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Lehmann Lovegrass—Central South Africa and Arizona, USA

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Lehmann lovegrass *(Eragrostis lehmanniana)*, a warm-season sub-climax perennial bunchgrass from southern Africa, was introduced into the southwestern USA in 1932. Since that time it has invaded much of the semidesert rangelands of southeastern Arizona. The extent and nature of this invasion concerns environmentalists, ranchers, and public land administrators who wish to stimulate the return of native grasses. Questions of interest regarding Lehmann lovegrass include: (1) What is the current distribution in Africa and North America?, (2) How is the grass managed in both continents? and (3) How similar are rainfall and temperature patterns in two countries where the grass dominates?

Distribution and History

Southern Africa

Lehmann lovegrass is widely distributed in west central South Africa (Fig. 1) where it has been an important forage

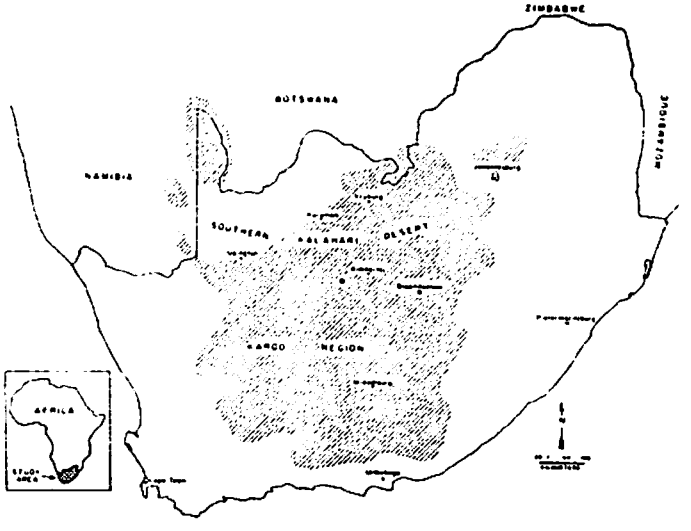

Fig. 1. *Distribution of Lehmann lovegrass in Southern Africa. (* Denotes the Griqualand West Region of South Africa).*

plant for wild and domestic ungulates for thousands of years. The grass occurs at elevations between 2,800 to 4,800 ft; where annual rainfall varies between 8 and 22 inches, and most rainfall occurs in spring, summer, and fall (November to April in the southern hemisphere). There are two major

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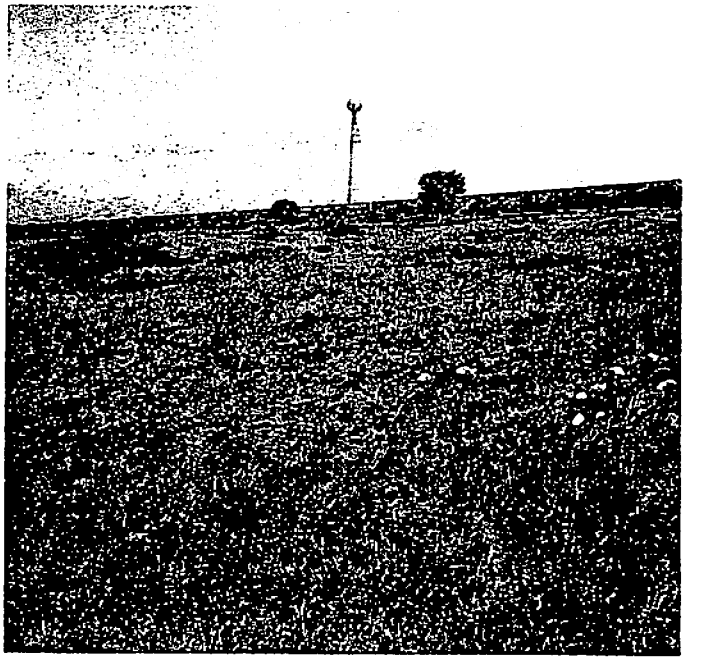

Fig. 2. *Grazed Lehmann lovegreass near Vryburg, South Africa.*

centers of distribution in South Africa: one is west of Kimberley in the southern Kalahari Desert (Fig. 2), and the other is near Middleburg in the Karoo. When surface soils are sand to sandy loams, as in these areas, Lehmann lovegrass often occurs in pure stands and constitutes the bulk of the available forage. The grass is tolerant to grazing but dies in summers when rainfall is below average; however, when soil moisture conditions improve, it reestablishes from seed.

Arizona

In 1932, F.J. Crider, director of the Boyce Thompson Southwestern Arboretum at Superior, Ariz., received Lehmann lovegrass seed collected in the Griqualand West Region of South Africa (Fig. 1-*). Crider planted Lehmann lovegrass seed on the arboretum grounds and observed that seedlings produced seedheads during the first year of growth. In 1935 Crider organized a series of screening tests at the Plant Materials Nursery, United States Department of Agriculture-Soil Conservation Service (USDA-SCS), in Tucson, Arizona. Of the many Lehmann lovegrass accessions tested, Crider selected one that matured quickly and produced abundant seed under irrigation. The accession was numbered "A-68", and the USDA-SCS initiated a seed production program in 1937.

Between 1937 and 1940 approximately 300 pounds of Lehmann lovegrass seed were produced at Tucson and distributed to soil conservationists and scientists within USDA-SCS for field plantings. By 1940 Lehmann lovegrass seed

had been sown in Arizona, New Mexico, and Texas. Within a short time it began to appear on areas which had not been seeded.

Early seeding success sparked interest and the demand for Lehmann lovegrass seed exceeded the USDA-SCS supply. Between 1951 and 1984 the USDA-SCS provided 2,186 pounds of Lehmann lovegrass seed to commercial seed growers, and commerical growers produced 165,500 pounds. Approximately 70% of the commercially available seed was sown on rangeland and along highways in Arizona, New Mexico, and Texas. The majority of the remaining seed was transported to Mexico and planted in the northern frontier states of Chihuahua, Coahuila, and Sonora.

Major stands of Lehmann lovegrass in Arizona are located in the counties of Cochise, Graham, Pinal, and Santa Cruz. Surface soils on these sites (shaded areas in Fig. 3) vary from sand to sandy loams, elevations range from 3,250 to 4,800 ft, and winter temperatures (December to February in the northern hemisphere) rarely fall below 32° F for more than 4 hours within a 24-hour period.

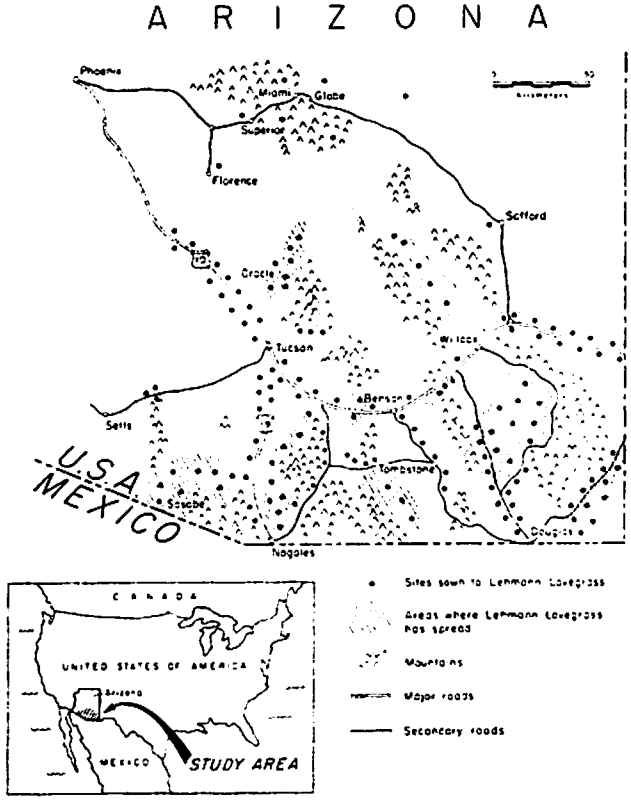

Fig. 3. *Distribution of Lehmann lovegrass in the United States.*

Since 1937 Lehmann lovegrass has been successfully established on more than 165,000 acres and has spread naturally to an additional 182,000 acres in southeastern Arizona. Private land owners in cooperation with USDA-SCS, USDA-Forest Servce and United States Department of Interior, Bureau of Land Management have sown almost 155,100 acres or 94% of the seeded areas. The total area on which Lehmann lovegrass is the major plant species is currently about 347,000 acres.

Perennial shrubs dominated the majority of the area successfully sown to Lehmann lovegrass in southeastern Arizona. Mechanical treatments were used to reduce shrub competition, increase water infiltration, and prepare a seedbed to enhance Lehmann lovegrass seed germination and seedling growth.

Mechanical soil disturbance due to highway, pipeline, and powerline construction began to accelerate after 1960 in southeastern Arizona. Because of soil erosion on disturbed areas, the Arizona Department of Transportation began to seed Lehmann lovegrass in 1965. Between 1965 and 1985 the Department seeded 4,100 acres. The majority of the seeded area (75%) was along Interstate 10 between Tucson and the New Mexico Border, and along Interstate 19 between Tucson and Nogales, Mexico (Fig. 3). Approximately, 6,750 pounds of Lehmann lovegrass seed have been sown along highways in southeastern Arizona.

The total rangeland area successfully sown to Lehmann lovegrass is more than 31 times greater than that area sown along highway, pipeline (960 acres), and powerline (240 acres) rights-of-way. However, the spread of Lehmann lovegrass may be more closely related to plantings along rights-of-way than rangeland plantings because highway, pipeline, and powerline plantings established continuous corridors into rangelands, and traverse many environmental gradients. Field plantings, on the other hand, were made in rectangular shapes and were confined to localized areas.

Grazing

Southern Africa

In South Africa, where non-preferred perennial grasses (such as Lehmann lovegrass) occur infrequently, land managers use limited grazing to stimulate preferred perennial climax grasses and non-use to limit the growth of non-preferred grasses. The hypothesis is that preferred grasses are stimulated by moderate grazing (less than 50% removal), but under moderate grazing animals will not utilize non-preferred grasses. In theory the non-preferred grasses accumulate litter, growth rate declines, and plants die and are replaced by preferred grasses.

Where South African rangelands are dominated by Lehmann lovegrass or nonpreferred perennial grasses, the grazing strategy for range improvement is based on extended rest. If the rancher is to provide long rest periods he needs many pastures within which to rotate grazing animals (multi-camp system). The ideal number of pastures, in the multi-camp system, is generally regarded as 6 to 8 per herd or flock although as many as 15 pastures are sometimes used. Within 6 to 8 pastures the rancher grazes for 7 to 14 days and rests for 35 to 98 days. Grazing periods of 7 days and rest periods for 35 to 49 days are recommended when grasses are actively growing in spring and summer. When grasses are dormant or semidormant, grazing periods are 14 days or more and rest periods are 50 to 98 days.

South African ranchers and researchers believe the multi-camp grazing system increases the competitiveness of preferred climax grasses at the expense of the less desirable non-preferred grasses. Data to support this assumption, however, are unavailable.

Arizona

In southern Arizona where Lehmann lovegrass occurs with native grasses, selective cattle grazing may favor the

establishment and spread of Lehmann lovegrass. Under conventional year long grazing management, cattle prefer native grasses during the summer growing-season and lightly graze Lehmann lovegrass. In contrast, cattle utilize Lehmann lovegrass in fall, winter, and spring because the foliage remains green longer than that of most native grasses. This seasonal pattern of animal selectivity is thought to reduce native grass vigor, because plants are repeatedly grazed during active growth. Consequently, Lehmann lovegrass may obtain a competitive advantage.

Climatic Comparison

When moisture and temperature regimes are similar at widely spaced points on the globe, a plant from one site should be adapted at the other. If this assumption is correct, moisture and temperature regimes where Lehmann lovegrass occurs as the predominant species in Africa and North America should be similar.

Seven locations in southeastern Arizona and in central South Africa were selected where Lehmann lovegrass has been the predominant forage plant for at least 20 years. Precipitation and temperature records were summarized for the seven sites in each continent. Total annual precipitation averaged 15.8 inches in South Africa and 15.9 inches in Arizona, while mean annual maximum and minimum temperatures were 78 and 49° F, and 76 and 48° F, respectively, for the South Africa and Arizona locations. While the means are similar, they do not reveal significant climatic differences that occur between African and North American locations.

In central South Africa 87% of the annual rainfall is distributed between October and March (late spring to early fall), and winters are dry (Fig. 4). In southeastern Arizona precipitation is bimodally distributed in summer (60%) and winter (40%), and spring and fall are dry. Temperatures are warmer in spring when soil moisture is available in South Africa, while summer and fall temperatures are warmer in Arizona (Fig. 5).

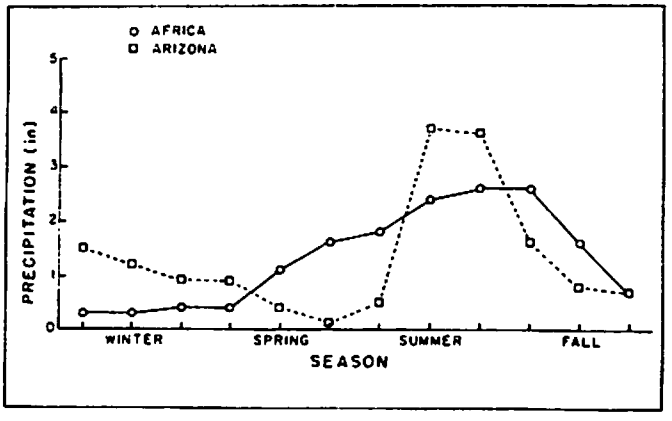

Fig. 4. *The distribution of precipitation in central South Africa and southeastern Arizona, United States of America.*

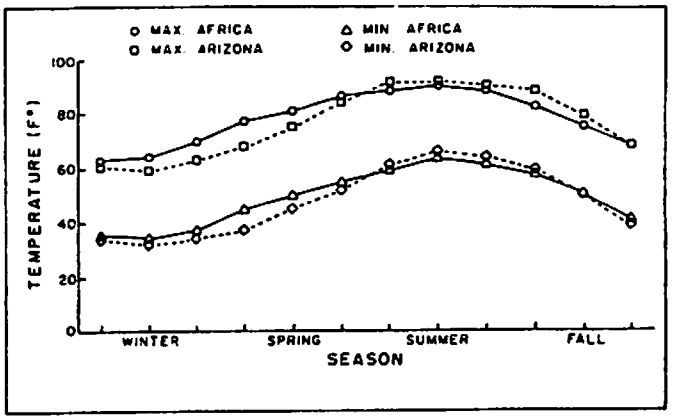

Fig. 5. *Mean maximum and minimum seasonal temperatures in central South Africa and southeastern Arizona, United States of America.*

Precipitation distribution in South Africa closely parallels that of the North American Temperate Grasslands and the Chihuahuan Desert. Winter minimum temperatures, however, in the American Temperate Grasslands and Chihuahuan Desert are 4 to 10° F cooler than southern Arizona and central South Africa. If cold temperatures are the primary regulator influencing the distribution of Lehmann lovegrass we could not expect the species to invade north, east, or southeast of its current area of distribution in Arizona. Precipitation predominantly occurs in winter and summer temperatures are 2 to 4° F higher to the west of southeastern Arizona. Under such conditions Lehmann lovegrass can be established in winter and spring, but it fails to survive hot, dry summers.

It is commonly believed that Lehmann lovegrass will continue to spread in the southwestern USA because it is adapted to a wide range of climatic and edaphic conditions. Recent studies, however, suggest that this grass is more narrowly adapted than previously thought. Climatic and edaphic conditions seem to have limited the spread of Lehmann lovegrass to southeastern Arizona. We suspect that Lehmann lovegrass invasion into native rangelands has been ecologically curtailed and subsequent population increases will largely be through increased stand densities at existing sites.