

Composition and Distribution of Blackbrush (*Coleogyne ramosissima*) Communities in Southern Nevada

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Abstract—The distribution of blackbrush (*Coleogyne ramosissima* Torr.) communities was surveyed on 15 elevational transects in the Spring and Sheep Mountain Ranges adjacent to Las Vegas Valley in southern Nevada. Species richness, density, and abundance were compared among the 15 transects and within subsets of the data delineated by geographical and elevational distribution. Three communities were classified into five vegetation zones: below blackbrush, where the plant community was dominated by creosote bush-bursage (*Larrea tridentata*-*Ambrosia dumosa*), at the lower and upper ecotones and in the center of the blackbrush community, and above blackbrush where the community is dominated by pinyon-juniper-sagebrush (*Pinus monophylla*-*Juniperus osteosperma*-*Artemisia tridentata*). Blackbrush communities shared relatively broad upper and lower ecotones with pinyon-juniper-sagebrush and creosote bush-bursage, respectively. Blackbrush communities were more frequently found on level topography than on steep slopes or in washes. Lower blackbrush ecotones generally contained the highest species richness, whereas pinyon-juniper-sagebrush stands normally contained the lowest. Blackbrush was less dense at lower blackbrush ecotones than at upper ecotones, primarily due to the presence of other shrub species. Soil moisture generally increased with elevation along the lower blackbrush boundary in Lucky Strike Canyon of the Spring Mountains.

Blackbrush communities are one of the major plant communities in southern Nevada and the Mojave Desert. They are distributed at a particular elevation between creosote bush-bursage and pinyon-juniper-sagebrush communities and are distributed on terraces and slopes of gravelly soils (Bowns 1973). Their current distributions probably developed since the last pluvial period (20,000-10,000 B.P.; Bradley 1964). West (1983) states that blackbrush communities establish primarily in sandstone and limestone-derived soils and have a low tolerance of excessive salinity and low soil moisture. Blackbrush growth begins in March but ceases when soil moisture is depleted in June; a low growth rate of blackbrush may be caused by shallow soils and a caliche layer, approximately 30 to

50 cm below the surface that impedes root growth and soil moisture (West 1983). Bowns (1973) proposed that cold air temperature limits the upper elevational boundary and that low soil moisture limits the lower elevational boundary of blackbrush communities in the state of Utah. However, no one has examined the factors limiting blackbrush distribution in southern Nevada. In this paper, we assess the composition and distributional patterns of 15 blackbrush communities on the Spring and Sheep Mountain Ranges, both located just north of Las Vegas in southern Nevada and compare those distributions to various physical factors.

Methods

We calculated species richness, density, and proportional abundance of all perennial woody species on 15 transects that spanned the elevational distribution of blackbrush in the Spring Range (12 transects) and the Sheep Range (three transects) near Las Vegas, Nevada. The transects in the Spring Range were subdivided into three geographical areas based on aspect of the mountain. Five vegetation zones were represented in our study and identified by their dominant species: creosote bush-bursage, blackbrush, pinyon-juniper-sagebrush and the upper and lower blackbrush ecotones. Mean elevations of the five vegetation zones among the 15 transects were recorded. Each of the 15 transects ran from the upper portion of creosote bush-bursage through the blackbrush belt, and terminated at the lower portion of the pinyon-juniper-sagebrush plant community. Circular plots with a 5.65-m radius (100 m²) were placed at a fixed altitudinal interval of 65 m. Transects generally contained 9 to 16 plots depending on the range of the upper and lower boundaries of the blackbrush community; a total of 181 plots were sampled. Habitats included in the transects were classified as slopes, flat surfaces, and dry washes. Cliffs and stream beds were excluded, but substitute plots were measured at the identical elevation. All plots were greater than 50 m from existing roads to eliminate possible road effects. Rank abundance curves were plotted based on the proportional abundance (Pi) for each species in 15 transects and in each vegetation zone. The value of Pi was calculated by dividing the total number of individual species by the total number of all species present at each plot. We measured water content in soils across the lower elevational boundaries of blackbrush in Lucky Strike Canyon on the east side of the Spring Mountain Range in order to determine if a positive relationship existed between elevation,

In: Roundy, Bruce A.; McArthur, E. Durant; Haley, Jennifer S.; Mann, David K., comps. 1995. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19-21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

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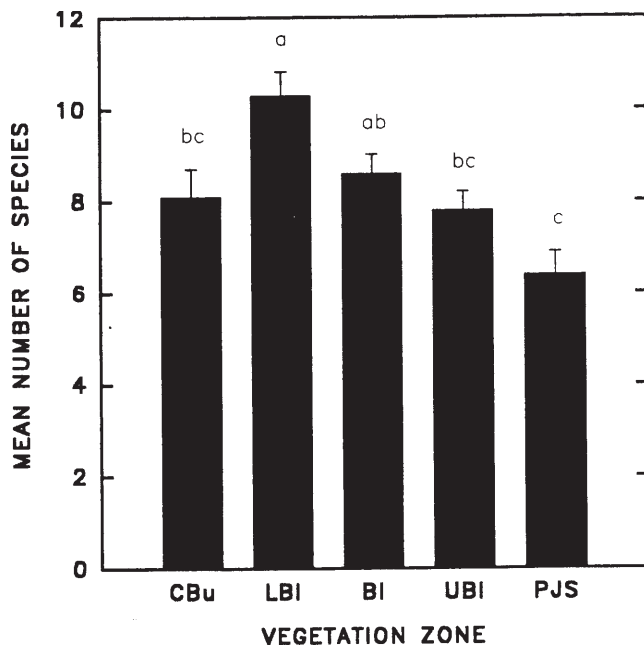


Figure 1—Mean species richness with standard errors among 15 elevational transects divided into five vegetation zones in the Spring and Sheep Mountain Ranges. Symbols: Creosote bush-bursage (CBu); lower blackbrush ecotone (LBI); blackbrush (BI); upper blackbrush ecotone (UBI); and Pinyon-juniper-sagebrush (PJS). Columns with the same letter are not significantly different ($p < 0.05$).

soil moisture content, and blackbrush density. Soil samples (0-15 cm) were collected from 36 plots, sifted through a 2-mm sieve in the field, then weighed, dried for 72 hours at 110 °C, and reweighed to determine gravimetric moisture content.

Results and Discussion

With all 15 transects combined, species richness declined significantly ($p = 0.0001$) from the lower blackbrush ecotone to the pinyon-juniper-sagebrush plant community (Fig. 1). The only deviation from this pattern was among the transects on the south side of the Spring Mountain Range, where greater species richness occurred at higher elevation, mainly due to the presence of riparian vegetation in Red Rock Canyon. Plants in riparian areas were generally more diverse, perhaps due to less water stress during droughts. Creosote bush and bursage both had highest mean densities at plots below the lower limits of blackbrush and lower densities in the lower blackbrush ecotone (Fig. 2). They were completely absent from the central portion of the blackbrush communities. Sagebrush first appeared at the upper blackbrush ecotone with less than 10% cover and replaced blackbrush at higher elevation with greater than 60% cover (Fig. 2). In southern Nevada, blackbrush stands rarely established above 2,000 m unless they were situated on south-facing slopes. Blackbrush sometimes established below 1,350 m

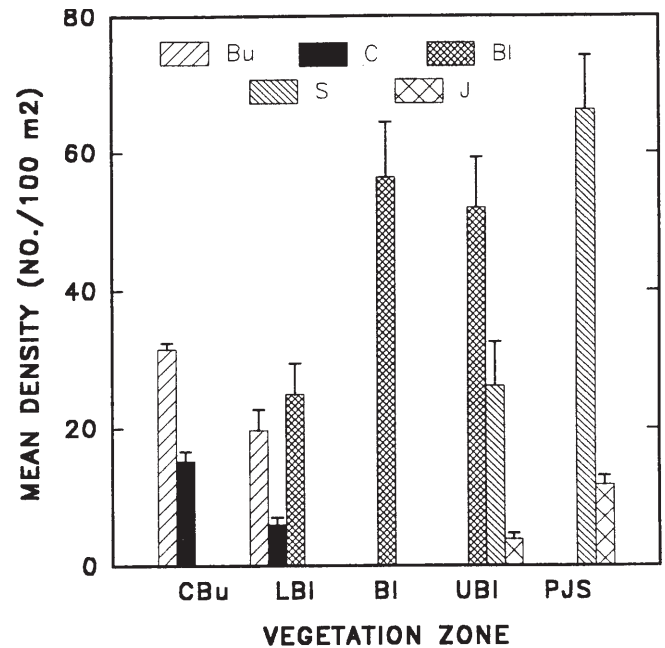


Figure 2—Mean densities with standard errors of dominant woody plant species in 15 transects within five major vegetation zones in the Spring and Sheep Mountain Ranges. Symbols are explained in Figure 1.

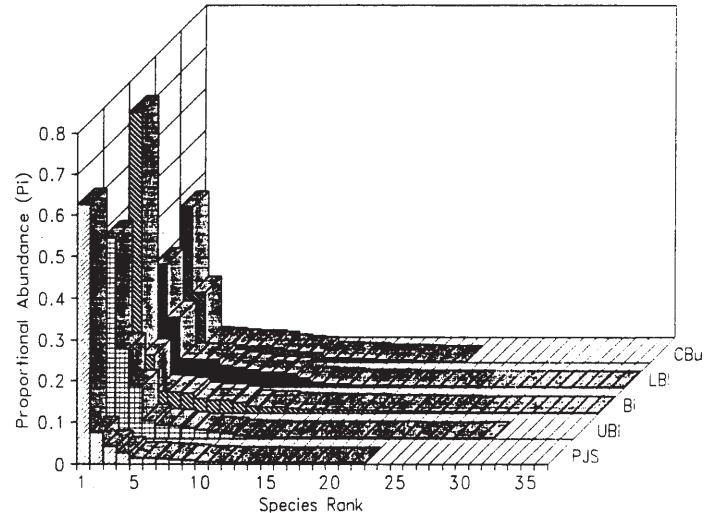


Figure 3—Rank-abundance curves of woody plants in five vegetation zones in the Spring and Sheep Mountain Ranges. Symbols are explained in Figure 1.

in elevation on north-facing slopes. Mean elevations of the five vegetation zones on the 15 transects were: 1,155 m in the creosote bush-bursage stand; 1,335 m in the lower blackbrush ecotone; 1,560 m in the blackbrush stand;

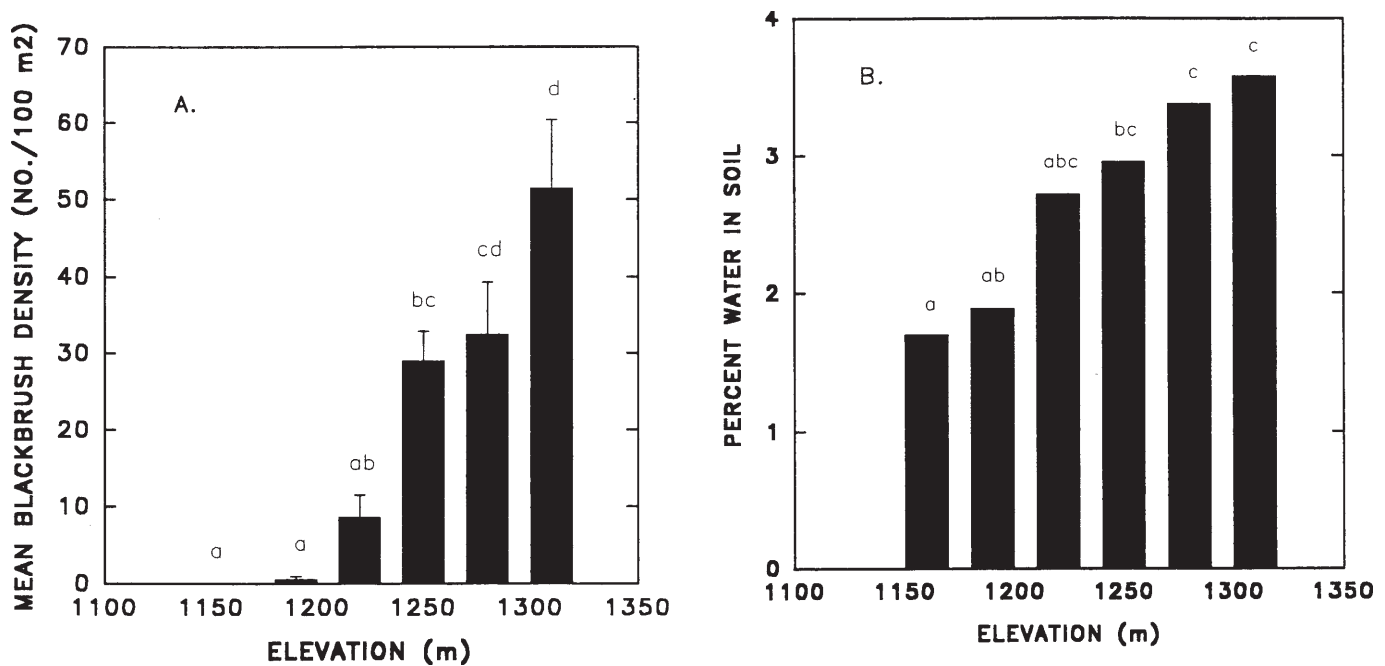


Figure 4—A. Mean density of blackbrush in Lucky Strike Canyon on the east side of the Spring Mountain Range. B. Soil moisture content measured at Lucky Strike Canyon in the month of August. Columns with the same letter are not significantly different ($p < 0.05$).

1,770 m in the upper blackbrush ecotone; 1,870 m in the pinyon-juniper-sagebrush stand. Blackbrush communities generally have relatively broad upper and lower ecotones. The zone of vegetation dominated by blackbrush overlapped with creosote bush-bursage and pinyon-juniper-sagebrush communities by as much as 100 m in elevation.

Creosote bush-bursage, blackbrush, and big sagebrush dominated their respective plant communities (Fig. 3). The blackbrush and lower blackbrush ecotones had the greatest species richness with 36 species in each community. The creosote bush-bursage stand had the highest species evenness ($E = 0.24$) as noted by the flat abundance curve, indicating similar abundance of most shrub species. However, the blackbrush community had the lowest evenness ($E = 0.05$) due to the dominance of blackbrush shrubs. Relatively mature and stable blackbrush stands tend to form monospecific communities. Pinyon-juniper-sagebrush stands also had a low species evenness ($E = 0.09$) and a relatively steep rank-abundance curve because of the domination of big sagebrush. Pinyon and juniper trees, although visually a dominant component of the vegetation at the upper elevation, were not abundant in our study plots. The upper blackbrush ecotone had a higher evenness ($E = 0.11$) than the pinyon-juniper-sagebrush community. Blackbrush stands are more commonly established on level topography (39%) or gentle slopes (50%) than on steep slopes ($>45^\circ$; 5%) or in active washes (6%).

Bowns and West (1976) suggested that low soil moisture is a factor limiting the distribution of blackbrush at its lower elevational boundaries. Our data support their suggestion. The mean density of blackbrush differed significantly along the lower blackbrush limits (Fig. 4A) and

was positively correlated with elevation ($r = 0.98$; $p < 0.0000$) and soil moisture (Fig. 4B; $r = 0.84$; $p = 0.0434$) in Lucky Strike Canyon on the east side of the Spring Mountain Range. Correlations between blackbrush density and soil moisture increased as the summer season progressed.

Conclusions

The blackbrush community is one of the dominant vegetation types in southern Nevada. Blackbrush stands range from approximately 1,350 m elevation on north-facing slopes to over 2,000 m on south-facing slopes. The lower blackbrush boundary had the greatest species richness; pinyon-juniper-sagebrush stands had the lowest richness. However, this pattern was only significant when all 15 elevational transects were combined, presumably due to elevational and topographical variations among transects. Despite broad ecotones, blackbrush communities were nearly monospecific. All five vegetation zones were dominated by one or two species that accounted for greater than 16% of all vegetation cover of the dominant species. Species evenness generally decreased with elevation, but was lowest for the blackbrush community. Only sagebrush had higher densities than blackbrush. A positive correlation between abundance of blackbrush and soil moisture across the lower elevational limits of blackbrush in Lucky Strike Canyon suggested that moisture may be a factor that limits the distribution of blackbrush at its lower elevational boundary.

Acknowledgments

We thank Yin-Chin Lei and Steven Lei for collecting soil samples. The University of Nevada Las Vegas motor pool and the Department of Biological Sciences provided logistical support.

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