Mourning Dove Nesting on Tobosa Grass-Mesquite Rangeland Sprayed with Herbicides and Burned

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Highlight: *A 2-year study of the effects herbicide spraying, and particularly, prescribed burning might have on mourning dove (*Zenaida macroura*) nesting ecology in rangelands infested with mesquite revealed that the loss of trees as nesting sites was compensated by the occurrence of gound nesting. Newly burned areas fostered better utilization (i.e., higher nesting densities) than did older burns except under drought conditions. Ground nests did not suffer from excessive predation, and differences in the productivity of ground nests probably were related to nesting density rather than to the apparent suitability of the site. Ground nests were more successful than tree nests.*

The mourning dove is a major game bird throughout the Southwest; its importance in this region is nowhere greater than in Texas, where past estimates of the annual harvest have reached four million birds (Wight, 1961). By 1969, however, call-count surveys in the Central Management Unit, which includes Texas, were at an 11-year low (Ruos, 1970).

Suggestions for the cause of this alarming trend are varied, but large scale habitat changes are probably among the factors involved (Kiel, 1969). The Dove Advisory Committee at its meeting of June 24, 1969, accordingly called for programs leading to the preservation and improvement of dove nesting habitat. As brush infestations and the efforts to control brush have resulted in extensive habitat changes in much of Texas, the impact of these conditions seemed relevant to dove populations nesting in Texas. For example, the Soil Conservation Service reported that in 1953 there were 88 million acres inhabited by woody species in Texas, of which 30–35 million acres have been treated. Mesquite (*Prosopis* spp.) is the most serious problem to grazing management, as it alone occupies over 56 million acres (Smith and Rechenthin, 1964).

In addition to the attempts to control mesquite, research and management efforts are simultaneously being directed toward the management of rangeland grasses with the use of fire (Wright, 1972).

Several studies have shown that mesquite is important to mourning dove nesting ecology (e.g., Jackson, 1940; Clark, 1969); hence, efforts to control mesquite might conflict with mourning dove management in Texas. This study was initiated in April, 1970, and continued through August, 1971, to investigate the nesting ecology of mourning doves on tobosa grass-mesquite rangeland treated with herbicide and/or prescribed burning.

We are indebted to W. J. Waldrip of the Renderbrook-Spade Ranch for providing the research area and living quarters, and also to T. C. Moore for access to his property. H. A. Wright planned and conducted the prescribed burns for this project. K. R. Kattner and R. R. George ably assisted with portions of the field work.

Study Area

The study was conducted 13 miles

Table 1. Mesquite density (no./acre) by diameter class, Mitchell County, Tex., 1970–71. Total mourning dove nestings are shown in parenthesis for each diameter class.

Treatment	Diameter class[a] 3–5 inch		6–8 inch		9+ inch	
Sprayed 1965						
Not burned[b]						
1970	54.0	(5)	16.6	(17)	3.9	(17)
1971	58.0	(4)	15.1	(7)	8.1	(4)
Burned 1969						
Before	57.1		13.8		3.8	
After	30.7	(4)	5.0	(3)	1.3	(2)
Burned 1970						
Before	45.0		2.5		1.0	
After	29.4	(5)	1.9	(6)	0.5	(1)
Burned 1971						
Before	87.5		11.9		3.8	
After	42.5	(1)	7.5	(1)	2.8	(2)
Not sprayed						
Burned 1969[c]	111.0	(16)	11.0	(14)	1.7	(4)

[a]Includes all mesquite regardless of crown condition.
[b]Six 5-acre plots in the Sprayed-65 and Not Burned area in 1970 were later burned in 1971.
[c]Mesquite larger than 2 inches diameter were not damaged by fire.

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south of Colorado City, Mitchell County, Tex., on the Renderbrook-Spade Ranch. The ranch is located in the southwestern edge of the Rolling Plains ecological area described by Thomas (Gould, 1969). Extensive brush control measures have been undertaken on the ranch. Large areas were chained, aerially sprayed with herbicide, and/or burned. Areas of similar untreated tobosa grass-mesquite rangeland were limited to small isolated clumps.

The study area is characterized by nearly level clayey soils. The principal plant species were mesquite (*Prosopis glandulosa* var. *glandulosa*), tobosa grass (*Hilaria mutica*) and buffalograss (*Buchloe dactyloides*). The mesquite occurred in various growth forms, shrub-like to large trees.

Treatment Area Descriptions

Sprayed 1965-Unburned

A 7,000-acre area was aerially sprayed in 1965. The mesquite in this treatment was generally large in diameter (Table 1). A few isolated trees appeared undamaged, and by 1970 many mesquite had made extensive regrowth from the root collar and/or trunk.

At the time of the study, the tobosa grass and other grasses provided about 11% of the basal area cover. The tobosa grass stood 7 to 14 inches tall. Litter cover was highest in this treatment (61%) and the amount of bare soil the lowest (26%).

Sprayed 1965-Burned

Portions of the area sprayed in 1965 were burned in March of 1969, 1970, and 1971, following the prescribed burning techniques of Wright (1972). "Hot" head-fires were applied to areas of 2,000, 1,000, and 400-acres, respectively. This permitted the examination of mourning dove nesting on burned areas of three age classes: (1) current year's burn, (2) 1-year-old burn, and (3) 2-year-old burn. The density of top-killed and sprouting mesquite was reduced by the fire (Table 1); foliage cover was limited to root collar and trunk sprouts.

The effect burning had on ground cover depended on the amount of precipitation which preceded and followed the fire (Wright, 1972). Generally, the percentage of basal area cover provided by tobosa regrowth and litter was lowest the year of the fire and increased each year after the fire (Table 2). Moisture conditions were good in 1969 and fair in 1970. The 1971 nesting season began with drought conditions in most of the Southwest. At this time tobosa grass stood 12-14 inches tall in the 2-year-old burn and 6-8 inches in the 1-year-old burn. Prior to June 1, tobosa grass in the 1971 burn (current year burn was 0-1 inches tall. Rains on May 28-29 subsequently increased the height of tobosa grass in the 1971 burn to 3-5 inches.

Unsprayed-Burned 1969

Added to the study in 1971, this area supported tree-sized live crown mesquite (Table 1). This treatment consisted of a "cool" fire in April 1969, after green-up had started. The fire top-killed only the shrub-like mesquite with basal diameters of less than 2 inches. The tobosa grass stood 5-8 inches tall in 1971.

Method for Monitoring Dove Populations

Eight 5-acre plots were randomly established in each of the treatment types. Four of the plots of each treatment type were intensively searched for dove nests each week, with the other four plots searched on alternate weeks. Nest searches began the first week of April and continued through the last week of August. Searches were conducted by two individuals on foot. Active nests were examined at least once each week. A complete description and history was maintained for each nest found.

Results and Discussion

Nesting Density

The prescribed burning of mesquite-tobosa grass rangeland previously sprayed caused a decrease in the occurrence of tree nesting by mourning doves and an increase in ground nesting. On rangeland not previously sprayed, the "cool" burn, which did not damage the mesquite overstory, apparently had no effect on nesting activity; all the doves nested in the mesquite trees.

A "hot" prescribed fire on sprayed rangeland affected tree-nesting doves by reducing the availability of nesting sites. Mourning doves showed a preference for nesting in the large diameter mesquite, apparently in response to the better support provided by the larger branches and forks (Table 1).

This study was conducted in part on the same area studied by Britton and Wright (1971). They were able to burndown 14 to 89% of the mesquite previously top-killed by herbicide. They found that the percentage of burndown increased as the size of the mesquite increased. Burndown was highest for the 5-inch or larger diameter class and lowest for the 2-inch diameter class. Thus burning reduced the availability of upright dead mesquite trees for nest sites.

Breeding-pair density, as measured by the maximum number of nests simultaneously active, was lower on the Sprayed 1965-Unburned area than in the Unsprayed-Burned 1969 area, where the mesquite had live crowns. There were fewer nesting attempts in the sprayed mesquite, but the decrease in tree nesting was partially compensated for by increased ground-nesting activities (Table 3).

Burning the previously sprayed rangeland had a definite and positive effect on mourning dove ground-nesting density (Table 3). However, this effect decreased each successive year after the burn as the cover of vegetation and litter increased, approaching the pre-burn condition. The breeding pair densities for ground-nesting mourning doves were highest in the current year's burn, progressively lower in the older burns, and lowest in the unburned areas.

The study area was gripped by drought in 1971. The current year's burn remained essentially bare soil covered with some ash and fallen trees

Table 2. Basal area ground cover (%), tobosa grass-mesquite rangeland, Mitchell County, Tex., 1971.

Cover	Treatment				
	Not sprayed burned 1969	Sprayed 1965			
		Not burned	Burn 1969	Burn 1970	Burn 1971
Tobosa	5.5	8.6	13.7	9.5	4.4
Other grass	2.8	2.3	1.7	3.3	0.4
Forbs	0.2	1.0	*[a]	1.2	1.6
Opuntia	0.4	*[a]	0.1	0.5	*[a]
Mesquite	0.3	0.1	0.7	0.5	0.3
Fallen branch	0.9	1.2	1.2	1.6	2.4
Litter	33.7	61.0	45.0	28.8	19.8
Bare soil	56.2	25.8	37.6	54.6	71.1

[a]Observed but not in sample.

Table 3. Mourning dove nesting densities on treated mesquite-tobosa grass rangeland, Mitchell County, Tex., 1970 and 1971.

Treatment	1970					1971				
	Breeding pairs/acre[a]			Nestings/acre		Breeding pairs/acre[a]			Nestings/acre	
	Ground	Tree	Total	Ground	Tree	Ground	Tree	Total	Ground	Tree
Sprayed 1965										
Not burned	.057	.314	.371	.230	.800	.075	.075	.150	.150	.275
Burned										
Year of burn	.175	.075	.250	.550	.150	.275	.050	.325	.475	.100
1 year after burn	.150	.025	.175	.430	.050	.175	.025	.200	.575	.025
2 years after burn						.125	.025	.150	.425	.025
Not sprayed										
2 years after burn						0	.225	.225	0	.825

[a]Based on maximum number of nests simultaneously active; estimated to be 16% below true number of pairs nesting on an area.

Table 4. Mourning dove nesting success on sprayed and/or burned tobosa grass-mesquite rangeland, Mitchell County, Tex., 1970–71.

Treatment	1970				1971				Total			
	Ground		Tree		Ground		Tree		Ground		Tree	
	Total nests	Percent of total	Total nests	Percent of total	Total nests	Percent of total	Total nests	Percent of total	Total nests	Percent of total	Total nests	Percent of total
Sprayed 1965												
Not burned	11	45	39	23	6	50	15	7	17	47	54	18
Burned												
Year of burn	37	27	10	10	26	19	4	25	63	24	14	14
1 year after burn	28	21	7	29	39	18	2	0	67	19	9	22
2 years after burn					23	17	2	0	23	17	2	0
Not sprayed												
2 years after burn					0	–	34	12	0	–	34	12
Total/average	76	28	56	21	94	20	57	11	170	23	113	16

from the time of the burn in March until the first weeks of June. Heavy rains the last days of May stimulated a rapid regrowth of tobosa grass. Except for a single successful ground-nesting in late April, among the branches of a fallen mesquite, the 1971 burn area was not used by ground-nesting mourning doves until June 9 when, apparently in response to the tobosa regrowth, mourning doves began nesting on the area. The breeding pair density then quickly exceeded that on the other areas (Table 3).

Apparently in response to the drought, tree-nesting activity declined in 1971, but ground-nesting activity remained stable or increased over 1970 levels (Table 3).

Ground-nesting densities in our study compare with a density of 0.15 ground-nesting pairs per acre of suitable habitat on North Carolina islands (Hon, 1956) and exceed the 0.025 pairs per acre found in northeastern Oklahoma (Downing, 1959). Jackson (1940), in 1939, a drought year, found 34 tree nests in 640 acres of mesquite pasture in the Texas Rolling Plains. The maximum number of nests found in any one month was 16. If these were indeed the efforts of 16 different pairs, the breeding pair density was 0.025 pairs per acre. The drought ended the following year and nesting activity increased; however, Jackson ended his study in May before comparable data were collected. Clark (1969) reported a peak tree nest density of one active nest per 4.8 acres (0.208/acre) for a mesquite-huisache habitat in the South Texas Plains.

Nesting Success

Ground-nesting mourning doves were more successful at fledging young than were tree-nesting doves (Table 4); 23% of the 170 ground-nesting attempts were successful, compared to 16% of the 113 nestings in trees. Downing (1959) reported a 29% ground-nesting success for doves in Oklahoma. Mourning dove studies in the Southwest have shown great variability in tree-nesting success, ranging from 15% (Dobson, 1955) to 62% (Swank, 1955). Such variation of nesting success likely reflects the great differences between weather patterns and predator populations.

Predation accounted for the majority of the nest losses (Tables 5 and 6). The western coachwhip (*Masticophis flagellum testaceus*) was common and probably was a major predator on both tree and ground nests. Other predators common to the study area were the rattlesnake (*Crotalus a. atrox*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), ground squirrel (*Citellus* sp.) and wood-rat

Table 5. Fates (percent of total nestings) of mourning dove ground nestings on sprayed and/or burned tobosa grass-mesquite rangeland, Mitchell County, Tex., 1970–71.

Treatment	No. nestings	Fates			
		Predation (%)	Hail (%)	Abandoned (%)	Successful (%)
Sprayed 1965					
Not burned	17	35	0	18	47
Burned					
Year of burn	63	62	3	11	24
1 year after burn	67	58	9	13	19
2 years after burn	23	61	4	17	17

Table 6. Fates (percent of total nestings) of mourning dove tree nestings on sprayed and/or burned tobosa grass-mesquite rangeland, Mitchell County, Tex., 1970–71.

Treatment	No. nestings	Fates			
		Predation (%)	Wind and hail (%)	Abandoned (%)	Successful (%)
Not sprayed					
2 years after burn	34	65	17	6	12
Sprayed 1965					
Not burned	54	61	7	14	18
Burned	25	64	16	4	16

Table 7. Average ground cover (%) around successful and unsuccessful ground nests, Mitchell County, Tex., 1971.

Area	Height of tobosa (inches	Average ground cover[1]	
		Successful nests	Unsuccessful nests
Sprayed 1965			
Not burned	7–14	27	35
Burned			
Year of burn	3–5	26	17
1 year after burn	6–8	23	28
2 years after burn	12–14	43	25

[1] Ocular estimate of cover around (1.2 ft radius) nests.

(*Neotoma* sp.). Additionally, several tree nests were destroyed by avian predators.

Severe storms are common in the Texas Rolling Plains, particularly during April and May. High winds destroyed several tree nests in 1970 but ground nests were secure from wind. However, in 1971, a late May storm with high winds, flooding rains, and hail destroyed 92% of the 12 then-active dove tree nests and 88% of the 8 ground nests.

Abandonment was the cause of nest failure for 18% of the ground nestings and 9% of the tree nestings. About half of these losses can definitely be attributed to the activities of our investigations.

The success of ground nestings in the unburned area was higher than in the burned areas (Table 3). Young fledged from 47% of the ground nestings in the unburned area as compared to 21% in the burned treatments. Ground-nesting success was higher in the current year's burn than in the older burns.

There was no consistent relationship between ground-nesting cover and nesting success (Table 7). Nesting success instead appeared more closely related to nesting density (Figure 1). Ocular estimates of cover around ground nests (1.2 ft radius) ranged from 14 to 48% for successful nests and 8 to 51% for unsuccessful nests. The presence of pricklypear, mesquite sprouts, or fallen branches beside the nest (Fig. 2) likewise was not consistently related to nesting success (Table 8).

Doves that used tree-nesting sites with some foliage cover, whether in a sprayed or unsprayed mesquite, were more successful than doves using sites lacking foliage (Table 9).

Productivity

Prescribed burning of previously sprayed tobosa grass-mesquite rangeland reduced overall mourning dove productivity per acre in 1970, when precipitation was near normal and tree-nesting densities were highest (Table 10). Drought apparently reduced tree-nesting activity in 1971 whereas ground-nesting activity remained stable or increased. As a result, more doves fledged per acre from the burned areas.

Productivity per acre generally paralleled nesting density. Young fledged per acre was highest from ground nests in the new burn, lower in the older burns and lowest in the unburned area (Table 10). In 1971 nesting did not begin in the current year's burn until heavy rains stimulated grass regrowth in early June. Thus, while the 1971 burn supported the highest breeding pair density, the late start resulted in fewer nesting attempts.

A rotation system of burning providing both new and old burns for

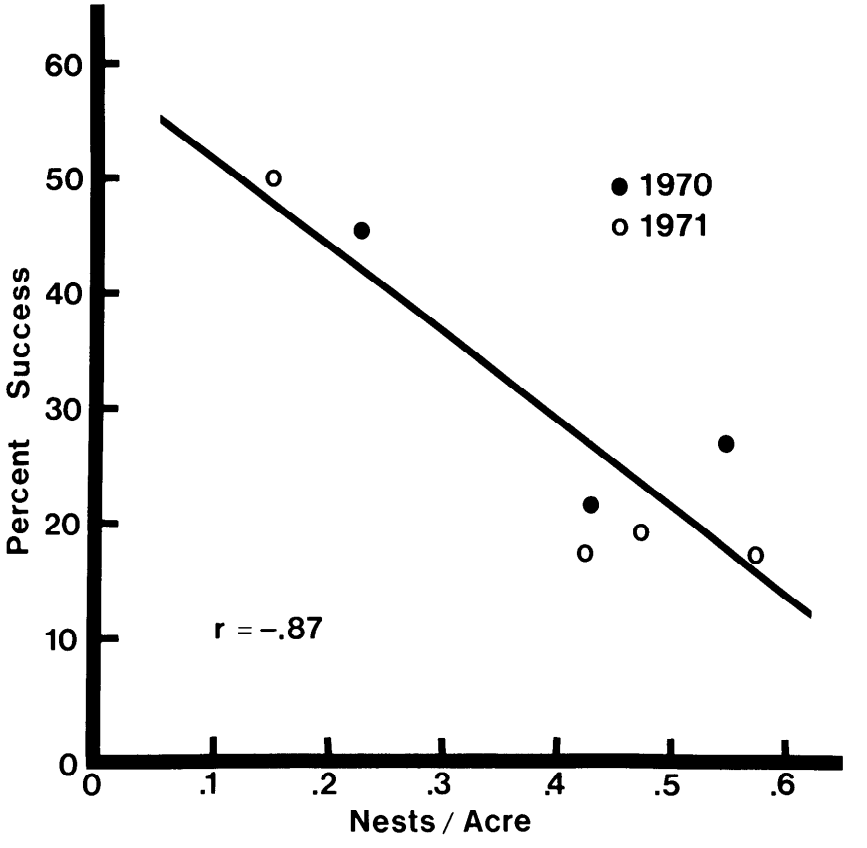

Fig. 1. *Relationship of ground-nest success with nest density. Correlation is highly significant (P < .01).*

Table 8. Success of mourning dove ground nests located beside vertical cover other than tobosa, i.e., pricklypear pads, mesquite sprouts, or fallen mesquite branches.

Nesting season	Nests beside vertical cover		Nests lacking vertical cover	
	Number	Percent successful	Number	Percent successful
1970	59	23.7	17	41.2
1971	70	24.3	24	8.3
Total	129	24.0	41	21.9

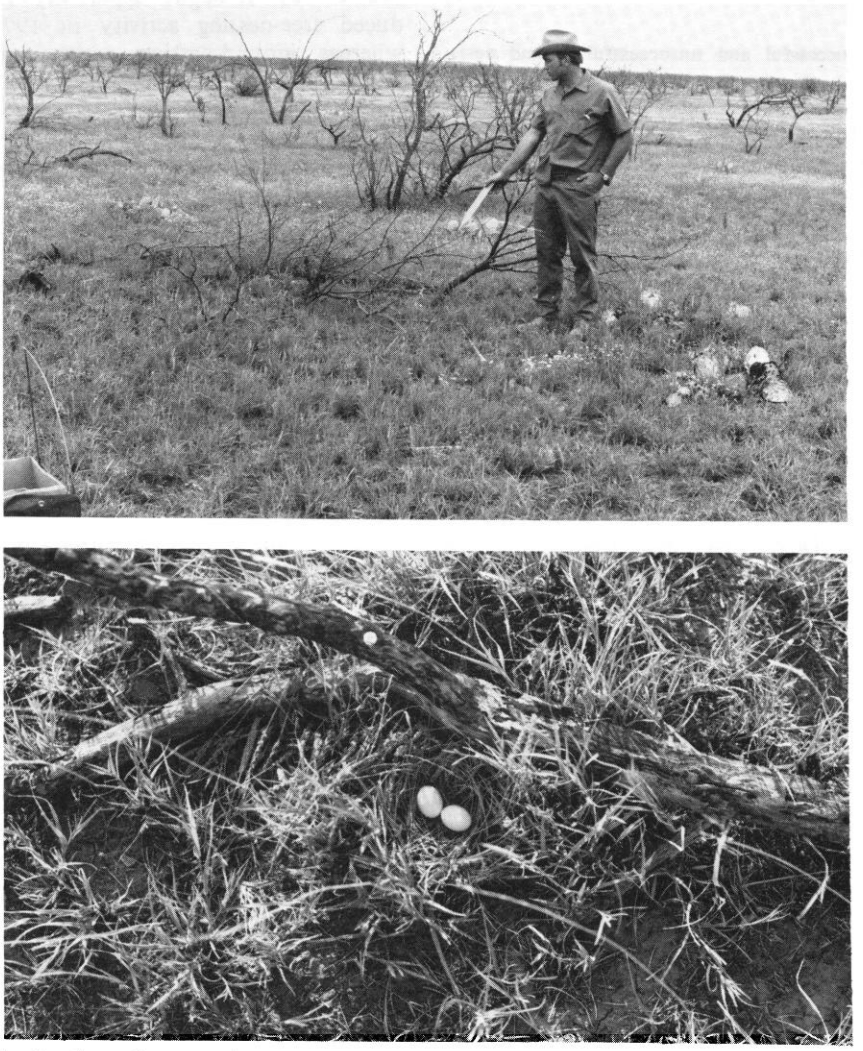

Fig. 2. *General aspect of newly burned rangelands and location of mourning dove ground nest* (upper). *Close-up of mourning dove ground nest amid tobosa grass litter and burned mesquite branch* (lower).

dove nesting would likely permit a stable level of mourning dove production. Good grazing management as well as the enhancement of dove nesting requires that burning be postponed when drought conditions exist or threaten.

Nesting Sites

Mourning doves nested in dead, sprouting top-killed, and live-crown mesquite. The likelihood of mesquite serving as a nest site increased as the tree's basal diameter increased. Thirty-one percent of the tree nests were in mesquite with a basal diameter of 3–5 inches, 42% in the 6–8 diameter class, and 27% in the 9 inch or larger diameter class. The high use of the larger trees is in sharp contrast with the lower density of the larger trees (Table 1). Selection by doves of the larger size mesquite may be a response to the increased support provided by the larger branches and forks.

Support, not cover, appeared to be the primary prerequisite of a tree for a nest site. Even those nests associated with foliage fostered the impression of being exposed. Mesquite foliage is lacey, open, and concentrated at the outer edges of the tree. Thirty-one percent of the 35 nestings in live-crown mesquite had some foliage cover associated with the nest. However, the preferred nest sites—large forks, crotches, and branches—were usually lower on the tree and not located within foliage.

Basal and trunk sprouts on the sprayed mesquite often grew up and around the lower, large forks and crotches, providing some cover for nests located there. Doves also used clumps of trunk sprouts as nest sites. Doves using the sprouting top-killed mesquite placed 62% of 40 nestings in sites having some foliage cover.

Ground nests were found only in areas sprayed or sprayed and burned. In no case was ground nesting due

Table 9. Success (number) of mourning dove nests in relationship to mesquite crown condition and the presence of foliage cover near the nests, Mitchell County, Tex., 1970–71.

Area	Total foliage kill		Top killed with sprouts				Live crown			
			Foliage cover		No cover		Foliage cover		No cover	
	Success	Fail	Success	Fail	Success	Fail	Success	Fail	Success	Fail
Sprayed 1965 and not burned	2	21	5	14	1	7	1	2	1	0
Sprayed 1965 and burned	3	12	1	4	0	5	0	0	0	0
Not sprayed and burned 1969	0	0	0	1	0	2	3	5	1	22

Table 10. Mourning dove productivity on treated tobosa grass-mesquite rangeland, Mitchell County, Tex., 1970–71.

Treatment and nest location	1970 No. nests	1970 Nestlings fledged: Per nesting attempt	1970 Nestlings fledged: Per acre	1971 No. nests	1971 Nestlings fledged: Per nesting attempt	1971 Nestlings fledged: Per acre
Unsprayed						
2 years after burn						
tree				34	.212	.175
Sprayed 1965						
Unburned						
tree	39	.487	.389	15	.133	.037
ground	11	1.125	.259	6	1.000	.150
Year of burn						
tree	10	.200	.050	4	.500	.050
ground	37	.459	.425	26	.346	.225
1 year after burn						
tree	7	.428	.075	2	0	0
ground	28	.321	.225	39	.333	.325
2 years after burn						
tree				2	0	0
ground				23	.308	.200

alone to the absence of mesquite. Ground nests were never more than 200 ft, and usually less than 100 ft, from a tree (Fig. 2, upper). Cowan (1952) noted a similar situation in California, where doves ground nested in cotton fields even though adequate nesting sites were available in willow groves.

All the ground nests were in association with tobosa grass. "Monotypic" areas of buffalograss, annual broomweed (*Gutierrezia dracunculoides*) or common sunflower (*Helianthus annua*) were not used as ground-nesting cover. Unburned patches within burn areas were not used by ground-nesting doves.

Ground nests were usually located beside pricklypear (*Opuntia engelmannii*), mesquite sprouts or fallen mesquite branches (Fig. 2, lower). Such vertical cover was beside 75% of all ground nests but was most important for nests located in the current year's burn (89%), progressively less important in the older burns (76 and 61%), and least important in the unburned area (41%). An ocular estimate of total cover around the ground nests (1.2 ft radius) averaged 25% and ranged from a low of 8% to a high of 51%. Cover height ranged from 1 inch for some fallen branches and tobosa grass to 3 ft for some mesquite sprouts. Usually, tall dense vegetation was avoided. Overhead cover was only rarely present.

Ground-nesting mourning doves seem to prefer open cover with large amounts of bare soil and little litter. Reports of mourning dove ground nests in grain stubble (Downing, 1959); Hanson and Kossack, 1963) and cotton fields (Jackson, 1940; Cowan, 1952) also suggest this preference. Burning increased the attractiveness of an area to ground-nesting doves by opening up the cover and reducing the litter.

The availability of choice nest material is important in determining the territorial boundaries of mourning doves (Goforth and Baskett, 1971). Moreover, mourning doves prefer to collect their nest materials from areas with sparse cover (Swank, 1955). Thus burning, while reducing the total amount of available litter, added to the suitability of the habitat by increasing the amount of open space where doves might collect nest materials.

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