

HOME RANGE USE AND MOVEMENTS OF DESERT MULE DEER IN SOUTHWESTERN TEXAS

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Abstract: Average home range size for 10 desert mule deer (*Odocoileus hemionus crookii*) was 384.1 ha. The average home range size for 5 bucks (493.4 ha) was 1.7 times larger than that of 5 does (283.7 ha). Home range sizes increased with age and were largest among deer 5 to 7 years old. Deer 7.5 to 8+ years old had somewhat smaller home ranges than animals 5.5 years old. Seasonal migration or seasonal shifts in home ranges were not apparent; however, vegetative type preferences within home ranges did vary according to season. During the winter months deer preferred the skeletonleaf goldeneye (*Viguiera stenoloba*) / catclaw (*Mimosa biuncifera*) cover type. The juniper (*Juniperus Pinchotii*) / javelina bush (*Condalia ericoides*) / catclaw cover type was preferred by deer during the spring, summer, and fall seasons. Skeletonleaf goldeneye / catclaw cover types were preferred diurnal bedding sites during the fall months. Diurnal movements of deer during the study period ranged from 0.1 to 1.3 km, with a mean of 0.7 ± 0.4 km.

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Knowledge of home range and seasonal movements is a basic requirement for the management of game species. The desirability of knowing summer and winter range boundaries and migration pathways has been stressed by Hunter and Yeager (1956:450-451) for the proper management of mule deer. The desert mule deer has not received the investigative attention accorded other subspecies of mule deer. Knowledge of home ranges and movements of desert mule deer is limited to studies by Clark (1953) in Arizona, and by Hailey (1963, Final P-R Rep., Proj. W-57-R-11, Job 8, Texas Parks and Wildlife, Austin), and Phillips (1974) in Texas. Results of these studies indicate desert mule deer are not migratory between seasonal ranges as are more northern subspecies of mule deer. However, these studies relied on occasional resightings of marked deer for obtaining locations used in calculating home range size and seasonal movements. Radio-telemetry equipment was used in the current study to enable the authors to accumulate more locations of marked deer, with minimal disturbance of marked animals.

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MATERIALS AND METHODS

The study area is a 3,876 ha pasture on the Longfellow Ranch, 26.6 km west of Sanderson in Pecos County, Texas (Fig. 1), on the Stockton Plateau, a westward extension of the Edwards Plateau. The climate is a warm, temperate, semi-desert type, with mild winters and long hot summers. Average annual precipitation of 28.5 cm mainly

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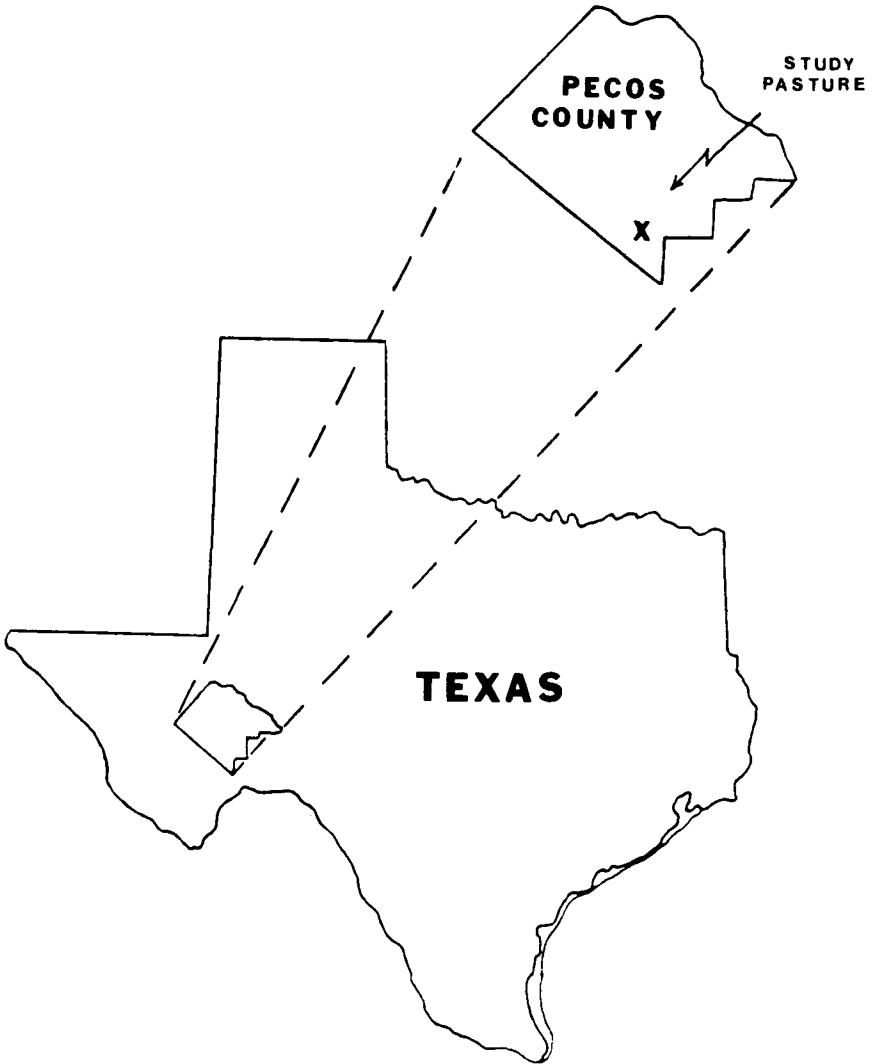


Fig. 1. Desert mule deer home range study area.

occurs between May and October (Soil Conservation Service 1974). Topography consists of broad, nearly level plateaus and rolling to steep hills and canyon walls, with alternating broad valleys (Soil Conservation Service 1974) and lateral header canyons which lead to mesa tops (Nance 1973).

Dominant grasses on the study area are blue grama (*Bouteloua gracilis*), Wright's threeawn (*Aristida Wrightii*), and buffalo grass (*Buchloe dactyloides*) (Scientific name according to Correll and Johnston 1970). The main forbs are coldenia (*Coldenia canescens*), grassland croton (*Croton dioicus*), and broom snakeweed (*Xanthocephalum sarothrae*) (Phillips 1974). Redberry juniper is found throughout the study area. Skeletonleaf goldeneye and catclaw dominate slopes and hilltops while mesquite (*Prosopis glandulosa*), tarbush (*Flourensia cernua*), and creosote bush (*Larrea*

tridentata) are found in low areas. Sotol (*Dasyliroion texanum*) is common on the steep slopes just below the rimrock. Water drainage areas contain shrub communities composed primarily of Mohr's oak (*Quercus Mohriana*), hackberry (*Celtis reticulata*), littleleaf sumac (*Rhus microphylla*), and Spanish walnut (*Juglans microcarpa*).

The study area contains 7 major cover types (Fig. 2) based on dominant shrub species (Nance 1973). The ranch is stocked with Santa Gertrudis cattle (1 animal unit per 21 ha) and supports a deer density of 1 deer per 2.4 ha (Dickinson 1978).

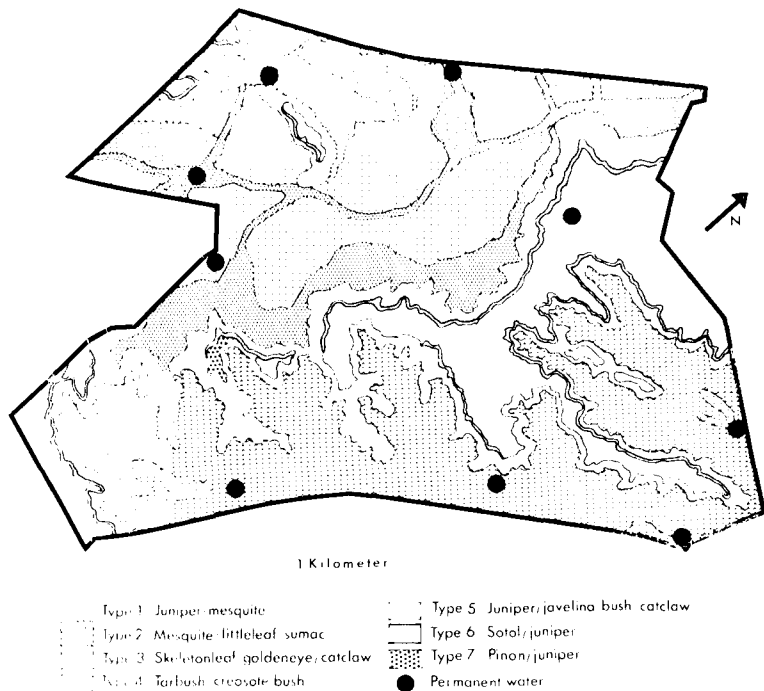


Fig. 2. Cover type maps of the study area, Texas, 1977.

Seven deer (4 bucks and 3 does) were captured during November and December 1976. Succinylcholine chloride was administered with a Cap-Chur gun at a dosage rate of 0.07 to 0.11 mg/kg of body weight (Pearson et al. 1963). Immobilized deer were aged based on the tooth wear technique described by Robinette et al. (1957). Each deer was color coded with 2.5 cm aluminum ear tags and 2.5 x 7.5 cm colored streamers. Transmitters (151 mHz) and neck collars weighed approximately 410 g.

Radio-instrumented deer were monitored to obtain a minimum of 2 locations per week until radio transmitters failed in April 1977. Subsequent data collection was limited to visual relocations made by patrolling the study area in a vehicle and searching for marked deer. In addition to the 7 radio-collared deer, locations were also recorded for 3 previously marked deer (Phillips 1974).

Deer locations through 31 October 1977 were plotted on topographic maps with an accompanying hand-drawn map and field description of the exact location. Additional data collected for each deer location included cover type, deer activity, and number of animals in the group. Locations marked on field maps were transferred to overlays on aerial photographs, and home range size and movement distances were determined.

Home ranges were described for each deer for each of 4 seasons: Winter - December through February, Spring - March through May, Summer - June through August, Fall - September through November.

An adjusted version of the modified-minimum-area method (Harvey and Barbour 1965) was used to determine home range boundaries. Half (rather than 0.25) of the range length was used as the greatest distance in determining the outer boundaries of the home range. This modification was necessary due to the relatively small number of locations recorded and the large distances involved between locations. Mean annual home ranges were converted to home range length for comparisons to other research results in Texas.

Knowledge of the intensity of use of various habitat types in an area by an animal is essential to understanding the biological significance of the animal's home range (Hayne 1949). Therefore, the home range for each deer was grouped by cover types. The percentage in each cover type was determined with a compensating polar planimeter. Cover type preferences within home ranges were examined using chi-squared tests (Steel and Torrie 1960).

RESULTS AND DISCUSSION

The majority of locations (71.1%) were either winter (34.3%) or spring locations (36.8%) with 19.7% in the summer and 9.2% in the fall (Table 1). Radio transmitter failures in late April 1977 and resultant difficulties in locating marked animals caused this inequality in seasonal data collection. Therefore, annual home ranges presented in this paper are weighted toward the winter and spring seasons.

Annual Home Range

The home range lengths reported by Hiale 1963, Final P-R Job Rep., Proj. W-57-R-11, Job 8, Texas Parks and Wildlife, Austin) and Phillips (1974) of 2.5 and 2.3 km respectively were comparable to the average home range length of the 2.9 km for the 10 deer monitored on the Longfellow Ranch. The mean annual home range size of 384.1 ha is much smaller than home range size (1,148.3 ha) for nonmigratory mule deer in the Tucson mountain region of Arizona (Clark 1953). The smaller home ranges of mule deer on the Longfellow Ranch may be partially attributed to forage availability and the abundance of watering areas (one watering source/4.3 km²) scattered throughout the study pasture (Fig. 2).

The average annual home range size of 5 bucks (493.4 ha) was 1.7 times larger than those of 5 does (283.7 ha). Similar results were reported by Dasmann and Taber (1956) for Columbian black-tailed deer (*Odocoileus hemionus columbianus*), Thomas et al. (1964) for white-tailed deer (*O. virginianus*), and Robinette (1966) for Rocky Mountain mule deer (*O. h. hemionus*). The larger home ranges of bucks on the Longfellow Ranch may be a reflection of apparent nomadic behavior of bucks prior to and following the breeding season.

However, the annual home range of a yearling doe was 2.4 times as large as that of a yearling buck (Table 1). This relationship may be partially explained by the location of the "centers of activity" (Hayne 1949) for each animal. The center of activity for the doe was located 1.9 km from the nearest watering area (Fig. 3), whereas that of the buck was only 0.8 km from a water source (Fig. 4). The additional distance doe D3 traveled for water would increase her home range size proportionately.

Age is an important factor involved in home range size. Younger (1.5 years old) animals had smaller home ranges than intermediate and older age class animals. This trend was evident among both sexes, but to a lesser degree for does (Fig. 5). These data indicate the home range size of desert mule deer increases with age. Dasmann and Taber (1956) found yearling bucks to be less mobile than older bucks, however no mention is made in the literature about the home range size of older bucks (7 years and older).

TABLE 1. Annual and seasonal home range sizes of 10 desert mule deer on the Longfellow Ranch, Pecos County, Texas, 1976 to 1977.

Sex	Deer Number	Age class (years)	Home range (ha/sample size)					Annual
			Winter	Spring	Summer	Fall		
Female	D-3	1.5	<u>150.1</u> 15	<u>66.9</u> 12	<u>110.7</u> 6	<u>47.4</u> 3	<u>253.6</u> 36	
Female	D-5	2.5	<u>136.5</u> 20	<u>139.1</u> 18	<u>57.4</u> 5	<u>42.1</u> 5	<u>262.1</u> 48	
Female	D-4	3.5	<u>167.7</u> 15	<u>182.8</u> 20	<u>192.0</u> 5	1 ^a	<u>350.7</u> 40	
Female	D-2	5.5	<u>70.0</u> 6	<u>171.3</u> 11	<u>165.8</u> 10	<u>73.1</u> 6	<u>234.9</u> 33	
Female	D-1	7.5	<u>149.6</u> 11	<u>197.3</u> 16	<u>290.5</u> 10	<u>11.3</u> 6	<u>317.5</u> 43	
Average	for females		134.8	151.5	163.3	43.5	283.8	
Male	B-8	1.5	<u>58.4</u> 20	<u>53.9</u> 20	<u>36.5</u> 12	<u>65.6</u> 5	<u>106.8</u> 57	
Male	B-10	3.5	<u>202.6</u> 14	<u>262.1</u> 12	<u>51.5</u> 5	<u>387.4</u> 3	<u>444.9</u> 34	
Male	B-7	4.5	<u>261.7</u> 7	<u>845.4</u> 9	<u>207.6</u> 6	1	<u>896.6</u> 22	
Male	B-9	8.5	<u>562.1</u> 15	<u>247.6</u> 14	<u>11.3</u> 5	<u>62.2</u> 3	<u>695.9</u> 37	
Male	B-6	8+	<u>188.8</u> 4	<u>165.0</u> 4	<u>135.5</u> 9	<u>57.8</u> 3	<u>322.7</u> 20	
Average	for Males		254.7	314.8	88.5	143.3	493.4	
Average	for all Deer		194.8	233.2	125.9	93.4	388.6	

^aInsufficient locations to calculate home range size.

The 1976-77 home ranges for the 3 deer (Deer D1, D2-Fig. 6; B6-Fig. 7) originally monitored by Phillips (1974) showed little change from 1973 (Deer D1, D2, B6, Table 1). Although home range boundary lines varied slightly between the 2 studies, the major center of activity for does D1 and D2, and buck B6 remained approximately the same (Fig. 6 and Fig. 7). The home range of buck B6 was reduced by 1/3 from the home range size reported by Phillips (1974). This decrease was attributed to age (8+ years) and an apparent break of the right femur which the animal sustained in January 1976. The cause of this injury is unknown but the animal favored the leg and was in poor physical condition throughout the remainder of the study.

Seasonal Movements

Due to transmitter failures and the resultant limited locations recorded during the summer and fall, a comparison of seasonal home range sizes is not practical. However, the annual home ranges of marked deer indicate that most mule deer on the Longfellow

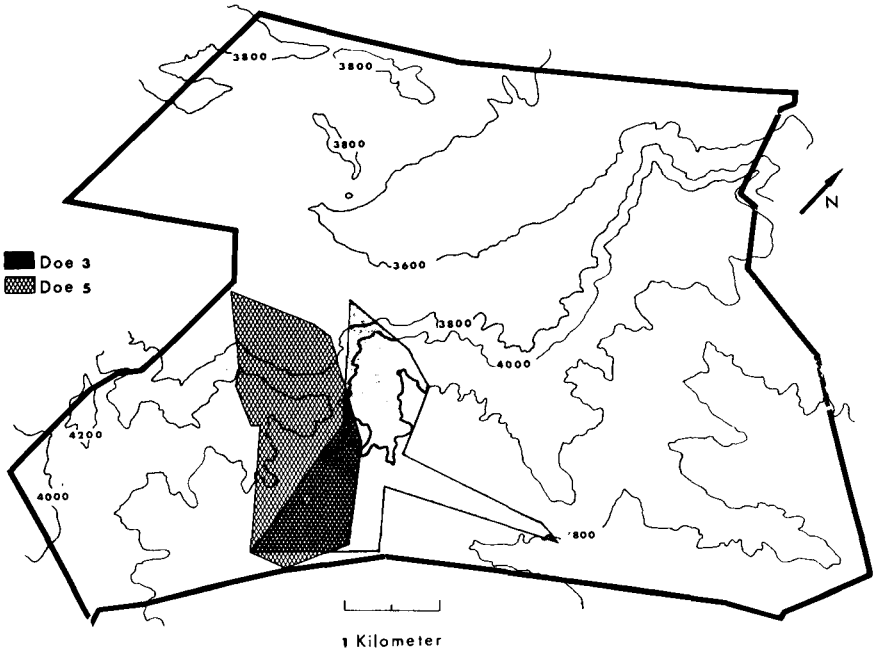


Fig. 3. Observed annual home ranges for desert mule deer does D3 and D5, Pecos County, Texas, 1976-77.

Ranch are nonmigratory. Although actual seasonal home ranges may vary slightly in size, deer tend to remain in the same general locale throughout the year. This nonmigratory status agrees with the findings of Hahn (1945), Hahn and Taylor (1950), and Progulske and Baskett (1958) for white-tailed deer on ranges where weather conditions do not vary markedly throughout the year. However, buck B10 did not follow this trend. A major shift in home range occurred during the late spring, summer and fall (Fig. 7).

Buck B10 was observed on a regular basis in the Divide Windmill area of the study pasture throughout the winter and early spring months, until after transmitter failures in April. This buck seemingly disappeared and was not observed again until late May 1977, approximately 4.5 km from the center of its' earlier home range (Fig. 7). Although summer locations were limited, this deer apparently remained in the new area throughout the summer of 1977. In late fall the buck was again observed in its original home range. This may represent a seasonal shift in home range. However, the right ear streamer and ear tag were missing and the radio collar harness was partially torn possibly indicating that an incident of unknown nature may have influenced this movement.

Seasonal Home Range Use

Home ranges of desert mule deer on the Longfellow Ranch varied in size seasonally, and the intensity of use of various cover types within these home ranges fluctuated throughout the year.

Three cover types (skeletonleaf goldeneye/catclaw; juniper/javelina bush/catclaw; and juniper/mesquite) accounted for 91.3% of the total home ranges (Table 2). Other cover types were found in lesser quantities (4.6%). The remainder of those home ranges that did not total 100% (Table 2) was composed of combinations of these types and/or broad transitional areas between cover types.

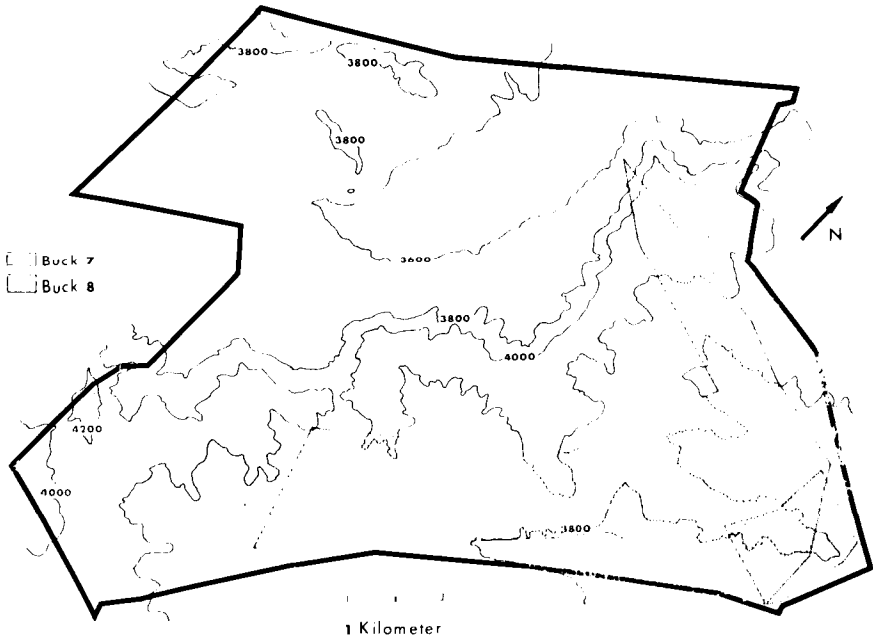


Fig. 4. Observed annual home ranges for desert mule deer bucks B7 and B8, Pecos County, Texas, 1976-77.

Preferred Feeding Types

Observed feeding locations of marked deer were grouped by season and vegetative type (Table 3) to compare feeding use. Results show 94.2% of feeding locations of marked deer occurred in 3 cover types (skeletonleaf/goldeneye/catclaw; juniper/javelina bush/catclaw; and juniper/mesquite). The skeletonleaf goldeneye/catclaw cover type was highly preferred for feeding during the winter months (35.0% feeding locations vs. 13.1% cover type in home ranges, $\chi^2 = 36.6$, 1 df, $P < 0.0005$), but were not preferred during the summer months (1.6% feeding locations vs. 13.1% cover type in home ranges, $\chi^2 = 10.1$, 1 df, $0.001 < P < 0.005$). The juniper/javelina bush/catclaw cover types were preferred feeding areas during the spring (40.8% feeding locations vs. 20.5% cover type in home ranges, $\chi^2 = 20.1$, 1 df, $P < 0.0005$), summer (54.1% feeding locations vs. 20.5% cover type in home ranges, $\chi^2 = 55.1$, 1 df, $P < 0.0005$), and fall (63.3% feeding locations vs. 20.5% cover type in home ranges, $\chi^2 = 89.4$, 1 df, $P < 0.0005$). The juniper/mesquite cover types were avoided during the spring (36.7% feeding locations vs. 57.7% cover type in home ranges, $\chi^2 = 7.6$, 1 df, $0.001 < P < 0.005$), summer (37.7% feeding locations vs. 57.7% cover type in home ranges, $\chi^2 = 6.9$, 1 df, $0.001 < P < 0.005$), and fall (23.3% feeding locations vs. 57.7% cover type in home ranges, $\chi^2 = 20.5$, 1 df, $P < 0.0005$).

All locations used for these comparisons were feeding locations, indicating a preference for forages found within those cover types. Dickinson (1978) also reported the 3 cover types were preferred by deer during the corresponding seasons, suggesting that forage preferences were the controlling factor for those preferences.

Preferred Diurnal Bedding Types

Skeletonleaf goldeneye/catclaw cover types were preferred diurnal deer bedding areas (Table 4) during the spring (26.3% bedded locations vs. 13.1% cover type in home

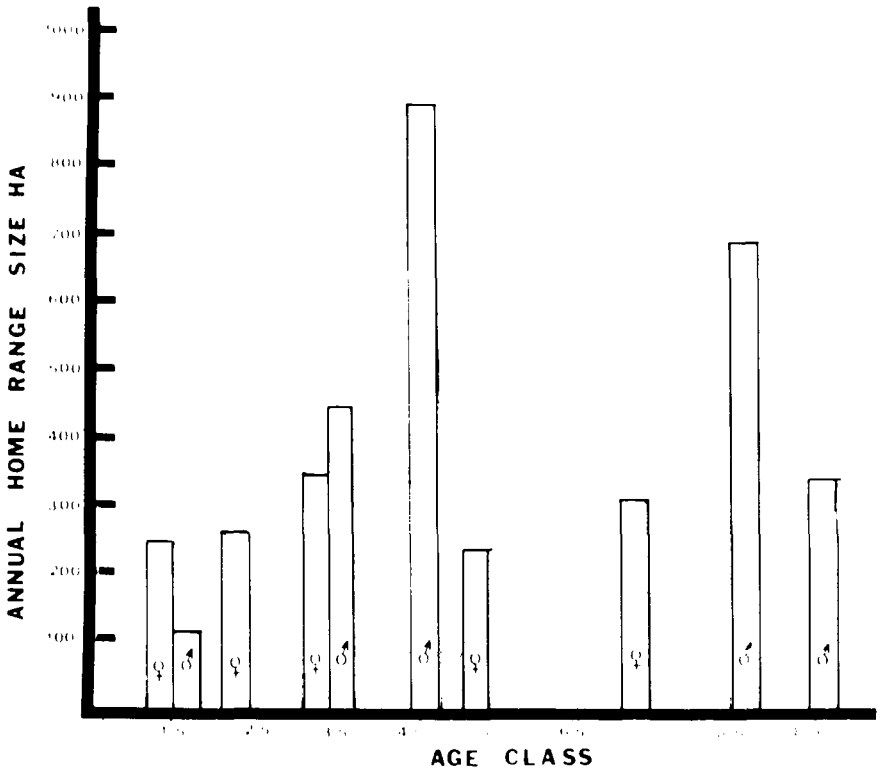


Fig. 5. Annual home range size by age and sex class for marked desert mule deer, Pecos County, Texas, 1977.

ranges, $\chi^2 = 13.5$, 1 df, $P < 0.0005$), and fall (33.3% bedded locations vs. 13.1% cover type in home ranges, $\chi^2 = 31.5$, 1 df, $P < 0.0005$) seasons. Deer avoided the juniper/mesquite cover types during the fall season (33.3% bedded locations vs. 57.7% cover type in home ranges, $\chi^2 = 10.3$, a df, $0.001 < P < 0.005$).

The preference or avoidance of cover types during the fall is believed inaccurate due to the small sample size for that period (Table 4). Reasons for deer preference for skeletonleaf goldeneye/catchlaw cover types as diurnal bedding sites during the spring season are not apparent.

Diurnal Movements

Limited data indicate diurnal movements ranged from 0.1 to 1.3 km with a mean of $0.7 \text{ km} \pm 0.4 \text{ SD}$. The largest diurnal movement observed was that of a buck 8+ years old, and the smallest was that of a 1.5 year old buck. Diurnal movements varied widely among age and sex classes. Clark (1953) indicated the daily movements of deer in Arizona were largely governed by climatic conditions and changes, and the availability of food and water.

Management Implications

Home range sizes were relatively small when compared to desert mule deer in other regions. A major factor believed to be contributing to the small home range sizes was the

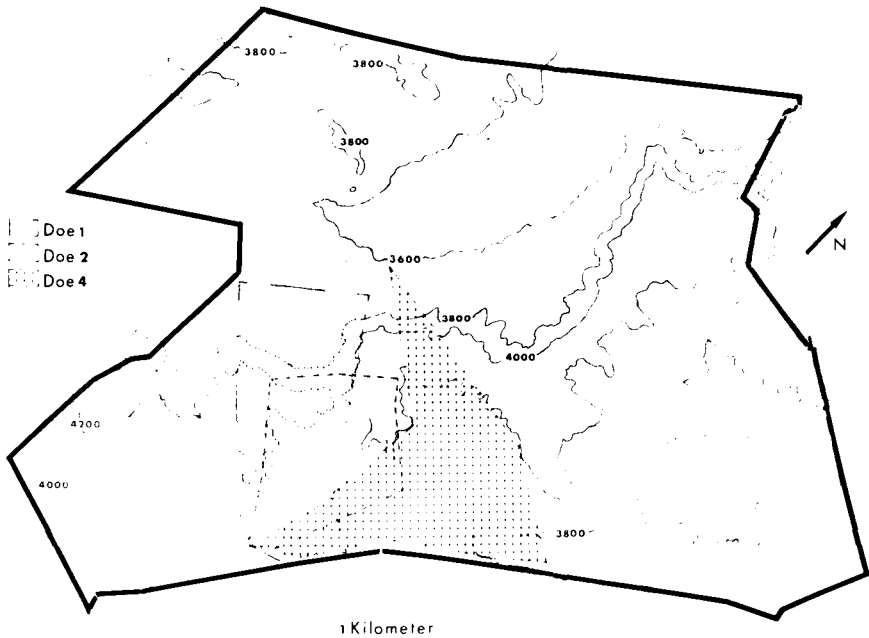


Fig. 6. Observed annual home ranges for desert mule deer does D1, D2, and D4, Pecos County, Texas, 1976-77.

abundance of permanent water sources in the study area. Management that would provide 1 permanent water source per 4 km² in similar habitat would result in development of areas capable of supporting a similarly dense (1 deer/2.4 ha) deer herd.

Desert mule deer on the Stockton Plateau in southwest Texas are nonmigratory and prefer skeletonleaf goldeneye/catclaw, juniper/javelina bush/catclaw, and juniper/mesquite cover types for feeding and daytime bedsites. The stability of these 3 cover types is an important factor to consider in the management of this deer herd. Those management practices (brush control) that would affect the vegetational composition within these 3 cover types can be expected to have an impact upon the deer herd.

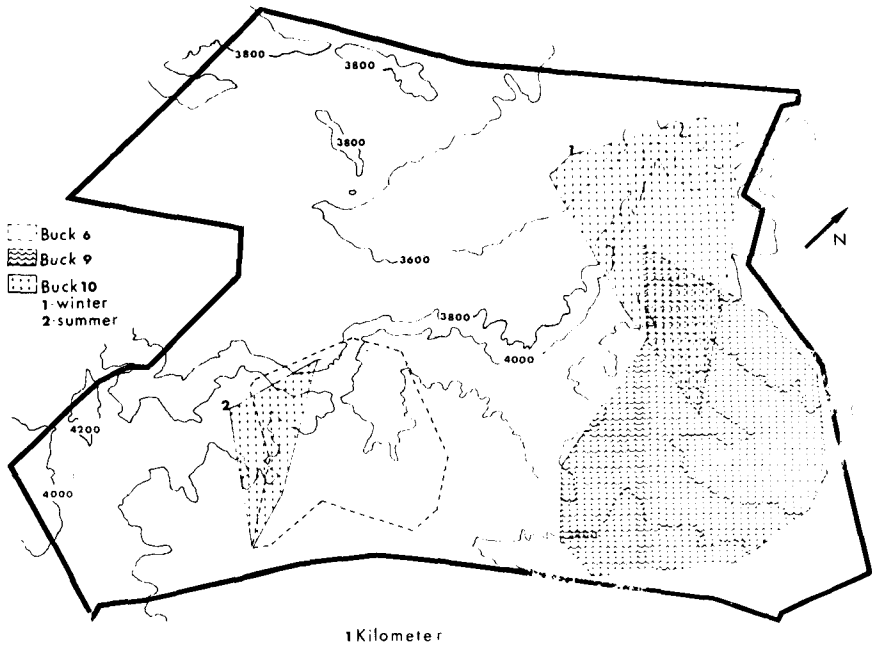


Fig. 7. Observed annual home range for desert mule deer bucks B6, B9, and B10, Pecos County, Texas, 1976-77.

TABLE 2. Cover type composition of the annual home ranges of 10 marked deer on the Longfellow Ranch, Pecos County, Texas, 1976 to 1977.

Deer number	Percentage of cover type used						
	Juniper/mesquite	Juniper/javelina bush/catclaw	Skeletonleaf goldeneye/catclaw	Pinon/juniper	Creosote/tarbush	Mesquite/littleleaf sumac	Sotol/juniper
D-1	58.1	18.6	2.3	4.7	t ^a	t	t
D-2	73.0	17.0	10.0	t	t	t	t
D-3	71.0	17.0	12.0	t	t	t	t
D-4	68.1	17.0	5.3	t	t	t	t
D-5	60.0	11.4	2.9	5.7	8.6	t	t
B-6	59.0	23.8	11.9	t	t	t	t
B-7	62.5	20.0	15.2	t	t	t	t
B-8	50.0	35.7	14.3	t	t	t	t
B-9	55.4	20.4	16.8	t	t	t	t
B-10	20.0	24.4	40.0	t	t	t	t
Average % of home range in cover type	57.7	20.5	13.9	1.0	0.9	t	t

^a = cover type not present or in trace amounts within the home range.

TABLE 3. Percentage of observed feeding locations of 10 marked deer by cover type and season on the Longfellow Ranch, Pecos County, Texas, 1976 to 1977.

Season	Percentage use of cover type/sample size					
	Juniper/ mesquite	Mesquite/ littleleaf sumac	Skeletonleaf goldeneye/ catclaw	Juniper/ javelina bush/ catclaw	Sotol/ juniper	Pinon/ juniper
Winter	<u>50.4</u> 52	<u>1.9</u> 2	<u>35.0</u> 36	<u>11.7</u> 12	<u>1.0</u> 1	
Spring	<u>36.7</u> 36	<u>5.1</u> 5	<u>12.2</u> 12	<u>40.9</u> 40	<u>4.1</u> 4	<u>1.0</u> 1
Summer	<u>37.7</u> 23	<u>4.9</u> 3	<u>1.6</u> 1	<u>54.2</u> 33		<u>1.6</u> 1
Fall	<u>23.3</u> 7		<u>13.3</u> 4	<u>63.4</u> 19		

TABLE 4. Percentage of observed bedded locations of 10 marked deer by cover type and season on the Longfellow Ranch, Pecos County, Texas, 1976 to 1977.

Season	Percentage use of cover type/sample size				
	Juniper/ mesquite	mesquite/ littleleaf sumac	Skeletonleaf goldeneye/ catclaw	Juniper/ javelina bush/ catclaw	Pinon/ juniper
Winter	<u>66.7</u> 16	<u>4.2</u> 1	<u>12.5</u> 3	<u>12.5</u> 3	<u>4.2</u> 1
Spring	<u>50.0</u> 19		<u>26.3</u> 10	<u>21.1</u> 8	<u>2.6</u> 1
Summer	<u>61.5</u> 8		<u>15.4</u> 2	<u>15.4</u> 2	<u>7.7</u> 1
Fall	<u>33.3</u> 1		<u>33.3</u> 1		<u>33.3</u> 1

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