Technical Report No. 260

Herbage Dynamics Studies At The Pantex Site, 1972

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ABSTRACT

Aboveground herbage component estimates were obtained on 10 sampling dates in 1972 at the Pantex site. Root biomass samples were collected four times throughout the year.

On all sample dates more total aboveground biomass was harvested from the Opuntia stratum than from the blue grama stratum. Maximum standing crop in the cactus and grass plots was 946 and 316 g/m^2, respectively. These data corresponded to the July 14 and July 31 sampling dates. Current live production peaked in May and again in July. This was caused by annual cool season grass growth early and primarily blue grama growth in mid summer.

Aboveground plant tissue death is extremely rapid from May 22 through June 20 and again from August 24 through September 9. This standing dead current years production is then transferred into the litter fraction rapidly.

Seasonal low crown biomass -- 200 g/m^2 -- was found on May 22. Crown tissue then reached a maximum biomass -- over 500 g/m^2 -- on July 14. The dynamic nature of this tissue demonstrates its importance as an energy storage tissue.

Litter biomass estimates were highly variable throughout the season. Maximum decomposition rates again were found in late August.

Total root biomass maxima in all treatments were found on the September 9 sampling date. Over 750 g/m^2 of root material was harvested in the top 10 cm of soil on this date. On all other dates, less than 350 g/m^2 were found in this soil increment. Little difference in root biomass was found below 20 cm on all sampling dates.

INTRODUCTION

Herbage dynamics data from a shortgrass prairie ecosystem located near Amarillo, Texas were taken 10 times until late summer on grazed and non-grazed areas.

The ungrazed area (treatment 1) consists of a 40-acre pasture which had been grazed moderately until 1969, then was fenced to prevent large herbivores from grazing. The moderately grazed area (treatment 3) is located contiguous to treatment 1 and it has had similar past grazing use as treatment 1 until early 1970. Steers and cows with calves have been used to moderately graze the area since 1970.

Blue grama (Bouteloua gracilis) is the dominant forage species in both treatments. Minor amounts of buffalograss (Buchloe dactyloides), sand dropseed (Sporobolus cryptandrus) and purple three-awn (Aristida purpurea) prevail throughout both areas. Disturbed areas around anthills or small mammal diggings are represented with tumblegrass (Schedonnardus paniculatus), ticklegrass (Panicum capillare), tumble windmillgrass (Chloris verticillata), and stinkgrass (Eragrostis megastachya). Seasonal aspects of little barley (Hordeum pusillum) and six weeks fescue (Vulpia octoflora) are prominent until early June if soil water was adequate the previous fall.

The dominant dicots in both treatments are scarlet globemallow (Sphaeralcea coccinea), pigweeds (Amaranthus spp.), and plains pricklypear cactus (Opuntia polycantha). Subordinate forbs in the area are: pepperweed (Lepidium densiflorum), tansy mustard (Descurainia pinnata) and summer cypress (Kochia scoparia). Most of these herbs comprise less than 5 percent of the aboveground biomass in these treatments.

The Pantex site had experienced severe drought until mid 1971 when 8 inches (21 cm) of precipitation were received in July and August. Throughout 1972, the site received approximately 13 inches (33 cm) of water which is well below the average for this area. Fortunately most of this occurred during the growing season thus promoting herbage growth and development.

Objectives of the 1972 sampling period were: (1) to estimate aboveground and belowground biomass in a grazed and non-grazed shortgrass prairie, and (2) to evaluate differences in herbage productivity within the pricklypear cactus stratum and the nearly pure blue grama stratum.

METHODS AND PROCEDURES

Because of the subjective nature in delimiting the blue grama and cactus strata, a modified delineation technique was used throughout 1972 to obtain a more accurate analysis of herbage production. If less than 15 percent foliage cover of cactus was present within a randomly selected plot, the plot was considered to be a part of the blue grama stratum. Cactus cover had to exceed 15 percent of the plot's area to be called a pricklypear plot. In this area the cactus consists of many old-widespread individuals interspersed by juvenile plants with few cladophylls. The new sampling technique was designed then to include these smaller cactus plants.

Six, 0.5 sq m circular plots were sampled in each of two replicates per strata. Thus, 24 plots were harvested in each of the two treatments. Samples were taken at monthly intervals until late June when a two to three week interval was used.

Aboveground herbage was clipped near the soil surface with power shears. Clippings were removed from the shear head with a D-Vac to

prevent loss of herbage by wind and to capture insects which had been missed in the earlier collection under the quick trap. Any detached plant material which had not fallen to the soil surface was manually removed by hand and placed in the D-Vac bag used for litter before clipping the aboveground. This minimized confounding litter with standing dead plant materials.

When all standing material had been removed, the vacuum was used to carefully remove all litter and soil surface insects from the plot. After this was completed, crowns of all plants were left exposed for removal with the power shears.

Aboveground biomass samples were placed in Berlese funnels 24 hours for insect extractions. Plant materials were then transferred to a drying oven set at 70 C. After drying to a constant weight, samples were removed and placed on fine mesh screens for washing to remove as much soil as possible. When reasonably cleaned, samples were returned to the drying oven. After drying, total biomass of each plant part was recorded to the nearest .01 g. All material was hand separated into species or groups of species, and again weighed.

After dry weights were recorded for all components (litter, crowns, aboveground), a composite subsample from each replication and stratum was taken. This sample was ground in a Wiley Mill to pass a 40-mesh screen. An aliquot of this homogeneous tissue was used for ashing purposes to correct all sample weights to a mineral-free basis.

Belowground biomass samples were taken on four dates with a tractor-mounted hydraulic coring device. A 7.62 cm diameter soil tube was placed over each denuded plot and was inserted as deeply as possible. The undisturbed cores were cut into 10 cm segments and later were washed in

32-mesh nylon bags. Root materials remaining in the bags were dryed at 70 C for 24 hours, weighed, and ashed.

RESULTS AND DISCUSSION

To facilitate a readable report, only the most relevant data resulting from our 1972 sampling year will be presented. Details of specific compartment yields and associated errors are presented in Appendix I.

Aboveground Standing Crop

On all sampling dates more total aboveground biomass was recorded in the pricklypear (6%) than the blue grama (94%) stratum (Fig. 1). The ungrazed treatment, on most sampling dates, contained more standing crop than was found on the grazed treatment. In the blue grama stratum two biomass maxima were found; one in late May and the other in late July. These maxima reflect that cool season annual grasses are very abundant early while the warm season grass, blue grama, grows rapidly in mid summer. Recent dead plant biomass also depicts the two maxima. Again rapid growth and death of the annual cool season grasses are responsible for the first maximum on June 20 followed by death of blue grama beginning July 31. Old dead from previous years growth in the pricklypear stratum peaked on May 22 in both treatments and gradually decomposed or became litter reaching the seasonal low biomass on August 24.

Productivity was determined by the following method: amount of green standing material at one date - amount of green standing material at the preceding date ÷ the interval (in no. of days) between the two dates. Productivity within the blue grama stratum treatments 3 and 1 from April 22 to May 22 was 1.9 and 3.8 $g/m^2/day$, respectively (Fig. 2). Following this period a negative productivity was found until June 20. After June 20 blue grama and associated

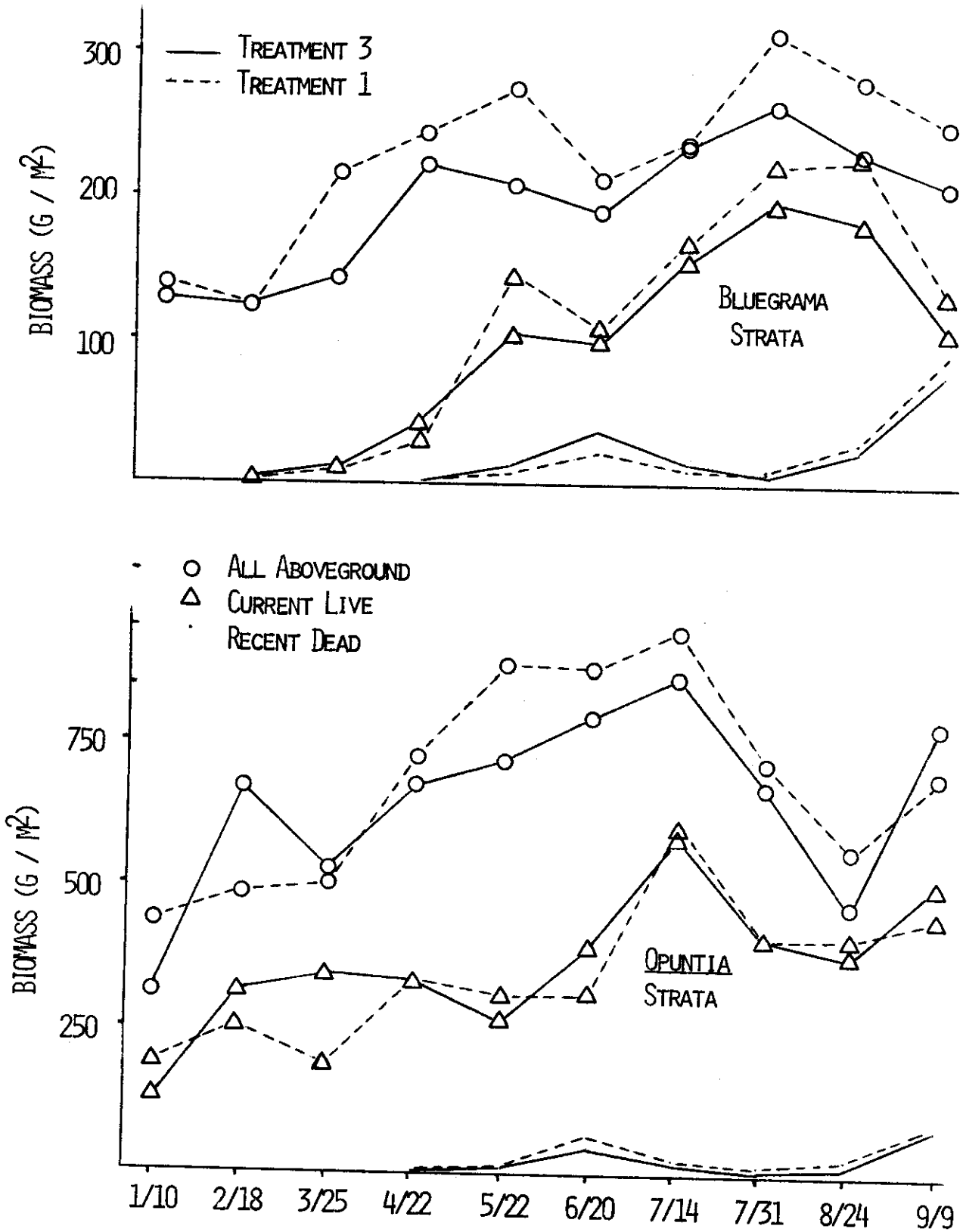

Fig. 1. Aboveground, current alive, and recent dead plant materials in blue grama and Opuntia strata at Pantex site in 1972.

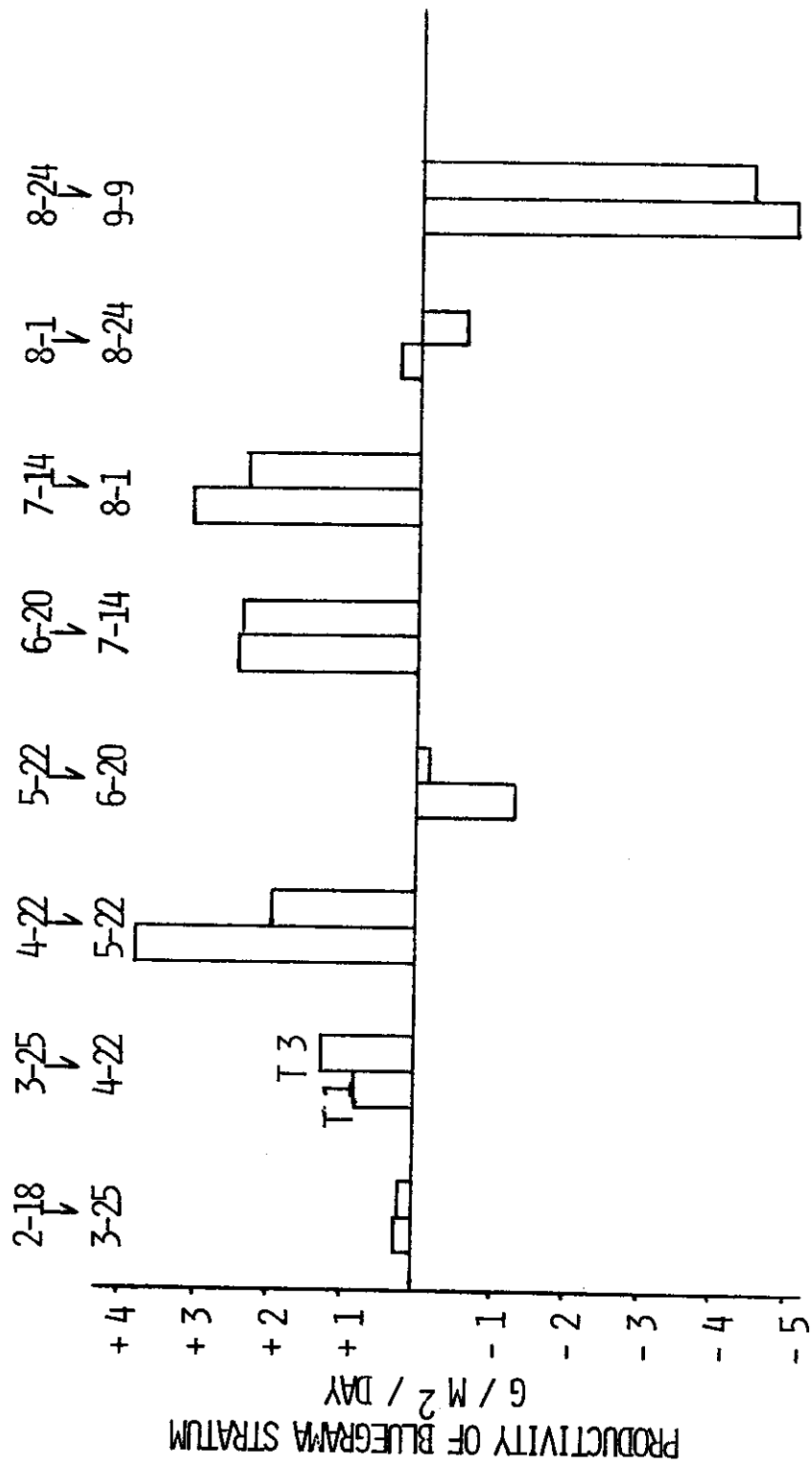

Fig. 2. Productivity of the blue grama stratum on the Pantex site, 1972. Negative values show that a loss of green aboveground herbage occurred at three times.

growth continued until August 1 at which time productivity rates decreased rapidly. Heavy accumulations of standing dead plant material prevailed in late August and early September.

Annual Cool-Season Grass Dynamics

Little barley and six weeks fescue dominate this site's aspect until late May of each year if soil water the previous fall was adequate for germination. These species are prolific seed producers and possibly are very competitive with the perennial warm season grasses for water.

Data in Fig. 3 show the rapid productivity and death of these two species. Peak standing crop for both occurred on May 22 and by June 20 no current living tissue was present. On the June sampling date over 20 g/m^2 of recently dead little barley was harvested while on May 22 only a trace was present. Six weeks fescue, on the other hand, had recently dead tissue at least two weeks prior to the barley.

These data also show that the recent dead standing plants become a part of the litter component rapidly. Decomposition of this tissue is essentially completed by September. Spikelet parts, however, remain on the soil surface for some time before decomposition occurs.

Crown Component

Crowns or stem bases of plants in this shortgrass ecosystem have responded similarly in 1972 as was found in the 1971 sampling period. Our data reveal that crown biomass in both the grazed and non-grazed treatment is least after the cool season annual grass growth terminates and just before the warm season grasses begin growth (Fig. 4). After May 22 crown biomass in the blue grama stratum dramatically increased until July 10 then decreased rapidly. Within the cactus stratum, peak summer biomass was obtained June 20 and gradually declined until late August.

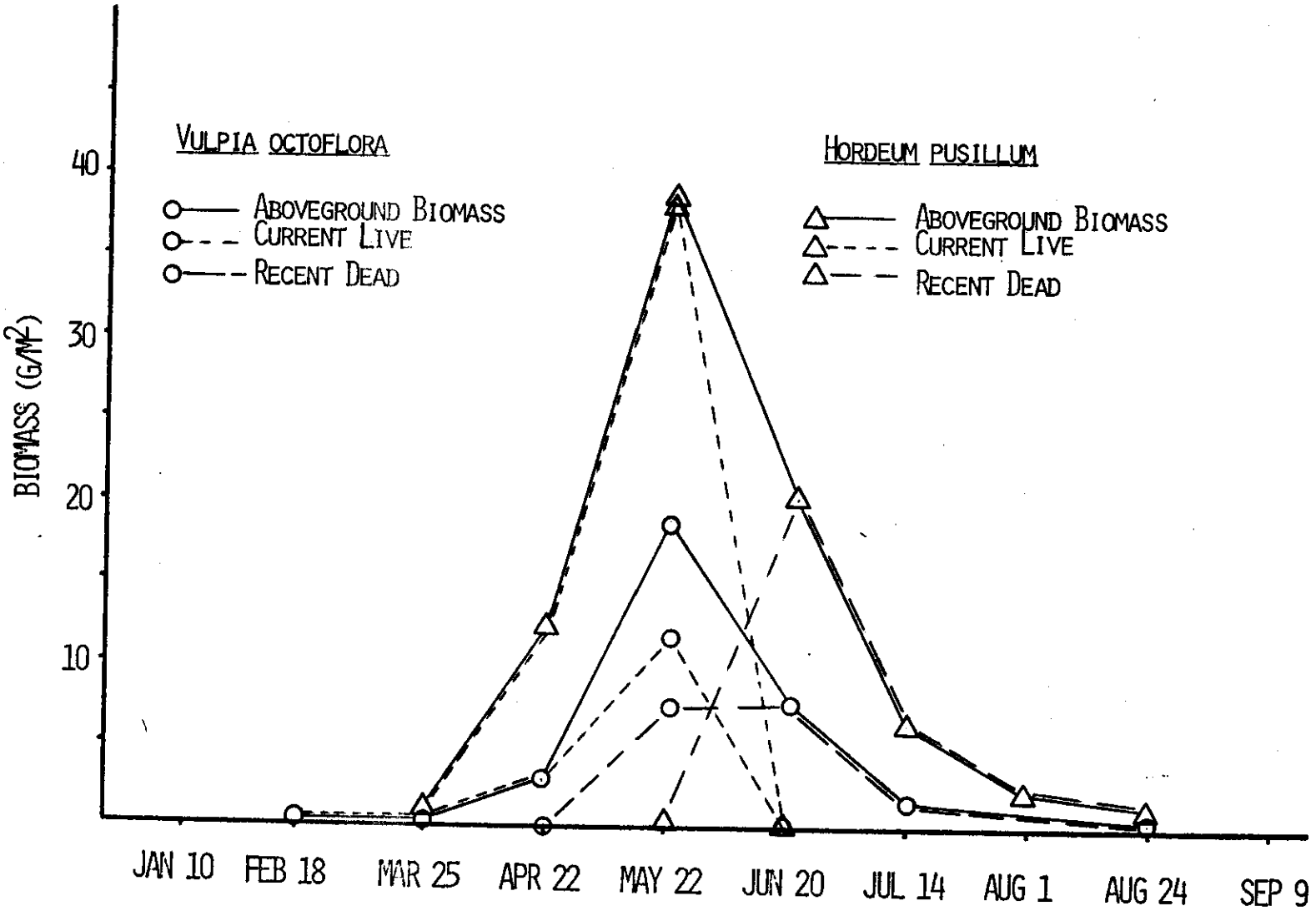

Fig. 3. Herbage dynamics of the two important annual cool-season grasses at the Pantex site, 1972.

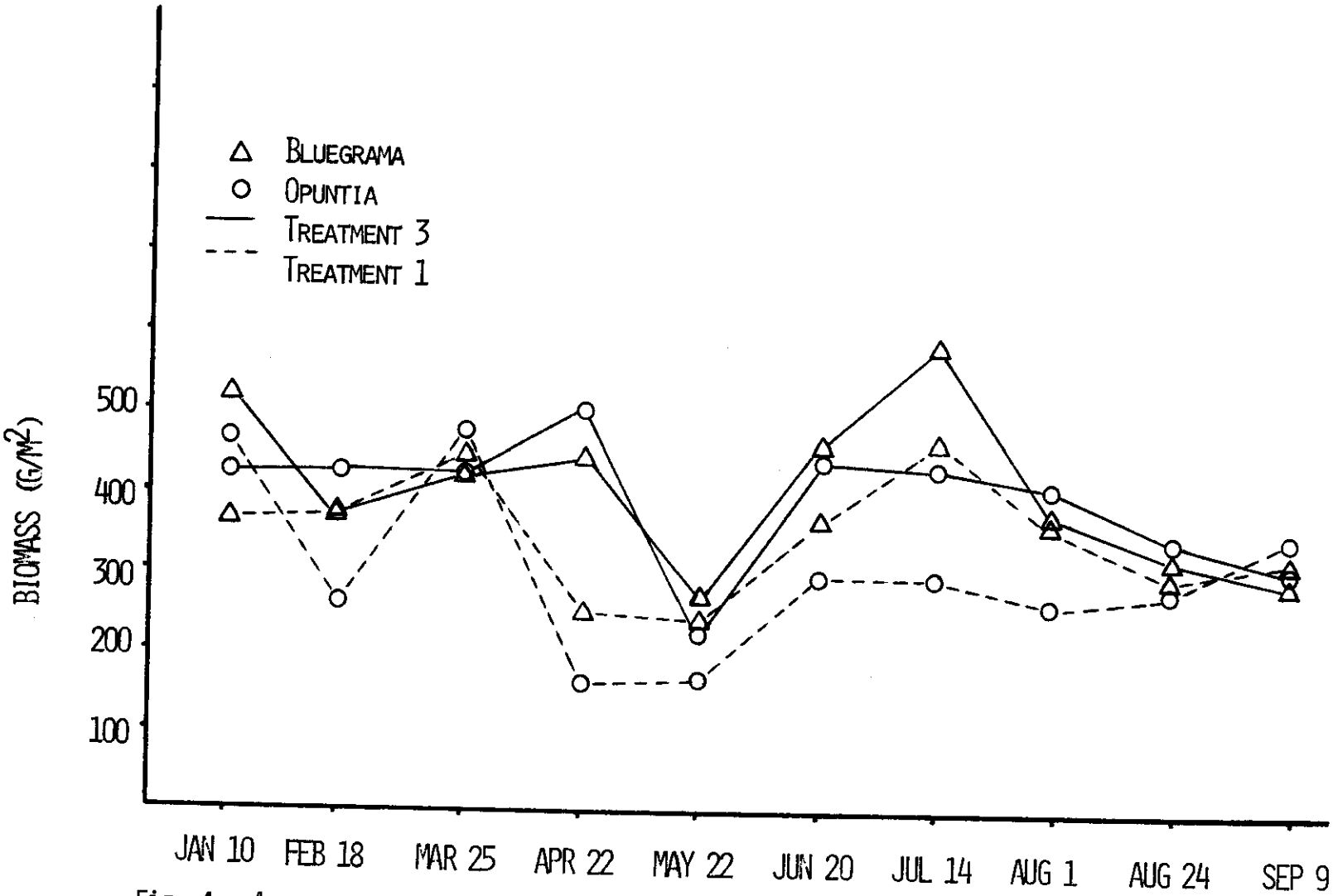

Fig. 4. Average crown biomass in grazed and ungrazed blue grama and Opuntia strata at Pantex site, 1972.

Cursory examination of crown biomass estimates suggest that moderate grazing promotes a greater crown biomass than when these plants are not grazed. Other data on blue grama growth as affected by grazing indicates that it retains a bunchgrass growth when not grazed. However, when grazed its growth form is modified into a "sod-forming" grass. Consequently more of its biomass is in the crown area.

Reasons for the biomass loss from April 22 through May 22 are not clear. Transfer of energy from the crowns into leaf tissue may explain part of this loss.

Litter

Litter biomass data for the Pantex site in 1972 showed no consistent pattern as in the previous year (Fig. 5). In general more litter biomass was found in the cactus stratum than in the grass plots. In addition, litter is lost from this system in early spring -- until May 22 -- then accumulates until mid July. After mid July decomposition of the litter must be rapid as over 50 percent of it disappeared the first three weeks of August. The 1971 data revealed a loss of greater magnitude during this time period, however, more precipitation was received in this time period in 1971.

Belowground Biomass

Root biomass samples were taken on the following dates in 1972: April 23, June 20, August 1, and September 9. On the first two dates samples were taken to a depth of 40 cm or more while the August and September sample was to a 30 cm depth.

Results clearly showed most root biomass to occur in the top 20 cm of soil (Fig. 6). In addition much more root biomass in the top 10 cm was found on the last sampling date than at any other time.

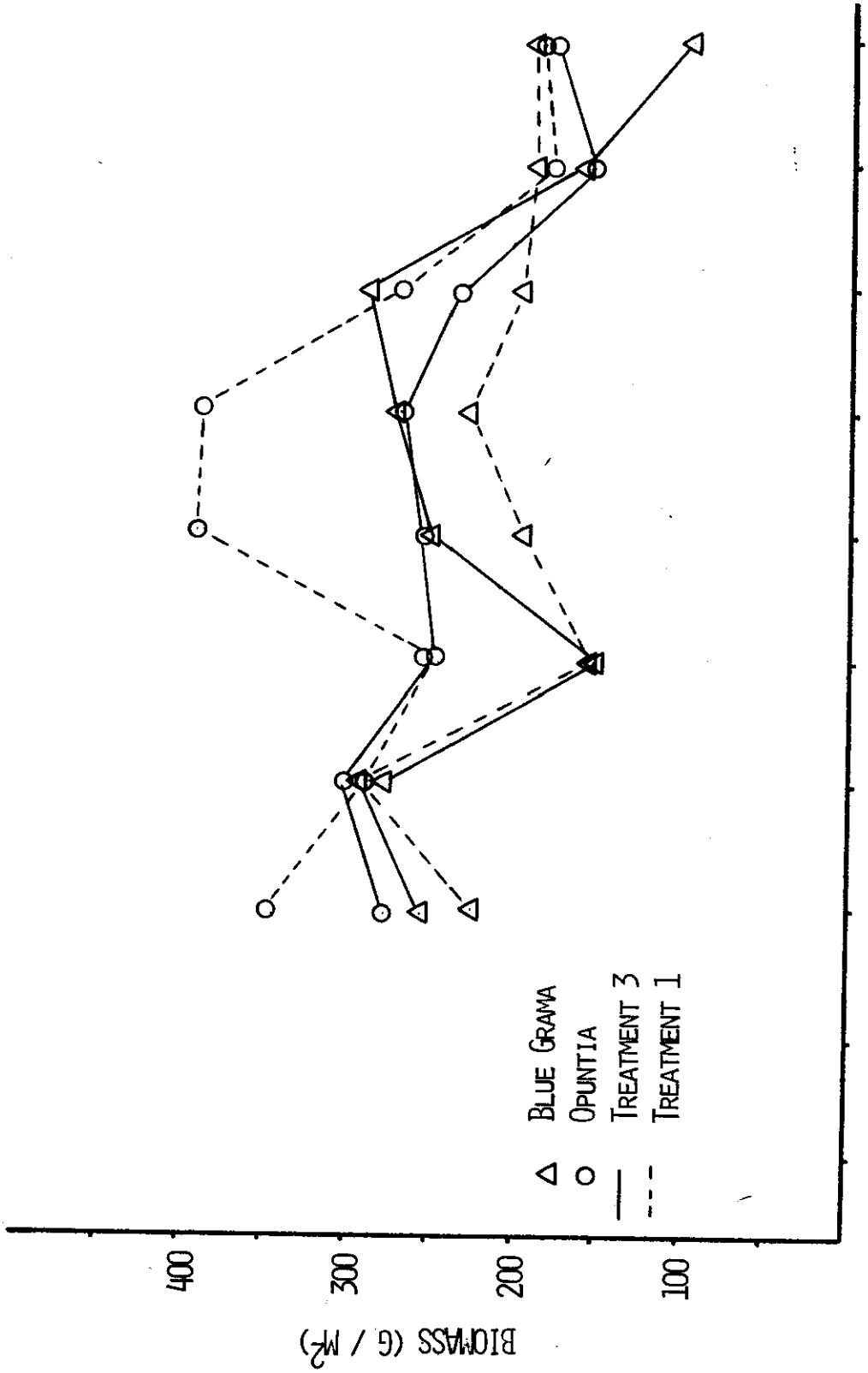

Fig. 5. Average litter biomass in grazed and ungrazed blue grama and Opuntia strata at Pantex site, 1972.

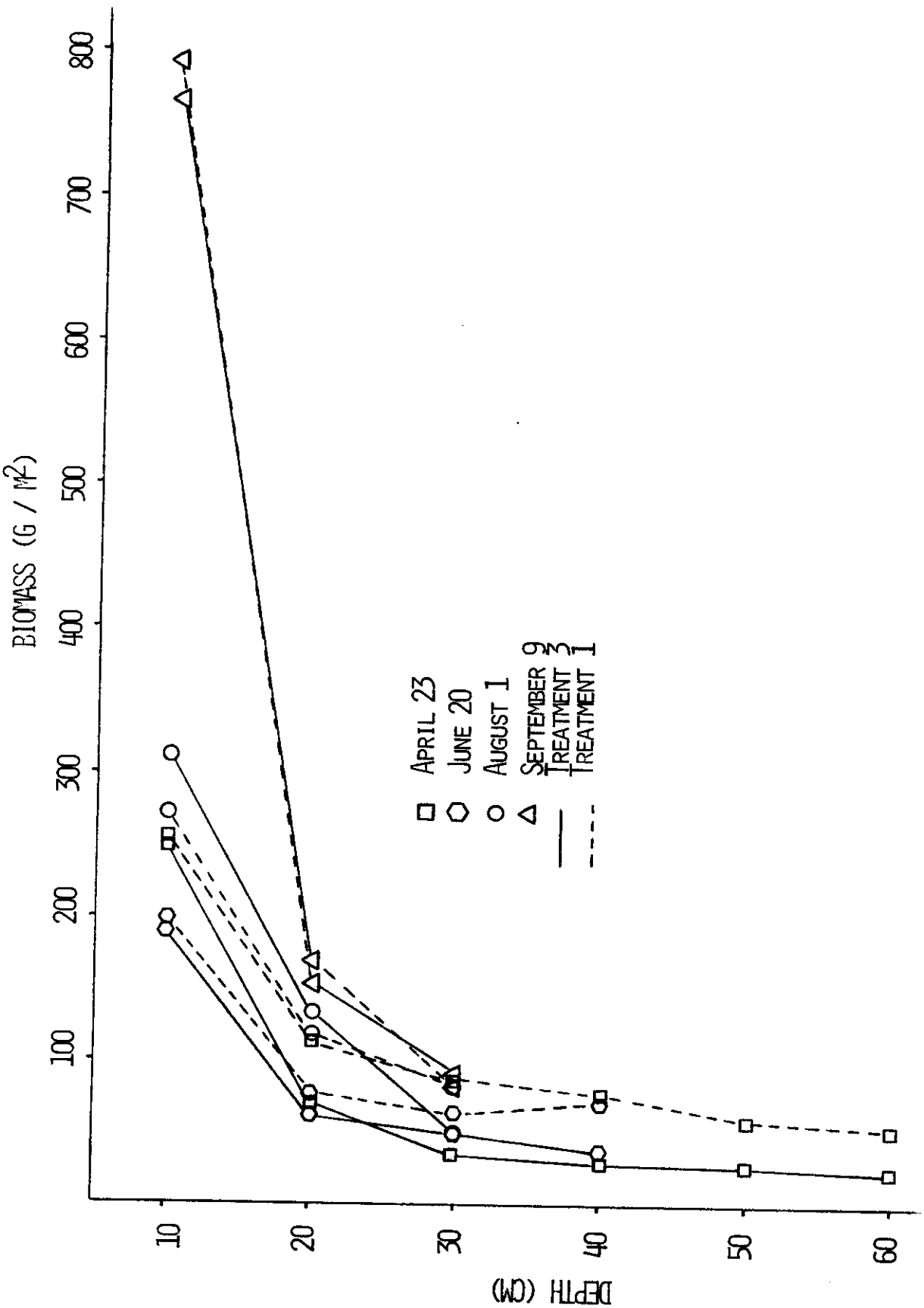

Fig. 6. Belowground biomass profiles of grazed and ungrazed plots at Pantex site, 1972.

The effect of grazing upon root biomass within the blue grama stratum was negligible. Similar root biomass results were obtained in the Opuntia stratum.

APPENDIX I

APPENDIX TABLES

Appendix Table 1. The mean belowground biomass by depth with standard error for blue grama stratum, Pantex, 1972. Biomass in g/m^2.

Trt.	Depth (cm)	April 23 Ash-Free Weight	April 23 $S_{\bar{x}}$	June 20 Ash-Free Weight	June 20 $S_{\bar{x}}$	August 1 Ash-Free Weight	August 1 $S_{\bar{x}}$	September 9 Ash-Free Weight	September 9 $S_{\bar{x}}$
1	0 - 10	255.35*	28.25	192.34	26.63	273.35	23.95	791.39	141.46
	10 - 20	112.79	7.67	62.09	4.03	115.37	8.36	153.21	18.94
	20 - 30	88.36	10.19	51.07	7.03	84.14	9.67	81.01	7.12
	30 - 40	78.62	3.55	40.60	3.17				
	40 - 50	60.81	5.77	**					
	50 - 60	56.95	4.32						
3	0 - 10	250.20	30.31	198.40	27.91	312.48	59.03	765.12	113.41
	10 - 20	71.28	13.97	76.79	14.98	132.63	19.90	167.17	22.04
	20 - 30	34.54	3.18	66.32	6.59	50.33	6.24	87.81	14.06
	30 - 40	30.49	5.34	71.28	27.04				
	40 - 50	29.94	6.31						
	50 - 60	25.90	5.17						

* Each figure represents average of 12 samples

** No data taken

Appendix Table 2. Average crown biomass (g/m^2) of shortgrass prairie species at Pantex, 1972.

Sampling Date	Trt.	Blue grama Strata	Pricklypear Strata
1/10	3	515*	420
	1	364	468
2/18	3	368	423
	1	371	258
3/25	3	412	416
	1	443	475
4/22	3	440	500
	1	248	154
5/22	3	258	221
	1	234	157
6/20	3	458	437
	1	388	292
7/10	3	592	433
	1	460	293
8/1	3	372	401
	1	369	259
8/24	3	310	330
	1	290	272
9/9	3	288	296
	1	319	345

* Each value is average of 12 samples

Appendix Table 3. Precipitation received in 1972 in rain gauge at Pantex. Values in inches of water.

Date	Water Received	Date	Water Received
3/23	.27	6/29	.93
4/29	.25	7/7	.18
5/5	.65	7/11	.20
5/9	.78	7/17	1.30
5/11	.04	8/8	.34
5/13	.29	8/14	.23
5/29	.98	8/27	.80
6/11	.74	8/29	.10
6/12	.07	9/4	.24
6/13	.20	9/12	.13
6/14	.59	9/13	.08
6/18	.42	9/20	.12
6/21	1.05	10/19	.44
6/23	.04	10/21	.43
6/24	.05	10/31	1.05

Appendix Table 4. Average ashed litter biomass (g/m^2) at Pantex, 1972

Sampling Date	Blue grama Strata		Pricklypear Cactus Strata	
	Ungrazed	Grazed	Ungrazed	Grazed
3/25	225.26	257.14	342.41	280.60
4/22	295.60	278.12	290.18	303.00
5/22	155.44	152.04	247.10	258.30
6/20	196.32	245.66	398.31	247.67
7/14	241.91	273.29	389.62	269.92
8/1	202.66	288.51	266.11	235.14
8/24	186.37	158.40	175.73	151.48
9/9	187.98	95.73	182.31	175.84

APPENDIX II

FIELD DATA

Aboveground Biomass

The 1972 Pantex aboveground herbage data are Grassland Biome data set A2U00EA. The data are recorded on form NREL-01, with the addition of a B or an O in column 65 to designate data from the BOGR (Bouteloua gracilis) or the OPPO (Opuntia polyacantha) strata respectively, and a sample data number in column 69. A sample form and listing of the data follow.

IBP

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FIELD DATA SHEET – ABOVEGROUND BIOMASS

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	CLIP-EST.	GROWTH FM.	GENUS	SPECIES	SUBSPECIES	CATEGORY	WEIGHT ESTIMATE	SACK NO.	DRY WEIGHT	CROWN PLOT SIZE	CROWN WEIGHT
			DAY	MO.	YR.															
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21-23	25	27	29-30	31-32	34	35	36-40	42-45	47-52	54-57	59-64
01																				

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
- 4 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 Grazed 1970, ungrazed 1971
- 7
- 8
- 9

CLIP-ESTIMATE
- 1 Harvested
- 2 Harvest and Est.
- 3 Estimated
- 4 Est. for Insect
- 5 Est. for Reference
- 6 Est. for Future Clip

GROWTH FORM
- 1 Perennial grass
- 2 Annual grass
- 3 Sedge, rush, etc.
- 4 Annual forb
- 5 Biennial forb
- 6 Perennial forb
- 7 Half-shrub
- 8 Shrub
- 9 Tree
- 0 Miscellaneous

CATEGORY
- 1 Live
- 2 Old dead
- 3 Recent dead

+++ EXAMPLE OF DATA +++

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110RF 10017211 0.5 003 1 2 PACA 62          1 000.83          0 1
110RF 10017211 0.5 003 1 1 BOGR 22          2 080.26          0 1
110RF 10017211 0.5 003 1 1 BOGR 25          3 261.86          0 1
110RF 10017211 0.5 003 1 6 OPPO  1          4 141.56          0 1
110RF 10017211 0.5 003 1 6 OPPO  2          5 039.62          0 1
110RF 10017211 0.5 004 1 4 AMRE  2          1 001.30          0 1
110RF 10017211 0.5 004 1 2 PACA 62          2 000.90          0 1
110RF 10017211 0.5 004 1 1 BOGR 22          3 082.07          0 1
110RF 10017211 0.5 004 1 1 BOGR 25          4 210.12          0 1
110RF 10017211 0.5 004 1 6 OPPO  1          5 147.57          0 1
110RF 10017211 0.5 005 1 1 BOGR 22          1 092.40          0 1
110RF 10017211 0.5 005 1 1 BOGR 25          2 139.24          0 1
110RF 10017211 0.5 005 1 6 OPPO  1          3 036.39          0 1
110RF 10017211 0.5 005 1 6 OPPO  2          4 194.95          0 1
110RF 10017211 0.5 006 1 1 BOGR 22          1 085.21          0 1
110RF 10017211 0.5 006 1 1 BOGR 25          2 255.72          0 1
110RF 10017211 0.5 006 1 6 OPPO  1          3 161.02          0 1
110RF 10017211 0.5 006 1 6 OPPO  2          4 017.29          0 1
110RF 10017212 0.5 001 1 4 AMRE  2          1 001.24          0 1
110RF 10017212 0.5 001 1 1 BOGR 22          2 074.49          0 1
110RF 10017212 0.5 001 1 1 BOGR 25          3 237.26          0 1
110RF 10017212 0.5 001 1 6 OPPO  1          4 135.22          0 1
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110RF 10017212 0.5 002 1 2 PACA 62      1 001.28      0 1
110RF 10017212 0.5 002 1 6 SPCO  2      2 001.38      0 1
110RF 10017212 0.5 002 1 1 BOGR 22      3 094.81      0 1
110RF 10017212 0.5 002 1 1 BOGR 25      4 389.12      0 1
110RF 10017212 0.5 002 1 6 OPPO  1      5 135.56      0 1
110RF 10017212 0.5 003 1 2 PACA 62      1 001.08      0 1
110RF 10017212 0.5 003 1 4 AMRE  2      2 000.26      0 1
110RF 10017212 0.5 003 1 1 BOGR 22      3 061.02      0 1
110RF 10017212 0.5 003 1 1 BOGR 25      4 138.54      0 1
110RF 10017212 0.5 003 1 6 OPPO  1      5 063.52      0 1
110RF 10017212 0.5 003 1 6 OPPO  2      6 068.33      0 1
110RF 10017212 0.5 004 1 2 PACA 62      1 000.40      0 1
110RF 10017212 0.5 004 1 4 AMRE  2      2 000.27      0 1
110RF 10017212 0.5 004 1 1 BOGR 22      3 101.80      0 1
110RF 10017212 0.5 004 1 1 BOGR 25      4 271.96      0 1
110RF 10017212 0.5 004 1 6 OPPO  1      5 034.19      0 1
110RF 10017212 0.5 005 1 2 PACA 62      1 000.70      0 1
110RF 10017212 0.5 005 1 1 BOGR 22      2 054.79      0 1
110RF 10017212 0.5 005 1 1 BOGR 25      3 161.82      0 1
110RF 10017212 0.5 005 1 6 OPPO  1      4 054.77      0 1
110RF 10017212 0.5 005 1 6 OPPO  2      5 042.19      0 1
110RF 10017212 0.5 006 1 1 BOGR 22      1 063.97      0 1
110RF 10017212 0.5 006 1 1 BOGR 25      2 240.31      0 1
110RF 10017212 0.5 006 1 6 OPPO  1      3 086.85      0 1
110RF 10017212 0.5 006 1 6 OPPO  2      4 024.83      0 1
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110RF 10017231 0.5 001 1 2 KOSC  2      2 002.52      0 1
110RF 10017231 0.5 001 1 1 BOGR 22      3 094.34      0 1
110RF 10017231 0.5 001 1 1 BOGR 25      4 309.96      0 1
110RF 10017231 0.5 001 1 6 OPPO  1      5 093.03      0 1
110RF 10017231 0.5 001 1 6 OPPO  2      6 025.73      0 1
110RF 10017231 0.5 002 1 2 PACA 62      1 008.83      0 1
110RF 10017231 0.5 002 1 4 AMRE  2      2 003.01      0 1
110RF 10017231 0.5 002 1 1 BOGR 22      3 071.38      0 1
110RF 10017231 0.5 002 1 1 BOGR 25      4 287.69      0 1
110RF 10017231 0.5 002 1 6 OPPO  1      5 093.93      0 1
110RF 10017231 0.5 002 1 6 OPPO  2      6 072.89      0 1
110RF 10017231 0.5 003 1 2 PACA 62      1 000.97      0 1
110RF 10017231 0.5 003 1 2 ERCI  2      2 001.00      0 1
110RF 10017231 0.5 003 1 4 AMRE  2      3 004.71      0 1
110RF 10017231 0.5 003 1 1 BOGR 22      4 068.53      0 1
110RF 10017231 0.5 003 1 1 BOGR 25      5 400.59      0 1
110RF 10017231 0.5 003 1 6 OPPO  1      6 019.63      0 1
110RF 10017231 0.5 004 1 2 PACA 62      1 002.67      0 1
110RF 10017231 0.5 004 1 4 AMRE  2      2 003.57      0 1
110RF 10017231 0.5 004 1 1 BOGR 22      3 068.20      0 1
110RF 10017231 0.5 004 1 1 BOGR 25      4 121.39      0 1
110RF 10017231 0.5 004 1 6 OPPO  1      5 044.37      0 1
110RF 10017231 0.5 004 1 6 OPPO  2      6 060.67      0 1
110RF 10017231 0.5 005 1 4 AMRE  2      1 002.12      0 1
110RF 10017231 0.5 005 1 2 PACA 62      2 004.61      0 1
110RF 10017231 0.5 005 1 1 BOGR 22      3 052.26      0 1
110RF 10017231 0.5 005 1 1 BOGR 25      4 294.84      0 1
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110RF 10017231 0.5 005 1 6 OPPO  2      6 026.87      0 1
110RF 10017231 0.5 006 1 2 ERCI  2      1 000.41      0 1
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110RF 10017231 0.5 006 1 2 PACA 62      3   0.85      0 1
110RF 10017231 0.5 006 1 1 BOGR 25      4 208.09      0 1
110RF 10017231 0.5 006 1 1 BOGR 22      5 067.96      0 1
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110RF 10017232 0.5 003 1 4 AMRE  2      1 000.52      0   1
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110RF 10017232 0.5 003 1 2 PACA 62      4 024.97      0   1
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110RF 10017232 0.5 003 1 1 BOGR 25      6 321.74      0   1
110RF 10017232 0.5 003 1 6 OPPO  1      7 138.33      0   1
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110RF 10017232 0.5 004 1 2 PACA 62      1 000.70      0   1
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110RF 10017232 0.5 004 1 6 OPPO  2      5 020.13      0   1
110RF 10017232 0.5 005 1 1 BOGR 22      1 055.87      0   1
110RF 10017232 0.5 005 1 1 BOGR 25      2 178.64      0   1
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110RF 10017232 0.5 005 1 6 OPPO  2      4 018.29      0   1
110RF 10017232 0.5 006 1 2 PACA 62      1 001.49      0   1
110RF 10017232 0.5 006 1 4 AMRE  2      2 001.04      0   1
110RF 10017232 0.5 006 1 1 BOGR 22      3 058.66      0   1
110RF 10017232 0.5 006 1 1 BOGR 25      4 231.14      0   1
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110RF 18027211 0.5   1 1 2 PACA 62      1 000.36      B   2
110RF 18027211 0.5   1 1 1 BOGR 22      2 061.96      B   2
110RF 18027211 0.5   1 1   CRWN  5      3 183.17      B   2
110RF 18027211 0.5   2 1 4 AMRE  2      1 001.41      B   2
110RF 18027211 0.5   2 1 2 PACA 62      2 007.31      B   2
110RF 18027211 0.5   2 1 1 BOGR 22      3 065.50      B   2
110RF 18027211 0.5   2 1   CRWN  5      4 130.02      B   2
110RF 18027211 0.5   3 1 2 PACA 62      1 006.93      B   2
110RF 18027211 0.5   3 1 1 BOGR 22      2 058.46      B   2
110RF 18027211 0.5   3 1   CRWN  5      3 099.91      B   2
110RF 18027211 0.5   4 1 1 BOGR 22      1 047.53      B   2
110RF 18027211 0.5   4 1   CRWN  5      2 277.67      B   2
110RF 18027211 0.5   5 1 1 BOGR 22      1 080.08      B   2
110RF 18027211 0.5   5 1   CRWN  5      2 191.22      B   2
110RF 18027211 0.5   6 1 2 PACA 62      1  02.83      B   2
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110RF 18027211 0.5   6 1   CRWN  5      3 158.91      B   2
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110RF 18027212 0.5   1 1 2 FEOC 21      2 000.30      B   2
110RF 18027212 0.5   1 1 1 BOGR 22      3 070.33      B   2
110RF 18027212 0.5   1 1   CRWN  5      4 221.90      B   2
110RF 18027212 0.5   2 1 4 AMRE  2      1 000.30      B   2
110RF 18027212 0.5   2 1 2 PACA 62      2 000.63      B   2
110RF 18027212 0.5   2 1 1 BOGR 22      3 052.30      B   2
110RF 18027212 0.5   2 1   CRWN  5      4 155.86      B   2
```

Belowground Biomass

The belowground biomass data were collected at the Pantex Site on form NREL-03. Two strata were sampled: blue grama and cactus. These data have the Grassland Biome designation of A2U002A. Examples of the data form and data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA SHEET - BELOWGROUND BIOMASS

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	CORE DIAM.	HORIZON	TOP DEPTH	BOTTOM DEP.	LENGTH	WASH WT.	DRY WT.	ASH WT.	CROWN DRY WT.
			Day	Mo	Yr													
1-2	3-4	5-7	8-9	10-11	12-13	14	15	16-19	21-23	25-27	29	31-33	35-37	39-41	43-47	49-54	56-61	63-68

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

HORIZON

1 AO
2 A
3 B
4 C

EXAMPLE OF DATA

```
         1         2         3         4         5         6         7
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0310LDB220472110.50 001 7.6 2  10  20  10  03.0  0.67  0.13  BOGR
0310LDB220472110.50 001 7.6 2  20  30  10  03.0  0.51  0.19  BOGR
0310LDB220472110.50 001 7.6 3  30  40  10  03.0  0.60  0.23  BOGR
0310LDB220472110.50 001 7.6 3  40  50  10  03.0  0.60  0.33  BOGR
0310LDB220472110.50 001 7.6 3  50  60  10  03.0  0.49  0.16  BOGR
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0310LDB220472110.50 002 7.6 3  40  50  10  03.0  0.75  0.41  BOGR
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0310LDB220472110.50 003 7.6 3  40  50  10  03.0  0.34  0.19  BOGR
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0310LDB220472110.50 004 7.6 3  40  50  10  03.0  0.47  0.26  BOGR
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0310LDB220472110.50 005 7.6 2  00  10  10  03.0  0.83  0.13  BOGR
0310LDB220472110.50 005 7.6 2  10  20  10  03.0  0.41  0.08  BOGR
0310LDB220472110.50 005 7.6 2  20  30  10  03.0  0.41  0.15  BOGR
0310LDB220472110.50 005 7.6 3  30  40  10  03.0  0.60  0.23  BOGR
0310LDB220472110.50 005 7.6 3  40  50  10  03.0  0.47  0.26  BOGR
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0310LDB220472110.50 006 7.6 2  20  30  10  03.0  0.97  0.37  BOGR
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0310LDB230472120.50 002 7.6 2  20  30  10  03.0  0.58  0.08  BOGR
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0310LDB230472120.50 003 7.6 2  20  30  10  03.0  0.60  0.08  BOGR
0310LDB230472120.50 003 7.6 3  30  40  10  03.0  0.44  0.11  BOGR
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0310LDB230472120.50 004 7.6 2 10 20 10 03.0 0.46 0.09 BOGR
0310LDB230472120.50 004 7.6 2 20 30 10 03.0 0.53 0.07 BOGR
0310LDB230472120.50 004 7.6 3 30 40 10 03.0 0.54 0.12 BOGR
0310LDB230472120.50 004 7.6 3 40 50 10 03.0 0.72 0.24 BOGR
0310LDB230472120.50 004 7.6 3 50 60 10 03.0 0.34 0.05 BOGR
0310LDB230472120.50 005 7.6 2 00 10 10 03.0 1.30 0.12 BOGR
0310LDB230472120.50 005 7.6 2 10 20 10 03.0 0.54 0.11 BOGR
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0310LDB220472110.50 006 7.6 2 20 30 10 03.0 0.04 0.01 CACTUS
0310LDB220472110.50 006 7.6 3 30 40 10 03.0 0.06 0.04 CACTUS
0310LDB220472110.50 006 7.6 3 40 50 10 03.0 0.04 0.01 CACTUS
0310LDB220472110.50 006 7.6 3 50 60 10 03.0 0.02 0.01 CACTUS
0310LDB230472120.50 001 7.6 2 00 10 10 03.0 0.30 0.03 CACTUS
```

```
0310LDB230472120.50 001 7.6 2  10  20  10  03.0  0.32  0.07 CACTUS
0310LDB230472120.50 001 7.6 2  20  30  10  03.0  0.38  0.10 CACTUS
0310LDB230472120.50 001 7.6 3  30  40  10  03.0  0.31  0.16 CACTUS
0310LDB230472120.50 001 7.6 3  40  50  10  03.0  0.26  0.13 CACTUS
0310LDB230472120.50 001 7.6 3  50  60  10  03.0  0.13  0.05 CACTUS
0310LDB230472120.50 002 7.6 2  00  10  10  03.0  0.75  0.08 CACTUS
0310LDB230472120.50 002 7.6 2  10  20  10  03.0  0.13  0.04 CACTUS
0310LDB230472120.50 002 7.6 2  20  30  10  03.0  0.12  0.03 CACTUS
0310LDB230472120.50 002 7.6 3  30  40  10  03.0  0.26  0.18 CACTUS
0310LDB230472120.50 002 7.6 3  40  50  10  03.0  0.30  0.15 CACTUS
0310LDB230472120.50 002 7.6 3  50  60  10  03.0  0.26  0.10 CACTUS
0310LDB230472120.50 003 7.6 2  00  10  10  03.0  3.14  0.34 CACTUS
0310LDB230472120.50 003 7.6 2  10  20  10  03.0  0.80  0.18 CACTUS
0310LDB230472120.50 003 7.6 2  20  30  10  03.0  0.64  0.17 CACTUS
0310LDB230472120.50 003 7.6 3  30  40  10  03.0  0.64  0.33 CACTUS
0310LDB230472120.50 003 7.6 3  40  50  10  03.0  0.45  0.23 CACTUS
0310LDB230472120.50 003 7.6 3  50  60  10  03.0  0.30  0.12 CACTUS
0310LDB230472120.50 004 7.6 2  00  10  10  03.0  1.70  0.19 CACTUS
0310LDB230472120.50 004 7.6 2  10  20  10  03.0  1.29  0.29 CACTUS
0310LDB230472120.50 004 7.6 2  20  30  10  03.0  0.38  0.10 CACTUS
0310LDB230472120.50 004 7.6 3  30  40  10  03.0  0.35  0.18 CACTUS
0310LDB230472120.50 004 7.6 3  40  50  10  03.0  0.81  0.41 CACTUS
0310LDB230472120.50 004 7.6 3  50  60  10  03.0  0.30  0.12 CACTUS
0310LDB230472120.50 005 7.6 2  00  10  10  03.0  1.70  0.19 CACTUS
0310LDB230472120.50 005 7.6 2  10  20  10  03.0  0.70  0.16 CACTUS
0310LDB230472120.50 005 7.6 2  20  30  10  03.0  0.38  0.10 CACTUS
0310LDB230472120.50 005 7.6 3  30  40  10  03.0  1.26  0.65 CACTUS
0310LDB230472120.50 005 7.6 3  40  50  10  03.0  1.14  0.57 CACTUS
0310LDB230472120.50 005 7.6 3  50  60  10  03.0  0.27  0.11 CACTUS
0310LDB230472120.50 006 7.6 2  00  10  10  03.0  0.35  0.04 CACTUS
0310LDB230472120.50 006 7.6 2  10  20  10  03.0  0.31  0.07 CACTUS
0310LDB230472120.50 006 7.6 2  20  30  10  03.0  0.16  0.04 CACTUS
0310LDB230472120.50 006 7.6 3  30  40  10  03.0  0.24  0.12 CACTUS
0310LDB230472120.50 006 7.6 3  40  50  10  03.0  0.31  0.15 CACTUS
0310LDB230472120.50 006 7.6 3  50  60  10  03.0  0.13  0.05 CACTUS
```

Litter

The litter data were collected at the Pantex Site on form NREL-02. As in the belowground biomass data for this site, the litter data were divided into two strata: blue grama and cactus. These data have the Grassland Biome designation of A2U001A. Examples of the data form and data follow.

IBP

GRASSLAND BIOME

U.S. INTERNATIONAL BIOLOGICAL PROGRAM

FIELD DATA-SHEET - LITTER

DATA TYPE	SITE	INITIALS	DATE			TREATMENT	REPLICATE	PLOT SIZE	QUADRAT	TYPE	SACK NO.	DRY WT.	SACK WT.	ASH WT.	PREVIOUS DATE		
			Day	Mo	Yr										Day	Mo	Yr
1-2	3-4	[illegible]	[illegible]	[illegible]	[illegible]	14	[illegible]	[illegible]	[illegible]	25	27-30	[illegible]	[illegible]	[illegible]	51-52	53-54	55-56

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

TYPE
1 Quadrat, total
2 Quadrat, part
3 Cleared plot
4 Litter bag

EXAMPLE OF DATA

```
         1         2         3         4         5         6
123456789012345678901234567890123456789012345678901234567890123456789
0210RF 100172310.50  1 1   1  67.5111.65   4.40          BOGR
0210RF 100172310.50  2 1   2 100.9111.65   4.40          BOGR
0210RF 100172310.50  3 1   3 213.9011.65   4.40          BOGR
0210RF 100172310.50  4 1   4  81.1011.65   4.40          BOGR
0210RF 100172310.50  5 1   5  86.9811.65   4.40          BOGR
0210RF 100172310.50  6 1   6  98.2011.65   4.40          BOGR
0210RF 100172320.50  1 1   1 118.6916.21   7.84          BOGR
0210RF 100172320.50  2 1   2 160.7016.21   7.84          BOGR
0210RF 100172320.50  3 1   3 159.4516.21   7.84          BOGR
0210RF 100172320.50  4 1   4 126.3116.21   7.84          BOGR
0210RF 100172320.50  5 1   5 224.9816.21   7.84          BOGR
0210RF 100172320.50  6 1   6 111.4816.21   7.84          BOGR
0210RF 100172510.50  1 1   1  82.4515.79   9.97          BOGR
0210RF 100172510.50  2 1   2 138.9115.79   9.97          BOGR
0210RF 100172510.50  3 1   3  94.2315.79   9.97          BOGR
0210RF 100172510.50  4 1   4 239.2315.79   9.97          BOGR
0210RF 100172510.50  5 1   5 240.6615.79   9.97          BOGR
0210RF 100172510.50  6 1   6 115.6915.79   9.97          BOGR
0210RF 100172520.50  1 1   1 101.9616.29   9.75          BOGR
0210RF 100172520.50  2 1   2 170.1016.29   9.75          BOGR
0210RF 100172520.50  3 1   3 169.0516.29   9.75          BOGR
0210RF 100172520.50  4 1   4 105.9616.29   9.75          BOGR
0210RF 100172520.50  5 1   5 130.6616.29   9.75          BOGR
0210RF 100172520.50  6 1   6 135.1916.29   9.75          BOGR
0210RF 100172310.50  1 1   1  92.1515.99   7.81       CATCUS
0210RF 100172310.50  2 1   2 107.5015.99   7.81       CACTUS
0210RF 100172310.50  3 1   3 187.1015.99   7.81       CACTUS
0210RF 100172310.50  4 1   4 102.9615.99   7.81       CACTUS
0210RF 100172310.50  5 1   5 137.3915.99   7.81       CACTUS
0210RF 100172310.50  6 1   6 156.8215.99   7.81       CACTUS
0210RF 100172320.50  1 1   1 100.6109.84   2.93       CACTUS
0210RF 100172320.50  2 1   2 152.2009.84   2.93       CACTUS
0210RF 100172320.50  3 1   3 125.8109.84   2.93       CACTUS
0210RF 100172320.50  4 1   4  85.7209.84   2.93       CACTUS
0210RF 100172320.50  5 1   5 160.5609.84   2.93       CACTUS
0210RF 100172320.50  6 1   6  91.7409.84   2.93       CACTUS
0210RF 100172510.50  1 1   1  93.8615.53   6.99       CACTUS
0210RF 100172510.50  2 1   2 170.7015.53   6.99       CACTUS
0210RF 100172510.50  3 1   3 102.1515.53   6.99       CACTUS
0210RF 100172510.50  4 1   4 227.6615.53   6.99       CACTUS
0210RF 100172510.50  5 1   5  77.9215.53   6.99       CACTUS
0210RF 100172510.50  6 1   6 143.8115.53   6.99       CACTUS
0210RF 100172520.50  1 1   1  98.5115.00   8.15       CACTUS
0210RF 100172520.50  2 1   2 197.0115.00   8.15       CACTUS
0210RF 100172520.50  3 1   3  60.2515.00   8.15       CACTUS
0210RF 100172520.50  4 1   4 100.6015.00   8.15       CACTUS
0210RF 100172520.50  5 1   5  91.5215.00   8.15       CACTUS
0210RF 100172520.50  6 1   6  87.2315.00   8.15       CACTUS
```