

Exclosures on the Beaver Dam Slope in Arizona and Utah

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Background

A study of exclosures was conducted by the Arizona Strip District of the Bureau of Land Management on the Beaver Dam Slope (Fig. 1) during the summer of 1992 to evaluate the effects of livestock grazing and trampling on cover components and vegetation composition. The exclosures are: 1) Tortoise Exclosure, Arizona- a five hundred acre area which excludes livestock in tortoise habitat in Arizona. This exclosure was built in 1977 on the limy upland, limy upland deep and cobbly limy upland deep ecological sites with elevation varying from 2460 feet to 2680 feet; 2) Utah Beaver Dam Exclosure- a one acre exclosure in Utah built in 1956 on the limy upland ecological site at an elevation of 2960 feet; and 3) I-15 Fenced Right-Of-Way in Arizona, built about 1965 on the limy upland and sandy upland ecological

described as hot and dry. Three major air masses influence the climate of the area; the tropical Atlantic (Gulf), the tropical Pacific, and the polar Pacific. These masses create a bi-seasonal climatic pattern typical of most of the southwestern U.S. The area receives most of the annual precipitation during two peak storm periods-winter (November to February) and summer (July to September). Summer storms are convectional, local, intense, and of short duration with the eastern Mojave receiving more of its annual rainfall from these storms than does the western Mojave Desert (Bailey 1981). The driest months are April through June and September. Prevailing winds in the winter are westerly and storms are frontal in nature. Annual precipitation has varied from 3.12 inches in 1968 to 14.32 inches in 1978 with an average of 7.08 inches. Regional climatic data for Kanab, Utah shows the decade of the 1980s was the wettest of the century.



Fig. 1. The Beaver Dam Slope of Utah and Arizona.

sites at 1960 feet elevation.

Livestock grazing use in the area can be characterized as light as evidenced by utilization studies and comparison of vegetation inside and outside of exclosures. Hughes (1990) reported that four trend transects in the area from 1981 to 1989 all show upward trend on key species. Average utilization during that time was 22 percent with a range of utilization from 11 to 34 percent. Ecological site inventory (ESI) data shows the present vegetation is at or near the potential natural community on most ecological sites.

Climate

The climate of the eastern Mojave desert can be

Methods

Ecological Site Inventory

Ecological Site Inventory was conducted in accordance with the Soil Conservation Service National Range Handbook and BLM Manual Handbook H-4410-1. The soils were mapped, ecological sites identified, and plant production and composition by dry weight were determined by



The Tortoise Exclosure, Arizona, was constructed in 1977 and shows the ungrazed area on the left and grazed area on the right during the fall of 1993.

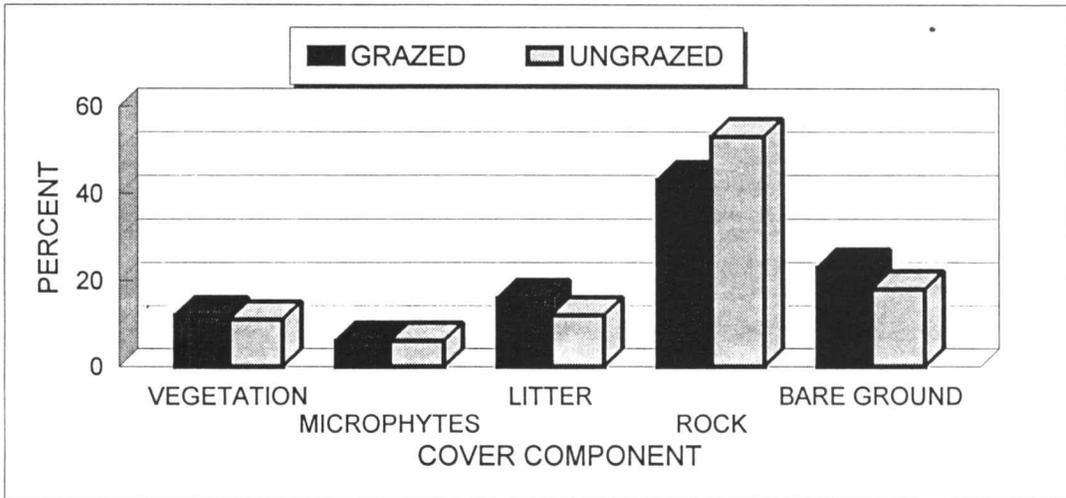


Fig. 2. Cover components during 1992 in Tortoise Exclosure, Arizona. Established in 1977.

estimating, or by a combination of estimating and harvesting.

Cover Transect

Cover components of basal and foliar vascular vegetation, visible microphytes (non-vascular plants), litter, rock and bare ground were documented along 10 pace frequency transects each consisting of 100 16 x 16 inch quadrats systematically located at five-pace intervals over a distance of about 1/2 mile using a method similar to Smith and Despain (1987) for estimating species composition by the Dry-Weight-Rank method. Rank 1 corresponds to .5 percent cover, rank 2 to .3 percent and rank 3 to .2 percent per quadrat. Percent trampling of the ground surface and microphytes by livestock were also determined for each quadrat and summarized for each transect.

Vegetation and Soils

Creosotebush and white bursage are the dominant vegetation on all sites except the sandy upland which is dominated by warm season grasses such as sand dropseed and big galleta. There is also a good mix of other species in the area such as joshua tree, mormon tea, ratany, paperflower, cactus, brittlebush, winterfat, wolfberry, bush muhly, Indian ricegrass, desert trumpet, globemallow, and desert marigold. Soil textures are primarily sandy loam with the exception of the sandy upland site which is a loamy sand. All soils are calcareous except the sandy upland site. These are all deep soils (greater than 60 inches) except the limy upland site which is typically less than 20 inches in depth. About half of the soil surface of the cobbly limy upland deep site is covered by gravel, cobbles and stones. The sandy upland site is essentially free of gravel and rock,

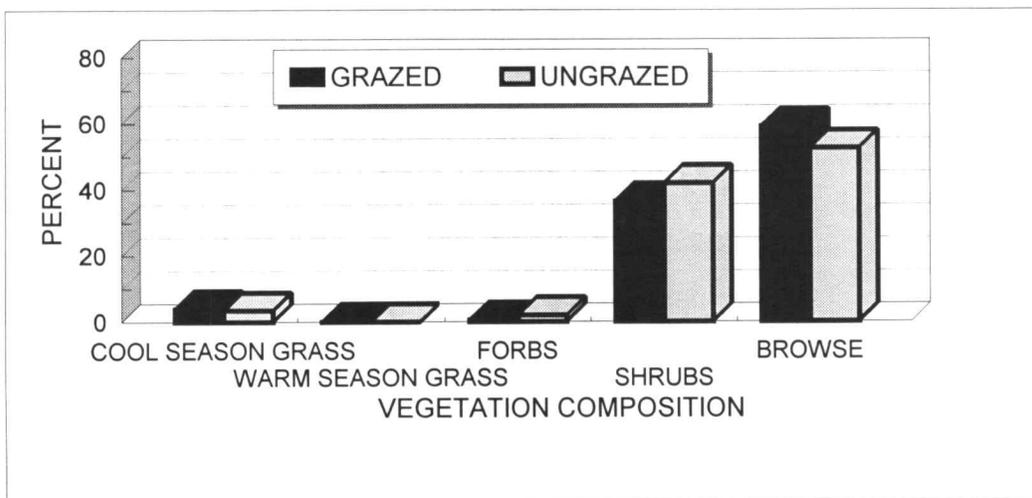


Fig. 3. Vegetation Composition during 1992 in Tortoise, Exclosure, Arizona. Established in 1977.

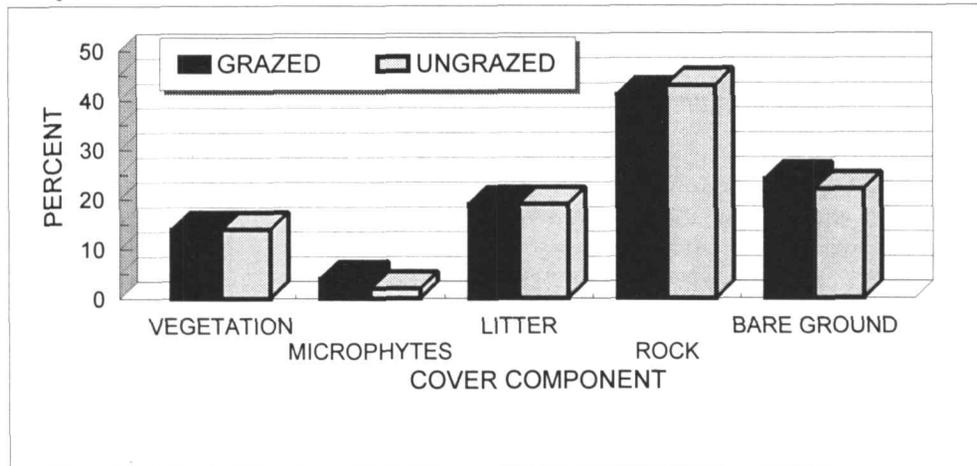


Fig. 4. Cover components during 1992 in Beaver Dam Slope Exclosure, Utah. Established in 1956.

whereas the other sites vary from 10 to 30 percent gravel and rock.

Results

Tortoise Exclosure, Arizona

Figures 2 and 3 show cover and vegetation composition data for the tortoise exclosure in Arizona. When the grazed area is compared with the ungrazed exclosure, there is no measurable difference in vegetation cover and microphyte cover. Research has shown that cover of microphytic species is reduced by heavy grazing and recovery of disturbed microphytic crusts occurs in 10-18 years after grazing is removed (Anderson et al., 1982). The light grazing use has had little effect on the microphytic cover which is

sensitive to heavy grazing. There is 33 percent more litter, 18 percent less rock, and 25 percent more bare ground on the grazed area than inside the exclosure. The most noticeable difference in species composition is more browse (woody plants used as forage for ungulates) on the grazed area than inside the exclosure.

Utah Beaver Dam Exclosure

Figures 4 and 5 show cover and vegetation data for the Utah Beaver Dam exclosure. When the grazed area is compared with the ungrazed exclosure, there is no measurable difference in vegetation litter, and rock cover, and bare ground. There is 73 percent more microphyte cover on the grazed area than inside the exclosure. There is no measurable difference in species composition inside or outside of the exclosure.

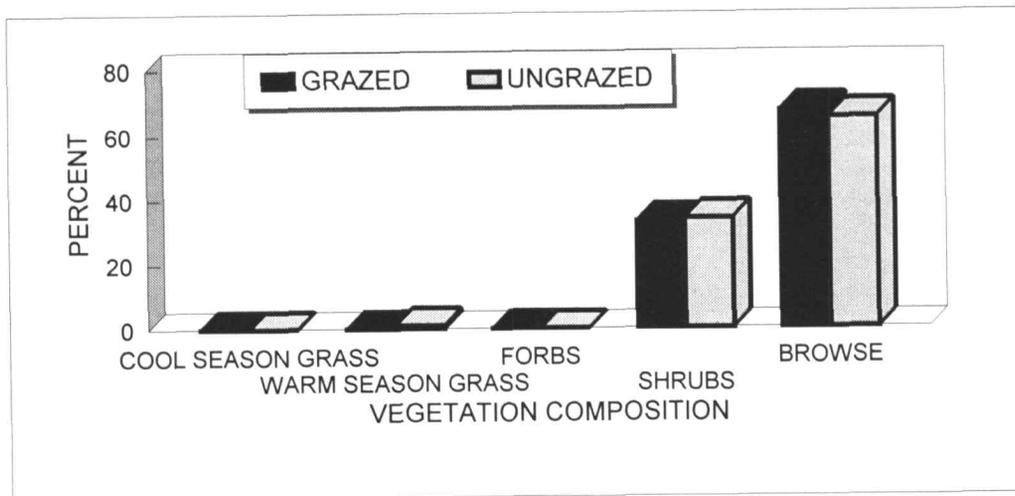


Fig. 5. Vegetation Composition during 1992 in Beaver Dam Slope Exclosure, Utah. Established in 1956.

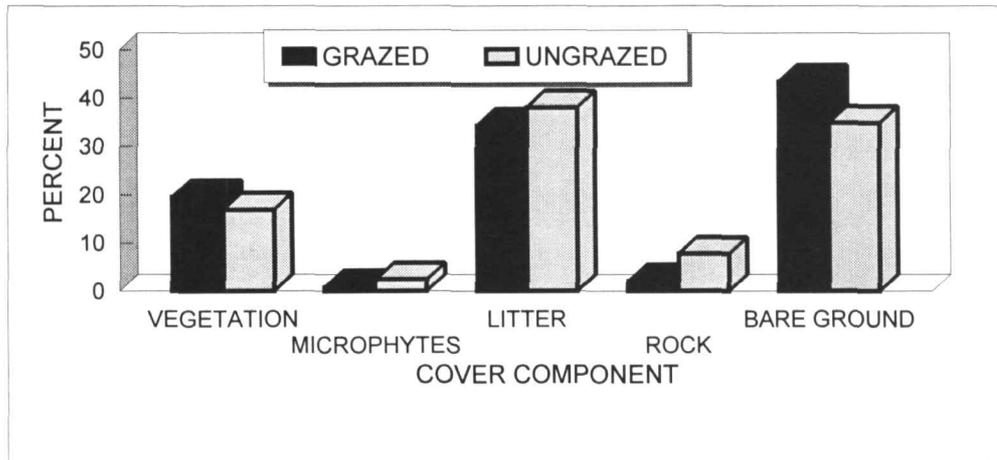


Fig. 6. Cover components during 1992 in 1-15 Right-of-Way, Arizona. Established approximately 1965.

I-15 Fenced Right-of-Way

Figures 6 and 7 show cover and vegetation composition data for the fenced I-15 right-of-way in Arizona. Cover data was collected only on the sandy upland site. When the grazed area is compared with the ungrazed area inside the right-of-way, there was 15 percent more vegetation cover, 67 percent less microphyte cover, 11 percent less litter, 74 percent less rock, and 24 percent more bare ground on the grazed area than inside the right-of-way. The sandy upland site is dominated by warm season perennial grasses and the limy upland site is dominated by woody species inside and outside of the fenced right-of-way. The other noticeable difference is a higher species composition of perennial grasses and browse and less forbs on the grazed sandy upland area than inside the right-of-way.

conjunction with the literature findings support the following conclusions: 1) vegetation cover is slightly higher outside (grazed) the enclosures than inside (ungrazed), 13.4 percent and 12.7 percent respectively; 2) microphytic cover is slightly higher in the grazed condition (4.6 percent) versus the ungrazed condition (4.2 percent) and it appears that grazing on the Beaver Dam Slope during the past 20 years has been light and has not affected the development of microphytes; 3) microenvironment and ecological site appeared to have more influence on occurrence of microphytes than did trampling from light to moderate grazing; 4) most soils on the Beaver Dam Slope are sandy in texture and have low potential for developing microphytic crusts and support an average of less than 2 percent microphytic cover which is not a substantive contribution to ground cover; 5) calcareous ecological sites (greater than 10 percent calcium carbonate) and with an annual precipitation less than eight inches are dominated by woody species with very little perennial grass present, and non-calcareous

Conclusions

Composite enclosure data from the Beaver Dam Slope in

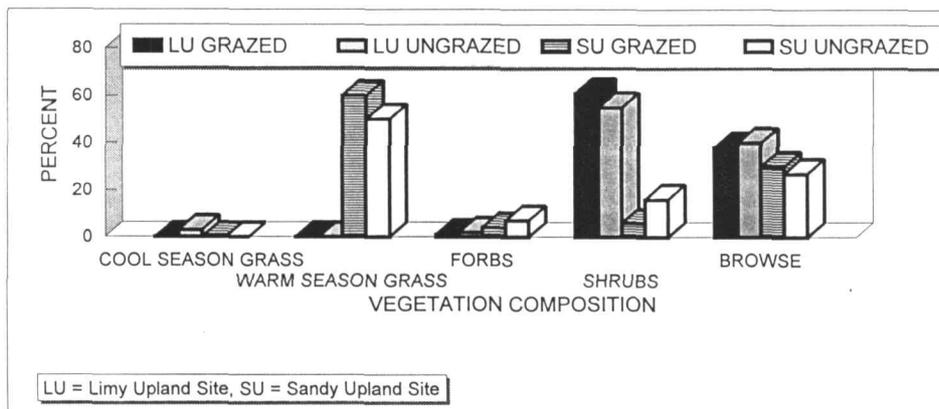
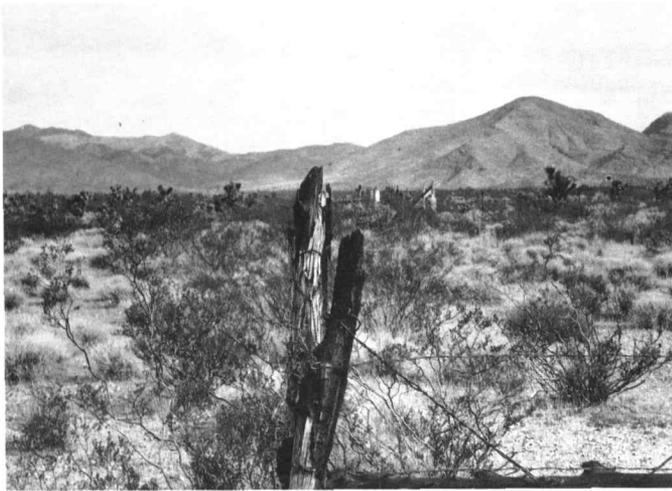


Fig. 7. Vegetation Composition during 1992 in 1-15 Right-of-Way, Arizona. Established approximately 1965.



The Utah Beaver Dam Exclosure was constructed in 1956 and shows the grazed area on the left and the ungrazed area on the right during the fall of 1993.

sandy upland sites under similar climatic conditions are dominated by warm season grasses both inside and outside of the exclosures; and 6) since vegetation cover has not responded with observable increases between the grazed and ungrazed conditions during the decade of the 80's (which was the wettest of century), it appears that vegetation cover on the Beaver Dam Slope is at or near its potential and is in a stable state.

The kind of vegetation is determined by site potential which is based on climate and soils where past and present grazing is proper. Not all species are found on every site, for example, on the sandy upland site (non-calcareous surface) winterfat and creosote bush are absent or greatly reduced whereas perennial warm season bunch grasses dominate. The Arizona Beaver Dam Slope has over 6100 acres (10.2 percent of total area in Arizona) dominated by perennial grasses which is in harmony with early USGS information. Not every ecological site will produce bush muhly and its presence is related to water availability. On the Beaver Dam Slope, bush muhly grows at the higher precipitation end of the limy upland site or in drainages (sandy wash sites) in the valley where additional moisture is available and the plant is usually found under the favorable microenvironment of a shrub.

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