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Cows, Condos, and the Contested Commons: The Political Ecology of Ranching on the Arizona-Sonora Borderlands

Thomas E. Sheridan

Despite the rapid urbanization of the Arizona-Sonora borderlands, cattle ranching continues to play a major, if increasingly contested, political, economic, and ecological role in the region. Unlike other industries, technological manipulation has failed to increase productivity in the range cattle industry. The constraints of aridity and climatic variability have not been overcome. Ranchers on both sides of the border therefore need access to large tracts of land to secure the natural forage their cattle need. Spain and Mexico both recognized communal as well as private forms of tenure, even though neoliberal reforms are weakening *comunidades* and *ejidos*. The United States, in contrast, has no communitarian tradition, and U.S. homestead laws never allowed individuals to preempt enough of the public domain to support a cow outfit. Instead, grazing allotments on both federal and state lands provide ranchers with exclusive rights to forage. Those rights are increasingly challenged by some environmentalists, who want cows off public lands. Faced with rising land prices, unstable markets, an unpredictable climate, enormous estate taxes, and increasing political uncertainty over their access to public lands, many ranchers choose or are forced to sell their private land to real estate developers or subdivide it themselves. The resulting fragmentation of the landscape and increasing densities of people deplete water resources and make large-scale ecosystem management, including the preservation of wildlife corridors and the reintroduction of fire, difficult if not impossible.

Key words: grazing commons, ranching, environmentalism, real estate development, water, Arizona-Sonora borderlands

Of all the extractive industries that dominate rural Arizona and Sonora, cattle ranching is the most widespread, penetrating every desert valley and mountain range (Peña and Chávez 1985; Sheridan 1995). More than a million cattle wander across the region's arid and semi-arid deserts and grasslands, and no other activity except dam building and groundwater pumping has affected the environments of Arizona and Sonora as profoundly.

Ranching is also one of the most mythologized, demonized, yet least understood industries in the western United States and northern Mexico. In Arizona, for example, most ranches are a mosaic of public and private lands. Information about the individual allotments that constitute a ranch may therefore be scattered in the offices of the U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the state land department. None of these agencies—or any other state or federal agency—collects socioeconomic data on ranching households.

Another reason for the paucity of information about the modern livestock industry may be the overwhelmingly urban nature of society in both Arizona and Sonora. World War II and the postwar boom transformed both states. An economy dominated by rural extractive industries, particularly copper mining, cotton farming, and cattle ranching, is now driven by urban service and manufacturing sectors. In Arizona, more than 90 percent of the population live in cities and towns (Sheridan 1995).

Nonetheless, ranching continues to play a major, if increasingly contested, political, economic, and ecological role on the both the Arizona and Sonoran landscapes. There are about 270,000 sheep—mostly on the Navajo Reservation—and 800,000-900,000 cattle in Arizona (Eakin 1997; Ruyle 1991). More importantly, ranching is the most land-extensive industry in Arizona and has been since the cattle boom of the 1880s, when cattle and sheep quickly spread across the entire Arizona territory (Sheridan 1995). According to range scientist George Ruyle (1991:85), "Approximately 86% of the 62.4 million acres of Arizona surface is rangeland, defined by its ability to support vegetation suitable for grazing animals." In absolute terms, the livestock industry may be a minor part of modern Arizona's economy, but ranching leaves its ecological, economic, political, and cultural imprint on rural landscapes and rural communities throughout the state.

Thomas E. Sheridan is curator of ethnohistory at the Arizona State Museum and professor of anthropology at the University of Arizona. Research for this article was partially funded by grants from the Udall Center for Studies in Public Policy at the University of Arizona and the National Oceanic and Atmospheric Administration, which supports the CLIMAS Project (NA86GP0061) at the University of Arizona.

Environmental Constraints

Conversely, those landscapes have left their imprint on ranching more than any other sector of Arizona or Sonora's economy. The urbanization of the Arizona-Sonora borderlands represents a triumph, however temporary, over desert constraints. Those desert constraints still dominate ranching. In his analysis of the transformation of Buenos Aires Ranch into Buenos Aires National Wildlife Refuge on the Arizona-Sonora border, anthropologist Nathan Sayre (1999:205-206) concludes:

Millions of dollars of public research, government support and ranchers' investments have aspired to control the natural processes upon which cattle reproduction and growth depend, but it cannot be concluded that they have succeeded. The pastoralist basis of range livestock production—reliance upon nature to do the value-producing work—has stubbornly refused to submit to technological manipulation.... It is time to acknowledge that dominating the range through scientific-technical manipulation has failed (Holling and Meffe 1996; Nelson 1995), and that improvement in range conditions will only be realized by embracing, rather than eliminating, the pastoralist element of ranch production.

Climate is the strongest, and most intractable, natural constraint on ranching in Arizona and Sonora. The southwestern United States and northwestern Mexico are hot and dry, primarily because of a subtropical high-pressure ridge that settles over the region for much of the year. Average annual rainfall in Arizona is only 322 millimeters (12.7 inches). As much as 50 percent of that precipitation falls at the hottest time of the year (July through September), when evapotranspiration rates are highest. A secondary maximum occurs during the winter (November through March), when cyclonic storms bring an average 30 percent of the annual rainfall (Sheppard et al. 1999). Ranchers therefore face extended dry periods in the fall and especially the "foresummer" (April through June), even during years of above-average precipitation.

An even greater challenge is the pronounced seasonal and annual variability of rainfall. The Southwest and northwestern Mexico lie between the subtropical and mid-latitude atmospheric circulation regimes, so periodic shifts in either regime trigger seasonal, annual, and even multiyear changes in the southwestern climate. Both the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation affect climatic variability during the winter.¹ During the summer, the North American monsoon—the major climatic pattern that distinguishes the Southwest from the rest of North America—exhibits great diurnal, intraseasonal, and seasonal variability.² Within a single monsoon season, periods of intense thunderstorms known as "bursts" alternate with drier periods called "breaks." Moreover, thunderstorms are often highly localized due to differential patterns of surface heating and convection. Consequently, ranchers have to contend with years of below-average winter rainfall, summer rainfall, or both.

Sometimes these droughts last for several years or more. One of the four most prolonged droughts in the United States occurred from 1950 to 1956—it was the worst drought in the Southwest during the 20th century. It was preceded by a series of dry summers during the 1940s and a return to dry conditions from 1962 to 1968. Based on the analysis of southwestern tree-ring records, this dry period rivaled the prolonged droughts of 1575-1595, 1667-1681, and 1730-1750 (Betancourt et al. 1993). During the 1990s alone, severe droughts in 1995-1996 and 1998-1999 withered ranges and dried up stock tanks, forcing many ranchers to haul water, buy feed, and reduce their herds.

Because of aridity and climatic variability, grasses and browse plants are not abundant. Hot desert shrublands like the Sonoran Desert produce 150-500 kilograms (kg) of forage per hectare (ha) compared to the southern mixed prairie, the most important rangeland type, which produces 1000-2500 kilograms per hectare (Holecheck, Piper, and Herbel 1998). Most hot desert plants, including grasses, are warm-season. They start growing in the spring, but rates of growth depend upon available moisture. In areas of severe and prolonged overgrazing, unpalatable half shrubs like broom snakeweed (*Gutierrezia sarothrae*) or annuals have replaced perennial grasses. Ranchers on degraded ranges may rely almost entirely upon herbaceous ephemerals because grasses have largely disappeared. In the north-central *municipio* (roughly analogous to a U.S. county) of Cucurpe, Sonora, winter ephemeral production is critical because it coincides with the onset of the driest time of the year (April-June). When winter rains fail, cows do not calve, and ranchers have to resort to drastic emergency measures such as singeing the thorns off prickly pear cactus to keep their cattle alive (Sheridan 1988).

Political (Dis)Solutions

Because of aridity, climatic variability, and sparse forage, the range cattle industry in Arizona and Sonora requires large tracts of land. Typical animal-land ratios on Arizona ranches range from eight to twelve animal units (defined as a mother cow with calf) per section (640 acres). Sonoran ranges are often grazed more intensively but suffer greater degradation as a result. My figures for the *municipio* of Cucurpe in 1980-81 reveal land-animal ratios of 6.74 hectares (16.7 acres) per animal unit for Cucurpe's peasant corporate communities and 8.59 hectares (21.3 acres) per animal unit for private ranches. The former federal Department of Agrarian Reform estimated that the carrying capacities of those ranges were at least 26 hectares per animal unit. Cucurpe ranchers were running three to five times as many animals as their ranges could support, making the cultivation of forage crops in their fields essential to the survival of their livestock (Sheridan 1988).

The first political problem ranchers face, then, is how to secure access to large amounts of rangeland with adequate water sources. Because cattle ranching developed on both

sides of the border under frontier conditions, the Spanish, Mexican, and U.S. governments have played pivotal roles in the ranching industry. Land unclaimed by recognized Indian communities was considered property of the Spanish crown, the Mexican Republic, or the United States. Sooner or later, those governments attempted to regulate access to these immense lands.

Despite facing similar environments in Arizona and Sonora, however, the governments of Spain and Mexico developed land policies that differed in fundamental respects from the land policies of the United States. Spain and Mexico both recognized communal as well as private forms of land tenure. Spanish peasant and Mexican indigenous communities, including Jesuit and Franciscan missions, usually held common lands, where all legitimate members of a community had the right to pasture their animals and to gather building material, fuelwood, and wild foods (Sheridan 1988; Vassberg 1974, 1984; Wolf 1957). These peasant corporate communities were called *comunes* or *comunidades* and served as models for the modern *ejido* system created after the Mexican Revolution. *Comunidades* and *ejidos* give small stockraisers (those with 50 head or less) access to rangeland and enable them to remain in ranching.

In Sonora, neoliberal economic reforms and changes in Article 27 of the 1917 Mexican constitution are eroding the foundations of agrarian reform and the *ejido* system. Private ranchers and neoliberal government officials accuse *ejidatarios* (members of *ejidos*) and *comuneros* (members of *comunidades*) of degrading their ranges through overgrazing. The so-called social sector is also considered less productive because *comuneros* and *ejidatarios* practice little or no selective breeding and clutter their ranges with nonmarketable animals such as burros and horses. *Ejidatarios* and *comuneros* counter that private ranchers often exceed the legal limits on private rangeland imposed by the agrarian reform code. Mexican and U.S. environmentalists also denounce private ranchers for destroying immense tracts of native desert and subtropical thorn forest vegetation to plant buffel grass (*Pennisetum ciliare*), an invasive species from Africa. Issues of equity and the environment dominate the debate over ranching in Sonora.

The United States, in contrast, has no such communitarian tradition. During the 19th century, federal land policy was dedicated to the principle that most lands in the public domain suitable for agriculture or other agrarian pursuits should be transferred into private hands. The government carried out that transfer in three major ways: 1) outright sale, often to land speculators; 2) grants to veterans or to corporations such as canal companies or railroads in return for the development of transportation networks; and 3) preemptions and homesteads to individuals to satisfy western demands for free land and Jeffersonian yearnings for an agrarian society composed of independent small farmers and ranchers (Foss 1960).

By the late 19th century, when the cattle industry boomed in Arizona, the cornerstone of the third process was the

General Homestead Act (1862), which enabled individuals to acquire up to 160 acres of land. But policies that may have worked in the humid Midwest failed miserably west of the 100th meridian, which marks the 18-inch rainfall line. Both the Desert Land Act (1877) and the Stockraising Homestead Act (1916) increased the amount of land that could be preempted to 640 acres (a section, or one square mile), but even a section of land was woefully inadequate for a stock outfit in arid or semiarid country.³ So even when western ranges were open and unfenced, stockraisers often attempted to solve this fundamental disjunction between land law and the environment by homesteading water sources and claiming exclusive customary use rights to the surrounding range, usually half the distance to the next water source.

If stockraising had developed slowly in Arizona, this mixture of legal and customary tenure might have had a chance to establish itself in a sustainable if not equitable fashion. But the conquest of the Yavapais and Apaches in the 1870s and 1880s—and the completion of two transcontinental railroad lines across Arizona in 1881—coincided with what Sayre (1999:67) calls “a period of massive capital surpluses in the British Empire, far exceeding domestic demand.” Attracted by free grass and high interest rates (1.5-2 percent per month), British investors and lenders poured money into the western range cattle industry. U.S. investors soon followed suit. The Great Plains were stocked and overstocked first. But after drought in the southern Plains led to massive die-offs in 1883-84, ranchers shipped their cattle by rail to other ranges, including Arizona. That massive transfer of livestock accelerated after blizzards killed hundreds of thousands of animals in Montana and the Dakotas during the winter of 1886-87. “It was in response to the crashes of the 1880s, both economic and ecological, that southern Arizona’s rich but fragile desert grasslands became a safety valve for booming livestock numbers,” Sayre writes (1999:73). “Faced with large herds of animals, low market prices, no forage and high debt, operators had little choice but to default or move, and Arizona was one of the last places where free grass remained.”

The result was the tragedy of the commons on Arizona’s open range. In 1870, pioneer stockmen estimated that there were about 38,000 head of cattle in Arizona. By the early 1890s, there were about 1.5 million cattle and more than 1 million sheep grazing the territory with no legal mechanism in place to regulate their numbers. Rampant overgrazing and widespread fuelwood cutting to power mines, crushers, and smelters coincided with an extended drought that lasted with several intervening wet years from 1885 until the early 1900s. The worst years were 1892 and 1893, when 50 to 75 percent of all cattle perished. Carcasses littered watercourses like San Simon Creek in southeastern Arizona, where cowboys had to strain their drinking water through burlap sacks to get rid of the maggots. Arizona looked like a lunar landscape in many places, and some of Arizona’s ranges have never recovered (Hadley n.d.; Sayre 1999; Sheridan 1995).

An American Commons: Grazing Allotments on Public Lands

Despite this ecological and economic collapse, the federal government remained wedded to the General Homestead Act and its variations for more than three decades—with predictable results. Most homesteaders in Arizona who tried to make a living as dry farmers in the early 20th century either failed or converted to stockraising. The legal mechanisms for withdrawing lands from the public domain and transferring them to individuals broke down in Arizona and the arid West because those mechanisms never allowed individuals to preempt enough land to run a cattle outfit.⁴

The only other alternative was to control access to the public domain itself. The history of public-lands ranching during the 20th century was the increasing regulation of stocking rates and the increasing improvement of stock management on federal and state lands. This regulation occurred in the context of a largely 20th century experiment—what historian Donald Worster (1993:104) calls the creation of “an entirely new kind of commons—an American commons—where individuals may go to find natural resources but which no one can take into his or her exclusive possession.”

The creation of that commons began with the establishment of the first forest reserves in the 1890s and early 1900s. To curb the erosion of western watersheds, millions of acres of public domain were withdrawn and placed under federal management. Preservationists like John Muir lost their battle to exclude logging and grazing from the forest reserves when President Teddy Roosevelt transferred them from the Department of the Interior to the Department of Agriculture in 1905 and placed them under the control of the newly created U.S. Forest Service. But conservationists like Gifford Pinchot, the first head of the Forest Service, established the federal government’s right to regulate those extractive activities to make them sustainable. By 1908, there were 17 national forests encompassing 13,163,710 acres in Arizona alone (Sheridan 1995).

Ranching on these “new American commons” was regulated through a system of grazing allotments that granted permittees the exclusive right to forage on the allotments they held. According to Sayre (1999), the apportionment of allotments in Arizona took place in three stages. The first occurred on the national forests in the early 1900s. The second stage unfolded after Arizona was admitted as a state in 1912, when the federal government deeded four sections of land per township to the state to generate revenues to support public education. Because so much of Arizona had already been withdrawn as national forests, Indian reservations, railroad grants, and homesteads, a state selection board was created to choose *en lieu* sections. From 1915 to 1935, the board concentrated on acquiring prime grasslands in central and southeastern Arizona. The state land department then leased these lands to ranchers (Sayre 1999).

The third and final stage extended the allotment system to all unappropriated federal lands in 1934, when Congress

passed the Taylor Grazing Act. Fencing became mandatory. Wild horses and burros were rounded up and sold for tallow, chicken feed, and horse meat. Windmills, stock tanks, and piping from springs to troughs increased the number of water sources and spread stock more evenly across Arizona ranges. Herd sizes dropped while herd quality improved. More and more ranchers sold cattle by the pound rather than by the head, as they began to think in terms of weight rather than sheer numbers. The era of the open range had come to an end.

Modern Public-Lands Ranching in Southern Arizona

Modern ranching in Arizona could not survive without access to public lands. Most ranches comprise a small nucleus of deeded land, sometimes a section or less, combined with various federal and state grazing permits. These permits allow ranchers to run a specified number of animal units for a specified time on an allotment of state or federal land. One-third of all Arizona ranches have allotments administered by two or more public-lands agencies, particularly the Bureau of Land Management and the Arizona State Land Department (Ruyle 1991). According to George Ruyle (1991:85), “The value of a ranch is directly tied to the ability to use the forage on the grazing allotment. Although public-land grazing permits are considered by the agencies to be a granted privilege rather than private property, they are commonly bought and sold along with the rest of the ranch.” If any of these allotments are lost or the number of animal-unit months on them significantly reduced, the economic viability of the entire ranch may be destroyed.

During the last two decades, environmentalist groups have increasingly challenged grazing on public lands. The Forest Guardians and the Center for Biological Diversity in particular have filed a series of lawsuits under the Endangered Species Act that affect allotments on Arizona’s national forests. Recently, some groups have also attempted to replace preferential grazing rights on state trust lands with competitive bidding. Such pressures make ranchers politically vulnerable at a time when declining cattle prices and a four-year drought have subjected them to severe economic stresses.

One major, if unintended, consequence of such pressures is the escalating transition from ranching to real estate development across much of rural Arizona, particularly the grasslands. Faced with rising land prices, unstable markets, an unpredictable climate, enormous estate taxes, and increasing political uncertainty over their access to public lands, many ranchers have chosen or been forced to sell their private land to developers or to subdivide it themselves.

There is a growing movement in Arizona and the West that sees sustainable ranching as a key component in the preservation and restoration of rural ecosystems and communities. Organizations in Arizona such as the Malpais Borderlands Group, the San Rafael Valley Association, the Sonoita Valley Planning Partnership, the Diablo Trust, the Santa Maria

Mountains Group, the Altar Valley Conservation Alliance, and the Arizona Common Ground Roundtable are part of this movement—a movement consisting of what rancher Bill McDonald, a founder of the Malpais Group and a recent MacArthur Foundation award winner, calls the “radical center.” These groups bring ranchers, scientists, and environmentalists together to discover their common ground and establish long-term goals for particular landscapes. These goals include *both* the conservation of biodiversity *and* the preservation of the Southwest’s ranching heritage. James H. Brown, a biologist at the University of New Mexico and past president of the Ecological Society of America who has carried out extensive ecological research in southeastern Arizona and southwestern New Mexico, points out that despite a century or more of intense cattle grazing, the area still has a greater variety of reptiles and amphibians than any other area in the United States. According to Brown, “Far more habitat has been destroyed to provide water for cities, subdivisions, and irrigated agriculture than by even the heaviest grazing pressure. The most serious challenge facing the West is keeping ranches intact” (Clifford 1998:A33).

From Cows to Condos: The Sonoita-San Rafael Valley

Not everyone agrees that cows are better than condos. The transition from ranching to real estate development is reshaping rural communities and landscapes across the West, yet this widespread phenomenon has received little serious study. My colleagues and I at the Arizona State Museum and the Office of Arid Lands Studies of the University of Arizona decided to compare and contrast two high grassland valleys with similar environments and histories in southeastern Arizona to examine what fuels the transition and what its social and ecological consequences are. To do so, we conducted structured interviews with ranchers, real estate agents, federal and state land managers, and people who had purchased property in all of Sonoita’s subdivisions. Research began in 1996 and continues today. Separate questionnaires were developed for each of these groups. We completed analyses of the demographic and economic impacts of real estate development and tourism in Sonoita, carried out title searches in the Santa Cruz County recorder’s office, and compiled data on the histories, layouts, acreage sizes, and deed restrictions of Sonoita subdivisions. Project personnel also attended meetings of the Sonoita Valley Planning Partnership and the Sonoita Crossroads Community Forum, two local grassroots organizations. The emphasis on Sonoita complements earlier work completed by Hadley and Sheridan (1995) on the San Rafael Valley. Interviews are also being conducted with San Rafael ranchers, The Nature Conservancy, and the Arizona State Parks Board concerning the recent sale of the San Rafael Ranch.

Except for the San Rafael Ranch—22,000 acres of private land that originated as the Mexican land grant of San Rafael de la Zanja⁵—private land in the San Rafael Valley

can be traced back to homesteads strung out along the upper Santa Cruz River and its tributaries. Between 1906 and 1931, 331 homesteads were filed, but 70 (21 %) were relinquished or canceled. Most of the rest passed out of the hands of the original homesteaders as ranches were consolidated into a relatively few big outfits, like the Heady-Ashburn, Lone Mountain, and Vaca, during the drought and depression of the 1920s and 1930s. Today there are 20-some private landowners in the valley, but half a dozen ranches dominate the range. Except for the San Rafael, those ranches could not survive without their Forest Service allotments (Hadley and Sheridan 1995).

The ranches themselves reflect just about every type of ranch ownership in the West. Until its recent purchase by The Nature Conservancy, the San Rafael Ranch was owned and operated for three generations by the Greene-Sharp family. The San Antonio (formerly the Heady-Ashburn), Lone Mountain, and Vaca ranches, on the other hand, have passed through numerous owners, including corporations like Kerr McGee. They are now run by professional ranch managers for individual owners who live on their ranches only part of the year. Nonetheless, those owners desperately want their ranches to remain working outfits, not ranchettes. The San Rafael Valley is one of the few prime grasslands in Arizona that has not yet been carved up into subdivisions.

It has not been an easy fight. In the 1960s, the Pruett and Wray Cattle Company bought the Ki He Kah and San Antonio ranches and announced plans to subdivide 4,300 acres of deeded land in 1971. Their plan called for the creation of 2,000 homesites. That prompted other landowners in the valley to form the San Rafael Valley Association to stop the development. The association fell dormant after Pruett and Wray abandoned their plans and sold the ranches because of concerns over water supply. In 1992, however, the current owner of the Ki He Kah, a German speculator named Count Ferdinand von Galen, subdivided about 1,600 acres of deeded land and sold off a few of the lots. San Rafael ranchers revitalized the association to mobilize against this new threat, and the owner of the neighboring Vaca Ranch actually bought 1,000 acres of the subdivided land to keep it from being developed.

Today, most of the valley remains in ranching, but rising land values and enormous estate and capital gains taxes may force other ranchers to sell their private land. On the San Rafael Ranch, heirs of the daughter of legendary ranching and mining magnate Colonel William Henry Greene faced staggering bills from the Internal Revenue Service after their mother died. Luckily, The Nature Conservancy was able to purchase the ranch and sell its development rights to Arizona State Parks, which holds them in perpetuity. Those development rights constitute 75 percent of the appraised value of the ranch itself. The Nature Conservancy then found a rancher willing to purchase the San Rafael as a working ranch, but neither the present owner nor future owners will be able to use it as anything other than a ranch. In other words, the bundle of private property rights associated with the San

Rafael *no longer includes* the rights to subdivide and develop it as residential or commercial property.

To see what the San Rafael would have become without the intervention of The Nature Conservancy, you must drive north over the Canelo Hills. Like the San Rafael Valley, the Sonoita-Elgin area is plains grassland, a highly restricted life zone occurring at elevations of 4,500 to 6,000 feet. Unlike the San Rafael, numerous ranches have been subdivided in Sonoita during the past 20 years, and a once-open grassland basin has been fragmented into smaller and smaller parcels.

This transition, which began in the late 1960s, has been stoked by the demographic juggernaut that has transformed Arizona from a rural to an overwhelming urban society since World War II. As Arizona's cities have mushroomed, more and more Arizonans want to retire to the countryside or commute from the country to cities like Tucson. In 1989, Sonoita had about 400 homes. By 1995, there were 707 homes in Sonoita—an increase of 76 percent—with a population of about 2,400. Conservative estimates project that population will nearly quadruple to more than 9,000 by 2040 (Naeser and St. John 1998).

Land values have also increased rapidly. Since 1989, the price of land in the Sonoita area has doubled in value, ranging from \$3,500 to \$15,000 an acre. Considering the land market, it becomes increasingly difficult for ranch operators to resist subdivision, especially given the highly variable price of cattle. In the 1990s alone, average national prices paid for feeder cattle (range cattle bound for feedlots) declined from \$80/cwt in 1994 to \$59 in 1996, a drop that threatened marginal and heavily indebted ranching operations. By 2000, prices had climbed back up to \$86/cwt and were as high as \$104/cwt in February 2001.

When ranchers sell off their private land to real estate developers, the size of parcels vary considerably depending upon county zoning regulations and subdivision deed restrictions. The minimum lot size in the Sonoita area is presently 1-3 acres, although grassroots efforts have tried, and failed, to raise the minimum to as high as 18 acres. The resulting land fragmentation usually affects wildlife, native vegetation, and soil cover more heavily than ranching, a land-extensive activity. Parcel owners may rearrange local topography to build houses, corrals, and outbuildings. They may enclose all or part of their properties with fencing that inhibits the movement of large wildlife. They may remove native vegetation, accelerating erosion, or replace it with exotic species. They may also introduce domestic animals—cats that prey on birds and rodents, dogs that chase wildlife, horses that remove native vegetation and trample the soil. Coyotes, javelinas, and deer are attracted to residential areas during food and water shortages, but other species like antelope and large predators are displaced. Moreover, recreational use and illegal activities outside the subdivisions, including wildcat dumping, poaching, off-road-vehicle use, and fuelwood cutting, accelerate. Recreation is not necessarily ecologically benign or “nonconsumptive” (Knight 1999).

Finally, there is a visual fragmentation of the landscape. Houses are usually constructed on the highest and most visible point on the property. Many people don't like Sonoita's chronic winds, so exotic trees are planted around houses as wind breaks and to provide shade. These modifications of the natural landscape disrupt the unique visual nature of the grassland, which attracted new residents in the first place.

Even more critical is the rising consumption of water. A study conducted by the Yale School of Forestry and Environmental Studies concluded that a cow-calf animal unit consumes about 15 gallons of water on a hot, dry day. Because there are an estimated 1,600 cow-calf units in the Sonoita Valley, cattle consume about 27 acre-feet of water per year, well below the estimated average annual recharge of 3,980 acre-feet. That figure also includes water consumption by wildlife, since pronghorn, deer, and javelina drink from the same water sources (Naeser and St. John 1998:186-200).

A single person in Sonoita, on the other hand, consumes about ten times as much water as a cow-calf unit. A conservative estimate of total water use at present is 337 acre-feet in Sonoita. Although this figure remains less than recharge now, future scenarios point to serious overdrafts. According to Yale hydrologists Robert Naeser and Anne St. John (1998:196), the safe-yield development density in Sonoita is one residence per 12.26 acres. Under current general rural zoning (4.13 acres), 17,000 residences could be built. That would result in annual groundwater withdrawals of 8,092 acre-feet per year (17,000 homes x 2.8 residents/home x 0.17 acre-ft/person/year).

That figure is three times greater than the available surplus recharge. More than one home per 12 acres means that Sonoita would have to mine its groundwater. To ensure safe yield, the minimum size of a parcel would have to be tripled. But downzoning—decreasing residential densities or land-use intensity—is now illegal in Arizona. Upzoning—increasing residential densities or intensifying landuse from residential to commercial or industrial—is usually enthusiastically approved by county boards of supervisors. Fairfield Homes' rezoning plan for Canoa Ranch in Pima County was the first time in 25 years that the Pima County Board of Supervisors denied a developer's request to increase residential densities on a large piece of property (Sheridan 2000). Whether supervisors will continue to control growth remains to be seen. If the regional economy slows down, the old arguments for development may acquire new vigor.

The strongest argument to keep ranches from being subdivided, however, is the preservation of large, unfragmented ecosystems and the biodiversity that depends upon them. Anthropologist Mette Brogden's research among residents of Sonoita subdivisions reveals how difficult it is to regulate the impact of thousands of individuals upon the landscape. Deed restrictions are easy to ignore or break. And as anyone who has ever belonged to a homeowners' association knows, consensus becomes ever more difficult to achieve as numbers grow, especially if people are attempting to regulate their own behavior rather than mobilizing against an outside threat.

Moreover, newcomers, no matter how well educated or well intentioned, are usually ecologically naive about the natural systems into which they are moving. Many, perhaps most, of their individual decisions contribute to the degradation and fragmentation of the landscape.

The result is a growing constraint on true large-scale ecosystem management. Wildlife habitat and wildlife corridors are fragmented or destroyed, particularly for large predators, like mountain lions, jaguars, and black bears, and ungulates, like pronghorn antelope and elk. The reintroduction of fire as a natural process or as a management tool becomes difficult if not impossible. For the last century, fire suppression has been an obsessive goal of federal public lands agencies. Recently, however, scientists, ranchers, and land managers have recognized the beneficial role fire plays in the preservation of grasslands and the maintenance of forest health. Working in close collaboration, the Malpais Borderlands Group, the Forest Service, and The Nature Conservancy have developed a fire plan for more than 100,000 acres in the Peloncillo Mountains on the Arizona-New Mexico border. The U. S. Fish and Wildlife Service's (USFWS) concern over two endangered species—the ridgenose rattlesnake (*Crotalus willardi*) and the lesser longnosed bat (*Leptonycteris curasoae yerbabuena*)—have repeatedly delayed implementation of the plan. Nonetheless, the reintroduction of fire in that isolated area should become a reality because the number of private landowners is limited and consensus regarding the reintroduction of fire has been achieved.

Once subdivision occurs, however, fire is seen as a threat to private property, not as a tool to restore the ecosystem. Controlled burns cannot be carried out and natural fires are suppressed. Shrubs continue to invade grasslands, while forests continue to build up biomass until truly destructive “crown fires” rage. Meanwhile, the protection of grassland habitat—and the creation of wildlife corridors across grasslands that link mountain ranges from crest to crest—become ever more elusive. Some human impacts can be reversed, but subdivisions are forever.

Multiple Use, Interest Group Politics, and the Ascendancy of Policy by Litigation

If a “radical center” can agree that we need to keep good ranchers on the land, the current atmosphere of agency gridlock, policy by litigation, and polarization needs to be defused. Since 1960, land management on national forests has been governed by the Multiple Use and Sustained Yield Act (MUSY). MUSY mandates that national forests be “administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.” That sweeping and rather vague mandate was extended to the BLM in 1976 by the Federal Land Policy and Management Act (Cawley and Freemuth 1997).

Political scientists R. McGregor Cawley and John Freemuth (1997) argue that multiple use has resulted in gridlock as single-interest groups have proliferated regarding

the management of public lands. They believe MUSY has created a zero-sum game, where the attitude of “I must restrict or eliminate your use to protect my use” has dominated the debate. They go on to say, “Indeed, the logic of a zero-sum game encourages the various participants to concentrate their energies on the task of blocking the moves of their opponents rather than on seeking to establish a common ground upon which compromises could be constructed. Moreover, a predictable outcome of a zero-sum game in which the players are relatively equal is stalemate” (Cawley and Freemuth 1997:35-36).

I concur with Cawley and Freemuth's critique of single-interest-group politics. Recently, however, the temporary success of litigation using the Endangered Species Act (ESA) and the National Environmental Policy Act (NEPA) has aggravated agency gridlock even further. It has also placed ranchers in a particularly vulnerable position because they have little formal say in how agencies comply, or do not comply, with ESA and NEPA requirements. When areas administered by federal agencies have been designated as critical habitat or potential critical habitat of threatened or endangered species, the agency in question is required to conduct a biological assessment. This biological assessment makes a preliminary determination about how new or authorized activities such as grazing would affect the species. The biological assessment is then sent to the U. S. Fish and Wildlife Service, which renders a biological opinion about whether the new or authorized activity will jeopardize the survival and recovery of the species in question.

This process often takes years to complete. Meanwhile, if an agency like the Forest Service or BLM decides that an activity like grazing is “likely to adversely affect” the endangered species, it can reduce or eliminate those activities. Understaffed federal agencies often do not have the personnel to make those assessments in a timely fashion. Sometimes when they do, their scientific evidence is so limited, ambiguous, or poorly interpreted that it would never pass muster if subjected to the common standards of scientific peer review. Nonetheless, ranchers may have their allotments cut, their incomes reduced, and their livelihoods jeopardized, even though they have little say in the decision-making process itself.

Border Crossings: The Sonora Chub

A case in point is the Chilton Ranch in southern Arizona. Beginning in 1995, the Sonora chub (*Gila ditaenia*), a minnow listed as a threatened species in the United States in 1986, expanded its known range in southern Arizona by swimming upstream from Sonora, Mexico. It now seasonally occupies a few hundred meters of seasonally flowing water in California Gulch at the south end of Schumacher Pasture on the Montana Allotment (27,940 acres) in Coronado National Forest south of Arivaca. Even though flow in California Gulch is ephemeral and dries up completely nearly every year, the Chiltons fenced a 400-meter stretch of streambed (40 acres) where the chub had been found to exclude cattle.

Despite this exclusion, however, USFS fisheries biologist Jerome Stefferud concluded, "It is logical and supportable to conclude that livestock grazing has contributed, and perhaps continues to contribute, to the overall degradation of the channels and aquatic habitat conditions in California Gulch" (Stefferud 1998:2). In his March 1998 Species Effects Assessment, Stefferud therefore issued a Preliminary Affects determination that livestock grazing on the Montana Allotment was "likely to adversely affect" the Sonora chub. He based that preliminary determination on a March 2, 1998, Allotment Summary Sheet by Barry Imler, rangeland management specialist for the Nogales Ranger District of Coronado National Forest. Imler stated that while conditions on all other pastures in the Montana Allotment were "good" in an upward trend, the range condition trend in Schumacher Pasture was "Fair/Down," that 44 percent of the Montana Allotment had "impaired" soil conditions, and 11 percent had "unsatisfactory" conditions, and that the main channel of California Gulf was "in unsatisfactory condition, but in an upward trend (30% satisfactory, 70% unsatisfactory)" (Imler 1998:2).

In response to Stefferud's preliminary determination, the Chilton Ranch & Cattle Company contacted Drs. Jerry Holechek and Dee Galt, respected range scientists who have been employed by the Forest Service itself to assess allotments on the Gila and Lincoln National Forests. Dr. Holechek is also senior author of the leading text in his field, *Range Management: Principles and Practices* (Holechek, Pieper, and Herbel 1998). Holechek and Galt agreed to survey "rangeland ecological condition, soil stability, and grazing intensity" on the Schumacher, Ruby, and Warsaw pastures of the Montana Allotment. They carried out their research in April 1998. Their conclusions on "range trend" are quoted in full:

Parker transects evaluated by Forest Service conservationists on the Montana Allotment (File Code 2100) show a consistent and strong upward trend in rangeland ecological condition from 1985 to 1996. The Chiltons acquired the Montana Allotment in 1991. We believe that the custodianship of the Montana Allotment by the Chiltons has been highly effective. We also give credit to the Forest Service range conservationists for developing a sound range management plan for the Montana Allotment.

We do note one important inconsistency in Forest Service reports on ecological condition and trend in the Montana Allotment. Data collected in Schumacher Pasture by Forest Service personnel on condition/trend in 1996 show condition scores of 73% for C3, and 68% for P11. The average score is 70% or high good. This level of remaining climax vegetation is considered ideal when multiple use goals of livestock production, wildlife habitat, water quality, soil stability and biodiversity are all considered (Holechek et al. 1998). Our analysis of Forest Service range inventory and condition forms... for the Schumacher Pasture indicate a strong upward trend. This is inconsistent with Forest Service File Code 2100 which indicates Schumacher pasture is in fair condition and in a downward trend. *This is a major error that needs to be corrected by Forest Service biologists* [italics added].

We fail to understand why File Code 2100 shows range condition in Schumacher Pasture to be fair when the range inventory and condition forms show it to be in high good condition. Further Forest Service 1984 and 1996 condition/trend data indicate range condition has improved from poor to high good In 1984 Schumacher pasture was dominated by curly mesquite. In 1996-1998, it was dominated by sprucetop grama and sideoats grama. Mid grasses were nearly absent from the pasture in 1984 while in 1996-98 they were common and dominated many parts of the pasture. Quantitative and qualitative assessments of range condition in Schumacher Pasture by Forest Service range personnel show great improvement in ecological condition between 1984 and 1996. *This improvement occurred even though 1995-96 was the driest period on record for the Arivaca area. These data all show range management in Schumacher Pasture has been highly successful, and no changes are needed to protect habitat for the Sonora chub* [italics added] (Holechek and Galt 1998:10-11).

Holechek and Galt's summary states that "soils in Schumacher, Ruby, and Warsaw Pastures were stable, with no signs of accelerated erosion"; that the three pastures were in "good (late seral) or better ecological condition"; that "overall grazing use in the Montana Allotment (across years)" was "conservative (30-35% use)"; that "all pastures (Schumacher, Ruby, Warsaw) were "in a upward trend in ecological condition based on Forest Service transect data collected in 1984 and 1996"; that "water quality" was "good in all pastures. All streams and tanks had clear water with no signs of siltation"; that "riparian vegetation in California Gulch" was "rapidly improving in vigor and composition. Much new establishment was noted of desirable shrub species. Mid to tall grasses dominated stream corridors"; that "mining" was "the primary threat to esthetic quality and ecological condition of the Montana Allotment" (Holechek and Galt 1998:12).

Holechek and Galt concluded, "In our opinion livestock grazing as presently practiced is having no negative impacts on the Sonora chub and may be positively impacting vegetation on the Montana Allotment" (Holechek and Galt 1998:12). They go on to say, "We emphasize that the Chiltons have expressed a complete willingness to voluntarily reduce livestock numbers to levels consistent with forage resources when drought conditions occur. We consider the Chiltons to be responsible, ecologically sensitive ranchers. *We strongly believe that reduction in the grazing permit for the Montana Allotment to protect endangered species and other ecological values in completely unnecessary*" (Holechek and Galt 1998:13).

Senior U.S. District Judge Robert Broomfield concurred in a decision issued on December 14, 1999. The Arizona Cattle Growers' Association sued USFWS and the USFS concerning incidental take statements on six national forest grazing allotments, including the Montana Allotment. Broomfield held that an incidental take statement is justified only when the activity in question—in this case, grazing—is "reasonably certain" to kill or injure members of a listed

species. He ruled that USFWS's decision to issue an incidental take statement (ITS) for the Gila topminnow (*Poeciliopsis occidentalis occidentalis*) on the Sears-Club/Chalk Mountain Allotment was arbitrary and capricious. He sustained the ITS issued by USFWS only for the loach minnow (*Tiaroga cobitis*) on the Cow Flat Allotment and set aside the Incidental Take Statements for loach minnow and spikedace (*Meda fulgida*) on the East Eagle Allotment, for Sonora chub and lesser long-nosed bat on the Montana Allotment, for Gila topminnow on the Sears-Club/Chalk Mountain Allotment, for lesser long-nosed bat on the Sheep Springs Allotment/Heber Reno Sheep Driveway, and for loach minnow on the Wildbunch Allotment.

Concerning the Montana Allotment, Broomfield concluded:

The court finds that the FWS [U. S. Fish and Wildlife Service] had insufficient evidence to rationally support a finding that a take of Sonora chub or lesser long-nosed bat had occurred or was reasonably certain to occur. The FWS's finding of take of Sonora chub was based on the "potential" for those fish to move upstream from the California Gulch and on the downstream effects of grazing. The mere potential for harm, however, is insufficient. Furthermore, the FWS only offered general evidence regarding the possible effects of livestock grazing on riparian and aquatic habitats. It offered no evidence that this was actually occurring or that it was reasonably certain to occur. Unlike the Cow Flat Allotment, it had no evidence of aspects of the Montana Allotment that would increase the likelihood of effects from livestock grazing on the aquatic habitat. Finally, the FWS offered no evidence of how these potential effects of livestock grazing would actually harm the Sonora chub.

With regard to the lesser long-nosed bat, the FWS relied on the fact that known roosts were approximately 40 miles away and that the allotment contained potential foraging plants. The FWS, however, had no evidence that the bats actually forage on the Montana Allotment, and it only offered evidence that cattle grazing "may" affect these forage plants (*Arizona Cattle Growers' Association v. United States Fish and Wildlife Service and United States Forest Service*, CIV # 99-0673 PHX RCB, December 14, 1999:32-33).

Beyond Litigation: Habitat Conservation Plans

As of this writing, despite Judge Broomfield's decision, the Chiltons and the Forest Service were still at loggerheads, with range scientists the Forest Service had employed in the past contesting the findings of Forest Service and Fish and Wildlife Service scientists. As in most litigation, science had become an adversarial weapon wielded by both sides to support their claims. In the process, the Chiltons have spent thousands of dollars—and hundreds of hours—defending their management of the Montana Allotment against the Endangered Species Act (ESA) listing of a minnow that swims upstream from Sonora when California Gulch flows and dies off when the ephemeral stream dries up.

Unfortunately, the experience of the Chiltons is not an isolated one. Other listings, such as the Hualapai Mexican Vole (*Microtus mexicanus hualpaiensis*) on Prescott National Forest in north-central Arizona, have proven to be even more dubious, threatening the livelihoods of ranchers despite the fact that Forest Service biologists themselves admitted that very little was known about: 1) the vole's range; 2) the vole's habits or habitat; 3) the impact of grazing upon the vole; or 4) even if the voles on the Prescott National Forest were the same subspecies as the vole listed as endangered.⁶

Clearly the administration of federal regulations, particularly the Endangered Species Act and NEPA, need to be carried out in a more timely, equitable, and scientifically justifiable fashion. Once an agency makes a "likely to adversely affect" decision that recommends the reduction or removal of stock on an allotment, some sort of structured timetable for mitigation should be implemented before the livelihood of the rancher is threatened. To ensure that any decisions requiring mitigation be based upon the best available scientific evidence, those decisions should be reviewed by a panel of independent, outside scientific experts, including range scientists and wildlife biologists, following the standard procedures of scientific peer review. And if the review challenges the decision of the agency, the decision should be reversed or the mitigation plan modified to conform to the best scientific evidence available. Until such review and revision are completed, the rancher should not be adversely affected by having an allotment reduced or removed.

An even better model is the development of cooperative management plans involving ranchers, scientists, environmentalists, and other "stakeholders." In areas where ranchers possess large tracts of private land, habitat conservation plans (HCPs), a modification of the ESA approved by Congress in 1982, should be developed. Many environmentalists view habitat conservation plans with considerable skepticism (Luoma 1998). Others, in contrast, agree with Michael O'Connell of The Nature Conservancy in California, who said, "The HCP process can offer a way to conserve endangered species in a much more biologically effective way than we'd ever get just hammering people over the head with the law. Yes, we still need the law there as a disincentive to people doing horrible things. But the best of these plans are trying to go way beyond the Endangered Species Act" (Luoma 1998:39).

The Upper Verde River Management Partnership

An Arizona example of cooperative management is the Upper Verde River Adaptive Management Partnership (UVRAMP), which involves the Prescott National Forest, the Forest Service's Rocky Mountain Research Station, and three ranchers with grazing allotments along the Upper Verde River in north-central Arizona. The partnership seeks to designate the Upper Verde watershed as an adaptive management unit. There ranchers and scientists from the Forest Service plan to cooperate in a six-to-ten year research project

to monitor the effects of dormant-season grazing on a three and one-half mile stretch of the Upper Verde that includes a threatened species, the spikedace minnow (*Meda fulgida*). No grazing has taken place along the river for four years, and the river is now in what ecologists call "proper functioning condition." A limited number of cattle will be reintroduced during the dormant season, and the effects of grazing will be monitored, using a half-mile enclosure as a controlled comparison. There will also be a 300-foot long enclosure where Forest Service biologists have been sampling a local population of spikedace.

Such collaborative projects are absolutely critical if we are ever going to move beyond polemics. Fisheries biologist John Rinne of the Rocky Mountain Research Station (1998:76) points out that even though "The general consensus is that livestock grazing has an irrefutable, negative impact on fishes, and their habitats," "no definitive, scientifically-based data are yet available to support such conclusions." Rinne's own research on the Río de las Vacas in northern New Mexico reveals that there were greater densities of Rio Grande suckers (*Catostomus plebeius*) and Rio Grande chubs (*Gila pandora*) on grazed vs. ungrazed stretches of the river. Ungrazed stretches, on the other hand, supported greater densities of trout (*Oncorhynchus* and *Salmo*). In Rinne's words, "grazing certainly cannot be unequivocally demonstrated to have a negative influence on fishes. Indeed, one might interpret this multiple use [i.e. grazing] to be beneficial to minnows, suckers and total fish population in this montane stream. By contrast, the opposite conclusion could be drawn for trout populations" (Rinne 1998:79).

Rinne concluded his overview of grazing and fishes in the Southwest with words that summarize one of the major goals of collaborative groups like the Malpais Borderlands Group and the Arizona Common Ground Roundtable—the need to move "from opinion-based to fact-based decision making." According to him, "Finally, the time has come to remove ourselves from promoting and sustaining the 'litany' or 'dogma' on effects of grazing on fishes and embrace collection of sound, defensible information that can be used by land managers" (Rinne 1998:81).

The Upper Verde River Adaptive Management Partnership is one attempt to do so. Ironically, preliminary data on the Rio Verde Ranch indicate that exotic fish species dominate stretches of the Upper Verde that have been restored to "proper functioning condition." The threatened spikedace, in contrast, is thriving in a stretch of the river running through a private horse pasture that has not been restored, particularly in a spot where vehicles regularly cross the river. Simply restoring riparian habitat and removing cattle are not achieving the goal of protecting the threatened species in question.

Conclusion

Perhaps the lesson to be drawn from such preliminary studies is that ecosystems are incredibly complex and only long-term scientific investigations offer any possibility of

comprehending them. The landscapes of the Arizona-Sonora borderlands need to be viewed as dynamic systems that change through time, not ecological morality plays with pristine "befores" and degraded "afters." Climatologists, anthropologists, and historians are still struggling to understand the complex interplay between climate and human impact. Ranchers and range scientists are still trying to adapt breeds, grazing systems, and stocking rates to variable arid and semi-arid climates. As our understanding of range ecology advances, ranching is one of the few industries with the potential to be truly sustainable, and compatible, with other land uses. But until such an understanding is achieved, the uncritical administration of federal regulations such as the ESA or NEPA may drive more ranchers off the land without really addressing the biological issues in question. The Endangered Species Act and the National Environmental Policy Act are serious laws that should be administered in a responsible, not a trivial or punitive, fashion. Otherwise, large-scale ecosystem management will become ever more elusive in our ever more endangered rural West.

Notes

¹El Niño events are characterized by an increase in sea surface temperature in the eastern equatorial Pacific Ocean. The active center of atmospheric convection then shifts from the western to the central equatorial Pacific, causing shifts in precipitation patterns on a near-global scale. El Niño events typically bring cool, wet winters to the Southwest and dry winters to the Pacific Northwest. La Niña events, in contrast, bring warm, dry winters. ENSO events generally last two to ten years at three-to-four-year intervals. According to Sheppard et al. (1999:7), "El Niño events have outnumbered La Niña events by a ratio of nine to one over the last twenty years, whereas they used to occur approximately equal before." The Pacific Decadal Oscillation (PDO) is a temporal variation in sea surface temperatures across the Northern Pacific Ocean. During positive phases of the PDO when sea surfaces are warm, more winter precipitation falls across western North America. Moreover, PDO intensifies ENSO events, with El Niño growing stronger during positive phases of PDO and La Niña growing stronger during negative phases (Sheppard et al. 1999).

²By definition, a monsoon is a seasonal change in the direction of the wind of 120 degrees or more. The North American monsoon begins when westerlies retreat and the subtropical high pressure ridge advances. In the Southwest and northwestern Mexico, most of the monsoon's moisture comes from the Gulf of California and the eastern Pacific, not the Gulf of Mexico as previously thought (Sheppard et al. 1999).

³In his famous *Report on the Lands of the Arid Regions of the United States*, John Wesley Powell (1983[1879]) recognized the ecological incompatibility of applying federal land policies west of the 100th meridian. He advocated the establishment of "pasturage farms" no smaller than 2,560 acres. Moreover, he argued that these "pasturage farms" should not be fenced so herds could "roam in common." The farms should be divided according to topographic features, not abstract grids on a map, "to give the greatest number of water fronts to the pasturage farms." He concluded by saying, "As the pasturage lands should have water fronts and irrigable tracts, and as the residences should be grouped, and as the lands cannot be economically fenced and must be kept in common, local communal regulations or cooperation is necessary" (Powell 1983[1879]:24). Ironically, Mexican comunidades and ejidos are closer to Powell's model than U.S. ranches.

⁴According to Sayre (1999), the federal government never issued large grants of land for stockraising because it did not want to create the kind of landed aristocracy found across much of Europe.

⁵Granted in the early 1820s to *parcioneros* (partners) from the nearby community of Santa Cruz, Sonora, the San Rafael de la Zanja was one of eight Spanish and Mexican land grants in Arizona confirmed by the U.S. Court of Private Land Claims (Officer 1987).

⁶Rather than carrying out a systematic study to rectify its lack of knowledge about the vole, the Forest Service recommended that cattle be removed from 80 percent of the Forest Service allotment on the Cross U Ranch, owned by Dennis and Deborah Moroney. Faced with such draconian measures, the Moroneys put their ranch up for sale, knowing full well another rancher would never purchase it. "A ranch with those kind of restrictions could not be sold, or even given away," Dennis Moroney wryly noted. "With the potential for perpetrating a 'taking' of a listed species, a rancher may as well put a gun to his head." More than six months after ranchers like the Moroneys had been informed that they might have to remove most of their cattle from Forest Service allotments, an unrelated study focusing on hanta virus among rodents discovered more voles than previously expected. That prompted the Fish and Wildlife Service to declare that local vole populations were not endangered after all. A new District Ranger on Prescott National Forest reversed the decision of his predecessor and told ranchers that grazing could still occur on vole habitat (Sheridan 1999).

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