1976

Jornada Validation Site Report

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1975 PROGRESS REPORT

JORNADA VALIDATION SITE REPORT

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US/IBP DESERT BIOME
RESEARCH MEMORANDUM 76-4

in

REPORTS OF 1975 PROGRESS
Volume 2: Validation Studies
Jornada, 34 pp.

1975 Proposal No. 2.2.2.4

Printed 1976

Citation format: Author(s). 1976. Title.
US/IBP Desert Biome Res. Memo. 76-4.
Utah State Univ., Logan. 34 pp.

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ABSTRACT

The precipitation patterns in 1975 established it as a "good" year on the Jornada site. Rainfall was recorded in every month except June. This rainfall pattern produced high reproduction and "new resident" establishment of bajada mammals and high activity levels of termites and soil surface arthropods. Birds and reptiles were censused in May and June and compared with previous years. Litter distribution was studied and was affected by intense summer rain storms. Data were collected on plant production but these samples are being processed and these data are not reported at this time.

ACKNOWLEDGMENTS

Throughout the course of this project we have been fortunate to have the able assistance of many people. Individuals contributing to the Jornada Validation Site work in 1975 are listed below, as are authors of the various sections.

Category	Assistance in field or laboratory	Authorship
Abstract		Walter Whitford
Abiotic data	Martha Bryant Dirk DePree Patrick Hamilton	Martha Bryant
Birds	Wayne Pilz	Wayne Pilz
Pitfall traps	Richard Johnson Dirk DePree	Richard Johnson Dirk DePree
Mammals	Scott Dick-Peddie Dirk DePree Richard Johnson Elaine DePree Priscilla Johnson Patrick Hamilton Walter Smith Martha Bryant Walter Whitford	Walter Whitford Jean Duboch
Termites	Priscilla Johnson	Priscilla Johnson
Lizards	Scott Dick-Peddie Dirk DePree Richard Johnson Patrick Hamilton	
Litter	Elaine DePree Dirk DePree Patrick Hamilton Martha Bryant	Elaine DePree Walter Whitford
Acrididae	Timothy D. Schowalter	Timothy D. Schowalter

INTRODUCTION

Validation studies at the Jornada site were initiated on the playa in 1970 and expanded to include the bajada in 1971. From 1971 through spring of 1974, measurements of state variables were made over short time increments, i.e., every other week or monthly depending upon the variable. In 1974 we concentrated our activities on those projects that required little additional effort in order to produce a publishable manuscript and on those projects which were needed to "flush out" the model. In 1975 we continued minimal validation work, concentrating our efforts on synthesis and manuscript production.

This report represents the results of the 1975 validation data which have been summarized to date. There has been no attempt to provide between-year comparisons to any great extent since most writing effort has been focused on synthesizing and reducing data for publication in peer-reviewed journals. The data presented in this report can be compared with data in previous reports if desired (Whitford and Ludwig 1971; Whitford et al. 1972, 1973, 1974, 1975).

LITERATURE CITED

WHITFORD, W. G. (Coordinator) et al. 1972. Jornada Validation Site report. US/IBP Desert Biome Res. Memo. 72-4. Utah State Univ., Logan. 138 pp.

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WHITFORD, W. G. (Coordinator), and J. LUDWIG. 1971. The Jornada Validation Site (playa -- NMSU Ranch). US/IBP Desert Biome Res. Memo. 71-5. Utah State Univ., Logan. 68 pp.

DATA COLLECTION DESIGN

Parameters measured	DSCODE	Pages
Air temperature		
Playa	A3UWJ02	6
Bajada	A3UWJ64	17
Solar radiation		
Playa	A3UWJ04	6
Bajada	A3UWJ66	17
Precipitation		
Playa	A3UWJ07	6
Bajada	A3UWJ63	17
Relative humidity		
Playa	A3UWJ03	6
Bajada	A3UWJ65	17
Wind		
Playa	A3UWJ08	
Bajada	A3UWJ62	17
Soil temperature		
Playa	A3UWJ06	6
Bajada	A3UWJ67	17
Soil moisture		
Playa	A3UWJ05	
Bajada	A3UWJ61	17

Data Collection Design, continued

Parameters measured	DSCODE	Pages
Annuals		
Playa	A3UWJ51, 52, 53, 54	
Bajada	A3UWJ74	
Small perennials		
Playa	A3UWJ51, 52, 53, 54	
Bajada	A3UWJ74	
Large perennials		
Playa	A3UWJ55	
Bajada	A3UWJ75	
Invertebrates		
Relative abundance, diversity and family composition	A3UWJ21, 25	
Mesquite plant-part mortality	A3UWK01, 02, 03	
Flush transect census	A3UWJ96	
Pitfall traps	A3UWJ22	11, 23
Vertebrates		
Reptiles and amphibians		
Playa	A3UWJ13	16
Bajada	A3UWJ69	16
Birds		
Playa	A3UWJ16	13
Bajada	A3UWJ60	24
Rodents		
Playa	A3UWJ11	13
Bajada	A3UWJ68	24
Lagomorphs	A3UWJ15	
Soil microorganisms	A3UWJ30	

FINDINGS

PLAYA

ABIOTIC

Air Temperature

Air temperature was monitored on the Jornada playa site in 1975. Table 1 gives weekly means and ranges of maximum and minimum air temperatures. These data were collected from a standard climatic monitoring station on the southwest corner of the playa bottom. Air temperatures were monitored with a thermograph (as part of a hygrothermograph, Belfort Instrument Company). Data description is given by DSCODE A3UWJ02.

Relative Humidity

Relative humidity was monitored on the Jornada playa site in 1975. Table 2 gives weekly means and ranges of relative humidities collected. These data were collected from a standard climatic monitoring station on the playa site. The relative humidity was monitored with a Belfort Instrument Company hygrothermograph (A3UWJ03).

Soil Temperature

Mean, average maximum and average minimum weekly soil temperatures were recorded at depths of 10 cm (Table 3) and 50 cm (Table 4). Temperatures dropped to a minimum of —1 C the first two weeks of January at the 10-cm depth; no freezing temperatures were recorded at 50 cm (A3UWJ06).

Solar Radiation

Solar radiation was monitored on the playa site and the weekly means (langleys/day) are presented in Table 5. Monitoring techniques were those described in Whitford et al. (1973; A3UWJ04).

Precipitation

Precipitation data from the Jornada playa site from 1975 are presented in Table 6. Monthly total precipitation is given.

The data were collected with a recording rain gauge (weighing-bucket type, Belfort Instrument Co.) near the playa weather station. The instrument is checked after each suspected rainfall, and duration and intensity of rainfall occurrences are recorded.

Total precipitation on the playa in 1975 was 200.92 mm, with no precipitation recorded in June. September had the greatest amount of rainfall with 74.68 mm in four rainfall events. July had the greatest number of rainfall events, but the seven events resulted in only 29.72 mm of rain.

The differences in numbers of events and amounts of rainfall between playa and bajada sites (approximately 1.6 km apart) emphasize the localized storm activities that are prevalent in the Chihuahuan Desert (A3UWJ07).

Literature Cited

Whitford, W. G. (Coordinator) et al. 1973. Jornada Validation Site report. US/IBP Desert Biome Res. Memo. 73-4. Utah State Univ., Logan. 332 pp.

Table 1. Weekly air temperature data (°C) acquired at the Jornada playa site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	1.66	18	-8
2	Jan 08-Jan 14	3.29	16	-10
3	Jan 15-Jan 21	5.29	21	-9
4	Jan 22-Jan 28	6.86	23	-6
5	Jan 29-Feb 04	9.43	17	3
6	Feb 05-Feb 11	8.29	20	-4
7	Feb 12-Feb 18	7.14	20	-10
8	Feb 19-Feb 25	5.71	21	-10
9	Feb 26-Mar 04	11.43	26	-4
10	Mar 05-Mar 11	11.17	23	-3
11	Mar 12-Mar 18	10.71	26	-6
12	Mar 19-Mar 25	11.14	27	-12
13	Mar 26-Apr 01	7.75	23	-4
14	Apr 02-Apr 08	11.00	25	-5
15	Apr 09-Apr 15	13.29	19	-12
16	Apr 16-Apr 22	14.14	36	-2
17	Apr 23-Apr 29	18.33	29	4
18	Apr 30-May 06	12.00	28	-4
19	May 07-May 13	19.86	33	-1
20	May 14-May 20	20.86	30	10
21	May 21-May 27	20.20	33	4
22	May 28-Jun 03	23.00	31	5
23	Jun 04-Jun 10	22.43	36	8
24	Jun 11-Jun 17	26.00	39	10
25	Jun 18-Jun 24	25.57	37	8
26	Jun 25-Jul 01	27.40	38	16
27	Jul 02-Jul 08	25.71	38	16
28	Jul 09-Jul 15	24.57	35	16
29	Jul 16-Jul 22	26.00	37	16
30	Jul 23-Jul 29	25.00	36	14
31	Jul 30-Aug 05	26.50	38	14
32	Aug 06-Aug 12	25.85	37	14
33	Aug 13-Aug 19	25.83	36	15
34	Aug 20-Aug 26	30.00	37	17
35	Aug 27-Sep 02	26.71	37	13
36	Sep 03-Sep 09	21.85	32	17
37	Sep 10-Sep 16	20.71	33	13
38	Sep 17-Sep 23	19.14	32	3
39	Sep 24-Sep 30	18.57	34	4
40	Oct 01-Oct 07	16.00	30	2
41	Oct 08-Oct 14	17.57	30	4
42	Oct 15-Oct 21	14.71	29	1
43	Oct 22-Oct 28	14.71	33	1

Table 1, continued

Week	Time Intervals	Mean	1975 Max.	Min.
44	Oct 29-Nov 04	12.85	26	-1
45	Nov 05-Nov 11	13.28	27	-2
46	Nov 12-Nov 18	8.57	26	-8
47	Nov 19-Nov 25	6.00	20	-6
48	Nov 26-Dec 02	6.57	21	-6
49	Dec 03-Dec 09	6.71	21	-4
50	Dec 10-Dec 16	8.80	21	-5
51	Dec 17-Dec 23	6.60	22	-6
52	Dec 24-Dec 31	3.40	14	-6

Table 2. Relative humidity on the playa site (percent)

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	71.4	99.	7.
2	Jan 08-Jan 14	58.1	99.	18.
3	Jan 15-Jan 21	58.1	99.	16.
4	Jan 22-Jan 28	63.1	99.	12.
5	Jan 29-Feb 04	75.2	99.	30.
6	Feb 05-Feb 11	51.1	99.	17.
7	Feb 12-Feb 18	53.1	99.	14.
8	Feb 19-Feb 25	55.2	99.	9.
9	Feb 26-Mar 04	44.7	99.	18.
10	Mar 05-Mar 11	51.1	99.	20.
11	Mar 12-Mar 18	52.7	99.	18.
12	Mar 19-Mar 25	39.8	98.	15.
13	Mar 26-Apr 01	55.5	80.	22.
14	Apr 02-Apr 08	45.1	99.	15.
15	Apr 09-Apr 15	53.7	98.	15.
16	Apr 16-Apr 22	40.4	99.	17.
17	Apr 23-Apr 29	37.6	84.	20.
18	Apr 30-May 06	38.0	50.	27.
19	May 07-May 13	40.5	99.	12.
20	May 14-May 20	40.8	99.	18.
21	May 21-May 27	34.2	72.	19.
22	May 28-Jun 03	46.7	99.	19.
23	Jun 04-Jun 10	41.7	85.	17.
24	Jun 11-Jun 17	42.6	99.	18.
25	Jun 18-Jun 24	50.2	99.	28.
26	Jun 25-Jul 01	48.7	99.	21.
27	Jul 02-Jul 08	73.0	99.	40.
28	Jul 09-Jul 15	64.4	99.	29.
29	Jul 16-Jul 22	65.8	99.	30.
30	Jul 23-Jul 29	70.2	99.	30.
31	Jul 30-Aug 05	69.0	99.	22.
32	Aug 06-Aug 12	55.0	99.	26.
33	Aug 13-Aug 19	68.5	99.	33.
34	Aug 20-Aug 26	62.1	99.	30.
35	Aug 27-Sep 02	66.7	99.	36.

Table 2, continued

Week	Time Intervals	Mean	1975 Max.	Min.
36	Sep 03-Sep 09	85.4	99.	46.
37	Sep 10-Sep 16	80.7	99.	21.
38	Sep 17-Sep 23	56.1	99.	20.
39	Sep 24-Sep 30	47.2	90.	19.
40	Oct 01-Oct 07	50.2	99.	18.
41	Oct 08-Oct 14	43.7	99.	10.
42	Oct 15-Oct 21	41.8	80.	7.
43	Oct 22-Oct 28	29.7	92.	1.
44	Oct 29-Nov 04	41.7	99.	7.
45	Nov 05-Nov 11	35.7	92.	8.
46	Nov 12-Nov 18	35.4	99.	7.
47	Nov 19-Nov 25	51.2	99.	10.
48	Nov 26-Dec 02	44.0	99.	9.
49	Dec 03-Dec 09	55.0	99.	7.
50	Dec 10-Dec 16	61.2	99.	12.
51	Dec 17-Dec 23	70.0	99.	34.
52	Dec 24-Dec 31	74.4	99.	9.

Table 3. Weekly soil temperature data (°C) at a depth of 10 cm acquired at the Jornada playa site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	-.57	1	-1
2	Jan 08-Jan 14	.71	2	-1
3	Jan 15-Jan 21	1.2	3	0
4	Jan 22-Jan 28	2.5	6	0
5	Jan 29-Feb 04	6.1	8	4
6	Feb 05-Feb 11	5.2	8	3
7	Feb 12-Feb 18	5.1	7	1
8	Feb 19-Feb 25	3.2	6	1
9	Feb 26-Mar 04	6.4	10	3
10	Mar 05-Mar 11	8.4	11	6
11	Mar 12-Mar 18	7.7	11	0
12	Mar 19-Mar 25	9.8	13	6
13	Mar 26-Apr 01	8.2	12	4
14	Apr 02-Apr 08	9.5	13	0
15	Apr 09-Apr 15	10.2	15	6
16	Apr 16-Apr 22	13.2	16	9
17	Apr 23-Apr 29	14.1	17	11
18	Apr 30-May 06	15.5	19	12
19	May 07-May 13	15.7	19	12
20	May 14-May 20	18.5	20	15
21	May 21-May 27	19.2	24	15
22	May 28-Jun 03	20.1	26	16
23	Jun 04-Jun 10	22.4	26	19
24	Jun 11-Jun 17	24.0	28	20
25	Jun 18-Jun 24	25.0	29	22
26	Jun 25-Jul 01	27.0	31	23

Table 3, continued

Week	Time Intervals	Mean	1975 Max.	Min.
27	Jul 02-Jul 08	26.4	30	23
28	Jul 09-Jul 15	25.1	29	21
29	Jul 16-Jul 22	25.0	27	22
30	Jul 23-Jul 29	24.8	29	21
31	Jul 30-Aug 05	25.4	28	21
32	Aug 06-Aug 12	24.5	28	22
33	Aug 13-Aug 19	24.5	28	22
34	Aug 20-Aug 26	24.2	28	21
35	Aug 27-Sep 02	24.8	28	23
36	Sep 03-Sep 09	22.1	25	19
37	Sep 10-Sep 16	20.0	26	16
38	Sep 17-Sep 23	19.7	24	14
39	Sep 24-Sep 30	17.1	21	14
40	Oct 01-Oct 07	15.8	19	13
41	Oct 08-Oct 14	16.2	19	13
42	Oct 15-Oct 21	14.0	18	11
43	Oct 22-Oct 28	12.5	15	10
44	Oct 29-Nov 04	11.4	15	8
45	Nov 05-Nov 11	10.7	14	8
46	Nov 12-Nov 18	8.0	12	4
47	Nov 19-Nov 25	4.7	10	2
48	Nov 26-Dec 02	4.1	7	2
49	Dec 03-Dec 09	4.0	6	1
50	Dec 10-Dec 16	2.5	8	0
51	Dec 17-Dec 23	3.4	6	1
52	Dec 24-Dec 31	2.0	6	1

Table 4. Weekly soil temperature data (°C) at a depth of 50 cm acquired at the Jornada playa site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	2.4	3	1
2	Jan 08-Jan 14	2.4	3	1
3	Jan 15-Jan 21	3.0	4	1
4	Jan 22-Jan 28	3.4	5	2
5	Jan 29-Feb 04	5.4	7	4
6	Feb 05-Feb 11	6.0	7	5
7	Feb 12-Feb 18	6.0	7	4
8	Feb 19-Feb 25	4.8	6	3
9	Feb 26-Mar 04	5.5	8	4
10	Mar 05-Mar 11	7.7	9	6
11	Mar 12-Mar 18	8.0	9	7
12	Mar 19-Mar 25	8.7	10	7
13	Mar 26-Apr 01	8.7	10	7
14	Apr 02-Apr 08	8.7	10	7
15	Apr 09-Apr 15	9.4	11	8
16	Apr 16-Apr 22	11.2	13	10
17	Apr 23-Apr 29	12.4	14	10
18	Apr 30-May 06	13.1	14	12
19	May 07-May 13	13.8	16	12
20	May 14-May 20	15.8	17	15
21	May 21-May 27	16.7	18	15
22	May 28-Jun 03	17.5	19	16
23	Jun 04-Jun 10	19.0	20	10
24	Jun 11-Jun 17	20.2	22	18
25	Jun 18-Jun 24	21.4	23	20
26	Jun 25-Jul 01	22.7	24	21
27	Jul 02-Jul 08	23.7	24	22
28	Jul 09-Jul 15	23.0	24	21
29	Jul 16-Jul 22	22.8	23	22
30	Jul 23-Jul 29	22.8	24	22
31	Jul 30-Aug 05	23.1	24	22
32	Aug 06-Aug 12	23.0	24	22
33	Aug 13-Aug 19	22.8	24	21
34	Aug 20-Aug 26	22.7	24	22
35	Aug 27-Sep 02	23.0	23	22
36	Sep 03-Sep 09	21.7	23	20
37	Sep 10-Sep 16	19.8	21	19
38	Sep 17-Sep 23	19.1	21	18
39	Sep 24-Sep 30	17.8	20	17
40	Oct 01-Oct 07	16.2	18	16
41	Oct 08-Oct 14	16.4	18	15
42	Oct 15-Oct 21	15.0	17	14
43	Oct 22-Oct 28	13.8	15	12
44	Oct 29-Nov 04	13.0	14	12
45	Nov 05-Nov 11	11.7	14	10
46	Nov 12-Nov 18	9.8	12	9
47	Nov 19-Nov 25	7.8	10	4
48	Nov 26-Dec 02	6.5	9	1
49	Dec 03-Dec 09	6.1	8	5
50	Dec 10-Dec 16	6.0	7	5
51	Dec 17-Dec 23	5.2	7	4
52	Dec 24-Dec 31	4.4	6	3

Table 5. Weekly solar radiation data acquired at the Jornada playa site during 1975 (mean langleys/day)

Week	Time Intervals	Mean
1	Jan 01-Jan 07	323
2	Jan 08-Jan 14	386
3	Jan 15-Jan 21	384
4	Jan 22-Jan 28	374
5	Jan 29-Feb 04	288
6	Feb 05-Feb 11	470
7	Feb 12-Feb 18	416
8	Feb 19-Feb 25	449
9	Feb 26-Mar 04	528
10	Mar 05-Mar 11	492
11	Mar 12-Mar 18	578
12	Mar 19-Mar 25	524
13	Mar 26-Apr 01	501
14	Apr 02-Apr 08	611
15	Apr 09-Apr 15	628
16	Apr 16-Apr 22	638
17	Apr 23-Apr 29	650
18	Apr 30-May 06	752
19	May 07-May 13	653
20	May 14-May 20	716
21	May 21-May 27	759
22	May 28-Jun 03	707
23	Jun 04-Jun 10	677
24	Jun 11-Jun 17	717
25	Jun 18-Jun 24	743
26	Jun 25-Jul 01	753
27	Jul 02-Jul 08	639
28	Jul 09-Jul 15	638
29	Jul 16-Jul 22	612
30	Jul 23-Jul 29	648
31	Jul 30-Aug 05	664
32	Aug 06-Aug 12	652
33	Aug 13-Aug 19	605
34	Aug 20-Aug 26	570
35	Aug 27-Sep 02	612
36	Sep 03-Sep 09	445
37	Sep 10-Sep 16	492
38	Sep 17-Sep 23	558
39	Sep 24-Sep 30	542
40	Oct 01-Oct 07	543
41	Oct 08-Oct 14	537
42	Oct 15-Oct 21	437
43	Oct 22-Oct 28	485
44	Oct 29-Nov 04	432
45	Nov 05-Nov 11	432
46	Nov 12-Nov 18	391
47	Nov 19-Nov 25	372
48	Nov 26-Dec 02	312
49	Dec 03-Dec 09	327
50	Dec 10-Dec 16	338
51	Dec 17-Dec 23	256
52	Dec 24-Dec 31	327

Table 6. Precipitation data from the Jornada playa site in 1975. Monthly total precipitation is shown in inches and millimeters

Month	Total in inches	Total in millimeters
January	0.66	16.76
February	0.33	8.38
March	0.33	8.38
April	0.03	0.76
May	0.08	2.03
June	--	--
July	1.17	29.72
August	1.27	32.26
September	2.94	74.68
October	0.52	13.21
November	0.34	8.64
December	0.24	6.10

PLANTS

The plant data for 1975 have not yet been reduced and analyzed due to the absence of Dr. John Ludwig, who has been on sabbatical leave. These data will be included in the next progress report.

INVERTEBRATES

Pitfall Traps

In order to gain some insight into ground arthropod populations within well-defined boundaries, pitfall traps were employed inside a fixed area. The area was surrounded with a 15-cm lawn edging to prevent emigration and immigration of the arthropods and it encompassed an area of 400 m^2. Ten traps were placed within the area for a trap density of one trap per 40 m^2. Cattle grazed the playa site throughout the summer of 1975, making it necessary to locate the traps within a barbed wire enclosure on the north fringe. Vegetation in this area is mixed *Ephedra trifurca* and *Prosopis glandulosa*.

Traps were checked twice weekly beginning June 11 and continuing through the remainder of the year. Ground beetles were marked with fingernail polish and released to gain mark-recapture information. All other arthropods were removed from the traps and preserved in 70% ethanol for later identification. Pholcid spiders were not removed after it was discovered that they sought the traps as residences, thus giving erroneous random trapping results.

The total number of beetles captured during the year was extremely small (Table 7). Only four species, three Tenebrionidae and one Scarabaeidae, were represented. This is somewhat disconcerting in light of the much greater diversity at the family level, observed during 1973 using open-area trapping grids on the same site, when members of the families Carabidae and Cleridae were very conspicuous in the arthropod community.

The data in Table 7 are computed using the Lincoln Index. The Bailey modification of the index is used frequently as the capture numbers necessitated and, therefore, generally the data indicate minimum population estimates.

Eleodes sp. was by far the most commonly encountered species throughout the sampling period, present both earlier and later than any other beetle species represented. Their numbers were perhaps slightly higher in the late summer months. This is probably due to either increased precipitation (see "Playa Precipitation"), milder temperatures or a combination of the two.

The other two members of the family Tenebrionidae, *Eleodes omissa* and *Megasida* sp., were infrequently encountered. The latter was represented by a total of only two individuals and the former by four.

The skin beetle, *Trox* sp., was more abundant in the early summer months but, even then, capture numbers were very low.

Termites

Termite populations were estimated on the playa and bajada sites for the summer of 1975 using the line intercept method. This method was later modified to a simple belt transect. On the playa site the density of cow dung was estimated using the same method (Table 8). There was no dung present on the bajada. Along with active surface colonies, the food material on which the termites were foraging was recorded.

Identifiable termites encountered on the playa were 50% *Amitermes wheeleri* and 50% *Gnathamitermes perplexus*. On the bajada, 92% of the encountered termites were *A. wheeleri* and 7% *G. perplexus*. This apparent imbalance of the two species on the bajada could be due to the soil or vegetation differences in the two sites. The playa transect is a sandy loam with a caliche layer (calcium carbonate deposition layer), about 50 cm beneath the soil surface. *Prosopis glandulosa* (mesquite) and *Ephedra trifurca* (long-leaf Mormon tea) are the most prevalent shrubs on the

Table 7. Animals captured in pitfall traps on the Jornada playa site during 1975

	Coleoptera Tenebrionidae *Eleodes* sp.	Coleoptera Tenebrionidae *Megasida* sp.	Coleoptera Tenebrionidae *Eleodes omissa*	Coleoptera Scarabaeidae *Trox* sp.
0611	2	0	0	0
0626	3	0	0	0
0708	3	1	0	0
0716	3	0	0	3
0723	3	0	0	1
0806	14	0	0	1
0814	32	1	0	1
0825	3	0	1	0
0901	6	0	3	0
0908	10	0	1	1
0914	4	0	0	1
0922	1	0	0	0
0929	1	0	0	0
1006	No Data	-	-	-
1013	0	0	0	0
1020	2	0	0	0
1027	6	0	0	0
1103	3	0	0	0
1113	0	0	0	0
1120	0	0	0	0
1128	0	0	0	0

Table 8. Cow dung density on Jornada playa site in 1975

Date	Total number of chips/ha	Number fresh chips/ha	Number semidry chips/ha	Number dry chips/ha
Jun 3	110.55	28.42	31.59	50.54
Jul 1	154.77	6.32	126.34	22.11
Jul 17	170.57	0.00	85.28	85.28
Aug 26	185.00	45.00	80.00	60.00
Nov 28	335.00	0.00	95.00	240.00

site, occurring at estimated densities of about 486/ha. The bajada soils vary from sandy gravels to sandy loams, with a caliche layer 10-40 cm beneath the soil surface. Along the edges of the arroyos, the principal vegetation includes *P. glandulosa*, *Chilopsis linearis* (desert willow), *Yucca baccata* (banana yucca) and *Opuntia violacea* (prickly pear cactus).

The most frequently attacked material was cow dung. The termites attacked mostly semidry dung. Ferrar and Watson (1970) reported that attacks on wet dung are less frequent and the termites are probably then seeking moisture. Other materials attacked were yucca logs, surface litter and surface wood.

Termite populations were estimated for June, July, August and late November-early December (Table 9). In June there was no precipitation on either site and the bajada had 3.01 foraging groups per hectare, whereas the playa had 12.63 foraging groups per hectare. This was the lowest number of foraging groups per hectare for the summer months. Peaks were reached on both sites in August (Table 9).

Termite casings were found under all ground litter on the bajada in August. On the playa there was evidence that termites had attacked not only the semidry cow chips, but also fresh and dry dung. Termite populations on both sites were lowest during late November-early December. At this time the bajada had no active foraging groups.

Comparisons between rainfall and termite activity seem to indicate that activity is directly proportional to rainfall. Precipitation on the sites is shown in Table 10.

Literature Cited

Ferrar, P., and J. A. L. Watson. 1970. Termites (Isoptera) associated with dung in Australia. J. Austral. Entomol. Soc. 9:100-102.

Table 9. Number of active termites and active foraging groups of termites on the Jornada bajada and playa sites

Date	Number of surface active termites/ha	Number surface active groups/ha
BAJADA		
Jun 4	373.33	3.01
Jun 27	33.12	6.02
Jul 18	66.23	9.03
Aug 27	165.00	10.00
Dec 2	0	0
PLAYA		
Jun 3	457.99	12.63
Jul 1	3038.59	53.70
Jul 17	2008.89	47.38
Aug 26	6540.00	170.00
Nov 8	675.00	2.50

Table 10. Precipitation for bajada and playa sites for 1975

	Rainfall (mm)	
Month	Bajada	Playa
Jun	0	0
Jul	16.51	29.72
Aug	29.46	32.26
Sep	76.71	74.68
Oct	12.70	13.21
Nov	8.13	8.64
Dec	3.05	6.10

VERTEBRATES

Mammals

The mammal fauna on the playa and fringe in 1975 had a reduced species composition when compared to some previous years (e.g., 1972 and 1973; Whitford 1976). Densities were generally lower in 1975 than recorded for comparable periods in the previous year (Tables 11-16), probably reflecting the dry conditions of winter, spring and early summer 1975.

Birds

During 1975, the only bird census conducted was in May. Four successive days were used to determine the numbers of birds in the different ecological groupings described below. May was selected for censusing since breeding bird species would be present in maximum numbers, giving an indication of recruitment potential.

Table 11. Estimated gross density for *Dipodomys merriami* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

	MONTH											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	240.0 (36.92)	-	154.0 (23.69)	26.67 (4.10)	-	-	55.0 (8.46)	-	-	-
1971	36.0 (5.54)	-	27.0 (4.15)	15.4 (2.37)	71.8 (11.04)	-	154.0 (23.69)	-	144.0 (22.15)	-	-	14.67 (2.26)
1972	-	20.8 (3.20)	-	-	16.0 (2.46)	31.1 (4.79)	-	40.5 (6.23)	-	-	21.0 (3.23)	-
1973	-	70.0 (10.77)	-	28.4 (4.38)	-	-	-	-	97.8 (15.04)	-	-	-
1974	-	111.0 (17.08)	-	-	63.9 (9.83)	-	-	34.0 (5.23)	-	-	22.0 (3.38)	-
1975	-	-	-	-	21.0 (3.23)	-	-	5.0 (0.77)	-	-	-	-
	MONTH											
DIRECT COUNT	1	2	3	4	5	6	7	8	9	10	11	12
1970	9	8	33	16	34	23	16	17	19	11	-	-
1971	23	-	23	14	53	-	58	-	44	-	-	12
1972	-	19	-	8	7	25	-	23	-	-	9	-
1973	-	42	-	23	11	-	-	-	36	-	-	-
1974	-	67	-	-	53	-	-	22	-	-	15	-
1975	-	-	-	-	11	-	-	5	-	-	-	-

Table 12. Estimated gross density for *Peromyscus maniculatus* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

	MONTH											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	-	-	-	6.25 (0.96)	-	-	-	-	-	-
1971	50.0 (7.69)	-	28.0 (4.31)	14.0 (2.15)	21.0 (3.23)	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	-	-
1973	-	-	-	10.5 (1.62)	-	-	-	-	26.7 (4.11)	-	-	-
1974	-	44.0 (6.77)	-	-	58.3 (8.97)	-	-	-	-	-	60.0 (9.23)	-
1975	-	-	-	-	48.0 (7.38)	-	-	14.0 (2.15)	-	-	-	-
	MONTH											
DIRECT COUNT	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	4	14	12	12	6	2	12	7	6	-	-
1971	29	-	13	10	16	-	1	-	1	-	-	-
1972	-	-	-	-	9	1	-	1	-	-	-	-
1973	-	5	-	9	6	-	-	-	21	-	-	-
1974	-	44	-	-	37	-	-	1	-	-	15	-
1975	-	-	-	-	13	-	-	10	-	-	-	-

Table 13. Estimated gross density for *Dipodomys ordii* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

						MONTH						
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	8.3 (1.28)	4.5 (0.69)	42.0 (6.46)	-	-	-	-	-	-	-
1972	-	-	-	-	-	2.0 (0.31)	-	12.0 (1.85)	-	-	-	-
1973	-	-	-	-	-	-	-	-	-	-	-	-
1974	-	77.0 (11.85)	-	-	36.6 (5.63)	-	-	22.0 (3.38)	-	-	40.0 (6.15)	-
1975	-	-	-	-	4.5 (0.69)	-	-	9.0 (1.38)	-	-	-	-

						MONTH						
DIRECT COUNT	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	2	2	3	2	1	1	3	4	-	-
1971	10	-	7	4	16	-	13	-	3	-	-	1
1972	-	2	-	1	2	2	-	7	-	-	2	-
1973	-	5	-	1	-	-	-	-	11	-	-	-
1974	-	37	-	-	32	-	-	17	-	-	12	-
1975	-	-	-	-	4	-	-	7	-	-	-	-

Table 14. Estimated gross density for *Perognathus penicillatus* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

						MONTH						
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	-	-	-	10.0 (1.54)	-	-	-	-	-	-
1971	2.0 (0.31)	-	9.0 (1.38)	-	72.0 (11.08)	-	-	-	48.0 (7.38)	-	-	-
1972	-	-	-	-	-	-	-	33.0 (5.08)	-	-	10.0 (1.54)	-
1973	-	-	-	17.5 (2.69)	-	-	-	-	14.0 (2.15)	-	-	-
1974	-	-	-	-	33.0 (5.08)	-	-	42.0 (6.46)	-	-	13.3 (2.05)	-
1975	-	-	-	-	-	-	-	-	-	-	-	-

						MONTH						
DIRECT COUNT	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	1	1	6	6	9	9	5	4	-	-
1971	2	-	9	2	21	-	21	-	22	-	-	-
1972	-	1	-	2	2	7	-	15	-	-	6	-
1973	-	3	-	10	6	-	-	-	10	-	-	-
1974	-	-	-	-	17	-	-	22	-	-	11	-
1975	-	-	-	-	-	-	-	3	-	-	-	-

Table 15. Estimated gross density for *Sigmodon hispidus* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

						MONTH						
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	18.0 (2.77)	-
1973	-	63.3 (9.74)	-	28.0 (4.31)	-	-	-	-	85.3 (13.13)	-	-	-
1974	-	8.0 (1.23)	-	-	4.0 (0.62)	-	-	-	-	-	98.8 (15.2)	-
1975	-	-	-	-	32.5 (5.0)	-	-	22.4 (3.45)	-	-	-	-

						MONTH						
DIRECT COUNT	1	2	3	4	5	6	7	8	9	10	11	12
1970	-	-	1	-	-	-	-	-	1	1	-	-
1971	2	-	-	4	2	-	3	-	1	-	-	-
1972	-	1	-	1	2	1	-	1	-	-	8	-
1973	-	26	-	19	-	-	-	-	52	-	-	-
1974	-	6	-	-	4	-	-	1	-	-	46	-
1975	-	-	-	-	16	-	-	20	-	-	-	-

Table 16. Listing of species captured by sampling period, and direct count of new mammals marked within each period for 1975

						MONTH						
SPECIES	1	2	3	4	5	6	7	8	9	10	11	12
DIME					11			5				
PEMA					13			10				
DIOR					4			7				
NEAL					-			-				
PEPE					-			3				
SIHI					16			20				
DISP					-			-				
REME					19			11				
PEFL					7			11				
ONTO					-			-				
PEER					-			1				
PEIN					1			1				
PELE					24			20				
MUMU					-			-				
SPSP					-			-				
NEMI					1			2				

The census method was the same as in previous years, the strip census method of Emlen (1971). The census route is 1600 m, following a square pathway. This route bordered the playa bottom which facilitated sampling of both playa edge and bottom. The lateral distance between observer and each bird sighted was recorded to calculate a coefficient of detection (CD value) for each species. CD values were used to correct for actual number counted.

The species occurring on the playa and bajada have been grouped into ecologically similar assemblages: breeding species, including those primarily insectivorous species which breed on the area; mourning doves and scaled quail; raptors; nonbreeding insectivores; nonbreeding seedeaters; aquatic species which appear on the playa when flooded; and a small number of miscellaneous species.

During May 1975, no aquatic species occurred on the playa. Raptor density was 2.8/km^2 in 1975 as opposed to 3.4/km^2, the mean for the four previous years. Nonbreeding insectivores did not occur in 1975 censuses, whereas mean appearance for previous years was 24.2/km^2. Winter seedeaters were low in numbers with 14.1/km^2 compared to a four-year mean of 55.2/km^2. Doves and quail had a density of 48.2/km^2, very similar to the four-year mean of 48.4/km^2. Miscellaneous species totaled 0.8/km^2, as opposed to 1.8/km^2 as mean appearance for the four previous years. Breeding species had a density of 56.1/km^2, close to the 1971-74 mean of 55.5/km^2.

Lizards

Playa and bajada lizard densities were estimated on May 21, 22 and June 3 and 4, 1975, by four persons walking 20 x 500 m transects selected at random on the bajada and the playa fringe. All lizards encountered on the transect were recorded. Transects were run between 0900 and 1100 hr to ensure maximum activity. The densities were averaged for the four sample days and are presented in Table 17.

Table 17. The mean density of lizards on the playa and bajada sites May 21 through June 4, 1975

Species	Playa*	Bajada*
Cnemidophorus tigris	24	28
Cnemidophorus tesselatus	6	9
Uta stansburiana	4	3
Sceloporus magister	1	0
Phrynosoma cornutum	5	4

*Numbers given per hectare.

On the bajada, the grid did not traverse an arroyo which probably explains the absence of *Holbrookia texana*, an abundant lizard of the arroyos on the bajada (Whitford and Creusere 1976). The densities of *Cnemidophorus* sp. are lower than in 1974, probably due to the drought of that year.

Literature Cited

EMLEN, J. T. 1971. Population densities of birds derived from transect counts. Auk 88:323-342.

WHITFORD, W. G. 1976. Temporal fluctuations in density and diversity of desert rodent populations. J. Mammal. 57:351-369.

WHITFORD, W. G., and F. M. CREUSERE. 1976. Seasonal and yearly fluctuations in Chihuahuan Desert lizard communities. Herpetologica 32:7-18.

BAJADA

ABIOTIC

Air Temperature

Air temperature was monitored on the Jornada bajada site in 1975. Table 18 gives weekly means and ranges of maximum and minimum air temperatures. These data were collected from a standard climatic monitoring station on the bajada site. Air temperatures were monitored with a thermograph (as part of a hygrothermograph, Belfort Instrument Company; A3UWJ64).

Relative Humidity

Relative humidity was monitored on the Jornada bajada site in 1975. Table 19 gives weekly means and ranges of relative humidities collected at a standard climatic monitoring station on the bajada site. The relative humidity was monitored with a Belfort Instrument Company hygrothermograph (A3UWJ65).

Solar Radiation

Solar radiation was monitored on the bajada site (langleys/day) and the weekly means are presented in Table 20. Monitoring techniques were those described in Whitford et al. (1973; A3UWJ66).

Soil Temperature

Soil temperatures were monitored at depths of 10 and 50 cm on the Jornada bajada site in 1975. Tables 21 and 22 give weekly means, minimum and maximum temperatures for the two soil depths. These data were collected at the standard climatic monitoring station on the bajada site (A3UWJ61, 67).

Weekly Wind

Weekly wind data from the Jornada bajada site from 1975 are presented in Table 23. Total kilometers, as well as mean kilometers per day and mean kilometers per hour, are presented.

These data were collected from the anemometer on the bajada site. The meter was read once each week and the means were calculated from these figures. Occasional malfunction of the anemometer resulted in periods when no data were obtained (A3UWJ62).

Precipitation

Precipitation data from the Jornada bajada site from 1975 are presented in Table 24. Monthly total precipitation is given.

These data were collected with a recording rain gauge (weighing-bucket type, Belfort Instrument Company) near the bajada weather station. The instrument is checked after each suspected rainfall event and duration and intensity of rainfall occurrences are recorded.

Total precipitation for 1975 on the bajada site was 186.45 mm, with no precipitation recorded in June. September and August had the greatest number of recorded events, but the six events in September total 76.71 mm, the greatest amount of rain in any month (A3UWJ63).

Literature Cited

Whitford, W. G. (Coordinator) et al. 1973. Jornada Validation Site report. US/IBP Desert Biome Res. Memo. 73-4. Utah State Univ., Logan. 332 pp.

Table 18. Weekly air temperature data (° C) acquired at the Jornada bajada site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	2.50	13	-8
2	Jan 08-Jan 14	5.80	16	-4
3	Jan 15-Jan 21	9.14	37	-1
4	Jan 22-Jan 28	10.28	24	-1
5	Jan 29-Feb 04	10.85	17	4
6	Feb 05-Feb 11	10.71	21	-2
7	Feb 12-Feb 18	10.00	21	1
8	Feb 19-Feb 25	8.80	21	-10
9	Feb 26-Mar 04	15.71	37	3
10	Mar 05-Mar 11	15.42	24	7
11	Mar 12-Mar 18	10.71	23	1
12	Mar 19-Mar 25	16.71	30	2
13	Mar 26-Apr 01	11.00	21	2
14	Apr 02-Apr 08	13.57	26	1
15	Apr 09-Apr 15	13.85	28	2
16	Apr 16-Apr 22	18.28	30	2
17	Apr 23-Apr 29	19.00	29	4
18	Apr 30-May 06	19.57	28	9
19	May 07-May 13	21.42	34	5
20	May 14-May 20	24.00	33	13
21	May 21-May 27	24.00	34	10
22	May 28-Jun 03	24.71	38	12
23	Jun 04-Jun 10	27.85	38	18
24	Jun 11-Jun 17	29.71	41	14
25	Jun 18-Jun 24	28.57	38	18
26	Jun 25-Jul 01	31.14	39	18
27	Jul 02-Jul 08	28.42	36	22
28	Jul 09-Jul 15	27.85	38	19
29	Jul 16-Jul 22	28.71	39	21
30	Jul 23-Jul 29	27.57	37	19
31	Jul 30-Aug 05	29.57	38	20
32	Aug 06-Aug 12	29.42	36	23
33	Aug 13-Aug 19	28.28	37	20

Table 18, continued

Week	Time Intervals	Mean	1975 Max.	Min.
34	Aug 20-Aug 26	28.00	37	20
35	Aug 27-Sep 02	29.57	37	21
36	Sep 03-Sep 09	24.00	31	19
37	Sep 10-Sep 16	22.42	32	14
38	Sep 17-Sep 23	24.00	34	12
39	Sep 24-Sep 30	24.57	36	14
40	Oct 01-Oct 07	22.42	33	10
41	Oct 08-Oct 14	23.00	33	11
42	Oct 15-Oct 21	17.85	30	6
43	Oct 22-Oct 28	17.00	28	8
44	Oct 29-Nov 04	17.40	27	8
45	Nov 05-Nov 11	17.71	27	8
46	Nov 12-Nov 18	14.14	27	1
47	Nov 19-Nov 25	8.00	19	0
48	Nov 26-Dec 02	5.57	18	-4
49	Dec 03-Dec 09	7.85	18	-1
50	Dec 10-Dec 16	10.75	19	3
51	Dec 17-Dec 23	4.00	12	-2
52	Dec 24-Dec 31	8.00	21	3

Table 19. Relative humidity on the Jornada bajada site (percent)

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	68.4	99.	23.
2	Jan 08-Jan 14	53.2	99.	24.
3	Jan 15-Jan 21	50.1	92.	23.
4	Jan 22-Jan 28	56.8	99.	18.
5	Jan 29-Feb 04	74.5	99.	35.
6	Feb 05-Feb 11	46.8	72.	22.
7	Feb 12-Feb 18	48.5	90.	24.
8	Feb 19-Feb 25	50.1	99.	21.
9	Feb 26-Mar 04	36.7	71.	19.
10	Mar 05-Mar 11	43.8	80.	24.
11	Mar 12-Mar 18	47.2	100.	22.
12	Mar 19-Mar 25	34.7	64.	16.
13	Mar 26-Apr 01	48.1	70.	22.
14	Apr 02-Apr 08	36.4	93.	16.
15	Apr 09-Apr 15	45.2	92.	18.
16	Apr 16-Apr 22	34.5	76.	18.
17	Apr 23-Apr 29	28.0	40.	22.
18	Apr 30-May 06	28.5	38.	24.
19	May 07-May 13	75.0	99.	18.
20	May 14-May 20	79.1	99.	22.
21	May 21-May 27	Data Missing		
22	May 28-Jun 03	10.7	25.	3.
23	Jun 04-Jun 10	14.2	36.	2.
24	Jun 11-Jun 17	15.1	48.	3.
25	Jun 18-Jun 24	20.5	45.	8.

Table 19, continued

Week	Time Interval	Mean	1975 Max.	Min.
26	Jun 25-Jul 01	19.7	48.	4.
27	Jul 02-Jul 08	39.4	79.	20.
28	Jul 09-Jul 15	38.1	60.	16.
29	Jul 16-Jul 22	39.8	86.	16.
30	Jul 23-Jul 29	41.5	76.	22.
31	Jul 30-Aug 05	34.5	71.	15.
32	Aug 06-Aug 12	25.8	51.	13.
33	Aug 13-Aug 19	38.4	55.	16.
34	Aug 20-Aug 26	39.5	62.	10.
35	Aug 27-Sep 02	33.1	59.	12.
36	Sep 03-Sep 09	53.4	72.	31.
37	Sep 10-Sep 16	49.2	66.	17.
38	Sep 17-Sep 23	40.5	62.	12.
39	Sep 24-Sep 30	24.2	28.	12.
40	Oct 01-Oct 07	31.0	57.	12.
41	Oct 08-Oct 14	27.2	46.	14.
42	Oct 15-Oct 21	30.2	52.	12.
43	Oct 22-Oct 28	21.0	52.	4.
44	Oct 29-Nov 04	21.0	43.	6.
45	Nov 05-Nov 11	14.2	30.	5.
46	Nov 12-Nov 18	14.4	52.	4.
47	Nov 19-Nov 25	17.0	47.	7.
48	Nov 26-Dec 02	22.2	54.	7.
49	Dec 03-Dec 09	26.0	48.	5.
50	Dec 10-Dec 16	29.0	74.	9.
51	Dec 17-Dec 23	24.0	56.	9.
52	Dec 24-Dec 31	22.0	54.	7.

Table 20. Weekly solar radiation data acquired at the Jornada bajada site during 1975 (mean langleys/day)

Week	Time Intervals	Mean
1	Jan 01-Jan 07	315
2	Jan 08-Jan 14	336
3	Jan 15-Jan 21	356
4	Jan 22-Jan 28	321
5	Jan 29-Feb 04	270
6	Feb 05-Feb 11	435
7	Feb 12-Feb 18	420
8	Feb 19-Feb 25	399
9	Feb 26-Mar 04	497
10	Mar 05-Mar 11	450
11	Mar 12-Mar 18	533
12	Mar 19-Mar 25	577
13	Mar 26-Apr 01	454
14	Apr 02-Apr 08	596
15	Apr 09-Apr 15	630
16	Apr 16-Apr 22	625

Table 20, continued

Week	Time Intervals	Mean
17	Apr 23-Apr 29	654
18	Apr 30-May 06	741
19	May 07-May 13	653
20	May 14-May 20	692
21	May 21-May 27	704
22	May 28-Jun 03	687
23	Jun 04-Jun 10	685
24	Jun 11-Jun 17	709
25	Jun 18-Jun 24	718
26	Jun 25-Jul 01	721
27	Jul 02-Jul 08	639
28	Jul 09-Jul 15	546
29	Jul 16-Jul 22	601
30	Jul 23-Jul 29	646
31	Jul 30-Aug 05	644
32	Aug 06-Aug 12	634
33	Aug 13-Aug 19	588
34	Aug 20-Aug 26	544
35	Aug 27-Sep 02	554
36	Sep 03-Sep 09	401
37	Sep 10-Sep 16	484
38	Sep 17-Sep 23	545
39	Sep 24-Sep 30	558
40	Oct 01-Oct 07	527
41	Oct 08-Oct 14	509
42	Oct 15-Oct 21	423
43	Oct 22-Oct 28	448
44	Oct 29-Nov 04	417
45	Nov 05-Nov 11	399
46	Nov 12-Nov 18	359
47	Nov 19-Nov 25	337
48	Nov 26-Dec 02	321
49	Dec 03-Dec 09	324
50	Dec 10-Dec 16	342
51	Dec 17-Dec 23	251
52	Dec 24-Dec 31	300

Table 21. Weekly soil temperature data (°C) at a depth of 10 cm acquired at the Jornada bajada site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	-.57	3	-1
2	Jan 08-Jan 14	1.0	5	-1
3	Jan 15-Jan 21	4.7	9	0
4	Jan 22-Jan 28	5.1	12	-1
5	Jan 29-Feb 04	7.7	12	3

Table 21, continued

Week	Time Intervals	Mean	1975 Max.	Min.
6	Feb 05-Feb 11	7.3	12	2
7	Feb 12-Feb 18	7.4	12	0
8	Feb 19-Feb 25	5.3	12	-1
9	Feb 26-Mar 04	12.4	19	5
10	Mar 05-Mar 11	13.7	19	9
11	Mar 12-Mar 18	11.7	16	0
12	Mar 19-Mar 25	15.4	20	9
13	Mar 26-Apr 01	10.1	17	5
14	Apr 02-Apr 08	13.6	22	6
15	Apr 09-Apr 15	14.0	24	6
16	Apr 16-Apr 22	18.9	25	11
17	Apr 23-Apr 29	20.1	25	19
18	Apr 30-May 06	21.7	29	15
19	May 07-May 13	23.1	30	17
20	May 14-May 20	25.9	31	20
21	May 21-May 27	25.6	33	19
22	May 28-Jun 03	27.1	37	18
23	Jun 04-Jun 10	30.9	36	25
24	Jun 11-Jun 17	32.3	40	24
25	Jun 18-Jun 24	32.0	39	26
26	Jun 25-Jul 01	35.4	42	28
27	Jul 02-Jul 08	33.4	41	27
28	Jul 09-Jul 15	32.4	41	23
29	Jul 16-Jul 22	33.3	40	27
30	Jul 23-Jul 29	31.7	39	25
31	Jul 30-Aug 05	32.4	40	23
32	Aug 06-Aug 12	32.7	40	27
33	Aug 13-Aug 19	32.7	39	26
34	Aug 20-Aug 26	30.7	40	23
35	Aug 27-Sep 02	32.7	40	27
36	Sep 03-Sep 09	25.4	34	19
37	Sep 10-Sep 16	23.1	33	17
38	Sep 17-Sep 23	25.6	35	17
39	Sep 24-Sep 30	24.9	33	20
40	Oct 01-Oct 07	23.9	30	18
41	Oct 08-Oct 14	19.6	29	16
42	Oct 15-Oct 21	19.6	30	15
43	Oct 22-Oct 28	15.6	21	11
44	Oct 29-Nov 04	Data Missing		
45	Nov 05-Nov 11	Data Missing		
46	Nov 12-Nov 18	Data Missing		
47	Nov 19-Nov 25	Data Missing		
48	Nov 26-Dec 02	Data Missing		
49	Dec 03-Dec 09	16.3	21	12
50	Dec 10-Dec 16	8.2	11	1
51	Dec 17-Dec 23	10.0	13	3
52	Dec 24-Dec 31	8.2	11	1

Table 22. Weekly soil temperature data (°C) at a depth of 50 cm acquired at the Jornada bajada site during 1975

Week	Time Intervals	Mean	1975 Max.	Min.
1	Jan 01-Jan 07	2.42	3	1
2	Jan 08-Jan 14	3.1	4	0
3	Jan 15-Jan 21	4.5	6	3
4	Jan 22-Jan 28	5.8	8	4
5	Jan 29-Feb 04	8.1	9	8
6	Feb 05-Feb 11	8.0	9	7
7	Feb 12-Feb 18	8.8	10	8
8	Feb 19-Feb 25	7.5	9	0
9	Feb 26-Mar 04	9.0	9	0
10	Mar 05-Mar 11	13.0	14	12
11	Mar 12-Mar 18	12.2	13	10
12	Mar 19-Mar 25	13.5	15	12
13	Mar 26-Apr 01	13.7	16	10
14	Apr 02-Apr 08	12.7	15	12
15	Apr 09-Apr 15	13.4	16	13
16	Apr 16-Apr 22	16.2	19	16
17	Apr 23-Apr 29	18.4	20	17
18	Apr 30-May 06	19.5	21	18
19	May 07-May 13	20.5	21	19
20	May 14-May 20	23.2	24	22
21	May 21-May 27	23.5	26	23
22	May 28-Jun 03	24.5	26	23
23	Jun 04-Jun 10	27.4	28	26
24	Jun 11-Jun 17	28.2	30	27
25	Jun 18-Jun 24	29.8	30	29
26	Jun 25-Jul 01	30.8	32	30
27	Jul 02-Jul 08	31.7	32	30

Table 22, continued

Week	Time Intervals	Mean	1975 Max.	Min.
28	Jul 09-Jul 15	30.5	32	29
29	Jul 16-Jul 22	30.4	31	30
30	Jul 23-Jul 29	30.1	32	29
31	Jul 30-Aug 05	31.1	32	30
32	Aug 06-Aug 12	31.2	32	30
33	Aug 13-Aug 19	31.0	32	31
34	Aug 20-Aug 26	30.7	32	30
35	Aug 27-Sep 02	31.2	32	31
36	Sep 03-Sep 09	30.1	32	27
37	Sep 10-Sep 16	26.5	28	23
38	Sep 17-Sep 23	26.0	28	24
39	Sep 24-Sep 30	25.1	26	24
40	Oct 01-Oct 07	25.2	29	24
41	Oct 08-Oct 14	24.7	25	24
42	Oct 15-Oct 21	23.0	24	22
43	Oct 22-Oct 28	20.5	20	18
44	Oct 29-Nov 04	Data Missing		
45	Nov 05-Nov 11	Data Missing		
46	Nov 12-Nov 18	Data Missing		
47	Nov 19-Nov 25	Data Missing		
48	Nov 26-Dec 02	Data Missing		
49	Dec 03-Dec 09	18.4	19	18
50	Dec 10-Dec 16	14.1	16	11
51	Dec 17-Dec 23	19.6	20	19
52	Dec 24-Dec 31	18.0	19	17

Table 23. Wind data for the Jornada bajada site from 1975. Total kilometers as well as mean kilometers per day and mean kilometers per hour are presented. Data monitored as described in Whitford et al. (1973; DSCODE A3UWJ62)

Week	Time intervals	Total kilometers	Mean per day	Mean per hour
1	Jan 01-Jan 07	1517.3	216.7	9.0
2	Jan 08-Jan 14	1694.3	242.0	10.1
3	Jan 15-Jan 21	1866.1	266.5	11.1
4	Jan 22-Jan 28	1391.0	198.7	8.2
5	Jan 29-Feb 04	1340.9	191.6	8.1
6	Feb 05-Feb 11	1413.7	201.9	8.4
7	Feb 12-Feb 18	1677.7	239.7	10.0
8	Feb 19-Feb 25	1444.6	206.4	8.5
9	Feb 26-Mar 04	916.7	131.0	5.5
10	Mar 05-Mar 11	1668.7	238.5	10.0
11	Mar 12-Mar 18	1796.6	256.6	10.6
12	Mar 19-Mar 25	N.D.*	N.D.	N.D.
13	Mar 26-Apr 01	2090.1	298.6	12.4
14	Apr 02-Apr 08	2015.0	287.9	12.1
15	Apr 09-Apr 15	1669.3	238.5	10.0
16	Apr 16-Apr 22	1770.5	252.9	10.6
17	Apr 23-Apr 29	1740.8	250.4	10.5
18	Apr 30-May 06	1945.4	277.9	11.6
19	May 07-May 13	1562.2	223.2	9.3
20	May 14-May 20	1656.1	236.5	9.8
21	May 21-May 27	1918.4	274.0	11.4
22	May 28-Jun 03	1690.1	241.5	10.1
23	Jun 04-Jun 10	1758.2	251.2	10.5
24	Jun 11-Jun 17	1655.5	236.5	9.8
25	Jun 18-Jun 24	2219.5	317.1	13.2
26	Jun 25-Jul 01	1762.0	251.7	10.5
27	Jul 02-Jul 08	1433.9	204.8	8.5
28	Jul 09-Jul 15	1166.7	166.7	6.9
29	Jul 16-Jul 22	1335.8	190.8	7.9
30	Jul 23-Jul 29	1381.7	197.4	8.2
31	Jul 30-Aug 05	1283.0	183.3	7.6
32	Aug 06-Aug 12	1227.5	175.2	7.2
33	Aug 13-Aug 19	1236.7	176.7	7.4
34	Aug 20-Aug 26	1236.7	176.7	7.4
35	Aug 27-Sep 02	1269.2	181.3	7.6
36	Sep 03-Sep 09	1526.9	218.0	9.0
37	Sep 10-Sep 16	849.4	121.3	5.0
38	Sep 17-Sep 23	961.4	137.4	5.8
39	Sep 24-Sep 30	811.6	116.0	4.8
40	Oct 01-Oct 07	742.1	106.0	4.3
41	Oct 08-Oct 14	1359.3	194.1	8.1
42	Oct 15-Oct 21	980.0	140.0	5.8
43	Oct 22-Oct 28	1238.9	177.0	7.4
44	Oct 29-Nov 04	1256.6	179.6	7.4
45	Nov 05-Nov 11	954.1	136.3	5.6
46	Nov 12-Nov 18	922.0	131.6	5.5
47	Nov 19-Nov 25	472.7	67.6	2.7
48	Nov 26-Dec 02	1931.4	275.9	11.4
49	Dec 03-Dec 09	2501.4	357.4	15.0
50	Dec 10-Dec 16	N.D.	N.D.	N.D.
51	Dec 17-Dec 23	N.D.	N.D.	N.D.
52	Dec 24-Dec 31	N.D.	N.D.	N.D.

* N.D. - no data available due to malfunction of equipment.

Table 24. Precipitation data from the Jornada bajada site in 1975. Monthly total precipitation is shown in inches and millimeters

Month	Total in inches	Total in millimeters
January	0.74	18.80
February	0.27	6.86
March	0.42	10.67
April	0.02	0.51
May	0.12	3.05
June	--	--
July	0.65	16.51
August	1.16	29.46
September	3.02	76.71
October	0.50	12.70
November	0.32	8.13
December	0.12	3.05

PLANTS

The plant data for 1975 have not yet been reduced and analyzed due to the sabbatical leave of Dr. John Ludwig. These data will be included in the next progress report.

INVERTEBRATES

Pitfall Traps

Two 30-m-diameter circular trapping grids surrounded by 15-cm lawn edging were constructed on the bajada site (706.5 m^2 enclosed per grid). Fifteen can traps were located within the grids, arranged in concentric circles at radii 1, 7 and 0 m with 9, 5 and 1 traps equally spaced in each circle.

The first enclosure (designated as Bajada I) was located so that it was transected by a small feeder arroyo. Vegetation in this enclosure was predominantly *Larrea tridentata* but some *Yucca baccata* and *Prosopis glandulosa* were also present. The second enclosure (designated as Bajada II) was located on a pure *L. tridentata* stand east of the main arroyo.

Sampling dates and methods were the same as those described in the "Playa" section of this report.

Tables 25 and 26 indicate the number of ground beetles caught during the 1975 season. The numbers were computed using the Lincoln Index with the Bailey modification where necessary due to extremely low recapture numbers.

The beetle composition was nearly the same for both grids. *Eleodes* sp. was the predominant species, followed at some distance by *Megasida* sp., while *Eleodes omissa* was represented by only one individual on Bajada I and was absent from Bajada II. *Saprinus* sp. was absent from Bajada I, with three individuals captured on Bajada II.

As in the case of the playa data, the diversity and number of individuals captured were very low compared to data taken in 1970 using open-area trap grids. Several families were entirely absent from the 1975 data. It is not known whether this is due to the decreased and restricted trapping area or to some other phenomena.

Termites

The bajada termite data are presented in the section on termites in the "Playa" section.

Table 25. Animals captured in pitfall traps on the Jornada Bajada I site during 1975

	Coleoptera Tenebrionidae *Eleodes* sp.	Coleoptera Tenebrionidae *Megasida* sp.	Coleoptera Tenebrionidae *Eleodes omissa*
0611	0	0	0
0626	0	0	0
0708	0	0	0
0716	0	2	0
0723	0	4	0
0806	3	4	0
0814	3	0	0
0825	2	0	1
0901	2	0	0
0908	2	0	0
0915	4	0	0
0922	9	0	0
0929	3	0	0
1006	No Data	-	-
1013	6	0	0
1020	1	0	0
1027	0	1	0
1103	0	0	0
1113	0	0	0
1120	0	0	0
1128	0	0	0

Table 26. Animals captured in pitfall traps on the Jornada Bajada II site during 1975

	Coleoptera Tenebrionidae *Eleodes* sp.	Coleoptera Tenebrionidae *Megasida* sp.	Coleoptera Histeridae *Saprinus* sp.	Coleoptera Cerambycidae *Moneilema*
0611	0	0	0	0
0626	0	0	0	0
0708	2	0	0	0
0716	1	0	0	0
0723	0	5	3	0
0806	1	3	0	0
0814	0	0	0	0
0825	2	1	0	0
0901	4	0	0	0
0908	2	0	0	0
0915	2	0	0	0
0922	2	0	0	0
0929	0	0	0	0
1006	no data	-	-	-
1013	2	0	0	0
1020	1	0	0	0
1027	2	0	0	0
1103	2	0	0	0
1113	0	0	0	0
1120	0	0	0	0
1128	0	0	0	0

VERTEBRATES

Mammals

Unlike the playa site, the bajada mammals exhibited population increases between 1974 and 1975 (Tables 27-32). The grazing treatment applied to the playa site could be a contributing factor in this population difference. The reduction in estimates over the summer is attributable to juvenile mortality.

Birds

As on the playa, bajada birds were censused only in May 1975. The same census method was used on the bajada as on the playa. The route is 2200 m, 800 of which follow the course of the main arroyo that bisects the area. Ecological groupings are the same as used on the playa.

Raptors appeared in the May census for the first time in five years, with a density of .714/km^2. Winter seedeaters

Table 27. Estimated gross density for *Dipodomys merriami* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

						MONTH						
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	38.77 (17.23)	49.0 (21.78)	48.52 (21.56)	48.86 (21.71)	-	114.0 (50.67)	-	-
1972	16.0 (7.11)	-	17.5 (7.78)	55.8 (24.80)	34.83 (15.48)	57.5 (25.56)	24.92 (11.07)	-	-	-	20.0 (8.89)	-
1973	-	42.0 (18.67)	29.75 (13.22)	-	45.71 (20.32)	37.89 (16.84)	50.40 (22.40)	-	27.44 (12.20)	-	88.71 (39.43)	-
1974	-	48.56 (21.58)	-	-	51.81 (23.03)	-	-	43.88 (19.50)	-	-	76.08 (33.81)	-
1975	-	-	-	-	172.50 (76.67)	-	-	48.75 (21.67)	-	-	-	-
DIRECT COUNT						MONTH						
	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	33	43	44	44	-	46	-	-
1972	15	-	16	39	24	29	24	-	-	-	18	-
1973	-	31	23	-	38	35	40	-	23	-	59	-
1974	-	43	-	-	45	-	-	37	-	-	53	-
1975	-	-	-	-	79	-	-	45	-	-	-	-

Table 28. Estimated gross density for *Peromyscus maniculatus* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

						MONTH						
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	2.0 (0.89)	-	-	-	-	-	-	-
1972	-	-	-	-	10.0 (4.44)	-	-	-	-	-	-	-
1973	-	-	5.33 (2.37)	-	23.33 (10.37)	28.0 (12.44)	21.0 (9.33)	-	30.80 (13.69)	-	71.50 (31.78)	-
1974	-	4.0 (1.78)	-	-	6.0 (2.67)	-	-	-	-	-	12.0 (5.33)	-
1975	-	-	-	-	36.0 (16.0)	-	-	-	-	-	-	-
DIRECT COUNT						MONTH						
	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	2	-	-	-	-	1	-	-
1972	-	-	-	4	9	-	-	-	-	-	2	-
1973	-	3	5	-	22	19	13	-	26	-	22	-
1974	-	4	-	-	5	-	-	2	-	-	7	-
1975	-	-	-	-	12	-	-	8	-	-	-	-

were low with a density of 4.5/km² as opposed to a May mean of the four previous years of 19.0/km². Miscellaneous species during the 1975 census at 2.5/km² were near the mean of 3.7/km². Breeding species numbers were higher than usual, at 60.8/km² as opposed to 53.7/km². The 1975 density was the second highest recorded in past years. Doves and quail were present in greater densities than in most years, with 61.7/km² contrasting with a four-year mean of 21.0/km². Nonbreeding insectivores were low with a density of 2.9/km², while mean appearance for previous years was 22.2/km².

Lizards

The section on lizards in the "Playa" section also includes the data from the bajada site.

Table 29. Estimated gross density for *Perognathus penicillatus* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

	MONTH											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	-	15.0 (6.67)	4.0 (1.78)	11.25 (5.0)	-	-	-	-
1972	-	-	-	17.50 (7.78)	7.50 (3.33)	1.0 (0.44)	-	-	-	-	20.0 (8.89)	-
1973	-	21.0 (9.33)	-	-	21.0 (9.33)	16.5 (7.33)	32.50 (14.44)	-	10.0 (4.44)	-	17.5 (7.78)	-
1974	-	4.0 (1.78)	-	-	21.60 (9.60)	-	-	12.0 (5.33)	-	-	14.0 (6.22)	-
1975	-	-	-	-	28.0 (12.44)	-	-	12.0 (5.33)	-	-	-	-
DIRECT COUNT	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	8	9	4	10	-	6	-	-
1972	-	-	1	10	6	1	3	-	-	-	8	-
1973	-	11	8	-	13	14	22	-	10	-	13	-
1974	-	4	-	-	16	-	-	12	-	-	11	-
1975	-	-	-	-	13	-	-	8	-	-	-	-

Table 30. Estimated gross density for *Neotoma albigula* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

	MONTH											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	3.0 (1.33)	9.0 (4.0)	-	-	-	8.0 (3.56)	-	-
1972	-	-	-	1.0 (0.44)	-	2.0 (0.89)	6.0 (2.67)	-	-	-	2.0 (0.89)	-
1973	-	-	2.0 (0.89)	-	-	13.5 (6.0)	12.0 (5.33)	-	14.0 (6.22)	-	28.0 (12.44)	-
1974	-	-	-	-	10.0 (4.44)	-	-	-	-	-	-	-
1975	-	-	-	-	-	-	-	3.0 (1.33)	-	-	-	-
DIRECT COUNT	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
1971	-	-	-	-	3	7	4	3	-	5	-	-
1972	2	-	-	1	1	2	4	-	-	-	2	-
1973	-	5	2	-	-	10	6	-	12	-	13	-
1974	-	6	-	-	6	-	-	1	-	-	3	-
1975	-	-	-	-	2	-	-	3	-	-	-	-

Table 31. Estimated gross density for *Perognathus intermedius* populations sampled over a six-year period. Simple Lincoln Index values are given with adjusted densities per hectare in parentheses

YEAR	1	2	3	4	5	MONTH 6	7	8	9	10	11	12
1971	-	-	-	-	-	12.00 (5.33)	10.0 (4.44)	3.0 (1.33)	-	56.0 (24.89)	-	-
1972	-	-	-	15.0 (6.67)	6.0 (2.67)	-	-	-	-	-	-	-
1973	-	-	-	-	6.0 (2.67)	12.0 (5.33)	6.0 (2.67)	-	6.25 (2.78)	-	6.0 (2.67)	
1974	-	-	-	-	21.3 (9.48)	-	-	11.67 (5.18)	-	-	-	-
1975	-	-	-	-	-	-	-	6.0 (2.67)	-	-	-	-

DIRECT COUNT	1	2	3	4	5	MONTH 6	7	8	9	10	11	12
1971	-	-	-	-	-	7	8	3	-	17	-	-
1972	-	-	2	7	4	2	-	-	-	-	-	-
1973	-	7	1	-	4	9	6	-	6	-	4	-
1974	-	-	-	-	13	-	-	9	-	-	4	-
1975	-	-	-	-	8	-	-	4	-	-	-	-

Table 32. Listing of species captured by sampling period, and direct count of new mammals marked within each period for 1975

SPECIES	1	2	3	4	5	MONTH 6	7	8	9	10	11	12
DIME					79			45				
PEMA					12			8				
PEPE					13			8				
PEER					4			-				
NEAL					2			3				
ONTO					-			-				
PEFL					1			1				
PEIN					8			4				
DIOR					11			12				
PELE					1			2				
REME					-			-				
SPSP					-			-				
NEMI					-			-				
SIHI					-			-				
ONLE					1			-				

APPENDIX II

THE DISTRIBUTION OF LITTER ON THE CHIHUAHUAN DESERT ECOSYSTEM

E. M. DePree and W. G. Whitford

Introduction

Noy-Meir (1974) stated that "more quantitative information is needed about the fate of dead organic material (macro- and microdecomposition, erosion and redistribution) in arid ecosystems." Distribution of litter is an aspect of the Chihuahuan Desert ecosystem that has been ignored even though litter estimation is useful in locating nutrient pools. Location and redistribution of available nutrients in the system could be an important determinant of the distribution and activity of soil arthropods, microorganisms and vegetation.

One of the reasons it has been a neglected area for study is the extreme difficulty in devising a random scheme for litter sampling that would effectively show changes in litter in microhabitats from season to season. Diverse vegetation patterns and distribution and the seasonal nature of winds and rain increase the difficulty of collecting representative samples.

Previous studies concerned with litter on the soil surface in the Chihuahuan Desert ecosystem (Nickell 1972), were limited to estimates of the leaf biomass produced each growing season, and shed during and after the growing season, and they assumed that biomass production approximately equaled litter production. This yielded information on the quantity of litter but not on spatial distribution.

Purpose

This study was designed to develop methods for use in future litter studies in the desert ecosystem. A sampling scheme was needed to yield data showing the relative seasonal and spatial distribution of litter. Data collected on litter distribution were correlated with data collected on plant species distribution and distribution of termites and other soil arthropods.

Study Site

The study was conducted on the Jornada Validation Site, 40 km NNE of Las Cruces, New Mexico. The site chosen for the study is a bajada (alluvial fan) formed by the erosion of Mt. Summerford, directly to the west. The bajada is cut by one large wash, which flows from south to north on the gridded sample area. To the west of the large wash there are several smaller washes which are tributaries to the large wash. To the east of the large wash there are many shallow, broad arroyos which run downhill to the east.

Aerial maps show that the large arroyo constitutes approximately 0.75 ha of the 25-ha bajada site. The small arroyos represent approximately 3.25 ha and the nonarroyo area represents approximately 20 ha of the total sample area.

The perennial vegetation in each of these areas is quite distinct, so that each area has a distinct litter production. The large arroyo is populated with large deciduous shrubs, the small arroyos are populated by small deciduous and evergreen shrubs, while the gently rolling hills between arroyos are covered with the evergreen shrub, *Larrea tridentata*.

Two climatic factors influence the distribution of litter on the desert ecosystem: gusting springtime winds and late summer and early autumn rains. Intense rain results in runoff on the sloped bajada and the eroded soils and litter drain into the arroyos.

Methods

A stratified sampling scheme was used to sample the three main topographical regions; the large wash, the small arroyos and the nonarroyo areas. A distinction was made between samples taken on the east and west sides of the large arroyo and those taken in open areas and under shrubs. Square meters were D-Vaced of all surface litter and two cores samples, 5 and 10 cm in depth and 12.5 cm in width, were taken in the D-Vaced areas. Samples were sorted into the following categories: plant stem, leaf rachises, roots, reproductive parts, feces, animal material and sand with unidentified litter. Each category was weighed and the sand with unidentifiable litter was ashed to estimate the amount of organic material. Samples were taken in May, following the spring winds, and in November after the fall rains.

Results and Discussion

There are several general trends in litter distribution (Table 1). Total amounts of above-ground litter on all areas were higher under shrubs. Litter initially falls under the plants and shrubs catch, or trap, litter during winds and rains where runoff occurs.

The small arroyos accumulate most of the litter because of the following: 1) most of the runoff from rains travels through small arroyos before reaching the large arroyo; 2) the small arroyos are densely populated with shrubs, which produce eddies and back currents where litter accumulates during runoff. The depression and the denser vegetation of small arroyos trap litter during the winds.

There was more litter per unit area at the end of the growing season. The amount of woody material collected was significantly higher while the amount of leaf material collected was significantly lower in November (Table 1). In November, leaf fall from deciduous plants was not complete, and some leaf material which had fallen in the small arroyos had probably been washed away or buried during rains. Runoff undoubtedly has less effect on the translocation of heavier wood. The increase in leaf material from November to May may be due to winds blowing leaves and annuals from the nonarroyo areas into the small arroyos. There was a visibly larger amount of annual material in the May sample.

Appendix II, Table 1. Average weight of surface litter·m⁻². The major accumulation of litter is under shrubs, and in small arroyos. Differences in surface litter between east and west sides of the large arroyo are due to different patterns of soil erosion

Area	Litter	Surface samples ($g \cdot m^{-2}$)			
		May sample		November sample	
		West*	East*	West*	East*
Non-arroyo					
Under bush	Stems	14.85	47.57	25.67	56.45
	Leaves	5.54	42.63	20.37	50.60
	Feces	.01	3.45	2.16	2.79
	TOTAL	35.88	124.42	57.95	132.27
Not under bush	Stems	5.02	9.38	16.50	12.09
	Leaves	1.58	11.26	4.66	9.13
	Feces	.23	2.16	1.08	2.60
	TOTAL	22.97	37.27	27.34	29.86
Small arroyo					
Under bush	Stems	131.24	78.77	288.25	144.42
	Leaves	193.86	123.57	77.80	82.32
	Feces	2.10	2.27	1.46	1.77
	TOTAL	369.90	231.61	429.35	255.00
Not under bush	Stems	5.00	1.91	4.71	6.36
	Leaves	9.20	2.39	4.93	8.99
	Feces	.65	.52	.02	.99
	TOTAL	23.29	16.38	12.41	18.94
Large arroyo					
Under bush	Stems	19.52		62.95	
	Leaves	13.58		134.97	
	Feces	.95		1.54	
	TOTAL	102.68		222.86	
Not under bush	Stems	2.35		4.86	
	Leaves	.88		46.36	
	Feces	.65		8.50	
	TOTAL	23.01		75.67	

* West and East refer to the side of the large arroyo on which the sample was taken -- not to the large arroyo samples.

Appendix II, Table 2. Average percentage of organic material in core samples (5 and 10 cm). There is no significant difference ($P < .05$) between samples taken in May and November; taken under shrubs or in the open; or taken at 5 or 10 cm. It is hypothesized that the low and unvarying percentages of organic material are due to soil arthropods moving the detritus out of the upper layers of the soil

Area	Sample	Average % organic material			
		May sample		November sample	
		West*	East*	West*	East*
Non-arroyo					
Under bush	10 cm	3.3	2.8	2.2	2.2
	5 cm	3.0	2.6	2.5	2.2
Not under bush	10 cm	1.7	3.8	2.8	2.8
	5 cm	2.7	3.7	2.3	1.8
Small arroyo					
Under bush	10 cm	4.2	3.6	1.6	1.7
	5 cm	2.0	1.8	.9	1.0
Not under bush	10 cm	1.9	1.7	2.3	2.1
	5 cm	1.7	1.2	1.3	1.1
Large arroyo					
Under bush	10 cm	4.2		1.1	
	5 cm	2.3		.9	
Not under bush	10 cm	1.6		.9	
	5 cm	1.8		.8	

* West and East pertain to the side of the large arroyo on which the samples were taken -- not to the large arroyo.

The amount of surface litter in the large arroyo greatly increased from May to November with the majority of this increase being leaf material. This increase is probably due in part to the deciduous nature of the large shrubs in the large arroyo and, in part, due to litter being washed by rains into the large arroyo. Bands of litter caused by rains were visible in the center of the arroyo in November, accounting for a large proportion of the increase in litter in the open areas.

In nonarroyo areas, there was a larger amount of litter in the above-ground samples in November than in May. This was due to the loss of leaf and stem material on creosote in the fall (Ludwig 1975). The decrease from November to May is probably due to wind export, decomposition and soil arthropod activity.

An interesting aspect of the results is the difference found in surface litter on the west and east sides of the arroyo. On nonarroyo areas the east side had more litter than the west side; in small arroyos, the west side had more litter (Table 1). The soils to the west of the large arroyo are being eroded, while the soils on the east side are being built up. The lower surface litter on the nonarroyo areas on the west side probably results from the soils and the litter being continually washed away, whereas erosion is not as rapid on the east side. When the nonarroyo soils and litter are washed away, they are carried by the small arroyos. More soil and litter are washed from the west-side hills than the east side, so more litter accumulates in west-side arroyos. Other factors which may cause more litter accumulation in small arroyos on the west side include the shape of the west-side arroyos which are narrow and deep compared to the broad, shallow arroyos on the east side. This would allow more litter to be caught on the west side during winds.

However, it is curious that the core samples on the east side of the arroyo show no significant increase in the percentage of litter over the west side. There was no significant change in percentage of organic material from May to November, or between areas, or under shrubs or in interspaces (Table 2). The average percentage of organic material in the soil was 2.2%, with the median at 2.1% and the range from 0.8-4.2%. Denser populations of soil arthropods and microorganisms probably occur in areas where the greatest amount of food is available for growth and reproduction.

Investigations of termite distribution and activity on the same site using toilet paper grids to estimate termite densities (Johnson and Whitford 1975) showed that termite activity was greatest on grids stradling small arroyos. For example, in August 1973, an average of 30.5% of the rolls in small arroyos exhibited recent feeding, while only 9% of the rolls on nonarroyo areas exhibited feeding activity. The greatest amount of litter was found in small arroyos. It was also found that the termite activity was greater in small arroyos on the west side of the large arroyo than on the east side. In August 1973, 39% of the rolls in west-side arroyos exhibited activity while 22% of the rolls in east-side arroyos exhibited activity. More litter accumulated in the west-side arroyos. They found greater termite activity on east-side, nonarroyo areas than west side, which correlates with the greater litter accumulation on the east-side, nonarroyo areas. It was also noted that termite activity was highest in all areas under shrubs, where litter accumulates. Johnson and Whitford (1975) attributed termite distribution to soil depth and moisture, but the distribution may also be influenced by areas where food is most abundant.

A study of soil microarthropod population densities on the bajada site in various areas of the large arroyo showed that the lowest densities were recorded from soil samples from unvegetated areas in the middle of the arroyo (comparable to litter samples listed as not under shrubs). Soil mites were absent from these samples and nematodes predominated. The highest densities were recorded from mid-arroyo under mixed vegetation (comparable to litter samples listed as under shrubs; Whitford et al. 1973). No attempt to explain the results was made in the report, but one possible explanation (along with soil moisture and temperature) is the distribution of soil arthropods according to the availability of food.

This study has shown that the major accumulation of litter is under shrubs, and that the major area of accumulation of litter is the small arroyos. The distribution of soil arthropods on the bajada site appears to be correlated with the distribution of surface litter. We hypothesize that the soil arthropods, as well as other detritivores, are moving the detritus out of the upper layers of the soil, thereby accounting for the low, unvarying percentages of soil organic material found in the core samples.

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APPENDIX III

ACRIDIDAE OF THE JORNADA EXPERIMENTAL RANGE

INTRODUCTION

The short-horned grasshoppers, family Acrididae, are the most important members of the order Orthoptera. Many species reach high population levels. Since all acridids feed primarily on plant material, they appear to be responsible for a major portion of the energy flow through herbivores and are considered to be among the most economically important insects.

This paper is designed to aid in identification of acridid grasshoppers on the IBP validation site on the Jornada Experimental Range, 40 km NNE of Las Cruces, Dona Ana County, New Mexico. Although specimens collected on the site during the summers of 1975 and 1976 and specimens available in the collections housed in the Department of Biology and the New Mexico Department of Agriculture on the New Mexico State University campus were utilized in this preparation, it should not be considered an exhaustive account of species present on the site. The possibility of overlooking occasional or low-density species has been reduced by including all species collected from similar habitats in Dona Ana County. Biological data are based on personal observation as well as on Ball et al. (1942) and Helfer (1963).

KEY OF ACRIDIDAE

1a. Hind tibia with both inner and outer immovable spines at tip (Fig. 1A). Subfamily Romaleinae. 2

1b. Hind tibia with only the inner immovable spine at the tip; outer spine absent (Fig. 1B). 4

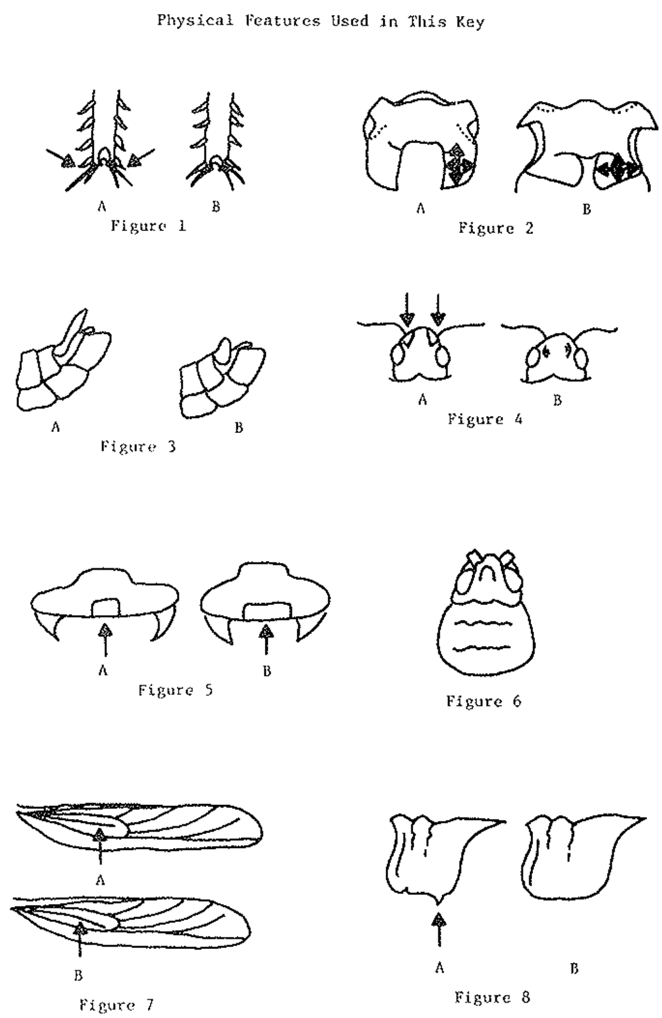
2a. Pronotum equally long at sides and middle; hind margin nearly straight across as seen from above. *Brachystola magna.* Plains lubber. Length: male, 38 mm; female, 50-79 mm. Reddish-brown, brown or grayish-green, marked with brown, green, blue and black. Short-winged, with black spots on pinkish wing pads. Eggs in large, gourd-shaped pods overwinter, hatch in July and August; adults, August to October. Found on rocky or gravelly soil with sparse grass and coarse weeds. Common in desert grassland and northern grassland, although not collected on the Jornada itself. Occurs throughout the Midwest from the Mississippi to the Rockies.

2b. Pronotum much longer at middle than at sides with the hind margin angling back to the midline. 3

3a. Wing red with black border. *Taeniopoda eques.* Horse lubber. Length: male, 38-50 mm; female, 64-75 mm. Shining black with yellow, orange and red markings. Tegmina black with network of yellow veins. Adults, August to October. Found mainly on spiny shrubs and succulent annuals. Often found on roads, feeding on their own dead. Occurs from the desert grassland up to the live-oak belt from Arizona and Texas south to Costa Rica.

3b. Tegmina and wings reduced, pronotum flattened and rough. *Phrynotettix tshivavensis.* Toad lubber. Length: male, 27 mm; female, 56 mm. Brown to gray or mahogany red. Adults, June to November. Found in gravelly or rocky areas with sparse grass. Occurs in elevated areas of central New Mexico and Arizona.

4a. Prosternum between front legs armed with a conspicuous spine. Subfamily Cyrtacanthacridinae. 5



Appendix III, Figures 1-8. Physical features used in the Key of Acrididae

4b. Prosternum flat or with only a lamellate swelling. 8

5a. Mesosternum with lateral lobes longer than wide (Fig. 2A). *Schistocerca vaga.* Grey bird locust. Length: male, 40-50 mm; female, 60-70 mm. Gray or brown, mottled. Hind tibia brown to black with black-tipped white spines. Nymphs, May to November; adults, August to November; both stages may be found throughout the year. Found commonly on *Prosopis* (mesquite), but feeds on a variety of plants of the lower Sonoran Desert. Occurs from California to Texas and south to Nicaragua.

5b. Mesosternum with lateral lobes as wide or wider than long (Fig. 2B). 6

6a. Color bluish with bold red and yellow markings. *Dactylotum bicolor variegetum.* Rainbow grasshopper. Length: male, 20 mm; female, 35 mm. Short-winged black or bluish with red, white and yellow markings. Eggs, overwinter; nymphs, June; adults June to October. Omnivorous, usually found in desert grasslands, especially on gravelly soil with sparse vegetation. Occurs from Arizona to Texas and northern Mexico.

6b. Not colored as above. 7

7a. Male cercus long and slender (Fig. 3A.) *Melanoplus aridus.* Aridlands spur-throat. Length: male, 13 mm; female, 20 mm. Bluish-gray with lateral black stripes on the pronotum; wings short, oval, widely separated. Found on a variety of low-growing plants, primarily *Eriogonom* spp., from the lower zone of the Sonoran Desert up to the Canadian zone. Occurs from California to Texas. Common on the Jornada. Nymphs and adults collected in August.

7b. Male cercus wedge-shaped (Fig. 3B). *Melanoplus occidentalis.* Flagellate grasshopper. Length: 20-25 mm. Hind tibia blue, wings not exceeding hind femora. Adults, June to September. Abundant in grasslands of lower and upper Sonoran zones up to the lower Canadian zones. Occurs from Arizona to central Kansas and north to Canada. Identification on the Jornada uncertain. Specimens may represent another species of *Melanoplus.*

8a. Median ridge of pronotum thread-like; face often slanting and forming an angle with the vertex; antennae often flattened or sword-shaped; wings not brightly colored, wings often short. Subfamily Acridinae. 9

8b. Median ridge of pronotum raised or crest-like; face nearly vertical and rounded at vertex; hind wings usually brightly colored and banded, wings long. Subfamily Oedipodinae. 17

9a. Form slender and elongate, antennae conspicuously sword-shaped, usually flattened and rather broad at base, face slanting. 10

9b. Form moderately slender to robust, antennae slender to moderately flattened and narrowly sword-shaped, face vertical to slanting. 11

10a. Hind tibia with 15 or more spines in outer row. *Eremiacris pallida.* Desert toothpick grasshopper. Length: male, 25 mm; female, 40 mm. Light green to brown with pale stripe on side. Eggs laid in summer; nymphs, early spring; adults May to October. Found in grassland in *Bouteloua* sp. (grama grass) on the Jornada. Occurs from California to New Mexico.

10b. Hind tibia with 15 or more spines in the outer row. *Mermiria maculipennis.* Length: male 35 mm; female, 50 mm. Brownish to greenish with contrasting stripes. Hind tibia red. Eggs overwinter; nymphs, June to November; adults, June to November. Common in desert grassland of lower and upper Sonoran zones. Collected in tobosa grass on the Jornada, but found in grama grass on bajadas in surrounding areas. Occurs from Alberta and Saskatchewan south to Mexico.

11a. Bush inhabiting, stridulating day and night. 12

11b. Not found in shrubs. 13

12a. Gray-brown, wing yellowish at base, becoming brown toward tip. Found on *Flourensia. Goniatron planum.* Pecos clicker grasshopper. Length: 18-28 mm. Occurs in Texas and Mexico. Collected on *Flourensia cernua* on the bajada of Mt. Summerford. Potentially territorial.

12b. Green with pearly white, brown and black markings. Found on *Larrea. Bootettix argentatus.* Creosotebush grasshopper. Length: male, 20 mm; female, 26 mm. Nymphs, March to August; adults, May to November, collected as late as mid-December in the Las Cruces area. Common on the bajada of Mt. Summerford but difficult to locate, although the males advertise their presence with a buzz repeated at 20-sec to 1.5-min intervals. Territorial. Occurs in New Mexico and Texas, south to Mexico.

13a. Fastigium with lateral foveolae rather distinct and visible from above (Fig. 4A). 14

13b. Fastigium with lateral foveolae indistinct or absent. 15

14a. Antennal segments not flattened, lateral ridges of pronotum bent in at middle, bordered by light markings. *Psoloessa delicatula.* Length: male, 18 mm; female, 22 mm. Brown to dark gray with dark and light markings. Nymphs overwinter as second or third instars; adults, April to September. Found in short grasslands from lower Sonoran to Canadian zones. One of the most common species on the Jornada. Occurs from Alberta and Manitoba to California and Texas.

14b. Antennae distinctly flattened, lateral ridges of pronotum feeble. *Cordillacris crenulata.* Crenulated grasshopper. Length: male, 17 mm; female, 19 mm. Light brownish, tegmen with a dark brown crenulated area, cheeks marked with gray. Found in dry areas with parched grass; especially common on *Bouteloua* sp. Upper Sonoran. Occurs from Alberta to Texas and Arizona.

15a. Hind tibia with 15-25 spines in outer row; sexes different in appearance; male wing blackish or brown. *Syrbula fuscovittata.* Length: male, 25 mm; female, 40 mm. Female green or gray with brown markings on the top of pronotum and on tegmen. Male usually dark brown, occasionally with green areas, with a yellow stripe along the tegmen and lower edge of pronotum. Eggs, overwinter; nymphs, April to August; adults, June to October. Found in tall grass in lower and upper Sonoran zones. Occurs from Arizona to Texas and Colorado. Common on the Jornada.

15b. Hind tibia with 16 or fewer spines in outer row, wing not blackish or brown. 16

16a. Pronotum about equally wide in front and rear as seen from above; lateral ridges parallel. *Opeia obscura.* Length: male, 13 mm; female, 25 mm. Light brown or green; wings reduced; antennae flattened. Eggs, overwinter; nymphs, March to October; adults April to October. Found on grasslands and cropland from lower Sonoran to lower transition zones. Occurs from Alberta to Manitoba south to California, Arizona, New Mexico and Texas. Common on the Jornada.

16b. Pronotum wider at rear and with lateral ridges bent inward at middle. *Eritettix variabilis.* Velvet-striped grasshopper. Length: male, 16 mm; female, 24 mm. Gray, brown or green. Light markings border the lateral ridges of the pronotum. Found in grassland from lower Sonoran to lower transition zones. Occurs from Arizona to southwestern Texas. Common on the Jornada; adults, April to October.

17a. Pronotum with a high semicircular crest. *Tropidolophus formosus.* Great crested grasshopper. Length: male, 40 mm; female, 45 mm. Green with brown markings; margin of crest toothed. Wings orange with imperfect black band. Eggs, overwinter; nymphs, May to June; adults, June to August. Found on desert grassland on low-growing Malvaceae in areas of thick grass. Collected on the upper bajada of Mt. Summerford. Occurs from Arizona to Wyoming, Kansas, Oklahoma, Texas and Mexico.

17b. Pronotum without a high semicircular crest. 18

18a. Pronotum with median ridge distinct throughout, entire or cut by one sulcus. 19

18b. Pronotum with median ridge indistinct in some part or cut by two or three sulci. 22

19a. Interspace between metasternal foramina longer than wide (Fig. 5A). 20

19b. Interspace between metasternal foramina as wide as or wider than long (Fig. 5B). 21

20a. Wing red, body black or brown. *Arphia pseudonietana.* Length: male, 30 mm; female, 35 mm. Black or brown, speckled, sometimes with white on the head. Wing red with black band. Crackles in flight. Eggs, overwinter; nymphs, July to September; adults, June to December. Found in grass from lower Sonoran to upper Sonoran zones. Occurs from British Columbia to Michigan, Mexico and California.

20b. Wing orange or yellow, body light brown. *Arphia conspersa.* Length: male, 25 mm; female 32 mm. Brown; forewings with pale stripe along anal vein. Eggs, early summer; nymphs, overwinter; adults, May to August. Found on rocky hillsides primarily in the upper Sonoran zone. Occurs from Alaska to eastern Texas and Mexico.

21a. Hind tibia orange, wing yellow. *Spharagemon collare.* Mottled sand grasshopper. Length: male, 30 mm; female 38 mm. Gray to brown or reddish with dark markings. Wing yellow with black band and short spur. Hind tibia orange or red. Median ridge of pronotum high, notched by one sulcus. Eggs, overwinter; adults, June to September. Found in cultivated fields and grasslands in sandy areas in the upper Sonoran and transition zones. Occurs from Alberta and Manitoba to Arizona and east to the Atlantic and Gulf coasts.

21b. Hind tibia not orange, wing black with pale margin. *Dissosteira carolina*. Carolina grasshopper. Length: male, 40 mm; female, 50 mm. Grayish or brownish to black, tegmina speckled. Median ridge high, notched by one sulcus. Adults, June to September. Flight butterfly-like. Found in cultivated areas, pastures and rangeland from upper Sonoran to transition zones. Widespread in the United States.

22a. Posterior margin of pronotum broadly rounded, front margin with a pair of short rounded projections; wing pale yellow without a band (Fig. 6). *Cibolacris parviceps*. Cream grasshopper. Length: male, 20 mm; female, 32 mm. Cream, gray, brown or reddish, tegmina with blackish markings. Wing transparent, light blue or yellow. Nymphs, overwinter, common in May; adults, March to June. Found on thin exposed soil and rocky areas in the desert, feeding on *Larrea* at night. Lower to upper Sonoran from California to Colorado, New Mexico and Mexico.

22b. Posterior margin of pronotum angulate, wing banded. 23

23a. Size large, form robust; median ridge cut by two sulci, the anterior one shallow; lateral ridges indistinct. 24

23b. Size small, form slender, median ridge cut by two nearly equal sulci; lateral ridges indistinct. 25

24a. Wing disc yellow, hind legs red. *Xanthippus corallipes*. Red-shanked grasshopper. Length: male, 45 mm; female, 52 mm. Brown with darker markings, tegmen with "leopard spots." Head blue at base beneath pronotum. Pale stripe along anal vein. Nymphs, overwinter; adults, April to September. Desert grassland in lower and upper Sonoran zones. Occurs from British Columbia to Manitoba, Oregon, Texas, Minnesota and Iowa.

24b. Wing disc blue, hind legs not red. *Leprus robustus*. Length: male, 37 mm; female, 45 mm. Reddish-brown or grayish-brown, tegmina banded. Ring pale bluish-green, hind tibia blue. Eggs, overwinter; adults, August to December. Desert grassland and rock hillsides in the lower Sonoran to upper Sonoran zones. Occurs from Arizona to Texas and Colorado.

25a. Metazona rough with tubercles and short ridges, lateral prominences on each side near median ridge. *Derotmema haydenii*. Length: male, 20 mm; female, 30 mm. Brownish or gray, speckled with black. Wing red or yellow with broad band and long spur. Eggs, overwinter; adults, July to December. Occurs on bare flats in areas of sparse grass. Common on the Jornada. Occurs from Alberta and Saskatchewan to California, Arizona, Texas and Mexico.

25b. Without the above characteristics. 26

26a. Tegmen with intercalary vein rather straight, usually midway between the media and cubitus at its outer end; pronotum with metazona less than 1½ times as long as prozona (Fig. 7A). *Mestobregma plattei*. Length: male, 25 mm; female, 35 mm. Brown, tegmina with black bands, pronotum marked black obliquely at sides. Wing yellow or red with black border. Eggs, overwinter; adults, June to October. Common on rocky soil with sparse grass in the desert grassland from lower Sonoran to transition zone. Occurs from Montana to Arizona, Texas and Oklahoma.

26b. Tegmen with intercalary vein curved and closer to media than cubitus at its outer end; metazona at least 1½ times as long as prozona. 27

27a. Pronotum with a tooth at hind angle of lateral lobe; hind tibia reddish. *Trimerotropis strenua*. Length: male, 32 mm; female, 42 mm. Whitish, gray or brown with dark bands on tegmina. Wing yellow with strong band and spur. Hind tibia reddish with light ring near base. Adults, June to September. Occurs on rocky soil in grassy areas from lower Sonoran to transition zones. Occurs from Oregon and California to Colorado and Texas (Fig. 8A).

27b. Pronotum without a tooth, hind tibia yellow. *Trimerotropis pallidipennis*. Pallid-winged grasshopper. Length: male, 31 mm; female, 42 mm. Coloration similar to *T. strenua*. Multivoltine. Eggs most common overwintering stage. Found in areas of thin soil and sparse vegetation and in cropland in lower and upper Sonoran zones. Occurs from British Columbia to Manitoba and south to Chile. One of the most common grasshoppers on the Jornada.

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