Mima mounds was seeded to intermediate and crested wheatgrasses, smooth brome, Russian wildrye, and big bluegrass in 1949-53. In 1959 yield determinations and stand evaluations were made on the mounds and between the mounds to determine the effects of microrelief on the seeded species.

Herbage yields on the Mima mounds were 94 percent (intermediate wheatgrass) to 542 percent (big bluegrass) greater than between the mounds. Stands were better on the mounds by 29 percent (Russian wildrye) to 183 percent (smooth brome).

Nitrogen, as estimated from organic matter, was 66 percent greater on the mounds than in the intermound areas. Although water holding capacity was about the same for both locations, the depth of soil above bedrock was twice as great in the mounds as between the mounds, allowing greater volume of water to be stored in the mounds.

It is suggested that the higher yields on top of the mounds result from a combination of better stands, more nitrogen, and a greater soil volume available for water storage.

**LITERATURE CITED**

**Grazed Glades Can Grow Good Grass**

ROBERT F. BUTTERY

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The glades, southwest Missouri's only natural grasslands, have been overused by livestock for many years, and herbage production is far below what it should be. How much herbage can the glades produce? How fast do glade ranges recover from abuse? What is the reaction of glades to complete protection from grazing? Some answers to these questions were found by sampling the vegetation inside and outside two exclosures located on the glades.

These small areas, fenced to exclude livestock, are the Lizard Pen Exclosure, established in 1938, and the Caney Tower Exclosure, established in 1956. Both are about 1 acre in size and are located on typical glade range on the Ava District of the Missouri National Forest in Taney County, Missouri.

Ocular estimates of herbage production and composition were made inside and outside the exclosures at the end of the growing season in 1956, 1957, and 1958. In 1959 production and composition were estimated outside and sampled inside by clipping, sorting to species, and weighing the herbaceous vegetation on eight randomly located, 2.4-square-foot quadrats in each exclosure.

Observations in the Caney Tower Exclosure show that under complete protection, glade ranges recover quickly from abuse and are capable of producing nearly seven times as much herbage as they now produce (Figure 1).

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1 Maintained in cooperation with the School of Forestry, University of Missouri Agricultural Experiment Station, Columbia, Missouri.

Figure 1. Caney Tower Exclosure 4 years after fencing. Herbage production inside is about 2,800 pounds (oven-dry) per acre and only about 400 pounds per acre outside.
Table 1. Herbage production and percent composition by oven-dry weight, Caney Tower and Lizard Pen Exclosures, 1959

<table>
<thead>
<tr>
<th>Species</th>
<th>Caney Tower 4 years protection</th>
<th>Lizard Pen 21 years protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lbs./acre</td>
<td>Percent</td>
</tr>
<tr>
<td>Little bluestem</td>
<td>1,555</td>
<td>56</td>
</tr>
<tr>
<td>Big bluestem</td>
<td>465</td>
<td>17</td>
</tr>
<tr>
<td>Indian grass</td>
<td>310</td>
<td>11</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Baldgrass</td>
<td>220</td>
<td>8</td>
</tr>
<tr>
<td>Panic grass</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sedges</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Forbs</td>
<td>195</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,775</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

After one growing season of protection there was very little difference in herbage production and composition inside and outside the exclosure. However, by the end of the fourth growing season herbage production inside the exclosure had increased to 2,775 pounds per acre, an increase of nearly 600 percent in only 4 years. Baldgrass, (Sporobolus neglectus Nash.) which had been the dominant species, had decreased to only 8 percent of the total production while little bluestem had increased from almost nothing to 56 percent.

Big bluestem (Andropogon gerardii Vitman) and Indian grass, (Sorghastrum nutans (L) Nash.) had increased from a trace to 17 percent and 11 percent, respectively.

In 1956, as now, the glades outside the exclosures were producing about 400 pounds of oven-dry herbage per acre, mostly the less desirable baldgrass and black-eyed susan (Rudbeckia hirta L.) with a scattering of the more desirable little bluestem (Andropogon scoparius Michx.) and Indian grass (Table 1).

Herbage production in the nearby Lizard Pen Exclosure probably reached a peak 5 or 6 years after fencing, but production decreased about 25 percent over the years. Such a decrease is typical of the reaction of any grassland area where the old herbage is not removed periodically. After 21 years of complete protection, herbage production has stabilized, because of continued complete protection, at about 2,150 pounds per acre, 23 percent less than production in the Caney Tower Exclosure. The greatest difference was in production of little and big bluestem, but the significance of this difference was offset to some extent by greater Indian grass production in the Lizard Pen Exclosure.

Many of southwest Missouri's glade ranges in poor condition could contribute more to the forage resource of the region if they were given 3 or 4 years of complete protection from grazing and moderately stocked thereafter. Complete recovery would probably not be obtained after only 3 or 4 years, but the range should continue to improve under moderate grazing.

An Evaluation of Big Game Winter Range in Southwestern Alberta

GEORGE J. MITCHELL AND ROBERT G. H. CORMACK

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In southwestern Alberta, topographic and climatic features impose a heavy concentration of elk (Cervus canadensis nelsoni) and mule deer (Odocoileus hemionus hemionus) on undersized winter ranges. The problem of managing game herds in this region is further complicated by the fact that these same winter ranges must support large numbers of cattle and sheep during the spring and summer months.

The study reported herein was initiated in the summer of 1955. It is a follow-up of information gained from ground and aerial counts made during the winters of 1953 and 1954 in the Crow's Nest Forest Reserve by the senior author. The study consisted essentially of the determination of the density and composition of range grasses and forbs on heavily utilized big game winter ranges and the evaluation of these ranges in terms of their climax status.

This range study was made under the supervision of Mr. E. S. Huestis, Director of Forestry, Alberta Department of Lands and Forests. The writers wish to acknowledge the cooperation of the numerous forest officers in the Crow's Nest Forest Reserve who assisted with the range census in certain locales and/or submitted winter big game distribution maps and census figures for elk, moose, deer and bighorn sheep.

We also wish to thank Mr. J. A. Campbell, Department of Lands and Forests, for identifying certain grass specimens.