Technical Report No. 187

ECOLOGICAL STUDIES OF SMALL MAMMAL POPULATIONS AT THE COTTONWOOD AND OSAGE SITES, 1971

Robert S. Hoffmann and Elmer C. Birney

Museum of Natural History
The University of Kansas
Lawrence, Kansas

and

Bell Museum of Natural History
The University of Minnesota
Minneapolis, Minnesota

GRASSLAND BIOME

U.S. International Biological Program

November 1972

TABLE OF CONTENTS

	Page
Title Page	i
Table of Contents	ii
Abstract	iii
Introduction	1
Methods	1
Grids	1
Trapping	3
Data Types	3
Other Censusing Methods	4
Statistical Techniques	5
Study Areas	5
Osage	6
Cottonwood	7
Results	7
Osage--1970	7
Osage--1971	8
Summary	11
Survey of Small Mammal Disturbance	11
Jackrabbit Census	11
Cottonwood--1970	15
Cottonwood--1971	15
Summary	17
Small Mammal Excavation Survey	17
Jackrabbit Census	21
Discussion	22
Literature Cited	27
Appendix I. Appendix Table	28
Appendix II. Field Data	29

ABSTRACT

Livetrapping on grids at two Network Sites on the northern Great Plains (Osage and Cottonwood) provides the basis for estimates of small mammal standing crop biomass density at three times during the growing season.

Small mammal densities at Osage were low in May, but increased from then until October. Wet weight and dry weight (in parentheses) biomass density was calculated as 38.5 (11.6) g/ha in May, 348.9 (104.7) g/ha in August, and 1600.0 (480.0) g/ha in October. This increase in biomass density resulted primarily from increasing numbers of *Sigmodon hispidus*, which increased from 0 (0) g/ha to 192.8 (57.8) g/ha to 1372.8 (411.8) g/ha during the three collecting periods, and secondarily from those of *Microtus ochrogaster*, which increased from 7.0 (2.1) g/ha to 109.0 (32.7) g/ha to 118.7 (35.6) g/ha during the three collecting periods.

Small mammal densities at Cottonwood were relatively low at all three collecting periods. Biomass density estimates were 37.9 (11.4) g/ha, 379.0 (112.9) g/ha, and 225.3 (67.6) g/ha, respectively for the June, July, and September samples. The higher biomass density in July relative to that in September resulted largely from the number of thirteen-lined ground squirrels (*Spermophilus tridecemlineatus*) on the grids in July. Biomass density for ground squirrels alone was 280.5 (84.2) g/ha at that period. Ground squirrels were not captured on the grids in either June or September.

Lagomorphs on both sites were censused by means of roadside transects. A survey of disturbance caused by small mammals was also conducted at each site. Results and limitations of these studies are discussed. Demographic trends of small mammals on both sites through 2 years (1970 and 1971) are also considered.

INTRODUCTION

The purpose of the studies reported herein was to survey the status of and provide population estimates of small mammal populations on two second-order sites in the Comprehensive Network program of the IBP Grassland Biome project. During the period 16 May to 19 October 1971, field parties from the University of Kansas and the University of Minnesota studied and collected mammals during three collection periods on two Comprehensive Network Sites, Osage and Cottonwood (see Fig. 1), in the northern and central plains. Details of work accomplished at these sites in 1971 are reported herein. The composition of field crews varied through the summer, with the following persons involved: D. M. Armstrong, E. C. Birney, D. Byman, A. Cadena, R. J. Cinq-Mars, R. S. Hoffmann, R. P. Lampe, R. M. Timm, and M. D. Tuttle. Mammals collected have been catalogued in the Museum of Natural History at the University of Kansas and the Bell Museum of Natural History at the University of Minnesota. Some amphibians and reptiles were collected on Comprehensive Network Sites and are catalogued in the Bell Museum's collections (Appendix I).

METHODS

Grids

Grids were a square of 12 × 12 stations (144 total). The interval between each station in the rows and columns was 15 m, giving the grid an area of 2.76 ha. Each grid station was semi-permanently marked with a wooden stake, numbered with its row and column position. Grids trapped in 1971 were those used by Hoffmann, Jones, and Genoways (1971) in 1970.

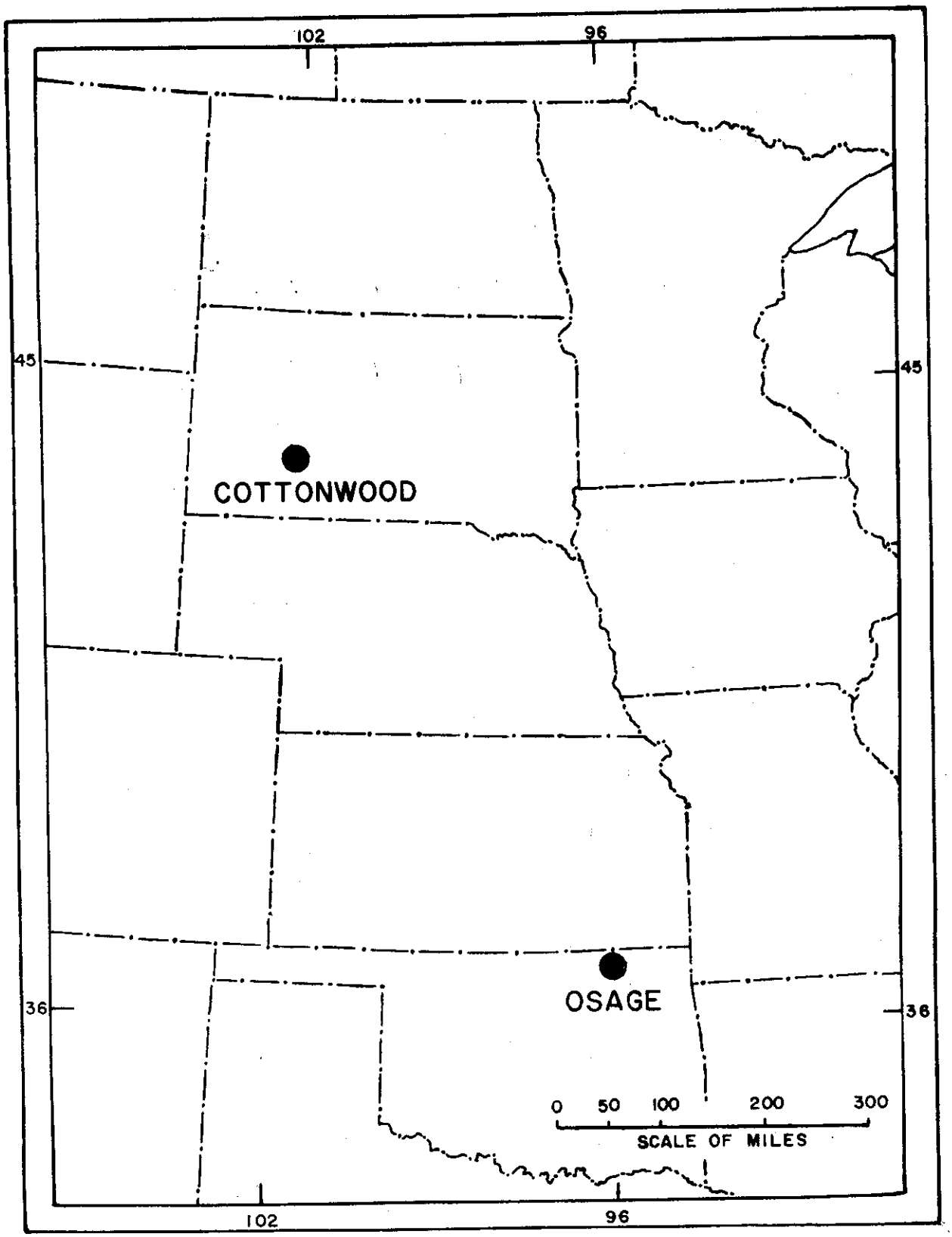

Fig. 1. Map of northern Great Plains showing location of the two IBP sites included in this report.

Trapping

Two aluminum Sherman live traps were placed at each station on the live trap grids, baited with a mixture of oatmeal and peanut butter, and set for 5 consecutive days unless rainy weather interfered, in which case a night was skipped. Traps were set in the late afternoon (usually between 1700 and 1900) each day. They were checked early in the morning (usually between 0600 and 0700), and all were sprung at that time.

Additionally, animals were kill-trapped in museum special snap traps (Animal Trap Company) from areas well removed from live trap grids. The specimens were autopsied for evaluation of diet and reproductive activity of the populations.

Data Types

Four data types were recorded on small mammals from our grids. Examples of data sheets are included with this report (Appendix II).

Information from the live trap grids was recorded on a "vertebrate--live-trapping" data sheet. Recorded on this sheet were the generic and specific identity of the animal and its condition in the trap (normal, torpid, escaped, or dead). All small mammals were marked by toe clipping, and the code number of each was recorded. Four toes were used on each foot for clipping, starting with the right hind foot. The relative age (juvenile, subadult, or adult) and reproductive condition (females--inactive, cornified, or vulva turgid, or pregnant or lactating; males--non-breeding, questionably breeding, or breeding) of each specimen were recorded. If an animal was found to be molting, the state of molt was noted. Finally, the grid location where the specimen was captured was recorded.

For each animal from off-grid snaptrapping and any dead animals from the live trap grid, additional information was recorded on two data sheets--"mammal collection" and "mammal reproductive." The mammal collection sheet had information on grid location of capture, generic and specific identity, field collector's number, external measurements, stage of molt, and type of specimen prepared. Saved from most specimens were ectoparasites and stomachs for analysis of contents. On the "mammal reproductive" sheets, reproductive condition and relative age were noted as for the livetrapped animals. In addition, for males the length and width of the testes and the condition of the epididymus and seminal vesicles were noted. The condition of the mammary glands and pubic symphysis were recorded for females. During autopsy the following information was obtained: number and size of embryos, number of embryos being resorbed, number of old and new scars, number of corpora lutea, presence or absence of corpora albicantia, and weight of the reproductive tract if it contained embryos.

Other Censusing Methods

Jackrabbits, deer, and carnivores were censused at night by spotlighting a 50-yard strip on one side of a slowly moving vehicle. All mammals observed in a minimum of 10 miles and a maximum of 40 miles at each site during each of the three collection periods were recorded. The width of the census strip was estimated, and the error of estimate was determined by measuring the distance to an object estimated to be 50 yards distant after each mile traversed.

Pocket gophers (*Thomomys talpoides*) were present only at Cottonwood. They were censused by counts of mounds and by trapping with Macabee gopher traps.

Disturbance of the habitat resulting from the activities of mammals was estimated at both sites. A series of ten 1-m sq quadrats was selected at random (by lottery) on the grids for study. Each quadrat was outlined with string and carefully searched to determine the number of runways, burrows, and mounds, and the area affected by these and other disturbances. At Cottonwood the total area on the grid disturbed by gopher mounds was measured during each collection period.

For additional discussions of methods used in small mammal sampling, see French (1971) and Hoffmann et al. (1971).

Statistical Techniques

Whenever possible, the Jolly stochastic procedure (Jolly, 1965) was used to estimate population size on the live trap grid as recommended by French (1971). However, when the assumptions of these procedures could not be met and no population could be obtained, the Zippin method (Zippin, 1956) was applied to the live trap data.

All weights were adjusted by subtraction of stomach weight and weight of reproductive tracts of pregnant females from total body weight. To convert wet body weight to dry body weight, the wet weight was multiplied by 0.3. The conversion of wet to dry weight is based upon results obtained by Golley (1960) for *Microtus pennsylvanicus*.

STUDY AREAS

The Comprehensive Network Sites visited by field teams from the University of Kansas and the University of Minnesota included Osage and Cottonwood. These sites are discussed briefly below. Information is presented on the types of

grids used, the location of the grids, the vegetation on the grids, and the general climate and topography of the area.

Osage

The Osage Site is located on the K. S. Adams Ranch 12 miles north and 5 miles east of Shidler, Osage County, Oklahoma. Both live trap and snap trap grids were studied at this site. The live trap grid was located in an ungrazed pasture just to the west of the ranch headquarters. Rows 11 and 12 were located in an area that was cultivated 12 years ago, but has not been worked since; the successional vegetation in this area was considerably different from the tallgrass on the remainder of the grid, having a dense, tall growth of forbs.

To the north and west of the grid are roads, which are bounded by moderately-grazed pastures. About 150 m south of the grid is a shelterbelt and about 250 m beyond this is a small lake. There appeared to be little or no slope on the live trap grid.

The average January temperature at Osage is 36.9°F, and the average July temperature is 81.8°F. The average annual precipitation is 36.6 inches with 25.0 inches received from April to September.

This area of northeastern Oklahoma is characterized by tallgrass prairie in uncultivated upland areas and deciduous trees along the canyons and streams. Common grasses (Risser, 1970) in the pasture where the grids were placed included big bluestem (*Andropogon gerardi*), little bluestem (*A. scoparius*), switchgrass panic (*Panicum virgatum*), Scribner panic (*P. scribnarianum*), side oats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), yellow Indian grass (*Sorghastrum nutans*), tall dropseed (*Sporobolus asper*), and common fall witchgrass (*Leptoloma cognatum*). Forbs in the area were heath aster

(*Aster ericoides*), plains wild indigo (*Baptisia leucophaea*), dotted gayfeather (*Liatris punctata*), and white prairie clover (*Petalostemum candidum*).

Cottonwood

The grid at the Cottonwood Site was located on the Cottonwood Range Field Station, which is 2 miles east of Cottonwood, Jackson County, South Dakota. It was placed in summer pasture 3, which has been lightly grazed since 1942. The grid had both north- and south-facing slopes, which met toward the center of the grid and then drained toward the west. Cottonwood Creek and a small dam and reservoir were about ½ mile to the northwest of the grid. The average annual temperature on the station is about 47°F, the average daily temperature being 32.5°F in January and 90.8°F in July. The average annual rainfall at the station is 15.22 inches, May (2.78 inches) and June (2.99 inches) being the wettest months.

Under good range conditions, the vegetation of the field station is dominated by midgrasses, especially western wheatgrass (*Agropyron smithii*) and green needlegrass (*Stipa viridula*) with an understory of shortgrasses, mainly consisting of blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Several forbs are conspicuous during the early part of the year. For additional information on plants of the Cottonwood Site, see Lewis (1970).

RESULTS

Osage--1970

During 1970 the prairie vole (*Microtus ochrogaster*) was the dominant small mammal at Osage. The population density of this vole appeared to be most strongly correlated with standing dead plant biomass.

The cotton rat (*Sigmodon hispidus*) was a potentially important contributor to small mammal standing crop density and biomass, but was restricted to a small area on the grid. *Blarina brevicauda* and *Reithrodontomys montanus* were captured on the grids in low numbers.

Peromyscus maniculatus and *Peromyscus leucopus* were restricted to the snap trap grid. Only *P. maniculatus* and *Reithrodontomys montanus* were trapped in the grazed pastures at Osage.

The best estimate of liveweight biomass of small mammals during 1970 at Osage was 1591.4 g/ha during the first trapping period and 1121.7 g/ha during the second trapping period. See Hoffmann et al. (1971) for additional details.

Osage--1971

Small mammals collected on the live trap grid at the Osage Site during the three 1971 sampling periods included *Blarina brevicauda*, *Reithrodontomys montanus*, *Sigmodon hispidus*, *Microtus ochrogaster*, *Peromyscus maniculatus*, *Peromyscus leucopus*, *Mus musculus*, *Perognathus hispidus*, and *Cryptotis parva*. Other mammals taken or observed in the general vicinity of the site were *Lepus californicus*, *Sylvilagus floridanus*, *Canis latraus*, and *Neotoma floridana*.

The most striking feature of small mammal populations at Osage 1971 is the increase of biomass density from the May trapping period (when it was extremely low) to October trapping period (Fig. 2). The prairie vole (*Microtus ochrogaster*) and the cotton rat (*Sigmodon hispidus*) were the codominant small mammals on the site during the last two trapping periods (Fig. 3).

The biomass density of *Blarina brevicauda*, *Cryptotis parva*, and *Peromyscus maniculatus* increased during the summer as indicated by results of the third

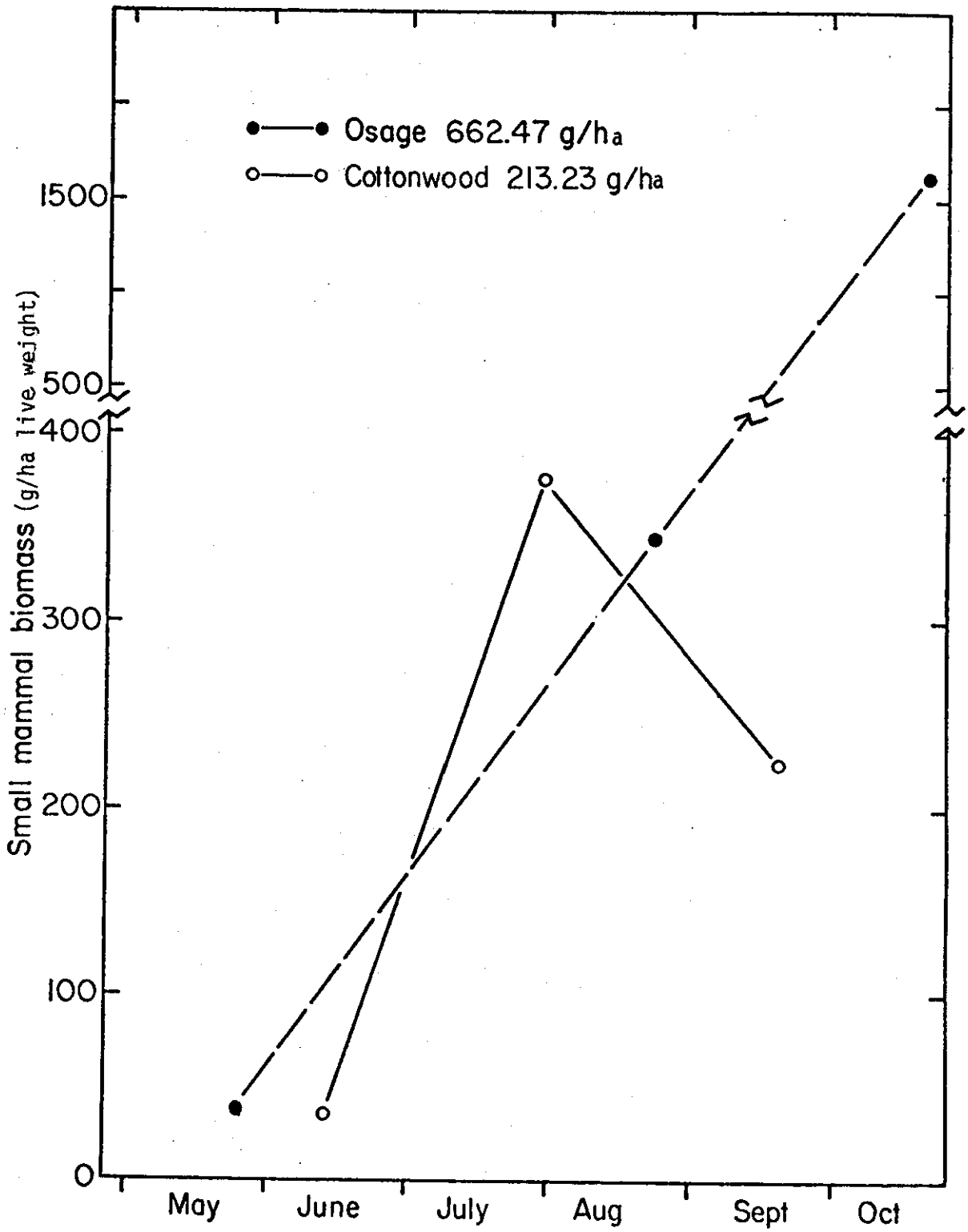

Fig. 2. Graph showing small mammal biomass (g live weight/ha) for three sampling periods on the Osage and Cottonwood Sites, 1971.

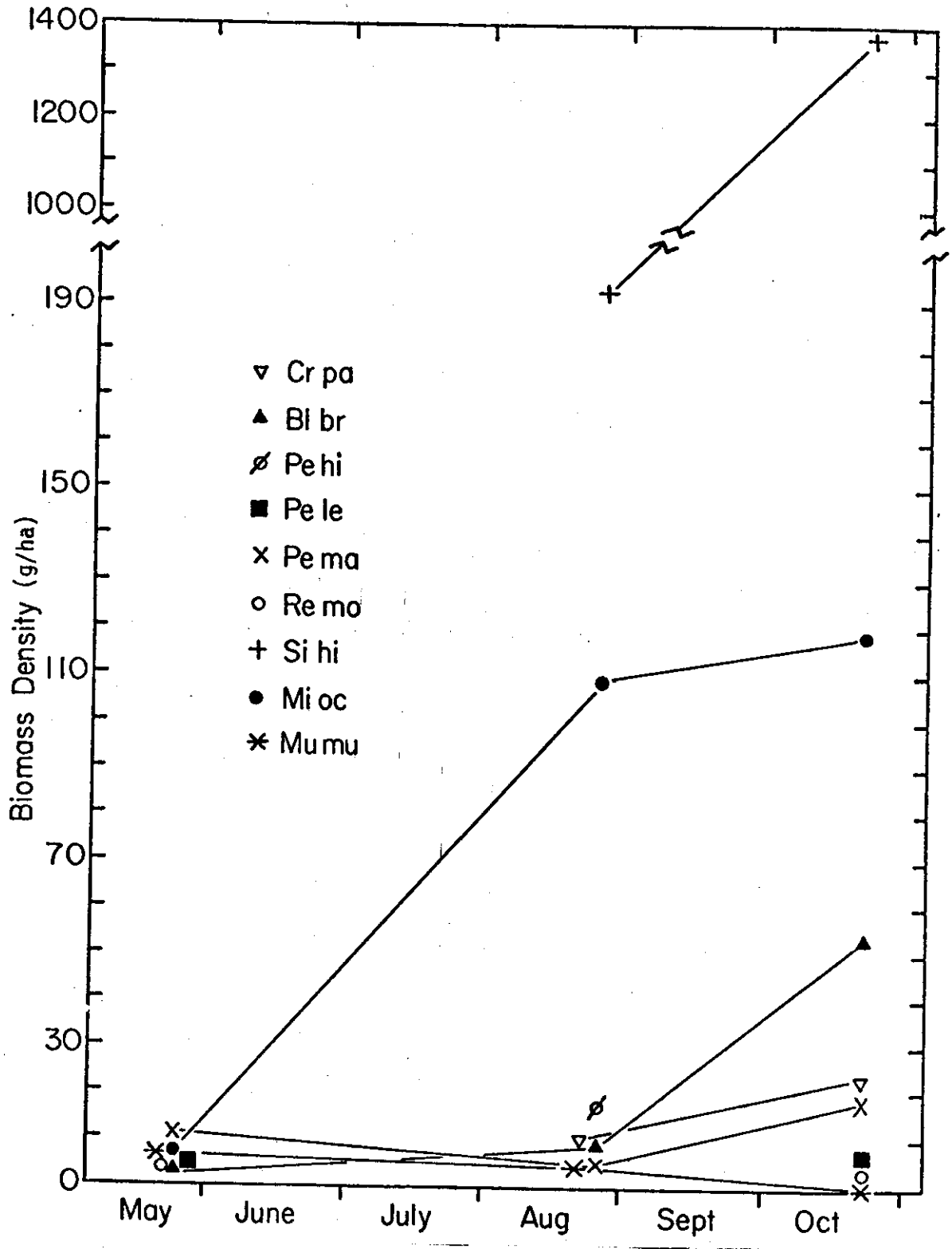

Fig. 3. Graph showing biomass density (g/ha) for each species of small mammal captured on the live trap grid at the Osage Site, 1971.

trapping period. Both *Peromyscus maniculatus* and *Peromyscus elucopus* were found on the live trap grid in contrast to the 1970 trapping when they were found only on the snap trap grid (Fig. 3).

Estimates of total numbers of small mammals on the live trap grid and of biomass densities are given in Tables 1 through 3.

Summary

Our best estimate of the liveweight biomass of small mammals at Osage is 38.51 g/ha during the first trapping period, 348.93 g/ha during the second trapping period, and 1599.89 g/ha during the third period.

Survey of Small Mammal Disturbance

Eight of the ten 1 m^2 quadrats studied in May showed signs of small mammal activity. These included six old inactive runways, one old active runway, one fresh runway, one nest, and one pile of vegetation cuttings. The total area disturbed was 0.60 m^2. Runways, mostly old and inactive, covering a combined area of 0.87 m^2 were measured in eight of 10 quadrats in August. In October, runways were observed in only two of 10 quadrats, and burrows were measured in two others. Total area disturbed was 0.30 m^2.

Jackrabbit Census

Roadside counts conducted after sunset between 2000 and 2400 resulted in the sighting of black-tailed jackrabbits (*Lepus californicus*), eastern cottontails (*Sylvilagus floridanus*), and coyotes (*Canus latrans*) in the vicinity of the Osage Site. Seven jackrabbits, four cottontails, and one coyote were sighted in 30.5 miles of transect in May; 12 jackrabbits and four cottontails were sighted in 39 miles in August; and two jackrabbits, one cottontail, and one coyote were seen during 20 miles of driving in October.

Table 1. Live trap grid--Osage (16 May through 20 May 1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Microtus ochrogaster	♂ adult	1	22.73	22.73	7.01
Peromyscus maniculatus	♂ adult	1	35.56	35.56	10.98
Blarina brevicauda	unknown	1	12.70	12.70	3.88
Reithrodontomys montanus	♀ adult	1	11.30[a/]	11.30	3.80
Peromyscus leucopus	♀ subadult	1	17.40	17.40	5.37
Mus musculus	♂ adult	1	14.2 [b/]	24.2	7.47
TOTALS		6		123.89	38.51

[a/] Value from 1970 data.

[b/] Value from University of Kansas collection.

Table 2. Live trap grid--Osage (16 August through 20 August 1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Microtus ochrogaster	♀ subadult	1	28.98[b/]	28.98	8.94
	♀ juvenile	1	20.50	20.50	6.33
	♂ adult	5	40.57	202.85	62.61
	♂ subadult	3	33.65	100.95	31.16
Total		10		353.28	109.04
Peromyscus maniculatus	♀ adult	1	16.02	16.02	4.94
Blarina brevicauda	♀ subadult	1	12.51[b/]	12.51	3.86
	♂ adult	1	17.07[b/]	17.07	5.27
Total		2		29.58	9.13
Mus musculus	♀ subadult	1	16.93[b/]	16.93	5.23
Cryptotis parva	♀ adult	3	6.30[b/]	18.90	5.83
	♂ adult	2	7.20[b/]	14.40	4.44
Total		5		33.30	10.27
Sigmodon hispidus	♀ adult	1	153.17[a/]	153.17	47.27
	♀ subadult	2	81.05	162.10	50.03
	♂ adult	1	160.37[a/]	160.37	49.50
	♂ subadult	3	49.70	149.10	46.02
Total		7		624.24	192.82
Perognathus hispidus	♂ subadult	1	27.60	27.60	8.52
	♂ juvenile	1	29.08[b/]	29.08	8.98
Total		2		56.68	17.50
TOTALS		28		1130.53	348.93

[a/] Value from 1970 data.

[b/] Value from University of Kansas collection.

Table 3. Live trap grid--Osage (14 October through 19 October 1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Microtus ochrogaster	♀ adult	3.65	44.90	163.89	50.58
	♀ adult	3.65	17.55	64.06	19.77
	♂ adult	3.65	27.55	100.56	31.04
	♂ juvenile	3.65	15.35	56.03	17.29
Total		14.6		384.54	118.68
Peromyscus maniculatus	♀ adult	.86	21.65	18.62	5.75
	♀ subadult	.43	23.4	10.06	3.10
	♂ adult	1.29	19.97	25.76	7.95
	unknown	.42	12.10	5.08	1.57
Total		3		59.52	18.37
Blarina brevicauda	♀ adult	3	11.60[a/]	34.80	10.74
	♂ adult	9	15.60	140.40	43.33
Total		12		175.20	54.07
Reithrodontomys montanus	♀ adult	.67	10.92	7.32	2.26
	♂ adult	.17	7.8	1.33	.41
	♂ subadult	.17	9.0	1.53	.47
Total		1		10.18	3.14
Peromyscus leucopus	♂ adult	1	24.85	24.85	7.67
Mus musculus	♀ juvenile	.5	8.0	4.0	1.23
	♂ juvenile	.5	6.1	3.05	.94
Total		1		7.05	2.17
Cryptotis parva	♀ adult	8.22	5.23	42.99	13.27
	♂ adult	5.48	5.80	31.78	9.81
Total		13.7		74.77	23.08
Sigmodon hispidus	♀ adult	11.22	79.40	890.87	274.96
	♀ juvenile	61.71	28.88	1782.18	550.06
	♂ adult	16.83	63.85	1074.60	331.67
	♂ subadult	5.61	69.30	388.77	119.99
	♂ juvenile	11.22	27.75	311.36	96.10
Total		106.6		4447.78	1372.78
TOTALS		152.9		5183.89	1599.96

[a/] Value from 1970 data.

Cottonwood--1970

Four species of small mammals were captured on the live trap grid in 1970. These were *Spermophilus tridecemlineatus*, *Peromyscus leucopus*, *P. maniculatus*, and *Microtus ochrogaster*. *P. maniculatus* was the dominant species, *M. ochrogaster* was present but scarce, and *S. tridecemlineatus* and *P. leucopus* were only transient on the grid. Biomass estimates of small mammals were 114.8 g/ha during June and 181.2 g/ha during August (Hoffmann et al., 1971).

Cottonwood--1971

Small mammals captured on the live trap grid at the Cottonwood Site during the three sampling periods included *Spermophilus tridecemlineatus*, *Perognathus hispidus*, *Peromyscus maniculatus*, *Microtus ochrogaster* and *Thomomys talpoides*. Off-grid trapping yielded specimens of all of the above in addition to specimens of *Peromyscus leucopus*, *Reithrodontomys megalotis*, *Mus musculus*, *Microtus pennsylvanicus*, and *Onychomys leucogaster*. One road-killed *Sylvilagus floridanus* and one *Mustela vison* found floating in a farm pond were prepared as specimens, and one *Cynomys ludovicianus* was collected several miles west of the site. Other mammals observed at or near the site were *Lepus townsendii*, *Odocoileus hemionus* (see below), and *Ondatra zibethicus*.

The small mammal biomass density at Cottonwood was extremely low during the first trapping period (June), and highest during the second trapping period (July, 379.99 g/ha). During the third trapping period (September) the biomass density dropped slightly (Fig. 2).

During the second trapping period the thirteen-lined ground squirrel was the dominant small mammal on the live trap grid, although it was completely absent during the first and third periods (Fig. 4). *Microtus ochrogaster*

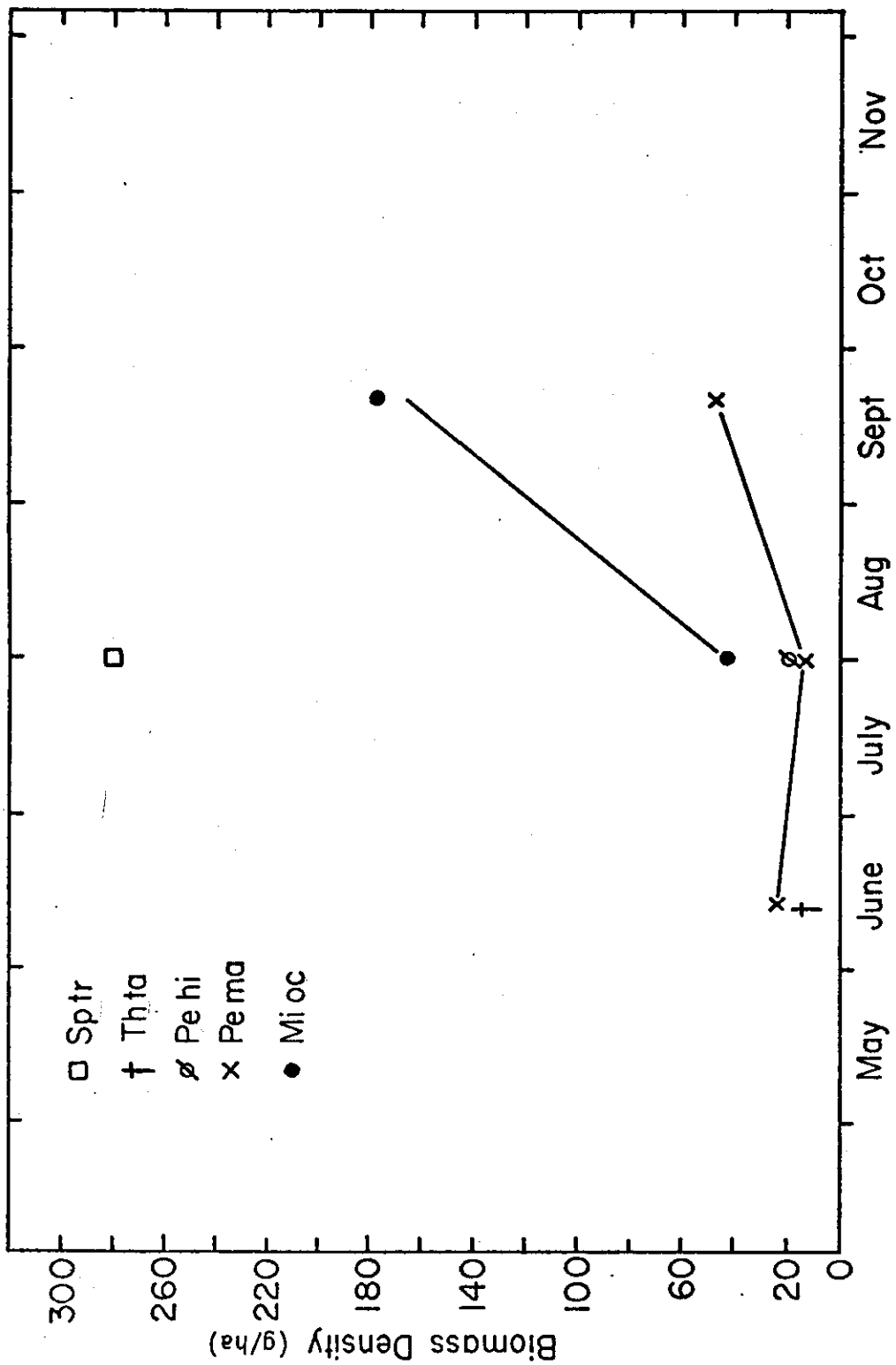

Fig. 4. Graph showing biomass density (g/ha) for each species of small mammal captured on the live trap grid at the Cottonwood Site, 1971.

was dominant in September and second in importance during the second trapping period. *Peromyscus maniculatus* was dominant during the first trapping period and second in importance during the third trapping period. Estimates of total numbers and biomass densities are given in Tables 4 through 6.

Off-grid collections in the vicinity of the Cottonwood Site showed consistently higher densities of small mammal populations than are indicated by the live trap estimates. This inconsistency probably resulted from the fact that the live trap grid is situated in a grazed pasture having scanty cover, whereas most of the off-grid trapping was conducted in less heavily-grazed areas having more vegetative cover. When grazed pastures were included in off-grid trapping, there probably existed a bias toward placing traps in areas of densest vegetation or in areas inhabited by substantial populations of *Peromyscus maniculatus*.

Summary

Our best estimate of the biomass of small mammals at Cottonwood during the first trapping period is 37.88 g/ha, 379.39 g/ha during the second trapping period, and 225.87 g/ha during the third trapping period.

Small Mammal Excavation Survey

Surveys to quantify disturbance to the habitat by small mammals at Cottonwood were of two types. In June, twenty 1 m^2 sample quadrats were selected, but none showed evidence of disturbance. Only 10 sample plots were viewed in July, and one small burrow and one *Microtus* runway were measured. No disturbance was seen within 10 quadrats in September.

Because a species of pocket gopher (*Thomomys talpoides*) is fairly common on the grid, and gopher mounds were seen on the grid at all collecting periods,

Table 4. Live trap grid--Cottonwood (5 June through 9 June 1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Peromyscus maniculatus	♀ adult	1	22.53	22.53	6.95
	♂ adult	1	20.27	20.27	6.26
	♂ subadult	2	15.62	31.24	9.64
Total		4		74.04	22.85
Thomomys talpoides	♂ subadult	1	48.70	48.70	15.03
TOTALS		5		122.74	37.88

Table 5. Live trap grid--Cottonwood (22 July through 26 July1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Microtus ochrogaster	♀ adult	1.91	50.89	97.20	30.00
	♀ subadult	.39	34.05	13.28	4.10
	♀ juvenile	.20	16.50	3.30	1.06
	♂ adult	1.71	37.89	64.79	20.00
	♂ subadult	.59	34.13	20.14	6.22
	♂ juvenile	.20	16.90	3.38	1.04
Total		5		202.09	62.38
Peromyscus maniculatus	♀ adult	.50	18.77	9.39	2.90
	♀ subadult	.67	17.32	11.60	3.58
	♂ adult	1.16	20.10	23.32	7.20
	♂ subadult	.67	16.70	11.13	3.44
Total		3		55.44	17.12
Spermophilus tridecemlineatus	♀ subadult	5.8	44.80	259.84	80.20
	♂ adult	5.8	111.90	649.02	200.51
Total		11.6		908.86	280.51
Parognathus hispidus	♂ adult	2	31.40	62.80	19.38
TOTALS		21.6		1229.19	379.39

Table 6. Live trap grid--Cottonwood (13 September through 17 September 1971).

Species	Sex-Age Class	Best Estimate of Total No.	Avg Live Wt (g)	Total Biomass Estimate (g)	Biomass Density (g/ha)
Microtus ochrogaster	♀ adult	5.40	51.68	279.07	86.13
	♀ subadult	1.08	32.82	35.09	10.83
	♀ juvenile	.43	19.65	8.45	2.61
	♂ adult	4.32	48.71	210.43	64.95
	♂ subadult	1.35	33.38	45.06	13.91
Total		12.7		578.10	178.43
Peromyscus maniculatus	♀ adult	1.67	20.21	33.75	10.42
	♀ subadult	.60	17.82	10.69	3.30
	♀ juvenile	.46	13.57	6.24	1.93
	♂ adult	3.49	19.07	66.55	20.54
	♂ subadult	1.67	16.02	26.75	8.26
	♂ juvenile	.60	13.25	7.95	2.45
Total		8.5		151.93	46.90
TOTALS		21.2		730.03	225.33

it was obvious that the above technique was not giving a valid estimate of disturbance. Therefore, each gopher mound on the grid was measured to the nearest centimeter at the points of greatest and least diameter; these two values were averaged to compute an estimated diameter, and the area was calculated as though the mound were a circle. Twenty-four mounds (mostly old), having a total area of 11.42 m^2, were observed in June; 36 mounds (ca. one-half new), having a total area of 29.28 m^2 were measured in July; and 56 mounds (mostly new), having a total area of 26.55 m^2, were present in September. By September most of the mounds recorded as "old" in June and July were absent or only barely perceptible under vegetation and thus were not measured. The area had received considerable rainfall only a few days before the September sampling date; and gophers were extremely active pushing up mounds of wet dirt, but most of these were small. Although no *Microtus* runways were detected by the random quadrat method in September, several active runways were observed on the grid while gopher mounds were being measured.

Jackrabbit Census

Roadside lagomorph censuses were conducted after sunset between the hours of 1945 and 2340. Twenty-six miles of transect in June resulted in sightings of 13 *Lepus townsendii*, 1 *Sylvilagus* sp., and an unrecorded number of *Odocoileus hemionus*. Only two *Lepus townsendii* and an unrecorded number of mule deer were sighted during 30 miles of transect in July. One Jackrabbit and nine mule deer were sighted in 18 miles of transect in September.

DISCUSSION

Population density has long been known to undergo dramatic fluctuations in at least some microtines. Although not entirely regular, these fluctuations have been termed "cycles" and have been the subject of much research (e.g., Krebs, 1970). The population of *Microtus ochrogaster* at Osage apparently was near the peak density of the cycle when first trapped in May 1970 (Hoffmann et al., 1971). The number of prairie voles on the live trap grid decreased slightly in 1970 between May and August, but had crashed by May 1971. Voles were still scarce in August 1971, but the population was beginning to recover by October (Fig. 3).

We anticipate that the vole population will be high again during 1972. The increase phase of a vole cycle is frequently characterized by winter breeding. Reproductive activity was high at Osage in October 1971, and the species has successfully bred at Lawrence, Kansas, throughout the autumn and early winter of 1971-72 (to mid-February; Robert K. Rose, personal communication).

During 1970, when vole populations were dense, only three other species of small mammals were detected on the live trap grid. *Reithrodontomys montanus*, *Sigmodon hispidus*, and *Blarina brevicauda* were present in low numbers at both sampling periods. All were relatively uncommon and *Sigmodon* was restricted in its activities on the grid to one corner characterized by mixed grasses and weedy forbs.

In 1971 when *Microtus* numbers were low, the species listed above plus five additional species (*Cryptotois parva*, *Perognathus hispidus*, *Mus musculus*, *Peromyscus maniculatus*, and *P. leucopus*) were captured on the grid (Fig. 3). The number of *S. hispidus* appreciably increased, and individual cotton rats were captured more or less randomly over the live trap grid. It will be of interest to compare the relative densities of *Sigmodon* and *Microtus* in 1972,

since both species "cycle" (Krebs, Keller, and Tamarin, 1969; Haines, 1971) and the two probably compete for at least some environmental resources (Fleharty and Olson, 1969).

Because the live trap grid at Cottonwood is grazed by livestock and thus does not provide much cover, the population of *Microtus ochrogaster* there will probably not attain densities comparable to that observed on the ungrazed grid at Osage in 1970. A total of only five *M. ochrogaster* were captured on the live trap grid at Cottonwood during both sampling periods in 1970, and none were taken in June of 1971; but by September they were the dominant species there (Fig. 3). Off-grid trapping at Cottonwood revealed high populations of reproductively-active *Microtus ochrogaster* and *M. pennsylvanicus* in September 1971. Perhaps populations of *M. ochrogaster* at Cottonwood are also in the increase phase of the cycle. It is not anticipated that *M. pennsylvanicus* will be taken on the relatively dry live trap grid even though the species is common in more mesic habitats in the immediate area.

The relative abundance of *Spermophilus tridecemlineatus* at Cottonwood in July was surprising, since no ground squirrels were captured or observed on the grid in June. This can be explained partially by the preponderance of young squirrels captured in July. These probably had not yet emerged from their natal burrows in June, as one female obtained from off-grid trapping was lactating. No ground squirrels were observed at the site in September, probably because most or all were in hibernation.

Studies of small mammal disturbance at both sites demonstrated a noticeable lag between the time of actual activities and the time when the activities cease to have an obvious effect on the ecosystem. At Osage some runways remained visible as late as August 1971. Because density of *Microtus* was low at that time and had been low at least since May, it is probable that

these were made in the previous summer or autumn prior to the population crash. Even so, they clearly had an effect on vegetation during the 1971 growing season.

Gopher mounds at Cottonwood represent a similar instance wherein the activity of small mammals in one year affects primary productivity at least a year later. New and old gopher mounds observed in June 1971 were roughly equal in number. Old mounds were those erected in 1970, but not yet covered with vegetation.

Density estimates of mammals too large to be captured in the Sherman live traps probably are unreliable. For example, the number of lagomorphs appear from the data to have decreased at both sites during the summer of 1971. Although this may be true, we consider it unlikely. Roadside counts are probably not accurate because roads and road ditches influence the movements of rabbits to some unknown extent. Additionally, growth of roadside and pasture vegetation during the growing season may result in sufficient cover for rabbits to be passed unnoticed. Two transects conducted at the same site on consecutive nights frequently resulted in quite different numbers of lagomorph sightings. For example, 19 miles of transect at Osage on 16 August and 17 August resulted in no sighting of *Lepus californicus* and only one sighting of *Sylvilagus floridanus*, but 9 miles of transect on 18 August produced sighting of seven *L. californicus* and three *S. floridanus*.

We believe that the density and biomass estimates of small mammals (those trappable in Sherman traps) at the Osage and Cottonwood Sites are probably reliable (Table 7). Estimates of other undomesticated mammals are probably unreliable, but will possibly have relative meaning on a year-to-year basis. Because the live trap grid at Osage is in an ungrazed pasture whereas that

Table 7. Average small mammal standing crop--Osage and Cottonwood 1971.

Site	Date	Biomass Density		
		Wet Weight (g/ha)	Dry Weight (g/ha)	Dry Weight (g/ha)
Osage I	16 - 23 May 1971	38.51	11.55	.0012
Osage II	16 - 23 Aug. 1971	348.93	104.68	.0105
Osage III	14 - 19 Oct. 1971	1599.89	479.97	.0480
Cottonwood I	5 - 9 June 1971	37.88	11.36	.0011
Cottonwood II	22 - 26 July 1971	375.95	113.82	.0113
Cottonwood III	13 - 17 Sept. 1971	225.87	67.76	.0068

at Cottonwood is in a grazed pasture, there is little comparability between the two sites as regards live trapping. Nevertheless, interesting demographic pictures are emerging from both sites. Off-grid trapping at both sites in grazed and ungrazed habitats serves as a rough index for purposes of comparison and as a measure of control concerning interpretations of data from the grids.

LITERATURE CITED

Fleharty, E. D., and L. E. Olson. 1969. Summer food habits of *Microtus ochrogaster* and *Sigmodon hispidus*. J. Mammal. 50:475-486.

French, N. R. 1971. Small mammal studies in the U.S. IBP Grassland Biome. Ann. Zool. Fennici 8:48-53.

Golley, F. B. 1960. Energy dynamics of a food chain in an old-field community. Ecol. Monogr. 30:187-206.

Haines, H. 1971. Characteristics of a cotton rat (*Sigmodon hispidus*) population cycle. Texas J. Sci. 23:3-27.

Hoffmann, R. S., J. K. Jones, Jr., and H. H. Genoways. 1971. Small mammal survey on the Bison, Bridger, Cottonwood, Dickinson, and Osage Sites. U.S. IBP Grassland Biome Tech. Rep. No. 109. Colorado State Univ., Fort Collins. 69 p.

Jolly, G. M. 1965. Explicit estimates from capture-recapture data with both death and immigration--stochastic model. Biometrika 52:225-247.

Krebs, C. J. 1970. *Microtus* population biology: Behavioral changes associated with the population cycle in *M. ochrogaster* and *M. pennsylvanicus*. Ecology 51:34-52.

Krebs, C. J., B. L. Keller, and R. H. Tamarin. 1969. *Microtus* population biology. I. Demographic changes in fluctuating populations of *M. ochrogaster* and *M. pennsylvanicus* in southern Indiana, 1965-67. Ecology 50:587-607.

Lewis, J. K. 1970. Comprehensive Network Site description, COTTONWOOD. U.S. IBP Grassland Biome Tech. Rep. No. 39. Colorado State Univ., Fort Collins. 26 p.

Risser, P. G. 1970. Comprehensive Network Site description, OSAGE. U.S. IBP Grassland Biome Tech. Rep. No. 44. Colorado State Univ., Fort Collins. 5 p.

Zippin, C. 1956. An evaluation of the removal method of estimating animal populations. Biometrika 12:163-189.

APPENDIX I

APPENDIX TABLE

Appendix Table 1. Amphibians and reptiles collected at or near the Cottonwood and Osage IBP Sites in 1971.

Species	Number(s)	Sex	Locality
Ambystoma tigrinum	RMT 128	♂	4 miles E Cottonwood, NE ¼ Sec. 15, T1S, R19E, Jackson Co., South Dakota
Scaphiopas bombifrons	RMT 131 RMT 132	♀ ♀	1 mile N Wasta, Pennington Co., South Dakota
Thamnophis radix	ECB 1763	♀	4 miles S, 2 miles E Cottonwood, NW ¼ Sec. 4, T25S, R19E, Jackson Co., South Dakota
Pituophis melanoleucus	RMT 130	♂	12 miles E Cottonwood, NW ¼ Sec. 18, T1S, R21E, Jackson Co., South Dakota
Natrix erythrogaster	RMT 219	♀	2½ miles (by road) SE K.S. Adams Ranch, 11 miles N, 6 miles E Shidler, 1250 ft, Osage Co., Oklahoma
Coluber constrictor	RMT 127	♀	4 miles E Cottonwood, NE ¼ Sec. 15, T1S, R19E, Jackson Co., South Dakota

APPENDIX II

FIELD DATA

Live Trap Grid Data

Small mammal live trap grid data collected in 1971 at the Cottonwood and Osage Sites are Grassland Biome data sets A2U10B4 and A2U10B9. Data were collected on form NREL-10. A sample data form and an example of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - VERTEBRATE - LIVE TRAPPING

DA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	GENUS	SPECIES	SUBSPECIES	CONDITION	MARK	NUMBER	MALE	FEMALE	WEIGHT	MOLT	LOCATION		PREVIOUS NO.
			Day	Mo	Yr														Row	Col	
1-2	3-4	5-7	8																		

DATA TYPE

01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Vertebrate - Collection
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology - Decomposition
41 Microbiology - Nitrogen
42 Microbiology - Biomass
43 Microbiology - Root Decomposition
44 Microbiology - Respiration

SITE

01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT

1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

MALE

0 Adult, non-breeding
1 Subadult, non-breeding
2 Juvenile, non-breeding
3 Adult breeding ?
4 Subadult breeding ?
5 Juvenile breeding ?
6 Adult breeding
7 Subadult breeding
8 Juvenile breeding
9 Undetermined

FEMALE

0 Adult, vulva inactive
1 Subadult, vulva inactive
2 Juvenile, vulva inactive
3 Adult, vulva turgid
4 Subadult, vulva turgid
5 Juvenile, vulva turgid
6 Adult, vulva cornified
7 Subadult, vulva cornified
8 Juvenile, vulva cornified
9 Pregnant

CONDITION

0 Normal
1 Escaped
2 Torpid
3 Dead

MOLT

0 No evidence
1 Post-juvenile
2 Post-subadult
3 Adult (vernal)
4 Adult (autumnal)
5 Molt of unknown stage
6 Undetermined

MARK

0 Normal
1 Unmarked
2 Ear tag
3 Toe Clip
4 Ear tag and toe clip
5 Natural amputation

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5         6
1234567890123456789012345678901234567890123456789012345678901234567890

1009MDT151071112.76 CRPA  0 1 1440    0        0 05 03
1009MDT151071112.76 BLRR  0 1 1441    0        0 06 01
1009MDT151071112.76 SIHI  0 3 1412    0        0 12 03
1009MDT151071112.76 SIHI  0 1 1442    3        0 12 05
1009MDT151071112.76 PEMA  0 1 1443 1           0 08 04
1009MDT151071112.76 SIHI  0 1 1444    0        0 07 08
1009MDT151071112.76 PEMA  0 1 1450 3           0 09 12
1009MDT151071112.76 MIOC  0 3 1354 6           0 06 10
1009MDT151071112.76 CRPA  0 1 1451 9           0 04 10
1009AC 161071112.76 MIOC  0 1 1452    3        0 06 03
1009AC 161071112.76 BLRR  0 1 1453    3        0 09 01
1009AC 161071112.76 SIHI  0 1 1454    2        0 10 02
1009AC 161071112.76 SIHI  0 1 1455 7           0 11 01
1009AC 161071112.76 SIHI  0 3 1434 6           0 11 01
1009AC 161071112.76 SIHI  0 1 1459 2           0 12 03
1009AC 161071112.76 SIHI  0 1 1500 2           1 12 04
1009AC 161071112.76 SIHI  0 1 1502    2        0 12 04
1009AC 161071112.76 SIHI  0 1 1503    2        1 12 05
1009AC 161071112.76 BLRR  0 3 1515    0        0 11 05
1009AC 161071112.76 SIHI  0 1 1504 2           0 11 04
1009AC 161071112.76 PEMA  0 3 1443 1           0 08 04
1009AC 161071112.76 BLRR  3 1                 3 0 06 05
1009AC 161071112.76 MIOC  0 3 1432    0        0 02 10
1009AC 161071112.76 MIOC  0 1 1515    9        0 02 12
1009AC 161071112.76 MIOC  0 3 1452 6           0 01 12
1009MDT171071112.76 BLRR  0 1 1510 0           0 02 01
1009MDT171071112.76 MIOC  0 3 1452    3        0 06 03
1009MDT171071112.76 SIHI  0 1 1523    2        0 06 02
1009MDT171071112.76 BLRR  0 1 1524 6           0 11 03
1009MDT171071112.76 SIHI  0 1 1525 0           4 11 02
1009MDT171071112.76 SIHI  0 1 1530    3        0 12 01
1009MDT171071112.76 SIHI  0 1 1531 2           1 12 03
1009MDT171071112.76 SIHI  0 1 1532 2           1 12 04
1009MDT171071112.76 SIHI  0 3 1503    2        0 12 05
1009MDT171071112.76 SIHI  0 3 1442    3        0 12 05
1009MDT171071112.76 BLRR  0 3 1515    3        0 12 05
1009MDT171071112.76 SIHI  0 1 1533 2           1 11 04
1009MDT171071112.76 PEMA  0 3 1443 1           0 09 05
1009MDT171071112.76 CRPA  0 1 1534    0        0 11 08
1009MDT171071112.76 BLRR  0 1 1535    9        0 08 11
1009MDT171071112.76 MIOC  0 3 1354 6           0 06 11
1009MDT171071112.76 MIOC  0 1 1540    0        4 05 12
1009MDT171071112.76 PEMA  0 3 1450 3           0 05 12
1009MDT171071112.76 MIOC  0 3 1522 6           0 02 10
1009MDT171071112.76 MIOC  0 3 1452 6           0 01 12
```

```
1009MDT181071112.76 SIHI  0 1 1541    2        0 04 03
1009MDT181071112.76 MIOC  0 3 1452    6        0 06 03
1009MDT181071112.76 SIHI  0 1 1542 1           0 10 02
1009MDT181071112.76 SIHI  0 1 1543 3           0 12 03
1009MDT181071112.76 SIHI  0 3 1503    2        0 12 04
1009MDT181071112.76 SIHI  0 1 1544 3           0 12 05
1009MDT181071112.76 SIHI  0 1 1545 3           4 12 06
1009MDT181071112.76 PEMA  0 3 1443 1           0 11 06
1009MDT181071112.76 CRPA  0 1 1550    9        0 06 06
1009MDT181071112.76 PEMA  0 1 1551 3           0 03 09
1009MDT181071112.76 MUMU  0 1 1552 3           0 10 12
1009MDT181071112.76 SIHI  0 1 1553 1           2 04 11
1009MDT181071112.76 BLBR  0 5 0440    3        0 08 11
1009MDT181071112.76 MIOC  0 3 1513 3           4 06 10
1009MDT181071112.76 MIOC  0 3 1354 3           0 06 10
1009MDT181071112.76 CRPA  0 1 1554    9        0 04 10
1009MDT181071112.76 PELE  0 1 1555 3           4 04 12
1009MDT181071112.76 MIOC  0 3 1432    9        0 02 11
1009MDT181071112.76 MIOC  0 3 1522 6           0 01 10
1009MDT181071112.76 MIOC  0 3 1452 3           0 01 12
1009MDT191071112.76 BLBR  0 3 1453    3        0 04 02
1009MDT191071112.76 SIHI  0 3 1533 2           1 11 01
1009MDT191071112.76 SIHI  0 3 1504 2           1 11 02
1009MDT191071112.76 SIHI  0 3 1512    3        0 12 03
1009MDT191071112.76 SIHI  0 3 2503    2        0 12 04
1009MDT191071112.76 MIOC  0 3 1513 0           4 06 03
1009MDT191071112.76 MIOC  0 3 1452    3        0 06 03
1009MDT191071112.76 BLBR  0 3 1524 0           0 12 06
1009MDT191071112.76 SIHI  0 3 1442    3        0 12 05
1009MDT191071112.76 SIHI  0 1 2000 2           0 12 05
1009MDT191071112.76 CRPA  0 1 2001             0 07 09
1009MDT191071112.76 MUMU  0 3 1552 3           0 10 12
1009MDT191071112.76 PEMO  0 1 2002 3           0 04 11
1009MDT191071112.76 MIOC  0 3 1522 6           0 06 11
1009MDT191071112.76 MIOC  0 3 1354 0           0 06 12
1009MDT191071112.76 PELE  0 3 1555 3           0 04 12
1009MDT191071112.76 MIOC  0 3 1432    9        0 02 11
1009MDT191071112.76 MIOC  0 3 1515    6        0 01 11
1009MDT191071112.76 MIOC  0 3 1452 0           0 01 12
```

Small Mammal Collection Data

Small mammal collection data collected in 1971 at the Cottonwood and Osage Sites are Grassland Biome data sets A2U1024 and A2U1029. Data were collected on forms NREL-12A and NREL-14. Samples of these forms and an example of the data follow.

FIELD DATA SHEET - MAMMAL REPRODUCTIVE

DATA TYPE	SITE	INITIALS	DATE Day	DATE Mo.	DATE Yr.	TREATMENT	REPLICATE	PLOT SIZE	TRAP DAY	HOUR	GRID TRAP Row	GRID TRAP Col	GENUS	SPECIES	SUBSPECIES	SPECIMEN NUMBER	MALE EXTERNAL	MALE TESTES LN	MALE TESTES WD	MALE EPIDID	MALE SEM VES	FEMALE EXTERNAL	FEMALE MAMMARY	FEMALE PUBIC SEM	FEMALE NORMAL EMBRYOS L	FEMALE NORMAL EMBRYOS R	FEMALE EMBRYO LENGTH	FEMALE RESORB L	FEMALE RESORB R	FEMALE SCARS NEW L	FEMALE SCARS NEW R	FEMALE SCARS OLD L	FEMALE SCARS OLD R	FEMALE CORPORA LUTEA L	FEMALE CORPORA LUTEA R	FEMALE TRACT WEIGHT	FEMALE CORP ALB	FEMALE SPEC SOURCE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	15	16-19	20-22	23-26	27-28	29-30	31-32	33-34	35	36 - 42	44	45-47	48-49	50	51	52	53	54	55	56	57-59	60	61	62	63	64	65	66	67	68-72	71	72

MALE
0 Adult, non-breeding
1 Subadult, non-breeding
2 Juvenile, non-breeding
3 Adult breeding ?
4 Subadult breeding ?
5 Juvenile breeding ?
6 Adult breeding
7 Subadult breeding
8 Juvenile breeding
9 Undetermined

FEMALE
0 Adult, vulva inactive
1 Subadult, vulva inactive
2 Juvenile, vulva inactive
3 Adult, vulva turgid
4 Subadult, vulva turgid
5 Juvenile, vulva turgid
6 Adult, vulva cornified
7 Subadult, vulva cornified
8 Juvenile, vulva cornified
9 Undetermined

SEMINAL VESICLES
0 No observation
1 Minute
2 Small
3 Well developed

EPIDIDYMUS
0 No observation
1 Not convoluted
2 Slightly convoluted
3 Convoluted

MAMMARY
0 No observation
1 Small
2 Large
3 Lactating

SOURCE
1 Snap trap grid
2 Live trap grid
3 Other trap line
4 Misc. collection

PUBLIC SYMPHASIS
0 No observation
1 Closed
2 Slightly open
3 Open

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Mammal - Collection
13 Snap Trap Effort
14 Mammal Reproductive
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology-Decomposition
41 Microbiology-Nitrogen
42 Microbiology-Biomass
43 Microbiology-Root Decomposition
44 Microbiology-Respirption

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

FIELD DATA SHEET - MAMMAL COLLECTION

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	TRAP DAY	HOUR	GRID TRAP		GENUS	SPECIES	SUBSPECIES	SPECIMEN NUMBER	MARK	LENGTH	TAIL	FOOT	EAR	WEIGHT	MOLT	PARASITES	STOMACH WEIGHT	FOOD	EYE LENS	SPECIMEN	MAP REFERENCE		
			Day	Mo.	Yr.						Row	Col																	TWN	RNG	S

MARK
0 None
1 Snap-trap grid, unmarked
2 Snap-trap grid, marked
3 Live-trap grid, unmarked
4 Live-trap grid, marked
5 Other trapping

MOLT
0 No evidence
1 Post-juvenile
2 Post-subadult
3 Adult (vernal)
4 Adult (automnal)
5 Molt of unknown stage
6 Undetermined

PARASITES - EYE LENS
0 Not saved
1 Preserved

SPECIMEN
0 Not saved
1 Skin
2 Skull
3 Skin and skull
4 Skeleton
5 Liquid preservative

FOOD
0 None
1 Stomach only
2 Cheek pouch only
3 Both

DATA TYPE
01 Aboveground Biomass
02 Litter
03 Belowground Biomass
10 Vertebrate - Live Trapping
11 Vertebrate - Snap Trapping
12 Mammal - Collection
13 Snap Trap Effort
14 Mammal Reproductive
20 Avian Flush Census
21 Avian Road Count
22 Avian Road Count Summary
23 Avian Collection - Internal
24 Avian Collection - External
25 Avian Collection - Plumage
30 Invertebrate
40 Microbiology-Decomposition
41 Microbiology-Nitrogen
42 Microbiology-Biomass
43 Microbiology-Root Decomposition
44 Microbiology-Respiration

SITE
01 Ale
02 Bison
03 Bridger
04 Cottonwood
05 Dickinson
06 Hays
07 Hopland
08 Jornada
09 Osage
10 Pantex
11 Pawnee

TREATMENT
1 Ungrazed
2 Lightly grazed
3 Moderately grazed
4 Heavily grazed
5 Grazed 1969, ungrazed 1970
6
7
8
9

+++ EXAMPLE OF DATA +++

```
         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789
```

1204FCB1209711	2300	HTOC	001 0242	111	22	19	16	19.2010.8100		1S19E16
1204FCB1209711	2300	HTOC	001 0243	147	33	20	13	33.6411.4103		1S19E16
1204FCB1209711	2300	HTOC	001 0244	156	37	20	13	64.401	103	1S19E16
1204FCB1209711	2300	HTOC	001 0245	167	42	21	15	57.001	103	1S19E16
1204FCB1209711	2300	HTOC	001 0246	155	43	22	14	50.4402.1103		1S19E16
1204FCB1209711	2300	HTOC	001 0247	157	42	22	14	60.3412.0103		1S19E16
1204FCB1209711	2300	HTOC	001 0248	146	32	20	12	45.2014.2103		1S19E16
1204FCB1209711	2300	HTOC	001 0249	154	40	21	14	72.401	103	1S19E16
1204FCB1209711	2300	DEMA	001 0250	146	58	21	16	18.401	003	1S19E16
1204FCB1209711	2300	DEMA	001 0251	154	65	20	15	22.7411.1103		1S19E16
1204FCB1209711	2300	DEMA	001 0252	147	66	20	15	15.9010.9103		1S19E16
1204FCB1209711	2300	DELF	001 0253	153	61	22	15	17.[illegible].5103		1S19E16
1204FCB1209711	2300	DEMA	001 0254	137	52	19	14	15.2011.0103		1S19E16
1204FCB1209711	2300	DEMA	001 0255	123	45	18	15	14.5110.4103		1S19E16
1204FCB1209711	2300	DEMA	001 0256	155	61	20	15	27.2411.3103		1S19E16
1204FCB1209711	2300	DEMA	001 0257	145	65	18	15	20.0411.5103		1S19E16
1204FCB1209711	2300	DEMA	001 0258	142	57	19	15	16.0410.5103		1S19E16
1204FCB1209711	2300	DEMA	001 0259	141	57	19	14	16.1411.1103		1S19E16
1204FCB1209711	2300	DEMA	001 0260	137	54	18	15	21.6411.1103		1S19E16
1204FCB1209711	2300	DELF	001 0261	170	74	22	16	23.4011.1103		1S19E16
1204FCB1209711	2300	DELF	001 0262	159	70	22	15	18.4010.6103		1S19E16
1204FCB1209711	2300	DELF	001 0263	157	73	22	15	17.[illegible].4103		1S19E16
1204FCB1209711	2300	DELF	001 0264	156	67	22	15	19.[illegible].8103		1S19E16
1204FCB1209711	2300	DELF	001 0265	167	71	22	15	24.[illegible].7103		1S19E16
1204FCB1309711	3700	DEMA	02 00330	133	45	18	14	17.1110.9100		1S19E16
1204FCB1309711	3700	DEMA	02 00340	130	47	20	13	11.5010.7100		1S19E16
1204FCB1309711	3700	DEMA	02 00350	137	54	20	15	15.3010.7103		1S19E16
1204FCB1309711	3700	DEMA	02 00360	149	67	19	16	22.2411.7303		1S19E16
1204FCB1309711	3700	DEMA	02 00370	152	62	18	16	24.2410.7103		1S19E16
1204FCB1309711	3700	DEMA	02 00380	140	58	17	15	18.4211.1103		1S19E16
1204FCB1309711	3700	DEMA	02 00390	154	63	20	15	20.6410.7103		1S19E16
1204FCB1309711	3700	DEMA	02 00400	139	59	19	14	17.7010.5100		1S19E16
1204FCB1309711	3700	DEMA	02 00410	154	52	21	16	22.5011.2103		1S19E16
1204FCB1309711	3700	DELF	02 00420	156	72	22	15	21.2210.8103		1S19E16
1204FCB1309711	3700	DELF	02 00430	152	64	22	15	14.7211.4103		1S19E16
1204FCB1309711	3700	DELF	02 00440	164	73	22	15	21.7001.1103		1S19E16
1204FCB1309711	3700	DELF	02 00450	168	79	23	16	17.9010.5103		1S19E16
1204FCB1309711	3700	DELF	02 00460	182	48	22	15	27.2011.0103		1S19E16
1204FCB1309711	3700	DELF	02 00470	174	75	23	16	24.7411.0103		1S19E16
1204FCB1309711	3700	DELF	02 00480	177	76	22	15	25.7012.0103		1S19E16
1204FCB1309711	3700	DELF	02 00490	159	75	22	16	23.6011.2103		1S19E16
1204FCB1309711	3700	DELF	02 00500	165	76	23	15	19.5010.8103		1S19E16
1204FCB1309711	3700	DELF	02 00510	151	66	21	15	16.3210.3103		1S19E16
1204FCB1309711	3700	DELF	02 00520	145	61	19	16	13.4010.7103		1S19E16
1204FCB1309711	3700	[illegible]	02 00530	154	36	21	13	35.0210.9103		1S19E16
1204FCB1309711	3700	[illegible]	02 00540	130	51	15	12	10.[illegible].6103		1S19E16

1204FCB1309711	0700	MIOC	RRL02860	161	37	21	13	54.9013.4103	1S19E16
204FCB1309711	0700	MIOC	RRL02870	133	20	19	13	60.8013.9100	1S19E16
1204FCB1309711	0700	MIOC	RRL02880	152	33	21	12	45.8012.8103	1S19E16
1204FCB1309711	0700	MIOC	RRL02890	162	34	20	14	62.1015.0103	1S19E16
1204FCB1309711	0700	MIPE	RRL02900	162	37	20	12	52.0411.5103	1S19E16
1204FCB1309711	0700	MIPE	RRL02910	160	44	21	15	48.4011.9103	1S19E16
1204FCB1309711	0700	MIPE	RRL02920	151	40	20	13	42.8212.3103	1S19E16
1204FCB1309711	0700	MIPE	RRL02930	140	36	20	12	30.7010.9103	1S19E16
1204FCB1309711	0700	MIOC	RRL02940	150	33	20	13	55.5011.1103	1S19E16
1204FCB1309711	0700	MIOC	RRL02950	159	40	21	14	64.7011.5103	1S19E16
1204FCB1309711	0700	MIOC	RRL02960	162	47	20	14	54.8412.5103	1S19E16
1204FCB1309711	0700	MIOC	RRL02970	162	38	20	13	55.1411.6103	1S19E16
1204FCB1309711	0700	PELE	RRL02980	165	72	23	16	22.4411.0103	1S19E16
1204FCB1309711	0700	PELE	RRL02990	159	63	21	16	19.1009.4103	1S19E16
1204FCB1309711	0700	PELE	RRL03000	141	58	21	14	16.5110.9103	1S19E16
1204FCB1309711	0730	PEMA	RMT02790	140	54	21	14	19.5201.2103	1S19E17
1204FCB1309711	0730	PEMA	RMT02800	148	60	20	16	17.6211.2103	1S19E17
1204FCB1309711	0730	PEMA	RMT02810	128	49	17	15	12.7210.6103	1S19E17
1204FCB1309711	0730	PEMA	RMT02820	138	55	18	15	13.4210.3103	1S19E17
1204FCB1309711	0730	PEMA	RMT02830	159	66	20	16	22.1411.4103	1S19E18
1204FCB1309711	0730	PEMA	RMT02840	163	65	19	16	22.6000.9303	1S19E18
1204FCB1309711	0730	PEMA	RMT02850	137	53	20	15	15.2112.4103	1S19E18
1204FCB1309711	0730	MIOC	RMT0237	148	33	20	14	50.2012.8103	1S19E17
1204FCB1309711	0730	MIOC	RMT0238	139	34	20	12	34.8211.5103	1S19E17
1204FCB1309711	0730	PEMA	RMT0239	158	58	19	15	26.6012.2103	1S19E17
1204FCB1309711	0730	PEMA	RMT0240	145	57	19	15	21.7211.6103	1S19E17
1204FCB1309711	0730	PEMA	RMT0241	152	58	19	15	21.8410.9103	1S19E17
1204FCB1309711	0730	PEMA	RMT0242	134	53	19	14	14.6110.8103	1S19E17
1204FCB1309711	0730	PEMA	RMT0243	149	60	20	15	17.5410.4100	1S19E17
1204FCB1309711	0730	PEME	RMT0244	149	65	17	13	17.2000.6103	1S19E17
1204FCB1309711	0730	PELE	RMT0245	167	73	22	16	23.3011.5103	1S19E17
1204FCB1309711	0730	PELE	RMT0246	159	67	22	15	17.4010.4103	1S19E17
1204FCB1309711	0730	PELE	RMT0247	146	58	22	16	17.8110.8103	1S19E17
1204FCB1309711	0730	PELE	RMT0248	145	59	22	15	17.8100.7103	1S19E17
1204FCB1309711	0730	PELE	RMT0249	143	60	22	16	18.6110.5103	1S19E17
1204FCB1309711	0730	PELE	RMT0250	144	64	22	16	16.9100.5103	1S19E17
1204FCB1309711	0730	PELE	RMT0251	145	58	21	15	19.0111.1100	1S19E17
1204FCB1309711	0730	PELE	RMT0252	145	60	22	15	17.3110.8100	1S19E17
1204FCB1309711	0730	PELE	RMT0253	143	60	22	15	15.9110.6100	1S19E17
1204FCB1309711	0730	MIOC	RMT0269	151	35	20	12	40.9011.4100	1S19E17
1204FCB1309711	0730	MIOC	RMT0270	163	36	21	11	51.9011.4103	1S19E17
1204FCB1309711	0730	MIOC	RMT0271	162	37	22	14	48.6212.5100	1S19E17
1204FCB1309711	0730	MIOC	RMT0275	164	35	21	13	59.001	103 1S19E17
1204FCB1309711	0730	PEMA	RMT0276	158	61	20	15	21.0200.9100	1S19E17
1204FCB1309711	0730	PEMA	RMT0277	158	65	20	16	23.5211.5103	1S19E17
1204FCB1309711	0730	PEMA	RMT0278	159	63	20	15	24.6002.1103	1S19E17
1204FCB1209711	2300	PEME	RRL0276	135	66	17	12	10.5000.3103	1S19E16
1204FCB1209711	2300	PEMA	RRL0277	165	68	19	16	26.4012.9103	1S19E16
1204FCB1209711	2300	PEMA	RRL0278	150	62	20	15	21.8011.0103	1S19E16
1204FCB1209711	2300	PEMA	RRL0279	140	54	19	15	19.3210.3103	1S19E16
1204FCB1209711	2300	PEMA	RRL0280	144	57	18	16	21.8410.6103	1S19E16
1204FCB1209711	2300	PEMA	RRL0281	134	51	18	15	15.3100.3103	1S19E16
204FCB1209711	2300	PEMA	RRL0282	132	51	18	15	16.6101.6103	1S19E16
204FCB1209711	2300	PEMA	RRL0283	140	55	18	14	15.6001.1100	1S19E16
1204FCB1209711	2300	PEMA	RRL0284	152	63	20	14	18.6010.4100	1S19E16

```
1204FCB1209711          2300     MIOC RMT0262  163 38 20 14 53.50 1.0100 1S19E16
 204FCB1209711          2300     MIOC RMT0263  151 37 19 14 50.4002.3103 1S19E16
1204FCB1209711          2300     MIOC RMT0264  156 40 19 13 51.301   103 1S19E16
1204FCB1209711          2300     MIOC RMT0265  163 42 21 14 49.6211.4103 1S19E16
1204FCB1209711          2300     MIOC RMT0266  165 42 22 14 53.2411.6103 1S19E17
1204FCB1209711          2300     MIOC RMT0267  141 35 19 13 36.3011.4103 1S19E17
1204FCB1209711          2300     MIOC RMT0268  137 35 20 14 38.9102.1103 1S19E17
1204FCB1209711          2300     MIOC DR 0020  134 29 20 13 30.5211.7100 1S19E16
1204FCB1209711          2300     MIOC DR 0021  169 43 23 15 62.0414.2103 1S19E16
1204FCB1209711          2300     MIOC DR 0022  166 35 21 14 55.8013.2103 1S19E16
1204FCB1209711          2300     MIOC DR 0023  151 40 22 14 46.8413.0103 1S19E16
1204FCB1209711          2300     MIOC DR 0024  150 36 21 13 42.5012.6103 1S19E16
1204FCB1209711          2300     MIOC DR 0025  160 37 20 14 48.8013.8103 1S19E16
1204FCB1209711          2300     MIOC DR 0026  163 35 21 14 55.4013.6103 1S19E16
1204FCB1209711          2300     MIOC DR 0027  162 39 20 14 54.5011.7103 1S19E16
1204FCB1209711          2300     MIOC DR 0028  161 38 21 15 65.6411.7103 1S19E16
1204FCB1209711          2300     MIOC DR 0029  162 40 22 14 49.0412.4103 1S19E16
1204FCB1209711          2300     MIPE DR 0030  170 41 20 13 61.2003.8103 1S19E16
1204FCB1209711          2300     MIPE DR 0031  183 51 22 15 59.1010.9103 1S19E16
1204FCB1209711          2300     MIPE DR 0032  138 34 20 12 31.9111.5103 1S19E16
1204FCB1209711          2300     PELE DR 0008  167 69 21 15 29.7013.1100 1S19E16
1204FCB1209711          2300     PELE DR 0009  183 84 23 16 26.3010.8103 1S19E16
1204FCB1209711          2300     PELE DR 0010  184 84 23 15 28.7010.9103 1S19E16
1204FCB1209711          2300     PELE DR 0011  164 72 22 15 22.7410.8103 1S19E16
1204FCB1209711          2300     PELE DR 0012  156 64 21 15 20.4400.7103 1S19E16
1204FCB1209711          2300     PELE DR 0013  165 71 22 15 21.5410.6103 1S19E16
 204FCB1209711          2300     PELE DR 0014  155 64 22 15 17.6010.8103 1S19E16
1204FCB1209711          2300     PELE DR 0015  158 66 22 15 20.3011.3103 1S19E16
1204FCB1209711          2300     PELE DR 0016  142 53 21 14 12.9010.2100 1S19E16
1204FCB1209711          2300     MUMU DR 0017  151 73 17 13 11.501   100 1S19E16
1204FCB1209711          2300     MIPE DR 0018  172 44 20 14 70.5414.0103 1S19E16
1204FCB1209711          2300     MIOC DR 0019  138 33 20 13 27.2011.6100 1S19E16
1204FCB1209711          2300     MIOC RPL0266  134 35 19 14 36.2211.7103 1S19E18
1204FCB1209711          2300     MIOC RPL0267  152 36 20 14 46.2412.2103 1S19E18
1204FCB1209711          2300     MIOC RPL0268  140 36 20 16 38.4211.7103 1S19E18
1204FCB1209711          2300     MIOC RPL0269  165 40 20 14 65.4412.5103 1S19E18
1204FCB1209711          2300     PEMA RPL0270  149 56 20 16 23.8411.5103 1S19E18
1204FCB1209711          2300     PEMA RPL0271  154 61 20 16 23.6011.3103 1S19E18
1204FCB1209711          2300     PEMA RPL0272  138 56 19 15 17.3201.1103 1S19E18
1204FCB1209711          2300     PEMA RPL0273  130 51 20 14 13.0110.4100 1S19E18
1204FCB1209711          2300     PEMA RPL0274  130 47 18 15 13.4100.7100 1S19E18
1204FCB1209711          2300     DMLE RPL0275  131 33 21 16 31.5011.5103 1S19E18
1204FCB1409713 2.72 207001201PEMA RMT0254  156 69 19 15 18.3400.4103 1S19E21
1204FCB1409713 2.72 207000602MIOC RMT0272  136 34 20 13 33.0000.8103 1S19E21
1204FCB1409713 2.72 107001101PEMA RMT0255  137 57 20 15 16.6000.6103 1S19E21
1204FCB1409713 2.72 107000608PEMA RMT0256  146 57 19 15 14.7211.2103 1S19E21
1204FCB1409713 2.72 107000701PEMA RMT0257  150 62 19 16 16.8210.8103 1S19E21
1204FCB1409713 2.72 107001201PEMA RMT0258  155 64 19 16 21.4001.2103 1S19E21
1204FCB1409713 2.72 107000410PEMA RMT0259  129 51 18 14 13.1210.5100 1S19E21
1204FCB1409713 2.72 107000702PEMA RMT0260  110 21 20 15 19.8200.5100 1S19E21
1204FCB1409713 2.72 107001112PEMA RMT0261  128 52 18 14 12.8010.4100 1S19E21
1204FCB1509713 2.72 307001111JMIOC RMT0273  123 32 19 10 21.4110.5100 1S19E21
1204FCB1509713 2.72 307001101PEMA RMT0274  133 51 20 15 18.6100.6103 1S19E21
```

```
 204FCB1609713          0830     THTA DB 0054  204 64 28  6 87.9613.3103 1S19E21
1204FCB1609713          0830     THTA DB 00550 203 65 28  6 91.7613.1103 1S19E21
1204FCB1609713          1830     THTA PPL03010 189 55 26  6 87.3612.7103 1S19E21
1204FCB1609713          1830     THTA PMT02870 206 59 28  7 94.7014.3103 1S19E16
1204FCB1609713 2.72  40800111 0MIOC PMT02864 136 34 19 13 29.7210.5103 1S19E21
1204FCB1709713          0730     THTA FCB1918  205 60 28  7 77.0612.5103 1S19E16
1204FCB1709713          0730     THTA DB 0056  203 59 27  7 85.8613.3103 1S19E21
1404FCB1209711          2300     MIOC PPL0242          81100   000000000   003
1404FCB1209711          2300     MIOC PPL0243          31100   000000012   003
1404FCB1209711          2300     MIOC PPL0244          32331 3100000031 13103
1404FCB1209711          2300     MIOC PPL0245          33300   3000012220.813
1404FCB1209711          2300     MIOC PPL0246          02120   9000003210.513
1404FCB1209711          2300     MIOC PPL0247 6 141133                      3
1404FCB1209711          2300     MIOC PPL0248          32313   3000000131.013
1404FCB1209711          2300     MIOC PPL0249          32313 3000000014 10003
1404FCB1209711          2300     PEMA PPL0250 0  2 111                      3
1404FCB1209711          2300     PEMA PPL0251 3  8 532                      3
1404FCB1209711          2300     PEMA PPL0252 0  4 211                      3
1404FCB1209711          2300     PELE PPL0253          61100    00000000    03
1404FCB1209711          2300     PEMA PPL0254          71100    00000032    03
1404FCB1209711          2300     PEMA PPL0255 2  2 111                      3
1404FCB1209711          2300     PEMA PPL0256 6  9 633                      3
1404FCB1209711          2300     PEMA PPL0257 0  3 211                      3
1404FCB1209711          2300     PEMA PPL0258 0  5 311                      3
1404FCB1209711          2300     PEMA PPL0259 0  4 311                      3
1404FCB1209711          2300     PEMA PPL0260 3  9 633                      3
1404FCB1209711          2300     PELE PPL0261 0  2 111                      3
1404FCB1209711          2300     PELE PPL0262 0  2 111                      3
1404FCB1209711          2300     PELE PPL0263 0  2 111                      3
1404FCB1209711          2300     PELE PPL0264 0    00                       3
1404FCB1209711          2300     PELE PPL0265          62100    00007424    13
1404FCB1309711          0700     PEMA DB 0033          21143 3000000430.703
1404FCB1309711          0700     PEMA DB 0034 2  4 211                      3
1404FCB1309711          0700     PEMA DB 0035 0  6 311                      3
1404FCB1309711          0700     PEMA DB 0036          62301 5000015010.213
1404FCB1309711          0700     PEMA DB 0037 6 11 733                      3
1404FCB1309711          0700     PEMA DB 0038 0  3 211                      3
1404FCB1309711          0700     PEMA DB 0039 0  6 311                      3
1404FCB1309711          0700     PEMA DB 0040          32300   000005200   13
1404FCB1309711          0700     PEMA DB 0041          32300   000210231   13
1404FCB1309711          0700     PELE DB 0042          61100   000000000   03
1404FCB1309711          0700     PELE DB 0043          61100   000000000   03
1404FCB1309711          0700     PELE DB 0044          61100   000000400   13
1404FCB1309711          0700     PELE DB 0045          61100   000000000   03
1404FCB1309711          0700     PELE DB 0046          62300   000004600   13
1404FCB1309711          0700     PELE DB 0047 0  7 312                      3
1404FCB1309711          0700     PELE DB 0048          61100   000005500   03
1404FCB1309711          0700     PELE DB 0049          62100   000004300   13
1404FCB1309711          0700     PELE DB 0050 0  3 211                      3
1404FCB1309711          0700     PELE DB 0051 1  2 111                      3
1404FCB1309711          0700     PELE DB 0052 1  5 311                      3
 404FCB1309711          0700     MIPE DB 0053 1 11 622                      3
1404FCB1309711          0700     PEME PPL0285 6  7 533                      3
```

```
1404FCB1309711  0700  MIOC PPL0285                  62221  90600011211.203
1404FCB1309711  0700  MIOC PPL0287                  62124.0000044320.403
1404FCB1309711  0700  MIOC PPL0288                  61122  60000031220.903
1404FCB1309711  0700  MIOC PPL0289                  62131  70000000311.003
1404FCB1309711  0700  MIPF PPL0290 6 15 833                              3
1404FCB1309711  0700  MIPF PPL0291                  31233 16000000336.503
1404FCB1309711  0700  MIPF PPL0292                  31123  6000000330.503
1404FCB1309711  0700  MIPF PPL0293 3 13 833                              3
1404FCB1309711  0700  MIOC PPL0294                  61212 2e1000002210503
1404FCB1309711  0700  MIOC PPL0295                  31205 19100000067.503
1404FCB1309711  0700  MIOC PPL0296 0 15 833                              3
1404FCB1309711  0700  MIOC PPL0297 6 15 1033                             3
1404FCB1309711  0700  PELE PPL0298                  61100  000000000    03
1404FCB1309711  0700  PELE PPL0299 0    22                               3
1404FCB1309711  0700  PELE PPL0300 2  5 422                              3
1404FCB1309711  0730  PEMA PMT0279 1  7 411                              3
1404FCB1309711  0730  PEMA PMT0280 1  3 111                              3
1404FCB1309711  0730  PEMA PMT0281                  21100  000000022    03
1404FCB1309711  0730  PEMA PMT0282 2  4 211                              3
1404FCB1309711  0730  PEMA PMT0283 6 10 733                              3
1404FCB1309711  0730  PEMA PMT0284                  32333  5000000330.603
1404FCB1309711  0730  PEMA PMT0285 1  3 211                              3
1404FCB1309711  0730  MIOC PMT0237 6 13 822                              3
1404FCB1309711  0730  MIOC PMT0238 0  9 612                              3
1404FCB1309711  0730  PEMA PMT0239                  32334  4000000351.003
1404FCB1309711  0730  PEMA PMT0240                  41100  0004223422.913
1404FCB1309711  0730  PEMA PMT0241 6 10 633                              3
1404FCB1309711  0730  PEMA PMT0242 1  5 311                              3
1404FCB1309711  0730  PEMA PMT0243 0  5 212                              3
1404FCB1309711  0730  PEMA PMT0244                  33316 12000000152.403
1404FCB1309711  0730  PELE PMT0245 0  3 111                              3
1404FCB1309711  0730  PELE PMT0246 1  4 211                              3
1404FCB1309711  0730  PELE PMT0247                  71100  000000000   003
1404FCB1309711  0730  PELE PMT0248 1  3 111                              3
1404FCB1309711  0730  PELE PMT0249                  71100  000000000   003
1404FCB1309711  0730  PELE PMT0250 1  3 111                              3
1404FCB1309711  0730  PELE PMT0251 1  3 111                              3
1404FCB1309711  0730  PELE PMT0252                  71100  000000000   003
1404FCB1309711  0730  PELE PMT0253                  71100  000000000   003
1404FCB1309711  0730  MIOC PMT0269 4 11 822                              3
1404FCB1309711  0730  MIOC PMT0270                  32322  7000000231.103
1404FCB1309711  0730  MIOC PMT0271 6 14 922                              3
1404FCB1309711  0730  MIOC PMT0275                  32322  8000000221.213
1404FCB1309711  0730  PEMA PMT0276 4  6 312                              3
1404FCB1309711  0730  PEMA PMT0277 4  9 622                              3
1404FCB1309711  0730  PEMA PMT0278                  32333 14000000333.603
1404FCB1209711  2300  REME PPL0276 3  8 422                              3
1404FCB1209711  2300  PEMA PPL0277                  32200  000001922    13
1404FCB1209711  2300  PEMA PPL0278 3 11 633                              3
1404FCB1209711  2300  PEMA PPL0279                  41133 10010000341.803
1404FCB1209711  2300  PEMA PPL0280 6 10 633                              3
1404FCB1209711  2300  PEMA PPL0281 2  5 311                              3
1404FCB1209711  2300  PEMA PPL0282 1  6 211                              3
1404FCB1209711  2300  PEMA PPL0283 1  7 433                              3
1404FCB1209711  2300  PEMA PPL0284 3  7 533                              3
```

```
1404FCB1209711          2300     MIOC RMT0262 6 16 233                                3
1404FCB1209711          2300     MIOC RMT0263          32200  000002100    13
1404FCB1209711          2300     MIOC RMT0264          32210  9000012120.303
1404FCB1209711          2300     MIOC RMT0265 0 14 833                                3
1404FCB1209711          2300     MIOC RMT0266 6  9 633                                3
1404FCB1209711          2300     MIOC RMT0267 4 10 633                                3
1404FCB1209711          2300     MIOC RMT0268          41100  000000031    03
1404FCB1209711          2300     MIOC DR 0020 1  8 511                                3
1404FCB1209711          2300     MIOC DR 0021 0 141033                                3
1404FCB1209711          2300     MIOC DR 0022          62200  000002022    03
1404FCB1209711          2300     MIOC DR 0023 00  8 623                               3
1404FCB1209711          2300     MIOC DR 0024 3 12 833                                3
1404FCB1209711          2300     MIOC DR 0025 3 11 723                                3
1404FCB1209711          2300     MIOC DR 0026 6 14 933                                3
1404FCB1209711          2300     MIOC DR 0027 6 17 933                                3
1404FCB1209711          2300     MIOC DR 0028          32313 260000001313313
1404FCB1209711          2300     MIOC DR 0029          32200  000001213    13
1404FCB1209711          2300     MIPE DR 0030          32323 20000000233.103
1404FCB1209711          2300     MIPE DR 0031 6 161133                                3
1404FCB1209711          2300     MIPE DR 0032 1  6 411                                3
1404FCB1209711          2300     PELE DR 0008    5 31262100  000005522    13
1404FCB1209711          2300     PELE DR 0009 3  6 422                                3
1404FCB1209711          2300     PELE DR 0010          621                            3
1404FCB1209711          2300     PELE DR 0011          621                            3
1404FCB1209711          2300     PELE DR 0012 0  5 211                                3
1404FCB1209711          2300     PELE DR 0013          61100   00000000    13
1404FCB1209711          2300     PELE DR 0014          61100   00000000    03
1404FCB1209711          2300     PELE DR 0015 0  2 111                                3
1404FCB1209711          2300     PELE DR 0016 2  4 311                                3
1404FCB1209711          2300     MIMU DR 0017          31100  000000022    03
1404FCB1209711          2300     MIPE DR 0018          32323 180000000247.103
1404FCB1209711          2300     MIOC DR 0019          41100  000000000    03
1404FCB1209711          2300     MIOC RPL0266 1 10 733                                3
1404FCB1209711          2300     MIOC RPL0267 6 11 733                                3
1404FCB1209711          2300     MIOC RPL0268          41121  9000000210.803
1404FCB1209711          2300     MIOC RPL0269          31331 120000000222.003
1404FCB1209711          2300     PEMA RPL0270          611325.0000043430.303
1404FCB1209711          2300     PEMA RPL0271 6 10 733                                3
1404FCB1209711          2300     PEMA RPL0272 0  6 422                                3
1404FCB1209711          2300     PEMA RPL0273 1  5 411                                3
1404FCB1209711          2300     PEMA RPL0274 1  6 411                                3
1404FCB1209711          2300     ONLE RPL0275 0  7 511                                3
1404FCB1409713 2.72  207001201PEMA RMT0254 4  9 633                                  2
1404FCB1409713 2.72  207000602MIOC RMT0272          712236.0000000230.602
1404FCB1409713 2.72  107001101PEMA RMT0255 3  8 533                                  1
1404FCB1409713 2.72  107000608PEMA RMT0256 0  4 311                                  1
1404FCB1409713 2.72  107000701PEMA RMT0257          63100   00003105    11
1404FCB1409713 2.72  107001201PEMA RMT0258          62100   00006443    01
1404FCB1409713 2.72  107000410PEMA RMT0259          61100   00000000    01
1404FCB1409713 2.72  107000702PEMA RMT0260 0  3 600                                  1
1404FCB1409713 2.72  107001112PEMA RMT0261          81100  000000000    01
1404FCB1509713 2.72  307001110MIOC RMT0273          51100  000000000    02
1404FCB1509713 2.72  307001101PEMA RMT0274          41223 140000000234.402
1404FCB1609713          0830     THTA DR 0054          61300  000004500    14
1404FCB1609713          0830     THTA DR 0055          61100  000000000    04
1404FCB1609713          1830     THTA RPL0301 1  5 311                                4
1404FCB1609713          1830     THTA RMT0287          61100  000000000    04
1404FCB1609713 2.72  408001110MIOC RMT0286 4 11 733                                  2
1404FCB1709713          0730     THTA FCB1918          71100   00000000    04
1404FCB1709713          0730     THTA DR 0056          61100   00000000    04
```

Jackrabbit Transect Data

Jackrabbit transect data collected in 1971 at the Cottonwood and Osage Sites are Grassland Biome data sets A2U10C4 and A2U10C9. Data were collected on form NREL-15. A sample data form and an example of the data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET -- JACKRABBIT CENSUS

Data Type	Site	Initials	Date			Route	Strip Width	Hour	Genus	Species	Subspecies	Odometer	Measured Distance
			Day	Month	Year								
1-2	3-4	5-7	8-9	10-11	12-13	14-15	17-19	21-24	26-27	28-29	30	32-35	36-40
15													

Route

Investigator's identifier

Hour

24 hour clock

Strip Width

Width in feet of census strip

Measured Distance

Distance in feet to estimated point

+++ EXAMPLE OF DATA +++

```
        1         2         3         4         5
12345678901234567890123456789012345678901234567890

1509AC 16087104 150 2145       80.6  147
1509AC 16087104 150 2200       81.6  132
1509AC 16087104 150 2205       82.6  165
1509AC 16087104 150 2215       83.6  144
1509AC 16087104 150 2220       84.6  228
1509AC 16087104 150 2230       85.6  189
1509AC 16087104 150 2345       86.6  135
1509AC 16087104 150 2255 SYFI  87.3
1509AC 16087104 150 2300       87.6  153
1509AC 16087104 150 2310       88.6  189
1509AC 16087104 150 2320       89.6  132
1509AC 16087104 150 2330       90.6  180
1509FCB17087105 150 2105       50.0  111
1509FCB17087105 150 2115       51.0  138
1509FCB17087105 150 2120       52.0  138
1509FCB17087105 150 2135       53.0  198
1509FCB17087105 150 2140       54.0  159
1509FCB17087105 150 2155       55.0  162
1509FCB17087105 150 2200       56.0  150
1509FCB17087105 150 2210       57.0  132
1509FCB17087105 150 2215       58.0  150
1509FCB17087105 150 2220       59.0  138
1509RMT18087106 150 2145       74.5  135
1509RMT18087106 150 2145 SYFI  74.5
1509RMT18087106 150 2200       75.5  165
1509RMT18087106 150 2205       76.5  168
1509RMT18087106 150 2210 SYFI  76.9
1509RMT18087106 150 2215       77.5  177
1509RMT18087106 150 2220 LECA  78.3
1509RMT18087106 150 2225 LECA  78.4
1509RMT18087106 150 2228 LECA  78.5
1509RMT18087106 150 2228 LECA  78.5
1509RMT18087106 150 2228 LECA  78.5
1509RMT18087106 150 2230       78.5  156
1509RMT18087106 150 2240       79.5  147
1509RMT18087106 150 2245       80.5  165
1509RMT18087106 150 2250 LECA  81.0
1509RMT18087106 150 2255 LECA  81.3
1509RMT18087106 150 2300       81.5  142
1509RMT18087106 150 2305       82.5  159
1509RMT18087106 150 2307 SYFI  83.1
1509RMT18087106 150 2310       83.5  195
1509RMT19087106 150 2120       60.5  165
1509RMT19087106 150 2130       61.5  147
1509RMT19087106 150 2130 LECA  61.5
1509RMT19087106 150 2135       62.5  159
1509RMT19087106 150 2140 LECA  62.4
1509RMT19087106 150 2140 LECA  62.4
1509RMT19087106 150 2140 SYFI  62.4
```