

Technical Report No. 75
HYDROLOGIC DATA, 1970, PAWNEE GRASSLANDS

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GRASSLAND BIOME
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ABSTRACT

This report presents the data collected during the 1970 calendar year as part of the hydrologic process studies of the Grassland Biome Intensive Site Studies, IBP. Data presented are from the field recording instrumentation and daily observations and include precipitation, runoff from the microwatersheds, and observations from an evaporation station.

In general, the 1970 year was drier than normal with an annual total of 245 mm as compared to the 30-year mean annual rainfall of 310 mm. The greatest deficit occurred during the summer months from May through August. Precipitation during March and April was above normal, which helped to recharge soil water storage and offset the lack of rainfall later in the growing season.

Three runoff events occurred during the year. However, only one was of sufficient magnitude to produce runoff from all the microwatersheds and permit a comparison between treatments.

INTRODUCTION

This report presents the hydrologic data collected during the 1970 calendar year as part of the Hydrologic Process Studies of the Grassland Biome Intensive Site Studies, IBP. Data reported are primarily those which are collected on a routine basis in support of the hydrologic process studies and other studies and do not include results of individual field investigations. These are reported in other separate reports.

METHODS

Data collected during 1970 include precipitation, runoff, soil water content, and basic meteorological measurements. Since the automatic data collection system was still not completely operational, the bulk of the data reported was obtained using the back-up instrumentation and field measurements. The data obtained are suitable for general hydrologic and water balance analysis, but are not sufficiently detailed for rainfall/runoff modelling of the microwatersheds or central basin studies.

Precipitation

Precipitation was measured using a variety of gages. Beginning January 25, 1970, a recording rain gage was installed at microwatershed 2. February and March precipitation was measured by hand, using the modified standard rain gages at each microwatershed. An additional four recording rain gages were added on May 28 at microwatersheds 5, 6, 7, and 8. Thus, the recording gage of microwatershed 2 gives a good indication of precipitation at microwatershed 2 and 3 and a slightly less reliable indication at microwatershed 1. The gage at microwatershed 5 also was

representative of rainfall at microwatershed 4, and the other microwatersheds each had a separate recording gage. In addition to the five recording gages, a small plastic gage was installed at each microwatershed and measurement of selected storms begun about June 1.

In the process of installing the recording gage in January, it was observed that shielding the gages had an important effect on gage catch, especially snow storms accompanied by wind. Although this was anticipated, the magnitude of the effect was not. During March, for example, the shielded gages averaged about 1.25 inches while the unshielded gage recorded only .69 inches. The recording gages, have, therefore, all been shielded with modified alter shields. The plastic gages, which are not suitable for snow measurement, have not been shielded, and are read only during the warmer months.

During the growing season, the recording gages were operated with a six hour chart rotation. For rainfall/runoff modelling of small watersheds or runoff plots with rapid response systems, it is necessary to have at least 5 minute storm intensities with a good degree of accuracy. This is obtainable only with a rapid chart rotation. The primary difficulty with 6 hour rotation is that charts should be changed directly following a storm so that real time referencing can be obtained and the trace is not obscured by gage evaporation. This objective was not always obtained during the summer of 1970. Chart rotation was changed to 8-day rotation in October and will be continued until about March 15. Recording gage data are presented in Appendix A.

Runoff

Runoff from the microwatersheds was gaged during the year using Fischer/Porter A/D punched tape recorders. During the early summer, gages were operated continuously using a 5-minute punch interval. However, since rainfall/runoff modelling of rapid response system requires a more detailed hydrograph, the A/D recorder clocks were replaced with solid state electronic timers with 30, 60, or 120 second read-outs. The recorders were triggered with a microswitch so that a .01 ft increase in stage would turn the timer on and stage would be recorded at 30-second intervals thereafter. Electronic timers were installed in two phases as procurement permitted. The first timers were installed in July, the second four in September. Performance of the timers and trigger circuits has been satisfactory.

Water Samplers

Pumping type samplers were installed at microwatersheds 1, 2, 3, 5, and 7. These samplers pump a sample from the flow through the flume at pre-selected intervals. Individual samples are collected in separate bottles which may be returned to the laboratory for analysis. Sampling ports were installed in the flumes opposite the stilling well ports. Samples were triggered to the stage recorder triggers so that a rise in stage, in addition to starting the recorder timer, also started the sampler. Sampler timers were set at the shortest time interval possible and still get a sufficient volume of water for analysis. This consisted of a two-minute pumping period followed by a one-minute "off" period, or a separate sample every three minutes. Samples were returned to the lab and frozen until analysis could be obtained.

Soil Water Tensions and Soil Temperature

Although the automatic data system was not completely operational, a number of intervals when the system was operational did provide an intermittent record of soil water tensions and soil temperature. Soil water tension data were obtained from Coleman fiberglass resistance units and are reported in megohms. These data can be converted to bars of soil water tension using the calibration curves developed and making the necessary temperature corrections. Soil temperature data are printed out in °C. Both tension and temperature data are available at the 2, 10, 20, 40, and 80 cm depths.

Climatic Station

Beginning June 24, 1970, a class A Evaporation Station has been operated continuously with daily observations of maximum and minimum temperatures, pan evaporation, state of the weather, and continuous observations of temperature, humidity, and barometric pressure. Maximum and minimum temperatures were obtained with a standard USWB Max-Min Thermometers. Pan evaporation was measured by using a USWB 4 ft pan. A continuous record of temperature and humidity was obtained by using a hygrothermograph, and barometric pressure was measured by using a microbarograph. Data from the climatic stations are presented in Appendix B. Additional barometric pressure data were obtained from the Engineering Research Station (old missile site) and is given in Appendix C.

PRECIPITATION

Precipitation on the Pawnee Site during 1970 was below normal for the year, with the deficit occurring during May, June, July, and August (Fig. 1).

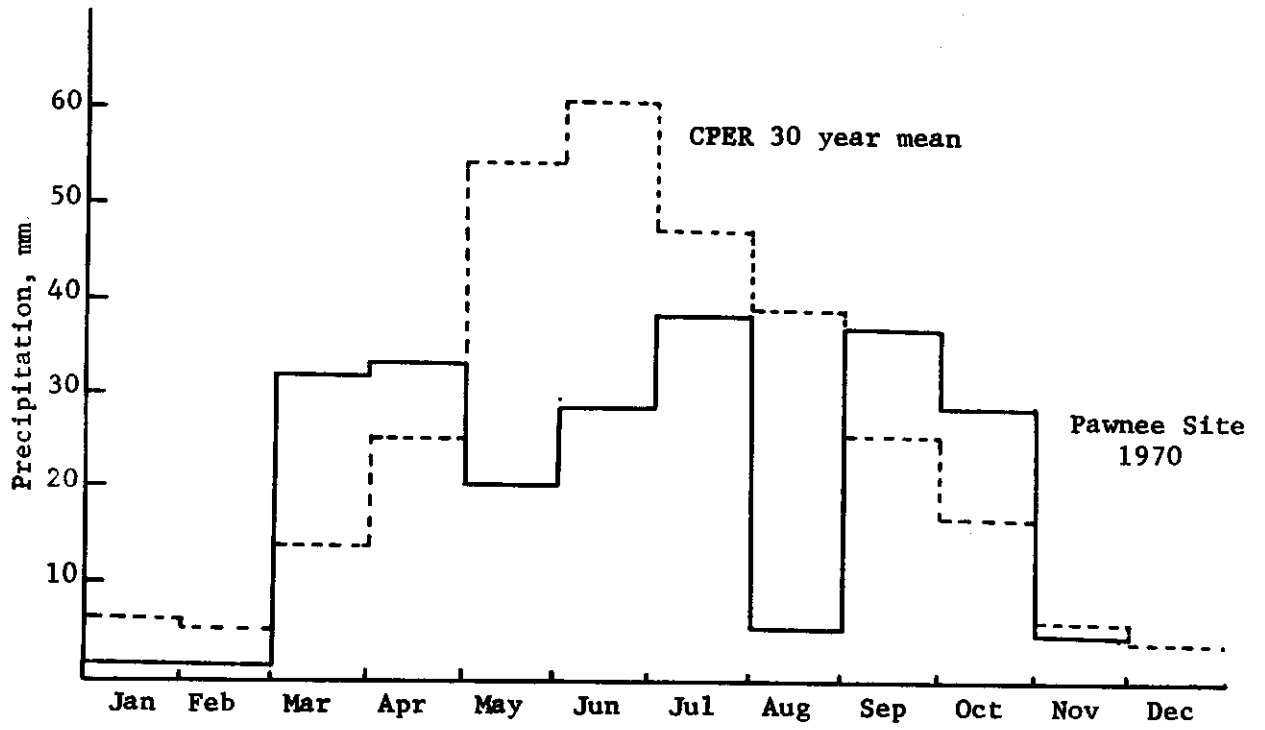


Fig. 1. Monthly precipitation, Pawnee Site, 1970.

Based on the CPER 30 year mean of 310 mm annually, 1970 precipitation was 65 mm below normal, or 245 mm (Fig. 2). Slight deficits occurred during January and February, with greater deficits during May, June, July, and August when evaporation demands were greatest. March and April were above normal and helped to recharge soil water to near maximum levels so that available water during the early part of the growing season was sufficient even though rainfall was below normal.

Precipitation on the microwatersheds showed considerable variation both for individual storms and monthly totals (Table 1). Greatest variation occurred during the summer months when rainfall events were largely convective storms with relatively small areal coverage. Maximum monthly differences occurred during July when 43 mm were recorded at watershed 2 and 27 mm recorded at watershed 5. Maximum difference for an individual storm occurred on July 12 when 30.5 mm were recorded on watershed 8, and 16.5 mm were recorded on watershed 5. There were numerous instances of up to 5 or 6 mm being recorded on a watershed with other watersheds receiving nothing.

For the period of actual recording on the microwatersheds (February to December, 1970), a total of 59 rainfall events were recorded. The size distributions of these events is given in Table 2.

The data given in Table 2 probably underestimate the less than 1 mm events, since the Belfort weighing gage lacked sufficient resolution to accurately detect very small rainfall events. This was especially true for events accompanied by wind or for gages with a 6 hour chart rotation. The tipping bracket gage, on the other hand, gave excellent resolution for small events, but is only operated during the growing season.

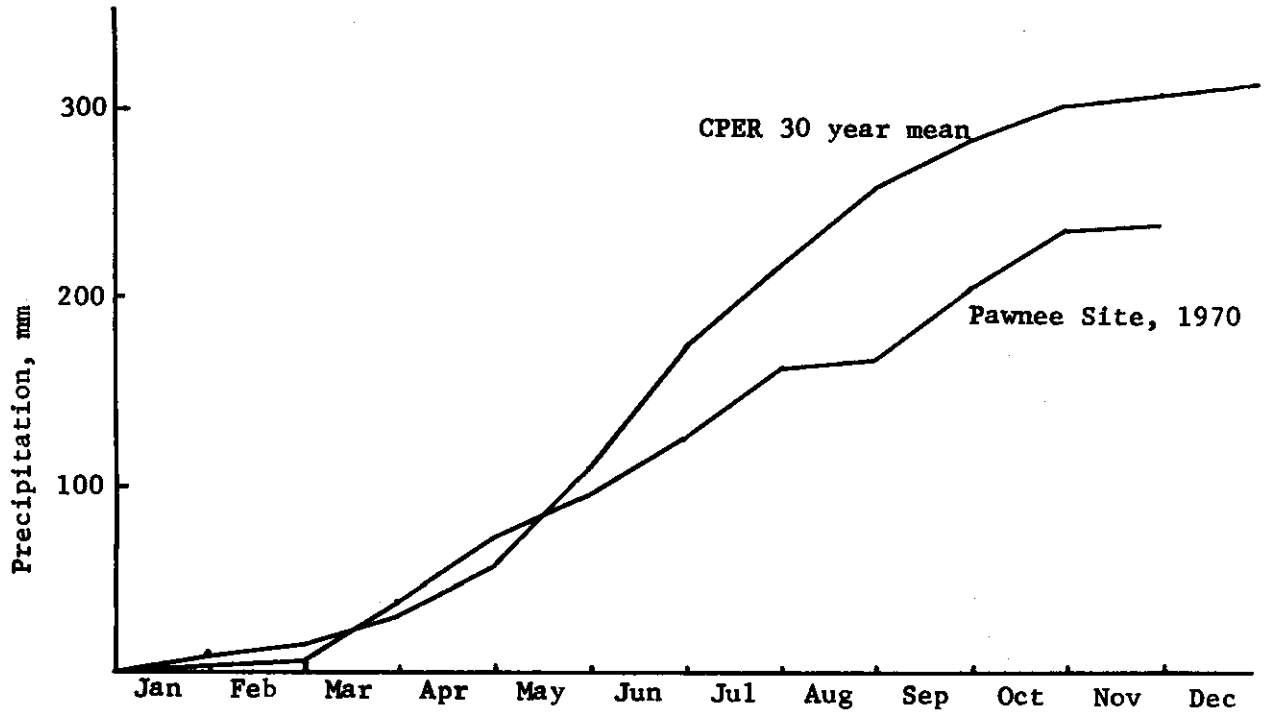


Fig. 2. Cumulative precipitation, Pawnee Site, 1970.

Table 1. Monthly precipitation in mm, Pawnee Site, 1970.

Month	Microwatershed								CPER
	1	2	3	4	5	6	7	8	
January	1.3*	1.3*	1.3*	1.3*	1.3*	1.3*	1.3*	1.3*	1.3
February	0.8	2.0	1.3	1.3	1.0	0.8	T	T	1.3
March	33.0	33.3	33.3*	31.0	30.7	33.0	33.0	32.5	33.3
April	33.5*	33.5*	33.5*	33.5*	33.5*	33.5*	33.5*	33.5*	34.0
May	22.3*	22.3	22.3	22.3*	22.3*	22.5*	22.3*	22.3	21.3
June	10.2*	10.2	10.2	10.2	10.2	14.5	18.8	21.3	29.0
July	43.2*	43.2	43.2	26.7	26.7	27.2	27.9	44.7	39.6
August	5.8	11.4	11.4	2.5	2.5	3.0	4.1	4.6	6.1
September	35.1	35.8	35.8	32.5	32.5	32.0	31.5	33.0	37.6
October	19.6*	19.6	19.6	21.6	21.6	21.6	20.1	18.5	29.2
November	4.6*	4.6	4.6	5.1	5.1	5.8	5.6	5.6	
December	4.3*	4.3	4.3	4.8	4.8	4.1	3.8	4.1	
Total	213.7	221.5	221.1	192.8	192.2	199.3	201.9	221.4	

* Gage data not complete. Monthly total estimated from adjacent gages or CPER gages.

Table 2. Size distribution of recorded precipitation events.

Month	< 1 mm	1 - 5 mm	5 - 10 mm	> 10 mm
February	3	-	-	-
March	2	6	1	-
April	2	-	3	1
May	1	2	3	-
June	3	1	-	1
July	6	5	-	1
August	3	1	-	-
September	1	3	1	1
October	-	2	-	-
November	1	2	-	-
December	-	2	-	-
(Total = 58)	22 = 3890	24 = 4170	8 = 1470	4 = 770
		68.6 mm (31%)	91.7 mm (41%)	61.2 mm (28%)

Table 3. Storm runoff events, 1970.

Microwatershed	Grazing Treatment	Total Storm Precipitation (mm)	Total Storm Runoff (mm)	Peak Runoff (1/sec)
Storm of July 12, 1970				
1	Heavy	25.9	2.64	7.42
3	Heavy	24.1	0.83	3.65
6	Moderate	18.3	0.24	0.97
7	Moderate	19.1	0.16	0.58
2	None	24.1	0.12	0.47
8	None	30.5	0.05	0.37
Storm of August 2, 1970				
3	Heavy	10.2	0.04	0.58
Storm of September 2, 1970				
1	Heavy	6.35	0.02	0.04
3	Heavy	6.35	0.01	0.39
2	None	6.25	0.01	0.09

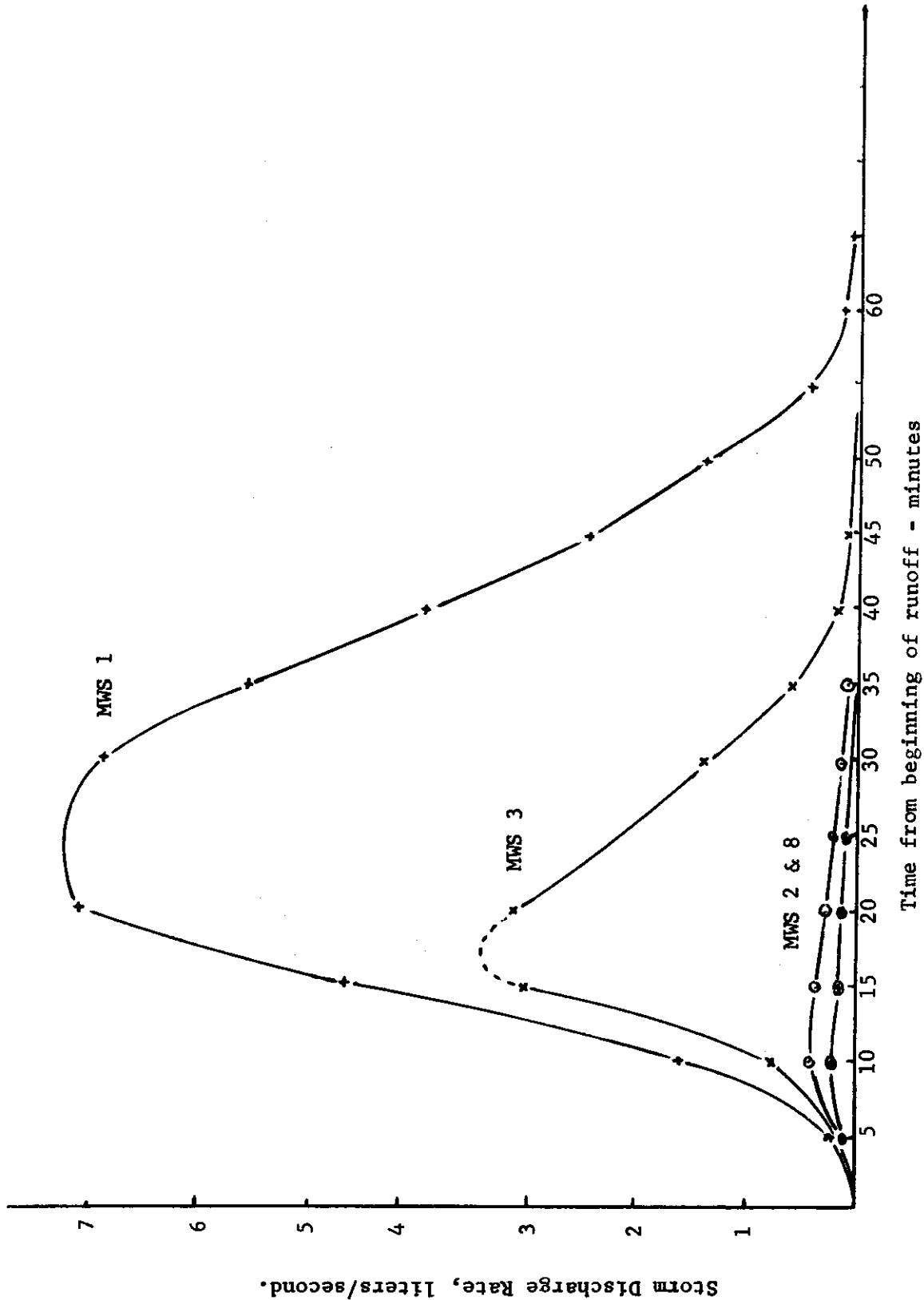


Fig. 3. Stormflow hydrographs, July 12, 1970.

RUNOFF

Three runoff events occurred during the year. Runoff will be produced by storms with intensities greater than the infiltration rate and of sufficient duration to permit the overland flow component to reach the channel or collector. Thus, in most runoff-producing storms, runoff is produced by only the more intense rainfall periods when infiltration capacities are exceeded.

The runoff events measured during 1970 are summarized in Table 3. The first and largest event occurred July 12 and caused runoff to occur on all microwatersheds. Unfortunately, two of the eight had the recorders removed for modification, but good hydrographs were recorded on the remaining six microwatersheds. The storm flow hydrographs are presented in Fig. 3.

As might be expected, surface runoff, both total and peak, is greatest on the heavy grazed pastures. Total runoff and peak runoff rates were substantially less on the moderately grazed pasture and lowest on the exclosed microwatersheds.

Runoff from the other two events (August 2 and September 2) was insignificant. The storm of August 2 amounted to 10.2 mm and produced .04 mm of runoff on microwatershed 3, a heavily grazed microwatershed. The adjacent ungrazed watershed produced no runoff. Recorded rainfall at the other microwatersheds during the same period was less than half that at #2 and #3 and produced no runoff.

Runoff from the storm of September 2 was caused by a 6.3 mm rain at microwatershed 1, 2, and 3. The maximum 10-minute intensity of this storm was about 33 mm/hour. The total runoff produced was very small.

Appendix A. Daily precipitation (mm), Pawnee Site, 1970.

Month	Day	Recording Gage				
		MWS 2	MWS 5	MWS 6	MWS 7	MWS 8
February	1	0.5	-	-	-	-
	2	0.8	-	-	-	-
	4	0.8	-	-	-	-
March	5	1.3	-	-	-	-
	9	0.5	-	-	-	-
	10	1.8	-	-	-	-
	15	6.9	-	-	-	-
	17	3.3	-	-	-	-
	18	4.3	-	-	-	-
	29	1.8	-	-	-	-
	30	3.0	-	-	-	-
	31	0.5	-	-	-	-
April	17	11.7	-	-	-	-
	18	9.9	-	-	-	-
	19	0.5	-	-	-	-
	20	0.8	-	-	-	-
	21	5.1	-	-	-	-
	22	5.6	-	-	-	-
May	13	0.8	-	-	-	-
	21	5.1	-	-	-	-
	22	5.6	-	-	-	4.3
	23	-	-	-	-	0.5
	24	1.3	-	-	-	0.8
	26	3.3	-	-	-	-
	29	6.4	6.4	6.4	4.1	4.3
	30	-	-	-	-	0.5

Appendix A. (Continued)

Month	Day	Recording Gage				
		MWS 2	MWS 5	MWS 6	MWS 7	MWS 8
June	9	-	-	-	-	0.5
	10	2.5	3.8	5.6	8.9	-
	11	7.6	6.4	8.9	8.9	17.5
	12	-	-	-	-	2.5
	23	-	-	-	0.5	0.3
	28	-	-	-	0.5	0.5
July	2	2.5	-	-	-	0.3
	6	-	-	-	-	0.3
	9	1.5	1.3	1.3	1.5	1.3
	12	24.1	16.5	18.3	19.1	30.5
	13	-	-	-	0.8	0.3
	17	1.3	3.8	2.5	2.5	2.8
	18	-	-	-	-	0.5
	19	-	-	-	-	1.3
	20	6.4	-	-	-	-
	22	-	-	-	-	0.5
	23	1.3	-	1.3	-	0.5
	25	-	-	-	-	2.3
	26	3.8	5.1	3.8	4.1	4.3
August	2	10.2	2.5	3.0	4.1	3.3
	14	-	-	-	-	0.5
	29	-	-	-	-	0.3
	30	1.3	-	-	-	0.5

Appendix A. (Continued)

Month	Day	Recording Gage				
		MWS 2	MWS 5	MWS 6	MWS 7	MWS 8
September	2	6.4	5.8	5.1	3.8	2.8
	13	5.1	3.8	-	-	2.0
	14	-	-	3.6	5.1	2.3
	15	-	-	-	-	0.5
	16	1.5	-	-	-	-
	21	15.2	17.8	17.8	17.5	19.8
	24	7.6	5.1	5.6	5.1	5.6
October	8	2.5	5.3	5.6	5.1	3.8
	10	-	0.8	-	-	-
	12	3.0	3.3	2.5	2.5	2.5
	25	5.1	12.2	12.4	12.4	12.2
	26	8.9	-	-	-	-
	27	-	-	1.0	-	-
November	7	1.3	1.5	1.8	1.5	1.8
	12	1.8	2.5	3.0	2.8	3.0
	23	1.5	1.0	1.0	1.3	0.8
December	10	2.8	2.5	2.5	2.5	2.3
	18	0.8	1.5	1.5	1.3	1.8
	20	0.8	0.8	-	-	-

APPENDIX B

Climatic Station Observations

June 24 - December 6, 1970

STANDARD WEATHER OBSERVATIONS

US-IRP GRASSLAND BIOME
CENTRAL PLAINS EXPERIMENTAL RANGE NUNN, COLORADO

PL. 1652 M (MSL) EXCLOSURE E 1/2 SEC 23 T10N R66W, 6TH P. M. PAMNEE SITE

US-IRP GRASSLAND BIOME
CENTRAL PLAINS EXPERIMENTAL RANGE NUNN, COLORADO

DATE	ST. AIR-TEMPERATURE		PAM-TEMPERATURE		EVAP.	WIND TRAVEL	OBSERVATIONS		PRECIPITATION	GENERAL COMMENTS
	TIME	MAX	MIN	ORS			TEMP.	WIND		
06/24/70	1935	31	10	23	-13.21	30	13	OVERCAST		
06/25/70	1900	32	14	25	-12.45	29	14	CLEAR		
06/26/70	1520	32	11	32	-9.14	24	14	CLEAR		
06/27/70	1730	34	10	27	-12.95	29	8	OVERCAST		STORM IN FR. W
06/28/70	1730	34	13	28	-13.72	31	14	OVERCAST		
06/29/70	1900	31	12	23	-11.18	29	14	SCATTERED		
06/30/70	1525	30	11	29	-10.67	24	13	CLFAR		
07/01/70	1800	29	9	27	-11.43	30	13	SCATTERED		PAN THERM. BRK.
07/02/70	1800	34	11	32	-11.43	30	13	SCATTERED		
07/03/70	1815	32	14	26	-12.19	26	14	SCATTERED		
07/06/70	1745	31	12	29	-11.43	31	12	SCATTERED		
07/05/70	1730	32	12	26	-9.14	32	12	OVERCAST		
07/05/70	1745	32	13	26	-7.62	26	13	OVERCAST		
07/07/70	1745	28	14	21	-9.14	28	14	OVERCAST		
07/08/70	1745	31	12	28	-8.64	28	12	THUNDERHEADS SCATTERED		
07/09/70	1745	33	13	29	-17.02	33	13	OVERCAST		
07/10/70	1840	33	13	21	-9.91	29	21	SCATTERED		
07/12/70	1745	29	12	21	-5.33	29	12	CLEAR		
07/13/70	1730	31	12	31	-7.11	31	12	CLEAR		
07/14/70	1715	33	14	27	-11.43	33	14	HAZY		
07/15/70	1700	34	11	29	-13.72	29	11	SCATTERED		
07/16/70	1800	33	13	29	-7.37	29	13	SCATTERED		
07/18/70	1730	33	16	30	-10.16	30	16	SCATTERED		
07/19/70	1730	30	7	22	-10.16	22	7	THUNDERHEADS		
07/20/70	1710	29	14	24	0.25	24	14	SCATTERED		
07/21/70	1650	29	14	29	-7.62	29	14	OVERCAST		
07/22/70	1800	29	14	20	-3.81	20	14	OVERCAST		
07/23/70	1715	28	14	24	-11.43	24	14	SCATTERED		
07/24/70	1750	29	9	27	-10.16	27	9	OVERCAST		
07/25/70	1730	32	10	27	-9.91	27	10	SCATTERED		
07/26/70	1730	29	-2	20	-3.05	20	-2	OVERCAST		
07/27/70	1815	29	14	24	-3.81	24	14	SCATTERED		
07/28/70	1715	29	12	27	-10.67	27	12	SCATTERED		
07/29/70	1730	32	12	28	-10.41	28	12	SCATTERED		
07/30/70	2010	32	12	21	-7.62	21	12	CLEAR		
07/31/70	1730	31	4	29	-11.43	29	4	SCATTERED		
08/01/70	1745	36	13	32	-3.81	32	13	OVERCAST		
08/02/70	1800	36	12	28	-7.62	28	12	OVERCAST		
08/03/70	1730	28	16	24	-7.11	24	16	OVERCAST		
08/04/70	1740	33	13	28	-8.64	28	13	OVERCAST		
08/05/70	1745	34	18	26	-10.92	26	18	OVERCAST		
08/06/70	1735	35	16	27	-8.64	27	16	OVERCAST		
08/07/70	1700	29	21	28	-10.67	28	21	OVERCAST		
08/08/70	1945	33	12	22	-10.67	22	12	OVERCAST		
08/09/70	1810	29	14	24	-10.67	24	14	SCATTERED		

TEMPERATURES (C), EVAPORATION (MM), WIND TRAVEL (KM/HAY)

STANDARD WEATHER OBSERVATIONS PANTEE SITE US-IRP GRASSLAND BIOME
 EXCLOSURE E 1/2 SEC 23 T10N R66W, 6TH P. M. CENTRAL PLAINS EXPERIMENTAL RANGE MUNN, COLORADO

FL. 1652 M (MSL)

DATE	MT. ST. AIR-TEMPERATURE		PAV-TEMPERATURE		EVAP. AMOUNT	WIND TRAVEL	OBSERVATIONS		PRECIPITATION	GENERAL COMMENTS
	TIME	MAX	MIN	ORS			MAX	MIN		
08/10/70	1735	29	11	27	-7.62		SCATTERED	HOT		LT. WIND
08/17/70	1736	31	14	30	-9.65		CLFAR	HOT		LT. WIND
08/12/70	1709	36	12	31	-11.18		SCATTERED	HOT		GUSTY
08/13/70	1821	8	6	32	-14.73		SCATTERED	HOT		GUSTY
08/14/70	1742	34	15	24	-9.65		SCATTERED	WARM		GUSTY
08/15/70	1816	24	13	20	-7.37		SCATTERED	CHILLY		LT. WIND
08/16/70	1744	29	7	27	-7.62		CLEAR	HOT		GUSTY
08/17/70	1800	35	-4	24	-15.24		OVERCAST	HOT		STRONG
08/18/70	1700	34	15	32	-15.24		SCATTERED	HOT		LT. WIND
08/19/70	1741	32	14	24	-14.22		OVERCAST	CHILLY		LT. WIND
08/20/70	1730	24	16	20	-6.60		OVERCAST	CHILLY		GUSTY
08/21/70	1740	29	15	26	-7.37		SCATTERED	WARM		GUSTY
08/22/70	1803	28	9	24	-8.64		CLEAR	WARM		GUSTY
08/23/70	1700	30	11	27	-9.40		OVERCAST	WARM		LT. WIND
08/24/70	1800	31	4	24	-9.14		SCATTERED	WARM		LT. WIND
08/25/70	1810	33	10	29	-9.14		CLEAR	HOT		LT. WIND
08/26/70	1800	35	9	27	-8.89		OVERCAST	WARM		LT. WIND
08/27/70	1800	33	13	26	-11.43		SCATTERED	WARM		STRONG
08/28/70	1730	32	14	24	-7.62		OVERCAST	WARM		LT. WIND
08/29/70	1741	33	14	24	-9.91		OVERCAST	WARM		GUSTY
08/30/70	1835	25	11	21	-9.65		OVERCAST	CHILLY		
08/31/70	1800	31	8	27	-10.41		OVERCAST	WARM		LT. WIND
09/01/70	1730	32	11	20	-7.62		OVERCAST	CHILLY		LT. WIND
09/02/70	1830	31	11	19	-7.62		OVERCAST	CHILLY		LT. WIND
09/03/70	1800	29	10	24	-3.81		SCATTERED	WARM		LT. WIND
09/04/70	1730	29	10	24	-11.43		SCATTERED	WARM		GUSTY
09/05/70	1730	29	8	24	-6.35		OVERCAST	WARM		GUSTY
09/06/70	1813	24	7	16	-7.62		OVERCAST	CHILLY		GUSTY
09/07/70	1845	26	4	20	-7.62		CLEAR	CHILLY		LT. WIND
09/08/70	1733	31	9	28	-7.62		CLEAR	WARM		LT. WIND
09/09/70	1733	38	8	16	-9.65		CLEAR	CHILLY		GUSTY
09/10/70	1745	23	-1	21	-3.81		CLEAR	WARM		LT. WIND
09/11/70	1735	31	-1	27	258.06		SCATTERED	WARM		STRONG
09/12/70	1645	26	0	6	-7.62		OVERCAST	COLD		STRONG
09/13/70	1721	27	0	9	-9.65		SCATTERED	COLD		STRONG
09/14/70	1724	9	2	9	-1.78		SCATTERED	CHILLY		STRONG
09/15/70	1715	17	5	15	-16.51		SCATTERED	WARM		STRONG
09/16/70	1727	24	4	18	-5.33		CLEAR	WARM		LT. WIND
09/17/70	1716	25	6	23	-9.14		SCATTERED	WARM		LT. WIND
09/18/70	1725	29	5	26	-7.62		CLEAR	WARM		LT. WIND
09/19/70	1744	29	4	24	-7.62		SCATTERED	WARM		LT. WIND
09/20/70	1735	29	6	22	-12.19		OVERCAST	CHILLY		STRONG
09/21/70	1710	22	6	9	-3.81		CLEAR	CHILLY		STRONG
09/22/70	1716	12	4	11	0.00		SCATTERED	CHILLY		LT. WIND
09/23/70	1810	21	2	15	0.00		SCATTERED	CHILLY		LT. WIND
09/24/70	1802	16	5	6	0.00		SCATTERED	CHILLY		GUSTY
09/25/70	1710	11	1	9	0.00		SCATTERED	CHILLY		LT. WIND
09/26/70	1735	16	0	12	0.00		CLEAR	CHILLY		LT. WIND

TEMPERATURES (C), EVAPORATION (MM), WIND TRAVEL (KM/DAY)

STANDARD WEATHER OBSERVATIONS PAWNEE SITE US-IRP GRASSLAND BIOME
 ENCLOSURE E 1/2 SEC 23 T10N R66W, 6TH P. M. CENTRAL PLAINS EXPERIMENTAL RANGE NUNN, COLORADO

ELE. 1652 M (MSL)

DATE	MT.	ST.	AT9-TEMPERATURE	PAN-TEMPERATURE	EVAP.	WIND	TRAVEL	SKY	TEMP.	WIND	PRECIPITATION	GENERAL COMMENTS
TIME	MAX	MIN	MAX	MIN	AMOUNT	TRAVEL	AMOUNT	TRAVEL	AMOUNT	DIR	AMOUNT	
11/13/70	4	-1	0	0								
11/14/70	0	-4	0	0								
11/15/70	13	-9	-3	0								
11/16/70	15	-5	8	1700								
11/17/70	15	1	3	1730								
11/18/70	4	-11	0	1930								
11/19/70	4	-7	0	1630								
11/20/70	13	-7	0	1900								
11/21/70	15	1	9	1730								
11/22/70	-3	-11	-11	1730								
11/23/70	-8	-19	-11	1715								
11/24/70	18	-12	11	1615								
11/25/70	18	4	14	1740								
11/26/70	14	10	-1	1630								
11/27/70	9	-2	7	1720								
11/28/70	9	-7	8	1625								
11/29/70	13	-6	6	1730								
11/30/70	10	1	3	1700								
12/01/70	10	2	3	1700								
12/02/70	6	-9	1	1715								
12/03/70	7	-6	2	1620								
12/04/70	14	-9	8	1760								
12/05/70	8	-9	3	1620								
12/06/70	13	-5	7	1630								

OBSERVATIONS
 CHILLY LT. WIND
 CHILLY LT. WIND
 COLD LT. WIND
 COLD LT. WIND
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 COLD LT. WIND
 CHILLY LT. WIND

OVERCAST
 CLEAR
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 CLEAR
 OVERCAST
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 SCATTERED
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 OVERCAST
 CLEAR

LT. SNOW
 DRIFTED SNOW
 3 IN. SNOW
 FOG-CEILING 0

APPENDIX C

Barometric Pressure as Reported by
the Engineering Research Station

January 20 - October 30, 1970

Appendix C. Barometric pressure as reported by the Engineering Research Station (old missile site) approximately six miles south of the Pawnee Site. Data are from a mercury barometer, corrected for scale error and temperature, but not reduced to sea level pressures.

Date	Hour	Pressure (mb)
1 - 20	0930	829.432
1 - 20	1320	832.052
3031	1300	831.432
4 - 15	1500	822.882
5 - 11	1000	827.364
6 - 4	1000	839.568
6 - 4	1400	837.361
6 - 10	1000	824.035
7 - 14	--	835.982
7 - 15	--	841.981
7 - 20	1545	836.948
7 - 21	1305	832.535
7 - 22	1030	831.156
7 - 23	1345	831.156
7 - 24	1300	833.569
7 - 31	1015	834.259
8 - 3	1020	833.914
9 - 4	0920	832.121
8 - 5	1255	832.535
8 - 5	1615	831.501
8 - 26	1500	835.638
8 - 27	--	836.948
8 - 28	1000	834.190
9 - 7	1400	831.501
9 - 10	--	836.672
9 - 17	1300	837.223
9 - 18	1045	835.500

Appendix C. (Continued)

Date	Hour	Pressure (mb)
10 - 1	1400	834.948
10 - 5	1300	821.159
10 - 6	1630	821.710
10 - 8	1600	831.501
10 - 15	1500	841.153
10 - 21	1500	825.985
10 - 22	1400	822.538
10 - 23	1300	824.606
10 - 29	1500	830.122
10 - 30	1300	828.743
