

Seasonal Diets of Cattle on Hot Desert Rangelands

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Introduction

Knowledge of season diets of grazing animals is useful in managing rangelands. Such information can be used to help in designing grazing systems, estimating proper levels of forage utilization, anticipating needs for nutritional supplements, and reducing conflicting needs of wildlife and domestic grazing animals (Heady, 1964). Relatively few diet studies have been done on cattle grazing in the hot desert ecosystem. The objectives of these studies was to study the seasonal changes of cattle diets in several different types of hot desert vegetation.

Review of Literature

Grazing animals are highly selective of plant species and plant parts, thus the nutritional value of the diet is usually higher than average nutrient content of the vegetation would indicate (Wallace, Free and Denham, 1972; Galt, 1972). Diet of the animal depends greatly on the species composition of the available vegetation. Preference for different plant species may be influenced by many factors such as chemical content or greenness of the forage, physical properties of the plants (leaf/stem ratios, leaf covering, etc.), previous experience of the animals, weather conditions and the like. Generally, selectivity is greatest at the peak of plant growth conditions (Springfield and Reynolds, 1951) and decreases as available forage matures (Wallace, Free and Denham, 1972). The results of some previous studies of cattle diets in semiarid rangelands of the Southwest are reviewed below.

On a northern desert shrub range in Nevada, Lesperance, Tueller and Bohman (1970) reported grasses comprised 83% of steer diets throughout the summer grazing period, although less than 15% of the vegetation cover consisted of grass. In another study on a southern Nevada shrub range, Conner, et al. (1973) found the average of cattle diets from July to December was 12% grass and 85% shrub. Shrubs made up 90% of the vegetation. However, monthly diets of steers varied from 0.2 to 85% grass.

Rosiere, Beck and Wallace (1975) determined seasonal cattle diets on a semidesert rangeland in New Mexico. They found that cattle consumed 56% of all species available on the study area, with the diet averaging 45, 29, and 19% grasses, forbs, and shrubs, respectively. Grass content of the diet was highest in summer and lowest in spring. Mesa dropseed (Sporobolus flexuosus) was the most important species. Percentage of forbs in the diet varied little among seasons, however different species of forbs were eaten

at specific seasons. Russian thistle (Salsola kali) was the dominant forb in the diet and was eaten mainly in the fall. Shrub content was highest in spring when soaptree yucca (Yucca elata) was grazed almost exclusively.

Galt et al. (1969) studied cattle diets on a semidesert rangeland in southern Arizona during the period of September through December. The diet from rumen fistulated steers was 81% grasses, 4% forbs, and 9% shrubs. Plains bristlegrass (Setaria macrostachya) and Arizona cottontop (Digitaria californica) made up 53% of the diet but only comprised 7 and 8%, respectively, of the vegetation. On the other hand, Lehmann lovegrass (Eragrostis lehmanniana) made up 69% of the vegetation but only 23% of the diet. In another study on semidesert grassland in southern Arizona, Galt (1972) found that the shrubs false mesquite (Calliandra eriophylla) and velvet mesquite made up substantial proportions of the diet both during winter and summer. Prickly pear (Opuntia engelmannii) was eaten in significant quantities in the winter. Forbs were insignificant in all seasons.

Study Areas and Methods

These studies were conducted in two areas, near Safford and near Globe, Arizona. The weather station in Safford is at an elevation of 2954 feet and has an average annual precipitation of 8.47 inches, 65% of which occurs from May to October. Precipitation during the study was below normal (7.01 inches). The samples were taken on the Whitehouse, Van Gausig, and Creosote grazing allotments (Safford District Bureau of Land Management) located 15 miles northwest, 16 miles south, and 7 miles southeast of Safford, respectively. Each of the three allotments had a different occurrence and pattern of range sites and vegetation (Table 1). In general, the vegetation ranges from desert shrub to semidesert grassland.

The other study area was located on the Sierra Ancha grazing allotment of the Tonto National Forest near Roosevelt Reservoir. This area lies at an elevation of 2400 feet. The average annual rainfall is 14.15 inches, of which about 50% comes from December through March and about 30% from July through September. In the year of this study (1979) winter rain was above average and summer rainfall was considerably below average. Three major vegetation types corresponding to range sites are found on the area. On the Sandy Bottom sites along dry arroyos mesquite (Prosopis velutina), blue palo verde (Cercidium floridum), catclaw (Acacia greggii), wolf berry (Lycium fremontii), and whitethorn (Acacia constricta) predominate. Loamy Upland range sites support jojoba (Simmondsia chinensis), foothill palo verde (Cercidium microphyllum), creosote bush (Larrea tridentata), triangle bursage (Ambrosia deltoidea), brittle bush (Encelia sp.), are saguaro (Cereus giganteus). On Limy Slopes site brittle bush, crucifixion thorn (Holacantha sp.), yucca (Yucca sp.) and several species of cholla (Opuntia spp.) are most abundant.

Table 1 Range sites and associated major plant species occurring on the Whitehouse, Van Gausig, and Creosote Allotments near Safford, Arizona.

Range Site	Allotment	Major Species
Sandy Loam Upland	Whitehouse Van Gausig	Burroweed Mormon Tea Yucca Whitethorn Mesquite
Limy Upland	Whitehouse Creosote	Creosote bush Mesquite Rayless goldenhead
Sandy Loam Bottom	Whitehouse	Saltbush Wolfberry Rayless goldenhead Yucca Mesquite
Loamy Bottom	Whitehouse	Shadscale Rayless goldenhead Creosote bush Fluffgrass
Sandy Bottom	Whitehouse	Burrobrush Catclaw Wolfberry Saltbush Mesquite
Clay Loam Upland	Van Gausig	Snakeweed Burroweed Mesquite Tobosa grass Sideoats grama Threeawns
Granitic Hills	Van Gausig	Burroweed Snakeweed Prickly pear Yucca Cholla
Clay Loam Bottom	Creosote	Saltbush Mesquite Snakeweed

Cattle diets were determined by the microhistological technique for analyzing fecal matter (Sparks and Malechek, 1968). On each allotment samples were taken from 2-3 locations at each sampling date. Samples were collected in vicinity of a watering point to facilitate location of fresh samples. At each location 5 samples were taken from fresh cattle dung and composited for analysis.

Sampling at the Safford locations was done approximately once per month from June, 1979 until June, 1980. Two locations were sampled on the Whitehouse Allotment, the Brimhall and Company windmills. These two locations represented different combinations of range sites and vegetation. On the Creosote Allotment, samples were taken from 3 locations throughout the year. On the Van Gausig Allotment sampling locations varied because this allotment was managed on a rotational grazing plan. On the Sierra Ancha Allotment 3 locations were sampled in each of two pastures on 9 dates from March 22, 1979 to October 19, 1979.

For a more complete description of methods used to determine diet composition and for statistical analysis see Soares (1980) and de Luna (1980).

Results

Whitehouse Allotment

Average diet composition for the year was 56% shrubs, 27% forbs and 9% grasses, with 12 species making up 82-99% of the diet on any given date. Shrubs made up the highest percentage of the diet on all sampling dates except on two dates in April when cool-season annual grasses and forbs predominated (Figure 1). Filaree (Erodium cicutarium) and Mediterranean grass (Schismus barbatus) were the principal species in the diet during this April period (Table 2). Tobosa grass (Hilaria mutica) was the only warm-season perennial occurring in significant amounts and it was only important in the month of August. Saltbush (Atriplex spp.) was the most important shrub component of the diet in most months. Prickly pear made up 35-50% of the diet in the months of December and January. Mesquite ranged from 3 to 17% of the diet from late spring until November. The data presented in Figure 1 and Table 2 are an average of the Company Well and Brimhall Well locations. On some dates there was a significant difference in diets at these two locations which apparently reflected the difference in occurrence and pattern of range sites at the two locations.

Creosote Allotment

Average diet was 90% shrubs in this allotment with 9 species making up 95-99% of the diet. Forbs made up 33-57% of the diet in the month of April but only minor amounts in other months (Figure 2). Grasses never made up more than 1% of the diet in any month. Borages (Plagiobothrys arizonicus, Cryptantha micrantha, and Amsinckia intermedia) were the most important cool-season annual forbs in April (Table 3). Saltbush made up more than 80% of the

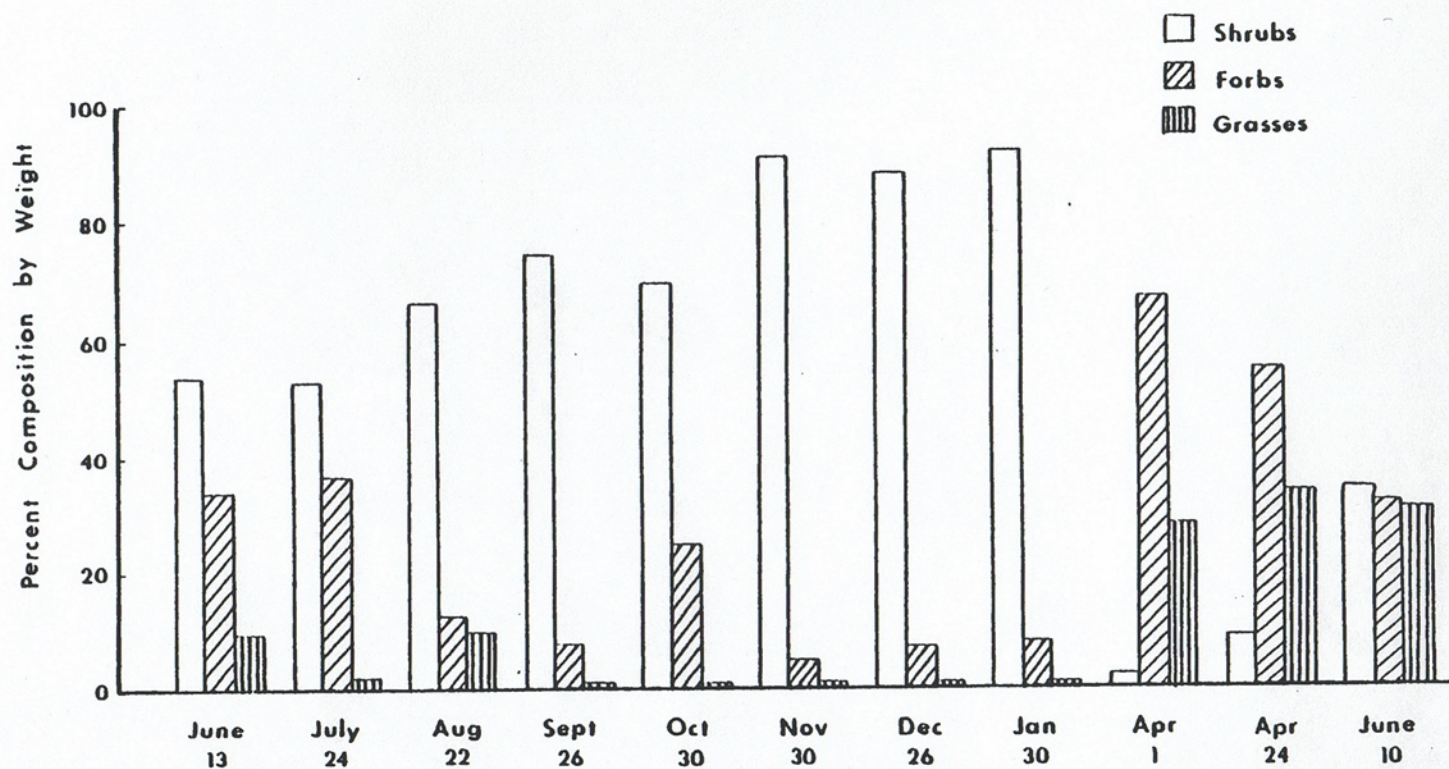


Figure 1. Percentage composition of the major shrubs, forbs, and grasses in cattle diets by sampling date on the Whitehouse allotment.

Table 2. Average percent seasonal composition of cattle diets for major species on the Whitehouse allotment.

	<u>6/13</u>	<u>7/24</u>	<u>8/22</u>	<u>9/26</u>	<u>10/30</u>	<u>11/30</u>	<u>12/26</u>	<u>1/30</u>	<u>4/1</u>	<u>4/24</u>	<u>6/10</u>
<u>Major Forbs</u>											
Borages	—	<1	—	—	<1	—	—	—	7	3	—
Filaree	34	35	12	7	24	4	7	6	52	52	32
Nama	<1	<1	—	—	—	—	—	—	8	<1	—
Globemallow	<1	—	—	—	—	<1	—	<1	<1	<1	<1
<u>Major Shrubs</u>											
Saltbush	50	40	58	65	52	85	31	39	<1	9	33
Menodora	—	1	1	—	<1	—	<1	—	<1	—	<1
Pricklypear	<1	—	—	—	—	—	35	50	—	—	—
Mesquite	3	12	8	7	17	6	2	3	<1	—	—
Yucca	—	—	—	3	—	—	21	<1	—	—	—
<u>Major Grasses</u>											
Foxtail brome	<1	<1	1	—	<1	—	—	<1	7	5	11
Mediterranean grass	8	1	1	<1	—	<1	—	<1	20	29	20
Tobosa grass	—	—	6	—	—	<1	<1	—	<1	—	—
<u>Others</u>	3	9	12	18	6	4	4	<1	3	2	3

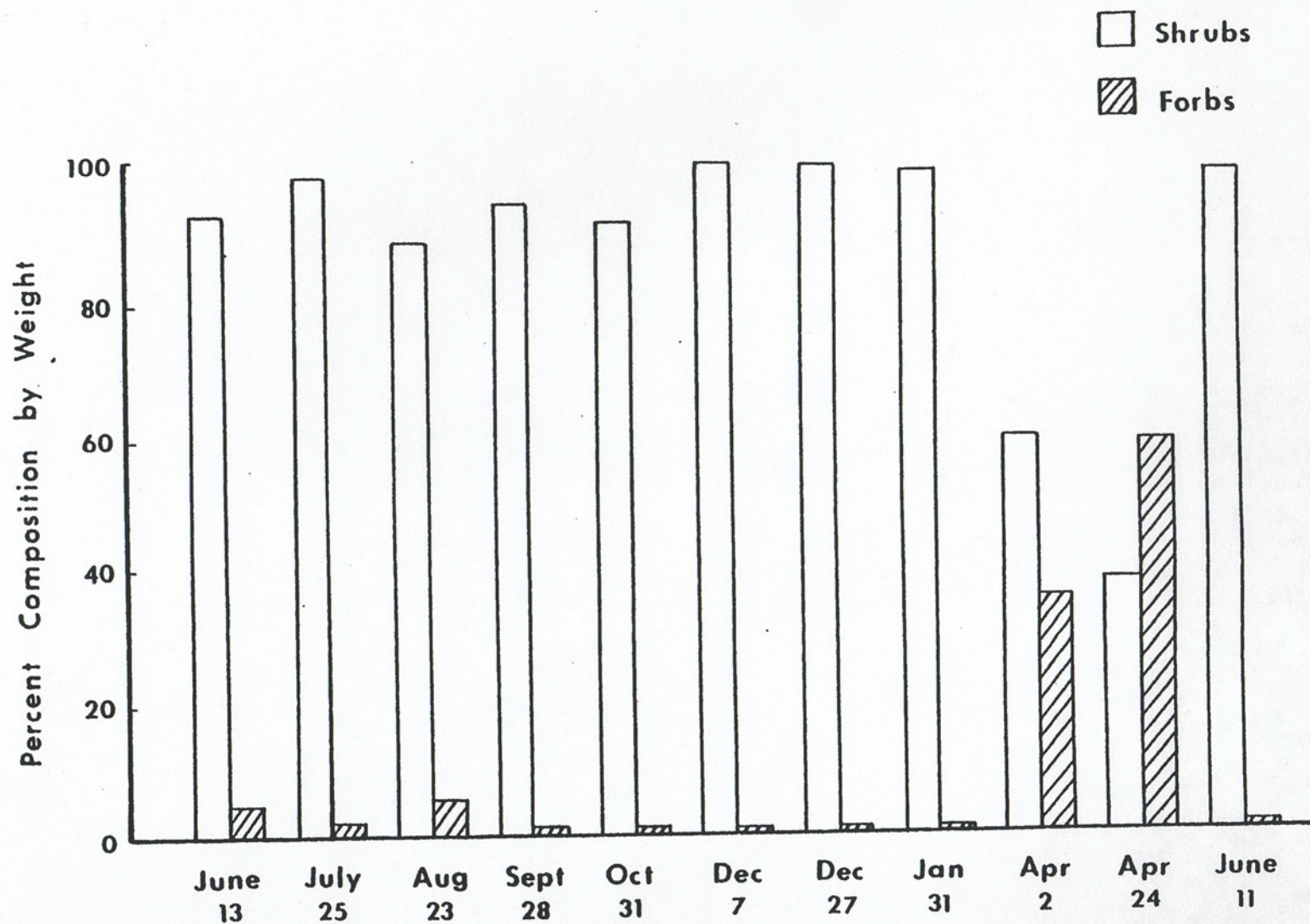


Figure 2. Percentage composition of the major shrubs and forbs in cattle diets by sampling date on the Creosote allotment.

Table 3. Average percent seasonal composition of cattle diets for major species on the Creosote allotment.

	<u>6/13</u>	<u>7/25</u>	<u>8/23</u>	<u>9/28</u>	<u>10/31</u>	<u>12/7</u>	<u>12/27</u>	<u>1/31</u>	<u>4/2</u>	<u>4/24</u>	<u>6/11</u>
<u>Major Forbs</u>											
Borages	—	—	—	—	—	—	—	—	32	56	<1
Gordon bladderpod	3	2	5	—	—	—	—	—	2	<1	—
Globemallow	<1	—	—	<1	—	<1	<1	<1	—	1	<1
Pinnate tansymustard	1	<1	—	—	<1	—	—	—	—	<1	—
<u>Major Shrubs</u>											
Gray ratany	2	<1	<1	—	—	—	—	<1	—	1	<1
Mesquite	4	4	6	1	2	2	9	5	<1	<1	6
Menodora	<1	—	4	<1	<1	—	—	—	—	—	2
Saltbush	87	93	78	93	97	97	89	93	59	34	91
Yucca	<1	<1	—	<1	—	<1	2	—	—	<1	—
<u>Others</u>	3	<1	7	5	<1	<1	<1	1	7	5	<1

diet in all months except April. There were minor amounts of other shrubs. The 3 sampling locations did not differ significantly on this allotment. These results reflect the lack of diversity of range sites and availability of palatable plant species on the area.

Van Gausig Allotment

The Van Gausig Allotment is operated on a rotation grazing system, thus diets are influenced not only by season of the year but by the composition of each pasture. Average diet over the year was 66% shrubs, 13% forbs, 10% grasses (Figure 3). Fourteen species comprised 80-99% of the diet for each sample date.

Mesquite made up 50-70% of the diet in June and early July (Table 4). After herbaceous plants greened up in response to summer rains, tobosa grass and globemallow (Sphaeralcea sp) made up 20% and 36%, respectively, of the diet, and mesquite fell to 3%. Cattle again turned to mesquite in September, October and November until it dropped its leaves. Yucca made up significant percentages from September through January. In the winter, prickly pear was a major component of the diet. Borages were high in April, reflecting seasonal availability of these cool-season annuals. In addition to tobosa grass in the summer, cattle ate significant amounts of bush muhly (Muhlenbergia porteri) in winter and sideoats grama (Bouteloua curtipendula) in spring.

Sierra Ancha Allotment

Cattle diets were mainly annual grasses and forbs in March, April and early May (Figure 4). The most important species were borages, filaree, deer vetch (Lotus humistratus), Mediterranean grass and foxtail brome (Bromus rubens) (Table 5). Shrubs only made up 3-10% of the diet in these months. In May, when the annuals began to dry up and jojoba and mesquite started to grow, cattle switched to these species. Jojoba made up 53% of the diet in late May and declined to 13% in October. Mesquite ranged from 15% to 40% from June through October. Foxtail brome declined to lows of 5 or 6% in May and June as cattle selected jojoba and mesquite, however this species again increased later in the summer even though it was dry at this time. This may have reflected the maturing of jojoba and mesquite forage later in the summer.

Jojoba is a key species for management in this area. These results indicate that if sufficient winter moisture comes to provide growth of annual forbs and grasses, jojoba will be little affected by spring grazing. If deferment is required to maintain vigorous populations of jojoba, then it would be needed in summer and early fall.

Conclusions

The results of diet studies from 4 different grazing allotments show marked differences in diets corresponding to different composition of the vegetation on these allotments. Diets from different locations on some allotments also varied

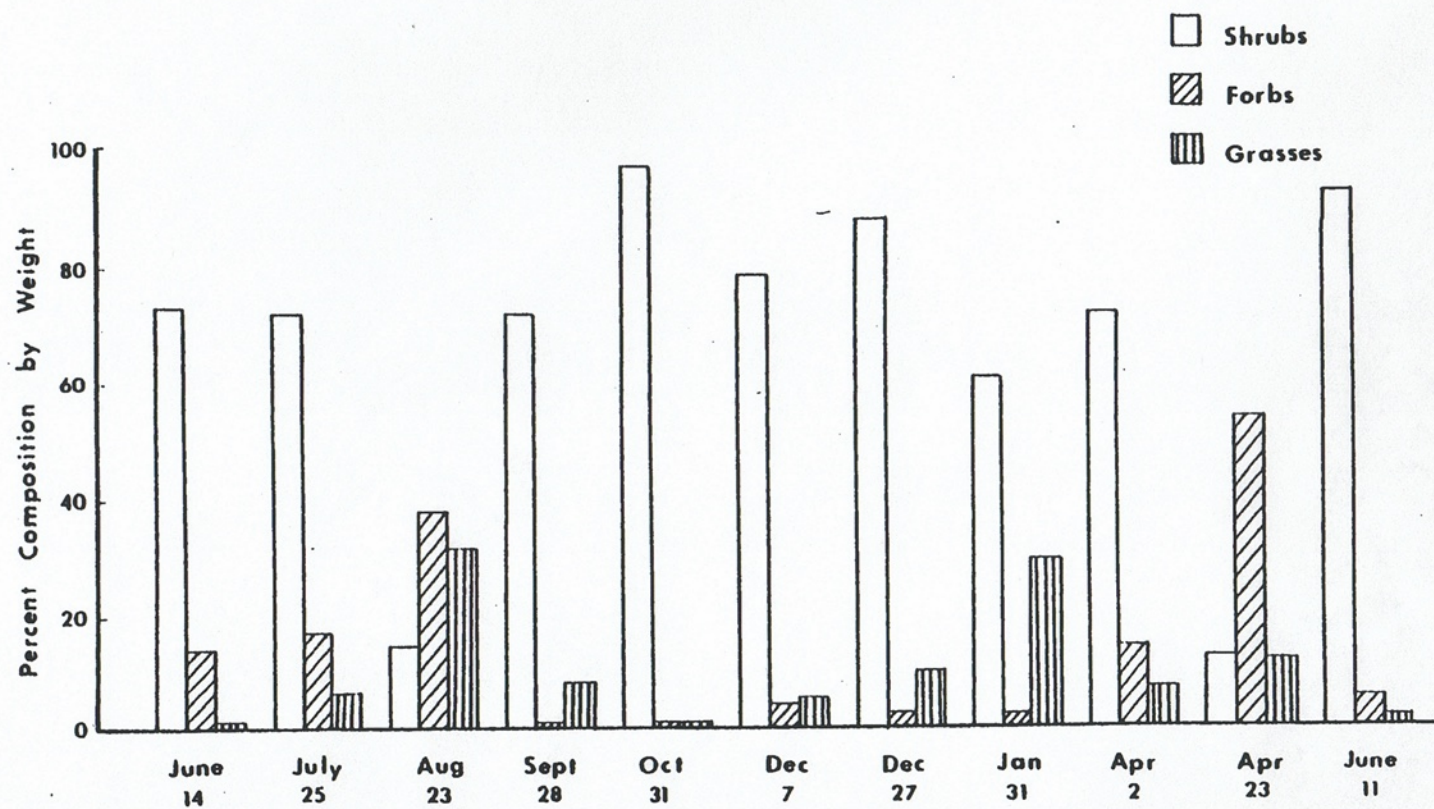


Figure 3. Percentage composition of the major shrubs, forbs, and grasses in cattle diets by sampling date on the Van Gausig allotment.

Table 4. Average percent seasonal composition of cattle diets for major species on the Van Gausig allotment.

	<u>6/14</u>	<u>7/25</u>	<u>8/23</u>	<u>9/26</u>	<u>10/31</u>	<u>12/7</u>	<u>12/27</u>	<u>1/31</u>	<u>4/2</u>	<u>4/23</u>	<u>6/11</u>
<u>Major Forbs</u>											
Borages	2	6	—	—	—	—	—	—	6	43	<1
Filaree	3	3	—	<1	—	—	1	1	<1	2	3
Nama	1	2	—	—	—	—	—	—	5	5	—
Eriastrum	2	1	<1	—	<1	4	<1	—	—	—	2
Globemallow	5	4	36	—	—	—	<1	1	2	—	—
<u>Major Shrubs</u>											
Saltbush	5	—	6	1	1	<1	1	<1	—	1	<1
Mesquite	64	71	3	47	34	25	5	5	4	<1	51
Pricklypear	—	—	2	2	—	8	52	34	66	14	—
Shortleaf baccharis	<1	<1	3	7	—	—	—	—	—	<1	—
Yucca	3	<1	<1	15	61	45	28	22	<1	<1	39
<u>Major Grasses</u>											
Bush muhly	—	<1	2	2	<1	3	9	21	4	1	—
Threeawns	—	—	3	<1	<1	<1	<1	1	<1	2	<1
Sideoats grama	<1	—	4	1	—	<1	—	3	—	9	1
Tobosa grass	1	5	21	4	—	<1	—	3	2	3	<1
<u>Others</u>	12	6	19	21	3	14	<1	8	8	16	3

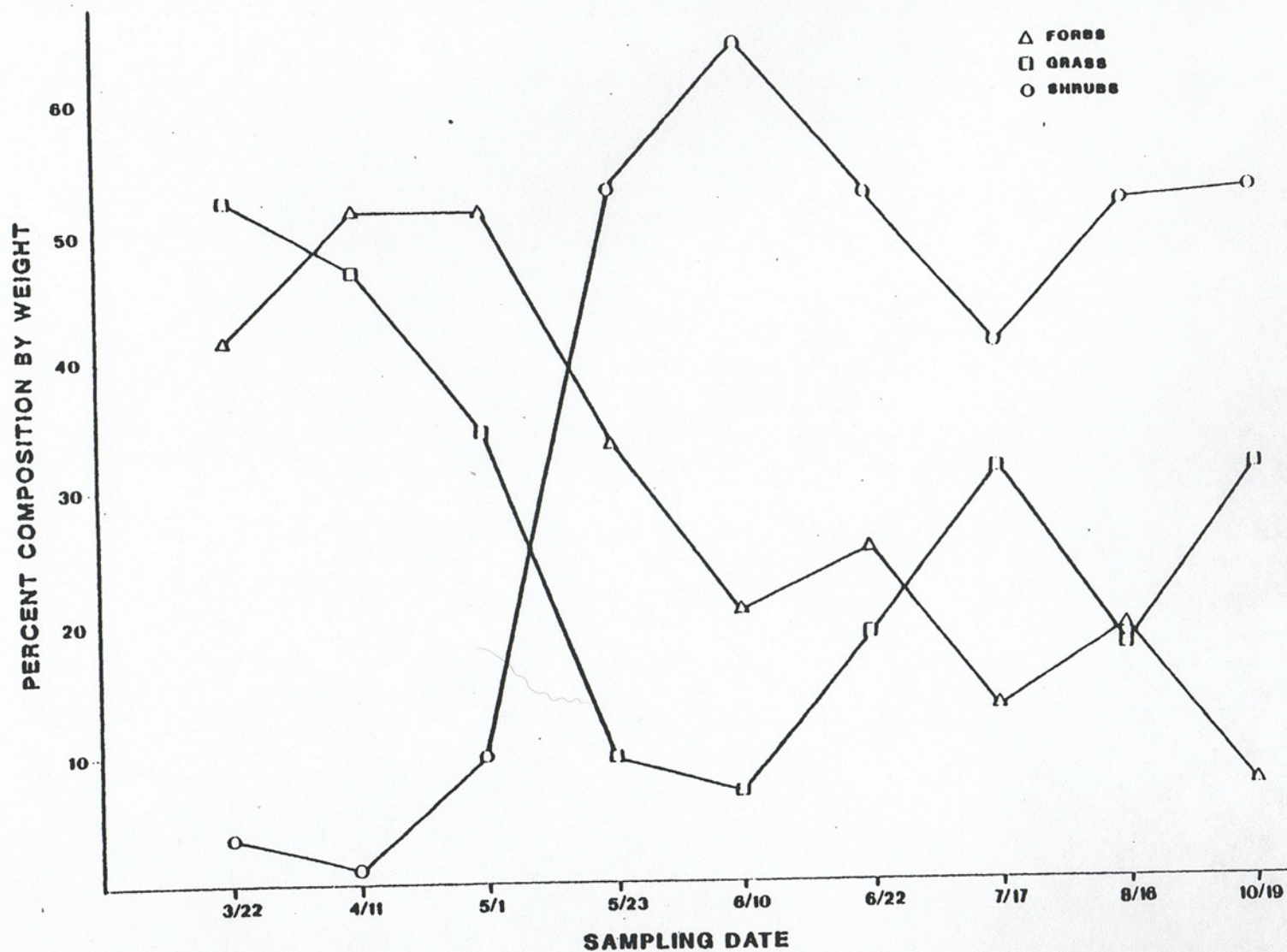


Figure 4. Percentage composition of major forbs, shrubs, and grasses in diets of cattle grazing on the Sierra Ancha allotment in spring and summer of 1979.

Table 5. Average percent composition of major forbs, shrubs and grasses by sampling date for cattle grazing on Sierra Ancha Allotment, March-October, 1979.

<u>Major Forbs</u>	<u>3/22</u>	<u>4/11</u>	<u>5/1</u>	<u>5/23</u>	<u>6/10</u>	<u>6/22</u>	<u>7/17</u>	<u>8/16</u>	<u>10/19</u>
Borages	10	5	1	<1	<1	<1	<1	<1	—
Filaree	25	28	20	16	6	3	2	1	—
Deervetch	3	12	26	6	2	2	2	1	<1
Globemallow	2	1	2	8	8	11	3	9	5
<u>Major Shrubs</u>									
Mesquite	—	—	<1	5	25	16	20	24	39
Jojoba	2	<1	9	45	34	31	14	24	13
<u>Major Grasses</u>									
Foxtail brome	28	27	22	5	6	17	31	17	31
Mediterranean grass	24	20	12	4	<1	2	<1	<1	—
<u>Other</u>	6	11	25	10	17	17	26	22	11

considerably for the same reason. Nevertheless, there are some general conclusions which can be reached based on these data.

Cattle diets are affected by availability of plant species and by the relative growth stage of different plant groups. A typical season pattern is as follows. Cattle prefer cool-season annuals, such as filaree and Mediterranean grass, in early spring when they are available. When these plants begin to dry and disappear cattle shift to shrubs, especially mesquite which leafs out in late April to early May. Cattle continue to eat shrubs until warm-season grasses and forbs green up in response to summer rains and these species form an important, but not necessarily dominant, part of the diet. As these herbaceous plants begin to dry up or are consumed, diets shift back to mesquite, yucca and other shrubs. Mesquite and many other shrubs lose their leaves in late fall and cattle may then consume large amounts of prickly pear and cholla through the winter until annuals green up again.

These data help explain how cattle can maintain good condition and nutritional status on these desert ranges with little or not supplemental feeding if stocking rates are low enough to allow selectivity.

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