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Vegetation Changes on Arid Rangelands of the Southwest

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Change, an inherent characteristic of ecosystems, is a recognized feature of vegetation in the arid and semiarid portions of the southwestern United States. Territorial surveys in the 19th century and terrestrial photography in the 19th century and early 20th century have been used to establish a base for vegetation conditions and then for recording variations from this base. All evidence indicates a dramatic shift from land with a high proportion of grassy vegetation to one dominated by shrubs. Most of these changes have occurred in the last 50-100 years. Following are some of the reasons and possible solutions to problems resulting from these changes that would be applicable to parts of Arizona, New Mexico, and Texas, with possible use in other arid and semiarid regions of the world.

Changes

There is little doubt that shrubs were invading grasslands slowly before man's influence, as evidenced by small pockets of shrubs. With the increase of ranching and farming activities in the late 19th and 20th centuries, there has been a rapid increase of shrubs. Woody plants were present under pristine conditions but they rarely migrated from very specific sites into grassland communities. Formerly restricted primarily to the waterways and drainages or occurring as scattered individuals, woody plants now form an almost continuous cover over large parts of the arid and semiarid rangelands of the Southwest. Figures 1 and 2 show the rapid increase of shrubs from 1858 (livestock water was developed about 1900) to 1963 on 144,000 acres of the Jornada Experimental Range in southern New Mexico.

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Editor's Note: Another paper on this subject appeared in the June 1984 issue of *Rangelands*, entitled "Vegetation Restoration in the Chihuahuan and Sonoran Deserts of North America" by Jerry R. Cox, Howard L. Morton, Thomas N. Johnsen Jr., Gilbert L. Jordan, S. Clark Martin, and Louis C. Fierro.

Vegetational history would indicate a slow drying of the Southwest since the Tertiary period with some intervening wet periods. P.V. Wells (1977) showed that some of the more xerophytic species, such as creosotebush, either entered or reentered the Chihuahuan Desert Region during the Holocene period, after having survived the Wisconsin glacials

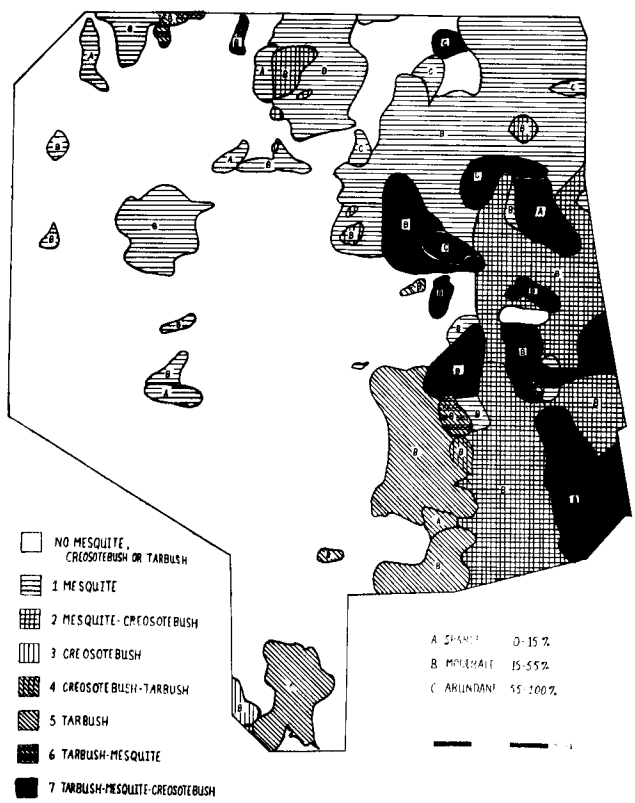

Fig. 1. *Major brush species by abundance classes in 1858 on the Jornada Experimental Range.*

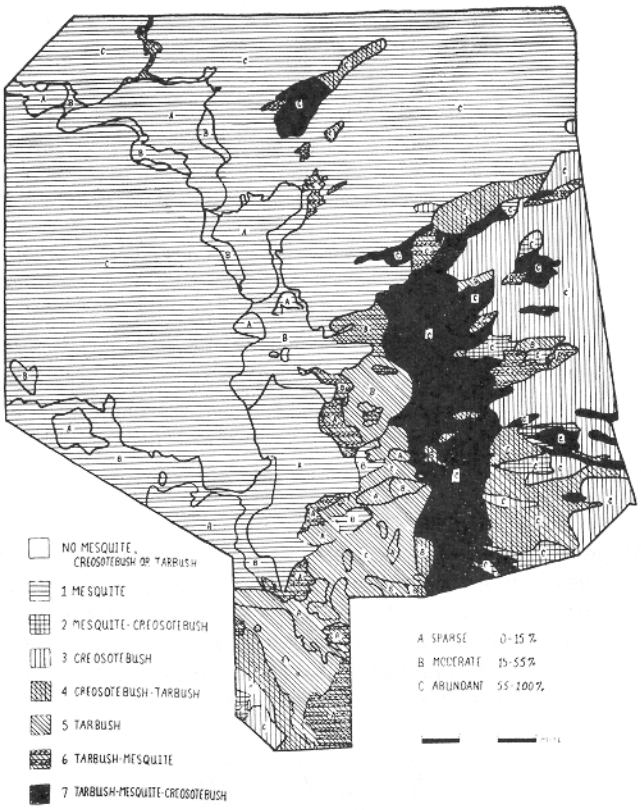

Fig. 2. *Major brush species by abundance in 1963 on the Jornada Experimental Range.*

further southwest.

Populations of native Indians and herbivores varied in prehistoric times, primarily in response to climatic factors. Expansion of Spanish ranching operations from northern Mexico into Arizona, New Mexico, and western Texas probably reached its peak about 1830. Nearly all of these ranches were abandoned by 1846 when the United States came into possession of the Southwest. Most of the livestock from these operations were abandoned when the Spanish settlers left but only small numbers of cattle remained in the Southwest by 1870. In the 1880's there were substantial movements of cattle from Sonora and South Texas into the area. Severe droughts in 1891-2 resulted in high losses of cattle by starvation.

Hastings and Turner (1965) reported that the current arroyo cutting cycle and the initiation of dramatic vegetation changes in the Southwest began about 1890. This coincides with a warming and drying trend (1875-90) plus heavy livestock use previously mentioned. Forage resources on the rangelands in New Mexico and southern Arizona were seriously depleted from this prolonged overstocking. Figure 3 shows a 1920 photograph in the southern part of the Jornada Experimental Range. The grass is black grama and most of the shrubs are tarbush. The same area is now covered with creosotebush, the area has several arroyos, and there has been a loss of 5 inches of top-soil.

Man and his activities influenced mammalian distribution in the Chihuahuan Desert. Some of the detrimental influences are overgrazing by domestic livestock, which has destroyed optimal habitat for some species, and hunting for food and recreation. Some beneficial activities by man are

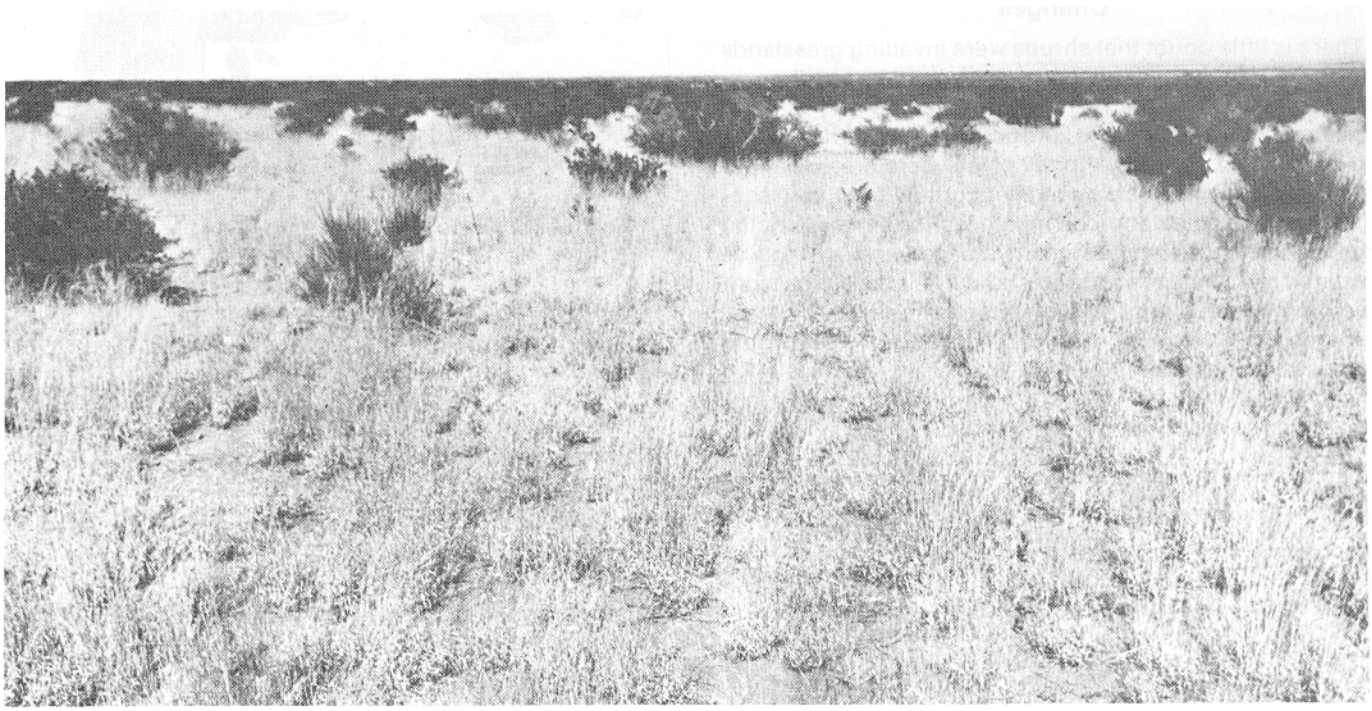

Fig. 3. *Grass-tarbush type in 1920; now covered entirely by creosotebush with some arroyos.*

improved habitat conditions for certain mammals by the construction of rock fences, water development, introduction of new plants, and reduction of some predators or other pests.

The Arizona chaparral was more open prior to livestock grazing in the 1870's than it is today. The heavy, yearlong grazing depleted the perennial grasses. Introduced annual grasses and forbs largely replaced the native perennial grasses that grew in openings between shrubs and as understory plants. Suppression of fires has resulted in thicker stands of shrubs in recent years. Photographic evidence of velvet mesquite stands in southern Arizona indicated that they will not decline due to natural causes as occurred with burroweed and jumping cholla cactus.

Reasons

Man's mobility and agricultural activities make him the greatest factor in the dispersal of plants. Man is also a disturber of natural systems, and his ability to create disturbances has increased as technology has advanced. Historically, high value has been placed on grazing lands for settlement purposes. Encroachment of woody plants into previously shrubless areas is closely correlated with the intensification of the activities of modern man. "People pressure" in combination with fluctuations in climate and local weather has increased the cover of shrubs. Man is the primary biotic factor that determines the fate of earth's natural resources. Before the influence of the white man, the mobility of native grazers naturally deferred grasslands during dry periods. Today, fences restrict the movement of grazing animals, making grazing management a part of man's responsibility.

Other influences of man in changing the plant cover of grasslands include:

1. Restriction or elimination of naturally occurring fires where fuel is adequate. Where there is sufficient fuel, fires will kill some plants. Fires were not an important factor in reduction of shrubs in arid grasslands because there was insufficient fuel.
2. Attempts to cultivate lands unsuited for crops.
3. Continual grazing pressure on grasslands by an increase in the number of grazers and timing of grazing use.
4. The increased mobility of man and his domesticated animals, which has resulted in greater seed dispersal. The seeds of several unwanted shrubs such as mesquite, creosotebush, and tarbush have been widely distributed within various ecosystems in the southwestern United States and await only the proper environmental conditions for establishment.

It is not economically, socially, or technically feasible to eliminate these factors but they must be recognized as ingredients for vegetation changes. Great weather fluctuations have been present in the Southwest for centuries. These perturbations have caused tremendous vegetation changes even in the absence of livestock grazing. The constant, very slow warming trend of the climate, coupled with livestock grazing, increased desertification.

Natural perturbations plus man's activities have reduced livestock production from most of the world's rangelands. Climax vegetation on rangeland is based largely on pristine conditions. Is there a grassland climate? I propose the following sequence for humid and subhumid grasslands:

forest + fire (man) = grassland; grassland – fire = forest

On arid and semiarid grasslands we have:

grassland + heavy grazing (man) + drought = desert

The following prevails:

good conditions range → poor condition range = weeds + erosion

Removal of a moderate amount of plant material, by grazing or fire, prevents stagnation of desirable plants.

Solutions

Range is a biological system and our commonly known physical laws do not always apply. We must use a holistic approach to the management of rangelands. We must consider the relations among weather, soils, plants (native and introduced), and animals (native and introduced). Because of the various multiple uses of rangelands, pristine conditions should not be confused with site potential. Pristine conditions are only a guide to site potential.

Because the increase of unwanted shrubs in the Southwest is irreversible, we must prescribe a remedy that is to man's benefit. This includes a combination of common range management practices. Shrubs are more efficient in the use of environmental resources such as water and soils than herbaceous plants. A positive approach is needed to replaced unwanted plants with those that are more useful to man. Useful practices may include: (1) mechanical, chemical, and/or biological control of unwanted plants; (2) fires to control unwanted plants where fuel is adequate; (3) revegetation to replace unwanted plants with useful plants; and (4) introduction of different animal species to use the range ecosystems more efficiently. These practices must also satisfy various socio-economic factors.

Man introduced a "shock" treatment when he colonized a fragile environment in the 19th and 20th centuries. Therefore, a "shock" treatment, such as brush control, is required to increase the stand of desirable herbaceous plants. Following brush control improved rangeland management practices must be implemented to prevent the domination of unwanted shrubs for sustained livestock productivity or other multiple use of rangelands of the southwestern United States. Revegetation may be necessary in selected areas without a remnant of desirable plants or where man desires change in plant composition.

History indicates, and present demography dictates, an increase in intensification in use of agricultural lands. Man must take a positive approach to maintain or improve production from rangelands.

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