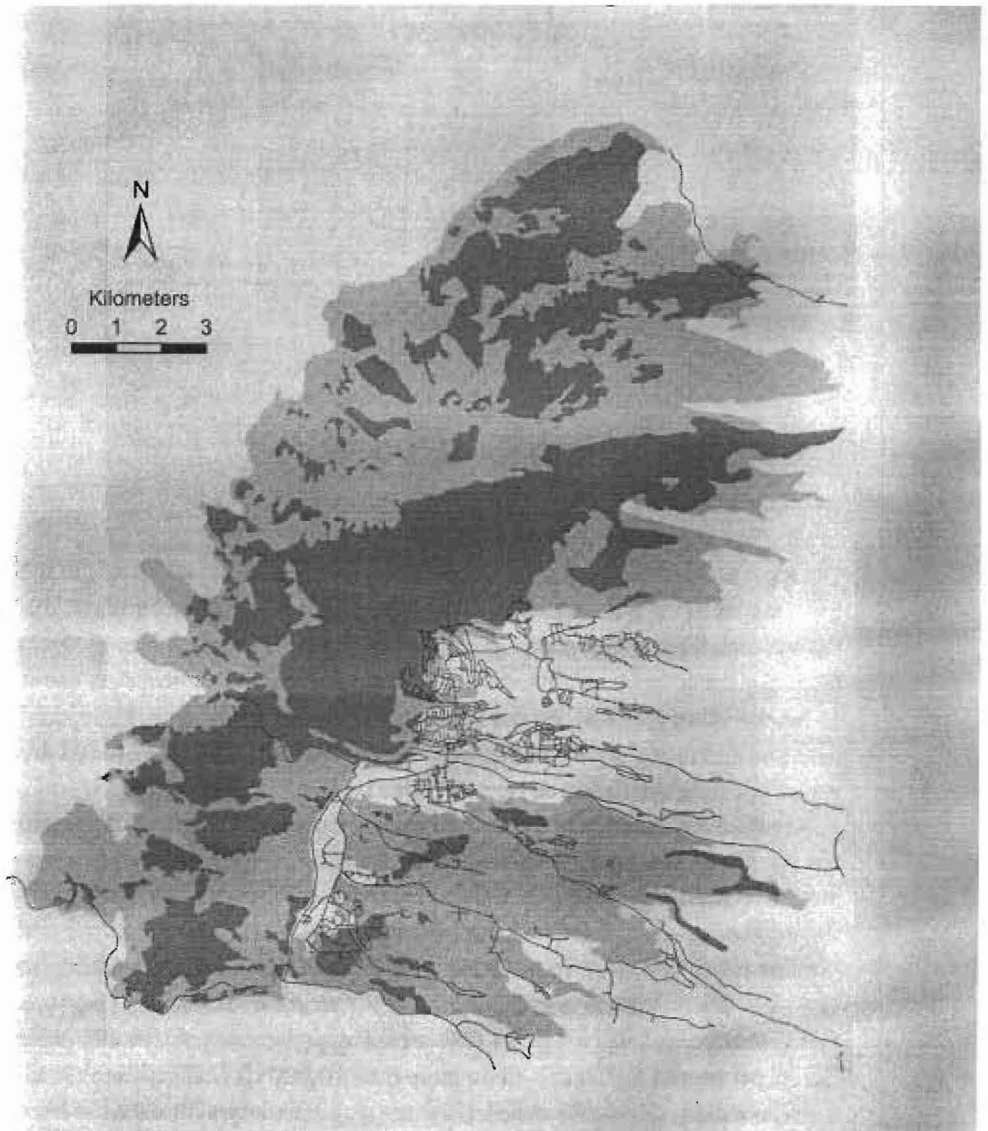

FIGURE 12.1 *Map of the Cerro Grande Fire near Los Alamos.* Lines are paved roads, highlighting urban and industrial land uses embedded in a wildland matrix of montane forests. Dark patches represent areas of crown fire with nearly total tree mortality. Lighter patches represent lower fire intensity. In May 2000, this fire burned into the western side of the townsite of Los Alamos, destroying almost 400 homes. The fire also burned across much of Los Alamos National Laboratory, causing extensive damage.

manipulated water flows for agricultural use and domestic consumption for at least the past 1,000 years. Ancestral Puebloans developed sophisticated means of increasing water availability for their crops, including terraces, check dams, grid gardens, cobble mulch gardens, irrigation diversions, and reservoirs (Powers and Orcutt 1999). Given the substantial human population of this region by the 1500s B.P., agricultural practices must have affected substantial portions of both upland and riparian landscape settings (Periman 1996, Powers and Orcutt 1999).

Local ditch systems known as acequias were developed with Spanish colonization (Rivera 1998). Stream valleys large and small show patchworks of long, narrow fields oriented at right angles to the streams and bordered by acequias. Acequia associations continue to serve as the beating heart of living rural communities in Rio Arriba, maintaining historical patterns of cultural persistence, community cooperation, and agricultural lands as increasingly valuable open space today.

Larger-scale commercial agriculture developed after 1870, particularly in the San Luis Valley of Colorado. The ecology and hydrology of the San Luis Valley was transformed from native grasslands, shrublands, and wetlands into farm fields, facilitated by the construction of extensive drainage and irrigation works across the valley (plate 6). By the late 1800s, flows were substantially reduced in the mainstem of the Rio Grande, sometimes even causing the river to run dry before reaching the Colorado–New Mexico border.

Rio Arriba rivers have been markedly altered by the construction of dams to control floods, reduce downstream sediment loads, and store water. The completion of Cochiti Dam in 1975 (figure 12.2) altered the ecology and hydrology of the Rio Grande both upstream and downstream (Allen, Hanson, and Mullins 1993; Crawford et al. 1993). This huge dam protects the middle Rio Grande valley downstream (including Albuquerque) from floods, reducing peak flows—historically more than 24,000 cubic feet per second (cfs), or 680 cubic meters per second (m^3/sec.)—to no more than 10,000 cfs (283 m^3/sec.). With the elimination of large flood flows, the ecology of the riparian zone has been greatly altered, resulting in invasion of Russian olive, tamarisk, and Siberian elm at the expense of native cottonwoods and willows (Crawford et al. 1993, Hanscom 2001). Most riparian sloughs and wetlands have also been lost (Crawford et al. 1993). Similar changes have occurred on the Rio Chama, caused by Heron, El Vado, and Abiquiu Dams.

Rio Arriba contains many additional dams on other Rio Grande tributary streams, including the Santa Cruz, Nambe, Jemez, Galisteo, and Santa Fe Rivers (figure 12.3). These dams have had similar downstream effects, individually and cumulatively, of pervasively altering the hydrology of this region by reduc-

FIGURE 12.2 *Cochiti Dam, on the Rio Grande at the Foot of the Jemez Mountains.* A public highway can be seen on the dam crest. This huge earth-fill dam provides flood and sediment control for human purposes downstream. Photograph by Craig D. Allen.

ing peak flows while storing water and sediment. The water and sediment impounded by these dams also have major upstream effects on rivers, ranging from drowning of terrestrial vegetation and blocking of fish migrations to development of new lake ecosystems. Ecosystem development in reservoirs is highly dependent on the magnitude and timing of water fluctuations behind each dam, which vary not only with the vagaries of natural precipitation but also with the authorized purposes of each reservoir and the perspectives of water managers.

Streamflows have obviously been markedly reduced by the extensive diversion of surface water and groundwater for consumptive human purposes, with perennial flows increasingly reduced to unnaturally low levels. Water yields have also declined from mountain watersheds in Rio Arriba because of the great increases in forest density over the past century (figure 12.3). Water yields have dropped because the increasingly closed forest canopies capture more snowfall, which can then sublimate (vaporize) directly back to the sky, and more trees pump more water out of the soil through evapotranspiration. The upper Santa Fe watershed is thought to be yielding 20% less water annually than it did in the early twentieth century (USDA Forest Service 2001).

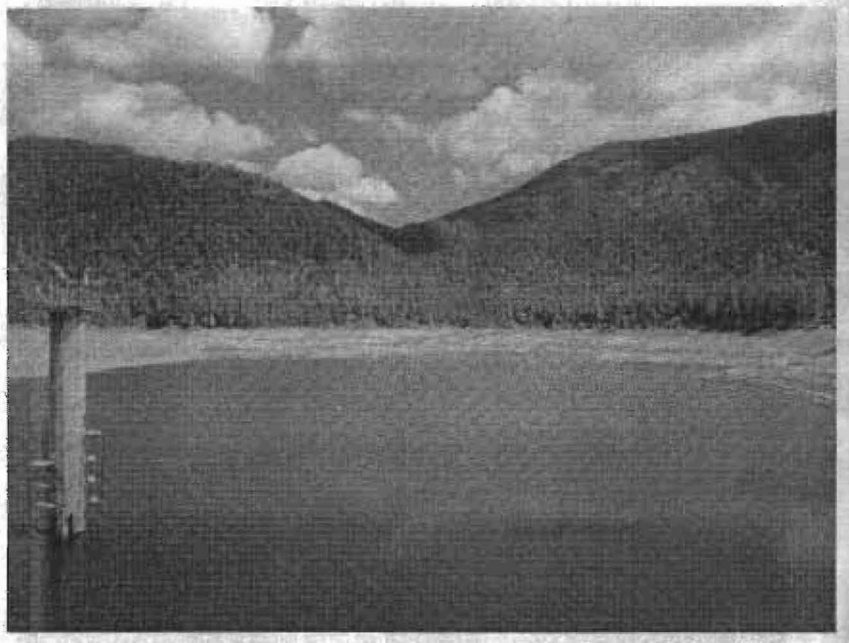

FIGURE 12.3 *McClure Reservoir, one of Two Storage Reservoirs on the Santa Fe River.* Together, the reservoirs provide approximately 40% of the municipal water supply of Santa Fe. McClure Reservoir had been drawn down to low levels after two dry winters when this photograph was taken, in fall 2000. Dense forests in the background are at risk of extensive crown fire, threatening the security of the city's downstream infrastructure and water supply. Photograph by P. S. Tharnstrom.

Water quality in the major streams has been degraded by a variety of human land uses. Extensive road networks and livestock grazing in uplands trigger accelerated soil erosion, resulting in excess sediment and more turbid water in streams. Cattle prefer to graze in riparian zones, trampling stream banks and defecating in streams. As human populations have grown, so have water contamination problems from sewage, solid waste, industrial and household products, and fertilizer and biocide residues from agricultural activities. Biocides that were applied to Rio Arriba forests in efforts to control natural insect "pests" still persist. For example, 423,000 kilograms (kg), or 1,133,622 pounds (lb.), of DDT was sprayed on 478,055 ha (1,846 mi.^{2}) of Santa Fe National Forest and Carson National Forest from 1955 to 1963 in operations against western spruce budworm, and DDT was repeatedly used against tent caterpillars and bark beetles at Bandelier National Monument in 1948–1962 (Allen 1989). A legacy of DDT-contaminated fish and soil remains along lower Frijoles Creek in Ban-

delier, which remains closed to fishing. A unique variety of heavy metal and radioactive contaminants are also part of the Rio Grande system, a legacy of almost sixty years of nuclear weapons research at Los Alamos National Laboratory (Graf 1994).

Altered fish communities provide another measure of human effects on Rio Arriba waters. The native fish communities of Rio Arriba have been decimated by modification of stream habitats and water quality, range fragmentation resulting from dams and engineered channels, and competition from introduced species (Platania 1991). The Rio Grande and Rio Chama, from Abiquiu Dam to Cochiti Dam, were historically inhabited by thirteen native fish species. Of these, six were extirpated in the twentieth century, and seven introduced nonnative species are now present (Platania 1991). One of these extirpated species, the Rio Grande silvery minnow (*Hybognathus amarus*), is a federally listed endangered species that is at the center of controversies over how to manage this river basin (Hanscom 1999). The precarious existence of the silvery minnow reflects the magnitude of ecological change imposed on the Rio Grande since the late 1800s.

Current Trends and Causes for Hope

As is the case elsewhere in the Rocky Mountains, the juggernaut of pervasive human-caused change is sweeping across the landscapes of northern New Mexico. Yet hope for a more sustainable future is brewing in Rio Arriba. There is much cultural and natural continuity and persistence, a certain timelessness, associated with this region. The native Indo-Hispano peoples of Rio Arriba have a long-term affection, a *querencia,* for this land that resists the short-term economic imperatives and carpetbagger ethics of our footloose modern world (Atencio 2001). Newcomers are attracted to this legacy of connectedness and quickly form commitments to the landscape. Even the land management bureaucracies have begun to recognize the value of place-focused approaches to stewardship. Throughout Rio Arriba, efforts are under way to support healthier and more sustainable ecosystems and human communities in the southern Rockies.

Ranchers, environmentalists, and federal land managers are beginning to work together in new ways to solve problems to the benefit of all interests. The Quivira Coalition, based in Santa Fe, has been working to constructively improve rangeland conditions, sustain small-scale Hispanic ranchers in Rio Arriba, keep progressive ranchers on the land, and protect their remaining open spaces from "ranchettization" (Atencio 2001). Toward these goals, The Quivira Coalition and the Santa Fe Group of the Sierra Club recently sponsored a report on

environmental justice and public land ranching in northern New Mexico. The Valle Grande Grass Bank fosters restoration of USDA Forest Service grazing allotments through collaboration among Santa Fe National Forest, The Conservation Fund, and small-scale Hispanic ranchers in groups such as the Santa Barbara Grazing Association, The Quivira Coalition, and the New Mexico Environment Department. The new Valles Caldera National Preserve protects the heart of the Jemez Mountains from subdivision and aims to establish a new model for science-based land management that will support healthy ecosystems and include livestock grazing by local ranchers.

Initial forest restoration efforts are encouraging. Degraded woodlands are treated by thinning young piñon and juniper trees, with the cut branches used to mulch the barren interspaces between older remnant trees (Sydoriak, Allen, and Jacobs 2000). Broad-based coalitions are initiating understory thinning and prescribed burning in overdense forests (USDA Forest Service 2001, Allen et al. 2002). Tree invasion of grasslands and meadows is being checked by similar management efforts (Swetnam, Allen, and Betancourt 1999). These restoration efforts shift ecological dominance back toward the natural pattern of more abundant herbaceous vegetation in most local ecosystems. This should also help resolve public range management conflicts by providing additional grazing capacity in upland settings, away from the environmental conflicts associated with grazing in riparian zones.

Water managers are adopting ecologically friendly approaches to reservoir operations. Episodes of highly fluctuating and long-term water storage in Cochiti Reservoir from 1978 to 1988 killed all vegetation that existed before construction of the reservoir, leaving bare sediment along the river and a dead zone like a bathtub ring extending as far as 37 m, or 120 feet (ft.), above river level and more than 24 stream km, or 15 stream mi., above the dam (see the photograph of McClure Reservoir in figure 12.3). Yet the legal authorization for this dam supports its use only for short-term floodwater storage that can be managed to mimic natural patterns of flooding (Allen, Hanson, and Mullins 1993). A permanent pool of 486 surface ha (1,200 surface acres) has been established at Cochiti Reservoir for conservation of fish and wildlife resources and recreation. Interactions among biologists and water managers from many entities, including pueblos and multiple agencies, resulted in more sensitive management of Cochiti Reservoir since the early 1990s, providing a measure of stability to the upstream environment that is allowing productive new ecosystems to develop. An ever-growing wedge of delta sediments at the slack headwaters of the reservoir is creating a complex environment of sediment bars, wetlands, and sloughs that resembles the preregulated condition of the Rio Grande (Allen, Hanson, and Mullins 1993; Crawford et al. 1993).

There has been a striking resurgence of ecological health in the reservoir area as vegetation has gtown back in the delta, including extensive wetlands and exuberant young thickets of native willow and cottonwood, which are rare elsewhere today along the flood-starved Rio Grande. This is a modest ecosystem management success story. If well managed, Cochiti Reservoir will continue to develop as a diverse and productive ecosystem occupying a strategic position on the Rio Grande flyway, a major migratory bird corridor. Already the reservoir is used by thousands of migratory waterfowl and songbirds as well as overwintering bald eagles. Alternatively, if Cochiti Reservoir is managed like a bathtub, solely for external human purposes and with indifference to its ecological condition and potential, it could end up a degraded and unproductive mudhole, as it was in the late 1980s. Given the unrelenting pressure for increased utilitarian efficiency and control of water resources in New Mexico, the ultimate fate of the Rio Grande and Cochiti Reservoir will be determined by choices yet to be made by our society.

Success at sustaining ecological health in the southern Rockies is uncertain. Yet Rio Arriba is abuzz with myriad creative efforts to build a harmonious landscape community. Involvement occurs at all levels: acequia associations and environmentalists, land trusts and federal agencies, river runners and ranchers, scientists and schoolchildren. Unique approaches to land stewardship will arise as local Native American and Hispanic people reassert their sovereignty and their cultural traditions of land as a community to which humans belong, and as newcomers become more deeply rooted and make commitments to this place. I am hopeful that these diverse efforts will collectively weave a strong fabric of long-term care for the wonderful landscapes of Rio Arriba.

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