NATIONAL ENRICHMENT FACILITY

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10 CFR 70.5

July 30, 2004

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ATTN: Document Control Desk
Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Louisiana Energy Services, L. P.
National Enrichment Facility
NRC Docket No. 70-3103

Subject: Transmittal of Sand Dune Lizard Survey for National Enrichment Facility Site

References:

1. Letter NEF#03-003 dated December 12, 2003, from E. J. Ferland (Louisiana Energy Services, L. P.) to Directors, Office of Nuclear Material Safety and Safeguards and the Division of Facilities and Security (NRC) regarding "Applications for a Material License Under 10 CFR 70, Domestic licensing of special nuclear material, 10 CFR 40, Domestic licensing of source material, and 10 CFR 30, Rules of general applicability to domestic licensing of byproduct material, and for a Facility Clearance Under 10 CFR 95, Facility security clearance and safeguarding of national security information and restricted data"

2. Letter NEF#04-002 dated February 27, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Revision 1 to Applications for a Material License Under 10 CFR 70, "Domestic licensing of special nuclear material," 10 CFR 40, "Domestic licensing of source material," and 10 CFR 30, "Rules of general applicability to domestic licensing of byproduct material"

3. Letter NEF#04-019 dated May 20, 2004, from R. M. Krich (Louisiana Energy Services, L. P.) to Director, Office of Nuclear Material Safety and Safeguards (NRC) regarding "Response to NRC Request for Additional Information Regarding the National Enrichment Facility Environmental Report"

By letter dated December 12, 2003 (Reference 1), E. J. Ferland of Louisiana Energy Services (LES), L. P., submitted to the NRC applications for the licenses necessary to authorize construction and operation of a gas centrifuge uranium enrichment facility. Revision 1 to these applications was submitted to the NRC by letter dated February 27, 2004 (Reference 2). The Reference 3 letter includes the responses to NRC Requests for Additional Information (RAI)

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concerning the National Enrichment Facility (NEF) Environmental Report. In the response to NRC RAI 3-4.C of the Reference 3 letter, LES committed to provide the results of future surveys of Sand Dune Lizards to the NRC.

As committed to in the Environmental Report, LES recently conducted a confirmatory Sand Dune Lizard survey for the NEF. The survey was performed in June 2004 and supplements the ongoing collection of environmental data for the NEF site. Therefore, in accordance with the LES response to NRC RAI 3-4.C, the results of this survey are included in the Enclosure, "The habitat and geographic range of the sand dune lizard , *Sceloporus arenicolus*, in Lea County, New Mexico, in the vicinity of Section 32,Township 21S, Range 38E. A survey report for the LES National Enrichment Facility project."

If you have any questions, please contact me at 630-657-2813.

Respectfully,

George C. Hayes FOR

R. M. Krich
Vice President – Licensing, Safety, and Nuclear Engineering

Enclosure:
The habitat and geographic range of the sand dune lizard , *Sceloporus arenicolus*, in Lea County, New Mexico, in the vicinity of Section 32,Township 21S, Range 38E. A survey report for the LES National Enrichment Facility project.

c: T.C. Johnson, NRC Project Manager (w/o Enclosure)
M.C. Wong, NRC Environmental Project Manager

ENCLOSURE

The habitat and geographic range of the sand dune lizard , *Sceloporus arenicolus*, in Lea County, New Mexico, in the vicinity of Section 32, Township 21S, Range 38E. A survey report for the LES National Enrichment Facility project

The habitat and geographic range of the sand dune lizard, *Sceloporus arenicolus* in Lea County, New Mexico in the vicinity of Section 32, Township 21S, Range 38E.

A survey report for the LES National Enrichment Facility project (NM, Lea Co., T21S, R38E, Sec.32).

July 29, 2004

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Summary

This report presents information on the sand dune lizard *Sceloporus arenicolus* and sand dune lizard habitat in the region of the proposed Louisiana Energy Services National Enrichment Facility Project (LES NEF), located in Lea Co. NM, T21S, R38E, Section 32. The status, conservation and management of the sand dune lizard are issues with various state and federal agencies, and private conservation organizations. Sand dune lizards are listed as threatened in NM and are currently undergoing court ordered review at the USFWS. Section 32 is located near the known extant range of sand dune lizards and contains habitat components that are associated with sand dune lizard presence. This report is the second of two studies on the sand dune lizard for this project. In September 2003, field work on sand dune lizards was conducted on the proposed NEF site and surrounding areas. The results of this study were reported in October 2003. This study found no sand dune lizards on section 32. Based on the plant communities, the habitat of section 32 and adjacent lands was classified as unsuitable for sand dune lizards. Sand dune lizards were found 5.7 miles north of section 32. A second study in June 2004 was conducted to collect additional data.

Additional lizard surveys, employing both observation and pitfall trapping techniques resulted in the detection of no sand dune lizards on section 32. The area between section 32 and occupied sand dune lizard habitat to the north was surveyed to determine the proximity of habitat and populations of sand dune lizards to section 32. This effort resulted in new geographical records for sand dune lizards, south of the known localities and north of section 32. Populations of sand dune lizards were found 3 miles north of section 32. No sand dune lizards occurred closer to section 32, in spite of intense and repeated searches. A band of dispersal habitat exists south of the dune field region occupied by sand dune lizards, but south of these shinnery oak flats, towards section 32 was unsuitable habitat. This habitat, like section 32 was ecotonal, with shin oak formations mixing with mesquite grasslands. Sand samples were compared from the sand dune lizard locality north of section 32, to substrates of three habitats on section 32. There were significant differences in substrates that supported the unsuitable habitat classification for section 32. The difference in substrates between occupied and unoccupied sites was also consistent with a New Mexico Dept. of Game and Fish study.

The sand dune lizard habitat north of section 32 contains some dune fields that support high populations of sand dune lizards. The populations of sand dune lizards north of section 32 exist in a band of habitat that extends east into TX and northwest across NM Hwy 18. A large dune field located 5.7 miles north of section 32 and extending into TX contains the major population of lizards in this area. Smaller, more discreet dune systems and isolated blowout complexes occur south towards section 32. Existing habitat west of Hwy 18 is both further away from section 32 and substantially more developed.

The habitat north of section 32 contains low-density oil/gas development and is used for livestock grazing, but overall, north of section 32 and east of Hwy 18, this habitat is relatively undisturbed and conditions are favorable for sand dune lizards. Section 32 lands are shielded from direct contact with sand dune lizard areas by distance and industrial facilities on the borders of section 32.

Introduction

This report presents additional information on the sand dune lizard *Sceloporus arenicolus* and sand dune lizard habitat in the vicinity of the proposed Louisiana Energy Services National Enrichment Facility (LES NEF) in Lea Co. NM (T21S, R38E, section 32). *Sceloporus arenicolus* (Sa) is listed as a threatened species by the New Mexico Department of Game and Fish (NMDGF) and is listed as a candidate species by the United States Fish and Wildlife Service (USFWS). The sand dune lizard is currently under review by the USFWS for federal listing under the Endangered Species Act. The Bureau of Land Management (BLM) has attempted to implement a management program for *S. arenicolus* on BLM lands. This study was commissioned by GL Environmental Inc. for the LES project to collect both site specific and regional biogeographic information on the sand dune lizard. Secondly, this study provided additional data to supplement a previous study of sand dune lizards (Sias, 2003b) conducted for this project.

The 2003 study of sand dune lizards had three purposes: 1) to determine the presence or absence of *S. arenicolus* on section 32; 2) to determine the habitat suitability of section 32 for *S. arenicolus*; 3) to determine the biogeographic relation between section 32 and the nearest suitable habitat. The 2004 study was conducted to collect additional data to provide the highest level of confidence in the determination of sand dune lizard presence or absence on section 32. The additional data would increase the level of confidence in the habitat classification of section 32 (unsuitable) and address additional dimensions of habitat classification. The 2004 work provided new data on the distribution and habitat of sand dune lizards in the vicinity of section 32 (NM and TX). This data was collected to address current and future regulatory and biological questions about the sand dune lizard. The 2003 study should be consulted for information about the vegetation, habitats and photographs of section 32. The 2004 study contains comprehensive information about the sand dune lizard, and information about the "sands" (substrates) associated with the lizard.

Sand dune lizards inhabit limited regions of southeast New Mexico and west Texas. They occupy habitats comprised of shinnery oak (*Quercus havardii*) sand dunes.

This species is a shinnery oak - sand dunes (shinnery dunes) habitat specialist. Furthermore this species is a microhabitat specialist, almost all sightings occur in blowouts (open sand bowl-like depressions) that develop in shinnery dune localities. Sand dune lizards exhibit a distinct preference to occupy large blowouts compared to any size blowouts (Fitzgerald et al. 1997, Sias and Snell 1998, Sias 2002). The proposed LES NEF site, section 32 contains patches of shin oak, sand dunes and a few blowouts. These shinnery oak habitats are ecotonal (ecotone = a zone where distinct/different habitats mix) with mesquite (*Prosopis glandulosa*) grassland formations throughout this section. Mesquite grasslands have not been shown to support sand dune lizards. Sias (2003b) showed that the shin oak habitats in section 32 are different (ecotonal) than the shin oak habitats in sand dune lizard occupied areas. The shin oak habitats on section 32 were isolated, patchy in distribution and small in size. The June 2004 study provided additional resources and methods to detect sand dune lizards in ecotonal areas.

This study shows the results of pitfall trapping and walking surveys for reptiles on section 32, following protocols used in previous studies of *S. arenicolus* (Fitzgerald et al. 1997, Sias and Snell 1996, Sias and Snell 1998, Sias 2002, Sias 2003a, Snell et al. 1997). The substrate types from section 32 and the closest sand dune lizard occupied site are compared. The area between occupied sand dune lizard habitat to the north and section 32 was surveyed for sand dune lizards and habitat. Results of sand dune lizard surveys between the occupied range and section 32 are presented.

Methods

Fieldwork was conducted 16-27 June 2004. Previous work had shown that this was a period of high lizard activity (growth, maintenance, breeding) and was selected to seasonally contrast the 2003 fieldwork (25-29 Sep.). Sand dune lizards were observed at the verification site (Table 5, Appendix 3 and in Sias 2003b) approximately 6 miles north of section 32 to provide a basis for detecting lizard activity that would be applicable to adjacent areas. Work related to the sand dune lizards was conducted under NMDGF scientific/educational permit 2876. Sand dune lizard locality and habitat information was

used from previous studies (Fitzgerald et al. 1997, Sias and Snell 1996, Sias and Snell 1998, Sias 2002, Sias 2003a,b).

Reptile and amphibian abbreviations are used in this paper and are described, along with scientific and common names in Table 1.

Habitat terms were used in this report that require definition. Figure 1 depicts the idea of habitat suitability used in this study and other studies on sand dune lizards. 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 dunes (sd) and blowout complexes, that sand dune lizards may move through at various times. The habitat that occurs most frequently between occupied shin dune complexes is shin oak or shinnery flats (sf), characterized by a dense growth of shin oak, scattered sand sage *Artemesia filafolia* and yucca *Yucca glauca.* 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.

The use of the term marginal for this study is used in reference to describing small groups of lizards that can't persist over time without an external source population. In many areas of the sand dune lizard range, there occur dune fields that support high-densities of sand dune lizards. Adjacent to these extensive dunes are isolated blowout complexes separated from the dune fields by shinnery flats. Sand dune lizards occur in these isolated blowout complexes (bc). In some cases, blowout complexes, consisting of only a single large blowout are separated from the more extensive shinnery dune habitat by .5-1.0+ mile (Sias 2002, 2003a). It is clear that sand dune lizards will not persist over time in these small habitats without re-colonization from larger source habitats, since the probability of local extirpation is high in small habitats occupied by only several pairs of lizards. These situations are termed marginal in this study. The presence of sand dune lizards in isolated blowouts suggests that dispersal through shinnery flats must be occurring in some fashion.

Pitfall trapping

Pitfall traps were constructed of five gallon buckets buried into the ground and level with the surface. A square shelter board (16" x 16", 3/4" plywood) was placed over the trap opening and spaced above the trap with 1 3/4" spacers. The top of each trap was piled with substrate and or logs to secure the tops. The bottom of each bucket was drilled with holes for water drainage and filled with several inches of substrate. Pitfall traps have been shown to be highly effective in catching sand dune lizards (Snell et al. 1997). Pitfall traps also tend to catch a difference mix of species than observed on walking surveys and provided an alternative sampling technique to study lizards. Thirty-six traps were placed in habitats and microhabitats preferred by sand dune lizards. The traps were checked, and animals caught were recorded and released.

Walking surveys

Standardized lizard surveys consisted of timed walking in predetermined areas/directions with close focusing binoculars and recording all reptiles seen. Additionally, various habitat components related to *S. arenicolus* are recorded. These surveys were only conducted during periods of sand dune lizard activity and by experienced observers. 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 site in Table 5). 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 walking surveys on section 32 recorded similar habitat information in Sias (2003b) since the June surveys covered the same area. Sias (2003b) describes the habitat information collected during these surveys. Complete survey data is reported in Appendix 1 and reptile survey data reported in Table 5. The purpose of the June surveys on section 32 was to provide a different seasonal sample of lizards and to put additional effort into searches to increase the probability of lizard detection. Surveys were also

conducted in the region between occupied habitat and section 32 to determine the boundaries of suitable habitat in relation to section 32.

Substrate analysis

The size distribution of substrate particles was compared from four sites. Substrate samples were collected from a blowout at the verification site (occupied suitable habitat) and three habitat types on section 32 (blowout in shinnery dunes, shinnery flat and mesquite grassland). A thin layer of substrate was spread on a flat surface and photographed at 1:1. The slides (Film = Velvia 100F, extremely fine grained) were scanned at 4000 dpi (48 bit color) and enlarged 1385.242% using Silverfast Ai, Silverfast HDR and Photoshop. These images were printed at 2880 dpi at 13" x 19" on Epson premium glossy paper with an Epson Stylus Pro 5500 printer. A diagonal transect was made across the photographs at the corners. At a random point on this transect, the diameter of 200 particles along this transect was measured. A Mitutoyo caliper, model CD-6"BS was aligned along the transect, and the particle width parallel to the transect was measured. Optivisor models 5 and 10 were used to view the particles as they were measured. Statview 5.0 was used for statistical analysis. An advantage of this visual method of examining substrate was that an array of differences would be apparent that would not be obvious using methods of sand sifting. The particle width measurements are given in Appendix 2. Sections of four substrate photographs are shown as Figure 5.

Geographic and habitat surveys

The locations of driving and walking surveys were recorded with GPS receivers. At each waypoint taken, habitat descriptions were recorded for line segments 25-100 m from the waypoint at north, east, south and west directions. For those habitat descriptions used in this report, abbreviations were used. The abbreviations describe the vegetation and topography and are shown in Table 2. A list of GPS waypoints is given in Appendix

3. Waypoints were taken from public access roads, maps, aerial photographs and field work on BLM, State and private lands where permission was granted.

Results

Pitfall trapping for lizards on section 32.

Table 3 shows the habitat, microhabitat and locations of 36 pitfall traps placed in section 32. Trap location was based on previous work in section 32 (Sias 2003b), and on known habitat preferences of sand dune lizards (Fitzgerald et al. 1997, Sias and Snell 1998, Sias 2002). Eighteen traps were placed in large blowouts (BH), two sets of two were placed in what were considered single large blowouts. Ten traps were placed in medium sized blowouts (BM), primarily because in the area of the traps there were no additional large blowouts (BH). Most of the blowouts occurred in patches of shinnery dunes that contained mesquite, there were few areas on section 32 that did not contain mesquite (Sias 2003b). Four traps were placed on ridges or valleys in shinnery mesquite coppice. Three traps were placed in shinnery flats between blowout formations. Mesquite was present at 35 traps (140/144 sample points, 4 points around each trap). Significant grass patches were present around 18 traps (69/144 sample points, 4 points around each trap). Figure 2 shows a map of the trap locations on section 32. Figures 3a-f are photographs of the "trap habitat" on section 32.

Table 4 shows the reptile and amphibian catch of the pitfall traps. The 36 traps were set 16-17 June 2004 and pulled 26-27 June 2004. Each trap was open for ten days resulting in a total trapping effort of 360 trap days (TD = 10 days x 36 traps). A total of 69 reptiles and amphibians were caught, 39 of these specimens were western whiptail lizards *Cnemidophorus tigris*, 17 side-blotched lizards *Uta stansburiana*, 4 six-lined racerunner lizards *C. sexlineatus*, 2 lesser earless lizards *Hobrookia maculata*, 2 great plains skinks *Eumeces obsoletus* and one each of western coachwhip snake *Masticophis flagellum*, western hog-nosed snake *Heterodon nasicus*, plains spadefoot toad *Spea bombifrons*, tiger salamander *Ambystoma tigrinum*. No sand dune lizards, or a close relative, the fence lizard *S. undulatus* were captured.

Standard walking surveys for lizards on section 32.

Table 5 shows the reptiles observed during standard walking surveys for the sand dune lizard. A survey on the west side (2 hrs) detected 39 reptiles excluding tracks of whiptail lizards (CxT, *Cnemidophorus* species tracks) and ornate box turtles (ToT, *Terrapene ornate*). Including all tracks, 69 reptiles were recorded. No sand dunes lizards were found. A survey on the east side (2.75 hrs) detected 40 reptiles, excluding tracks of CxT and ToT. Including all tracks, 135 reptiles were recorded. Sand dune lizards were not found. In contrast, at the verification site (6 mi north of section 32) during a non optimal time for sand dune lizard activity (early morning 7:10, after a violent rain storm) a 2.16 hour survey yielded 15 reptiles, excluding CxT and ToT tracks. Including all tracks, 30 reptiles were recorded. This count included 6 sand dune lizards (one additional hour, reported in Table 5 was spent observing sand dune lizards). The purpose of this survey was to see how sand dune lizards were reacting to the night storms. This provided activity information useful for determining times and places of lizard surveys.

In 2003 (Sias 2003b) a total of 8.75 hrs of standard surveys resulted in 133 reptiles excluding CxT and ToT tracks, and including all tracks 141 reptiles were recorded. No sand dune lizards were found. For both years in section 32, a total of 13.5 survey hours (during peak sand dune lizard activity) resulted in the detection of 212 reptiles excluding CxT and ToT tracks and 345 reptiles including tracks. No sand dune lizards were detected.

Reptiles and amphibians observed while working on section 32, exclusive of the walk survey and trap records.

Table 6 shows the reptiles and amphibians observed while working on section 32, but these observations exclude the pitfall catch and animals seen during walking surveys. Thirty-eight hours of work on section 32 resulted in the detection of 360 reptiles of at least nine species (some snake tracks can not be distinguished at the species level). No sand dune lizards were seen. Additionally an estimated 500+ toads of five species were

seen breeding at a mud hole that formed on the north border of the site (just south of the railroad tracks). This pool was the result of drainage off the quarry in section 29, to the north of section 32. Section 29 is part of a quarry operation that provides a mile wide barrier to any type of north-south small animal movement (ex. sand dune lizards to the north). The areas of disturbed land, industrial operations, and areas with reduced vegetation at the boundaries of section 32 are shown in Figure 4. Note that Figure 4 shows the large scale of industrial operations to the north, east and southeast of section 32. This water flow demonstrated that surface drainage from the surrounding areas of section 32 (north, northwest, northeast) was into section 32 and away from sand dune lizard habitat.

The formation of this mud hole blocked access to traps 1-12 and to check these traps the author had to walk across the center of the section to the northwest corner. The net effect was to increase the amount of time walking in shin oak formations. This resulted in more opportunities to detect lizards.

Substrates, a probable critical component of sand dune lizard habitat.

The specific habitat utilization of sand dune lizards (blowouts in shinnery oak sand dunes) implies a degree of specialization and dependence on certain substrate types. Sand dune lizards are only associated with sand dunes in southeast NM. However there are many localities in southeast NM that contain dunes and shin oak, but sand dune lizards are absent. One hypothesis for the absence of sand dune lizards from these sites (Fitzgerald et al. 1997), is that the composition of substrates differs between occupied and unsuitable sites. In this study we tested this hypothesis and extended this hypothesis to examine substrates from non-dune habitats (i.e. mesquite grasslands, shinnery flats).

Substrates were compared between the occupied verification site (V site) and habitats of section 32. The four samples were from: 1) a large blowout at the verification site; 2) a large blowout in the northwest 1/4 of section 32; 3) a shinnery flat between low shinnery dunes in the northeast 1/4 of section 32; 4) a mesquite grassland with shinoak from the southeast 1/4 of section 32. Section 32 samples were separated by 0.75 mi.

The primary comparison of interest was between blowout sand from the occupied site and the unoccupied NW 1/4 of sec 32. This location on section 32 contained large blowouts that most closely resembled occupied sand dune lizard habitat. Figure 5 shows the samples side by side, each view was taken from part of the 13" x 19" photographs. Figure 5 shows substantial differences between the substrate samples. Figure 6 shows the size distribution of substrate particles.

The sample from the verification site contained a higher proportion of large particles, and in contrast all samples from section 32 contained high proportions of fine particles. The color and shape differences indicated different origins. The particle size differed significantly between sites (ANOVA, df = 3, F = 319.093, $p < .0001$, mean particle size: V site blowout = 3.189 mm, Sec32NW blowout = 1.481 mm, Sec32NE shinnery flat = .908 mm, Sec32SE mesquite grassland = .673, measurements reported at scale 1385.242%). The V site particle size differed significantly from all section 32 sites (Bonferroni/Dunn, critical difference $p < .0083$, all pair-wise comparisons significant at this level except between mesquite grassland and shinnery flat). The distribution of particles by size differed significantly between the Sec32NW blowout (the site that most closely resembled sand dune lizard habitat, Sa absent) and the V site blowout (Sa present) (Kolmogorov-Smirov, df = 2, Chi-Square = 179.560, $p < .0001$).

These findings were fully consistent with a NMDGF study (Fitzgerald et al. 1997) comparing the distribution of substrate particle size from occupied (Sa) and unoccupied (Sa) blowouts. In this study we extended the analysis to a wider array of habitats that occur adjacent to blowouts (shinnery flats and mesquite grassland). The differences in substrate between section 32 and the sand dune lizard occupied site support the classification of section 32 as unsuitable habitat.

The geographic range and habitat of sand dune lizards in the vicinity of section 32.

Before this study was conducted, documented sand dune lizards occurred on T20S, R39E, Sec 31, 32, areas adjacent to section 32 in Gaines and Andrews Co. TX and T20S, R38E, Sec 36 (Fitzgerald et al. 1997, Sias and Painter 1998, Sias and Snell 1998). These areas are approximately six miles north of section 32. Fieldwork was conducted to

determine the status of the sand dune lizard and habitat between published locations and section 32.

No sand dune lizards have been reported in NM, south or west of section 32 (Fitzgerald et al. 1997, see Fig. 3 in Sias 2003b). However in these directions, lands immediately adjacent to section 32 were also investigated for sand dune lizard habitat. Lands to the east and south of section 32 borders were dominated by mesquite grassland and were less ecotonal with shinnery oak than section 32. There were no blowout formations or dunes evident. The land to the west of section 32 contained shinnery oak grasslands, a patch of shinnery oak dunes with mesquite (sd-(low/med)mg – see Table 2 and Appendix 1), mesquite shinnery grasslands and shinnery mesquite coppice. The small dunes west of section 32 were checked in 2003-04 during lizard surveys of the west part of section 32. Pitfall traps were also located along the western border of section 32. Therefore, habitat between known sand dune lizard localities to the north and section 32 was surveyed most intensively. This included habitat west, northwest, north and northeast of section 32. Habitat in TX was inspected by driving the Eunice-Andrews Hwy and roads to the north of this route, to the Nadine Rd in NM (TX Gaines Co Rd 314).

The closest sand dune lizard location (Appendix 3, EUN SVSA05) to section 32 was 2.9 miles north (357°) from the NE corner of section 32. This location occurred in a single isolated blowout (BH) (photo 1, appendix 4), approximately 3 miles south of documented localities (Fitzgerald et al. 1997, Sias and Painter 1998, Sias and Snell 1998). This blowout was separated from a dune field by 0.25 mi of shinnery flats. A mile due west of this site there was a similar location (Appendix 3, EUN SVSA07) that was 2.8 mi north (358°) from the NW corner of section 32. This site had the potential to support a small group of lizards, however no sand lizards were found (the only time available to check the site was not good detection time). In this study only the shortest distances to section 32 are reported, the straight-line distance from a lizard location to the closest point on section 32.

The second closest sand dune lizard location (Appendix 3, EUN SVSA04) to section 32 occurred in a large dune field and was 3.0 mi from the north border of section 32. Additional lizard locations, 3-6 miles from section 32 (Appendix 3) and the

configuration of dune systems helped determine the status of this habitat. These dunes occurred 3 mi north of section 32 and represented the closest area to section 32 that supported a population of sand dune lizards (Photo 2, Appendix 4). This area was classified as occupied suitable habitat. This area contained large isolated blowout complexes (Photo 3, Appendix 4), shinnery dune fields and flats (Photo 4, Appendix 4).

North of the most proximate locations to section 32, there was at least four miles of sand dune lizard habitat. This habitat contained low-density oil/gas development and was also used for livestock grazing. Some dune fields in this habitat support high-density populations of sand dune lizards. For example, the verification site occurs in a 1+ mi wide, east (TX) - west (NM) oriented dune field that supports high-density populations. This dune field occurs 5.7 miles north of section 32.

The verification site dunes were first visited in June 1994. Environmental conditions and the level of development were similar in June 2004. There was no indication of significant habitat change. Photographs of the verification site from June 1995 and 2004 show an almost unchanged landscape (Photo 5-6, Appendix 4).

No sand dune lizards were found south of the reported locations (Appendix 3). This was in spite of searches (walk surveys 6.5 hrs in Table 5) and visits over parts of 7 days. Note that most survey work covered ecotonal (mesquite-shinnery dune formations) and non-shinnery dune habitats adjacent to shinnery dune habitats. South of the occupied habitat, blowout complexes (BH, but mesquite-shinnery dune habitat) were checked during the periods of sand dune lizard activity in habitat to the north. No sand dune lizards were found in these complexes. The habitat where sand dune lizards were found in June is described in Table 7. Note that all sightings were in high shinnery dunes (sd-(high) and in large (BH = 14/15) and medium sized blowouts (BM = 1/15). Unlike section 32, these occupied habitats lacked a mesquite-grass component and were characterized by white sands (see Fig. 5)

South of the occupied sand dune lizard habitat (dunes and blowouts) there is a .1-.5 mi wide band of unoccupied shinnery flats (dispersal habitat). In this region the shinnery formations are ecotonal with mesquite habitats (Photo 7-8, Appendix 4). There is a clear demarcation of unsuitable habitats indicated by changes in substrate and vegetation.

The southern extent of sand dune lizard habitat is due north of section 32. In this region to the west, the lizard habitat veers NNW, away from section 32, and crosses NM Hwy 18 five miles north of section 32 latitude (see Figs. 2,3, Sias 2003b). To the east of the southern extent of sand dune lizard habitat, at the TX/NM border field observations indicated continuous habitat extended into TX in an eastward direction. Drives along the Eunice-Andrews Hwy, east of section 32 showed that shinnery dune habitat does not cross this highway, nor does it occur adjacent to this road. These observations support the eastward direction of habitat in TX, but north of section 32 and at a greater distance than the reported localities from section 32. Work on state and federal lands on the TX/NM border from 1994 to 1998 (Fitzgerald et al. 1997, Painter and Sias 1998, Sias and Snell 1998) provided evidence that the sand dune lizard habitat northeast of Eunice, and north of section 32 was occupied habitat in TX. This provided evidence sand dune lizards north of section 32 do not exist in isolation, but are part of a population that extends into TX.

Discussion

Sand dune lizards were not found on section 32 during this study or the 2003 field work (Sias 2003b). Considerable time and alternative methods were utilized to determine the presence or absence of this species, including standard walking surveys (13.5 hr), pitfall trapping (360 trap days) and 17 days of field work in the area. The habitat of section 32 was unsuitable for sand dune lizards. This was directly inferred by the absence of sand dune lizards and the presence of mesquite–grassland habitats (Sias 2003b). These are habitats where no sand dune lizards have been reported in any study, however, most studies of sand dune lizards focus on shinnery oak habitat. What is unique about the 2003-04 field work is the intensive effort to study the lizards in habitats and localities adjacent to occupied shinnery dunes. The unsuitable habitat classification was also indirectly inferred and supported by evidence of searches in ecotonal areas adjacent to occupied habitat and section 32. No sand dune lizards were found in shinnery dunes or blowout complexes that contained densities of mesquite beyond widely scattered individual trees (~50 m). Ecotonal environments (shinnery oak formation /

mesquite grasslands) and mesquite grasslands extend in all directions from section 32. These habitats were searched from section 32, north to the closest sand dune lizard localities, but no sand dune lizards were found.

The presence of mesquite indicates environmental conditions unfavorable to sand dune lizards. One of these conditions is different soil/plant associations. Section 32 substrates, when compared to sands from the nearest occupied sand dune lizard locality, were significantly different in particle size composition. The substrate findings in this study were consistent with Fitzgerald et al. (1997) findings that sands from blowouts where no lizards occurred, contained a higher proportion of small particles than sands from blowouts that supported lizards. The substrate analysis provided another ecological dimension defining the unsuitable habitat classification of section 32.

The closest population of sand dune lizards occurred 3 mi north of section 32. The primary population in the area occurred 5.7-6.7 mi north of section 32. Before this study was conducted, documented sand dune lizards occurred on T20S, R39E, Sec 31, 32, areas adjacent to section 32 in Gaines and Andrews Co. TX and T20S, R38E, Sec 36 (Fitzgerald et al. 1997, Sias and Painter 1998, Sias and Snell 1998). This study documented additional range for the sand dune lizard (Appendix 3). The range was extended south from historical geographic records to sites approximately 3 mi north section 32. The NM habitat north of section 32 is continuous with habitats further to the east.

This study provides evidence of larger range and more extensive habitat than previously known for the sand dune lizards in this region. Obviously, these increments in geographic range do not change the fundamental concerns for this species, but they provide a demographic and environmental basis for a higher probability of survival for sand dune lizards in this area. The primary reasons sand dune lizards are a NM state listed species are the small geographic range of the species, and habitat destruction within the geographic range.

The suitable habitat north of section 32, east of NM Hwy 18 to the NM-TX border is a mix of private, state and BLM land. The inclusion of public land in this suitable habitat allows for potential management for the species. The current level of land use in this suitable habitat is characterized by low-moderate density oil/gas development and

grazing. There was no evidence of Tebuthiron spraying. There was little evidence of habitat change in the primary population region of this suitable habitat. Visits to the verification site in June 1994, 95, 96, 97, 98, 2003 and June 2004 show little discernable change in the blowouts and level of development.

There will clearly be impacts of NEF development on the approximately 200 acres slated for development on section 32, of the 554 acres north of NM Hwy 234. There will also clearly be edge effects around the developed site, effects that will be manifest only immediately adjacent to the facility. The most basic edge effect arises from the juxtaposition of two different environments (industrial facility next to mesquite grassland). Another basic edge effect confronting an organism is the restriction of habitat (at an edge an organism is exposed less habitat compared to an organism located within habitat).

There are several dimensions to an evaluation of potential affects. First and obviously, construction and operation of an industrial plant will have immediate and continuing environmental effects adjacent to the facility. One would not predict any short-term effects of NEF development on sand dune lizards because of the distance populations exist from the section 32. Large industrial operations already exist north and northeast of section 32, which may have began exerting disturbance effects years ago. The current distribution of sand dune lizards could reflect this influence, but it is less likely the development of a site further away from sand dune lizards would create additional elements of disturbance. Nor would any direct effects be anticipated because section 32 is unsuitable habitat. The data collected in the 2003-04 studies provides evidence that short-term and direct effects of NEF development on section 32 are unlikely to influence sand dune lizard populations or habitat. There was no evidence that this species utilized habitat around section 32.

Secondly, some germane questions for this study are, will these effects extend at least 3 mi north, and influence sand dune lizards in some fashion? Will these effects extend 5.7-6.7 miles north and influence the primary population of sand dune lizards in the region?

Large industrial operations already exist around section 32. North is a quarry operation that covers part of several sections. East at the TX border is a hazardous waste

disposal facility, and southeast at the border is the Lea Co. Landfill. Hwy 18 and Hwy 234 already carry truck traffic from these facilities and regional oil/gas operations. The entire region supports many facilities devoted to the oil/gas industry. It could be predicted that incremental industrial activity would have marginally incremental effects, affects that already exist in the area. It is doubtful these predicted effects would be detectable, nor could they be assigned to a specific source. Sand dune lizards north of section 32 are currently exposed to these conditions, yet there is no evidence of habitat degradation or population declines in this area. Instead, June 2004 lizard surveys resulted in new geographic records. The NEF site is located in an industrial area, in unsuitable habitat for sand dune lizards and located at a distance from populations. These findings provide no evidence to conclude that overall cumulative effects will have anymore than a negligible effect on sand dune lizards.

There is no direct undisturbed habitat corridor from section 32 to populations of sand dune lizards. The Wallach Quarry blocks access to the north, towards the NM populations and the WCS, Inc site blocks access to the northeast and east towards TX populations. The proposed site of the LES NEF is already in an industrial area, so it is not destroying a large block of undisturbed habitat. The habitat that is at the NEF site is unsuitable for sand dune lizards. Additionally, both the Wallach Quarry and WCS, Inc are closer to sand dune lizard populations than the NEF site.

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Sias, D.S., and H.L. Snell. 1998. The sand dune lizard *Sceloporus arenicolus* and oil and gas development in southeastern New Mexico. Final report of field studies 1995-97. Submission to New Mexico Dept. of Game and Fish. Santa Fe.

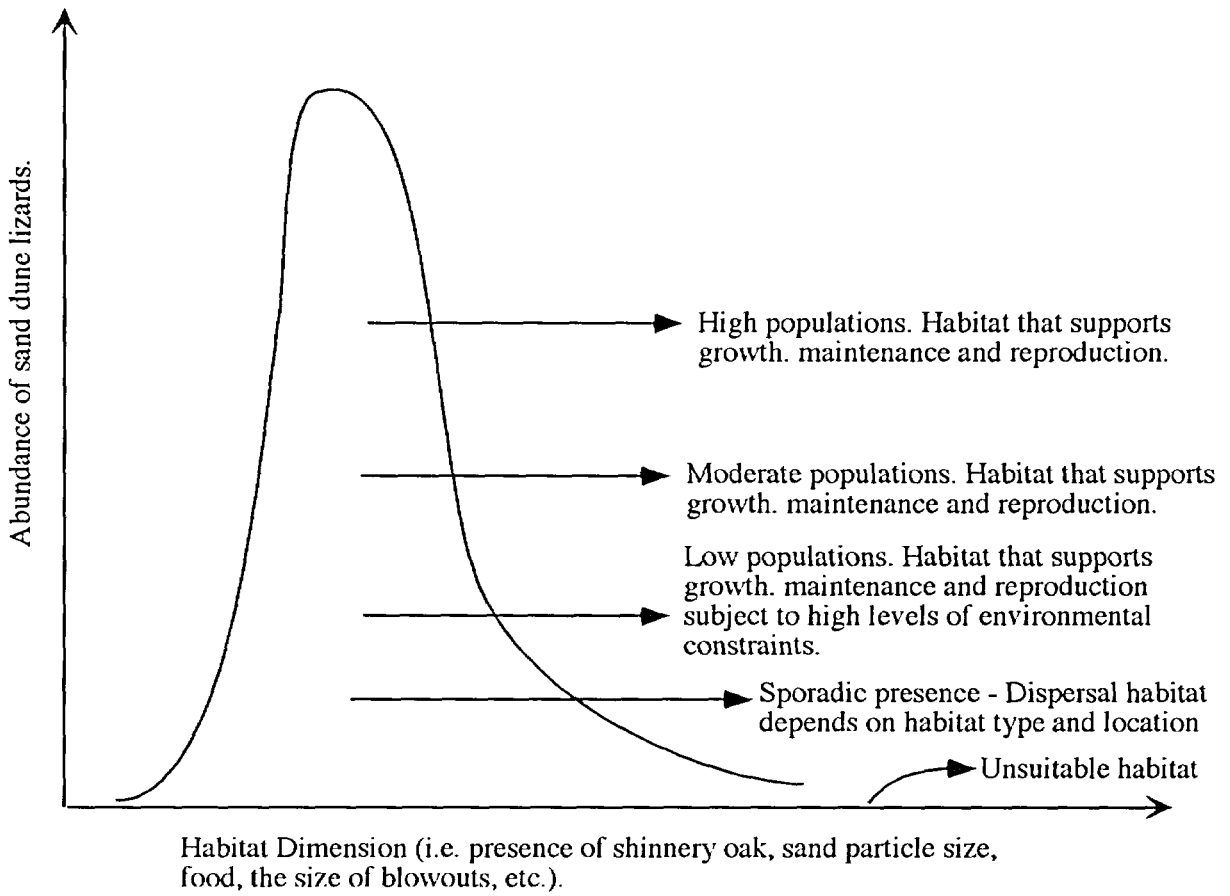
Sias, D.S. 2002. The status of the sand dune lizard, *Sceloporus arenicolus* in Lea County, New Mexico, Township 20S, Range 37E, sections 11, 14 and 15. A report for Conoco Corporation and the Bureau of Land Management (Carlsbad office). Submitted to Conoco, Inc., 10 Desta Drive, Suite 651W, Midland, TX 79705-4500.

Sias, D.S. 2003a. The status of the sand dune lizard, *Sceloporus arenicolus* and its habitat in Eddy County, New Mexico on CBS Operating Corporation leases northeast of Loco Hills. Submitted to the Bureau of Land Management (Carlsbad office) and CBS Operating Corpration. CBS Operating Corp., 300 W Louisiana, STE.200, P.O. Box 2236, Midland, TX 79702.

Sias, D.S. 2003b. The status and habitat of the sand dune lizard, *Sceloporus arenicolus* in Lea County, New Mexico at section 32, township 21S, range 38E. A survey report for the LES National Enrichment Facility project. GL Environmental Inc., 4200 Meadowlark Lane, Ste. 1A, Rio Rancho, NM 87124.

Snell, H.L, L.W. Gorum, L.J.S. Pierce, and K.W. Ward. 1997. Results from the fifth year (1995) research of the effect of shinnery oak removal on populations of sand dune lizards, Sceloporus arenicolus, in New Mexico. A final report submitted to the New Mexico Department of Game and Fish: contract #80-516.6-01. Unpubl. Rept. Submitted to New Mexico Dept. of Game and Fish. Santa Fe.

Figure 1. Definitions of suitable and unsuitable habitat.

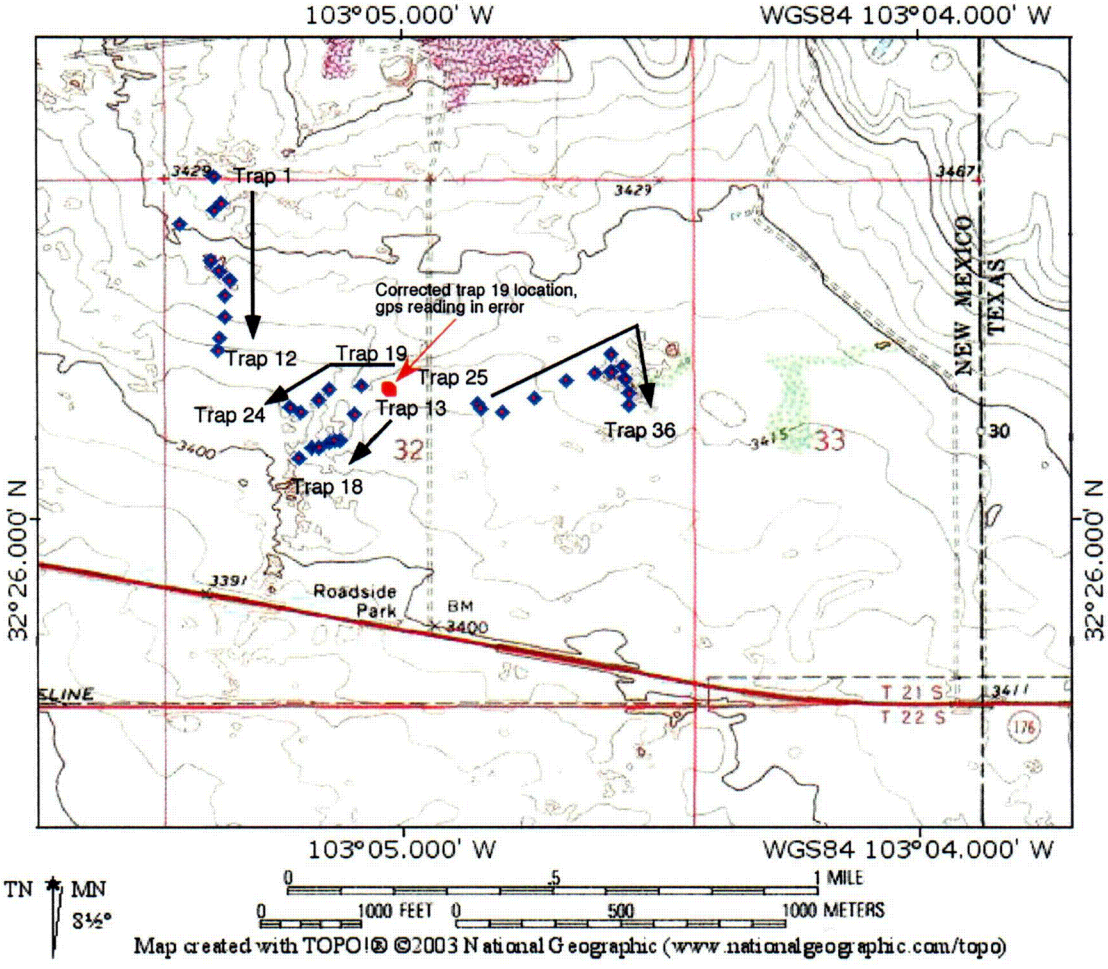


From text.

Habitat terms were used in this report that require definition. Figure 1 discusses the idea of habitat suitability used in this study and other studies on sand dune lizards. 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 (*Quercus havardii*) sand dunes (sd) and blowout complexes, that sand dune lizards may move through at various times. The habitat that occurs most frequently between occupied shin oak dune complexes is shinoak or shinnery flats (sf), characterized by a dense growth of shinoak, scattered sand sage *Artemesia filafolia* and yucca *Yucca glauca*. 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.

The use of the term marginal for this study is used in reference to describing small and isolated demes (groups) lizards that can not persist over time without an external source population. In many areas of this species range, there occur large dune fields which support high population densities of sand dune lizards. Adjacent to these extensive dune fields are isolated blowout complexes separated from the dune fields by shinnery flats. Sand dune lizards occur in these isolated blowout complexes (bc). In some cases, blowout complexes, consisting of only a single large blowout are separated from the more extensive shinnery dune habitat by .5-1.0 mile (Sias 2002, 2003a). It is clear that sand dune lizards will not persist over time in these small habitats without re-colonization from larger source habitats, since the probability of extinction is quite high in small habitats occupied by only several pairs of lizards. These situations are termed marginal in this study. The presence of sand dune lizards in isolated blowouts suggests that dispersal through shinnery flats must be occurring in some fashion.

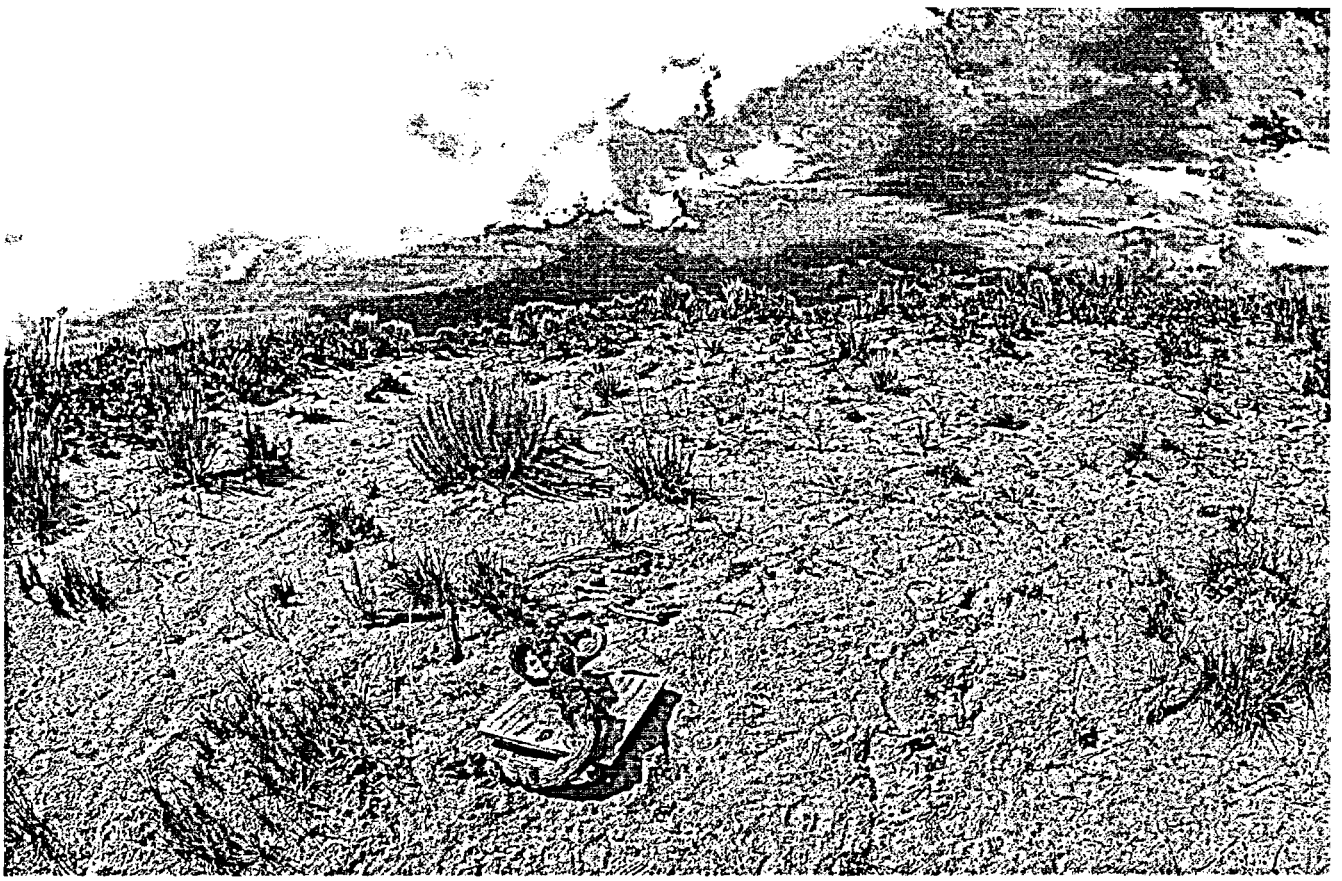
Figure 2. Map of the locations of pitfall traps for lizards on section 32.



Pitfall traps in shinnery oak associated formations. Traps placed < 20 m apart will show as one mark on this map. The southeast portion of section 32 is mesquite grassland with sparse shinnery oak. The southwest portion of section 32 is mesquite coppice with sand sage, and west of this is shinnery grass flats. These habitats are not known to support sand dune lizard habitats.

C01

Figure 3a. Examples of the habitat around some of the pitfall traps on section 32.

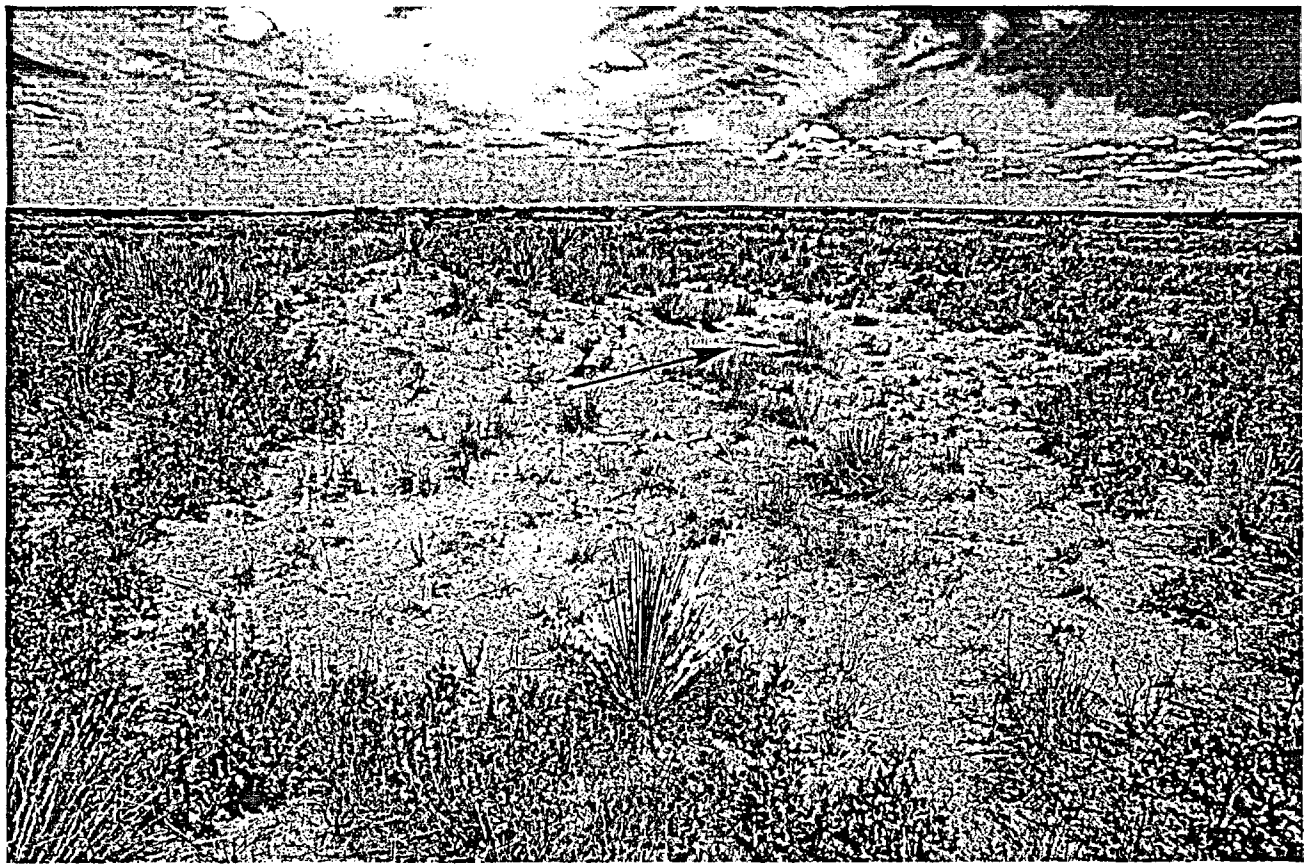


Trap 4 located in the northwest corner of section 32. The trap was in a large blowout located in a patch of shinnery oak dunes with sand sage, mesquite and yucca.

Figure 3b. Examples of the habitat around some of the traps on section 32.

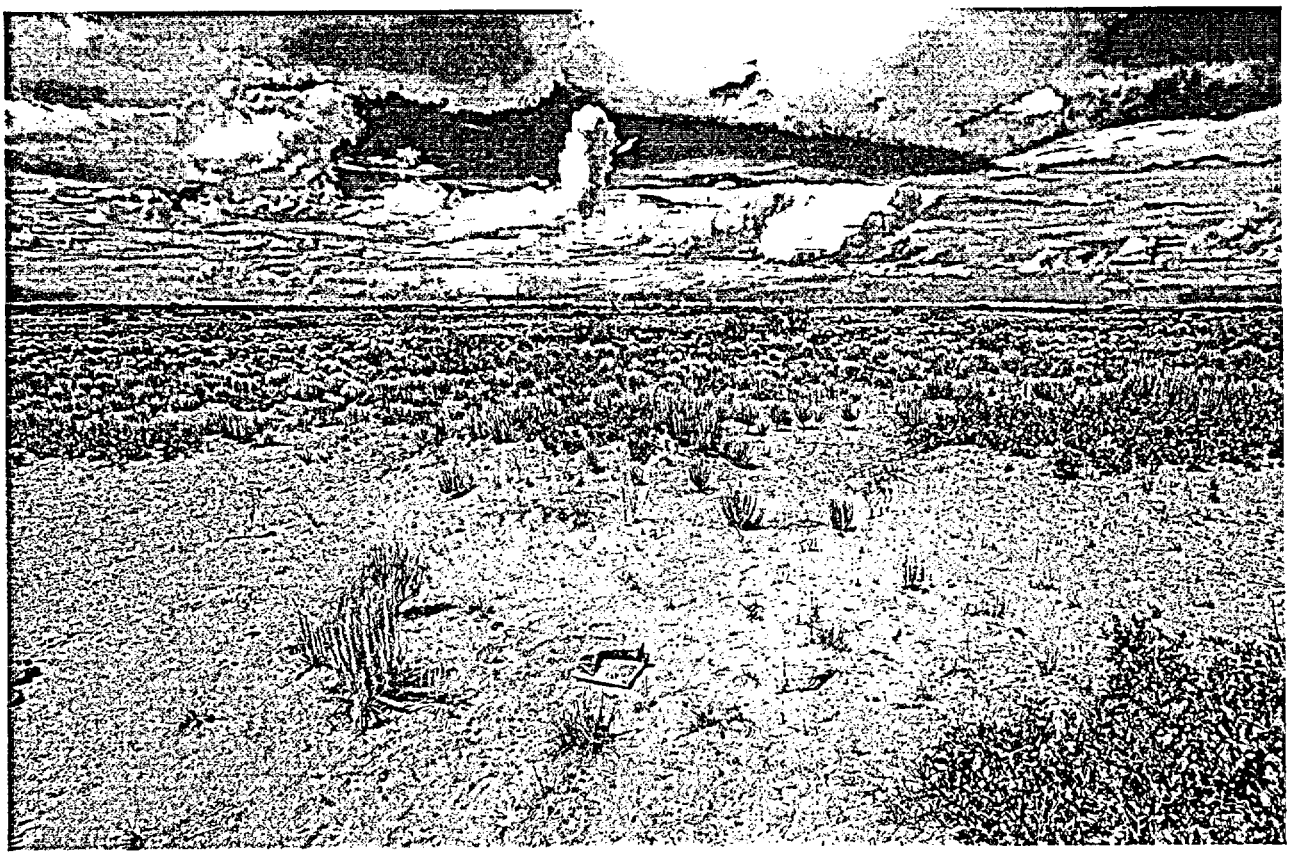
Another view of trap 4 showing the blowout and a view of section 31 to the west. This area has similarities to occupied sand dune lizard habitat. A substrate sample came from this area (section 32 NW 1/4 blowout).

Figure 3c. Examples of the habitat around some of the pitfall traps on section 32.



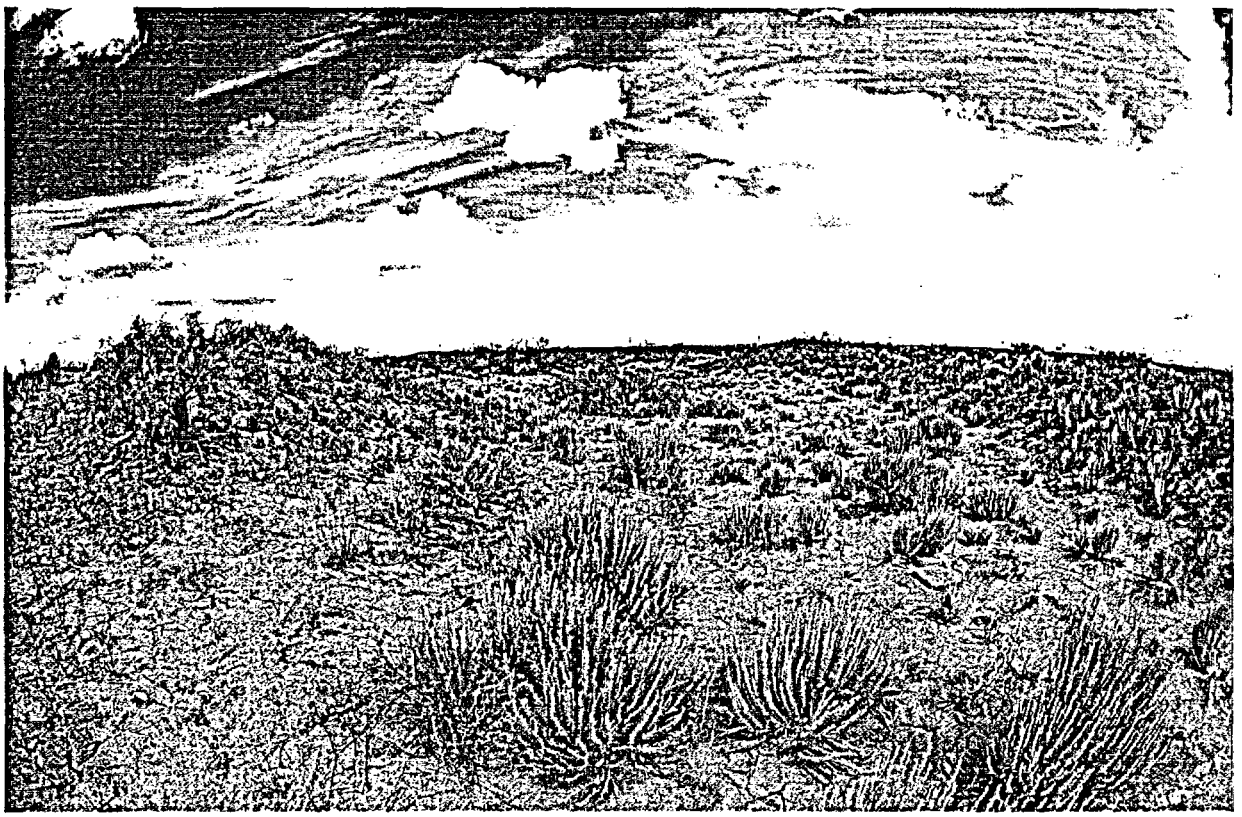
Trap 25 located in the east central part of section 32 in a medium sized blowout. The habitat was a patch of low shinnery dunes with grass, sand sage and and mesquite.

Figure 3d. Examples of the habitat around some of the pitfall traps on section 32.



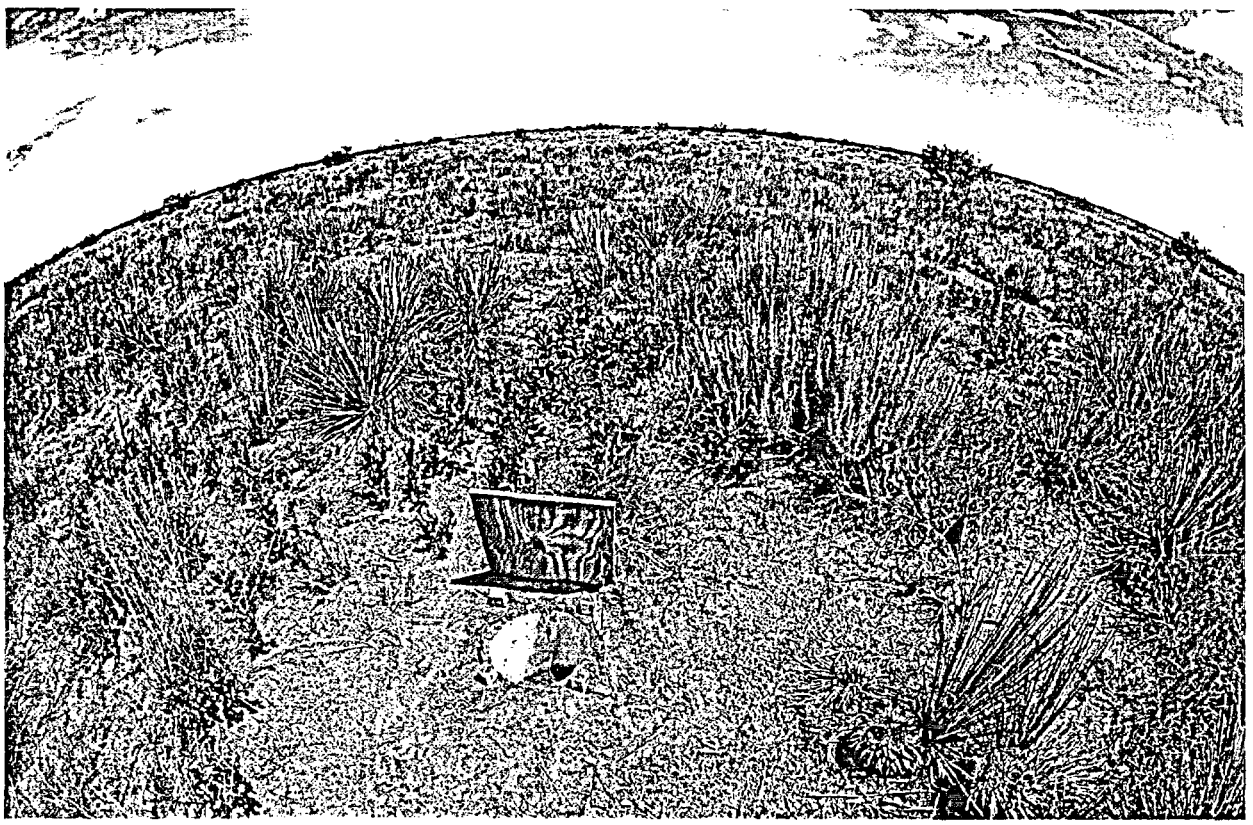
Trap 21 located in the west central part of section 32 in a large blowout. The habitat was low shinnery dunes with mesquite, grass and sand sage. The view is northeast, the Walloch quarry and WCS, Inc operations are visible.

Figure 3e. Examples of the habitat around some of the pitfall traps on section 32.



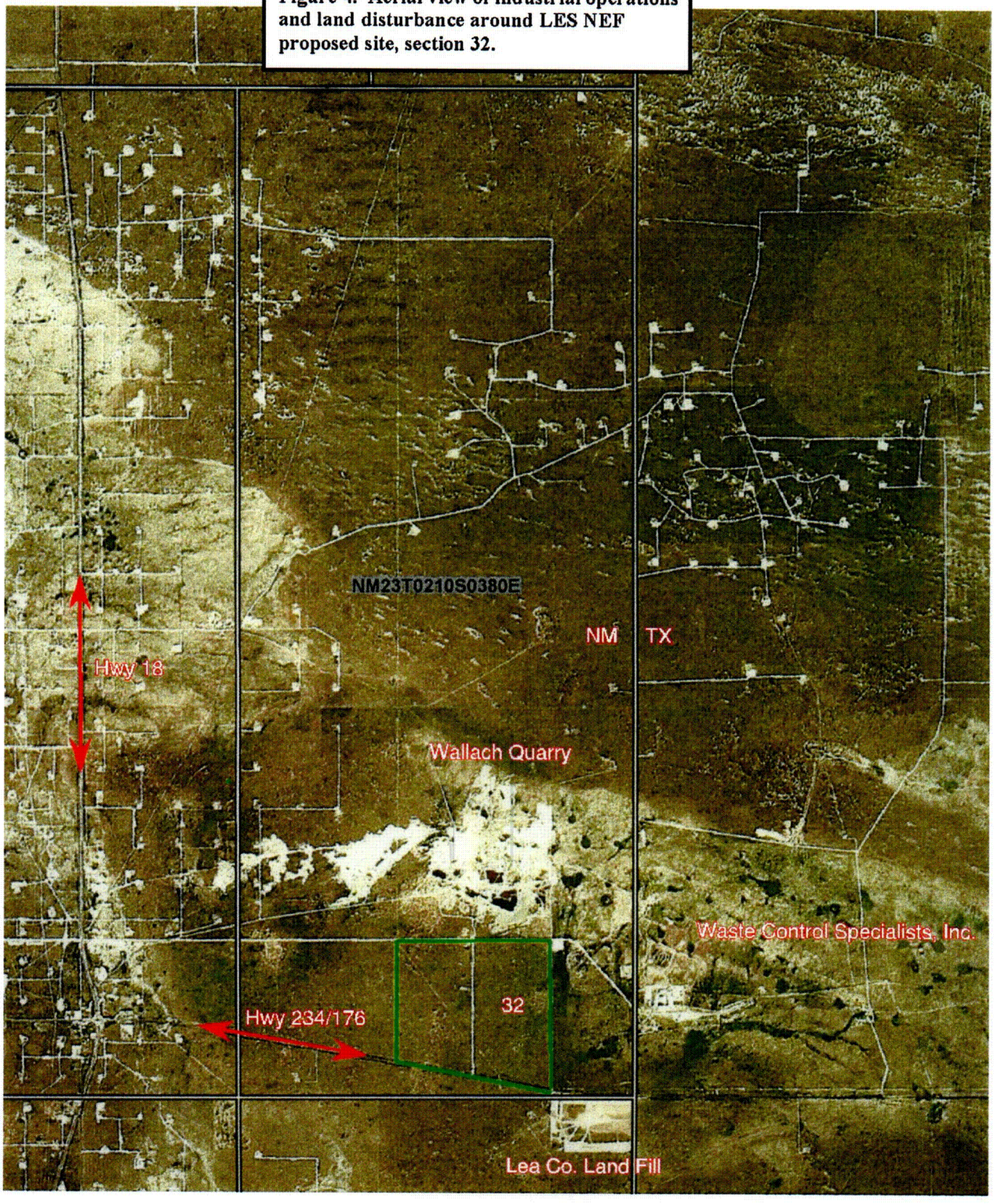
Trap 35 located on the eastern side of section 32 in a large blowout like formation. The habitat was medium height shinnery dunes and mesquite coppice with sand sage.

Figure 3f. Examples of the habitat around some of the pitfall traps on section 32.



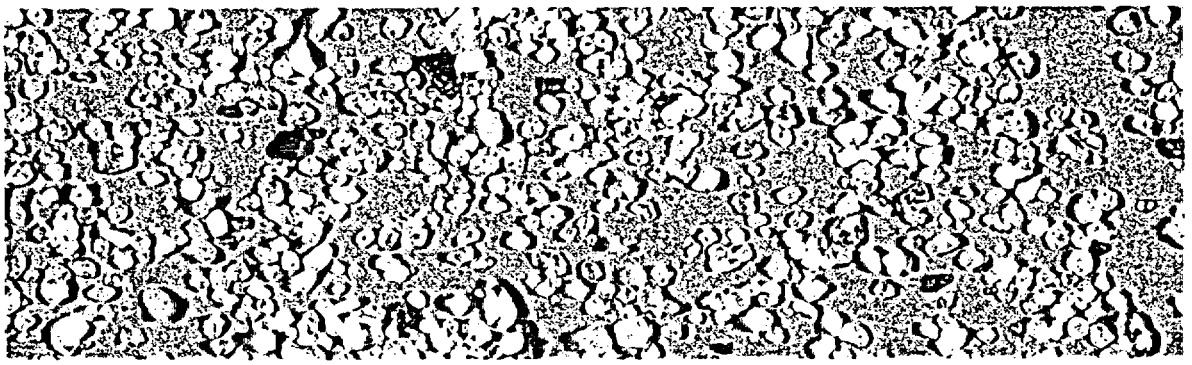
Trap 28 with the lid flipped open. This trap was located in the east central portion of section 32 between traps in low shinnery dunes (traps 25-27) and traps in shinnery dune - mesquite coppice formation (traps 29-36). The habitat was a shinnery flat with yucca, grass and sand sage. The view is 180 degrees (N). This wide angle view shows the extent of the flats and the patchiness of shinnery dune formations none of which are visible in this wide view.

Figure 4. Aerial view of industrial operations and land disturbance around LES NEF proposed site, section 32.

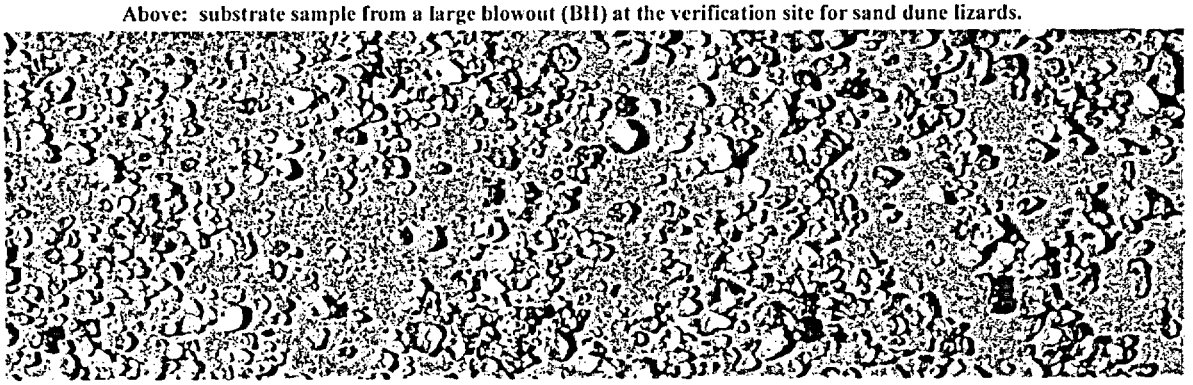


C02

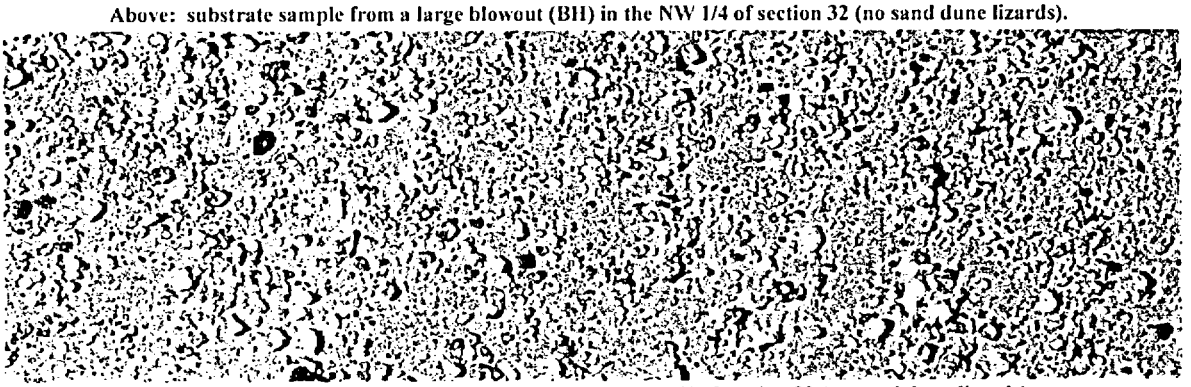
Figure 5. Views of thin layers of substrate samples from a sand dune lizard locality and from localities where no sand dune lizards occurred (scale = 1196% enlarged from 1:1).



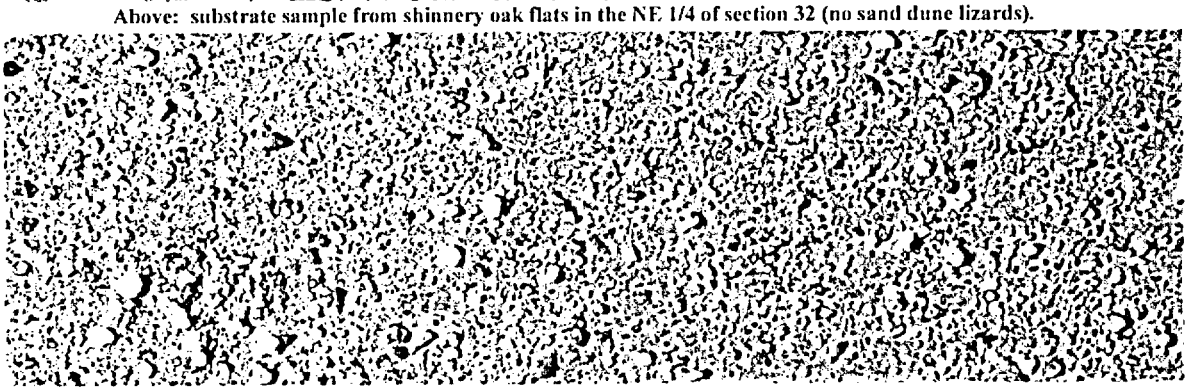
Above: substrate sample from a large blowout (BH) at the verification site for sand dune lizards.



Above: substrate sample from a large blowout (BH) in the NW 1/4 of section 32 (no sand dune lizards).

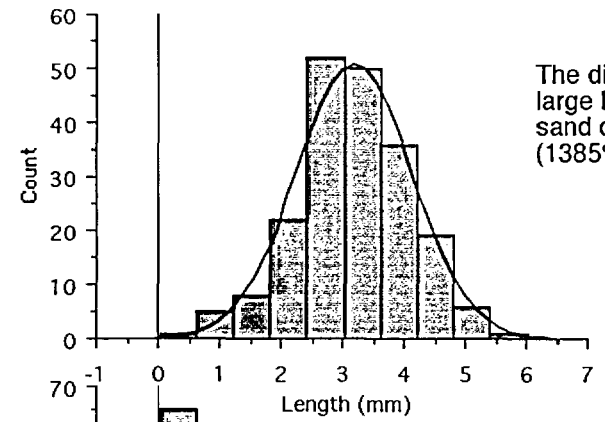


Above: substrate sample from shinnery oak flats in the NE 1/4 of section 32 (no sand dune lizards).

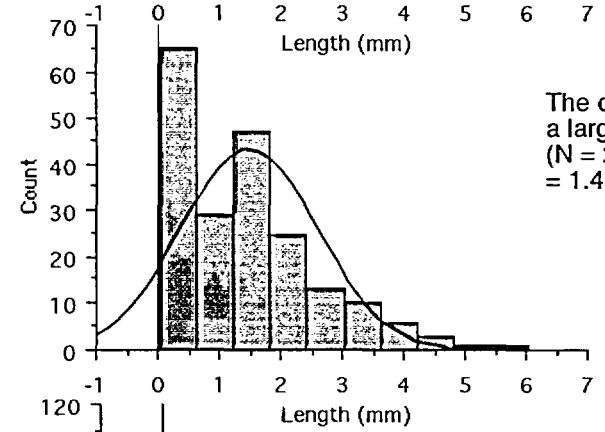


Above: substrate sample from mesquite grasslands in the SE 1/4 of section 32 (no sand dune lizards).

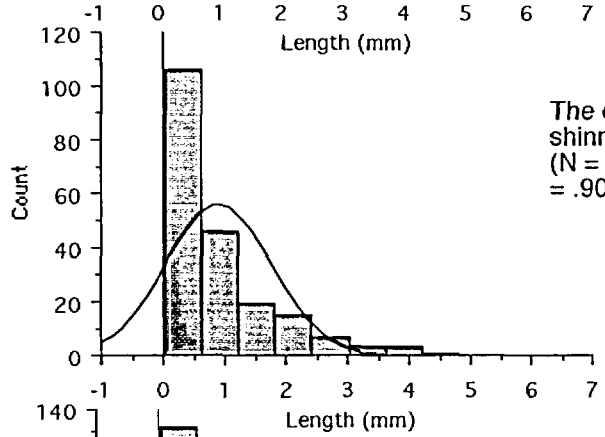
Figure 6. The distribution of substrate particle size from four locations, one site with sand dune lizards present, and three sites on section 32 where sand dune lizards were absent.



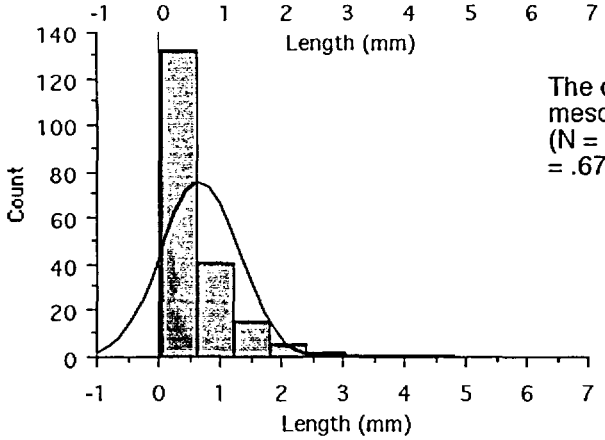
The distribution of substrate particle size at a large blowout (BH) from the Verification site for sand dune lizards. (N =200, mean size of scaled (1385%) particles = 3.189 mm).



The distribution of substrate particle size from a large blowout (BH) in the NW 1/4 of section 32. (N = 200, mean size of scaled (1385%) particles = 1.481 mm).



The distribution of substrate particle size from shinnery oak flats in the NE 1/4 of section 32. (N = 200, mean size of scaled (1385%) particles = .908 mm).



The distribution of substrate particle size from mesquite grasslands in the SE 1/4 of section 32. (N = 200, mean size of scaled (1385%) particles = .673 mm).

Table 1. Reptile and amphibian abbreviations used in this report.

Reptile abbreviations used in this report and tables	Scientific name	Common name	Recent name change
Reptiles			
Sa	*Sceloporus arenicolus*	Sand dune lizard	
yoy		young of year	
Us	*Uta stansburiana*	Side-blotched lizard	
Ct	*Cnemidophorus tigris*	Western whiptail lizard	*Aspidoscelis = Cnemidophorus*
CxT	*Cnemidophorus (tigris and sexlineatus) (tracks)*	Whiptail lizard tracks	*Aspidoscelis = Cnemidophorus*
Cs	*Cnemidophorus sexlineatus*	Six-lined race runner	*Aspidoscelis = Cnemidophorus*
Hm	*Holbrookia maculata*	Lesser earless lizard	
Su	*Sceloporus undulatus*	Praire (fence) lizard	
Cs	*Cnemidophorus sexlineatus*	Six-lined racerunner	
Pc	*Phrynosoma cornutum*	Texas horned lizard	
Eo	*Eumeces obsoletus*	Great plains skink	
To	*Terrapene ornata*	Ornate box turtle	
ToT	*Terrapene ornata (tracks)*	Ornate box turtle tracks	
Snake T		Snake tracks	
Cr.vi	*Crotalus viridus*	Western rattlesnake	
Ma.fl	*Masticophis flagellum*	Western coachwhip snake	
He.na	*Heterodion nasicus*	Western hog-nosed snake	
Xx-m		male	
Xx-f		female	
Xx-j		juvenile	
Xx-h		hatchling	
Amphibians			
Bu.co	*Bufo cognatus*	Great plains toad	
Bu.de	*Bufo debilis*	Green toad	
Bu.sp	*Bufo speciosus*	Texas toad	
Sc.co	*Scaphiopus couchii*	Couch's spadefoot	
Sp.bo	*Spea bombifrons*	Plains spadefoot	
Am.ti	*Ambystoma tigrinum*	Tiger salamander	

Table 2. Plant and habitat abbreviations used in this report.

Various combinations of these letters are used to indicate habitat types. Dominants are listed in priority for each description (ex. sd(ss)gy).	Description of plants and habitats in reference to sand dune lizards. Plant community abbreviations used in this report,tables and maps.	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 (*Prosopis glandulosa*). 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 (*Quercus havardii*), 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

Table 2. Plant and habitat abbreviations used in this report.

Various combinations of these letters are used to indicate habitat types. Dominants are listed in priority for each description (ex. sd(ss)gy).	Description of plants and habitats in reference to sand dune lizards. Plant community abbreviations used in this report,tables and maps.	Habitat Suitability (S = suitable, D = Dispersal, U = unsuitable)
ss or (ss) when next to s	Sand sage (*Artemisia filifolia*). Supports sand dune lizards when it occurs with or adjacent to Shinnery oak	S, D, U
sw	snake weed (*Guitierezia sarothrae*)	U, D, S
T	Treated with the herbicide Tebuthiron to kill Shinnery oak.	generally U. In areas where Shinnery Oak persists (usually high SD), sometimes remnant populations of sand dune lizards may be found (to date).
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	Yucca 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 *Yucca glauca*.	S, D, U
	Other abbreviations	
bc and bc-xxx	blowout complex	
BH	blowout-large (huge), linear or curvalinear length > 80 ft	
BM	blowout-medium, linear or curvalinear length 25-80 ft	
BS	blowout-small, linear or curvalinear length <25 ft	
Sa	*Sceloporus arenicolus* (sand dune lizard)	

Table 3. Habitat descriptions and locations of pitfall traps on section 32.

Trap no.	Blowout no.	Blowout size BH>80, BM=(25-80) (ft)	Blowout length (ft)	Relief (R1-5) (ft), 5 sample points	R2	R3	R4	R5	Mean local relief (R1-5) (ft)	Open sand (%) (10 point sample)
1	1	BH	160	10	15	8	12	7	10.4	50
2	2	BH	120	8	5	6	8	12	7.8	40
3	3	BM	60	5	5	10	10	8	7.6	30
4	4	BH	80	6	3	8	15	15	9.4	30
5	5.1	BH	220	20	25	8	10	18	16.2	40
6	5.2	BH	90	12	12	12	7	6	9.8	40
7	6.1	BH	130	10	15	0	6	9	8	40
8	6.2	BH	130	4	8	10	8	1	6.2	20
9	sand flat	flat		1	1	1	1	1	1	20
10	sand flat	flat		1	1	1	1	1	1	30
11	sand flat	flat		1	1	1	1	1	1	15
12	7	BM	60	1	1	1	1	1	1	20
13	8	BM	80	8	8	8	4	6	6.8	25
14	open substrate ridge	ridge in coppice	120	5	8	4	3	3	4.6	40
15	open substrate ridge	ridge in coppice	180	6	5	3	6	6	5.2	20
16	sand valley	valley in coppice	90	6	6	3	5	5	5	20
17	open substrate ridge	ridge in coppice	120	2	5	5	6	8	5.2	30
18	9	BH	300	8	12	6	3	8	7.4	60
19	10	BM	60	6	5	12	3	3	5.8	20
20	11	BH	80	5	6	8	4	5	5.6	30
21	12	BH	80	5	4	4	4	3	4	60
22	13	BH	90	7	10	5	3	1	5.2	30
23	14	BH	120	10	15	6	12	8	10.2	50
24	15	BH	80	8	8	12	10	3	8.2	30
25	16	BM	60	4	6	5	2	1	3.6	50
26	17	BH	90	6	6	3	8	1	4.8	40
27	18	BM	40	2	2	1	5	3	2.6	10
28	sand flat	flat	30	1	1	1	1	1	1	20
29	19	BM	60	5	5	3	3	3	3.8	20
30	20	BM	70	5	5	3	1	4	3.6	40
31	21	BH	180	5	6	9	6	10	7.2	50
32	22	BM	70	3	6	8	8	4	5.8	40
33	23	BH	220	4	4	15	15	10	9.6	40
34	24	BH	125	8	7	12	15	15	11.4	50
35	25	BH	190	8	10	12	6	5	8.2	40
36	26	BM	60	6	7	3	5	5	5.2	40

Table 3. Habitat descriptions and locations of pitfall traps on section 32.

Trap no.	Habitat-1 (4 points 25 m around trap)	Habitat-2	Habitat-3	Habitat-4
1	msd-(high)	sd-(high)m	sd-(high)mcopg	sd-(high)m
2	sd-(high)mss	sd-(high)mss	sd-(high)mss	sd-(high)mss
3	sd-(med)ssmy	sd-(med)ssmy	sd-(med)ssmy	sd-(med)ssmy
4	sd-(med)ssmy	sd-(med)ssmy	sd-(med)ssmy	sd-(med)ssmy
5	sd-(high)mssy	sd-(high)mssy	sd-(high)mssy	sd-(high)mssy
6	sd-(high)mssy	sd-(high)mssy	sd-(high)mssy	sd-(high)mssy
7	sd-(high)mssyg	sd-(high)mssyg	sd-(high)mssyg	sd-(high)mssyg
8	sd-(high)mgssy	sd-(high)mgssy	sd-(high)mgssy	sd-(high)mgssy
9	sfssgmy	sfssgmy	sfssgmy	sfssgmy
10	sfssgmy	sfssgmy	sfssgmy	sfssgmy
11	sfsd-(low)gssym	sfsd-(low)gssym	sfsd-(low)gssym	sfsd-(low)gssym
12	sfsd-(low)gm	sfsd-(low)gm	sfsd-(low)gm	sfsd-(low)gm
13	smcop	smcop	smcop	smcop
14	smcop	smcop	smcop	smcop
15	smcop	smcop	smcop	smcop
16	mcops(ss)g	mcops(ss)g	mcops(ss)g	mcops(ss)g
17	mcops(ss)	mcops(ss)	mcops(ss)	mcops(ss)
18	sd-(med)mcopss	sd-(med)mcopss	sd-(med)mcopss	sd-(med)mcopss
19	sd-(med)mgss	sd-(med)mgss	sd-(med)mgss	sd-(med)mgss
20	sd-(med)mgss	sd-(med)mgss	sd-(med)mgss	sd-(med)mgss
21	sd-(low)mgss	sd-(low)mgss	sd-(low)mgss	sd-(low)mgss
22	sd-(med)mcopgss	sd-(med)mcopgss	sd-(med)mcopgss	sd-(med)mcopgss
23	sd-(high)mcopss	sd-(high)mcopss	sd-(high)mcopss	sd-(high)mcopss
24	sd-(high)mgss	sd-(high)mgss	sd-(high)mgss	sd-(high)mgss
25	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm
26	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm
27	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm	sd-(low)gssm
28	sfygss	sfygss	sfygss	sfygss
29	sd-(low)ssm	sd-(low)ssm	sd-(low)ssm	sd-(low)ssm
30	sd-(low)ssm	sd-(low)ssm	sd-(low)ssm	sd-(low)ssm
31	sd-(med)ssm	sd-(med)ssm	sd-(med)ssm	sd-(med)ssm
32	sd-(med)ss	sd-(med)ss	sd-(med)ss	sd-(med)ss
33	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop
34	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop
35	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop	sd-(med)ssmcop
36	sd-(med)ssmg	sd-(med)ssmg	sd-(med)ssmg	sd-(med)ssmg

Table 3. Habitat descriptions and locations of pitfall traps on section 32.

Trap no.	GPS waypoint names (NAD83)	Degrees West	Mins.	Degrees North	Mins.	Elevation (ft)
1	EUNT01	32	26.569	-103	5.365	3352
2	EUNT02	32	26.525	-103	5.351	3446
3	EUNT03	32	26.513	-103	5.365	3468
4	EUNT04	32	26.490	-103	5.428	3470
5	EUNT05	32	26.427	-103	5.370	3455
6	EUNT06	32	26.427	-103	5.370	3438
7	EUNT07	32	26.411	-103	5.353	3432
8	EUNT08	32	26.395	-103	5.332	3433
9	EUNT09	32	26.368	-103	5.345	3432
10	EUNT10	32	26.334	-103	5.345	3433
11	EUNT11	32	26.297	-103	5.353	3420
12	EUNT12	32	26.277	-103	5.358	3415
13	EUNT13	32	26.173	-103	5.093	3427
14	EUNT14	32	26.129	-103	5.124	3422
15	EUNT15	32	26.125	-103	5.142	3430
16	EUNT16	32	26.118	-103	5.162	3422
17	EUNT17	32	26.117	-103	5.176	3425
18	EUNT18	32	26.100	-103	5.201	3420
19	EUNT19	32	26.129	-103	5.131	3426
20	EUNT20	32	26.220	-103	5.082	3441
21	EUNT21	32	26.213	-103	5.141	3427
22	EUNT22	32	26.196	-103	5.165	3428
23	EUNT23	32	26.176	-103	5.198	3412
24	EUNT24	32	26.183	-103	5.218	3426
25	EUNT25	32	26.189	-103	4.855	3427
26	EUNT26	32	26.182	-103	4.848	3426
27	EUNT27	32	26.176	-103	4.807	3428
28	EUNT28	32	26.200	-103	4.745	3423
29	EUNT29	32	26.228	-103	4.681	3429
30	EUNT30	32	26.241	-103	4.626	3431
31	EUNT31	32	26.243	-103	4.597	3428
32	EUNT32	32	26.271	-103	4.597	3428
33	EUNT33	32	26.252	-103	4.571	3426
34	EUNT34	32	26.232	-103	4.567	3430
35	EUNT35	32	26.209	-103	4.562	3423
36	EUNT36	32	26.189	-103	4.560	3417

Table 4. Reptiles and amphibians captured in pitfall traps on section 32.

Date	Trap	Sa	Su	Us-m	Us-f	Us(j/h)-f	Hm-m	Hm-f	Ct-m	Ct-f	Cs-m	Cs-f	Eo-m	Eo-f	Other species	Other sps no.	Trap Totals
16-Jun-04	set traps 1-18																
17-Jun-04	set traps 19-36																
19-Jun-04	trap check	0	0	1	1	0	0	0	6	4	0	0	0	0	Masticophis flagellum track at trap	1	13
22-Jun-04	trap check	0	0	1	4	0	0	0	4	6	0	1	0	0	Heterodon nasicus-m, Colubrid ST	2	18
25-Jun-04	trap check	0	0	4	1	0	0	1	2	2	1	1	0	0	Spea bombifrons-m, Ct escape at night w flood, Us eaten at night	3	15
26-Jun-04	trap check (1-18)	0	0	1	1	1	0	0	1	3	1	0	0	0		0	8
27-Jun-04	trap check(19-36)	0	0	0	1	0	1	0	4	6	0	0	1	1	Ambystoma tigrinum	1	15
26-Jun-04	pull traps 1-18																
27-Jun-04	pull traps 19-36																
Total catch		0	0	7	8	1	1	1	17	21	2	2	1	1		7	69

Table 5. Reptiles observed during walking surveys on section 32 and adjacent areas.

Sandard walk surveys for lizards	Time start	Total time (hrs)	Date	Sa-Total	Sa-m	Sa-f	Us-m	Us-f	Us-j	Us-Total	Hm-m	Hm-f	Hm-Total	Ct	CxT	Cs-m	Cs-f	Cs-Total	No ID lizard	To	ToT	Ma.fl	Snake Track	Total for survey, no tracks CxT, ToT	Total for survey with tracks
Totals: Verification site	7:10	3.16	18-Jun-04	6	3	3	2	1		3		2	2	1				0		3	15			15	30
Totals: Between Verification site and sec 32	8:15	4.92	20-Jun-04	1	1	0	14	14	0	28	1	2	3	10	41	2	1	3	0	3	8	0	0	48	97
Totals: EUNNORTH7-056-059	18:33	1.62	21-Jun-04	0	0	0	3	2	0	5	1	0	1	0	10	0	0	0	0	1	2	0	1	8	21
Totals: Sec 32 west side	12:45	2.75	22-Jun-04	0	0	0	7	6	0	13	0	2	2	24	28	0	0	0	0	0	2	0	0	39	69
Totals: Sec 32 east side	10:45	2.75	24-Jun-04	0	0	0	6	7	0	13	0	0	0	14	85	7	0	7	0	2	7	1	3	40	135
Totals: Sec 32 walk surveys		4.75		0	0	0	13	13	0	26	0	2	2	38	113	7	0	7	0	2	9	1	3	79	204

Table 6. Reptiles and amphibians observed while working on section 32, exclusive of the walk survey and trap records.

Complete	Date	Time start	Time stop	Total time (hrs)	Sa	Su	Us	Hm	Ct	Cs	Pc	He.na	Ma.fl	Snake T	To	ToT	Amphibians >>>	Bu.sp	Bu.de	Bu.co	Bu.sp x Bu.co	Sp.bo	Sc.co
Trap set	16-Jun-04			4:00			14	0	4	0			1		4	9							
Trap set	17-Jun-04			4:00			32	2	32	2					6	4							
	18-Jun-04						0	0	0	0													
Trap check/habitat/GPS	19-Jun-04	9:20	1:20	5:00			34	0	47	5				2	4	23							
	20-Jun-04						0	0	0	0													
	21-Jun-04						0	0	0	0													
Trap check/photo/walk area	22-Jun-04	7:25	12:20	4:55			17	1	12	3		1	1	6	8	12							
Ne Corner walk/Baker Spring (time is only on sec 32)	22-Jun-04	18:10	18:50	0:40			7	0	5	2					2								
Photo/wait for conditions for walk survey	24-Jun-04	8:30	10:45	2:15			4	0	3	0					2	3							
Visit sec 32 at night after rain	24-Jun-04	20:30	23:15	2:45			0	0	0	0								x	x	x	x	x	x
Trap check/fix	25-Jun-04	19:30	0:30	5:00			11	0	1	1					3							x	x
Photo trap/habitat	25-Jun-04	12:30	15:45	3:15			2	0	0	0				2									
Trap check/pull traps	26-Jun-04	17:30	20:45	3:15			7	1	2	1	1			3		2		x	x				
Trap check/pull traps	27-Jun-04	10:10	13:05	2:55			3	1	4	1													
Totals by species				38 hrs	0	0	131	5	110	15	1	1	2	13	29	53							
Total sightings reptiles (360)																							
Total estimated sightings of amphibains (500+)																							

Table 7. Habitat and microhabitat of sand dune lizards observed during June 2004 field work on LES NEF study.

Waypoint	General location	Sa-m	Sa-f	Sa-no sex	Blowout size	Blowout length (ft)	Blowout depth (ft)	Habitat	Micro location
EUN VERIFI	verification site (V site)		1		BH	150	45	sd-(high)	blowout ridge between blowouts
	verification site				BH	100	30	sd-(high)	blowout ridge between blowouts
EUN VERIFI	verification site			1	BH	200	40	sd-(high)	juv, blowout side
EUN VERIFI	verification site			1	BH	200	40	sd-(high)	blowout side
EUN VERIFI	verification site	1			BH	200	40	sd-(high)	blowout top
EUN VERIFI	verification site		1		BH	200	40	sd-(high)	blowout top
EUN VERIFI	verification site		1		BH	200	40	sd-(high)	blowout side
EUN VERIFI	verification site			1	BH	200	40	sd-(high)	blowout side
EUN VERIFI	verification site	1			BH	200	40	sd-(high)	blowout top
EUN VERIFI	verification site		1		BH	200	40	sd-(high)	blowout side
EUN SVSA01	south of V site, north of sec 32		1		BH	325	50	sd-(high)	blowout side
EUN SVSA02	south of V site, north of sec 32	1			BH	325	50	sd-(high)	blowout top
EUN SVSA03	south of V site, north of sec 32		1		BH	150	30	sd-(high)	blowout top
EUN SVSA04	south of V site, north of sec 32		1		BM	60	20	sd-(high)	blowout bottom
EUN SVSA05	south of V site, north of sec 32	1			BH	130	35	sd-(high)	blowout side
EUN SVSA06	south of V site, north of sec 32	1			BH	220	30	sd-(high)	blowout side

Appendix 1. Field data for standardized lizard surveys.

Survey name	Time start	Time end	Total time	Date	Sa-T	Sa-m	Sa-f	Us-m	Us-f	Us-j	Us-T	Hm-m	Hm-f	Hm	Ct	CxT	Cs-m	Cs-f	Cs	No ID lizard	To	ToT	Ma.fl	Snake Track	Relief R1 (ft)	R2	R3	R4	R5
Verification site	7:10	10:20	3:10	18-Jun-04	6	3	3	2	1		3		2	2	1				0		3	15							
Between verification site + sec 32	8:15	13:10	4:55	20-Jun-04	1	1					0			0		2			0		1	2							
	8:30				0						0			0					0						1	10	3	35	1
	8:45				0			4	1		5			0		6			0		1	1			3	3	1	1	1
	9:00				0			1			1			0		10			0						30	5	20	30	20
	9:30				0						0			0					0						2	10	25	25	2
	10:00				0			2			2	1		1	2	3	1	1	2		1				5	3	8	25	25
	10:30				0			2			2			0	1				0			3			3	8	6	6	5
	10:45				0			2			2			0	1	12			0			2			40	20	30	50	25
	11:00				0				3		3			0	3	8			0						1	1	20	28	3
	11:15				0						0			0					0						1	1	1	1	1
	11:30				0				3		3			0	1		1		1						25	20	5	5	3
	12:00				0						0			0					0						2	2	15	8	3
	12:15				0			2	4		6			0	2				0						6	3	2	5	5
	12:45				0				1		1		2	2					0						5	2	1	1	1
		13:10			0			1	2		3			0					0										
EUNNORTH7-EUN056-57 (west of quarry)	18:33	20:10	1:37	21-Jun-04	0			2	2		4			0		10			0		1	2		1	7	3	8	6	10
					0			1			1	1		1					0										
					0						0			0					0										
Westside, sec 32	12:45	14:45	2:00	22-Jun-04	0			4	4		8			0	17	23			0						10	7	7	3	3
	13:00				0						0			0					0						8	12	3	6	3
	13:15				0						0			0					0						1	1	1	1	1
	1:30				0						0		1	1	4				0						1	1	1	3	3
(W of west side of 32 (EUN058))	13:50	14:25			0			2	2		4			0					0			2							
	14:30	14:45			0			1			1		1	1	3	5			0						8	2	3	2	2
East side, sec 32	10:45	13:30	2:45	24-Jun-04	0			3	3		6			0	6	35			0		2	5	1	1	6	7	5	3	6
	11:15				0						0			0					0						1	1	1	1	1
	11:30				0						0			0					0						5	2	4	6	3
	11:45				0			3	4		7			0	8	40	7		7			2		2	1	1	1	1	1
	12:00				0						0			0					0						3	3	5	6	5
	12:15				0						0			0					0						8	10	3	2	2
	12:30				0						0			0		10			0						1	2	1	2	1
	12:45				0						0			0					0						1	1	1	1	1
	13:00				0						0			0					0						6	3	6	3	3
	13:15				0						0			0					0						3	3	1	1	1

Appendix 1. Field data for standardized lizard surveys.

Survey name	Open substrate (%)	No. BS	No. BM	No. BH	Plant habitats Q1	Q2	Q3	Q4	Comments from notes
Verification site									investigate Sa activity in prep for surveys sec 32, 1 hr of observation time in survey.
Between verification site + sec 32									
	40		1	1	sf	sf	sd-(high)	sfm	
	1		2		sfy	sfm	sfy	sfy	
	40	4	4	4	mss	sdmss	sf	sdmssg	
	40	3	4	1	sfm	sdm	sd	sd	
	30	15	20	3	sd-(low)mss	sd-(med)mss	sd-(high)m	sd-(high)m	
	30			1	mcops(ss)	msgssy	sfmssy	sfm	
	50				sd-(high)mss	sd-(high)mss	sfmssgy	sfmssgy	
	40	14	7		sfm	sd-(high)	sfm	sfm	
	0				sfm	sfm	sf	sd	
	40	13		1	sf	sd-(low)	sd-(high)m	sd-(high)m	
	20				sfm	sd-(low)m	sd(med)m	sfm	
	10	15	5	3	sd-(low)y	sfyg	sfy	sfmgy	
	10	25	7		sf	sf	sf	sfm	
		10	5						
EUNNORTH7-EUN056-57 (west of quarry)	10	10	15	10	sd-(low)mgss	sd-(med/low)	Mcops(ss)gy	sfg	
Westside, sec 32	40	11	18	10	smcopss	sd-(med)ssm	sd-(low)ssm	mcopssgs	
	40				mcop(ss)sy	mcop(ss)s	mcop(ss)s	mcop(ss)gs	
	20				gs	g(ss)s	gs(ss)	s(ss)	
	30	25	6	0	sd-(low)mssg	sfg(ss)m	sd-(low)g	sfg	
(W of west side of 32 (EUN058))		25	25	5	sd-(low/med)mg	sfmg	sfmg	sfmg	Blowouts clogged w of west side sec 32, firm red substrate
	40	3	5	1	gsf	sfg	sd-(med)mg	sd-(low)gm	
East side, sec 32	30	56	37	4	sd-(low)mss	sd-(low)mss	mg	sfyg	
	20				sfgy	sfgy	sfgym	sfgym	
	40	8	10	2	sd-(low)m	sfmg	sd-(low)mgy	sd-(low)mgy	
	10	75	46	8	mg(ss)s	mg(ss)s	mg(ss)s	mg(ss)s	
	50				mcopssgy	mcopssgy	mcopssgy	mcopssgy	
	30				mcop(ss)s	mcop(ss)s	sfssg	sd-(med)ssg	
	10				mg(ss)sy	mg(ss)sy	mg(ss)sy	mgy	
	10				mgs	mgsy	mgsy	mgsy	
	50				(ss)smy	(ss)smy	(ss)smy	(ss)smy	
	40				sd-(low)mssy	sd-(low)mssy	sd-(low)mssy	mgsy	

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
1	NWBsec32	0.51
2	NWBsec32	0.48
3	NWBsec32	4.09
4	NWBsec32	3.56
5	NWBsec32	2.29
6	NWBsec32	2.62
7	NWBsec32	0.53
8	NWBsec32	2.18
9	NWBsec32	2.29
10	NWBsec32	1.78
11	NWBsec32	1.55
12	NWBsec32	2.36
13	NWBsec32	2.16
14	NWBsec32	1.85
15	NWBsec32	2.44
16	NWBsec32	1.65
17	NWBsec32	1.57
18	NWBsec32	1.57
19	NWBsec32	0.53
20	NWBsec32	1.30
21	NWBsec32	2.77
22	NWBsec32	0.64
23	NWBsec32	0.61
24	NWBsec32	0.69
25	NWBsec32	1.78
26	NWBsec32	1.88
27	NWBsec32	1.27
28	NWBsec32	2.69
29	NWBsec32	2.11
30	NWBsec32	4.52
31	NWBsec32	1.37
32	NWBsec32	3.71
33	NWBsec32	3.18
34	NWBsec32	2.84
35	NWBsec32	0.89
36	NWBsec32	0.41
37	NWBsec32	0.41
38	NWBsec32	0.41
39	NWBsec32	1.19
40	NWBsec32	1.52
41	NWBsec32	1.83
42	NWBsec32	5.72
43	NWBsec32	2.41
44	NWBsec32	4.27
45	NWBsec32	0.43
46	NWBsec32	1.50
47	NWBsec32	2.69
48	NWBsec32	1.78
49	NWBsec32	2.18
50	NWBsec32	3.02
51	NWBsec32	1.50
52	NWBsec32	1.88
53	NWBsec32	3.61
54	NWBsec32	3.94
55	NWBsec32	1.63
56	NWBsec32	1.80
57	NWBsec32	3.00
58	NWBsec32	1.37
59	NWBsec32	1.78
60	NWBsec32	4.29
61	NWBsec32	1.60
62	NWBsec32	1.70
63	NWBsec32	1.68
64	NWBsec32	1.70
65	NWBsec32	1.78
66	NWBsec32	2.64
67	NWBsec32	2.21
68	NWBsec32	2.67

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
69	NWBsec32	3.40
70	NWBsec32	2.34
71	NWBsec32	1.75
72	NWBsec32	1.78
73	NWBsec32	2.01
74	NWBsec32	0.53
75	NWBsec32	0.36
76	NWBsec32	0.28
77	NWBsec32	1.42
78	NWBsec32	3.58
79	NWBsec32	1.70
80	NWBsec32	1.14
81	NWBsec32	0.99
82	NWBsec32	1.22
83	NWBsec32	1.50
84	NWBsec32	1.88
85	NWBsec32	2.01
86	NWBsec32	2.11
87	NWBsec32	0.69
88	NWBsec32	0.36
89	NWBsec32	1.57
90	NWBsec32	0.46
91	NWBsec32	3.76
92	NWBsec32	2.44
93	NWBsec32	1.24
94	NWBsec32	1.35
95	NWBsec32	0.41
96	NWBsec32	0.46
97	NWBsec32	0.18
98	NWBsec32	0.23
99	NWBsec32	0.03
100	NWBsec32	0.41
101	NWBsec32	0.94
102	NWBsec32	1.63
103	NWBsec32	3.05
104	NWBsec32	1.50
105	NWBsec32	3.30
106	NWBsec32	0.48
107	NWBsec32	0.97
108	NWBsec32	1.55
109	NWBsec32	0.53
110	NWBsec32	2.16
111	NWBsec32	1.75
112	NWBsec32	0.38
113	NWBsec32	0.48
114	NWBsec32	0.94
115	NWBsec32	3.18
116	NWBsec32	4.14
117	NWBsec32	2.31
118	NWBsec32	3.66
119	NWBsec32	1.22
120	NWBsec32	1.42
121	NWBsec32	1.68
122	NWBsec32	0.36
123	NWBsec32	0.51
124	NWBsec32	0.66
125	NWBsec32	1.68
126	NWBsec32	0.51
127	NWBsec32	0.48
128	NWBsec32	0.51
129	NWBsec32	0.43
130	NWBsec32	0.38
131	NWBsec32	0.51
132	NWBsec32	0.58
133	NWBsec32	0.56
134	NWBsec32	0.71
135	NWBsec32	2.01
136	NWBsec32	1.52

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
137	NWBsec32	1.78
138	NWBsec32	1.78
139	NWBsec32	2.03
140	NWBsec32	0.69
141	NWBsec32	1.55
142	NWBsec32	0.51
143	NWBsec32	0.89
144	NWBsec32	5.08
145	NWBsec32	0.97
146	NWBsec32	0.36
147	NWBsec32	0.33
148	NWBsec32	0.28
149	NWBsec32	0.28
150	NWBsec32	1.19
151	NWBsec32	0.69
152	NWBsec32	1.04
153	NWBsec32	0.84
154	NWBsec32	0.36
155	NWBsec32	0.43
156	NWBsec32	0.46
157	NWBsec32	0.56
158	NWBsec32	1.02
159	NWBsec32	0.66
160	NWBsec32	0.79
161	NWBsec32	0.41
162	NWBsec32	0.30
163	NWBsec32	0.30
164	NWBsec32	0.30
165	NWBsec32	0.30
166	NWBsec32	0.30
167	NWBsec32	0.30
168	NWBsec32	0.30
169	NWBsec32	1.52
170	NWBsec32	0.53
171	NWBsec32	0.76
172	NWBsec32	0.74
173	NWBsec32	0.41
174	NWBsec32	0.58
175	NWBsec32	1.32
176	NWBsec32	0.64
177	NWBsec32	0.64
178	NWBsec32	0.36
179	NWBsec32	0.41
180	NWBsec32	0.43
181	NWBsec32	0.43
182	NWBsec32	2.31
183	NWBsec32	0.61
184	NWBsec32	1.09
185	NWBsec32	1.60
186	NWBsec32	1.50
187	NWBsec32	2.16
188	NWBsec32	2.84
189	NWBsec32	1.78
190	NWBsec32	1.63
191	NWBsec32	2.08
192	NWBsec32	0.56
193	NWBsec32	0.56
194	NWBsec32	0.43
195	NWBsec32	0.36
196	NWBsec32	0.36
197	NWBsec32	0.48
198	NWBsec32	3.33
199	NWBsec32	2.97
200	NWBsec32	2.67
201	Vsite	1.91
202	Vsite	4.24
203	Vsite	2.46
204	Vsite	3.25

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
205	Vsite	2.41
206	Vsite	0.30
207	Vsite	3.45
208	Vsite	2.77
209	Vsite	4.72
210	Vsite	1.80
211	Vsite	5.38
212	Vsite	4.62
213	Vsite	3.76
214	Vsite	3.05
215	Vsite	3.48
216	Vsite	6.02
217	Vsite	2.84
218	Vsite	3.40
219	Vsite	4.14
220	Vsite	3.35
221	Vsite	3.91
222	Vsite	3.99
223	Vsite	2.49
224	Vsite	2.87
225	Vsite	3.43
226	Vsite	3.25
227	Vsite	3.23
228	Vsite	2.77
229	Vsite	3.66
230	Vsite	2.84
231	Vsite	4.39
232	Vsite	3.18
233	Vsite	2.69
234	Vsite	2.11
235	Vsite	4.32
236	Vsite	3.35
237	Vsite	3.28
238	Vsite	4.67
239	Vsite	3.00
240	Vsite	2.49
241	Vsite	2.67
242	Vsite	3.25
243	Vsite	1.96
244	Vsite	3.10
245	Vsite	2.79
246	Vsite	3.84
247	Vsite	3.38
248	Vsite	2.57
249	Vsite	2.74
250	Vsite	2.95
251	Vsite	4.72
252	Vsite	3.38
253	Vsite	3.40
254	Vsite	3.10
255	Vsite	3.10
256	Vsite	3.61
257	Vsite	2.69
258	Vsite	2.57
259	Vsite	3.61
260	Vsite	4.27
261	Vsite	3.51
262	Vsite	2.41
263	Vsite	3.51
264	Vsite	2.24
265	Vsite	2.44
266	Vsite	3.35
267	Vsite	3.86
268	Vsite	3.56
269	Vsite	2.97
270	Vsite	2.82
271	Vsite	2.41
272	Vsite	3.20

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
273	Vsite	3.35
274	Vsite	4.24
275	Vsite	1.88
276	Vsite	2.06
277	Vsite	2.90
278	Vsite	3.10
279	Vsite	4.78
280	Vsite	3.43
281	Vsite	2.97
282	Vsite	2.44
283	Vsite	4.95
284	Vsite	4.09
285	Vsite	5.23
286	Vsite	3.84
287	Vsite	3.99
288	Vsite	2.16
289	Vsite	3.23
290	Vsite	2.74
291	Vsite	3.38
292	Vsite	3.66
293	Vsite	2.36
294	Vsite	2.92
295	Vsite	1.68
296	Vsite	3.18
297	Vsite	2.01
298	Vsite	4.17
299	Vsite	3.45
300	Vsite	4.39
301	Vsite	4.72
302	Vsite	3.07
303	Vsite	2.18
304	Vsite	4.01
305	Vsite	2.36
306	Vsite	4.78
307	Vsite	2.57
308	Vsite	2.18
309	Vsite	3.78
310	Vsite	4.06
311	Vsite	2.49
312	Vsite	2.44
313	Vsite	3.86
314	Vsite	1.55
315	Vsite	3.12
316	Vsite	3.56
317	Vsite	4.11
318	Vsite	2.51
319	Vsite	4.19
320	Vsite	2.57
321	Vsite	3.02
322	Vsite	2.84
323	Vsite	2.24
324	Vsite	4.67
325	Vsite	4.01
326	Vsite	2.77
327	Vsite	4.19
328	Vsite	2.44
329	Vsite	2.59
330	Vsite	2.84
331	Vsite	3.61
332	Vsite	1.68
333	Vsite	3.99
334	Vsite	2.64
335	Vsite	3.96
336	Vsite	1.17
337	Vsite	3.45
338	Vsite	2.31
339	Vsite	3.73
340	Vsite	4.80

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
341	Vsite	5.21
342	Vsite	3.76
343	Vsite	1.02
344	Vsite	2.95
345	Vsite	2.59
346	Vsite	1.07
347	Vsite	2.57
348	Vsite	3.51
349	Vsite	3.99
350	Vsite	1.75
351	Vsite	3.25
352	Vsite	2.95
353	Vsite	2.90
354	Vsite	3.30
355	Vsite	2.59
356	Vsite	4.04
357	Vsite	5.31
358	Vsite	3.66
359	Vsite	3.63
360	Vsite	3.20
361	Vsite	3.81
362	Vsite	3.66
363	Vsite	2.82
364	Vsite	1.57
365	Vsite	4.85
366	Vsite	2.46
367	Vsite	2.51
368	Vsite	4.27
369	Vsite	3.20
370	Vsite	2.36
371	Vsite	2.11
372	Vsite	2.26
373	Vsite	3.10
374	Vsite	3.45
375	Vsite	4.11
376	Vsite	3.02
377	Vsite	4.70
378	Vsite	3.86
379	Vsite	4.70
380	Vsite	3.43
381	Vsite	3.71
382	Vsite	2.67
383	Vsite	2.54
384	Vsite	2.18
385	Vsite	4.06
386	Vsite	2.44
387	Vsite	1.40
388	Vsite	4.34
389	Vsite	2.90
390	Vsite	3.45
391	Vsite	2.21
392	Vsite	4.04
393	Vsite	3.53
394	Vsite	2.97
395	Vsite	2.74
396	Vsite	3.86
397	Vsite	1.27
398	Vsite	1.19
399	Vsite	1.04
400	Vsite	2.77
401	SFsec32	2.46
402	SFsec32	2.11
403	SFsec32	0.79
404	SFsec32	2.16
405	SFsec32	1.19
406	SFsec32	1.35
407	SFsec32	0.48
408	SFsec32	0.43

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
409	SFsec32	0.36
410	SFsec32	0.36
411	SFsec32	0.36
412	SFsec32	0.36
413	SFsec32	0.33
414	SFsec32	0.30
415	SFsec32	0.69
416	SFsec32	0.94
417	SFsec32	0.20
418	SFsec32	0.20
419	SFsec32	1.24
420	SFsec32	0.25
421	SFsec32	0.20
422	SFsec32	0.20
423	SFsec32	0.46
424	SFsec32	0.48
425	SFsec32	0.48
426	SFsec32	0.36
427	SFsec32	1.12
428	SFsec32	0.74
429	SFsec32	1.50
430	SFsec32	0.38
431	SFsec32	0.28
432	SFsec32	0.18
433	SFsec32	0.18
434	SFsec32	0.10
435	SFsec32	0.36
436	SFsec32	0.53
437	SFsec32	0.33
438	SFsec32	0.79
439	SFsec32	0.71
440	SFsec32	0.43
441	SFsec32	0.81
442	SFsec32	2.34
443	SFsec32	1.70
444	SFsec32	2.16
445	SFsec32	2.08
446	SFsec32	3.81
447	SFsec32	4.22
448	SFsec32	2.36
449	SFsec32	1.47
450	SFsec32	2.16
451	SFsec32	1.32
452	SFsec32	2.21
453	SFsec32	2.18
454	SFsec32	1.73
455	SFsec32	0.69
456	SFsec32	0.53
457	SFsec32	0.38
458	SFsec32	0.41
459	SFsec32	0.69
460	SFsec32	0.48
461	SFsec32	2.84
462	SFsec32	1.75
463	SFsec32	2.18
464	SFsec32	2.03
465	SFsec32	0.69
466	SFsec32	0.53
467	SFsec32	0.41
468	SFsec32	0.43
469	SFsec32	0.46
470	SFsec32	0.36
471	SFsec32	1.14
472	SFsec32	1.52
473	SFsec32	2.03
474	SFsec32	3.28
475	SFsec32	0.41
476	SFsec32	0.76

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
477	SFsec32	1.12
478	SFsec32	1.65
479	SFsec32	2.54
480	SFsec32	3.35
481	SFsec32	3.53
482	SFsec32	2.59
483	SFsec32	0.74
484	SFsec32	0.81
485	SFsec32	0.76
486	SFsec32	0.64
487	SFsec32	0.51
488	SFsec32	1.50
489	SFsec32	2.57
490	SFsec32	0.46
491	SFsec32	0.64
492	SFsec32	0.41
493	SFsec32	0.41
494	SFsec32	0.69
495	SFsec32	0.61
496	SFsec32	0.58
497	SFsec32	2.06
498	SFsec32	1.35
499	SFsec32	0.28
500	SFsec32	0.30
501	SFsec32	0.25
502	SFsec32	0.64
503	SFsec32	0.71
504	SFsec32	0.69
505	SFsec32	1.73
506	SFsec32	0.94
507	SFsec32	0.33
508	SFsec32	0.30
509	SFsec32	0.66
510	SFsec32	4.19
511	SFsec32	2.13
512	SFsec32	0.33
513	SFsec32	0.30
514	SFsec32	0.76
515	SFsec32	0.36
516	SFsec32	0.33
517	SFsec32	0.33
518	SFsec32	1.73
519	SFsec32	0.58
520	SFsec32	0.58
521	SFsec32	0.79
522	SFsec32	0.33
523	SFsec32	0.53
524	SFsec32	0.58
525	SFsec32	0.51
526	SFsec32	0.86
527	SFsec32	0.36
528	SFsec32	0.43
529	SFsec32	0.46
530	SFsec32	1.45
531	SFsec32	4.29
532	SFsec32	0.58
533	SFsec32	0.46
534	SFsec32	0.30
535	SFsec32	1.19
536	SFsec32	0.61
537	SFsec32	0.43
538	SFsec32	0.41
539	SFsec32	0.64
540	SFsec32	0.28
541	SFsec32	0.28
542	SFsec32	0.43
543	SFsec32	1.83
544	SFsec32	0.08

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
545	SFsec32	0.13
546	SFsec32	0.15
547	SFsec32	0.20
548	SFsec32	0.20
549	SFsec32	0.20
550	SFsec32	0.20
551	SFsec32	0.23
552	SFsec32	0.33
553	SFsec32	0.64
554	SFsec32	0.71
555	SFsec32	0.74
556	SFsec32	0.76
557	SFsec32	0.43
558	SFsec32	0.46
559	SFsec32	0.38
560	SFsec32	1.27
561	SFsec32	1.57
562	SFsec32	2.72
563	SFsec32	1.42
564	SFsec32	0.64
565	SFsec32	0.81
566	SFsec32	0.56
567	SFsec32	0.53
568	SFsec32	0.97
569	SFsec32	0.51
570	SFsec32	0.43
571	SFsec32	0.56
572	SFsec32	0.64
573	SFsec32	0.41
574	SFsec32	0.18
575	SFsec32	0.18
576	SFsec32	0.18
577	SFsec32	0.18
578	SFsec32	0.30
579	SFsec32	0.91
580	SFsec32	0.84
581	SFsec32	0.20
582	SFsec32	0.33
583	SFsec32	0.18
584	SFsec32	0.20
585	SFsec32	2.62
586	SFsec32	0.84
587	SFsec32	0.64
588	SFsec32	0.46
589	SFsec32	0.33
590	SFsec32	0.43
591	SFsec32	0.43
592	SFsec32	0.53
593	SFsec32	0.61
594	SFsec32	1.42
595	SFsec32	0.46
596	SFsec32	0.41
597	SFsec32	0.36
598	SFsec32	0.84
599	SFsec32	0.99
600	SFsec32	0.86
601	MGsec32	4.32
602	MGsec32	1.68
603	MGsec32	1.19
604	MGsec32	0.20
605	MGsec32	0.36
606	MGsec32	0.74
607	MGsec32	0.71
608	MGsec32	0.74
609	MGsec32	0.51
610	MGsec32	0.84
611	MGsec32	0.61
612	MGsec32	0.69

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
613	MGsec32	0.66
614	MGsec32	0.33
615	MGsec32	0.84
616	MGsec32	0.41
617	MGsec32	0.20
618	MGsec32	0.48
619	MGsec32	0.41
620	MGsec32	0.51
621	MGsec32	0.48
622	MGsec32	0.69
623	MGsec32	0.66
624	MGsec32	0.20
625	MGsec32	0.81
626	MGsec32	0.53
627	MGsec32	1.30
628	MGsec32	0.28
629	MGsec32	0.30
630	MGsec32	0.99
631	MGsec32	3.12
632	MGsec32	1.65
633	MGsec32	1.19
634	MGsec32	2.29
635	MGsec32	0.66
636	MGsec32	0.51
637	MGsec32	0.51
638	MGsec32	0.28
639	MGsec32	0.43
640	MGsec32	1.42
641	MGsec32	0.36
642	MGsec32	0.36
643	MGsec32	0.36
644	MGsec32	0.43
645	MGsec32	0.51
646	MGsec32	0.51
647	MGsec32	1.65
648	MGsec32	0.74
649	MGsec32	0.89
650	MGsec32	0.79
651	MGsec32	0.58
652	MGsec32	0.38
653	MGsec32	0.74
654	MGsec32	0.69
655	MGsec32	2.16
656	MGsec32	0.76
657	MGsec32	1.04
658	MGsec32	0.69
659	MGsec32	0.99
660	MGsec32	0.61
661	MGsec32	0.61
662	MGsec32	1.12
663	MGsec32	0.25
664	MGsec32	0.25
665	MGsec32	0.25
666	MGsec32	0.25
667	MGsec32	0.25
668	MGsec32	0.25
669	MGsec32	0.99
670	MGsec32	3.96
671	MGsec32	1.57
672	MGsec32	0.30
673	MGsec32	0.20
674	MGsec32	0.20
675	MGsec32	0.20
676	MGsec32	0.20
677	MGsec32	0.20
678	MGsec32	0.51
679	MGsec32	0.18
680	MGsec32	0.18

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
681	MGsec32	0.43
682	MGsec32	0.23
683	MGsec32	0.23
684	MGsec32	0.23
685	MGsec32	1.30
686	MGsec32	1.07
687	MGsec32	1.52
688	MGsec32	0.61
689	MGsec32	2.74
690	MGsec32	2.64
691	MGsec32	1.85
692	MGsec32	0.46
693	MGsec32	0.28
694	MGsec32	0.51
695	MGsec32	0.51
696	MGsec32	1.70
697	MGsec32	0.33
698	MGsec32	0.51
699	MGsec32	0.56
700	MGsec32	0.71
701	MGsec32	0.13
702	MGsec32	0.13
703	MGsec32	0.13
704	MGsec32	0.36
705	MGsec32	0.58
706	MGsec32	0.23
707	MGsec32	0.23
708	MGsec32	0.23
709	MGsec32	0.33
710	MGsec32	0.33
711	MGsec32	1.40
712	MGsec32	1.73
713	MGsec32	0.56
714	MGsec32	0.48
715	MGsec32	0.41
716	MGsec32	1.63
717	MGsec32	0.33
718	MGsec32	0.23
719	MGsec32	0.23
720	MGsec32	1.93
721	MGsec32	1.47
722	MGsec32	1.32
723	MGsec32	0.43
724	MGsec32	0.38
725	MGsec32	0.38
726	MGsec32	0.38
727	MGsec32	0.38
728	MGsec32	0.48
729	MGsec32	0.18
730	MGsec32	0.25
731	MGsec32	0.25
732	MGsec32	0.71
733	MGsec32	0.43
734	MGsec32	0.20
735	MGsec32	0.56
736	MGsec32	0.48
737	MGsec32	0.53
738	MGsec32	0.20
739	MGsec32	0.20
740	MGsec32	0.30
741	MGsec32	0.43
742	MGsec32	0.33
743	MGsec32	0.25
744	MGsec32	0.25
745	MGsec32	0.25
746	MGsec32	0.30
747	MGsec32	0.30
748	MGsec32	0.30

Appendix 2. Substrate particle width measurements.

Sample no.	Site	Length of particle (mm)
749	MGsec32	1.85
750	MGsec32	0.86
751	MGsec32	0.71
752	MGsec32	0.81
753	MGsec32	1.07
754	MGsec32	0.38
755	MGsec32	0.38
756	MGsec32	0.51
757	MGsec32	0.41
758	MGsec32	0.41
759	MGsec32	0.41
760	MGsec32	0.23
761	MGsec32	0.23
762	MGsec32	0.23
763	MGsec32	0.58
764	MGsec32	0.25
765	MGsec32	0.30
766	MGsec32	0.30
767	MGsec32	0.36
768	MGsec32	0.18
769	MGsec32	0.20
770	MGsec32	0.76
771	MGsec32	0.93
772	MGsec32	2.06
773	MGsec32	0.41
774	MGsec32	0.61
775	MGsec32	0.53
776	MGsec32	0.33
777	MGsec32	0.48
778	MGsec32	0.38
779	MGsec32	0.33
780	MGsec32	0.41
781	MGsec32	0.20
782	MGsec32	0.20
783	MGsec32	0.58
784	MGsec32	0.43
785	MGsec32	0.53
786	MGsec32	0.69
787	MGsec32	0.20
788	MGsec32	0.23
789	MGsec32	1.32
790	MGsec32	1.45
791	MGsec32	0.71
792	MGsec32	0.38
793	MGsec32	1.22
794	MGsec32	1.02
795	MGsec32	0.84
796	MGsec32	0.69
797	MGsec32	0.86
798	MGsec32	0.56
799	MGsec32	0.33
800	MGsec32	0.33

Appendix 3. Reference GPS points for all field work (2003-2004).

Name change (original in gps unit)	WP type	GPS WayPoints (NAD83)	Degrees	Mins	Degrees	Mins	Elevation (ft)	Date - Time	Date	Time part A	Time part B
	monitor	EUNM01	32	22.609	-103	18.719	3566	##########	23-Jun-04	10:31	AM
	monitor	EUNM02	32	22.970	-103	18.448	3584	##########	23-Jun-04	11:00	AM
	monitor	EUNM03	32	23.396	-103	18.637	3598	##########	23-Jun-04	11:13	AM
	monitor	EUNM04	32	23.919	-103	18.593	3585	##########	23-Jun-04	11:25	AM
	monitor	EUNM05	32	23.942	-103	18.202	3580	##########	23-Jun-04	11:28	AM
	monitor	EUNM06	32	25.280	-103	17.753	3600	##########	23-Jun-04	11:43	AM
	monitor	EUNM07	32	18.394	-103	18.231	3445	##########	23-Jun-04	8:14	PM
	monitor	EUNM08	32	18.661	-103	18.430	3459	##########	23-Jun-04	8:51	PM
	monitor	EUNM09	32	19.463	-103	18.755	3485	##########	23-Jun-04	8:58	PM
	monitor	EUNM10	32	26.686	-103	6.336	3429	##########	24-Jun-04	5:37	PM
	monitor	EUNM11	32	26.772	-103	5.678	3389	##########	25-Jun-04	4:57	PM
EUMM12	monitor	EUNM12	32	26.753	-103	5.823	3413	##########	25-Jun-04	4:59	PM
	monitor	EUNM13	32	26.886	-103	6.855	3405	##########	25-Jun-04	5:17	PM
EUMM14	monitor	EUNM14	32	28.313	-103	18.359	3625	##########	25-Jun-04	6:27	PM
	monitor	EUNM15	32	28.896	-103	18.403	3643	##########	25-Jun-04	6:47	PM
	monitor	EUNM16	32	33.541	-103	20.290	3618	##########	25-Jun-04	8:45	PM
	monitor	EUNM17	32	33.538	-103	19.866	3601	##########	25-Jun-04	8:50	PM
	monitor	EUNM18	32	33.179	-103	19.605	3595	##########	25-Jun-04	9:03	PM
	monitor	EUNM19	32	32.655	-103	19.597	3591	##########	25-Jun-04	9:07	PM
	monitor	EUNM20	32	23.669	-103	14.973	3545	##########	26-Jun-04	1:43	PM
	monitor	EUNM21	32	23.558	-103	14.234	3514	##########	26-Jun-04	1:53	PM
	monitor	EUNM22	32	22.911	-103	14.382	3509	##########	26-Jun-04	1:59	PM
	monitor	EUNM23	32	25.701	-103	7.000	3367	##########	26-Jun-04	2:53	PM
	Sa-New Record	EUN SVSA01	32	30.461	-103	5.919	3498	##########	18-Jun-04	12:10	PM
	Sa-New Record	EUN SVSA02	32	30.441	-103	5.878	3582	##########	18-Jun-04	12:29	PM
	Sa-New Record	EUN SVSA03	32	29.325	-103	5.332	3572	##########	18-Jun-04	2:02	PM
	Sa-New Record	EUN SVSA04	32	29.188	-103	4.837	3596	##########	18-Jun-04	2:28	PM
	Sa-New Record	EUN SVSA05	32	29.079	-103	4.586	3598	6/21/2004 9:38	21-Jun-04	9:38	AM
EUM SVSA06	Sa-New Record	EUN SVSA06	32	30.038	-103	6.339	3569	##########	23-Jun-04	4:31	PM
EUN059	Sa Location	EUN SVSA07	32	29.020	-103	5.579	3562	##########	23-Jun-04	12:52	PM
	Sa-Record	EUN VERI2	32	31.910	-103	5.826	3561	##########	26-Jun-04	12:19	PM
	Sa-Record	EUN VERI3	32	31.975	-103	5.624	3579	##########	26-Jun-04	12:25	PM
	Sa-Record	EUN VERIFI	32	31.535	-103	5.853	3631	##########	26-Sep-03	10:44	PM
	Sa Range	EUN NORTH1	32	29.544	-103	6.814	3475	##########	26-Sep-03	10:48	PM
	Sa Range	EUN NORTH5	32	27.373	-103	5.827	3476	##########	28-Sep-03	11:16	PM
	Sa Range	EUN NORTH6	32	27.759	-103	5.827	3483	##########	28-Sep-03	11:18	PM
	Sa Range	EUN NORTH7	32	27.303	-103	5.839	3448	##########	28-Sep-03	11:21	PM
	Sa Range	EUN010	32	31.325	-103	6.475	3418	##########	17-Jun-04	12:05	PM
	Sa Range	EUN011	32	30.497	-103	5.915	3561	##########	17-Jun-04	1:29	PM
	Sa Range	EUN012	32	30.484	-103	4.778	3594	##########	17-Jun-04	1:54	PM
	Sa Range	EUN013	32	30.460	-103	4.429	3587	##########	17-Jun-04	1:59	PM
	Sa Range	EUN014	32	29.975	-103	4.431	3586	##########	17-Jun-04	2:04	PM
	Sa Range	EUN015	32	29.861	-103	4.792	3591	##########	17-Jun-04	2:07	PM
	Sa Range	EUN016	32	29.764	-103	4.611	-6450	##########	17-Jun-04	2:10	PM

Appendix 3. Reference GPS points for all field work (2003-2004).

Name change (original in gps unit)	WP type	GPS WayPoints (NAD83)	Degrees	Mins	Degrees	Mins	Elevation (ft)	Date - Time	Date	Time part A	Time part B
	Sa Range	EUN017	32	29.522	-103	5.037	3587	##########	17-Jun-04	2:14	PM
	Sa Range	EUN018	32	29.414	-103	4.741	3596	##########	17-Jun-04	2:17	PM
	Sa Range	EUN019	32	29.157	-103	4.676	3591	##########	17-Jun-04	2:19	PM
	Sa Range	EUN020	32	28.988	-103	4.894	3587	##########	17-Jun-04	2:23	PM
	Sa Range	EUN021	32	28.887	-103	5.511	3561	##########	17-Jun-04	2:45	PM
	Sa Range	EUN022	32	28.814	-103	5.820	3527	##########	17-Jun-04	2:50	PM
	Sa Range	EUN023	32	28.563	-103	6.219	-6450	##########	17-Jun-04	2:53	PM
	Sa Range	EUN024	32	28.297	-103	6.493	3469	##########	17-Jun-04	2:57	PM
	Sa Range	EUN025	32	28.301	-103	7.478	3446	##########	17-Jun-04	3:01	PM
	Sa Range	EUN026	32	29.220	-103	5.336	3553	##########	17-Jun-04	8:25	PM
	Sa Range	EUN027	32	29.312	-103	5.312	3550	##########	17-Jun-04	8:33	PM
	Sa Range	EUN028	32	29.223	-103	5.194	3576	##########	17-Jun-04	8:48	PM
	Sa Range	EUN029	32	29.109	-103	5.200	3587	##########	17-Jun-04	9:00	PM
	Sa Range	EUN030	32	29.506	-103	3.800	3568	##########	17-Jun-04	9:39	PM
	Sa Range	EUN031	32	29.265	-103	5.047	3592	##########	18-Jun-04	1:30	PM
	Sa Range	EUN032	32	27.880	-103	5.244	3482	##########	18-Jun-04	5:20	PM
	Sa Range	EUN033	32	27.952	-103	5.083	3501	##########	18-Jun-04	5:24	PM
	Sa Range	EUN034	32	28.019	-103	4.938	3524	##########	18-Jun-04	5:29	PM
	Sa Range	EUN035	32	27.944	-103	4.894	3531	##########	18-Jun-04	5:37	PM
	Sa Range	EUN036	32	27.873	-103	4.813	3554	##########	18-Jun-04	5:44	PM
	Sa Range	EUN037	32	28.152	-103	4.666	3525	##########	18-Jun-04	6:13	PM
	Sa Range	EUN038	32	28.230	-103	4.540	3504	##########	18-Jun-04	6:19	PM
	Sa Range	EUN039	32	29.132	-103	4.496	3596	6/21/2004 8:59	21-Jun-04	8:59	AM
	Sa Range	EUN040	32	28.890	-103	4.490	3595	##########	21-Jun-04	10:00	AM
	Sa Range	EUN041	32	28.771	-103	4.402	3604	##########	21-Jun-04	10:11	AM
	Sa Range	EUN042	32	28.764	-103	4.176	3605	##########	21-Jun-04	10:33	AM
	Sa Range	EUN043	32	28.789	-103	3.947	3602	##########	21-Jun-04	10:47	AM
	Sa Range	EUN044	32	28.440	-103	4.376	3590	##########	21-Jun-04	11:26	AM
	Sa Range	EUN045	32	28.400	-103	4.550	3590	##########	21-Jun-04	11:39	AM
	Sa Range	EUN046	32	28.309	-103	4.997	3583	##########	21-Jun-04	12:33	PM
	Sa Range	EUN047	32	28.437	-103	5.078	3583	##########	21-Jun-04	12:52	PM
	Sa Range	EUN048	32	28.562	-103	5.153	3559	##########	21-Jun-04	1:03	PM
	Sa Range	EUN049	32	28.587	-103	5.249	3558	##########	21-Jun-04	1:12	PM
	Sa Range	EUN050	32	28.866	-103	5.191	3549	##########	21-Jun-04	1:32	PM
	Sa Range	EUN051	32	28.976	-103	4.676	-6450	##########	21-Jun-04	1:48	PM
	Sa Range	EUN052	32	28.928	-103	4.687	3572	##########	21-Jun-04	1:55	PM
	Sa Range	EUN053	32	30.573	-103	6.435	3578	##########	21-Jun-04	2:59	PM
	Sa Range	EUN054	32	26.842	-103	5.635	3433	##########	21-Jun-04	7:17	PM
	Sa Range	EUN055	32	27.305	-103	6.336	3432	##########	21-Jun-04	7:29	PM
	Sa Range	EUN056	32	27.369	-103	5.494	3457	##########	21-Jun-04	8:27	PM
EUM057	Sa Range	EUN057	32	27.837	-103	5.831	3483	##########	21-Jun-04	9:11	PM
	Sa Range	EUN058	32	26.318	-103	5.584	3183	##########	22-Jun-04	3:01	PM
	Sa Range	EUN060	32	29.387	-103	3.146	3539	##########	23-Jun-04	2:12	PM
	Sa Range	EUN061	32	29.055	-103	3.198	3540	##########	23-Jun-04	2:17	PM

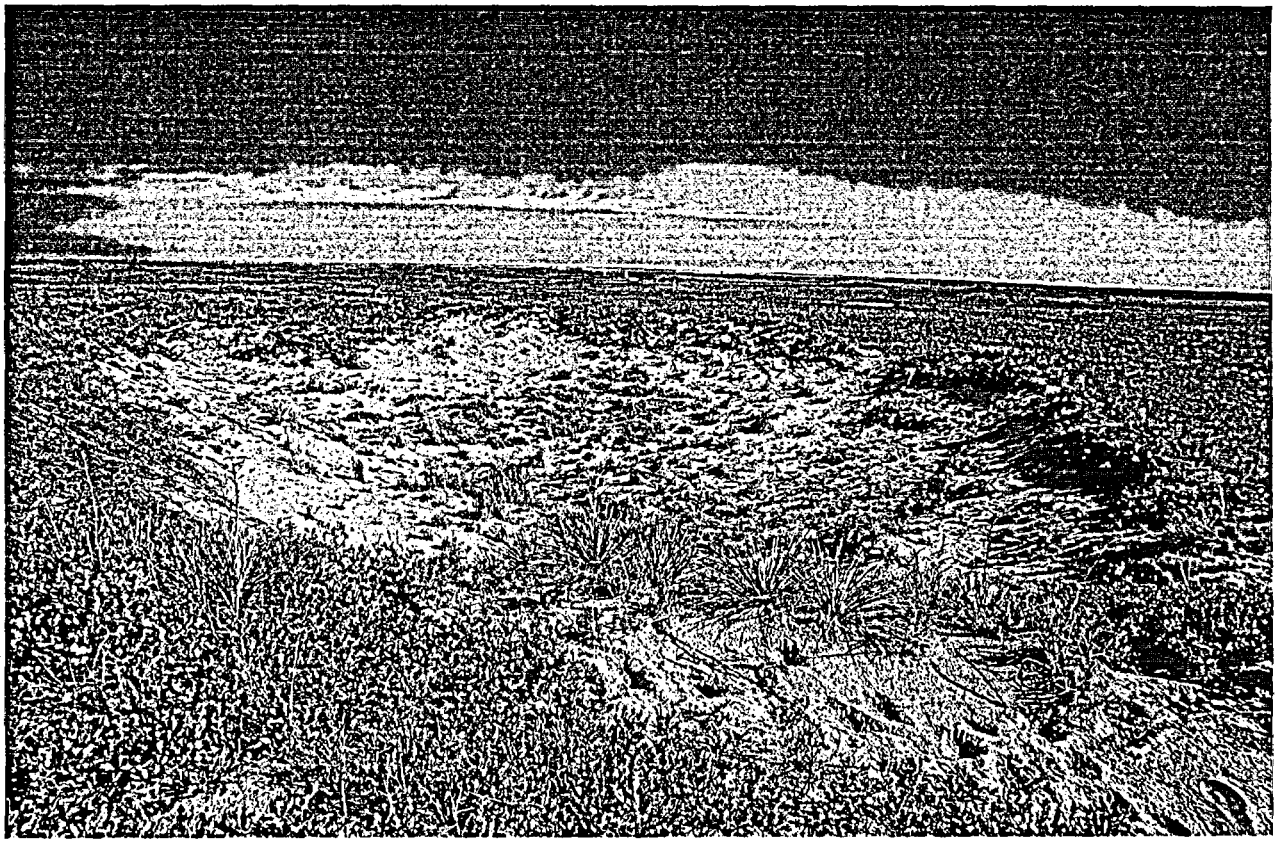
Appendix 3. Reference GPS points for all field work (2003-2004).

Name change (original in gps unit)	WP type	GPS WayPoints (NAD83)	Degrees	Mins	Degrees	Mins	Elevation (ft)	Date - Time	Date	Time part A	Time part B
	Sa Range	EUN062	32	29.127	-103	2.515	3528	##########	23-Jun-04	2:31	PM
	Sa Range	EUN063	32	29.338	-103	3.951	3572	##########	23-Jun-04	3:11	PM
	Sa Range	EUN064	32	29.166	-103	3.987	-6450	##########	23-Jun-04	3:20	PM
	Sa Range	EUN065	32	29.602	-103	6.337	3547	##########	23-Jun-04	4:48	PM
	Sa Range	EUN066	32	29.490	-103	6.366	3533	##########	23-Jun-04	4:56	PM
	Sa Range	EUN067	32	29.788	-103	6.339	3517	##########	23-Jun-04	6:04	PM
	Sa Range	EUN068	32	30.223	-103	6.339	3554	##########	23-Jun-04	6:19	PM
EUM069	Sa Range	EUN069	32	30.610	-103	6.634	3559	##########	23-Jun-04	6:30	PM
	Sa Range	EUNAE01	32	27.797	-103	5.833	3479	##########	21-Jun-04	9:07	PM
	Sa Range	EUNBAKERS2	32	26.969	-103	4.285	3474	##########	22-Jun-04	7:58	PM
	Sa Range	EUNBAKERSP	32	26.935	-103	4.222	3446	##########	22-Jun-04	7:40	PM
	Sa Range	EUNWINDM2	32	28.031	-103	5.476	3487	##########	26-Sep-03	10:51	PM
	Sec 32	EUN NBRAIL	32	26.565	-103	4.948	3458	##########	26-Sep-03	10:27	PM
	Sec 32	EUN NE SEC	32	26.564	-103	4.434	3426	##########	26-Sep-03	10:31	PM
	Sec 32	EUN NW SEC	32	26.562	-103	5.460	3413	##########	26-Sep-03	10:34	PM
	Sec 32	EUN SE HWY	32	25.747	-103	4.432	3398	##########	26-Sep-03	10:39	PM
	Sec 32	EUN SW HWY	32	25.907	-103	5.460	3375	##########	26-Sep-03	10:42	PM
	Sec 32	EUNRDENTRY	32	25.831	-103	4.984	3417	##########	26-Sep-03	10:22	PM
	Sec 32 Sur	EUN SUR001	32	26.569	-103	5.376	3437	##########	27-Sep-03	10:54	PM
	Sec 32 Sur	EUN SUR002	32	25.885	-103	5.322	3450	##########	27-Sep-03	10:57	PM
	Sec 32 Sur	EUN SUR003	32	26.539	-103	5.018	3467	##########	27-Sep-03	10:59	PM
	Sec 32 Sur	EUN SUR004	32	26.563	-103	4.649	3238	##########	28-Sep-03	11:02	PM
	Sec 32 Sur	EUN SUR005	32	25.754	-103	4.484	3435	##########	28-Sep-03	11:05	PM
	Sec 32 Sur	EUN SUR006	32	25.855	-103	4.747	3442	##########	28-Sep-03	11:08	PM
	Sec 32 Sur	EUN SUR007	32	26.248	-103	4.743	3431	##########	28-Sep-03	11:10	PM
	Sec 32 Sur	EUN SUR008	32	26.540	-103	4.826	3439	##########	28-Sep-03	11:13	PM
	Trap	EUNT01	32	26.569	-103	5.365	3352	##########	19-Jun-04	10:35	AM
	Trap	EUNT02	32	26.525	-103	5.351	3446	##########	19-Jun-04	10:39	AM
	Trap	EUNT03	32	26.513	-103	5.365	3468	##########	19-Jun-04	10:47	AM
	Trap	EUNT04	32	26.490	-103	5.428	3470	##########	19-Jun-04	10:54	AM
	Trap	EUNT05	32	26.427	-103	5.370	3455	##########	19-Jun-04	10:59	AM
	Trap	EUNT06	32	26.427	-103	5.370	3438	##########	19-Jun-04	11:01	AM
	Trap	EUNT07	32	26.411	-103	5.353	3432	##########	19-Jun-04	11:07	AM
	Trap	EUNT08	32	26.395	-103	5.332	3433	##########	19-Jun-04	11:11	AM
	Trap	EUNT09	32	26.368	-103	5.345	3432	##########	19-Jun-04	11:18	AM
	Trap	EUNT10	32	26.334	-103	5.345	3433	##########	19-Jun-04	11:22	AM
	Trap	EUNT11	32	26.297	-103	5.353	3420	##########	19-Jun-04	11:28	AM
	Trap	EUNT12	32	26.277	-103	5.358	3415	##########	19-Jun-04	11:32	AM
	Trap	EUNT13	32	26.173	-103	5.093	3427	##########	19-Jun-04	12:20	PM
	Trap	EUNT14	32	26.129	-103	5.124	3422	##########	19-Jun-04	12:23	PM
	Trap	EUNT15	32	26.125	-103	5.142	3430	##########	19-Jun-04	12:25	PM
	Trap	EUNT16	32	26.118	-103	5.162	3422	##########	19-Jun-04	12:31	PM
EUN17	Trap	EUNT17	32	26.117	-103	5.176	3425	##########	19-Jun-04	12:34	PM
	Trap	EUNT18	32	26.100	-103	5.201	3420	##########	19-Jun-04	12:40	PM

Appendix 3. Reference GPS points for all field work (2003-2004).

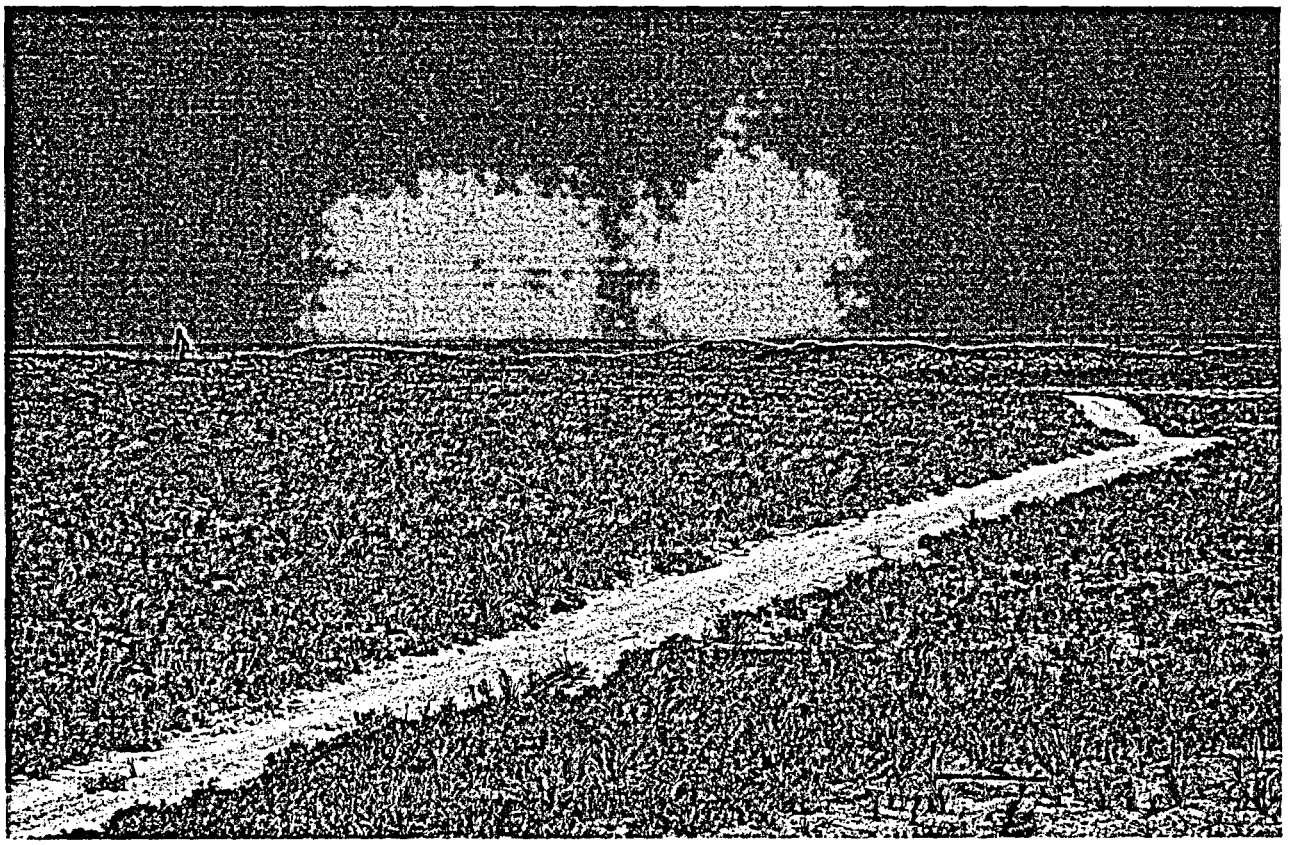
Name change (original in gps unit)	WP type	GPS WayPoints (NAD83)	Degrees	Mins	Degrees	Mins	Elevation (ft)	Date - Time	Date	Time part A	Time part B
	Trap	EUNT19	32	26.129	-103	5.131	3426	##########	19-Jun-04	12:56	PM
	Trap	EUNT20	32	26.220	-103	5.082	3441	##########	19-Jun-04	12:58	PM
	Trap	EUNT21	32	26.213	-103	5.141	3427	##########	19-Jun-04	1:01	PM
	Trap	EUNT22	32	26.196	-103	5.165	3428	##########	19-Jun-04	1:05	PM
	Trap	EUNT23	32	26.176	-103	5.198	3412	##########	19-Jun-04	1:09	PM
	Trap	EUNT24	32	26.183	-103	5.218	3426	##########	19-Jun-04	1:11	PM
	Trap	EUNT25	32	26.189	-103	4.855	3427	##########	19-Jun-04	1:30	PM
	Trap	EUNT26	32	26.182	-103	4.848	3426	##########	19-Jun-04	1:31	PM
	Trap	EUNT27	32	26.176	-103	4.807	3428	##########	19-Jun-04	1:33	PM
	Trap	EUNT28	32	26.200	-103	4.745	3423	##########	19-Jun-04	1:35	PM
	Trap	EUNT29	32	26.228	-103	4.681	3429	##########	19-Jun-04	1:38	PM
	Trap	EUNT30	32	26.241	-103	4.626	3431	##########	19-Jun-04	1:42	PM
	Trap	EUNT31	32	26.243	-103	4.597	3428	##########	19-Jun-04	1:44	PM
	Trap	EUNT32	32	26.271	-103	4.597	3428	##########	19-Jun-04	1:45	PM
	Trap	EUNT33	32	26.252	-103	4.571	3426	##########	19-Jun-04	1:49	PM
	Trap	EUNT34	32	26.232	-103	4.567	3430	##########	19-Jun-04	1:50	PM
	Trap	EUNT35	32	26.209	-103	4.562	3423	##########	19-Jun-04	1:52	PM
	Trap	EUNT36	32	26.189	-103	4.560	3417	##########	19-Jun-04	1:56	PM
	Txdrive	TX01	32	26.495	-102	50.175	3363	##########	21-Jun-04	5:23	PM
	Txdrive	TX02	32	29.162	-102	51.075	3389	##########	21-Jun-04	5:29	PM
	Txdrive	TX03	32	35.378	-102	48.417	3366	##########	21-Jun-04	5:42	PM
	Txdrive	TX04	32	34.463	-102	49.613	3364	##########	21-Jun-04	5:54	PM
	Txdrive	TX05	32	36.554	-102	50.311	3396	##########	21-Jun-04	6:04	PM
	Txdrive	TX06	32	36.094	-102	52.282	3416	##########	21-Jun-04	6:09	PM
	Txdrive	TX07	32	37.744	-102	52.826	3420	##########	21-Jun-04	6:17	PM
	Txdrive	TX08	32	37.409	-102	54.976	3461	##########	21-Jun-04	6:22	PM
	Txdrive	TX09	32	37.475	-103	3.887	3608	##########	21-Jun-04	6:36	PM
*	z Check	EUNOS01	32	17.838	-103	19.069	3334	##########	23-Jun-04	10:10	AM

Appendix 4, photo 1. Reference photographs of sand dune lizards habitat.



An isolated blowout (BH) that contained sand dune lizards (point SA05). This blowout was the closest location of sand dune lizards to section 32, approximately 3 miles south. The closest dune field was .25 miles northwest, across shinnery flats (dispersal habitat).

Appendix 4, photo 2. Reference photographs of sand dune lizard habitat.

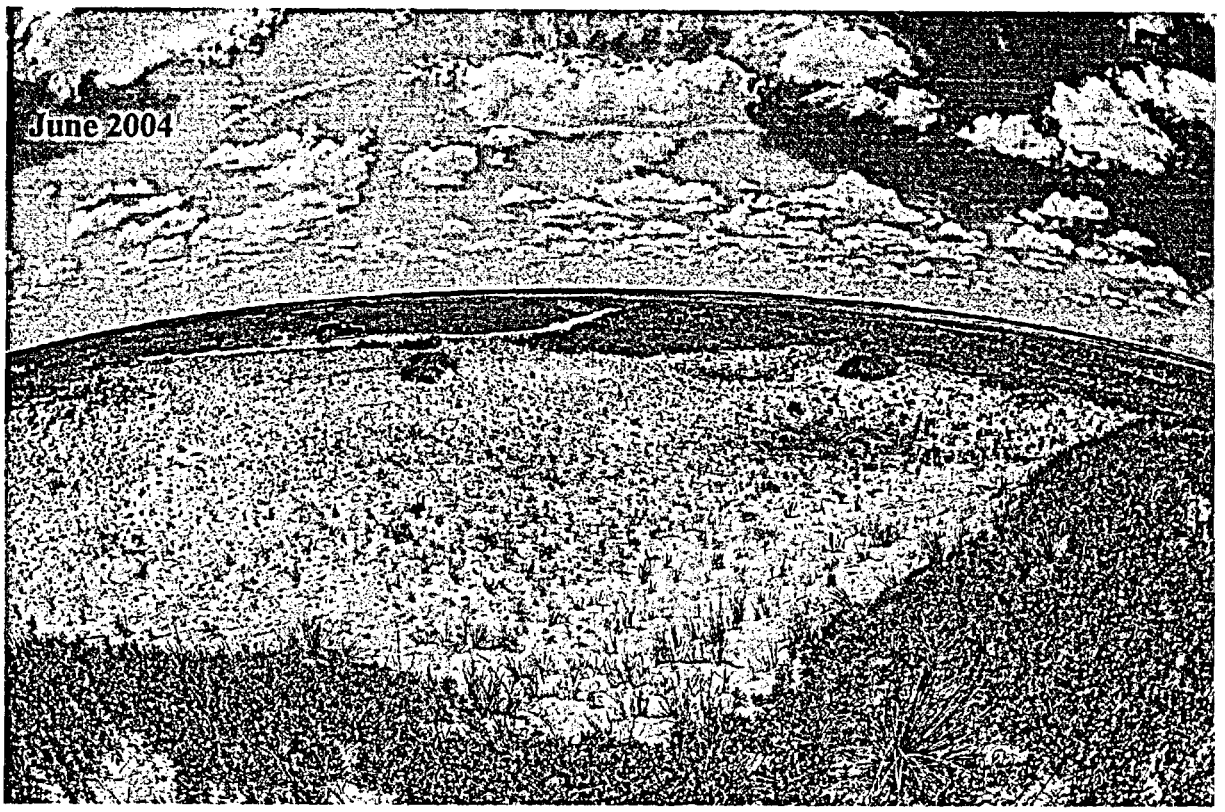


A shinnery oak dune field view, taken from a location 3.2 miles north of section 32. This dune field supported the closest population of sand dune lizards to section 32 (Figure 7, region 2). Note the lack of mesquite which, in contrast is abundant on section 32.

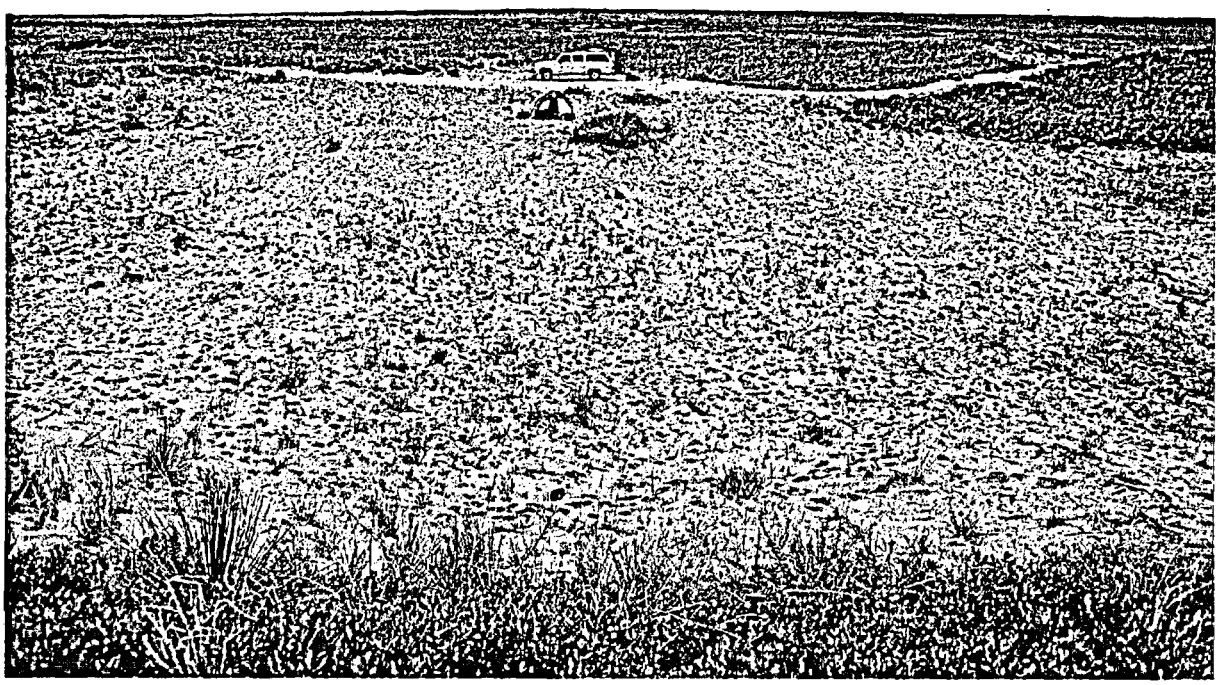
Appendix 4, photo 3. Reference photographs of sand dune lizard habitat.

A blowout complex approximately 5 miles north of section 32. Region 2 (from figure 7) contained shinnery dune fields and isolated large blowout complexes, both of which supported sand dune lizards.

Appendix 4, photos 4-5. Reference photographs of sand dune lizard habitat.

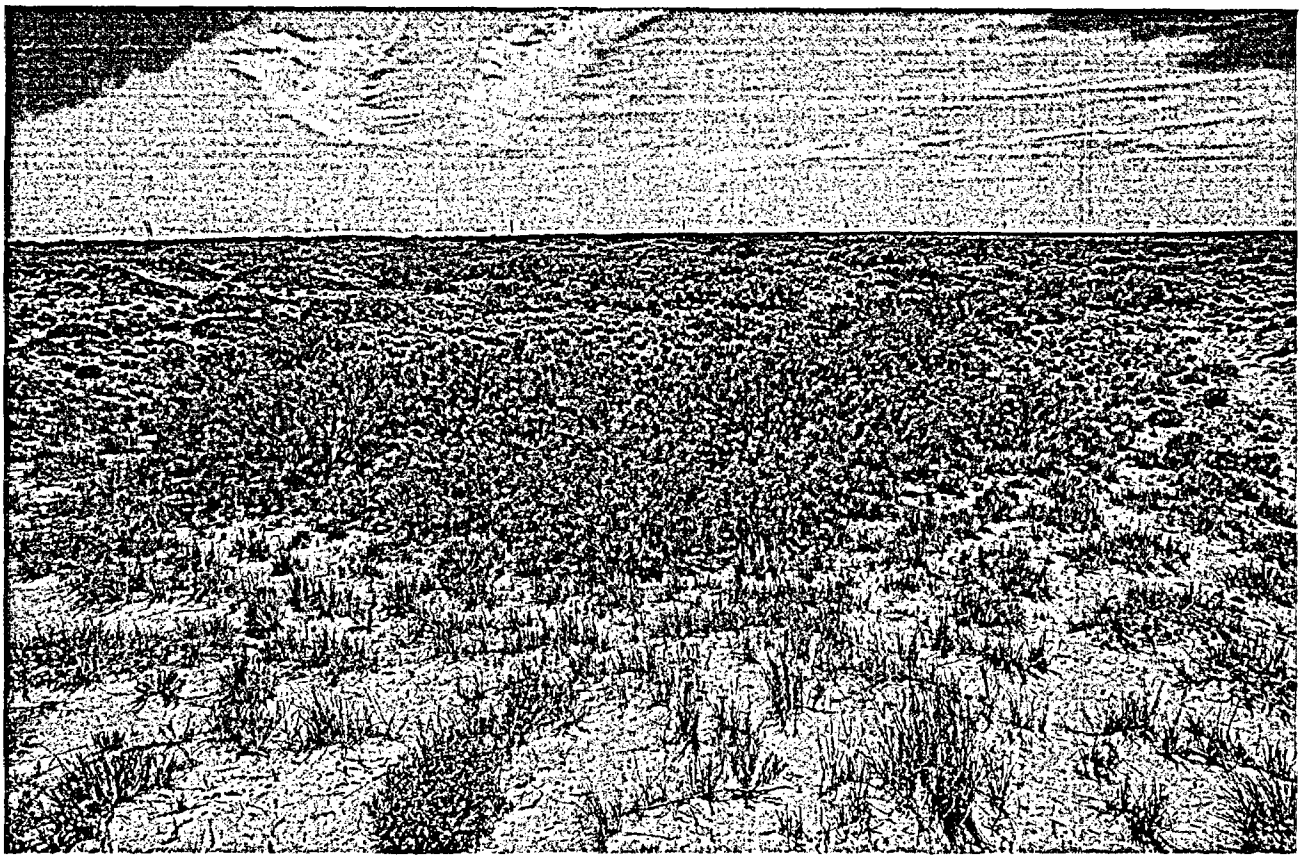


June 1995



Pictures of the verification site for sand dune lizards in June 2004 (top) and June 1995 (bottom). The 2004 picture is a wider angle, but it is obvious that the habitat here has not undergone any dramatic changes over this time period. The site was first visited in 1994.

Appendix 4, photo 6. Reference photographs of sand dune lizards habitat.

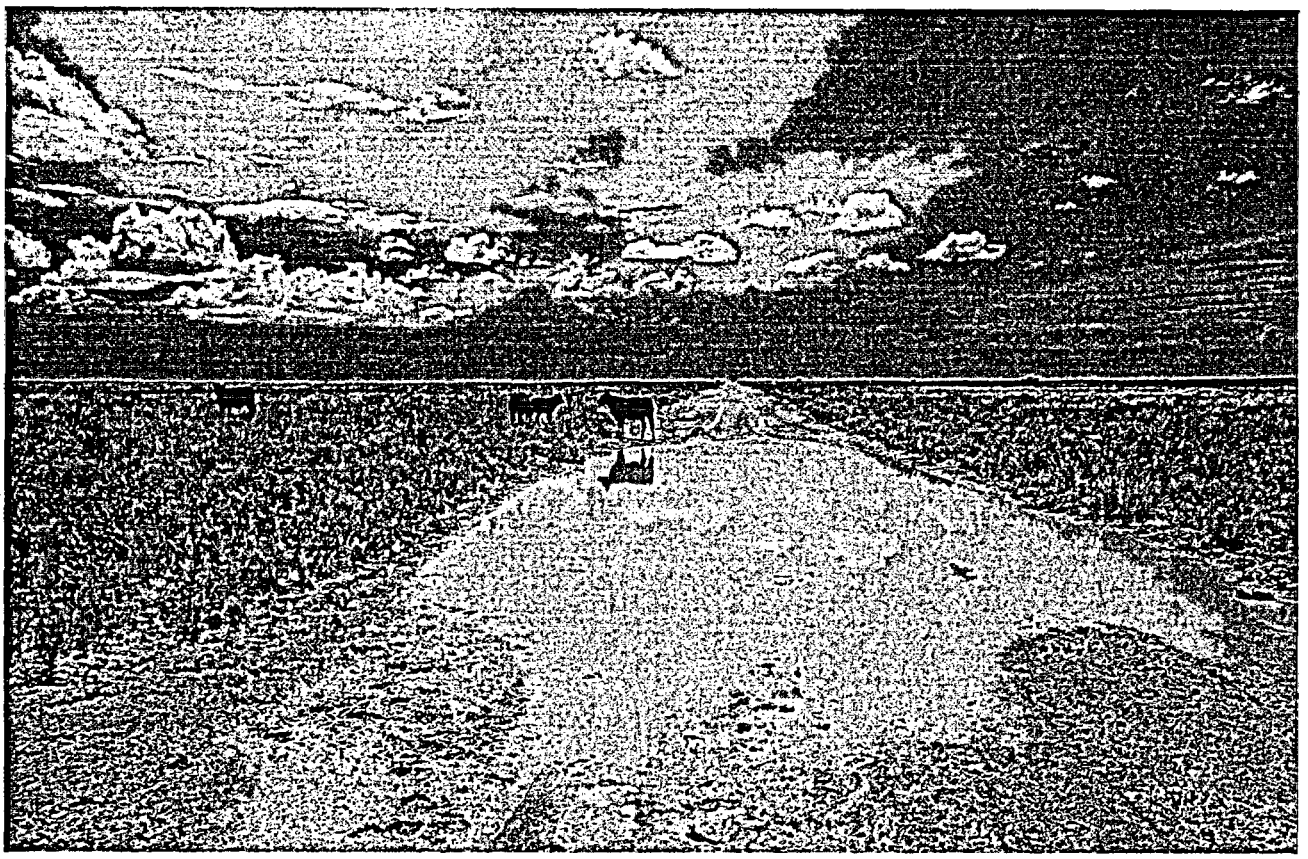


Ecotonal habitats south of region 1 and 3 on Figure 7. This view is just west of the TX border and looking southeast approximately 3 miles north of sec. 32 In this area there is a clear demarcation of shinnery oak dominant habitats and mesquite grassland habitats. In other areas this ecotone is marked by gradual changes in the densities of plants. The sudden change here is due to a change in substrates. Section 32 had both patches of shinnery dune habitat and areas of gradual ecotone.

Appendix 4, photo 7. Reference photographs of sand dune lizards habitat.

Approximately 3 miles north of section 32 on the TX/NM border. Section 32 is south of the white mounds on the horizon (quarry and WCS, Inc). The entire stretch from here to section 32 is mesquite grassland. The foreground is the end of the shinnery oak dominant environment. It coincides with the disappearance of the white sands that sand dune lizards occupy in this region and the underlying reddish substrates are exposed, the same substrates found on section 32. The power line runs along the border, marked by a red arrow. Note the mesquite habitat in TX.

Appendix 4, photo 8. Reference photographs of sand dune lizard habitat.



This view shows the extensive shinnery flats of region 3 (Figure 7). These shinnery flats are likely dispersal habitat for sand dune lizards, since sand dune lizards are found in some of the isolated blowout complexes in this area. This view is about 5 miles north of section 32, and south of the verification site. Note the low density oil development and grazing. The habitat that is utilized by sand dune lizards north of section 32 is relatively undisturbed, compared to other areas around Eunice. The view looks due west.