

STATUS AND HABITAT OF THE SAND DUNE LIZARD
SCELOPORUS ARENICOLUS
LEA COUNTY, NEW MEXICO
NATIONAL ENRICHMENT FACILITY PROJECT

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SUMMARY

Sand dune lizard (*Sceloporus arenicolus*) surveys were conducted at the proposed LES NEF site in Lea Co., NM, Section 32, T21S, R38E. This site is four miles east of Euncie, north of NM Hwy 234. *Sceloporus arenicolus* (Sa) is listed as a threatened species by the New Mexico Department of Game and Fish and is listed as a candidate species by the United States Fish and Wildlife Service. Field surveys during 26-29 Sep. 2003 resulted in no sand dune lizards detected and a determination of unsuitable habitat on Section 32 and the surrounding areas. Previous studies (Fitzgerald et al. 1997, Sias and Snell 1998) did not search the Section 32 study site, but did map some of the geographic range and habitat of the sand dune lizard 5.75 miles north of Section 32. Sand dune lizards were active in these areas on the same days Section 32 was searched with negative results for sand dune lizards.

This survey, and other recent surveys (vegetation) found some habitat components (sand dunes, shinoak, blowouts) that are associated with sand dune lizards. But the dunes, blowouts and shinoak occurred in configurations and locations that did not support sand dune lizards on Section 32. The shinoak habitat of Section 32 was ecotonal with mesquite and grassland associations. In contrast, the habitat of sand dune lizards is shinoak dominant, sand dunes. The vegetation on Section 32 probably reflects different substrate conditions (finer particle size) that will not support sand dune lizards.

The predominant microhabitat of sand dune lizards is sandy blowouts (open depressions in substrate). But section 32 had a significantly lower proportion of large blowouts than occupied sand dune lizard habitat. Section 32 shinoak dunes were low, small in extent, patchy in location and isolated from suitable habitat to the north. Only two habitat descriptions (2/76) were dunes dominated by shinoak. All other habitat descriptions (74/76) described other habitat types or shinnery dunes vegetated with mesquite scrub and grassland flora.

Surveys north of Section 32 showed that the area between occupied habitat and the study site consisted of roughly one mile of dispersal habitat (shinoak flats) trending south of occupied areas. These shinoak flats merged into ecotonal mesquite scrubland and mesquite grassland associations. These are habitats where sand dune lizards have not been detected and were classified as unsuitable.

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INTRODUCTION

This report presents the results of sand dune lizard (*Sceloporus arenicolus*) surveys in southeastern New Mexico, Lea County at a specific site: Township 21S, Range 38E, section 32 north of NM hwy 234, an area of 543 acres four miles east of the town of Eunice. This report also includes results of surveys in the vicinity of this site to determine the status and habitat of the sand dune lizard in this area and at this study site. Section 32 is NM state land and the proposed location for an LES National Enrichment Facility. This study was commissioned by GL Environmental Inc. for LES (Louisiana Energy Services).

Sceloporus arenicolus (Sa) is listed as a threatened species by the New Mexico Department of Game and Fish and is listed as a candidate species by the United States Fish and Wildlife Service. The primary threat to date has been habitat destruction in the limited regions of southeast New Mexico and west Texas where the species occurs. *S. arenicolus* occupies habitats primarily comprised of shinners oak (*Quercus havardii*) sand dunes (Appendix 4, photo 1). In addition to habitat specialization, this species is a micro-habitat specialist, almost all sightings occur in blowouts (open sand bowl-like depressions) that develop in shinners oak sand dune localities (Appendix 4, photo 2). Furthermore, *S. arenicolus* exhibits a distinct preference to occupy large blowouts (Fitzgerald et al. 1997, Sias and Snell 1998, Sias 2002). Localities near the known range of *S. arenicolus* that contain shinners oak, sand dunes and blowouts merit investigation.

Field surveys were based on protocols used in previous studies of *S. arenicolus* (Fitzgerald et al. 1997, Sias and Snell 1996, Sias and Snell 1998, Sias 2002, Sias 2003). As a consequence, survey data in this report is directly comparable to past and future sand dune lizard surveys. We used the data to address three project issues: 1) determine the presence or absence of *S. arenicolus* on section 32; 2) determine the habitat suitability of section 32 for *S. arenicolus*; 3) determine the biogeographic relation between sec. 32 and the nearest suitable habitat (occupied and or potential classifications).

MATERIALS AND METHODS

Information from this report came from the following sources. Field work was conducted from 25-29 Sep. 2003. Previous work in the area reported in Fitzgerald et al. (1997), Sias and Snell (1996), Sias and Snell (1998), Sias (2002) provided localities of sand dune lizards and habitat information. During the 25-29 Sep 2003 field surveys, no *S. arenicolus* were disturbed or collected. Standardized lizard surveys include timed walking in predetermined areas/directions with close focusing binoculars and recording all reptiles seen and various habitat components related to *S. arenicolus*. The methods used in these surveys are reported in detail in Fitzgerald et al. (1997) and Sias and Snell

(1998). Before and after standardized lizard surveys, sites of known sand dune lizard occurrence were visited to determine lizard activity (verification survey in Table 2). This provided a higher degree of confidence (i.e. information about the presence / absence and abundance of the lizard) for surveys where sand dune lizards were not found. The 25-29 Sep. field surveys covered the entire 550 acres, regardless of habitat type. No assumptions were made about *S. arenicolus* habitat utilization. If *S. arenicolus* were seen, these localities were recorded with GPS receivers and additional habitat information was collected to ascertain habitat and microhabitat utilization. This information is relevant to developing localized mitigation measures.

Four standard lizard surveys and a general area and boundary inspection were conducted on sec. 32. The standard lizard surveys started on the north boundary and the observer walked zigzag se-sw in a 1/4 mile band south until the Highway 234 fence was intersected. The observer then walked to the adjacent band, reversed direction and walked back to the north boundary.

The closest site of known *S. arenicolus* occurrence (T20S, R38E, sec 36) was visited before and after each sand dune lizard survey of the study site (sec. 32). The northwest corner of sec. 32 was 5.75 miles south (176°) of the verification site. The author of this study was aware of seasonal aspects of New Mexico lizard fauna activity. Before section 32 was even visited, the sand dune lizard verification locality was visited to evaluate the feasibility of *S. arenicolus* surveys. Six *S. arenicolus* were observed for one hour (12:00-13:00) to see what behaviors the lizards exhibited, what type of movements occurred and what microhabitats were utilized (Appendix 4, photos 3, 4, 5). *S. arenicolus* activity and daily temperatures determined the times of lizard surveys.

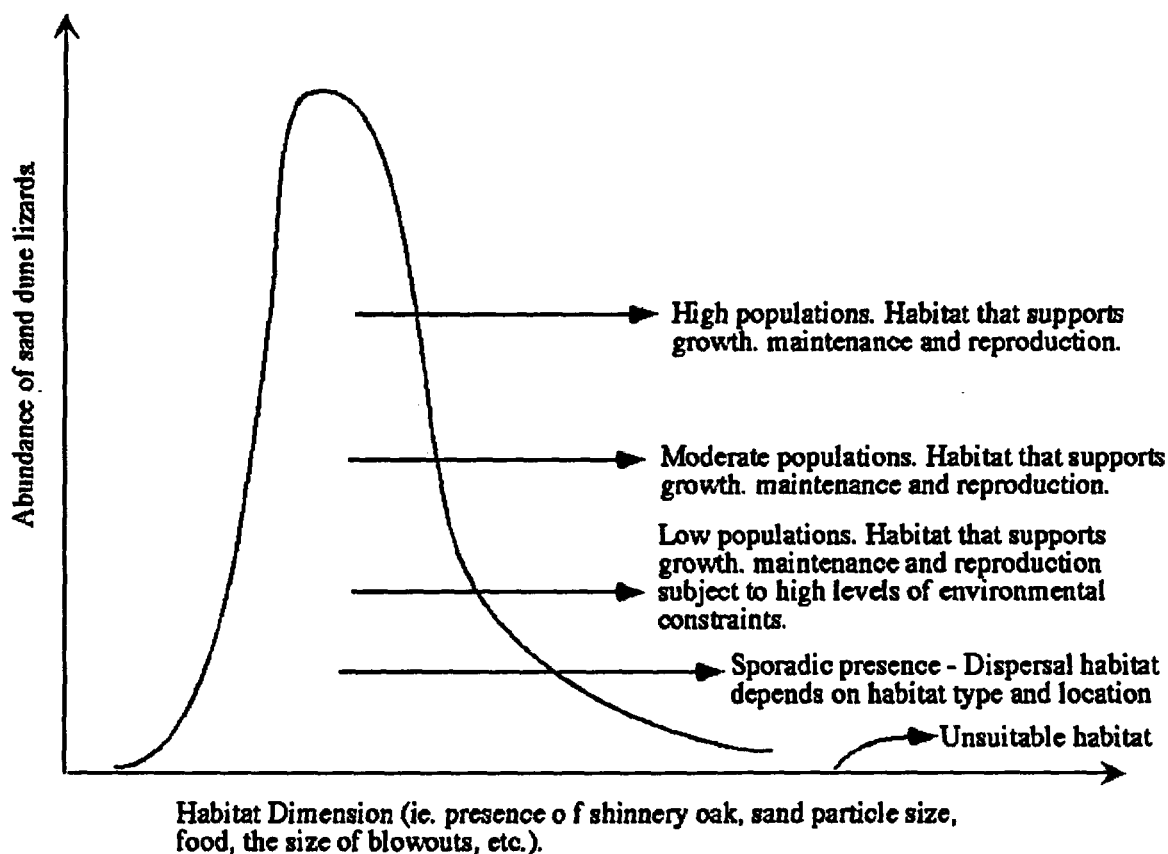
The environmental information collected during timed surveys described the habitat and microhabitat and was used in determining habitat suitability for *S. arenicolus*. This study collected the same information and used the same methods in Sias and Snell (1998), Sias (2002), Sias (2003). In brief, these surveys include collecting the following data. The number of blowouts walked through (Appendix 4, photos 2, 14-17). The size of these blowouts was recorded as BS, BM, BH (blowout maximum linear or curvilinear length, blowout small (BS) < 25 ft, blowout medium (BM) 25-80 ft and blowout huge (BH) > 80 ft). At *S. arenicolus* localities additional information collected would include the blowout depth (if the site was a blowout) or a description of the micro-habitat and habitat. At 15 minute intervals an estimation of open substrate (% based on ten points 25 m around the observer), local topographic relief (R), (5 points at 25 m around the observer and vegetation/habitat types was made (four quadrants (Q1-4) at 0-50 m based on N, E, S, W directions).

The vegetation-topography types (Table 4, Appendices 1, 3) are described in order of dominance using abbreviations (Appendix 3). For instance in Table 4 "mgy" indicates a mesquite grassland with scattered yucca, sd-(low)mgy indicates low shinnery dunes are predominant with mesquite, grass, and yucca present in order of their relative frequency. Air temperature (two inches above substrate) and substrate temperature was recorded at the beginning, middle and end of surveys.

The data collected during timed lizard surveys is presented in Appendix one. Reference GPS points for section 32 and the lizard/habitat surveys are shown in Appendix 2. Plant and vegetation community abbreviations are shown in Appendix 3. These are used in Appendix 1 and Table 4. Also Appendix 3 contains comments about plant associations that are suitable, unsuitable and dispersal habitat for *S. arenicolus*. Appendix 4 contains reference photographs of the habitat and sand dune lizards.

Several habitat terms were used in this report that require definition. Figure 1 (following) discusses the idea of habitat suitability used in this report.

Figure 1. Suitable and unsuitable habitat.



Suitable habitat is habitat that will support growth, maintenance and reproduction of sand dune lizards in high, moderate and low populations. It can be occupied or unoccupied by sand dune lizards. Dispersal habitat is habitat that generally occurs adjacent to shinnery oak sand dunes and blowout complexes, that sand dune lizards may move through at various times. Habitat is classified as dispersal if our knowledge of sand dune lizards suggests that sand dune lizards can move and disperse through this habitat with a reasonable level of survivability. Unsuitable habitat is habitat that does not support growth, maintenance, reproduction or dispersal of sand dune lizards.

Table 1, below shows the reptile abbreviations, common and scientific names used in this report and in Table 2, the summary of lizard surveys.

Table 1. Reptile abbreviations, common and scientific names used in this report.

Reptile abbreviations used in report and tables	Scientific name	Common name
Sa	Sceloporus arenicolus	Sand dune lizard
yoy		young of year
Us	Uta stansburiana	Side-blotched lizard
Ct	Cnemidophorus tigris	Western whiptail lizard
CtT	Cnemidophorus tigris (tracks)	Western whiptail lizard tracks
Hm	Holbrookia maculata	Lesser earless lizard
Su	Sceloporus undulatus	Praire (fence) lizard
Cs	Cnemidophorus sexlineatus	Six-lined racerunner
Pc	Phrynosoma cornutum	Texas horned lizard
To	Terrapene ornata	Ornate box turtle
ToT	Terrapene ornata (tracks)	Ornate box turtle tracks
Snake T		Snake tracks
Cr.vi	Crotalus viridus	Western rattlesnake
Mf.fl	Masticophis flagellum	Western coachwhip snake
Xx-m		male
Xx-f		female
Xx-juv		juvenile

RESULTS

The Occurrence of Sand Dune Lizards on Section 32, T21S, R38E.

Table 2 summarizes the reptiles found during lizard surveys. A portion of this table is shown below.

Table 2 portion. Summary of lizard surveys.

Survey Type	Survey date	Total time (hrs)	Aprox distance walked (mi)	Sa	Us	Ct	CtT	Hm	Su	No ID Liz	Cr.vi	Ma.fl	Snake Track	ToT
Sa verification	26-Sep-03	0.50	0.20	5	2	0	0	0	1	0	0	0	0	1
General site and boundary inspection	26-Sep-03	3.50	4.00	0	17	1	0	0	0	0	1	0	0	0
Road survey Hwy NM 234/ TX 176	26-Sep-03			0										
Sa verification	27-Sep-03	0.17	0.10	2	0	0	0	0	0	0	0	0	0	0
Sec. 32 west side	27-Sep-03	2.00	4.00	0	54	0	0	1		0	0	0	1	0
Sec. 32 west central	27-Sep-03	2.00	4.00	0	13	0	0	0	0	0	0	0	2	2
Sec. 32 west central	27-Sep-03													
Sa verification	27-Sep-03	0.25	0.05	3	6	0	0	0	0	0	0	1	1	1
Sec. 32 east side	28-Sep-03	2.75	5.50	0	36	2	0	0	0	1	0	0	0	0
Sec. 32 east central	28-Sep-03	2.00	4.00	0	21	2	4	0	0	0	0	0	0	2
Sa verification	28-Sep-03	0.57	0.30	6	6	0	0	0	0	0	0	0	0	0
Sa in vicinity, checked N of sec. 32. See T2, T3, Sa only recorded	29-Sep-03	1.75	3.00	0										

Table 2 includes surveys at the study site, verification site and a locality between the study site and the nearest *S. arenicolus* occupied locality, which in the case of this study was the verification site. During lizard and habitat surveys between the dates 26-29 Sep. 2003 no *S. arenicolus* were found on section 32 or in areas immediately adjacent to this site. A total of 12.25 man-hours of lizard/habitat surveys at sec. 32 yielded no *S. arenicolus*. Additionally a total of 8.75 man-hours of standardized lizard surveys yielded

no *S. arenicolus*. In contrast, at the verification site 1.49 man-hours yielded 16 *S. arenicolus*. A supplemental way of viewing this data was to compare distances walked with the numbers of *S. arenicolus* seen. A conservative estimation (walk speed two miles per hour, or 33% of time was spent writing notes or using binoculars) showed that 21.50 miles of walking in section 32 yielded no *S. arenicolus* compared to the verification site where 0.65 miles of walking resulted in 16 *S. arenicolus* observed.

Note that habitat inspection and formal lizard surveys were conducted on 26-28 Sep. at the site. During each day, before and after these surveys *S. arenicolus* were active at the verification site 5.75 miles to the north. Not included in the distance or time calculations was additional work at sec. 32. For instance on 29 Sep. the author went to the study site all morning to photograph habitat and re-inspect areas of shinnery oak sand dunes / blowouts. No *S. arenicolus* were observed during these walks.

The Geographic Range of Sand Dune Lizards In The Vicinity of Section 32, T21S, R38E.

Figure 2 is a map of the geographic range of *S. arenicolus* in southeastern NM. This map shows all historical range records and all locality records of *S. arenicolus* (present or absent) from more recent studies (Fitzgerald et al. 1997, Sias and Snell 1996, Sias and Snell 1998, Snell et al. 1997). Note that there are no documented records in NM of *S. arenicolus* west or south of the study site (open circles, Fig. 2).

The range of *S. arenicolus* in NM passes across localities located roughly six miles north of the study site. This shinnery dune field extends into east into Texas and contains occupied habitat (Painter and Sias 1998). Because of land ownership patterns, the range of *S. arenicolus* is incompletely known in Texas. On 26 Sep. the author drove 16.7 mi east of the entrance to sec. 32 on NM Hwy 234/TX Hwy 176 and inspected the habitat north and south of the highway. There was no adjacent shinnery dune habitat. Cleared mesquite (*Prosopis glandulosa*) fields, mesquite scrub, agricultural areas, mesquite shinoak scrub and mesquite shinoak grassland comprised the visible habitats. These habitats are unsuitable for *S. arenicolus*.

In Texas, on Hwy 234, 3.4 mi east of the section 32 Rd entrance, one can see on the north horizon the shinnery dune complexes that form the eastward extension of the verification site. These observations confirmed that there was no suitable habitat for *S. arenicolus* east of section 32 adjacent to NM Hwy 176/TX Hwy 234.

Figure 3 is a map that shows the immediate area between the study site and the nearest occupied *S. arenicolus* localities. This interlying area was checked for suitable habitat for *S. arenicolus* by driving on roads in this area and in some cases by lizard surveys (Table 2). Table 3 shows the notes on habitat observations made between the *S. arenicolus* verification site and section 32. A series of GPS waypoints were taken to mark these observations and are plotted on Figure 3 as open circles. No *S. arenicolus* were seen at any of these spots.

The waypoint EUN VERIFI (Fig. 3, large black circle) marks the verification survey site and a line of shinnery oak dune/blowout complexes that extend east into Texas. This dune field supports high population densities of *S. arenicolus* (Fitzgerald et al, 1997, Sias and Snell 1998). South of this field are extensive shinnery oak flats with widely scattered blowout complexes that are small in extent (<100 m), and low in height. No *S. arenicolus* have been reported from this area (Fig. 2-3, Fitzgerald et al. 1997). It is likely that *S. arenicolus*, during periods of high population abundance, may disperse through these shinnery oak flats and may survive for short periods in these small isolated blowout complexes (Sias 2002) that are near EUN VERIFI.

However, inspection of the area south of EUN VERIFI in 1994 (my field notes from the study Fitzgerald et al. 1997) and in 1996-7 (my field notes from the study Sias and Snell 1998) revealed few large blowouts to serve as appropriate microhabitat and no *S. arenicolus* or suitable survey sites were found. For some distance south of EUN VERIFI the habitat may be classified as suitable marginal and dispersal. Based on observations from EUN NORTH1 and EUN WINDM2 (table 3) this marginal and dispersal habitat may extend 1+ miles south of EUN VERIFI. This places section 32 at 4.75 miles south of marginal and dispersal habitat and 5.75 miles south of occupied habitat.

Table 3 notes show that at the next waypoint south, EUN NORTH1, 2.5 mi (south) at 22° from EUN VERIFI the shinnery oak habitat is fragmented and ecotonal. Some shinnery oak dune patches occur 100-200 m east and continue east of this waypoint. These isolated dune complexes end approximately 200 m south of the waypoint. Looking north, between EUN NORTH1 and the verification site are extensive shinnery oak flats interspersed with mesquite associations. Mesquite associations are evident in all directions. The waypoint EUN NORTH1 is 3.7 miles at 159° from the northwest corner of section 32. The frequency of mesquite was indicative unsuitable conditions for *S. arenicolus*.

West of all waypoints between EUN VERIFI and EUN NW SEC (32) (from north to south: EUN NORTH1, EUN WINDM2, EUN NORTH6, EUN NORTH5, EUN NORTH7) are mesquite scrublands and grasslands with a shinoak component. The frequency of mesquite and absence of dune formations make these areas unsuitable habitat for *S. arenicolus*.

At the locations EUN WINDM2, EUN NORTH5-7 and east of these locations are ecotonal shinnery-mesquite associations and non shinnery habitats. Small patches of shinnery oak flats and dunes are scattered throughout this area, but they are isolated from the extensive shinnery dominant habitats to the north. The small size, isolation and ecotonal aspect of these shinnery habitats suggest these areas north of section 32 are unsuitable habitat for *S. arenicolus*. Table 2 shows that a *S. arenicolus* survey was conducted in portions of sections 30, 19, T21S, R38E for 1.75 hours. This was an isolated patch of shinnery dunes (low/med), but it was searched since it appeared to contain the environmental characteristics associated with *S. arenicolus* occurrence. No *S. arenicolus* were found. This survey site (EUN NORTH5) was 4.8 mi at 180° from the nearest occupied habitat (EUN VERIFI). In a line north, intervening between these points was at

least 3 mi of unsuitable habitat (mesquite associations) before dispersal class habitat would be reached. Because of the small size and isolation of this dune field it is highly unlikely *S. arenicolus* would be able to colonize and persist in this area. Also the presence of mesquite surrounding this area suggests that the substrate particle size of this shinnery dune complex may be inappropriate (too fine) for *S. arenicolus* (Fitzgerald et al. 1997).

The Habitat and Habitat Classification of Section 32, T21S, R38E in Reference to the Sand dune Lizard.

Table 4 shows a summary of the plant habitat descriptions taken as point quadrant samples (Appendix 1) during lizard surveys on section 32. The surveys resulted in 76 different plant habitat descriptions out of a possible 136 different descriptions (Appendix 4, photos 6-17). High numbers of different habitat descriptions are characteristic of ecotonal areas and portray unsuitable habitat for *S. arenicolus*. Using this system of characterization in Table 4, *S. arenicolus* habitat would be described only by the terms (sd = shinnery dunes, sf = shinnery flats) sd-(high), sd-(med), sd-(low) and sf, with g (grass), ss (sand sage *Artemesia filifolia*), y (yucca *Yucca glauca*) present. There are no records of *S. arenicolus* taken from other habitats (Fitzgerald et al. 1997, Sias and Snell 1996, Sias and Snell 1998, Sias 2002, Sias 2003). Shinnery oak dune patches were only present in 2 of 76 samples and these were low dunes (sd-(low)). Low shinoak sand dunes are associated with low and marginal populations of *S. arenicolus* (Sias and Snell 1998, Sias 2002, Sias 2003). Shinnery oak dunes with mesquite present occurred in 25 of 76 samples (Appendix 4, photos 10, 13-17). Shinnery oak was present 63 of 76 samples and mesquite was present in 66 of 76 samples. These proportions describe unsuitable habitat for *S. arenicolus*.

The frequency of mesquite in this section suggests environmental conditions and substrates that can not support populations of *S. arenicolus* (Fitzgerald et al. 1997). Grass was present in 44/76 habitat descriptions. High frequencies of grass are not associated with conditions required to support populations of *S. arenicolus*.

When the herbicide Tebuthion is sprayed on extensive shinoak patches, it kills the shinoak and the grass component of the flora greatly increases. These chemically treated grassy areas are associated with large reductions (74-100%) in the numbers of *S. arenicolus* compared to adjacent untreated areas (Snell et al. 1997). *S. arenicolus* has not been found in mesquite grassland habitats or shortgrass habitats in southeast NM (Fitzgerald et al. 1997).

Blowouts, the key micro-habitat feature associated with *S. arenicolus* location in the environment (Fitzgerald et al. 1997, Sias and Snell 1998) were present in section 32 (Appendix 4, photos 13-17). Table 5 (below) compares size distribution of blowouts and the mean local relief between the study site and two other studies of *S. arenicolus* habitat also located in southeastern NM.

Table 5. A comparison of blowout size distribution and local topographic relief between section 32 and two other *S. arenicolus* habitat studies in southeast NM.

Area of study	No. blowouts small (BS)	No. blowouts medium (BM)	No. blowouts huge (BH)	Mean relief (ft)
Section 32	156 (52.7%)	105 (35.5%)	35 (11.8%)	3.8
Conoco (Sias 2002). A local Sa study 9.9 miles NW distant in Sa habitat	441 (48.4%)	323 (35.5%)	147 (16.1%)	10.6
Oil/Gas field study (Sias and Snell 1998) in Sa habitat	803 (43.2%)	580 (31.2%)	475 (25.6%)	13.1

The Conoco study (Sias 2002) located in Lea Co. T20S, R37E, secs. 11, 14, 15 was located 9.9 miles NW of section 32 and the Oil/Gas field study was comprised of transects located in occupied shinnery dune habitat in the south part of *S. arenicolus* range (Eddy, Lea Co.). Note that on section 32 huge blowouts comprised the smallest proportion of blowouts compared to the two studies in occupied habitat. The proportion of huge blowouts on section 32 was significantly lower than in the Oil/Gas field study, which represents samples all over the range of *S. arenicolus* in southern NM (Marginal homogeneity test, Chi-Square 26.974, df = 2, $p < .0001$).

The mean relief, a measurement of dune height and blowout depth was low for section 32 compared to the other studies. We know that the abundance and occurrence of *S. arenicolus* are positively associated with high relief (Sias and Snell 1998). Small values for the variable "mean relief" are a function of the field measurements and describe a predominantly flat terrain (Appendix 4, photos 6-9). On section 32 most of the terrain was almost "flat" resulting in small values for estimations of relief. Additionally, on section 32 the dune and blowout areas were small in extent, infrequent and patchy in distribution. The vegetation analysis and these measurements support classification of section 32 as unsuitable habitat for *S. arenicolus*.

DISCUSSION

The data collected during this study of *S. arenicolus* and the habitat in Lea Co. NM on section 32, T21S, R38E augmented the available information biologists have on *S. arenicolus*. On section 32 and surrounding lands no sand dune lizards were detected during September 2003 fieldwork and no sand dune lizards have been reported in previous studies. Because of habitat structure and distances from the nearest sand dune lizard populations there is a low probability that any sand dune lizards will be found on this section in the future. The presence of *S. arenicolus* at this site would indicate a long distance dispersal event, where a single lizard moves through unfavorable habitat. The closest populations of sand dune lizards occur 5.75 miles to the north in an east west oriented shinoak dune field.

The habitat of section 32 is unsuitable for sand dune lizards. The primary reasons are:

- The high frequency of mesquite and grassland associations, which are associated with environmental conditions that do not support sand dune lizards.
- Also, there is a low frequency and extent of shinoak dunes and large blowouts, which provide the habitat and micro-habitats necessary for sand dune lizard survival.
- The shinnery dune habitats that do exist are isolated from occupied shinnery dunes.
- Lastly, the ecotonal characteristics of this section are in contrast to the primary habitat of sand dune lizards, which is sand dunes dominated by shinoak, with scattered sand sage, yucca and grasses, and notable for an absence of mesquite.

In biological terms, any type of development in this section may be preferable to other more isolated sections and undisturbed areas. The reasons for this are the current locations of other developments in the area. The section immediately to the north of section 32 is the Walloch Quarry. To the east 1/2 section and across the TX/NM border is a Waste Control Specialists, Inc plant. One-half mile southeast from the dirt road entrance to section 32 is the entrance to the Lea Co. Landfill. A strong argument can be made that concentrated development conserves larger undeveloped land tracts, which have more value in preserving biodiversity.

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Figure 2. A map of the geographic range of sand dune lizards (*S. arenicolus*) in southeast NM. The section 32 study site is four miles east of Eunice on NM Hwy 234.

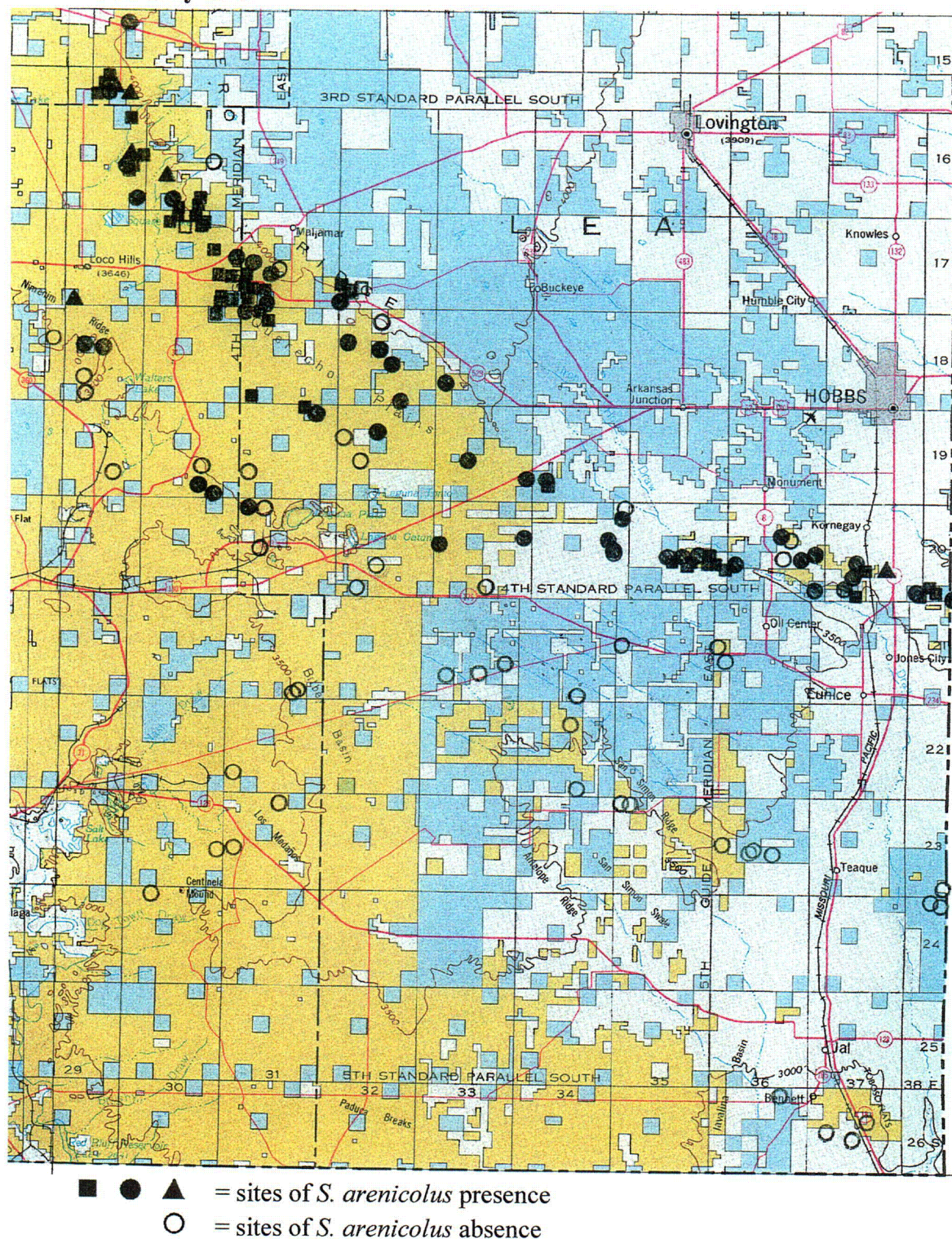
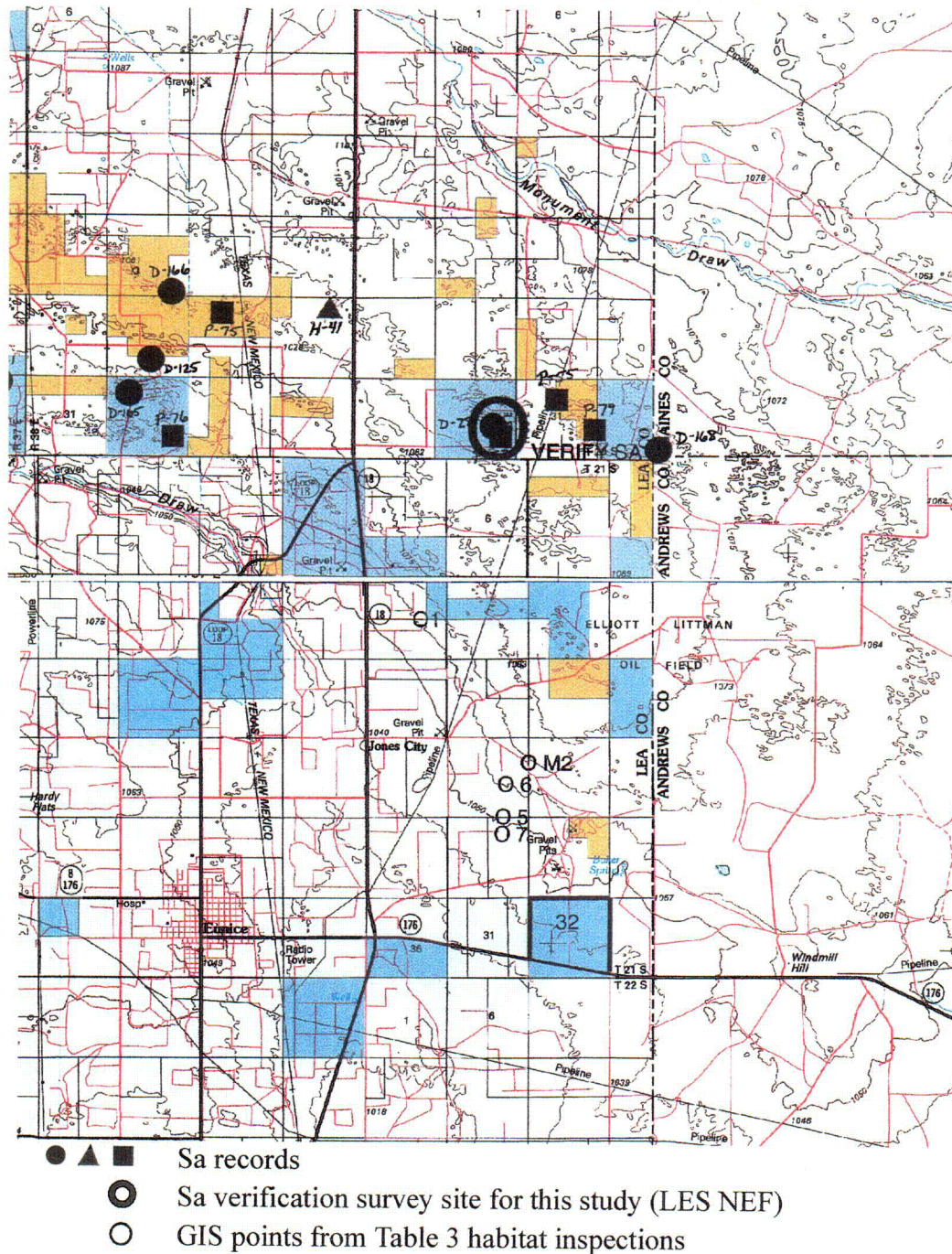


Figure 3. A map of the area between the study site (sec. 32) and the nearest sand dune lizard (*S. arenicolus*) (Sa) localities.



LES NEF sand dune lizard report. Figure 3.

Table 2. Summary of lizard surveys.

Survey Type	Survey date	Town- ship	Range	Sec- tion	Time start	Time stop	Total time (hrs)	Aprox. distance walked (mi) (2 mi/hr)	Temp. air (C)	Temp. substrate (C)	Time of temp.
Sa verification	26-Sep-03	20s	38e	36	12:00	12:30	0.50	0.20	29	32	12:10
General site and boundary inspection	26-Sep-03	21s	38e	32	13:30	17:00	3.50	4.00			
Road survey Hwy NM 234/ TX 176	26-Sep-03										
Sa verification	27-Sep-03	20s	38e	36	11:10	11:20	0.17	0.10	27.8	31	
Sec 32 west side	27-Sep-03	21s	38e	32	12:00	14:00	2.00	4.00			
Sec 32 west central	27-Sep-03	21s	38e	32	14:00	16:00	2.00	4.00	32	41	14:30
Sec 32 west central	27-Sep-03	21s	38e	32					29.5	39	16:00
Sa verification	27-Sep-03	20s	38e	36	16:20	16:35	0.25	0.05			
Sec 32 east side	28-Sep-03	21s	38e	32	11:00	13:45	2.75	5.50	28	37	11:00
Sec 32 east central	28-Sep-03	21s	38e	32	13:45	15:45	2.00	4.00	29	37	13:30
Sa verification	28-Sep-03	20s	38e	36	16:02	16:36	0.57	0.30			
Sa vicinity checked N of sec 32. See T3, points 05-7	29-Sep-03	21s	38e	30/ 19/	13:15	15:00	1.75	3.00			

Table 2. Summary of lizard surveys.

Survey Type	Sa	Us	Ct	CtT	Hm	Su	No ID Liz	Cr.vi	Ma.fl	Snake Track	ToT	Survey comments
Sa verification	5	2	0	0	0	1	0	0	0	0	1	inspect known locality for Sa, sand crusty surface, subsurface wet, rain previous day
General site and boundary inspection	0	17	1	0	0	0	0	1	0	0	0	general site, location, habitat, GIS position inspection
Road survey Hwy NM 234/ TX 176	0											look for visible sd habitat (no adjacent sd habitat to rd)
Sa verification	2	0	0	0	0	0	0	0	0	0	0	
Sec 32 west side	0	54	0	0	1		0	0	0	1	0	also checked sec 31 sd area next to fenceline, area contains sdm,sfm
Sec 32 west central	0	13	0	0	0	0	0	0	0	2	2	14:30 lots of clouds move in, hold heat in area, Ms hills/mcop, sfm
Sec 32 west central												
Sa verification	3	6	0	0	0	0	0	0	1	1	1	
Sec 32 east side	0	36	2	0	0	0	1	0	0	0	0	No ID lizard ran to yucca in grass/mesquite habitat, probably Us-juv. Ms dunes, sd-(low)m, mg
Sec 32 east central	0	21	2	4	0	0	0	0	0	0	2	mostly mg, patch sd-(low)m in n part.
Sa verification	6	6	0	0	0	0	0	0	0	0	0	
Sa vicinity checked N of sec 32. See T3, points 05-7	0											only recorded Sa to determine P/A, site was sd-(low/med) patch nearest to sec 32

Table 3. Notes on habitat between sand dune lizard occupied localities and section 32.

Waypoints from N to S	Map plot symbol on Fig 3	Distance to nw corner of sec 32 (mi)	Bearing to nw corner of sec 32 (d)	Lat	Lat deg	Lat min	Long	Long deg	Long min	Elevation (ft)	Date	Waypoint description
EUN VERIFI	large "o" with VERIFY SA	5.75	176	N	32	31.535	W	103	5.853	3631	26-Sep-03	verification site of Sa activity, 5.75 mi at 229d from NW corner of section
EUN NORTH1	o 1	3.7	159	N	32	29.544	W	103	6.814	3475	26-Sep-03	point s of verification site (2.48 mi n at 22d) checked for Sa habitat extension to s
EUNWINDM2	o m2	1.69	179	N	32	28.031	W	103	5.476	3488	26-Sep-03	point 1.69 mi n (167d) from nw corner of sec, checked for Sa habitat extending from n
EUN NORTH6	o 6	1.4	165	N	32	27.759	W	103	5.827	3484	28-Sep-03	point just n of "north5" that marks the end of sd, sf habitat checked for Sa
EUN NORTH5	o 5	1	159	N	32	27.373	W	103	5.827	3477	28-Sep-03	point nnw of sec 32 containing a line of sd, sf, checked for Sa
EUN NORTH7	o 7	0.9	157	N	32	27.303	W	103	5.839	3448	28-Sep-03	point just s of "north5" that marks the s end of the sd/sf habitat checked for Sa
EUN NW SEC	blue square 32			N	32	26.562	W	103	5.460	3414	26-Sep-03	nw corner of sec 32

Table 3. Notes on habitat between sand dune lizard occupied localities and section 32.

Waypoints from N to S	Map plot symbol on Fig 3	Habitat	Habitat west of these waypoints
EUN VERIFI	large "o" with VERIFY SA	South of this point are extensive shinnery flats with widely scattered, discrete dune blowout complexes.	
EUN NORTH1	o 1	100-200 m e of this point are widely scattered patches of low/med shinnery oak dunes. These extend 200 m south of this point, then the habitat changes to mesquite formations. Most of the terrain between this point and EUN VERIFY is shinnery flats and patches of mesquite formations.	The access rds (from the west) to these waypoints showed mesquite scrub with a shinnery component was the dominant association. No shinnery oak dunes were present.
EUN WINDM2	o m2	Small patches of shinnery dunes 150 m north of this point and some small patches aprox. .5 mi w. Area is wind eroded mesquite formations.	The access rds (from the west) to these waypoints showed mesquite scrub with a shinnery component was the dominant association. No shinnery oak dunes were present.
EUN NORTH6	o 6	The north end of an e-w field of low/med shinnery dunes/flats surrounded by mesquite dominated formations	The access rds (from the west) to these waypoints showed mesquite scrub with a shinnery component was the dominant association. No shinnery oak dunes were present.
EUN NORTH5	o 5	The center of this discrete field (6,5,7) of low/med sd/sf marking a line of dunes. This point is 4.8 mi at 180d from EUN VERIFI	The access rds (from the west) to these waypoints showed mesquite scrub with a shinnery component was the dominant association. No shinnery oak dunes were present.
EUN NORTH7	o 7	The south end of this sd/sf field (6,5,7). Open dumped and dug sands, from quarrying? Surrounded by mesquite formations.	The access rds (from the west) to these waypoints showed mesquite scrub with a shinnery component was the dominant association. No shinnery oak dunes were present.
EUN NW SEC	blue square 32		

Table 4. A summary of plant habitats from point descriptions taken during lizard surveys on section 32.

Habitat type, point samples	Survey east central	Survey east side	Survey west central	Survey west side	Total	Presence of shinoak (yes/no)	Presence of mesquite (yes/no)	Presence of sd without mesquite (yes/no)	Presence of sd with mesquite (yes/no)	Presence of grass (yes/no)
gsfym		2			2	y	y	n	n	y
gssym	2				2	n	y	n	n	y
m(ss)s		1			1	y	y	n	n	n
m(ss)sy		1			1	y	y	n	n	n
mcogyss		1			1	n	y	n	n	y
mcops(ss)		1			1	y	y	n	n	n
mcopssd-(med)ssy		1			1	y	y	n	y	n
mcopss		2	4		6	n	y	n	n	n
mcopss(sw)		1			1	n	y	n	n	n
mcopssg				2	2	n	y	n	n	y
mcopssy		2			2	n	y	n	n	n
mcopssy(sw)		1			1	n	y	n	n	n
mcopssys		2			2	y	y	n	n	n
mg	1	1			2	n	y	n	n	y
mg(ss)sy	1				1	y	y	n	n	y
mgs	1				1	y	y	n	n	y
mgs(ss)y	1				1	y	y	n	n	y
mgss		1			1	n	y	n	n	y
mgssy		1			1	n	y	n	n	y
mgys	3	1			4	y	y	n	n	y
mgys	2	4		1	7	n	y	n	n	y
mgys(ss)s	4				4	y	y	n	n	y
mgys	2				2	y	y	n	n	y
mgysd-(low)		1			1	y	y	n	y	y
mgys	1				1	n	y	n	n	y
mssg			2		2	n	y	n	n	y
mssgs			3		3	y	y	n	n	y
s(ss)yg		1			1	y	n	n	n	y
s(ss)ygm		1			1	y	y	n	n	y
s(ss)ymg		1			1	y	y	n	n	y
sd-(high)mcopss			1		1	y	y	n	y	n
sd-(high)mss			1		1	y	y	n	y	n
sd-(low)gym		2			2	y	y	n	y	y
sd-(low)m		2	1		3	y	y	n	y	n
sd-(low)mgys		3			3	y	y	n	y	y
sd-(low)mgys	1				1	y	y	n	y	y
sd-(low)mssgy	1				1	y	y	n	y	y
sd-(low)mssy			2		2	y	y	n	y	n
sd-(low)my		1			1	y	y	n	y	n
sd-(low)myg	1				1	y	y	n	y	y
sd-(low)ssy			1		1	y	n	y	n	n
sd-(low)ssym		1			1	y	y	n	y	n
sd-(low)yg	1				1	y	n	y	n	y
sd-(low)ygm				1	1	y	y	n	y	y
sd-(low)ym	2				2	y	y	n	y	n
sd-(low)ymg	1				1	y	y	n	y	y
sd-(low/med)m			2		2	y	y	n	y	n

Table 4. A summary of plant habitats from point descriptions taken during lizard surveys on section 32.

Habitat type, point samples	Survey east central	Survey east side	Survey west central	Survey west side	Total	Presence of shinoak (yes/no)	Presence of mesquite (yes/no)	Presence of sd without mesquite (yes/no)	Presence of sd with mesquite (yes/no)	Presence of grass (yes/no)
sd-(low/med)mss			1		1	y	y	n	y	n
sd-(med)m				1	1	y	y	n	y	n
sd-(med)mg			1		1	y	y	n	y	y
sd-(med)mss			4		4	y	y	n	y	n
sd-(med)mssg			1		1	y	y	n	y	y
sd-(med)ssym		1			1	y	y	n	y	n
sd-(med/high)m			2		2	y	y	n	y	n
sdym				1	1	y	y	n	y	n
sfgy				1	1	y	n	n	n	y
sfgym	2				2	y	y	n	n	y
sfmng				1	1	y	y	n	n	y
sfmgy		3			3	y	y	n	n	y
sfmssg			1		1	y	y	n	n	y
sfmssy			1		1	y	y	n	n	n
sfmy		1		2	3	y	y	n	n	n
sfmyg	2			1	3	y	y	n	n	y
sfmyss				1	1	y	y	n	n	n
sfss			1		1	y	n	n	n	n
sfssy		1			1	y	n	n	n	n
sfy			1	4	5	y	n	n	n	n
sfyg				6	6	y	n	n	n	y
sfygm				2	2	y	y	n	n	y
sfym	1			2	3	y	y	n	n	n
sgy	1				1	y	n	n	n	y
sgyssm	1				1	y	y	n	n	y
smg		1			1	y	y	n	n	y
smgy		1			1	y	y	n	n	y
smy				2	2	y	y	n	n	n
sy				2	2	y	n	n	n	y
Totals	32	44	32	28	136	y = 63	y = 66	y = 2	y = 25	y = 44

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Direction of walk	Date	Sa	Us-m	Us-f	Us-j	Hm	Ct	T	No ID lizard	ToT	Ma.fl	Snake Track
west side	12:00	se-sw	27-Sep-03		6	4	3							
west side	12:15	se-sw	27-Sep-03											
west side		se-sw	27-Sep-03											
west side	12:45	se-sw	27-Sep-03		3	3	7	1						
west side	13:00	se-sw	27-Sep-03											
west side	13:15	se-sw	27-Sep-03		5	7	3							
west side	13:30	se-sw	27-Sep-03											
west side	13:45	se-sw	27-Sep-03		4	5	4							1
west side			27-Sep-03											
west central	14:00	ne-nw	27-Sep-03											
west central	14:15	ne-nw	27-Sep-03		1	1	1							1
west central	14:30	ne-nw	27-Sep-03											
west central	14:45	ne-nw	27-Sep-03											
west central	15:00	ne-nw	27-Sep-03		1	1	3					1		1
west central	15:15	ne-nw	27-Sep-03											
west central	15:30	ne-nw	27-Sep-03		1	3	1					1		
west central	15:45	ne-nw	27-Sep-03											
west central	16:00	ne-nw	27-Sep-03											
east side	11:00	se-sw	28-Sep-03		4	2	1							
east side	11:15	se-sw	28-Sep-03		1	1	1		1					
east side	11:30	se-sw	28-Sep-03											
east side	11:45	se-sw	28-Sep-03		1	3	5							
east side	12:00	se-sw	28-Sep-03											
east side	12:15	se-sw	28-Sep-03		5	6	1		1					
east side	12:30	se-sw	28-Sep-03											
east side	12:45	se-sw	28-Sep-03											

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Direction of walk	Date	Sa	Us-m	Us-f	Us-j	Hm	Ct	Ct T	No ID lizard	ToT	Ma.fl	Snake Track
east side	13:00	se-sw	28-Sep-03		1	3	1							
east side	13:15	se-sw	28-Sep-03								1			
east side	13:30	w	28-Sep-03											
east central	13:45	ne-nw	28-Sep-03											
east central	14:00	ne-nw	28-Sep-03		6	4	3							
east central	14:15	ne-nw	28-Sep-03											
east central	14:30	ne-nw	28-Sep-03											
east central	14:45	ne-nw	28-Sep-03		1	3	3		2	4		2		
east central	15:00	ne-nw	28-Sep-03											
east central	15:15	ne-nw	28-Sep-03											
east central	15:30	ne-nw	28-Sep-03				1							
east central	15:45	ne-nw	28-Sep-03											

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Relief (R) 1 (ft)	R2	R3	R4	R5	Open substrate (%)	No. BS	No. BM	No. BH	Plant habitats Q1	Q2
west side	12:00	3	3	2	1	1	20	6	4	3	sfmy	mg
west side	12:15	0	1	2	1	1	20				sfyg	sfygm
west side												
west side	12:45	1	1	3	3	1	30	30	4	0	sy	sy
west side	13:00	3	3	1	1	1	30		9	3	sfy	sfyg
west side	13:15	1	0	0	0	3	30	45	12	1	sfy	sfyg
west side	13:30	8	2	2	1	1	20				sfyg	sfyg
west side	13:45	1	2	1	1	2	30		12	5	sfy	sfym
west central	14:00	15	12	10	3	6	50				sd-(med/high)m	sd-(low/med)m
west central	14:15	15	8	8	10	8	50	4	9	5	sd-(med)mss	sd-(med)mss
west central	14:30	10	15	10	12	8	50				mcopss	mcopss
west central	14:45	10	8	8	2	10	30				sd-(med)mss	mcopss
west central	15:00	2	1	1	1	2	30	17	6	4	sfy	sd-(low)mssy
west central	15:15	3	5	6	2	3	20				mssgs-(ld)	mssgs-(ld)
west central	15:30	2	3	3	2	1	30	2	2	4	mssg	mcopssg
west central	15:45	16	8	12	3	4	40				sd-(med)mssg	sd-(high)mcopss
west central	16:00											
east side	11:00	1	3	8	10	10	30		6	2	mg	smgy
east side	11:15	10	5	3	4	3	40	3	7	1	mgsy	sd-(low)mg
east side	11:30	1	3	6	2	6	30				sd-(low)gym	sfmg
east side	11:45	6	5	2	2	1	20	10	2		gsfym	gsfym
east side	12:00	6	1	1	1	2	20				mg	sfmg
east side	12:15	3	3	2	1	1	30	12	4	5	mgysd-(low)	mgss
east side	12:30	12	1	8	6	8	60				mcopss(sw)	mcopssy(sw)
east side	12:45	8	8	6	10	10	40				mcopss	mcopssy

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Relief (R) 1 (ft)	R2	R3	R4	R5	Open substrate (%)	No. BS	No. BM	No. BH	Plant habitats Q1	Q2
east side	13:00	3	5	8	8	5	30	2	6	1	sd-(med)ssym	mcops(ss)
east side	13:15	1	2	1	1	3	20				mgy	mgy
east side	13:30	2	1	1	2	2	20				mcogyss	s(ss)yg
east central	13:45	3	1	1	1	1	40				mgsy	mgsy
east central	14:00	1	1	1	2	1	30	4	11	1	mgy(ss)s	mgy(ss)s
east central	14:15	1	2	1	2	7	30				sd-(low)mssgy	mgyss
east central	14:30	1	2	2	1	1	30				sgy	sgyssm
east central	14:45	6	3	1	1	4	30	21	11		sd-(low)yg	sfmyg
east central	15:00	1	1	3	3	3	30				sfgym	sfgym
east central	15:15	3	2	1	1	3	40				mgs	mgsy
east central	15:30										mgy	mgys
east central	15:45											

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Q3	Q4	Comments from notes
west side	12:00	sfmg	sd-(med 6-15)m	start at patch of sdm-low-med
west side	12:15	sfmy	sfmyss	shinoak is low density
				went west of sec to examine patch of sd-med-high with BM,BS.Patch occurs in mesquite habitats (a sdg ridge in sfgy). B west of section are clogged, mostly BS, BM
west side				note sy = shinoak yucca, low density shinoak
west side	12:45	smy	smy	
west side	13:00	sfy	sfygm	all low density
				no real B, BS are clogged and "pseudo formations"
west side	13:15	sfmyg	sfgy	
west side	13:30	sfyg	sd-(low)ygm	
west side	13:45	sfym	sdym	
west central	14:00	sd-(high-med)m	sd-(low/med)m	low density shinoak. Area of sand hills more than blowout formations
west central	14:15	sd-(high)mss	sd-(low/med)mss	as go N sd "mounds start to look like Mcop with no shinoak, instead ss. Substrate becomes very fine and hardpacked. substrate noticeably fine-silty (not sands). Harvester ants present, can not build nests in sands
west central	14:30	sd-(med)mss	mcopss	
west central	14:45	sd-(low)mssy	sd-(low)ssy	silts, now just w of outhouses at center rd
west central	15:00	sfss	sfmssy	
west central	15:15	mssgs	sd-(low)m	s-(ld) = shinoak low density, fine sands-silts, now just sw of RR at N boundary
west central	15:30	mcopssg	mssg	
west central	15:45	sfmssg	sd-(med)mg	
west central	16:00			end (site was sampled at start of survey
east side	11:00	sd-(low)m	smg	fine red silts, low density shinoak
east side	11:15	sd-(low)mgy	sfmy	fine red silts, low density shinoak
east side	11:30	sfmgy	sd-(low)gym	fine red silts, low density shinoak
east side	11:45	sd-(low)mgy	sd-(low)m	fine red silts, low density shinoak
				fine red silts, low density shinoak, note allhabitat does not have distinct open areas of substrate, just low density of plants
east side	12:00	sd-(low)my	mg	
east side	12:15	m(ss)s	m(ss)sy	fine light brown soils
				at east side high point 12:25, fine light brown soils, hard substrate at bottoms
east side	12:30	sfssy	mcop(sd-(med)ssy	light brown fine substrate and hardpack
east side	12:45	mcopssy	mcopss	

Appendix 1. Field data for standard lizard/habitat surveys conducted on section 32.

Survey section 32	Time	Q3	Q4	Comments from notes
east side	13:00	mgssy	sd-(low)ssym	
east side	13:15	mcopssys	mcopssys	prob Us-juv (in mg), ran to y
east side	13:30	s(ss)ymg	s(ss)ygm	se point at fence, then cut w to start point for north walk
east central	13:45	sd-(low)ym	mgs(ss)y	light brown soils, point at which start n walk
east central	14:00	mg(y(ss)s	mg(y(ss)s	
east central	14:15	sd-(low)mgys	mg(ss)sy	
east central	14:30	gssym	gssym	
east central	14:45	sfmyg	sd-(low)ymg	area is a small patch of sd partially dev. in m habitats
east central	15:00	sd-(low)ym	sd-(low)myg	light brown fine sand
east central	15:15	sfym	mgys	
east central	15:30	mg(y	mg	fine red silts/clays, harvester ants in area
east central	15:45			end, point sample at start

Appendix 2. Reference GIS points for lizard/habitat surveys and the section 32 area.

Waypoints	Lat	Lat deg	Lat min	Long	Long deg	Long min	Elevation	Date	Waypoint description
Provided by GL ENV									
UEUNSEHWY	N	32	25.748	W	103	4.432			se corner of plot at hwy 234/fence
UEUNSWHWY	N	32	25.910	W	103	5.461			sw corner of plot at hwy 234/fence
UEUNNWSEC	N	32	26.566	W	103	5.459			nw corner of sec 32
UEUNESEC	N	32	26.566	W	103	4.432			ne corner of sec 32
From fieldwork 26-29 Sep									
EUN VERIFI	N	32	31.535	W	103	5.853	3631	26-Sep-03	verification site of Sa activity, 5.75 mi at 229d from NW corner of section
Sec 32 points	N			W					
EUNRDENTRY	N	32	25.831	W	103	4.948	3418	26-Sep-03	center rd entry to sec from hwy 176
EUN NBRAIL	N	32	26.565	W	103	4.948	3459	26-Sep-03	n boundary of sec, just s of rr
EUN NE SEC	N	32	26.564	W	103	4.434	3426	26-Sep-03	ne corner of sec 32
EUN NW SEC	N	32	26.562	W	103	5.460	3414	26-Sep-03	nw corner of sec 32
EUN SE HWY	N	32	25.747	W	103	4.432	3399	26-Sep-03	se corner of plot at hwy 234/fence
EUN SW HWY	N	32	25.907	W	103	5.460	3375	26-Sep-03	sw corner of plot at hwy 234/fence
Lizard surveys	N			W					
EUN SUR001	N	32	26.569	W	103	5.376	3437	27-Sep-03	start of west side sec 32 Sa survey
EUN SUR002	N	32	25.885	W	103	5.322	3451	27-Sep-03	s point of west side sec 32 Sa survey, at hwy 176/fenceline, start of west central Sec 32 Sa survey
EUN SUR003	N	32	26.539	W	103	5.018	3467	27-Sep-03	furthest ne point of west central Sa survey, just sw of rr at boundary/rd
EUN SUR004	N	32	26.563	W	103	4.649	3239	28-Sep-03	sart east side Sa survey, near ne corner of sec
EUN SUR005	N	32	25.754	W	103	4.484	3435	28-Sep-03	se point of east side Sa survey at Hwy 234/fenceline
EUN SUR006	N	32	25.855	W	103	4.747	3443	28-Sep-03	sw point of east central Sa survey, near Hwy 234/fenceline,
EUN SUR007	N	32	26.248	W	103	4.743	3431	28-Sep-03	Burrowing Owl Den in east central area sdm
EUN SUR008	N	32	26.540	W	103	4.826	3440	28-Sep-03	nw point of east central survey, near rr, then walk e

Appendix 2. Reference GIS points for lizard/habitat surveys and the section 32 area.

Waypoints	Lat	Lat deg	Lat min	Long	Long deg	Long min	Elevation	Date	Waypoint description
Off site points									
EUN VERIFI	N	32	31.535	W	103	5.853	3631	26-Sep-03	verification site of Sa activity, 5.75 mi at 229d from NW corner of section
EUN NORTH1	N	32	29.544	W	103	6.814	3475	26-Sep-03	point s of verification site (2.48 mi n at 22d) checked for Sa habitat extension to s
EUNWINDM2	N	32	28.031	W	103	5.476	3488	26-Sep-03	point 1.69 mi n (167d) from nw corner of sec, checked for Sa habitat extending from n
EUN NORTH5	N	32	27.373	W	103	5.827	3477	28-Sep-03	point nnw of sec 32 containing a line of sd, sf, checked for Sa
EUN NORTH6	N	32	27.759	W	103	5.827	3484	28-Sep-03	point just n of "north5" that marks the end of sd, sf habitat checked for Sa
EUN NORTH7	N	32	27.303	W	103	5.839	3448	28-Sep-03	point just s of "north5" that marks the s end of the sd/sf habitat checked for Sa

Appendix 3. Plant and habitat abbreviations used in this report (Appendix 1, Table 4).

Various combinations of these letters are used to indicate habitat types. Dominants are listed in priority for each description (ex. sd(ss)gy).	Vegetation description of plants in reference to sand dune lizards. Plant community abbreviations used in this report and table 3.	Habitat Suitability (S = suitable, D = Dispersal, U = unsuitable)
g	generally bunch grass species in se NM when included in surveys in habitats relevant to, and around Sa range	U, D, S
m	Mesquite (<i>Prosopis glandulosa</i>). In any configuration it generally signals environmental conditions where Sa are not found. Widely scattered mesquite (every 50-100 meters) may occur in some Sa habitat, these occur generally at the bottoms of blowouts.	U
mcop	Mesquite coppice (mesquite growing in substrate mounds, created by wind erosion.	U
osand	fields of open sand	D, U
s	Shinnery oak (<i>Quercus havardii</i>), occurring as a component of a dominant vegetation association such as mesquite (ex. ms) or grass (ex. gs).	D, U
sd	Shinnery oak sand dunes / blowouts	S, D
sd(ss)	Shinnery oak dunes with abundant Sand sage	S, D
sd-(high)	Shinnery oak sand dunes / blowouts - high means these areas contain blowouts with depths >20 ft	S, D
sd-(low)	Shinnery oak sand dunes / blowouts - Low. Means these areas contain blowouts with depths generally < 6 ft	S, D
sd-(med)	Shinnery oak sand dunes / blowouts - Med. Means these areas contain blowouts with depths 6- 20 ft	S, D
sdcop	Shinnery oak sand areas with sand mounds of Shinnery oak created by wind erosion. The blowouts are all interconnected and not distinct. These areas also occur at the edges of open sand areas.	S, D
sdm	Shinnery oak dunes with scattered mesquite, usually apparent where ever an observer looks. The presence of mesquite is indicative of different environmental conditions (i.e.. finer substrates, disturbance, others) that generally do not support sand dune lizards	D, U
sdosand	Shinnery oak dunes at the edge of open sand areas	S, D
sf	Shinnery oak flats	D, U
sfm	Shinnery oak flats with common scattered mesquite.	U
sm	Shinnery oak mesquite, the shinoak will be growing in lower densities than in sd or sf habitats.	U

Appendix 3. Plant and habitat abbreviations used in this report (Appendix 1, Table 4).

Various combinations of these letters are used to indicate habitat types. Dominants are listed in priority for each description (ex. sd(ss)gy). ss or (ss) when next to s	Vegetation description of plants in reference to sand dune lizards. Plant community abbreviations used in this report and table 3. Sand sage (<i>Artemisia filifolia</i>). Supports sand dune lizards when it occurs with or adjacent to Shinnery oak snake weed (<i>Gutierrezia sarothrae</i>)	Habitat Suitability (S = suitable, D = Dispersal, U = unsuitable)
sw		S, D, U U, D, S generally U. In areas where Shinnery Oak persists (usually high SD), sometimes remnant populations of sand dune lizards may be found (to date).
T	Treated with the herbicide Tebuthiron to kill Shinnery oak.	
tree	Various sps. Occurs generally as scattered groves and individual trees on mesquite coppice formation	U
Tsd	Treated Shinnery Oak sand dunes	U
Tsf	Treated Shinnery Oak sand flats	U
y	<i>Yucca</i> species. Individual yucca in blowouts often provide centers of activity and refugia for sand dune lizards. Occurs as a component of dominant vegetation types, Often <i>Yucca glauca</i> .	S, D, U
Sa	Other abbreviations <i>Sceloporus arenicolus</i> (sand dune lizard)	

Appendix 4. Photo references of habitats and species.

Photographs 1-17.

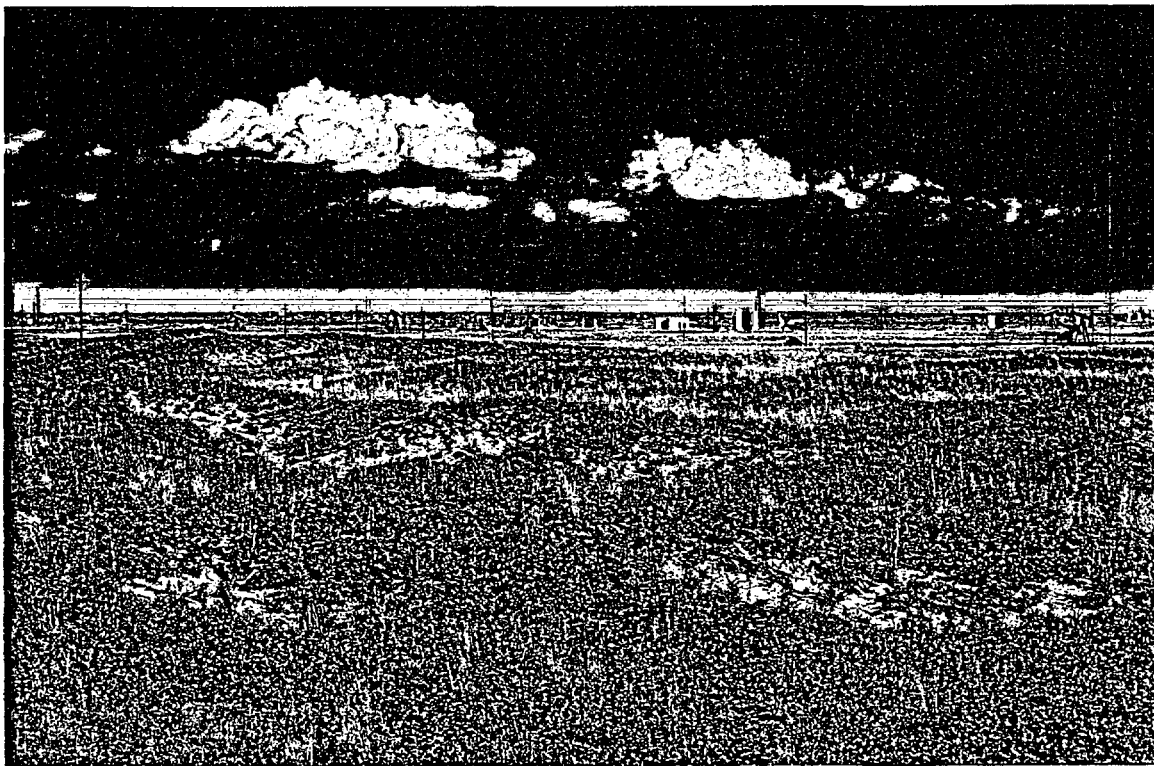


Photo 1. Sand dune lizard habitat of shinnery oak sand dunes with scattered grasses. These dunes are northeast of Eunice and are part of the same dune fields where the survey verification site for sand dune lizards was located. Open sand blowouts occur in the swales between the dunes. Note the white sand color and compare this to the red substrates on the study site (sec 32). The color differences suggest different origins of the substrate and the possibility of different environmental properties relevant to sand dune lizards.

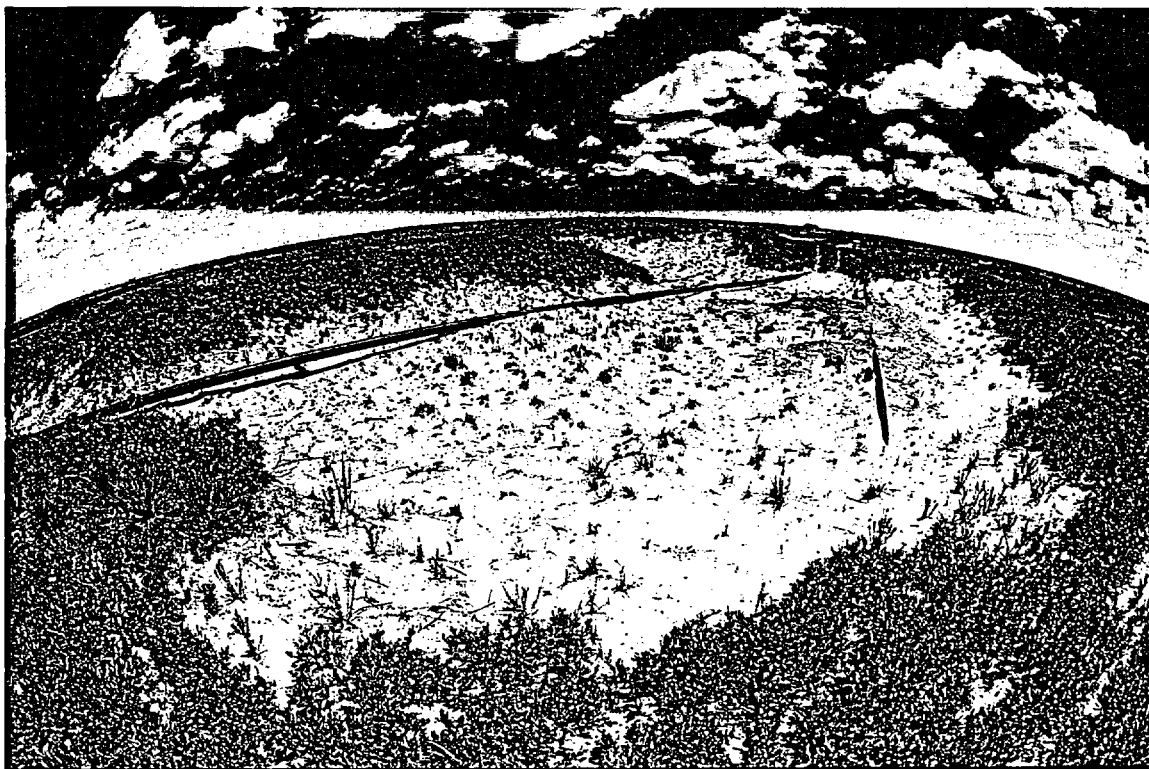


Photo 2. A huge blowout (BH) north of Eunice in sand dune lizard occupied habitat. Note the extensive and dense shinoak. Open blowouts are the preferred habitat of sand dune lizards. Section 32 blowouts tended to be smaller, shallower and clogged with vegetation. Additionally they occurred as small patches rather than in dune fields. These patches in section 32 were isolated and located approximately six miles south of occupied habitat.

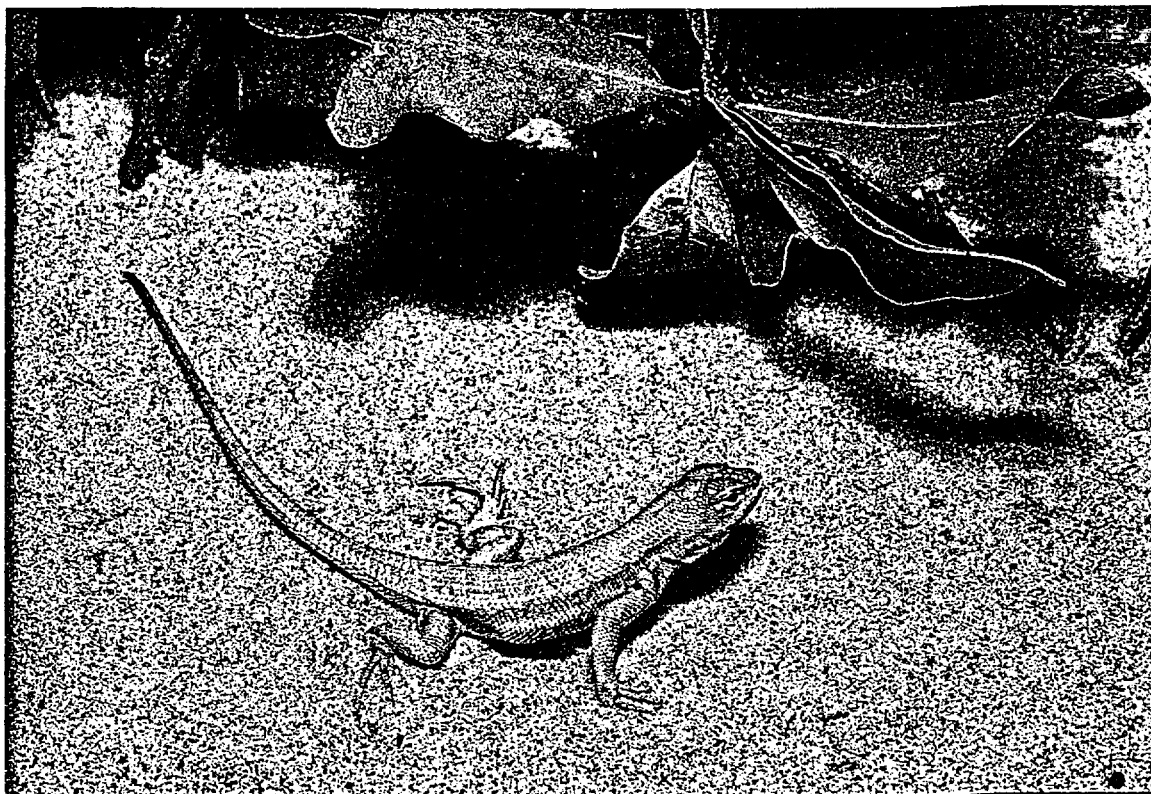


Photo 3. A juvenile sand dune lizard under shinoak leaves, observed at the verification site on 26 Sep 03 before lizard surveys were conducted at the study site (sec32). Note the coarse white sands, which contrast to the finer red substrates at section 32.

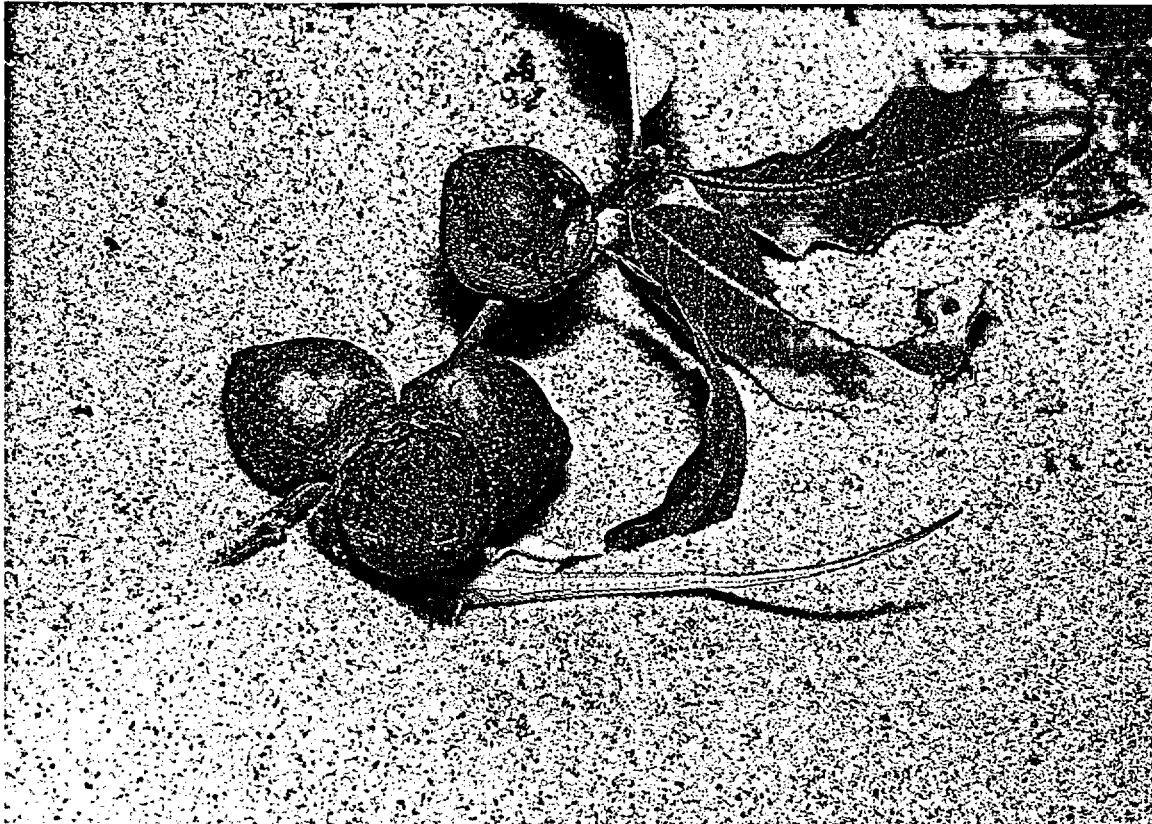


Photo 4. A hatchling sand dune lizard burying itself under shinoak at the verification site in the early evening 27 Sep 03. The loose sands facilitate this behavior.

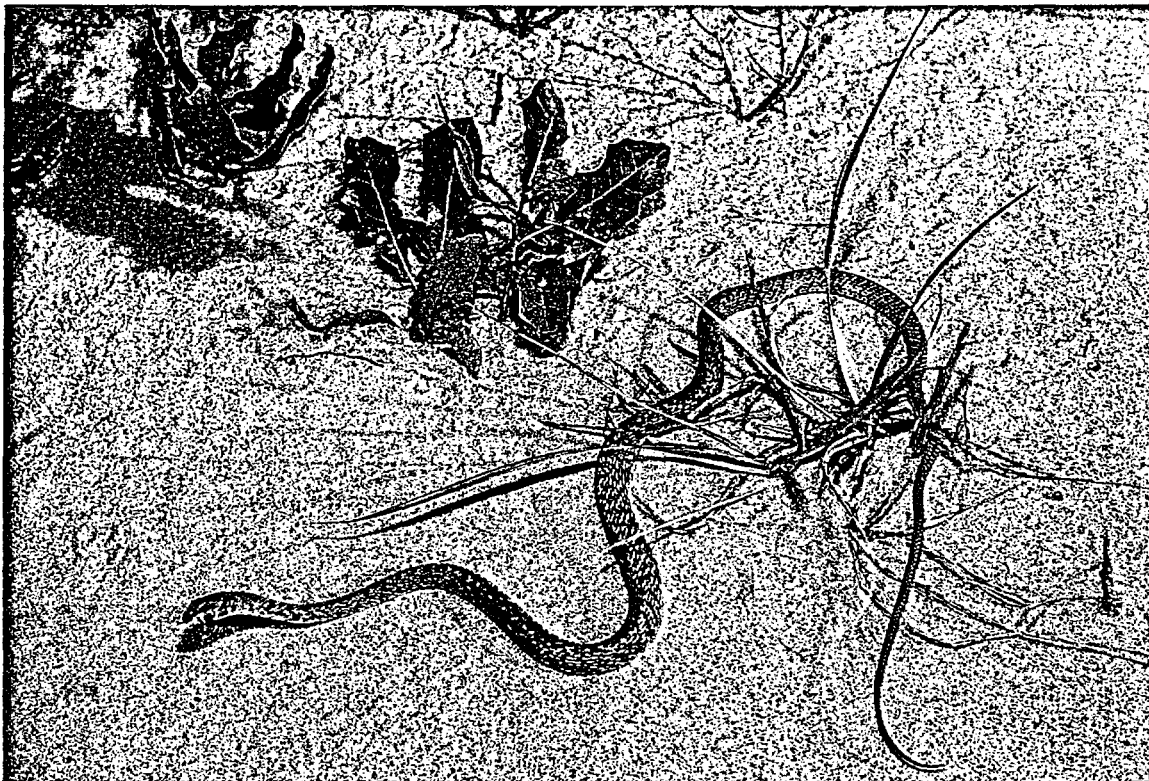


Photo 5. A juvenile western coachwhip snake at the verification site. Note the shifting loose sands have buried the base of the shinoak and grass clump in this picture. In contrast, at the study site (sec 32) there was evidence of wind erosion such as mesquite coppice formation. These often consist of firmer substrates inappropriate for sand dune lizards, but these coppice formations often provide firm bases for burrows. One indicator of these differences is substrate color (red in section 32), which suggest different origins of dune formation.



Photo 6. The “central road” (section 32) looking north at the Walloch Quarry. Note the mesquite associations on each side, and the lack of dune formations in the center of this section. This is a 180° view, which shows unsuitable habitat for the sand dune lizard.

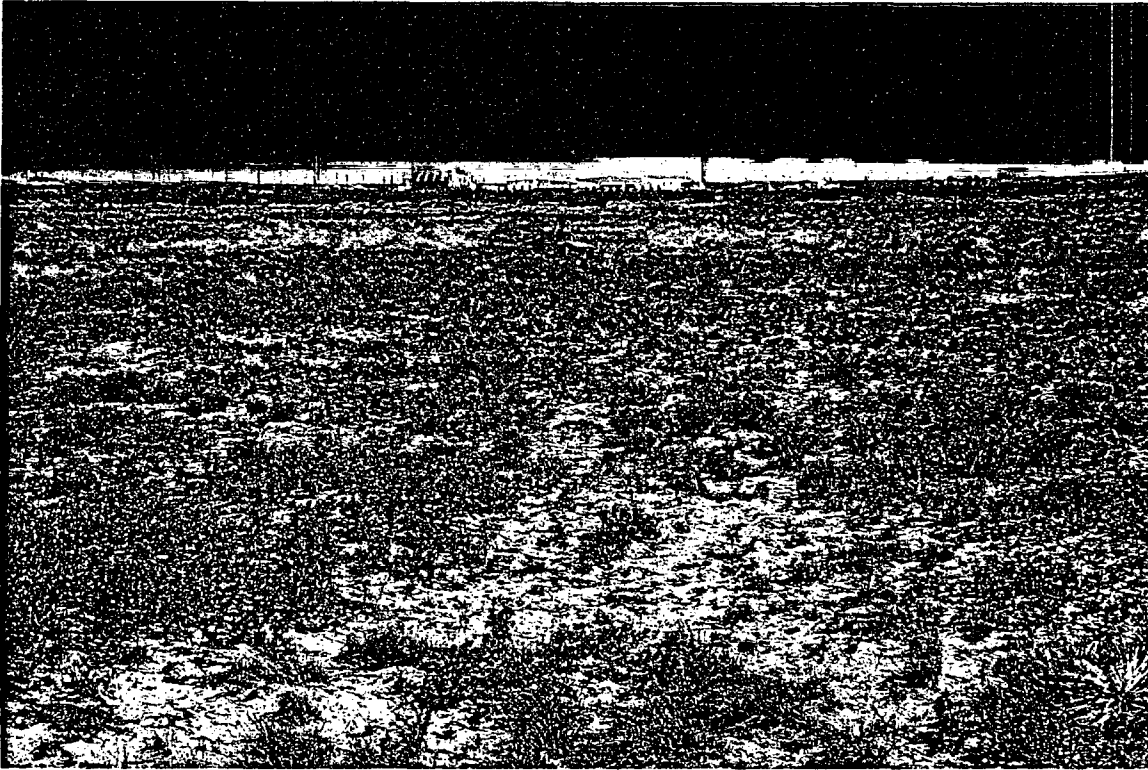


Photo 7. From the center of section 32 looking east towards the WCS plant in TX, this view shows mesquite associations and a lack of dune habitat for sand dune lizards.



Photo 8. This view was taken from the center of section 32 looking east at the WCS plant in TX. The entire northern portion of section 32 is covered with a denser growth of mesquite indicating unfavorable conditions for sand dune lizards.

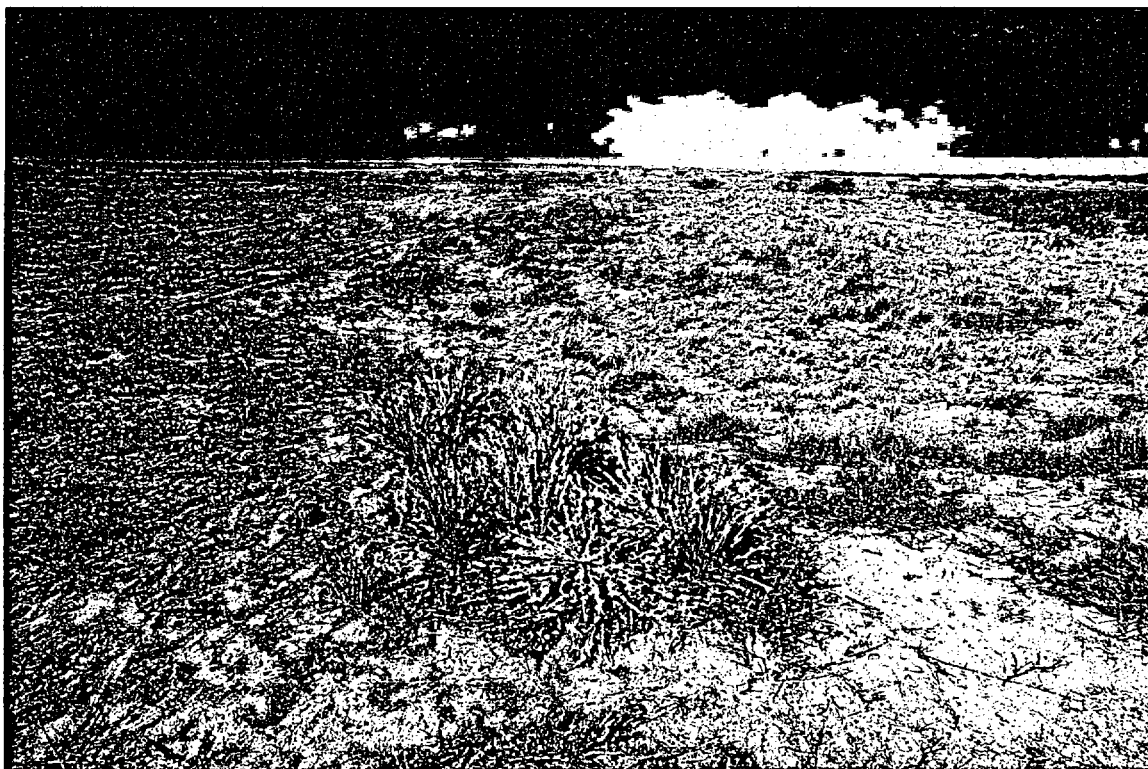


Photo 9. This view from the center of section 32 looks west and shows a mixture of yucca, shinoak, grasses, sand sage and mesquite. The lack of blowouts and sand dunes makes this unsuitable habitat for sand dune lizards.

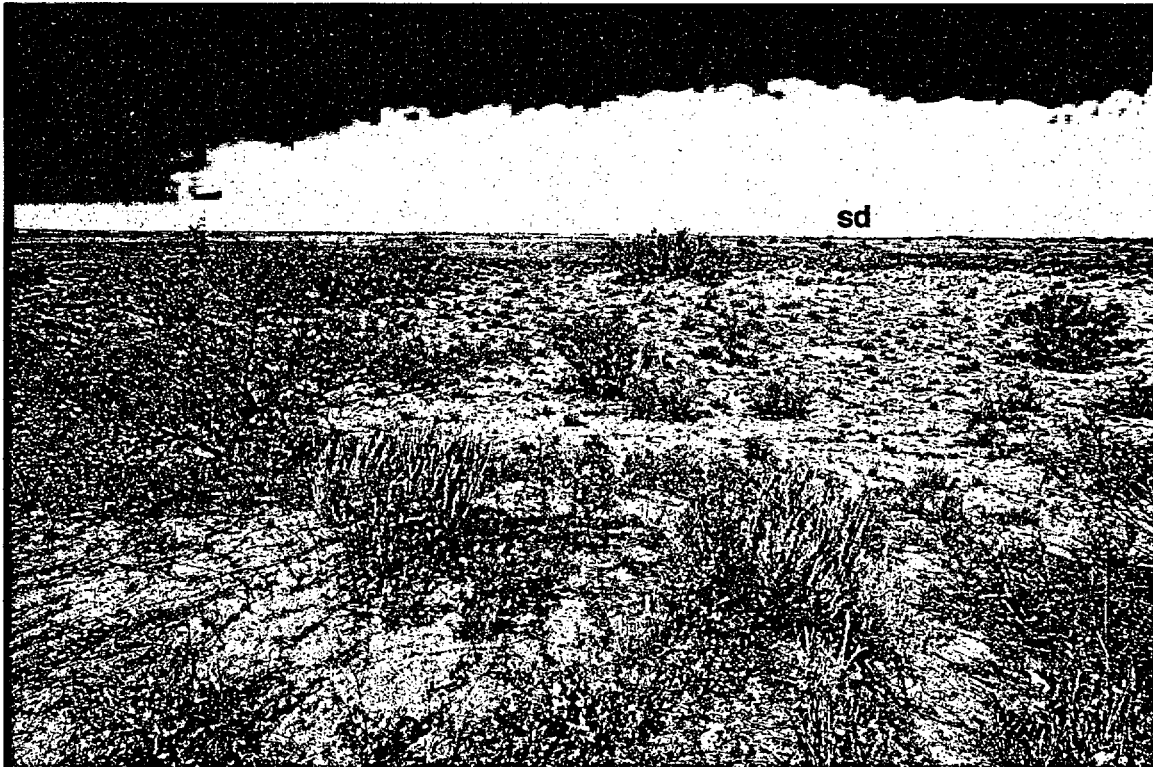


Photo 10. This view from the center of section 32 looking WWN shows open substrates with a mix of sand sage, mesquite and shinoak. The terrain is almost flat here but there is a patch of low shinnery dunes (sd) at the rear edge of the open substrate patch.



Photo 11. This view from the sandy "hills" at the south central portion of section 32 looks northwest. The white shapes on the horizon mark the Walloch Quarry. A mesquite coppice formation occurs in the mid-ground. Also, note the shinoak in the foreground growing on a sand mound. The mid ground area around the coppice formation is composed of fine hard packed substrate which is unsuitable sand dune lizard habitat.

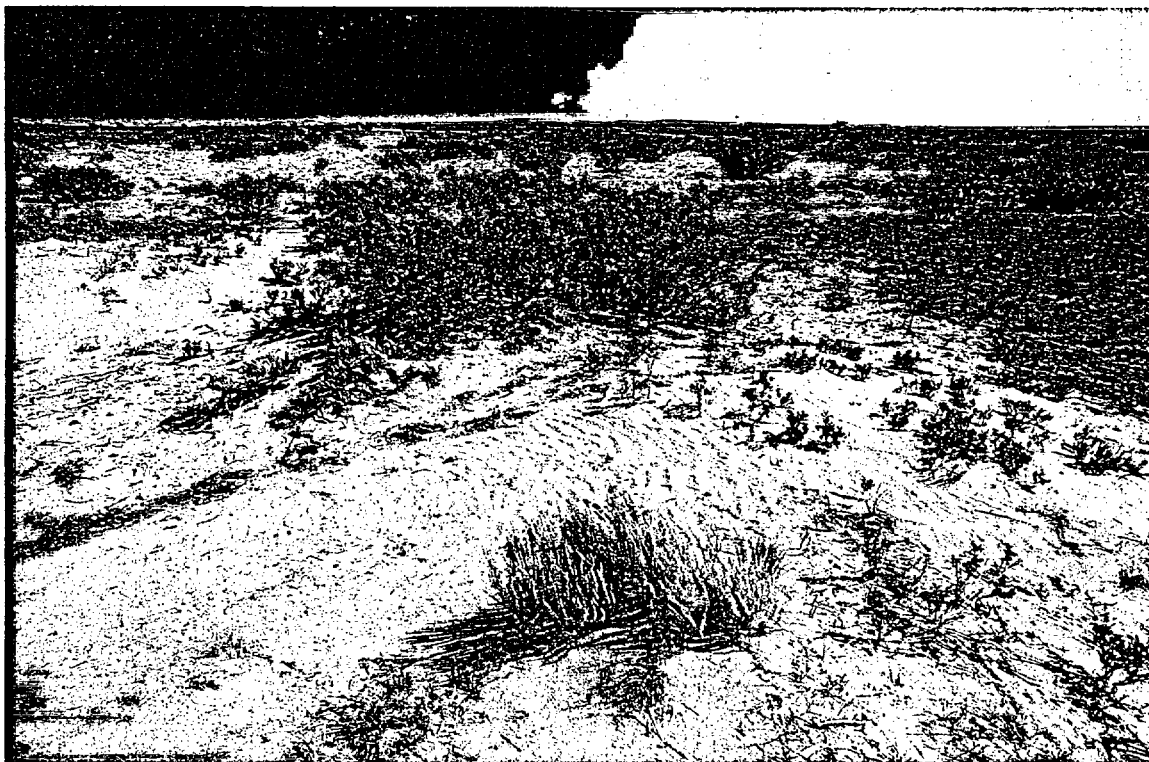


Photo 12. This view is from the sand "hills" in the south central portion of the section, west of the center rd. and looks NE. Note the open sand expanse with shinoak and sand sage, these habitat components, in some combinations may form sand dune lizard habitat. Note that this isolated sand hills patch is bordered by mesquite grassland in the background of the picture.

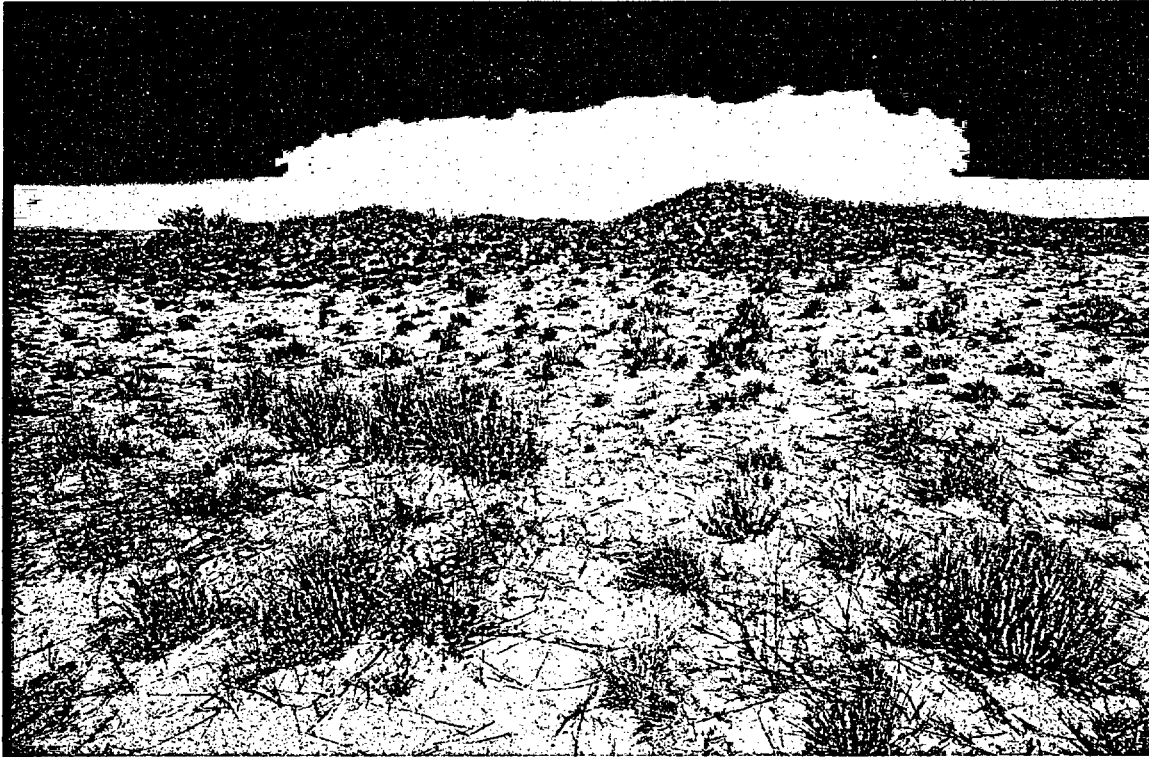


Photo 13. This view shows a small patch of low and medium height shinnery dunes in the west central portion of the section. This patch consists only of several medium sized and small blowouts and is both isolated from dune fields and too small to support sand dune lizards.

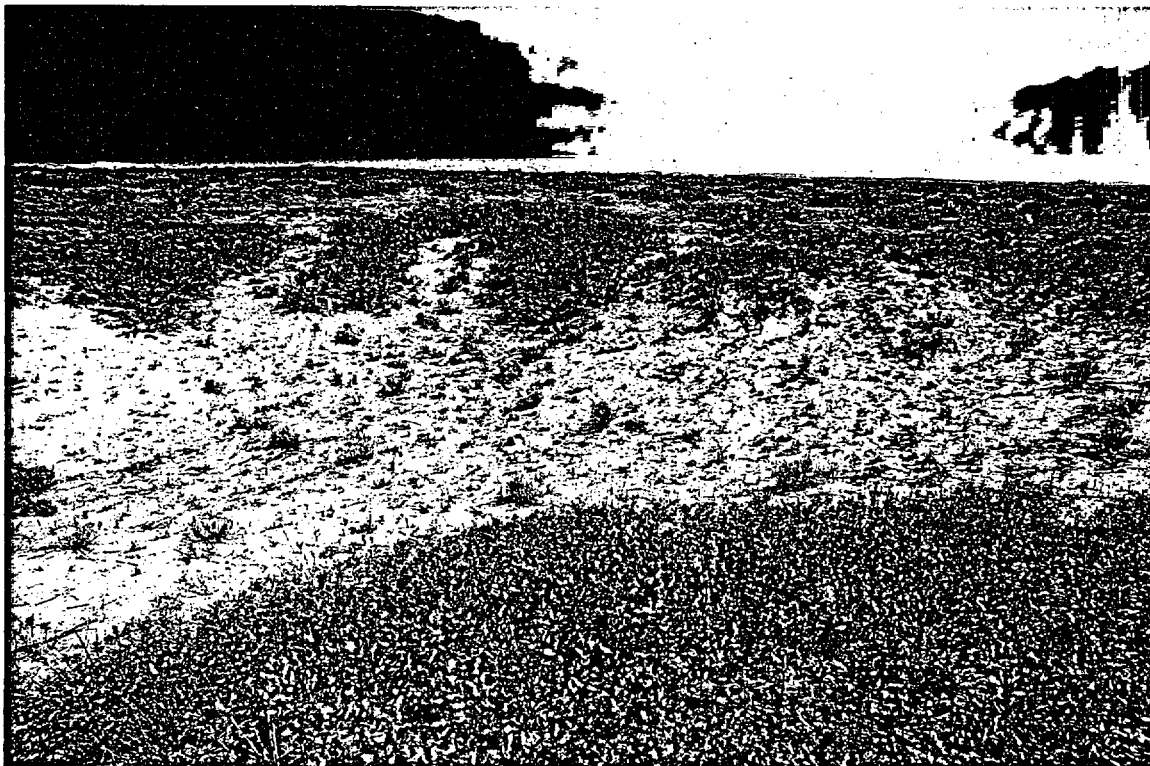


Photo 14. This view shows an isolated huge blowout in shinoak and mesquite. The view looks NE. The white shape on the left of the picture is the Walloch Quarry. Note the extensive mesquite growth in this northwest portion of the section, which is unsuitable habitat for sand dune lizards.

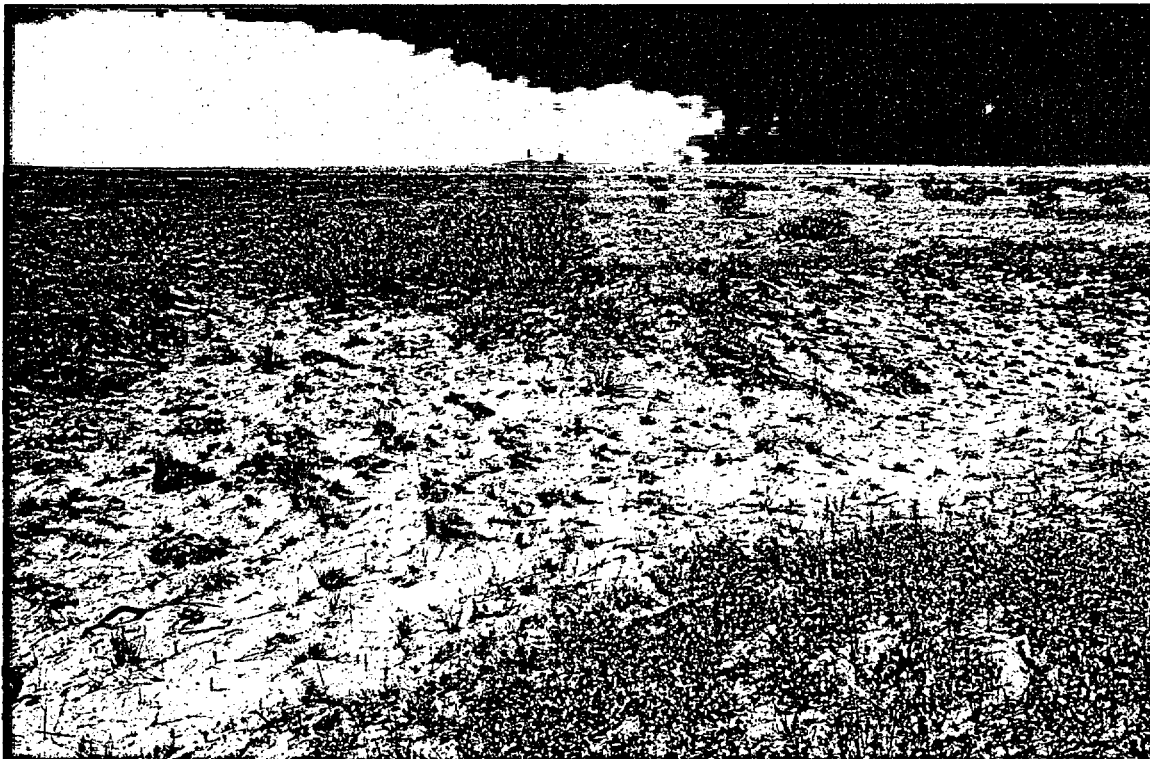


Photo 15. This is an isolated, low (<6 ft) blowout (BH) south of photo 14. The view looks SSW, Eunice is visible as a few white specks on the right side of the picture. Note the scattered mesquite and the absence of other visible blowouts.

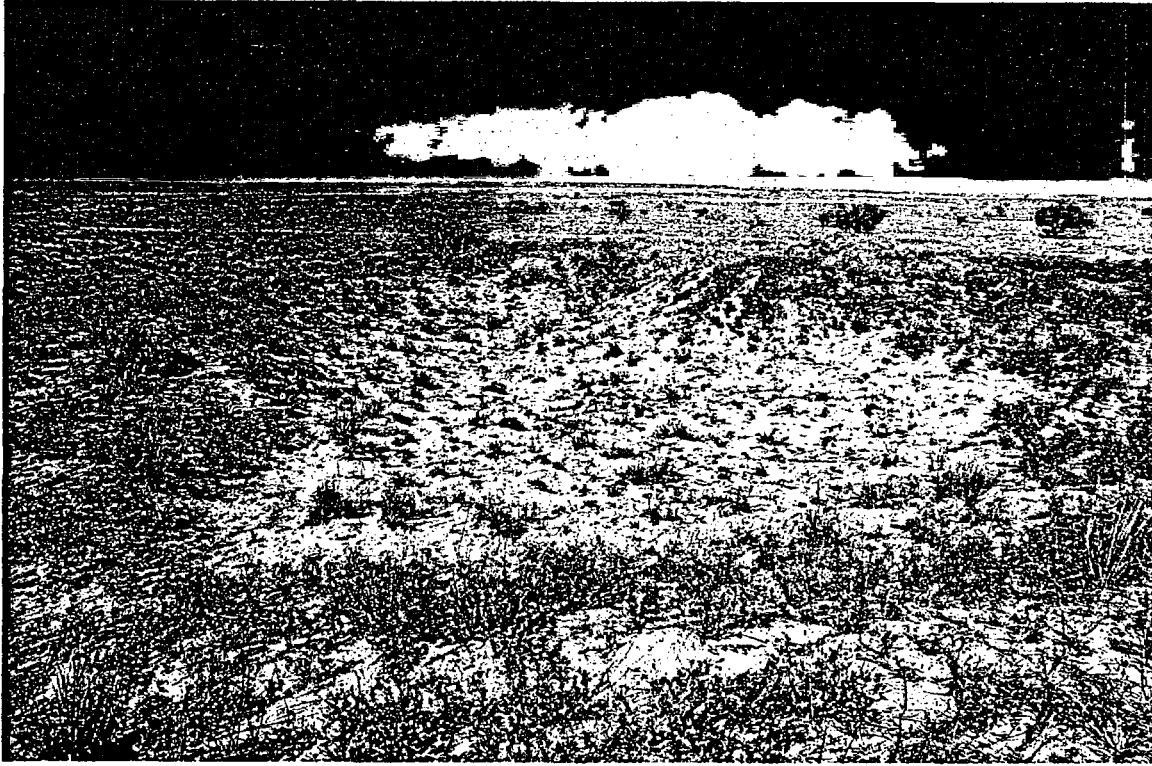


Photo 16. This view from the west side of section 32 looks west to similar habitat on section 31 (checked, see App. 1, west side survey). This is a patch of shinoak, sand sage, grasses and scattered mesquite. Medium and small blowouts were scattered though out this area. This entire patch was surrounded by mesquite scrub. Slightly higher points in this terrain marked small complexes of medium sized blowouts, which were included in the lizard surveys.

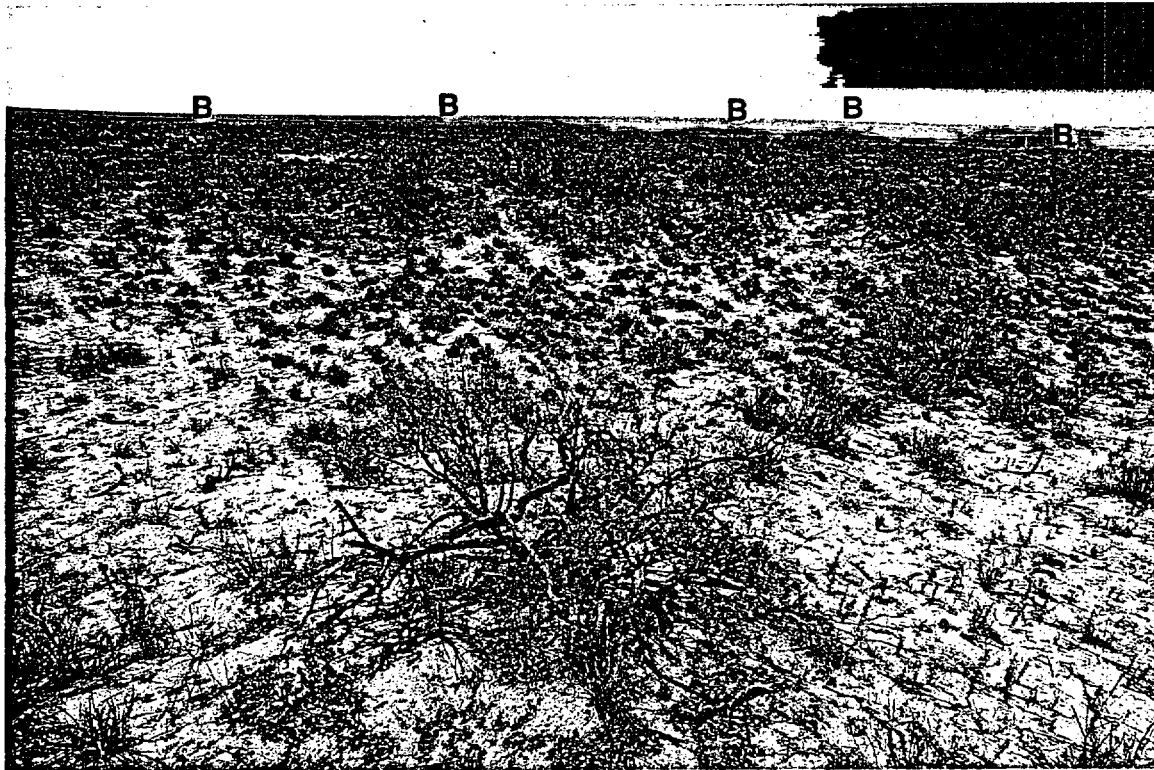


Photo 17. This view is from the NM 1/4 of section 32 looking south. The foreground shows a lot of vegetation, including mesquite in a low blowout. Sand dune lizards are found in more open blowouts (photo 2) and avoid these "clogged" blowouts. In the background are scattered blowout complexes comprised of clusters of low isolated dunes. The large blowout complexes (without mesquite) that sand dune lizards require are lacking in section 32.