



A Range of Lands and Uses

More than 87 percent of Arizona's land area is rangeland.

That figure varies depending on how rangeland is defined. Rangeland usually means land on which the native vegetation produces forage suitable for grazing or browsing animals: cattle, sheep, deer, elk or other large herbivores. A distinction between improved pastures and other rangeland is sometimes drawn, but is not clear-cut. Improved pastures rely on seeding, cultivation, irrigation, fertilization or other intensive treatment to maintain their level of forage production; the same or similar techniques may be used on other rangeland, but usually at less frequent intervals.

Likewise, the line between rangelands and forest lands is indistinct because many areas produce both forage vegetation and forest products. Even the dense spruce-fir forests may produce forage plants after cutting. However, most people recognize range as consisting primarily of grasslands, shrublands, woodlands, open forests and some deserts that can produce forage useful for grazing.

One point should be clarified: rangeland is a kind of land and not the use made of it.

Kind and Extent of Arizona Rangeland

Arizona's rangelands are extremely diverse in vegetation and soil types owing to the great climatic diversity in Arizona. As might be expected in a dry environment, the amount of precipitation, which is roughly related to elevation, is of prime importance. The lower-elevation areas of the state usually get less than 10 inches of annual rainfall and support desert scrub type vegetation. As elevation increases, with higher precipitation and cooler temperatures, effective moisture

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Photograph: Range cattle in open ponderosa pine forest at the Los Burros Campground on the Apache-Sitgreaves National Forest. (Photo by Ted Bundy.)



Needle-and-thread grass, a common range species in northern Arizona.

increases and vegetation changes successively to grassland, woodland and forest.

Temperature, and the timing of precipitation in relation to temperature, are other important factors governing range vegetation. Some range plants grow best after winter rains in the lower altitudes or in the cool early summer in the higher mountains. These cool-season plants include brome-grasses, wheat-grasses, needle-grasses, blue-grasses, many shrubs and the spring wildflowers of the desert. Warm-season plants grow mainly in response to summer rains, so they reach their best development in southeastern Arizona where summer rains are most reliable. These plants include grama grasses, bluestems, some other grasses, and some shrubs.

Who Owns Arizona Rangeland?

About 18 percent of Arizona land is in private ownership. Thirteen percent is owned by the state, 26 percent by the Indian tribes and the remaining 43 percent by the federal government. For rangeland, the percentage of private land is even smaller, since much of the private land is urban or farmland. (See map on page 12.)

Within a given area of rangeland the pattern of land ownership is often very complex; state, federal and private land may all be intermingled within a ranch and not fenced separately. Obviously, this pattern of ownership requires coordination among owners and often leads to disagreements when management priorities differ.

What caused this complex pattern?

Privately owned land derives from three major sources. One source was Spanish and Mexican land grants to individuals made before Arizona became part of the United States. These were generally honored by the U.S. government. A second source was grants to citizens made under the Homestead Act of 1863 and subsequent additional laws intended to transfer government land into private ownership. Since each of these grants could not exceed 640 acres, homesteaders generally selected the most productive lands and those with water sources on them. The third source was grants to subsidize building of transcontinental railroads. Alternate sections (a section is one square mile) were granted in a 20- to 40-mile-wide strip along any railroad right of way, resulting in a checkerboard pattern that persists today in many areas.

In the period of about 1865 to 1890, large areas were set aside as Indian trust lands or reservations. Arizona has a larger percentage of such lands than any other state. Mostly between 1905 and 1912, the National Forests were created and withdrawn from homestead entry. When Arizona was admitted to the Union in 1912, it was granted four sections in every township and certain other grants for the support of educational and other institutions. These are the state trust lands. The University of Arizona is called the "land grant" university because it is partially supported by revenues from these lands. Certain other areas have been set aside by either the federal or the state government for such uses as military bases, wildlife refuges, state or national parks, or historical sites.

All of the land which was not transferred to private ownership, Indians or the states, or not set aside for special uses, was referred to as the public domain. The federal government intended to transfer

this land to private ownership, but most of it was not productive enough to permit making a living on it within the size limitation of the homestead laws. Legislation passed in the 1960s and '70s finally withdrew these lands from homesteading and established the government's intent to retain and manage them. They are now called National Resource Lands and are managed by the Bureau of Land Management.

Products and Values from Arizona Rangelands

Beef cattle production is one of Arizona's major industries, and most of the beef cattle produced are raised on the range. At the start of 1981, Arizona range cattle and calves numbered 582,000. Ranches generally are categorized as cow-calf or steer operations. Cow-calf ranches, the most common type, maintain a herd of breeding cows on the range. Calves produced during the year are sold in the fall or spring at six to 15 months of age when they weigh about 400 to 600 pounds. These animals are either put directly into feedlots to be grown out and fattened for slaughter, or put on other pastures to gain more size and then fed out. Steer operations do not maintain a breeding herd but depend on buying of steers raised on other ranches, running them from six to 12 months and selling them to feedlots 100 to 300 pounds heavier than when purchased. Steers may be purchased in Arizona but are often brought in from other southwestern states or Mexico. Because they keep no permanent herd, steer operations are very flexible in taking advantage of forage when it is available. That makes them well adapted to ephemeral ranges in Arizona deserts. Some ranchers operate basically as cow-calf operations but may buy steers or hold over their own steers in years of plentiful forage.

Formerly, many sheep and goats were raised on Arizona ranges. Large bands of sheep were grazed in summer in the mountain grasslands and open forests in the White Mountains and elsewhere above the Mogollon Rim. In the fall they were driven along trails back down to the desert ranges and irrigated pasture in Maricopa and Pinal Counties where they spent the winter. In the spring the bands would return to the mountains. A few sheep operations still follow this pattern, but the number of sheep raised has declined greatly. Difficulty in obtaining labor to herd sheep, increased numbers of coyotes and other predators, and the economics of the wool market have all discouraged sheep operators. Many Angora goats were once raised for the mohair they produce, but they are now rare in Arizona. Interest in goat production seems to be increasing, however.

Hunting is another major value derived from rangelands. The great diversity of range vegetation in Arizona supports an unusually large number of game species, including mule deer, whitetail deer, elk, antelope, bighorn sheep, whitewing and mourning doves, Gambel's, scaled and Mearns quail, wild turkeys, blue grouse, bandtailed pigeon, black bear, and javelina.

In 1980, 193,700 Arizonans and 9,000 non-residents bought Arizona hunting licenses. The previous year's hunting harvest included 13,847 deer, 5,319 javelina, 1,728 elk, 847,000 cottontail rabbits, 94,000 tree squirrels, 2.9 million doves, 2.9 million quail, and several other species. The 1,834 trappers licensed for the 1980-81 season in Arizona caught 15,000 coyotes, 26,000 gray foxes, 3,000 kit foxes, 8,000 bobcats and several other species.



A San Carlos Apache cowboy brands a calf during fall roundup. (Photo by Ted Bundy.)



Other recreational value is derived from rangelands by hikers, picnickers, bird watchers and other nature enthusiasts who enjoy the wide open spaces and watching or photographing wildlife of all types. Although fishing may not be properly a range value, the quality of fish habitat is influenced by the management of adjacent rangelands.

No resource in Arizona is more important than water. Most of the runoff comes from forested land at higher elevations. Shrubland and grassland ranges produce relatively little runoff because of low rainfall, but these areas produce fairly large amounts of sediment because of sparse ground cover. This is true even under undisturbed conditions, but the sediment yield may be greatly increased by poor management. A major objective in range management is to minimize sediment yield (*i.e.* erosion) and maximize the beneficial use of water. This usually means trying to hold the raindrop where it falls to produce range vegetation. An exception is in the chaparral type, where research has shown that water yield can be increased by conversion from shrubs to grass.

An increasingly important resource from rangeland is energy. Millions of acres support juniper, pinyon, oak, mesquite, and other trees or shrubs which furnish firewood for fireplaces and stoves. Some have suggested the possibility of wholesale harvesting of plant biomass from ranges as a source of energy, but this process is not yet technically or economically feasible. Other technological advances might make range sites attractive for large-scale solar or wind energy installations.

With so many actual or potential uses of rangeland, it is no wonder that real or presumed conflicts arise among people interested in different uses. One area of conflict is in competition for forage between livestock and wildlife, especially the large grazing animals: deer, elk, antelope and bighorns. However, given the chance, different animal species often select different species of plants to eat and may use different parts of the range. On well-managed ranges, therefore, the extent to which two species are competitive depends largely on the amount of overlap in diet or in area used in each season. For example, cattle and elk select similar plants, so they are fairly competitive for forage, but

cattle and deer do not compete as much for forage since they have different diets and since deer use rougher country than cattle. On ranges that are overpopulated with either livestock or wildlife, or with wild horses or burros, animals have less chance to select their more preferred plants or areas so they are forced into greater competition.

Conflict of uses may arise in other ways. Regulations restricting effective means of controlling coyotes and giving greater protection to bears, mountain lions and eagles have resulted in increased loss of young calves and sheep to these predators. Nationwide, economic losses from predators are estimated at \$300 million dollars.

Brush control projects to increase livestock forage or to increase the quantity or quality of water from the watershed have often been criticized for alleged destruction of wildlife habitat. Some projects in the past were carried out with little regard for wildlife, but now most are designed to produce a mosaic of vegetation types, thereby increasing grass production but leaving strips or islands of brush for wildlife cover.

Statements that any particular practice is good or bad for wildlife are often misleading. "Wildlife" includes hundreds of species with such disparate characteristics as those of lizards, hawks, elk and skunks. Changes that improve the habitat for some species diminish its value for others. Thus, there is no such thing as a practice that is desirable for all wildlife. Protection of predators may hurt prey species; one mountain lion can kill and eat 50 deer a year. Vegetation changes can cut both ways, too. Between 1900 and 1950, brushy plants such as mesquite spread over much of southeastern Arizona that was previously desert grassland. This change favored mule deer and jackrabbits at the expense of grassland species such as antelope and cottontail rabbits. Now, clearing brush from patches of mesquite-invaded desert grassland can improve the habitat for scaled quail, Gambel's quail and cottontails while reducing its value for mourning doves, javelina and jackrabbits.

One practice that is beneficial for livestock management and for most wildlife is water development. Dirt tanks, wells and windmills, and spring developments put in by ranchers for cattle and sheep have provided year-round water for deer, elk and other animals where it was previously unavailable or unreliable. Similarly, natural wet areas such as streams, ponds and intermittent washes, and the adjacent vegetation they support are crucial to the habitat of many species of wildlife. Livestock management should be designed to protect critical portions of these.

Recreational use of ranges can be very compatible with their use for livestock grazing. Livestock, of course, should be fenced out of campgrounds and drinking water sources. The sight of cattle or sheep and cowboys or shepherders on a well-managed range is an attractive part of western lore for our mainly urban population. By the same token, well-behaved recreationists interfere very little with livestock operations. Unfortunately, the thoughtless or malicious acts of a few, such as leaving gates open, shooting holes in water tanks, using corrals for firewood, and killing or theft of stock often create a bad name for hunters and other recreationists just as flagrant overgrazing and abuse of the range on the part of a few ranchers often bring condemnation of livestock grazing in general.



Off-road vehicle use is an increasingly popular form of outdoor recreation. (Bureau of Land Management photo.)

Management Policies on Federal and State Lands

Very few ranches in Arizona operate wholly on private land. Typically from 10 percent to 30 percent of the ranch is private land and that fraction is often in scattered small parcels derived from homesteads. The rest may be national forest, BLM or state trust lands, or some combination of these.

Federal rangelands administered by either the Forest Service or BLM are divided into grazing allotments. Each allotment is tied to a particular ranch operation, though occasionally allotments are shared by more than one ranch. The allotment is an integral part of the ranch. Its grazing rights are normally transferred to the new owner when the ranch is sold. Which ranches would receive grazing allotments was decided when federal control over range use was established. The allocations were based on historically established use prior to federal control and on other factors such as private ownership of land or water sources that formed an interdependent system with the federal land.

The number of livestock permitted and the time of grazing permitted are determined by the agencies, based on range surveys and monitoring of range condition and consideration of other values and uses. Both federal agencies operate under a philosophy of multiple use and sustained yield. Range conservationists in the agencies work with permittees to develop an allotment management plan that describes how livestock will be managed on the range, including needed range improvements and consideration of other values such as wildlife.

Permittees are charged a grazing fee for use of the range. The current fee is about \$2.30 per animal-unit-month. An animal-unit-month is the amount of forage consumed by a mature cow in one month. Therefore, if a cow grazes on the federal range for a year the grazing fee would be about \$28. Grazing fees fluctuate according to a formula that ties them to the price of livestock and costs of production. Since the federal government pays no property taxes, 25 percent of the grazing fee is returned to the local county in lieu of taxes. Another share is set aside for range improvements.

In addition to the grazing fee, the permittee (rancher) usually is responsible for maintenance of fences, windmills, springs or other improvements on the allotment. The permittee may also share in the cost of developing new water sources, brush control, reseeding or other improvements. Details vary but a typical arrangement is for the government to buy materials, such as wire and posts, and for the rancher to contribute labor for construction and maintenance. Title to improvements remains with the government.

State trust lands are managed by the Arizona State Land Department. The philosophy of management which has been followed is to maximize income to the trust fund for support of schools and other institutions. Thus these lands are not considered to be public lands as are federal lands. Grazing is permitted on the basis of renewable 10-year leases. The State Land Department classifies grazing land according to its estimated grazing capacity and the lessee is charged on an animal-unit-month basis for the number of animals the land can carry whether he actually grazes the animals or not. To reduce costs of administration, most management has been left up to the lease holder, whose private land is often intermingled with that owned by the state. Current grazing fees on state land are about \$1.10 per animal-unit-month.



Sheep herd along a desert wash in western Gila County. (Photo by Ted Bundy.)

With permission from the State Land Department a lessee may make improvements, such as fencing, well drilling, brush control or seeding, on state land. The state does not pay for any part of these improvements and any additional carrying capacity resulting is charged at the full rate. The increased value of the ranch is also taxed, so that the lessee who wishes to improve the land must not only pay for the improvement but will also have to pay higher grazing fees and taxes as a result. If the lessee loses the state lease, he is compensated for the depreciated value of improvements he has made on state land.

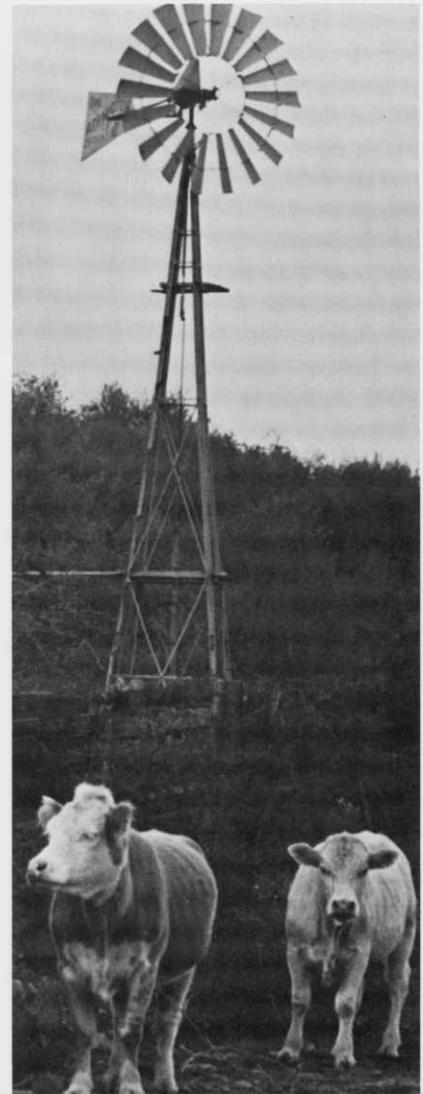
Range improvements must show a favorable benefit-cost ratio in order for federal funds to be spent for these improvements on federal rangelands. On private and state rangelands, conservation practices are encouraged by cost sharing under the federal Agricultural Conservation Program. These limited funds are administered by the Agricultural Stabilization and Conservation Service. The Soil Conservation Service provides the technical assistance and design for such projects.

Condition of Arizona Ranges

According to a 1980 report to Congress by the U.S. Forest Service, about seven million acres of Arizona rangeland is in good or excellent condition, 16 million in fair, 26 million in poor, and 10 million in very poor condition. These figures were compiled from data of a number of agencies which use different methods of interpreting range condition. Range condition is perhaps most simply defined as "the state of range health," *i.e.* an evaluation of whether a given range area is as productive as it could be and whether that productivity is being maintained. Inherent in this concept is that range condition must be interpreted in terms of potential of the site. The potential is determined mainly by soil type and rainfall. In other words, a mountain grassland site with deep soil and plentiful precipitation may produce more forage in poor condition than a desert shrub site would produce in excellent condition.

Condition is usually rated with respect to the similarity of the present vegetation to the original or undisturbed vegetation for a particular area. However, since the composition of the pre-settlement vegetation is not well known, and since differences in soil or precipitation often are not adequately considered, range condition ratings may reflect site potential more than status relative to potential. Another caution for interpreting reports of range condition is that standards do not relate very well to productivity for different uses. Thus, some ranges on which perennial grasses have declined and shrubs increased over the years are said to be in poor condition because there is less forage available for cattle. There may actually be a higher carrying capacity for deer than under the earlier conditions, because deer and cattle differ in diet and habitat requirements.

Despite these qualifiers, however, there is no question that profound changes have occurred in range plant communities and soils since the 1880s and that livestock carrying capacities are lower than they once were. Early accounts tell of plentiful grass where now mainly brush and annuals survive. Rivers that once supported beavers and fish along their marshy reaches are now typified by steep-sided arroyos which carry water only after a rain. What caused these changes and what can be done about it?



Windmill in chaparral country south of Globe pumps water for range cattle. (Photo by Ted Bundy.)



Many of these changes began in the period of about 1880-1910 when big herds of cattle were brought to Arizona from Texas and California. Cattlemen found good stands of grass and quickly stocked the ranges heavily. Used to more productive ranges in their home country, they overestimated the carrying capacity and failed to reckon with the variable nature of Arizona's climate. At any rate, all the range was free and open to anyone who could use it, bringing the inevitable result of common grazing land: lack of incentive to do anything but use all the forage before the next person's cattle get it. After cattlemen had established some degree of customary rights to particular ranges, migratory sheep outfits arrived that moved through the area indiscriminately and gave rise to range wars and the undeserved stigma sheep bear to this day. Severe droughts in the 1890s and early 1900s resulted in the death of thousands of cattle by starvation. Despite these warnings and the reports written by scientists at the University of Arizona and the Department of Agriculture, favorable rainfall from 1905 to 1925 and good markets during and after World War I led to continued heavy stocking. Some areas that were stocked with 30 to 40 head of cattle per square mile today will barely carry 10. The Depression and the establishment of government control over grazing in the national forests from 1908 to 1920 and on the public domain from 1934 to 1945 resulted in reduction of numbers and the beginning of better range management.

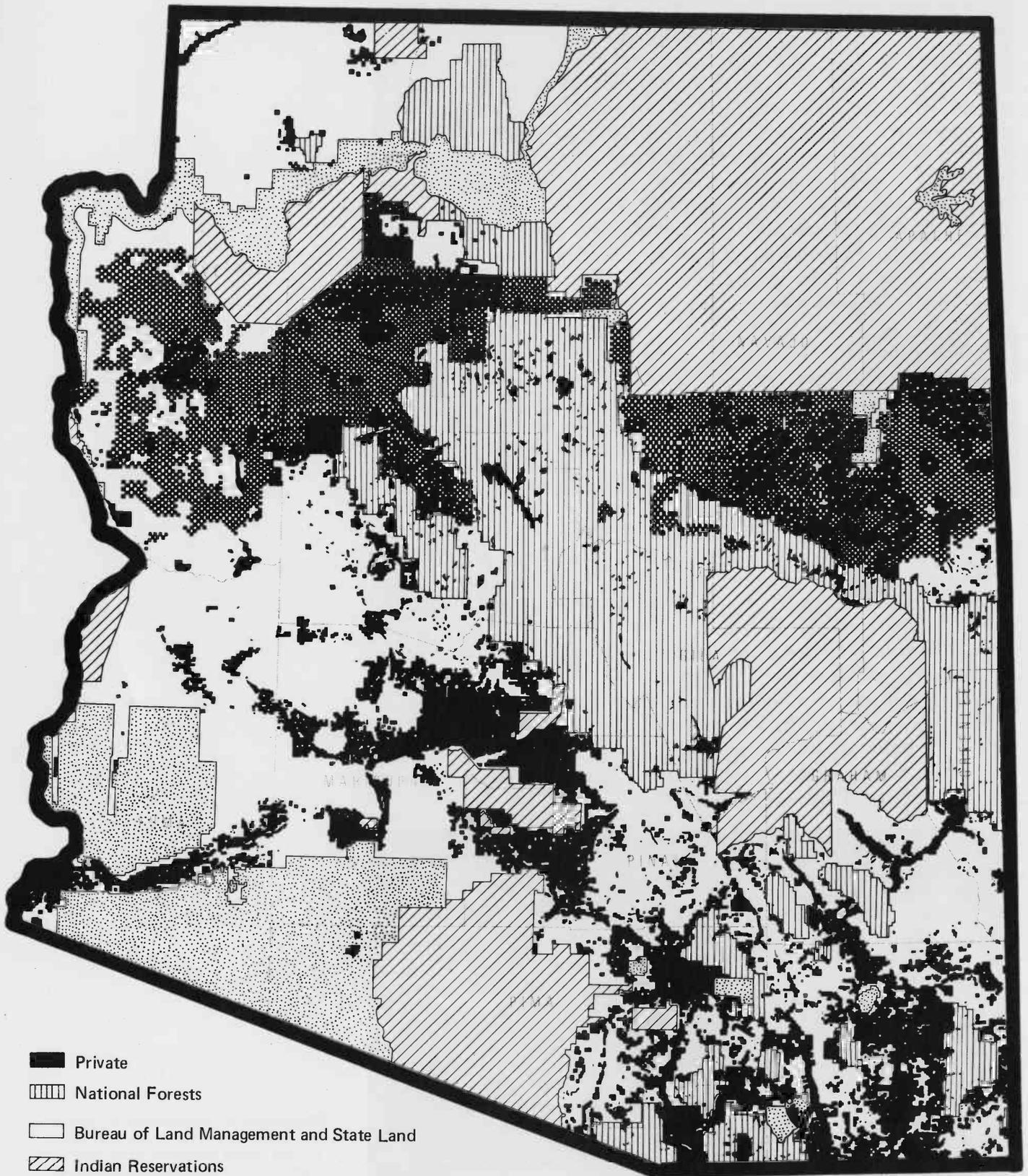
Although heavy year-round stocking by livestock resulted in reduction or elimination of desirable grasses and their replacement by annuals or inferior grasses in some areas, it is not clear that the pervasive increase in brush and extensive arroyo cutting were due entirely to overgrazing. Livestock were first introduced into southern Arizona by the Spaniards in the 16th century and ranching occurred throughout the latter 17th, 18th and early 19th centuries, except for periods when Indians drove them out. While livestock numbers were not large

compared to the early 20th century, there undoubtedly was locally heavy grazing along water courses, apparently without causing either brush increase or arroyo cutting. These phenomena began in Mexico about the same time as in Arizona even though the history of heavy livestock use went back much further and more continuously in Sonora. Evidence of previous cycles of arroyo cutting in pre-Columbian times indicates that it could occur in the absence of grazing. Evidence of uphill migration of vegetation types has led some researchers to conclude that climatic changes were mainly responsible for the spread of mesquite into grassland and the death of live oaks on the lower fringes of their habitat. Others think that periodic fires caused by lightning or set by Indians in hunting could have kept the grasslands relatively free of brush. Control of fires plus removal of fuel by grazing has greatly reduced the occurrence of grass fires. Once brush gets established, it uses much of the soil moisture that previously had supported grasses.

Whatever the real reasons for the changes, we do know that ranges are less productive of good forage grasses than they once were. Most of this deterioration took place 50 to 100 years ago and is not the result of current management practices. Because of improved management most of the ranges are in better condition than they were 30 to 50 years ago. However, on many currently well-managed ranges the mesquite, junipers and other shrubs continue to increase and choke out the grass. There is no evidence that good grazing management or even complete removal of livestock would reverse this trend or greatly improve those ranges already thick with brush. Restoring a good mixture of diverse plant species to provide forage for livestock and wildlife and protect the watersheds will require investment in brush control and revegetation with desirable grasses or browse plants followed by more intensive range management. The high cost of energy, and environmental restrictions on use of some lower cost, effective methods, have brought range improvement efforts to a virtual standstill over the past few years. There are, however, encouraging signs that the land management agencies are beginning to take a more positive approach toward improving the productivity of Arizona's rangelands.



Photographs of the same spot on the Santa Rita Experimental Range south of Tucson in 1903 (facing page) and 1942 (this page) show the increase in mesquite and cactus growth. In 1903, grass was plentiful enough to be cut for hay. (Note the haystacks.) Forty years later, grasses were losing to mesquite in the competition for water. (USDA photos: 1903 by David Griffiths, 1942 by Matt Culley.)



- Private
- ▤ National Forests
- Bureau of Land Management and State Land
- ▨ Indian Reservations
- ▧ Other, such as National Parks and military

Source: Arizona Office of Economic Planning and Development.
Public Land Ownership in Arizona. 1971.



Land Ownership in Arizona