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OBSERVATIONS OF CARBON DIOXIDE AND PLANT GROWTH IN AN ARCTIC ECOSYSTEM

FINAL REPORT

by

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ABSTRACT

This report presents the results of analyses of atmospheric carbon dioxide and ecological factors at Meade River Camp and at North Meadow Lake (Barrow), Alaska. The data summarize reference gas calibrations used in the CO_2 program, with a discussion of methods used to obtain the data for CO_2 concentrations in air at both stations. Variations of CO_2 in the air, at the ground level, and at 16 m above the ground are given for both the Meade River Station and North Meadow Lake. Meteorological observations are presented for the period of observations. The percent rate of growth of five species of tundra plants is shown, and the correlation between CO_2 concentration in the atmosphere and the percent of maximum ground is given. The data for the amounts of chlorophyll and dry weight production in each of four types of communities are presented. A list of publications resulting from the interpretation of these data is included.

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I. INTRODUCTION

This report is a record of the data for measurements of carbon dioxide in the atmosphere near the ground and ecological observations during the summer of 1966 at two field stations separated by approximately 1° of latitude. Observations were made throughout the growing season on the Arctic coastal plain of Alaska. The North Meadow Lake Station at an elevation of 6 m (71°18'N, 159°39'W) was 2 km south of the Arctic Ocean and the Navy Arctic Research Laboratory, Barrow, Alaska (Figure 18a). Atmospheric carbon dioxide has been monitored at this station from 1961 to 1967.

The Meade River Station at an elevation of 15 m (70°28'N, 157°26'W) is 110 km SSW of Barrow and was operated from 24 May to 9 September, 1966 (Figures 1 and 2). The terrain is of low relief between the two stations and contains numerous lakes and graminoid tundra vegetation of low stature. No permanent settlements or sources of atmospheric pollution occur between the two stations.

The data in this report are presented in two sections. The first section describes the carbon dioxide data observed at North Meadow Lake and at Meade River. The second section presents environmental and ecological data which documents the results of meteorological observations and measurements which support the progression of plant growth during the period of seasonal thaw. These results therefore extend from the beginning of snow melt in late May thru the growing season of approximately 80 days to the period of freezeup in early September.

Interpretations of these data have been published as reports and journal contributions and the references cited in the Bibliography should be consulted for an expansion of methodology, data synthesis and significance.

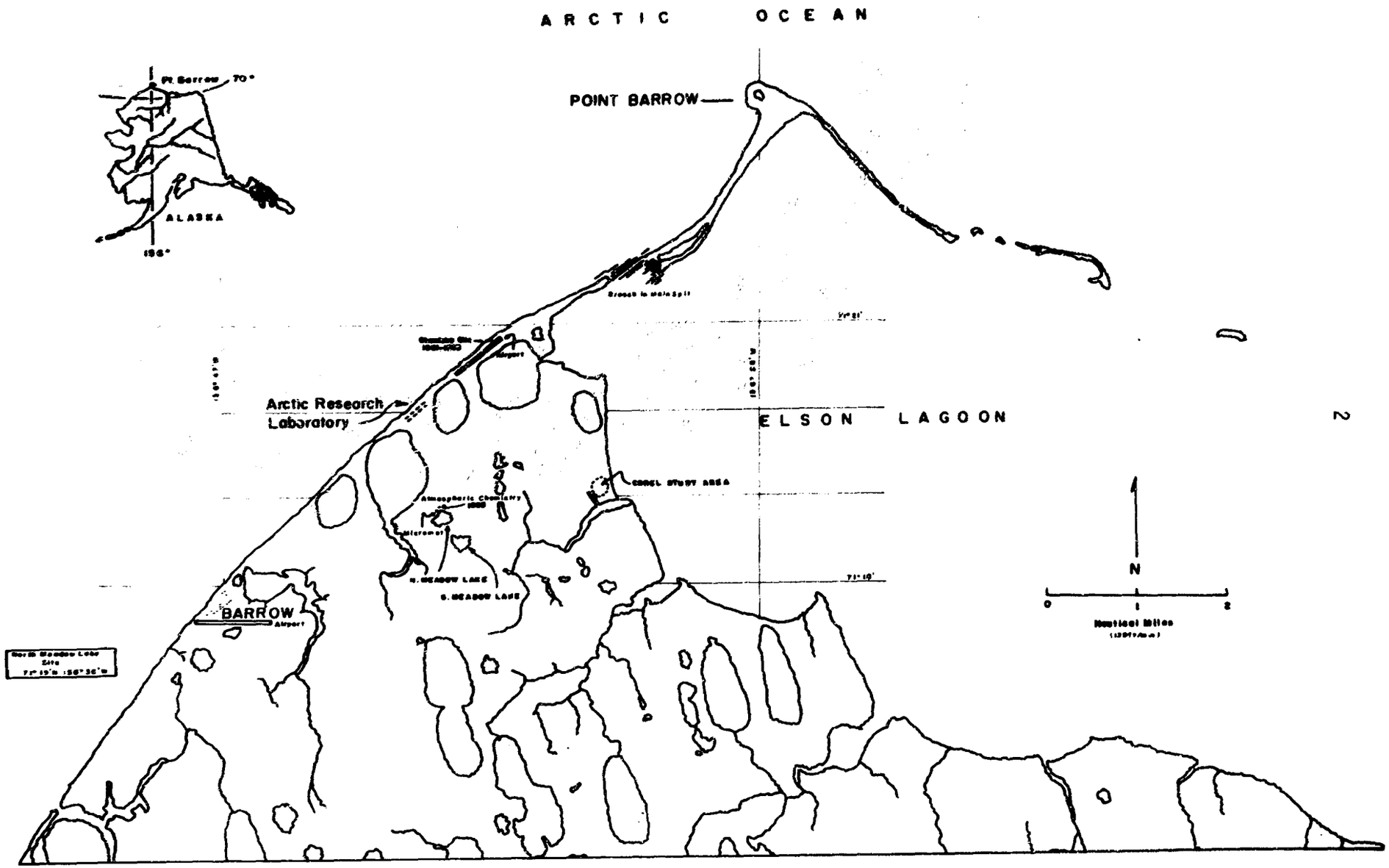

Figure 1. Location of North Meadow Lake Station (71°18'N, 159°39'W).

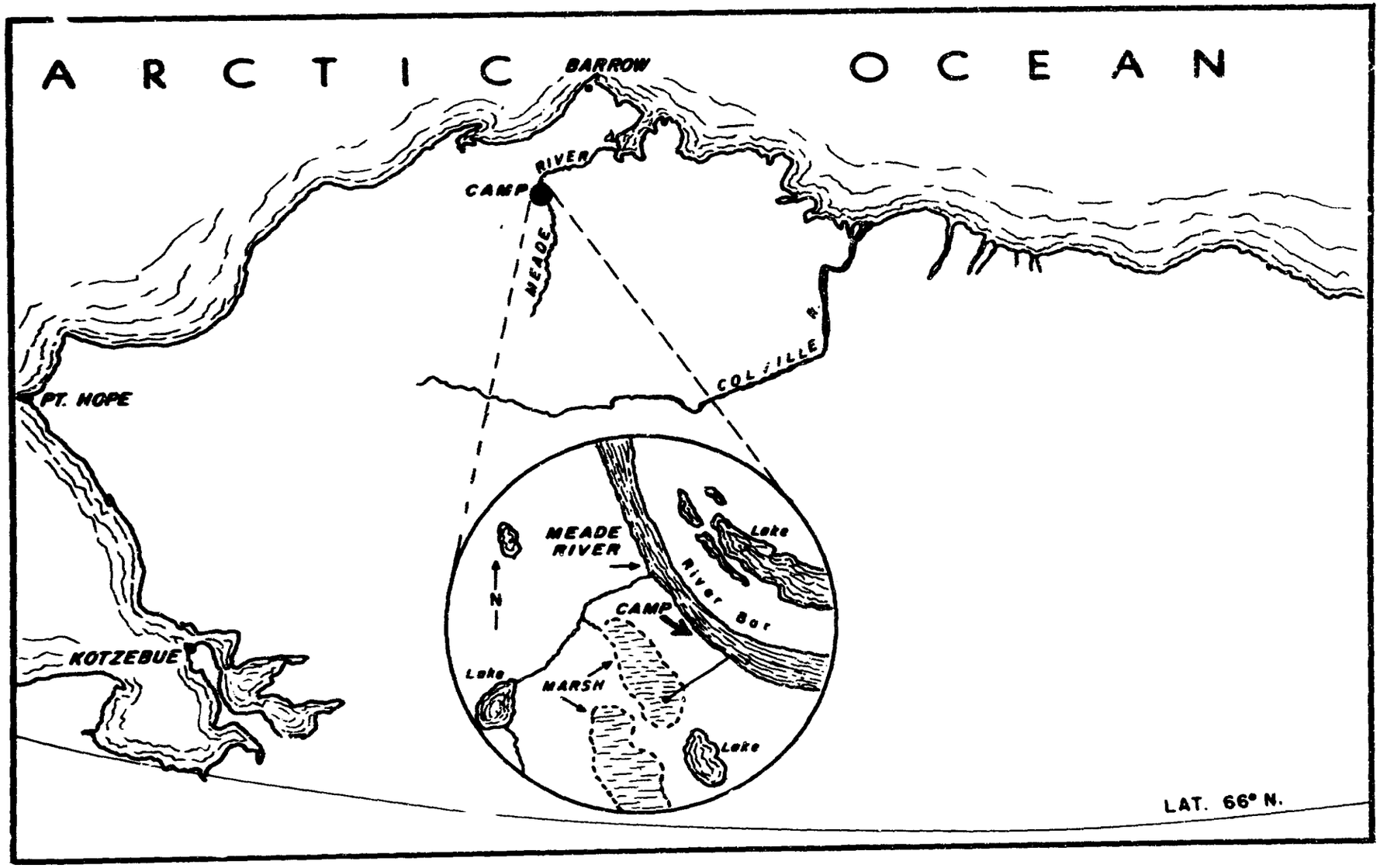

Figure 2. Location of NARL Camp on the Meade River 65 Miles SSW of Barrow (70°28'N, 157°26'W).

II CARBON DIOXIDE OBSERVATIONS

The tables pertaining to carbon dioxide measurements are arranged in such a way that it is possible to progress from the initial calibration of reference gases to final summaries of air CO_2 concentrations. This report does not include hourly values of CO_2 for Meade River Camp or for Barrow. These values are too numerous to tabulate and are documented fully on computer output sheets.[1] The data on the computer sheets are given in index form, that is, provisional parts per million by volume. Conversion to the manometric form, should it be necessary to use these data on an hourly basis, is accomplished by the following equation:

$$\text{MANOMETRIC CONCENTRATION} = (C - 311.51) \times 1.2186 + 311.51 \qquad (1)$$

where C is the index value.

In further discussions frequent reference will be made to Technical Report No. 2, An Analysis of Carbon Dioxide in the Arctic Atmosphere at Barrow, Alaska During 1961-62-63 by John J. Kelley, Jr., July 1966. Details of instrumentation and calibration are discussed in this report. Henceforth, reference to this report will be CO_2 Report, 1966. For example, reference to the manometric equation is given in the CO_2 Report, 1966 on page 14.

Explanation of Tables

TABLE 1

This Table presents the results of all calibrations at Meade River accomplished by the Mutual Comparison Method used at the University of Washington. These data again appear in the graph at the end of TABLE 6. This table follows the format of TABLE 2 in the CO_2 Report, 1966.

[1]Computer output sheets and data cards are presently located at the Institute of Marine Science, University of Alaska, College, Alaska, 99701.

Reference Cylinder 5752 was chosen as the Primary (Io), 0221 as the Span (Is), and 7055 as the Secondary (II). The choice of 5752 as the primary was unfortunate as it appeared to have the least number of calibrations and showed the most drift, however, analytical precision at the Meade River Station was better than 1 ppm.

TABLE 2

Summaries of Recorder Scale Factors are based on single set evaluations. These values are arranged in periods which seem to have the greatest internal continuity. The data are selective in that the original data showed single set values exhibiting values for any one period departing greatly from the average for the period. These come under the heading of "anomalous values" and since they would seriously affect the air data, they are not used. Thus, extreme values resulting from measurement malfunction or temporary air contamination were removed from the calibration.

TABLE 3

TABLE 3 summarizes the mutual comparison recorder scale factors and is similar to CO_2 Report, 1966 TABLE 4.

TABLE 4

Final values for all CRREL[2] reference cylinders are tabulated and are similar to CO_2 Report, 1966 Tables 5, 6, and 7. Note the fairly wide variation in concentrations with time. University of Washington cylinders generally did not exhibit such wide variations. It is possible that these

[2]U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

variations are a result of old gas cylinders which tend to pick up moisture and small quantities of organic coatings on the inside of the cylinder. These differentially outgas during the life of the tank and produce erratic depletions or additions to the contents of the cylinder. New chrome, molybdenum steel cylinders which have been cleaned and leaked before filling should eliminate this problem of outgassing.

TABLE 5

Index differences used in the computation of recorder scale factors are listed.

TABLE 6

This Table provides a list of sliding recorder scale factors similar to CO_2 Report, 1966 TABLE 5. All values were corrected to 30" Hg (10.16 centibars). The procedure for reducing these data is given in CO_2 Report, 1966.

TABLE 7

Sliding recorder scale factors (RSF) are presented for the North Meadow Lake data during the period of analysis. There is much less variation in the RSF for Barrow than for Meade River. The variation at Barrow (NML) is 0.3 RSF units; at Meade River it varied about 1.8 units.

TABLE 8

Average daily concentrations of atmospheric CO_2 at the 16 meter datum level at Meade River and North Meadow Lake are given. The air indices are taken from the computer output summaries. Manometric air concentrations are calculated according to the formula. (See CO_2 Report, 1966). The data are plotted for North Meadow Lake and Meade River in Figures 3 and 4.

It will be noticed that the variations at North Meadow Lake closely follow those at Meade River. The summer low appears to occur in September during the 1966 season, rather than late August as in the five preceeding years.

The period of maximum change in CO_2 concentrations occurs between late June and early July at both stations and is the period of maximum tundra growth. There is an apparent three-day phase lag between the two sites near the inflection point in the curves with Barrow lagging Meade River. Snow melt and plant growth was slower at Barrow than at Meade River.

TABLE 9

Summaries of the weekly averages of CO_2 in the air at 16 meters are given and plotted in the histograms shown in Figures 4 and 5.

Early in the season Meade River showed somewhat higher values than Barrow indicating that the snow is gone and there is both production of CO_2 and initial CO_2 utilization by the early tundra vegetation. During May and June the Barrow area was still snow covered.

The highest differences between the two sites occured during the week of July 4, and was 2.6 ppm, with Meade River now lower than Barrow.

TABLE 10

Monthly values for CO_2 at Meade River and Barrow are presented.

The following mean monthly differences in CO_2 measured at 16 m above the ground between the two stations was noted:

Month	MR - NML
June	+0.3 ppm
July	-1.8
August	+1.0

These data indicate a net flux of CO_2 from the tundra at Meade River in June, a net utilization in July, and a net utilization for Barrow in August.

TABLE 11

Assuming a constant wind blowing from a given direction and a changing plant growth rate it should be possible to estimate effects of horizontal advection of CO_2 near the ground. It is difficult to obtain a preferred wind orientation at both Meade River and Barrow simultaneously; however, a selection of CO_2 data for winds of 15° and 195° with indicated tolerances are presented in TABLE 11.

The long term average shows almost no horizontal changes along the NML-MR CO_2 transect with wind orientation by our techniques. The greatest detectable differences occurred in early July.

TABLE 12

The distribution of CO_2 near the ground is given. These data are taken from the original computer output sheets. Graphs of the data appear at the end of the section (Figure 7 and 8).

It is immediately seen that during late May and early June at North Meadow Lake, the ground CO_2 values were high. This is accounted for by the fact that these measurements were made under a cover of snow where accumulation occurs due to changing microbiological conditions in the winter, and perhaps physical changes in the active layer of the permanently frozen ground (Kelley *et al.*, 1968).

There was a growing season phase lag of about 3 days occurring during early July. From mid-July to early August the concentrations of CO_2 at Barrow and Meade River were nearly the same, while in late August and September the phase is reversed with Barrow showing effects of net utilization of CO_2 by tundra.

TABLE 13

Weekly average concentrations of CO_2 at ground level are given. The data were averaged to end each series on a Saturday corresponding to weekly vegetation measurements at Meade River. These data are shown graphically in Figures 9 and 10.

High values occurred at Barrow until June 28. This was due to CO_2 entrained under the snow cover. At Meade River ambient CO_2 showed values commensurate with the usual spring rise in CO_2 concentration. The phase lag discussed in the description of Table 12 is seen with the crossover between Meade River and Barrow occurring early to mid-July. After this period growing season of the Barrow area accelerated and utilized more CO_2 from the atmosphere near the ground than Meade River; thus, the higher Meade River CO_2 levels.

TABLE 14

This Table gives the monthly averages for CO_2 near the ground at Meade River and Barrow. Note that the June average is not used because of the anamalously high values at Barrow caused by CO_2 measurements underneath the snow.

TABLE 15

Three-day running means of CO_2 at Meade River and North Meadow Lake at 16 m are represented in Figures 11 and 12.

The major variations in atmospheric CO_2 at 16 m between Meade River and Barrow were:

Date	MR-NML
June 2	+2.1 ppm
14	+2.3
26	-1.0
July 4	-1.5
20	-2.1
28	-0.6
August 20	+0.8
28	+2.9

In early July a three-to four-day lag was noted with Barrow lagging Meade River.

TABLE 16

Six-day running means of CO_2 concentration at 16 m are given.

TABLE 17 and 18

Diurnal variations of CO_2 16 m above the ground are given for the Meade River Station (Table 17) and at North Meadow Lake (Table 18) and are shown in Figures 13 and 14. It was expected that respiration at night and assimilation during the day would cause a higher CO_2 concentration during the night and lower CO_2 concentrations during the late afternoon. This variation is seen for the months of July and August, but not for June 1966

at Meade River. North Meadow Lake shows the expected diurnal variation for all three months.

TABLE 19

Three month combined averages of the diurnal course of CO_2 for June, July and August 1966 for Meade River and Barrow are tabulated and shown in Figures 15, 16.

Figure 15 shows that minimum CO_2 concentrations occur during the mid- or late afternoon at N.M.L. with an 0.8 ppm change. Meade River shows a diurnal variation with the minimum occurring during the late evening with a maximum variation of 1.5 ppm.

TABLE 20

Carbon dioxide differences between the ground and 16 meter level above the ground are shown for the North Meadow Lake and Meade River Station. The data for both stations are plotted in Figure 17.

Table 1: Recorder Scale Factors: Mutual Comparison Method
Meade River, Alaska

Standard Tank No.	Compared Tank No.	Observed Scale Diff.	Number of Comparisons	Index Diff.	Recorder Single Set	Scale Factor Wgt'd Avg.	Date of Analysis
5752	0221	6.60	10	41.84	6.34		16 June 1966
5752	7055	6.50	10				
0221	7055	0.58	10				
5752	0221	7.08*	10*	41.84	5.91		
			20			6.12	
5752	0221	6.55	10	41.84	6.39		24 June 1966
5752	7055	5.94	10				
0221	7055	0.58	10				
5752	0221	6.52*	10*	41.84	6.42		
			20			6.40	
5752	0221	7.40	10	41.84	5.65		8 July 1966
5752	7055	6.80	10				
0221	7055	0.66	10				
5752	0221	7.46*	10*	41.84	5.61		
			20			5.63	
5752	0221	7.22	10	41.84	5.79		17 July 1966
5752	7055	6.56	10				
0221	7055	0.69	10				
5752	0221	7.25*	10*	41.84	5.77		
			20			5.78	

Table 1: Recorder Scale Factors: Mutual Comparison Method
Meade River, Alaska

Standard Tank No.	Compared Tank No.	Observed Scale Diff.	Number of Comparisons	Index Diff.	Recorder Single Set	Scale Factor Wgt'd Avg.	Date of Analysis
5752	0221	7.08	10	41.84	5.91		24 July 1966
5752	7055	6.32	10				
0221	7055	0.73	10				
5752	0221	7.05*	10*	41.84	5.93		
			20			5.92	
	Note: Machine repaired 8/8/66.						
5752	0221	6.65	10	41.84	6.29		9 August 1966
5752	7055	5.72	10				
0221	7055	0.67	10				
5752	0221	6.39*	10*	41.84	6.55		
			20			6.42	
5752	0221	7.04	10	41.84	5.94		30 August 1966
5752	7055	6.40	10				
0221	7055	0.68	10				
5752	0221	7.08*	10*	41.84	5.91		
			20			5.92	
5752	0221	7.54	10	41.84	5.55		9 September 1966
5752	7055	6.67	10				
0221	7055	0.68	10				
5752	0221	7.35*	10*	41.84	5.69		
			20			5.62	

Table 2: Summary of Recorder Scale Factors
Meade River, Alaska

Standard Tank No.	Compared Tank No.	Observed Scale Diff.	Number of Comparisons	Recorder Scale Factor	Single Set Bar. Press(mb)	Adjusted Recorder Scale Factor	Date of Analysis
2015	5752	4.23	1	4.75	1010	4.78	25 May 1966
5752	5532	4.70	1	5.41		5.44	
2015	5532	8.24	1	5.52		5.55	
				Average R.S.F. =		5.26	
0221	3732	4.39	1	4 84	1013	4.85	26 May 1966
3732	2156	2.00	1	3.82		3.83	
2156	5752	2.40	4	5.39		5.41	
2015	5752	4.39	1	4.57		4.58	
				Average R.S.F. =		4.67	
0221	5752	8.98	2	4.66	1022	4.63	27 May 1966
7055	2015	3.84	3	4.65		4.62	
7055	3732	3.67	7	4.65		4.62	
				Average R.S.F. =		4.62	
0221	5752	7.05	10	5.93	1022	5.89	7 June 1966
0221	3732	3.47	5	6.13		6.09	
3732	5752	3.55	4	5.79		5.76	
7055	5752	6.47	3	5.86		5.82	
				Average R.S.F. =		5.89	
7055	3732	2.83	1	6.03	1016	6.03	8 June 1966
7055	2015	2.97	10	6.01		6.01	

Table 2: Summary of Recorder Scale Factors
Meade River, Alaska

Standard Tank No.	Compared Tank No.	Observed Scale Diff.	Number of Comparisons	Recorder Scale Factor	Single Set. Bar. Press(mb)	Adjusted Recorder Scale Factor	Date of Analysis
7055	3732	2.76	7	6.18		6.18	
				Average R.S.F. =		6.07	
7055	3732	2.78	3	6.14	1007	6.19	9 June 1966
7055	3732	2.80	7	6.10	1001	6.19	10 June 1966
7055	3732	2.90	5	5.89	1006	5.95	11 June 1966
7055	3732	2.78	11	6.14	1011	6.17	12 June 1966
7055	3732	2.71	13	6.30	1013	6.32	13 June 1966
7055	[illegible]32	2.79	6	6.12	1014	6.13	14 June 1966

Table 3: Summary of Recorder Scale Factors - Mutual Comparison Method
Meade River, Alaska

Standard Tank No.	Compared Tank No.	Number of Comparisons	Scale Factor Average	Bar. Press. mb	Adjusted R.S.F.	Date of Analysis
5752	0221	10	6.34			16 June 1966
5752	7055	10	6.09			
0221	7055	10	6.21	10.12	6.23	
5752	0221	20	6.40	09.98	6.52	24 June 1966
5752	0221	20	5.63	10.06	5.70	8 July 1966
5752	0221	20	5.78	10.09	5.82	17 July 1966
5752	0221	20	5.92	10.26	5.86	24 July 1966
5752	0221	20	6.42	10.24	6.37	9 August 1966
5752	0221	20	5.92	10.16	5.93	30 August 1966
5752	0221	20	5.62	10.14	5.63	9 September 1966

Table 4: Index Values of Reference Gases
Meade River, Alaska

Tank	2156	41133	41862	380026	47055	5532	5752	63732	0221	2015
Use	II†	W_2	W_3	*	II	II†	I	W_1	I_{HS}	W_4
U.W.$_1$	300.40	305.25	301.58	228.90	325.01			307.93	328.91	307.41
N.M.L.	300.08	305.85	302.88		325.42	262.17	287.33	308.71	329.45	
M.R.		304.37			325.29			308.50		
					325.19			307.28		
					325.29					
U.W.$_2$	300.31	306.08	302.95		325.35	261.62		308.56	329.16	
Average Index	300.26	305.39	302.47	228.90	325.26	261.89	287.33	308.19	329.17	307.41

*Not used.

II† Occasional secondary reference.

Table 5: Index Differences of Reference Gases Used to Determine Recorder Scale Factors - Meade River, Alaska

Standard Tank	Compared Tank	Index Differences
3732	5752	20.86
0221	7055	2.25
2015	5752	20.08
5752	5532	25.44
2015	5532	45.52
2156	5752	12.93
3732	2156	7.93
0221	3732	21.27
7055	3732	18.73
7055	2015	19.51
0221	5752	41.84
7055	5752	39.59

Table 6: Summary of Recorder Scale Factors - Sliding Recorder Scale Factors. Meade River, Alaska

Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor
May 25	5.26	June 18	6.48	July 12	5.70
26	4.67	19	6.49	13	5.70
27	4.65	20	6.50	14	5.70
28	5.00	21	6.50	15	5.70
29	5.15	22	6.50	16	5.70
30	5.30	23	6.50	17	5.72
31	5.50	24	6.50	18	5.73
		25	6.47	19	5.75
June 1	5.65	26	6.45	20	5.75
2	5.80	27	6.37	21	5.80
3	5 85	28	6.30	22	5.85
4	5.90	29	6.25	23	5.87
5	5.95	30	6.20	24	5.90
6	6.00			25	5.95
7	6.07	July 1	6.10	26	5.97
8	6.15	2	6.00	27	6.00
9	6.20	3	5.95	28	6.00
10	6.25	4	5.90	29	6.05
11	6.27	5	5.85	30	6.10
12	6.30	6	5.80	31	6.10
13	6.35	7	5.75		
14	6.40	8	5.70	August 1	6.10
15	6.43	9	5.70	2	6.15
16	6.45	10	5.70	3	6.17
17	6.47	11	5.70	4	6.20

Table 6: Summary of Recorder Scale Factors - Sliding Recorder Scale Factors. Meade River, Alaska

Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor
August 5	6.25	August 30	5.90
6	6.27	31	5.88
7	6.30		
8	6.30	September 1	5.85
9	6.30	2	5.80
10	6.30	3	5.80
11	6.30	4	5.75
12	6.30	5	5.75
13	6.30		
14	6.30		
15	6.30		
16	6.25		
17	6.25		
18	6.20		
19	6.15		
20	6.15		
21	6.15		
22	6.10		
23	6.10		
24	6.10		
25	6.10		
26	6.10		
27	6.00		
28	5.90		
29	5.90		

Table 7: Smoothed Recorder Scale Factors for Barrow CO_2 Analyzer
Barrow, Alaska (North Meadow Lake)

Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor
May 24	3.93	June 17	3.91	July 11	3.88
25	3.93	18	3.90	12	3.88
26	3.93	19	3.90	13	3.88
27	3.93	20	3.90	14	3.88
28	3.93	21	3.90	15	3.88
29	3.93	22	3.90	16	3.87
30	3.93	23	3.90	17	3.87
31	3.93	24	3.90	18	3.87
		25	3.89	19	3.87
June 1	3.93	26	3.89	20	3.87
2	3.93	27	3.89	21	3.87
3	3.93	28	3.89	22	3.87
4	3.93	29	3.89	23	3.87
5	3.93	30	3.89	24	3.87
6	3.92			25	3.87
7	3.92	July 1	3.89	26	3.88
8	3.92	2	3.89	27	3.88
9	3.92	3	3.89	28	3.88
10	3.92	4	3.88	29	3.89
11	3.91	5	3.88	30	3.89
12	3.91	6	3.88	31	3.89
13	3.91	7	3.88		
14	3.91	8	3.88	August 1	3.90
15	3.91	9	3.88	2	3.90
16	3.91	10	3.88	3	3.90

Table 7: Smoothed Recorder Scale Factors for Barrow CO_2 Analyzer Barrow, Alaska (North Meadow Lake)

Date 1966	Recorder Scale Factor	Date 1966	Recorder Scale Factor
4	3.91	August 29	4.01
5	3.91	30	4.01
6	3.92	31	4.02
7	3.92		
8	3.93	September 1	4.02
9	3.94	2	4.02
10	3.94	3	4.02
11	3.95	4	4.02
12	3.96	5	4.02
13	3.96	6	4.02
14	3.96	7	4.02
15	3.97	8	4.02
16	3.97	9	4.02
17	3.97	10	4.02
18	3.98		
19	3.98		
20	3.98		
21	3.98		
22	3.99		
23	3.99		
24	3.99		
25	4.00		
26	4.00		
27	4.00		
28	4.01		

Table 8: Daily Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
May 24, 1966	322.9	325.4	321.3	323.4
25	322.9	325.4	320.9	322.9
26	321.1	323.2	320.9	322.9
27	319.7	321.5	321.0	323.1
28	321.3	323.4	321.1	323.2
29	322.6	325.0	321.3	323.4
30	323.3	325.9	321.6	323.8
31	324.3	327.1	322.1	324.4
June 1	323.0	325.5	321.3	323.4
2	321.9	324.2	321.2	323.3
3	319.9	321.7	321.2	323.3
4	320.9	322.9	320.8	322.8
5	322.6	325.0	-----	-----
6	320.4	322.3	321.0	323.1
7	321.6	323.8	321.0	323.1
8	320.8	322.8	320.9	322.9
9	321.3	323.4	320.9	322.9
10	321.4	323.6	320.7	322.7
11	321.4	323.6	-----	-----

Table 8: Daily Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
June 12, 1966	321.3	323	-----	-----
13	322.9	325.4	-----	-----
14	321.1	323.2	320.1	322.0
15	-----	-----	320.5	322.5
16	321.1	323.2	320.5	322.5
17	320.9	322.9	320.2	322.1
18	320.0	321.9	-----	-----
19	320.1	322.0	320.0	321.9
20	320.3	322.2	320.0	321.9
21	320.6	322.6	320.3	322.2
22	318.8	320.4	319.1	320.8
23	319.3	321.0	319.4	321.1
24	317.5	318.8	318.8	320.4
25	319.0	320.6	319.9	321.7
26	319.1	320.8	318.8	320.4
27	318.8	320.4	319.3	321.0
28	318.3	319.8	318.1	319.5
29	317.2	318.4	318.7	320.3
30	317.3	318.6	317.5	318.8

Table 8: Daily Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 1, 1966	316.8	318.0	317.4	318.7
2	317.0	318.2	318.5	320.0
3	317.7	319.0	318.6	320.1
4	316.9	318.1	318.2	319.7
5	315.8	316.7	318.5	320.0
6	315.7	316.6	318.3	319.8
7	315.0	315.8	317.1	318.3
8	312.6	312.8	315.7	316.6
9	313.0	313.3	314.5	315.1
10	315.1	315.9	316.3	317.3
11	312.5	312.7	314.4	315.0
12	311.8	311.9	314.2	314.8
13	314.5	315.1	313.8	314.3
14	312.0	312.1	313.4	313.8
15	312.4	312.6	312.0	312.1
16	312.0	312.1	312.4	312.6
17	310.7	310.5	313.3	313.7
18	312.6	312.8	314.5	315.1
19	310.9	310.8	313.5	313.9
20	312.8	313.1	312.5	312.7

Table 8: Daily Average Index of Carbon Dioxide (ppm)
Manometric Concentration Scale

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 21, 1966	311.1	311.0	310.9	310.8
22	310.5	310.3	314.1	314.7
23	312.1	312.2	313.8	314.3
24	312.3	312.5	313.3	313.7
25	313.7	314.2	314.0	314.5
26	313.5	313.9	314.1	314.7
27	313.7	314.2	314.2	314.8
28	314.0	314.5	314.2	314.8
29	313.2	313.6	313.4	313.8
30	312.6	312.8	313.0	313.3
31	311.4	311.4	310.9	310.8
August 1, 1966	311.4	311.4	312.0	312.1
2	309.5*	309.1*	312.3	312.5
3	308.8*	308.2*	312.1	312.2
4	308.1*	307.3*	311.8	311.9
5	309.5*	309.1*	311.3	311.2
6	308.3*	307.6*	311.5	311.5
7	308.6*	308.0*	311.7	311.7
8	312.7	313.0	312.0	312.1

*not used.

Table 8: Daily Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
August 9, 1966	312.5	312.7	311.4	311.4
10	312.5	312.7	311.5	311.5
11	312.4	312.6	311.1	311.0
12	312.4	312.6	311.1	311.0
13	312.6	312.8	311.1	311.0
14	312.5	312.7	311.1	311.0
15	311.2	311.1	310.2	309.9
16	311.0	310.9	310.5	310.3
17	311.4	311.4	310.2	309.9
18	311.1	311.0	310.2	309.9
19	310.5	310.3	310.3	310.0
20	311.1	311.0	310.7	310.5
21	311.9	312.0	311.3	311.2
22	311.3	311.2	310.9	310.8
23	313.5	313.9	310.9	310.8
24	310.9	310.8	310.8	310.6
25	313.6	314.1	310.9	310.8
26	312.5	312.7	311.9	312.0
27	314.7	315.4	311.2	311.1
28	310.6	310.4	310.1	309.8

Table 8: Daily Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration			
	Meade River		North Meadow Lake	
	Index	Manometric(ppm)	Index	Manometric(ppm)
August 29, 1966	309.9	309.5	310.1	309.8
30	310.2	309.9	310.2	309.9
31	310.4	310.2	310.3	310.0
September 1, 1966	310.0	309.7	310.3	310.0
2	309.7	309.3	310.0	309.7
3	309.9	309.5	310.1	309.8
4	309.6	309.2	309.7	309.3
5	311.2	311.1	310.9	310.8
6	310.4	310.2	311.5	311.5
7	309.6	309.2	309.8	309.4
8	312.1	312.2	311.3	311.2
9	309.8	309.4	310.3	310.0
10	310.0	309.7	310.9	310.8

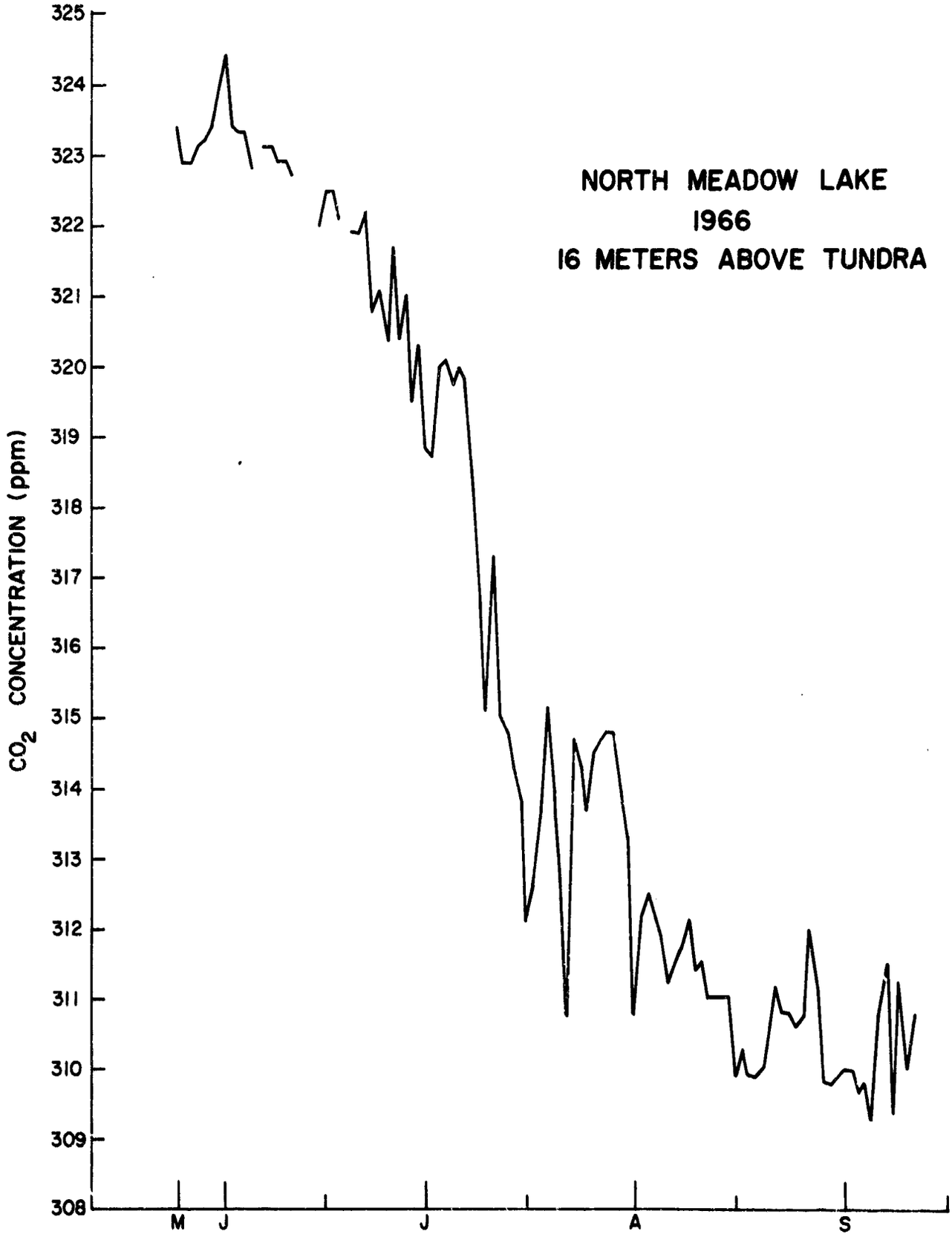

Figure 3. Daily Average CO_2 Concentration (ppm) at 16 m, North Meadow Lake, 1966.

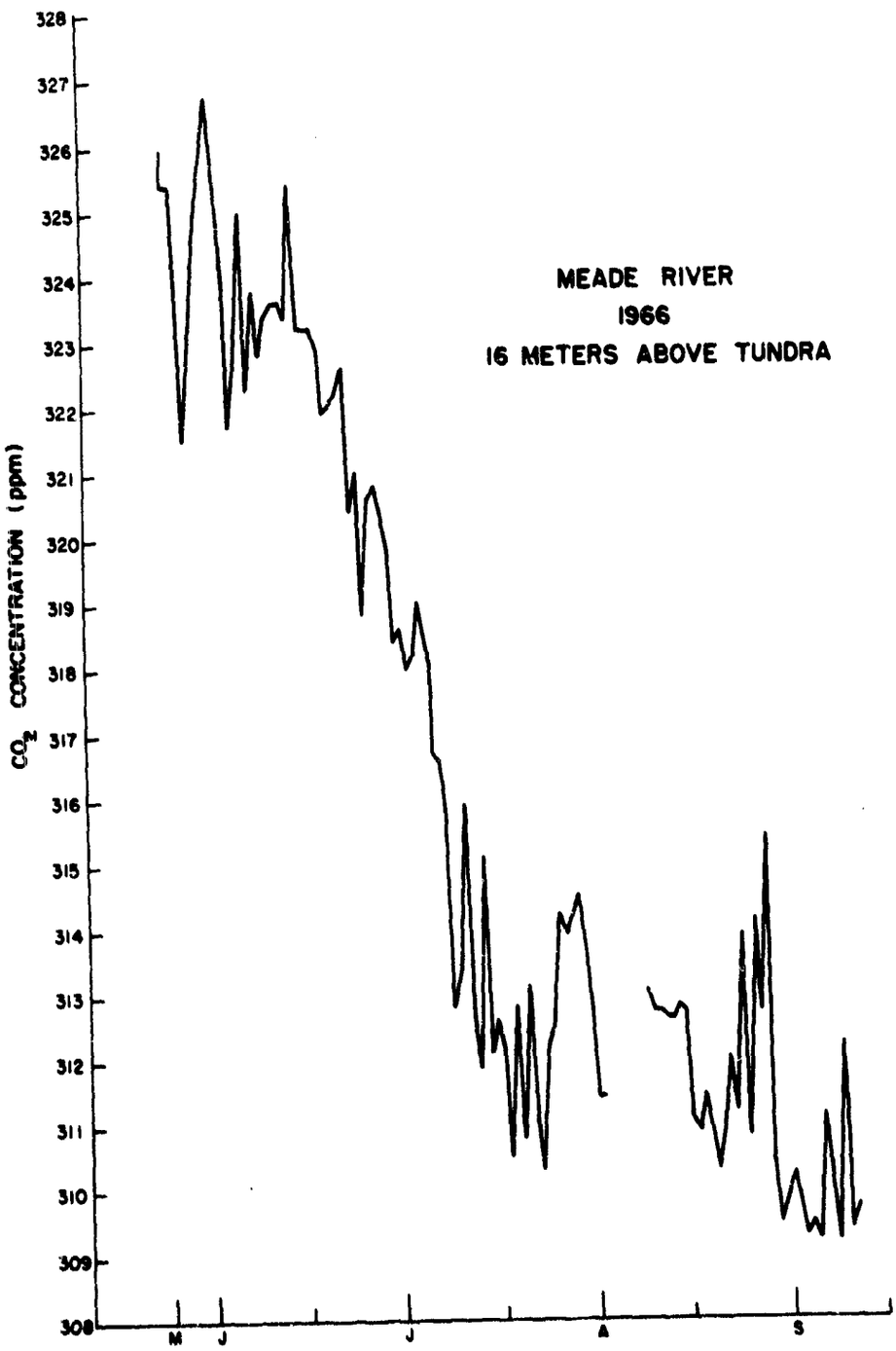

Figure 4. Daily Average CO_2 Concentration (ppm) at 16 m, North Meade River, 1966.

Table 9: Weekly Average Index of Carbon Dioxide (ppm) 16 meters
Manometric Concentration Scale

Date	CO_2 Concentration			
	Meade River		North Meadow Lake	
	Index	Manometric(ppm)	Index	Manometric(ppm)
5/22 - 5/28, 1966	321.6	323.8	321.0	323.1
5/29 - 6/4	322.3	324.6	321.4	323.5
6/5 - 6/11	321.3	323.5	320.9	322.9
6/12 - 6/18	321.2	323.3	320.3	322.3
6/19 - 6/25	319.4	321.1	319.6	321.4
6/26 - 7/2	317.8	319.2	318.3	319.8
7/3 - 7/9	315.2	316.0	317.3	318.5
7/10 - 7/16	312.9	313.2	313.8	314.3
7/17 - 7/23	311.5	311.5	313.2	313.6
7/24 - 7/30	313.3	313.7	313.7	314.2
7/31 - 8/6	311.4	311.4	311.7	311.7
8/7 - 8/13	312.5	312.7	311.4	311.4
8/14 - 8/20	311.2	311.2	310.5	310.2
8/21 - 8/27	312.6	312.9	311.1	311.0
8/28 - 9/3	310.1	309.8	310.2	309.9
9/4 - 9/10	310.4	310.1	310.6	310.4

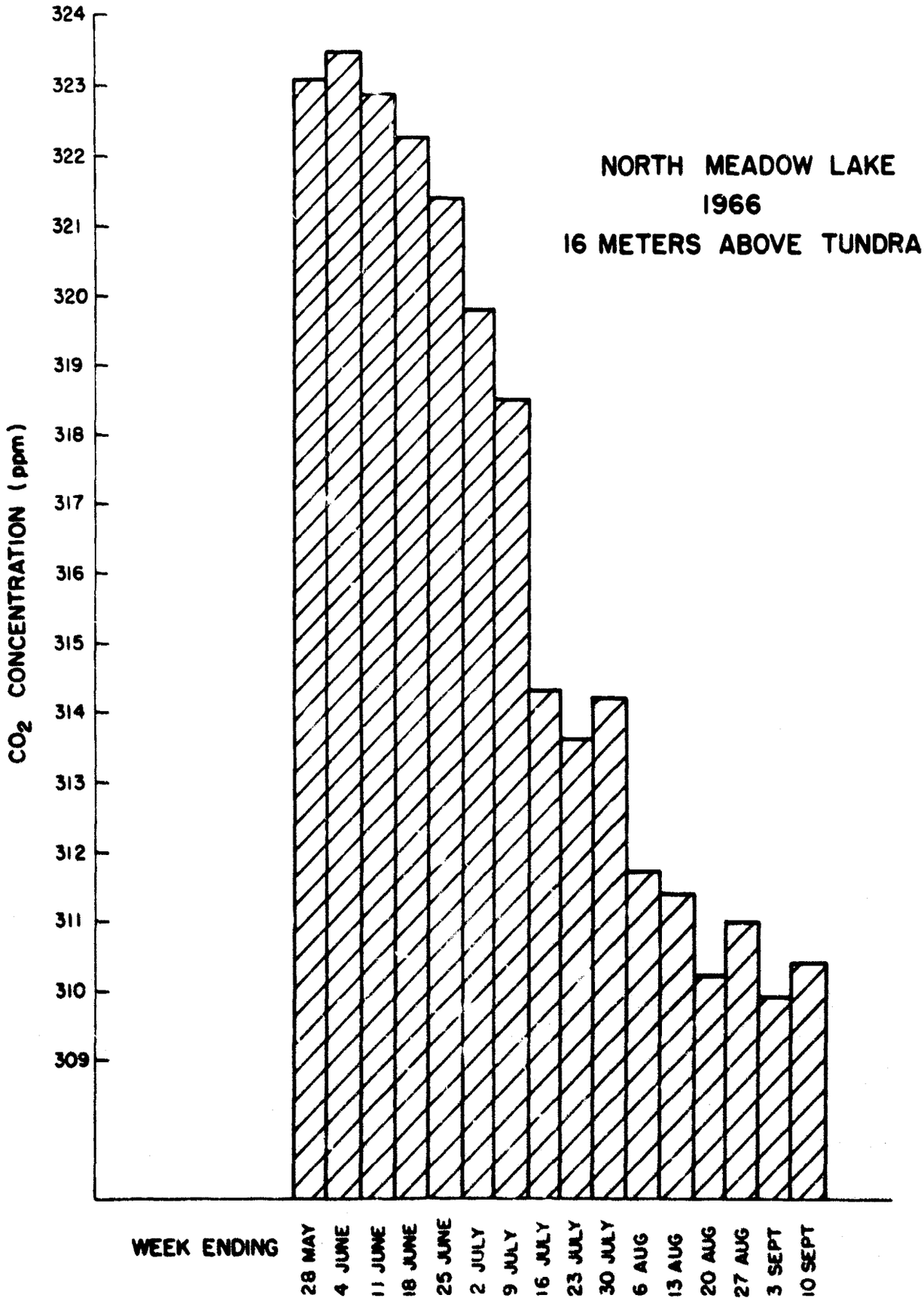

Figure 5. Weekly Average CO_2 Concentration (ppm) at 16 m, North Meadow Lake, 1966.

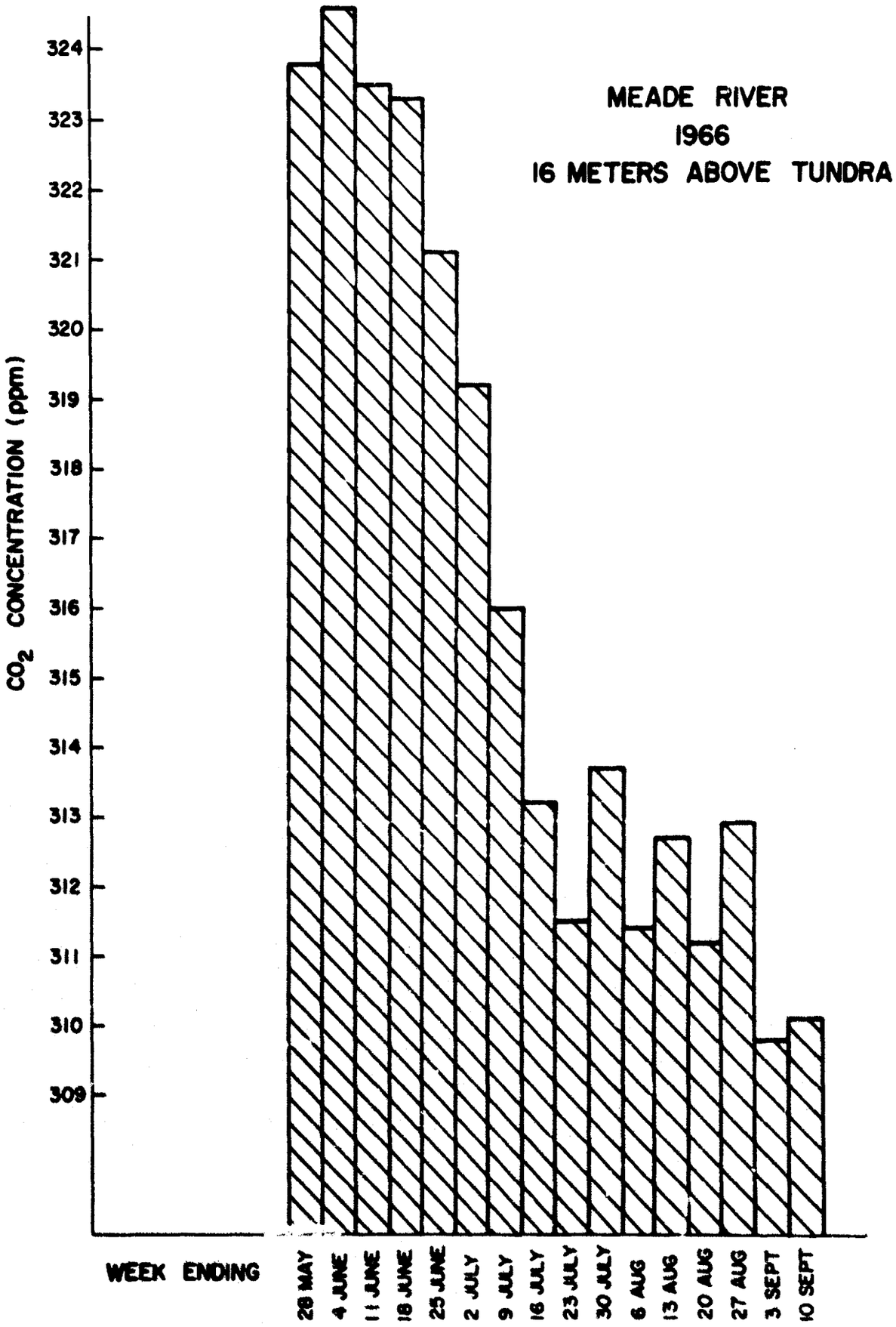

Figure 6. Weekly Average CO_2 Concentration (ppm) at 16 m, Meade River, 1966.

Table 10: Monthly Average Index of Carbon Dioxide (ppm) - Manometric Concentration Scale
Meade River and North Meadow Lake, Alaska

Date	CO_2 Concentration Manometric (ppm) Meade River	16 meters North Meadow Lake
1966		
June	322.2	321.9
July	313.8	315.3
August	311.9	310.9
Average	316.0	316.0

Table 11: Concentration of CO_2 with Wind Direction
Meade River and North Meadow Lake, Alaska

15° (360 to 70)

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 2, 1966	318.5	320.0	317.0	318.2
7	317.1	318.3	315.0	315.8
12	314.2	314.8	311.8	311.9
23	313.9	314.4	312.1	312.2
26	314.1	314.7	313.5	313.9
27	314.2	314.8	317.7	314.2
August 8	311.9	312.0	312.7	313.0
9	311.4	311.4	312.5	312.7
17	310.2	309.9	311.4	311.4
18	310.2	309.9	311.1	311.0
19	310.3	310.0	310.5	310.3
20	310.7	310.5	311.1	311.0
28	310.1	309.8	310.6	310.4
29	310.1	309.8	309.9	309.6
30	310.2	309.9	310.2	309.9
31	310.3	310.0	310.4	310.2
September 1	310.3	310.0	310.0	309.7
2	310.0	309.7	309.8	309.4
Average	312.1	312.2	311.9	311.9

Table 11: Concentration of CO_2 with Wind Direction
Meade River and North Meadow Lake, Alaska

195° (140 to 210)

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
June 20, 1966	319.9	321.7	320.3	322.2
21	320.3	322.2	320.6	322.6
29	318.6	320.2	317.2	318.4
July 9	314.5	315.2	313.0	313.3
19	313.5	313.9	310.9	310.8
August 25	310.9	310.8	313.6	314.1
26	311.9	312.0	312.6	312.8
Average	315.7	316.6	315.5	316.3

Table 12: Daily Average Index of Carbon Dioxide (ppm) Manometric Concentration Scale

Ground Level

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
May 24, 1966	323.2	325.8	329.2	333.1
25	322.9	325.4	339.6	345.7
26	321.1	323.2	340.3	346.6
27	320.7	322.7	338.4	344.3
28	321.8	324.1	342.4	349.1
29	322.7	325.2	342.1	8.8
30	324.5	327.3	344.4	351.6
31	324.8	327.7	341.5	348.1
June 1, 1966	323.2	325.8	334.7	339.8
2	322.6	325.0	333.8	338.7
3	320.3	322.2	363.0	374.3
4	322.2	324.5	403.3	423.4
5	323.4	326.0	-----	-----
6	320.7	322.7	366.8	378.9
7	321.4	323.6	347.9	355.8
8	320.9	323.0	373.6	387.2
9	321.3	323.4	375.1	389.0
10	322.1	324.4	383.9	399.7
11	322.2	324.5	-----	-----
12	322.7	325.2	-----	-----

Table 12: Daily Average Index of Carbon Dioxide (ppm) Ground Level
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meade Lake Index	North Meade Lake Manometric(ppm)
June 13, 1966	323.8	326.5	-----	-----
14	322.5	324.9	321.4	323.6
15	-----	-----	323.1	325.6
16	323.0	325.5	321.2	323.2
17	321.7	323.9	320.2	322.1
18	320.5	322.5	-----	-----
19	320.7	322.7	355.6	365.2
20	320.5	322.5	334.0	338.9
21	321.3	323.4	329.0	332.8
22	321.2	323.3	319.9	321.7
23	319.4	321.1	337.3	342.9
24	318.4	319.9	337.9	343.7
25	319.7	321.5	320.3	322.2
26	319.5	321.3	318.8	320.4
27	319.5	321.3	319.9	321.7
28	322.0	324.3	318.7	320.3
29	317.8	319.2	319.5	321.2
30	318.1	319.5	318.2	319.7

Table 12: Daily Average Index of Carbon Dioxide (ppm) Ground Level
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 1, 1966	316.7	317.8	317.3	318.6
2	317.3	318.6	318.5	320.0
3	317.2	318.4	318.6	320.1
4	316.9	318.1	318.2	319.7
5	315.7	316.6	318.5	320.0
6	316.2	317.2	319.7	321.5
7	314.4	315.0	319.9	321.7
8	313.1	313.5	316.0	317.0
9	313.0	313.3	314.1	314.7
10	314.6	315.3	316.3	317.3
11	312.1	312.2	314.5	315.1
12	312.4	312.6	314.0	314.5
13	315.2	316.0	313.6	314.1
14	311.8	311.9	313.1	313.4
15	311.6	311.6	311.3	311.2
16	312.6	312.8	312.2	312.3
17	310.5	310.3	312.8	313.1
18	313.0	313.3	313.9	314.4
19	312.8	313.1	315.0	315.8
20	314.1	314.7	313.7	314.2

Table 12: Daily Average Index of Carbon Dioxide (ppm)
Manometric Concentration Scale

Ground Level

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 21, 1966	310.9	310.8	310.3	310.0
22	309.9	309.6	313.7	314.2
23	312.7	313.0	313.9	314.4
24	310.4	310.2	312.4	312.6
25	313.2	313.6	310.8	310.6
26	313.8	314.3	313.5	313.9
27	313.8	314.3	313.5	313.9
28	314.4	315.0	313.9	314.4
29	313.8	314.3	313.4	313.8
30	312.2	312.4	312.9	313.2
31	312.9	313.2	311.0	310.9
August 1	313.6	314.1	311.5	311.5
2	317.7*	319.1*	312.1	312.2
3	309.4*	308.9*	311.7	311.7
4	308.1*	307.4*	311.3	311.2
5	310.5*	310.3*	310.8	310.6
6	308.3*	307.6*	311.1	311.0
7	308.9*	308.3*	311.4	311.4
8	313.7	314.2	312.0	312.1

*Not used.

Table 12: Daily Average Index of Carbon Dioxide (ppm) Manometric Concentration Scale

Ground Level

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
August 9, 1965	312.7	313.0	310.8	310.6
10	313.0	313.3	311.3	311.2
11	312.6	312.8	311.0	310.9
12	312.8	313.1	311.0	310.9
13	313.1	313.5	311.2	311.1
14	318.0	319.4	311.2	311.1
15	312.9	313.2	310.3	310.0
16	311.7	311.7	310.4	310.2
17	312.3	312.5	310.3	310.0
18	312.1	312.2	310.1	309.8
19	311.2	311.1	310.3	310.0
20	312.3	312.5	311.3	311.2
21	314.8	315.5	312.7	313.0
22	318.1	319.5	311.6	311.6
23	318.9	320.5	311.3	311.2
24	312.6	312.8	311.5	311.5
25	315.1	315.9	314.3	314.9
26	314.3	314.9	313.4	313.8
27	319.6	321.4	311.8	311.9
28	311.6	311.6	310.3	310.0
29	310.4	310.2	310.4	310.2

Table 12: Daily Average Index of Carbon Dioxide (ppm) Ground Level
Manometric Concentration Scale

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
August 30, 1966	311.0	310.9	310.5	310.3
31	311.0	310.9	310.5	310.3
September 1, 1966	310.5	310.3	310.3	310.0
2	310.1	309.8	310.1	309.8
3	310.3	310.0	310.1	309.8
4	312.9	313.2	310.3	310.0
5	318.5	320.0	314.9	315.6
6	311.8	311.9	313.0	313.3
7	311.2	311.1	310.2	309.9
8	313.0	313.3	311.7	311.7
9	310.7	310.5	310.6	310.4
10	310.8	310.6	311.0	310.9

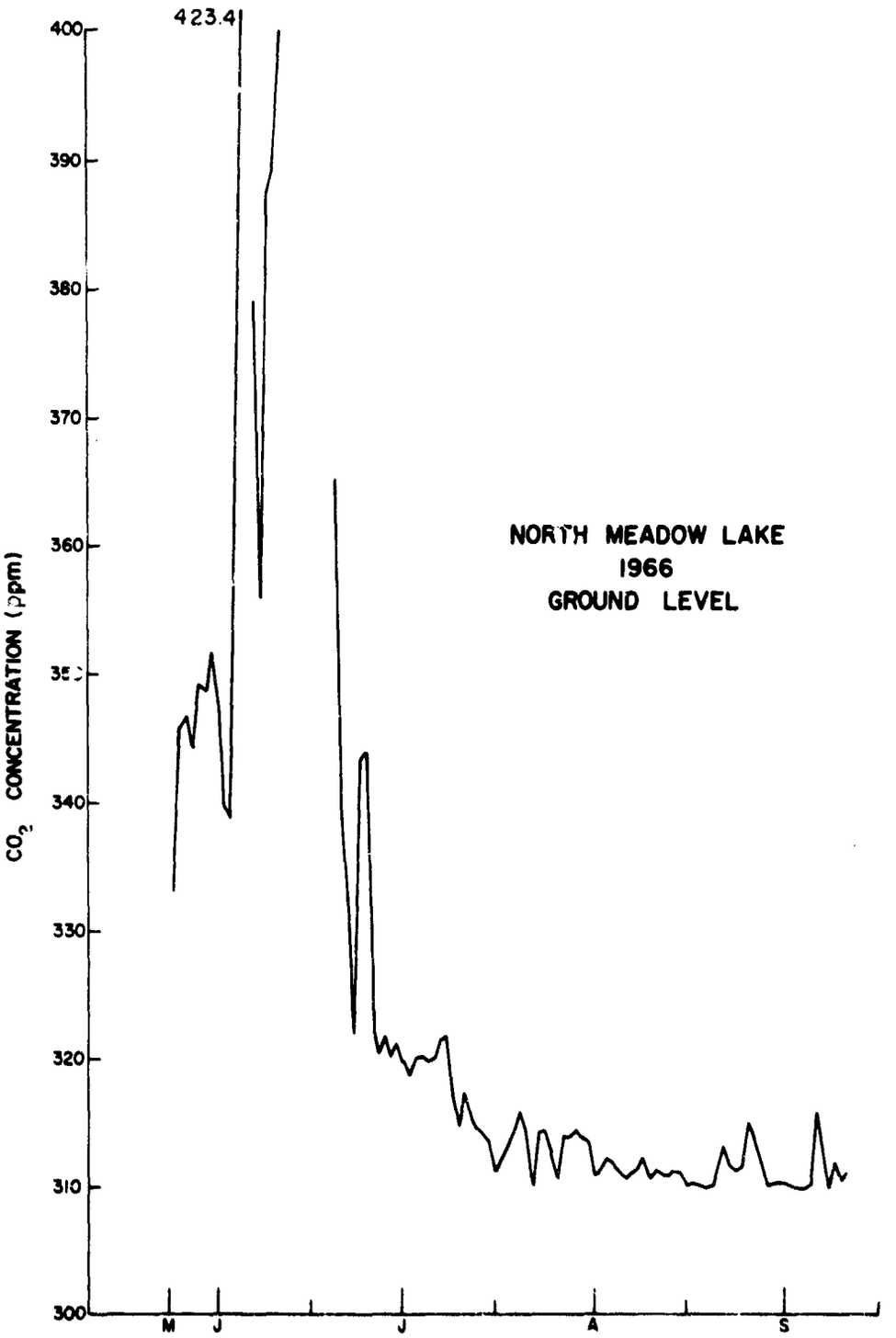

Figure 7. Daily Average CO_2 Concentration (ppm) at Ground Level, North Meadow Lake, 1966.

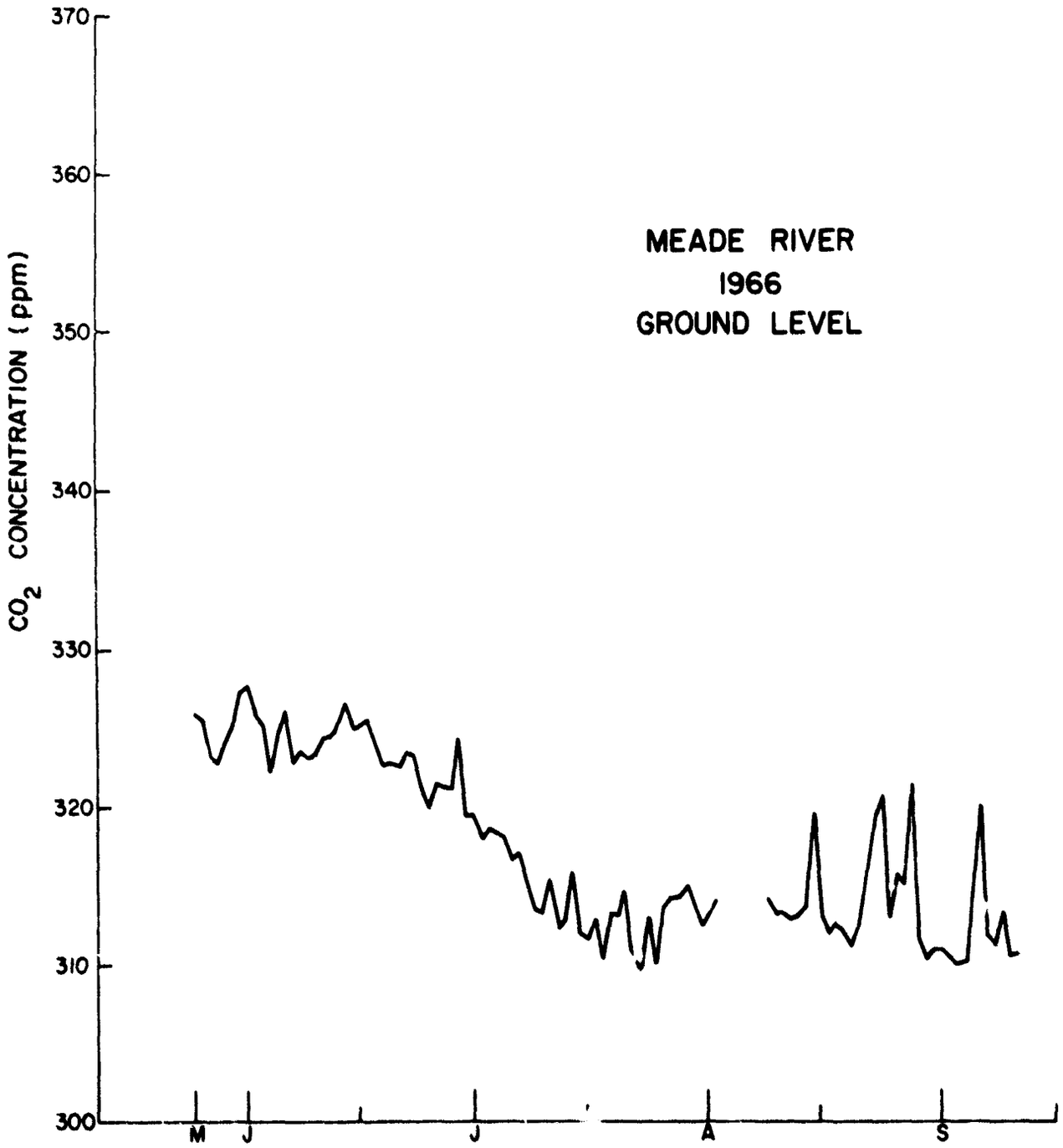

Figure 8. Daily Average CO_2 Concentration (ppm) at Ground Level, Meade River, Alaska, 1966.

Table 13: Weekly Average Index of Carbon Dioxide (ppm) Ground Level
Manometric Concentration Scale

Date	CO_2 Concentration			
	Meade River		North Meadow Lake	
	Index	Manometric(ppm)	Index	Manometric(ppm)
1966				
5/22-5/28	321.9	324.2	338.0	343.8
5/29-6/4	322.9	325.4	351.8	360.7
6/5-6/11	321.7	323.9	369.5	382.1
6/12-6/18	322.4	324.7	321.5	323.6
6/19-6/25	320.2	322.0	333.4	338.2
6/26-7/2	318.7	320.3	318.7	320.3
7/3-7/9	315.2	316.0	317.8	319.2
7/10-7/16	312.9	313.2	313.6	314.0
7/17-7/23	312.0	312.1	313.3	313.7
7/24-7/30	313.1	313.4	312.9	313.2
7/31-8/6	313.2	313.6	311.3	311.3
8/7-8/13	313.0	313.3	311.2	311.2
8/14-8/20	312.9	313.7	310.5	310.3
8/21-8/27	316.2	317.2	312.4	312.5
8/28-9/3	310.7	310.5	310.3	310.0
9/4-9/10	312.7	312.9	311.7	311.7

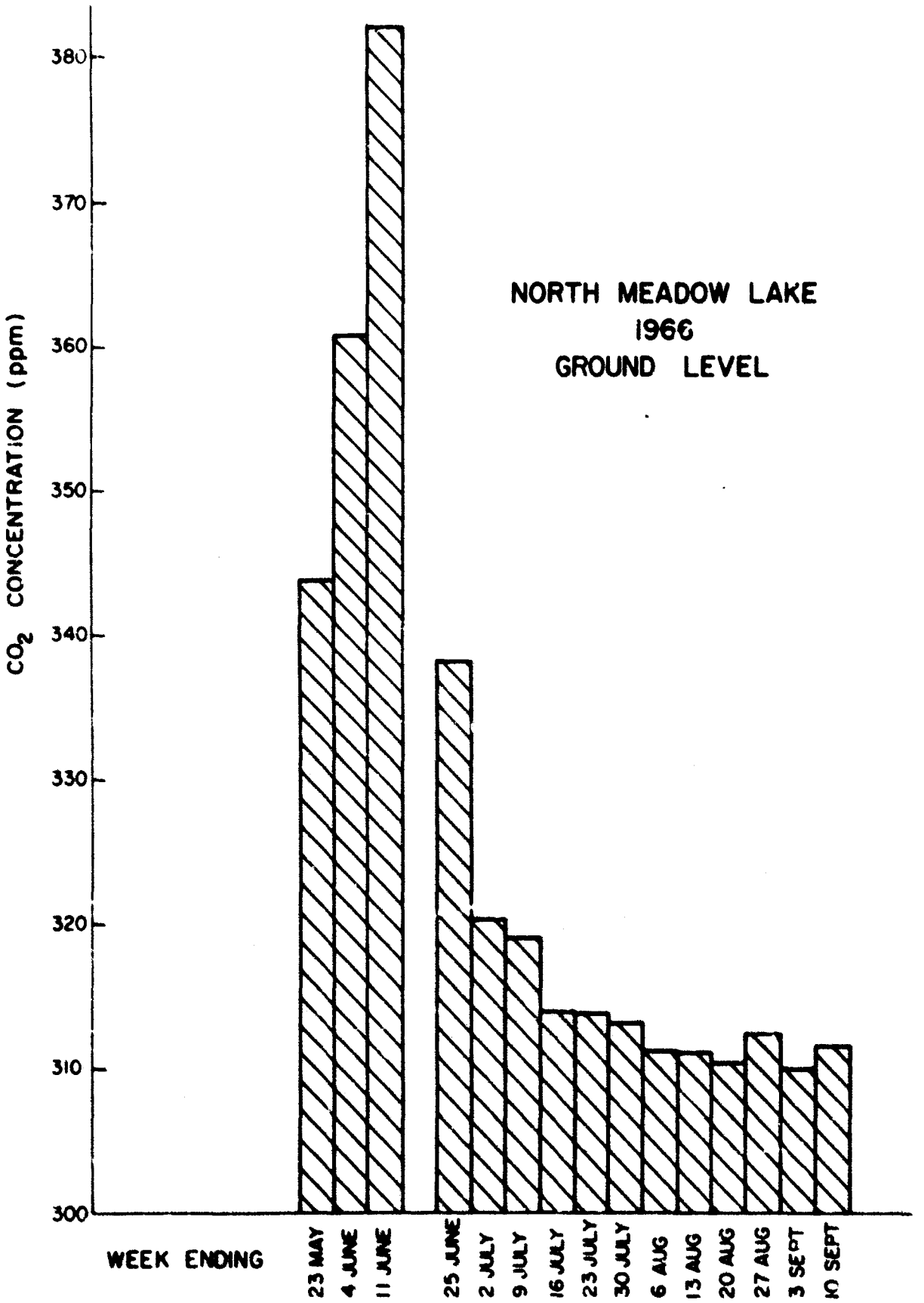

Figure 9. Weekly Average Concentration (ppm) at Ground Level, North Meadow Lake, 1966.

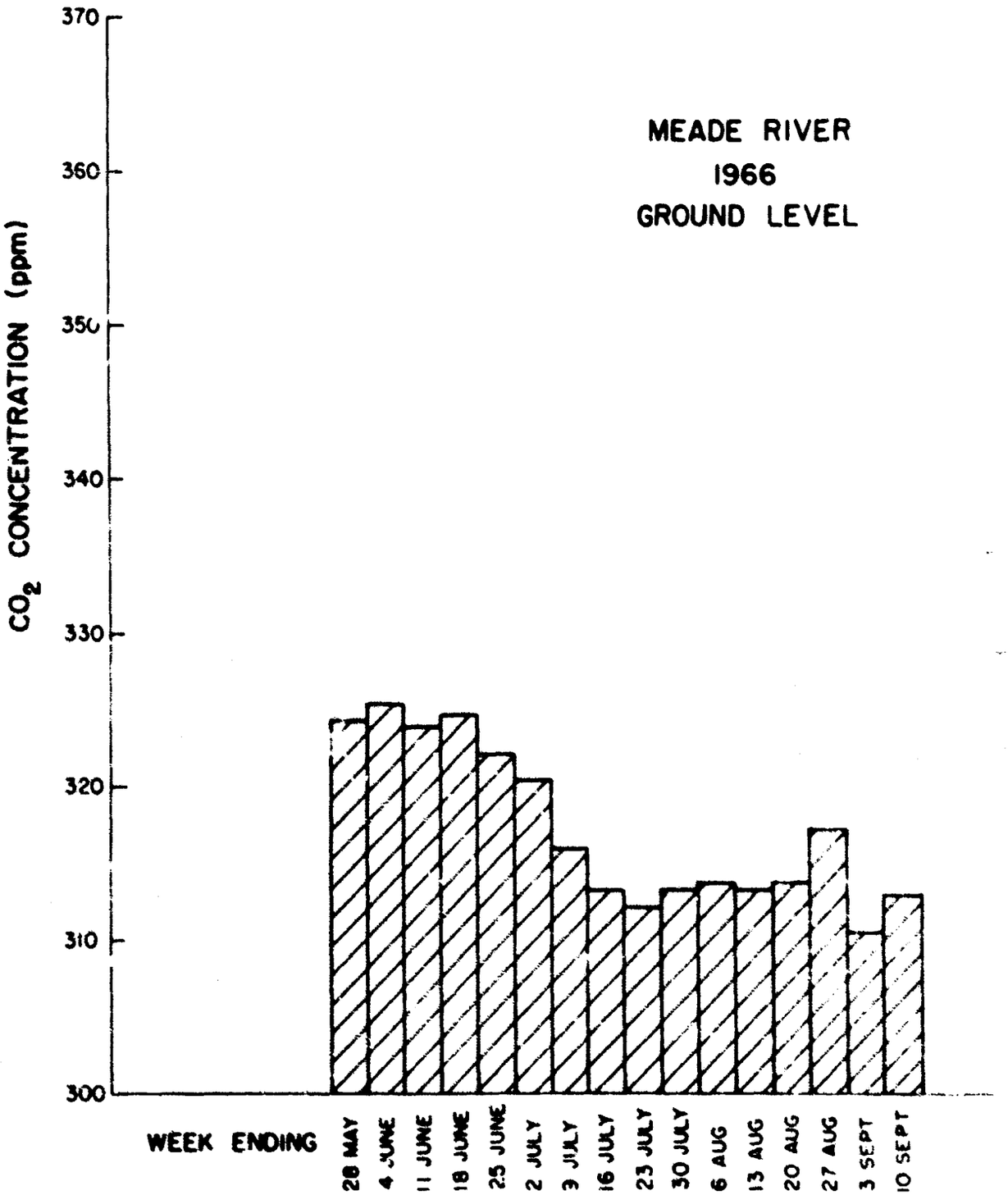

Figure 10. Weekly Average Concentration (ppm) at Ground Level, Meade River, 1966.

Table 14: Monthly Average Index of Carbon Dioxide (ppm)
Manometric Conce.tration Scale

Ground Level

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manom.cric(ppm)
1966				
June	321.1	323.2	339.9	346.1*
July	313.6	314.0	314.6	315.2
August	313.6	314.0	311.3	311.2
Average	316.1	317.1	321.9	324.2
Average for July, August	313.6	314.0	312.9	313.2

* CO_2 in air sampled under a snow cover.

Table 15: Three Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
May 26, 1966	322.3	324.7	321.0	323.1
27	321.2	323.3	320.9	322.9
28	320.7	322.7	321.0	323.1
29	321.2	323.3	321.1	323.2
30	322.4	324.8	321.3	323.4
31	323.4	326.0	321.7	323.9
June 1, 1966	323.5	326.1	321.7	323.9
2	323.1	325.6	321.5	323.7
3	321.6	323.8	321.2	323.3
4	320.9	322.9	321.1	323.2
5	321.1	323.2	321.0	323.1
6	321.3	323.4	320.9	322.9
7	321.5	323.7	321.0	323.1
8	320.9	322.9	321.0	323.1
9	321.2	323.3	320.9	322.9
10	321.2	323.3	320.8	322.8
11	321.4	323.6	320.8	322.8
12	321.4	323.6	320.7	322.7
13	321.9	324.2	-----	-----
14	321.8	324.0	320.1	322.0

Table 15: Three Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
June 15, 1966	322.0	324.3	320.3	322.2
16	321.1	323.2	320.4	322.3
17	321.0	323.1	320.4	322.3
18	320.7	322.7	320.3	322.2
19	320.3	322.2	320.1	322.0
20	320.1	322.0	320.0	321.9
21	320.3	322.2	320.1	322.0
22	319.9	321.7	319.8	321.6
23	319.6	321.4	319.6	321.4
24	318.5	320.0	319.1	320.8
25	318.6	320.1	319.4	321.1
26	318.5	320.0	319.2	320.9
27	319.0	320.6	319.3	321.0
28	318.7	320.3	318.7	320.3
29	318.1	319.5	318.7	320.3
30	317.6	318.9	318.1	319.5
July 1, 1966	317.1	318.3	317.9	319.3
2	317.0	318.2	317.8	319.2
3	317.2	318.4	318.2	319.7

Table 15: Three Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 4, 1966	317.2	318.4	318.4	319.9
5	316.8	318.0	318.4	319.9
6	316.1	317.1	318.3	319.8
7	315.5	316.4	318.0	319.4
8	314.4	315.0	317.0	318.2
9	313.5	313.9	315.8	316.7
10	313.6	314.1	315.5	316.4
11	313.5	313.9	315.1	315.9
12	313.1	313.4	315.0	315.8
13	312.9	313.2	314.1	314.7
14	312.8	313.1	313.8	314.3
15	313.0	313.3	313.1	313.4
16	312.1	312.2	312.6	312.6
17	311.7	311.7	312.[illegible]	312.8
18	311.8	311.9	313.4	313.8
19	311.4	311.4	313.8	314.3
20	312.1	312.2	313.5	313.9
21	311.6	311.6	312.3	312.5
22	311.5	311.5	312.5	312.7
23	311.2	311.1	312.9	313.2

Table 15: Three Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 24, 1966	311.6	311.6	313.7	314.2
25	312.7	313.0	313.7	314.2
26	313.2	313.6	313.8	314.3
27	313.6	314.1	314.1	314.7
28	313.7	314.2	314.2	314.8
29	313.6	314.1	313.9	314.4
30	313.3	313.7	313.5	313.9
31	312.4	312.6	312.4	312.6
August 1, 1966	311.8	311.9	312.0	312.1
2	311.4	311.4	311.7	311.7
3	-----	-----	312.1	312.2
4	-----	-----	312.1	312.2
5	-----	-----	311.7	311.7
6	-----	-----	311.5	311.5
7	-----	-----	311.5	311.5
8	312.7	313.0	311.7	311.7
9	312.6	312.8	311.7	311.7
10	312.6	312.8	311.6	311.6
11	312.5	312.7	311.3	311.2
12	312.4	312.6	311.2	311.1

Table 15: Three Day Running Mean Concentration Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
August 13, 1966	312.5	312.7	311.1	311.0
14	312.5	312.7	311.1	311.0
15	312.1	312.2	310.8	310.6
16	311.6	311.6	310.6	310.4
17	311.2	311.1	310.3	310.0
18	311.2	311.1	310.3	310.0
19	311.0	310.9	310.2	309.9
20	310.9	310.8	310.4	310.2
21	311.2	311.1	310.8	310.6
22	311.4	311.4	311.0	310.9
23	312.2	312.3	311.0	310.9
24	311.9	312.0	310.9	310.8
25	312.7	313.0	310.9	310.8
26	312.3	312.5	311.2	311.1
27	313.6	314.1	311.3	311.2
28	312.6	312.8	311.1	311.0
29	311.7	311.7	310.5	310.3
30	310.2	309.9	310.1	309.8
31	310.2	309.9	310.2	309.9

Table 15: Three Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration			
	Meade River		North Meadow Lake	
	Index	Manometric(ppm)	Index	Manometric(ppm)
September 1, 1966	310.2	309.9	310.3	310.0
2	310.0	309.7	310.2	309.9
3	309.9	309.5	310.1	309.8
4	309.7	309.3	309.9	309.5
5	310.2	309.9	310.2	309.3
6	310.4	310.2	310.7	310.5
7	310.4	310.2	310.7	310.5
8	310.7	310.5	310.9	310.8
9	310.5	310.3	310.5	310.3
10	310.6	310.4	310.8	310.6

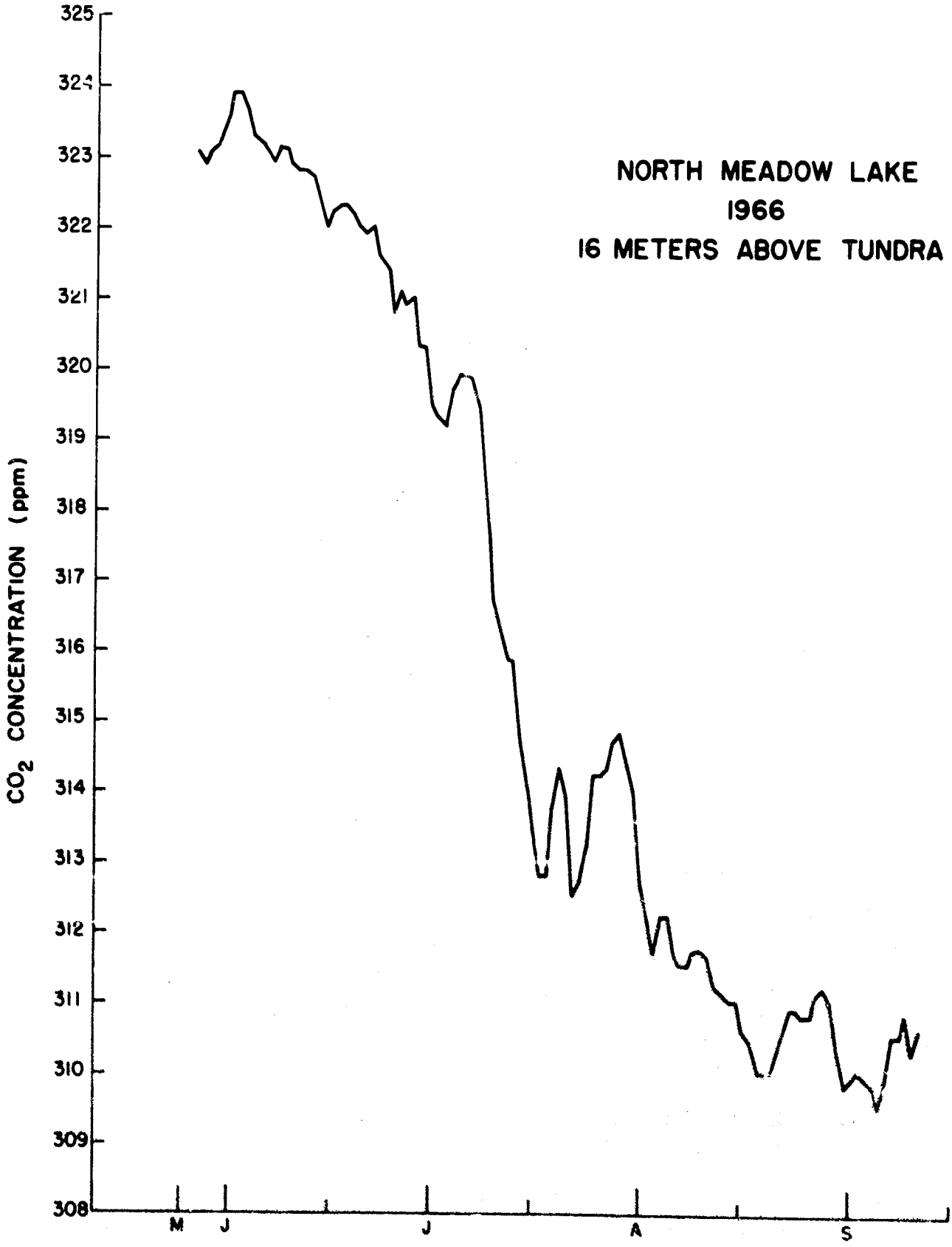

Figure 11. Three Day Running Mean of CO_2 Concentration at 16 m, North Meadow Lake, 1966.

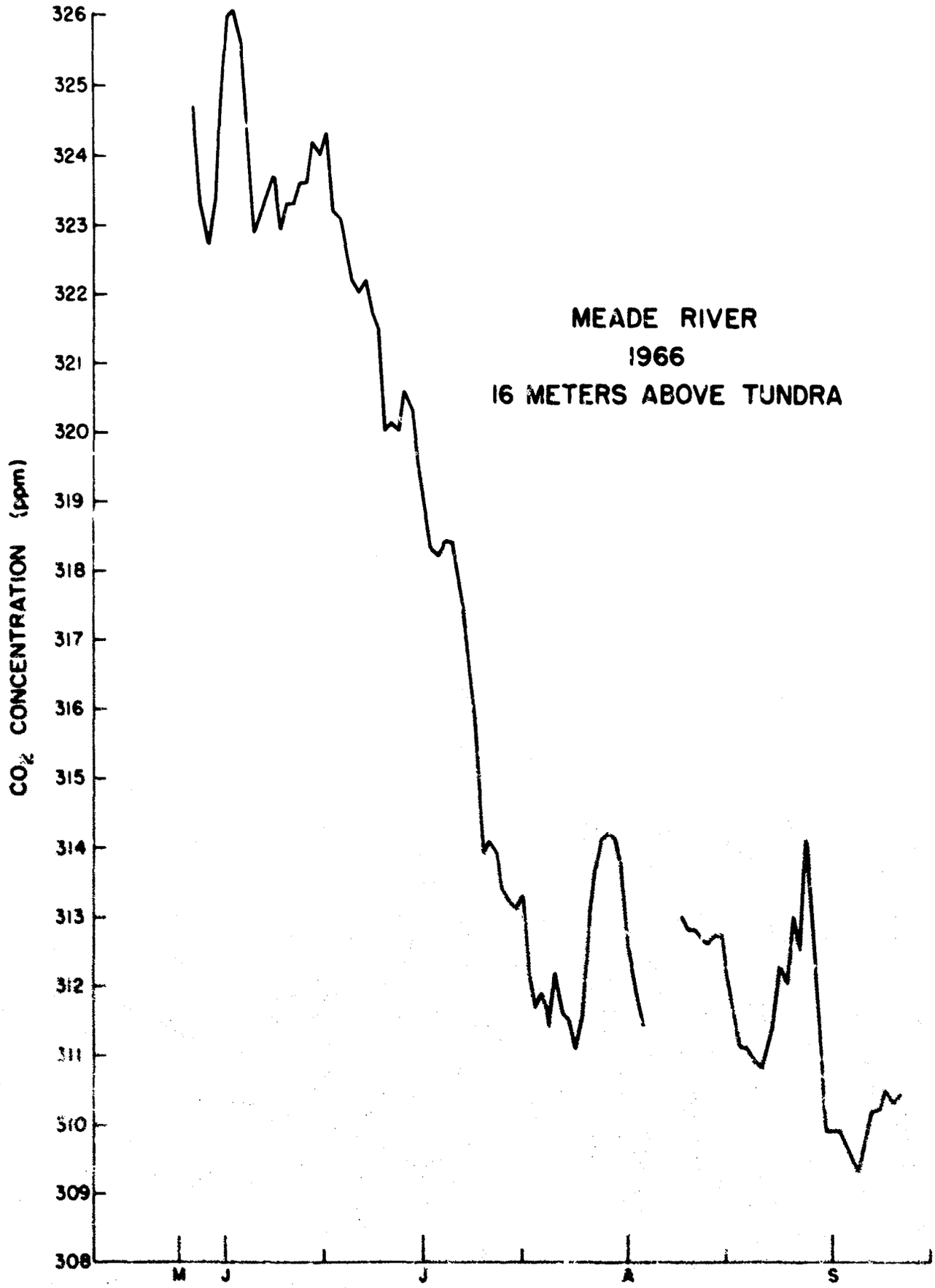

Figure 12. Three Day Running Mean of CO_2 Concentrations at 16 m, Meade River, 1966.

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
May 29, 1966	321.7	323.9	321.1	323.2
30	321.8	324.0	321.1	323.2
31	322.0	324.3	321.3	323.4
June 1, 1966	322.4	324.8	321.4	323.6
2	322.7	325.1	321.4	323.6
3	322.5	324.9	321.4	323.6
4	322.2	324.5	321.4	323.6
5	322.1	324.4	321.3	323.4
6	321.4	323.6	321.1	323.2
7	321.2	323.3	321.0	323.1
8	321.0	323.1	321.0	323.1
9	321.3	323.4	320.9	322.9
10	321.3	323.4	320.9	322.9
11	321.1	323.2	320.9	322.9
12	321.3	323.4	320.9	322.9
13	321.5	323.7	320.8	322.8
14	321.6	323.8	320.6	322.6
15	321.6	323.8	320.4	322.3
16	321.6	323.8	320.4	322.3

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric (ppm)	North Meadow Lake Index	North Meadow Lake Manometric (ppm)
June 17, 1966	321.5	323.7	320.3	322.2
18	321.2	323.3	320.3	322.2
19	320.6	322.5	320.3	322.2
20	320.5	322.5	320.2	322.1
21	320.5	322.5	320.2	322.1
22	320.1	322.0	319.9	321.7
23	319.8	321.6	319.8	321.6
24	319.4	321.1	319.6	321.4
25	319.2	320.5	319.6	321.4
26	319.0	320.6	319.4	321.1
27	318.7	320.3	319.2	320.9
28	318.7	320.3	319.0	320.6
29	318.3	319.8	318.9	320.5
30	318.3	319.8	318.7	320.3
July 1, 1966	317.9	319.3	318.3	319.8
2	317.6	318.9	318.2	319.7
3	317.4	318.7	318.1	319.5
4	317.1	318.3	318.1	319.5
5	316.9	318.1	318.1	319.5

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
July 6, 1966	316.6	317.7	318.2	319.7
7	316.3	317.3	318.2	319.7
8	315.6	316.5	317.7	319.0
9	314.8	315.5	317.0	318.2
10	314.5	315.1	316.7	317.8
11	314.0	314.5	316.0	317.0
12	313.3	313.7	315.4	316.2
13	313.2	313.6	314.8	315.5
14	313.1	313.4	314.4	315.0
15	313.0	313.3	314.0	314.5
16	312.5	312.7	313.4	313.8
17	312.2	312.3	313.2	313.6
18	312.4	312.6	313.2	313.6
19	311.8	311.9	313.2	313.6
20	311.9	312.0	313.0	313.3
21	311.7	311.7	312.8	313.1
22	311.4	311.4	313.1	313.4
23	311.7	311.7	313.2	313.6
24	311.6	311.6	313.0	313.3
25	312.1	312.2	313.1	313.4

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric (ppm)	North Meadow Lake Index	North Meadow Lake Manometric (ppm)
July 26, 1966	312.2	312.3	313.4	313.8
27	312.6	312.8	313.9	314.4
28	313.2	313.6	313.9	314.4
29	313.4	313.8	313.9	314.4
30	313.4	313.8	313.8	314.3
31	313.1	313.4	313.3	313.7
August 1, 1966	312.7	313.0	312.9	313.2
2	-----	-----	312.6	312.8
3	-----	-----	312.3	312.5
4	-----	-----	312.0	312.1
5	-----	-----	311.7	311.7
6	-----	-----	311.8	311.9
7	-----	-----	311.8	311.9
8	-----	-----	311.7	311.7
9	-----	-----	311.6	311.6
10	-----	-----	311.6	311.6
11	-----	-----	311.5	311.5
12	-----	-----	311.5	311.5
13	312.5	312.7	311.4	311.4

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
August 14, 1966	312.5	312.7	311.2	311.1
15	312.3	312.5	311.0	310.9
16	312.0	312.1	310.9	310.8
17	311.8	311.9	310.7	310.5
18	311.6	311.6	310.6	310.4
19	311.3	311.2	310.4	310.2
20	311.0	310.9	310.4	310.2
21	311.2	311.1	310.5	310.3
22	311.2	311.1	310.6	310.4
23	311.6	311.6	310.7	310.5
24	311.5	311.5	310.8	310.6
25	312.0	312.1	310.9	310.8
26	312.3	312.5	311.1	311.0
27	312.7	313.0	311.1	311.0
28	312.6	312.8	311.0	310.9
29	312.0	312.1	310.8	310.6
30	311.9	312.0	310.7	310.5
31	311.4	311.4	310.6	310.4
September 1, 1966	311.0	310.9	310.4	310.2

Table 16: Six Day Running Mean Concentration of Atmospheric Carbon Dioxide

16 meters

Date	CO_2 Concentration: Meade River Index	Meade River Manometric(ppm)	North Meadow Lake Index	North Meadow Lake Manometric(ppm)
September 2, 1966	310.1	309.8	310.2	309.9
3	310.0	309.7	310.2	309.9
4	310.0	309.7	310.1	309.8
5	310.1	309.8	310.2	309.9
6	310.1	309.8	310.4	310.2
7	310.1	309.8	310.3	310.0
8	310.5	310.3	310.5	310.3
9	310.4	310.2	310.6	310.4
10	310.5	310.3	310.8	310.6

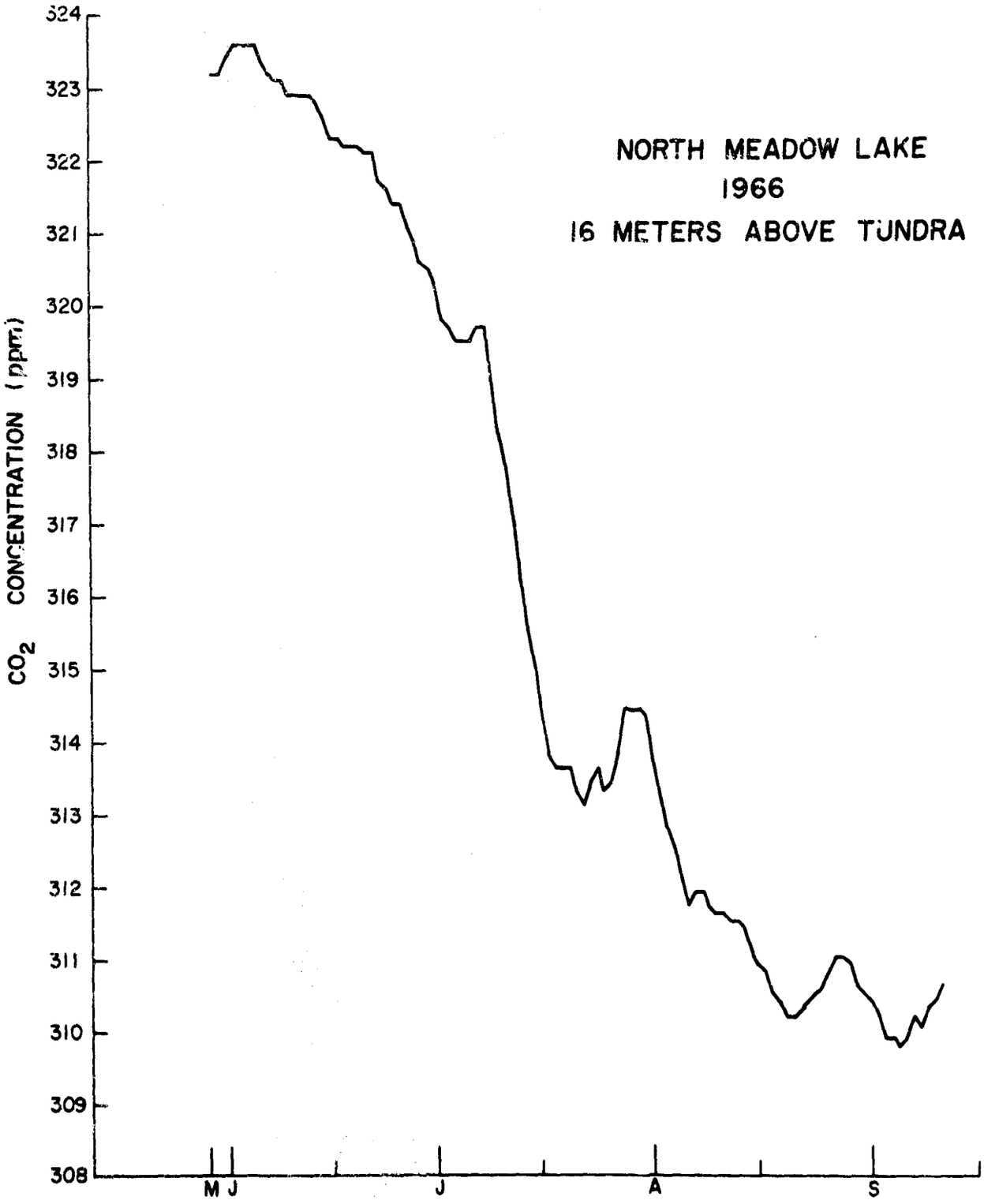

Figure 13. Six Day Running Mean CO_2 Concentration at 16 m, North Meadow Lake, 1966.

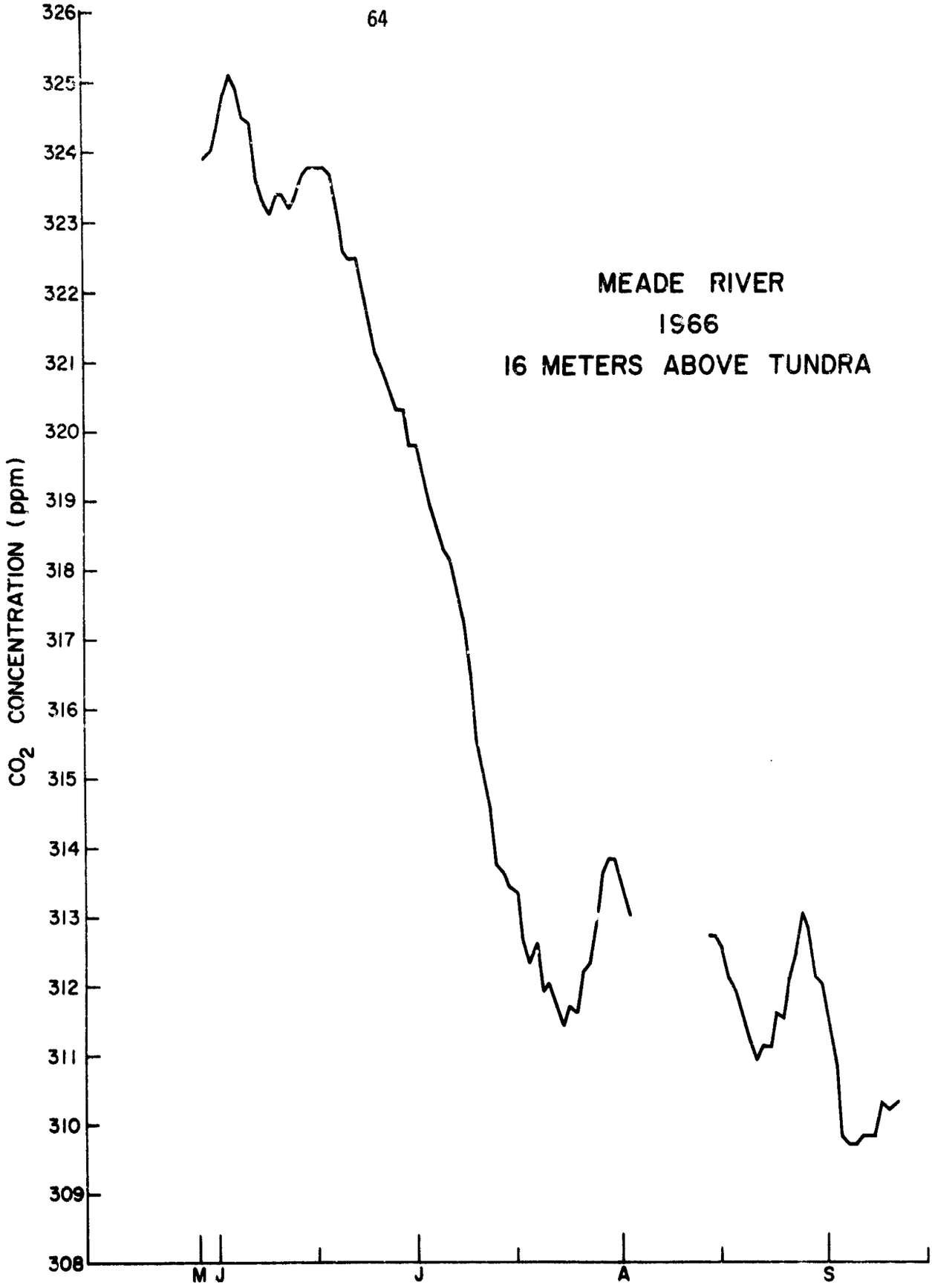

Figure 14. Six Day Running Mean CO_2 Concentration at 16 m, Meade River, 1966.

Table 17: Diurnal Course of Carbon Dioxide
Meade River, Alaska

16 meters

A.S.T.	Index June	Index July	Index August
1966			
00-01	319.4	314.1	312.2
01-02	319.4	314.3	312.5
02-03	319.9	314.5	312.7
03-04	320.0	314.6	312.5
04-05	320.0	314.7	312.7
05-06	319.8	314.7	312.6
06-07	319.2	314.3	312.3
07-08	319.5	313.9	312.0
08-09	319.8	313.8	311.7
09-10	319.7	313.0	311.7
10-11	320.5	312.8	311.6
11-12	321.0	312.4	311.5
12-13	320.8	312.7	311.5
13-14	320.9	312.5	311.7
14-15	320.6	312.8	311.5
15-16	320.7	312.7	311.2
16-17	320.0	312.9	310.8
17-18	319.9	312.9	311.0
18-19	319.4	312.9	310.9
19-20	319.6	312.5	311.0

Table 17: Diurnal Course of Carbon Dioxide
Meade River, Alaska

16 meters

A.S.T.	Index June	Index July	Index August
1966			
20-21	319.4	312.3	311.2
21-22	319.3	312.6	311.4
22-23	319.4	312.9	311.6
23-24	319.2	313.3	311.8

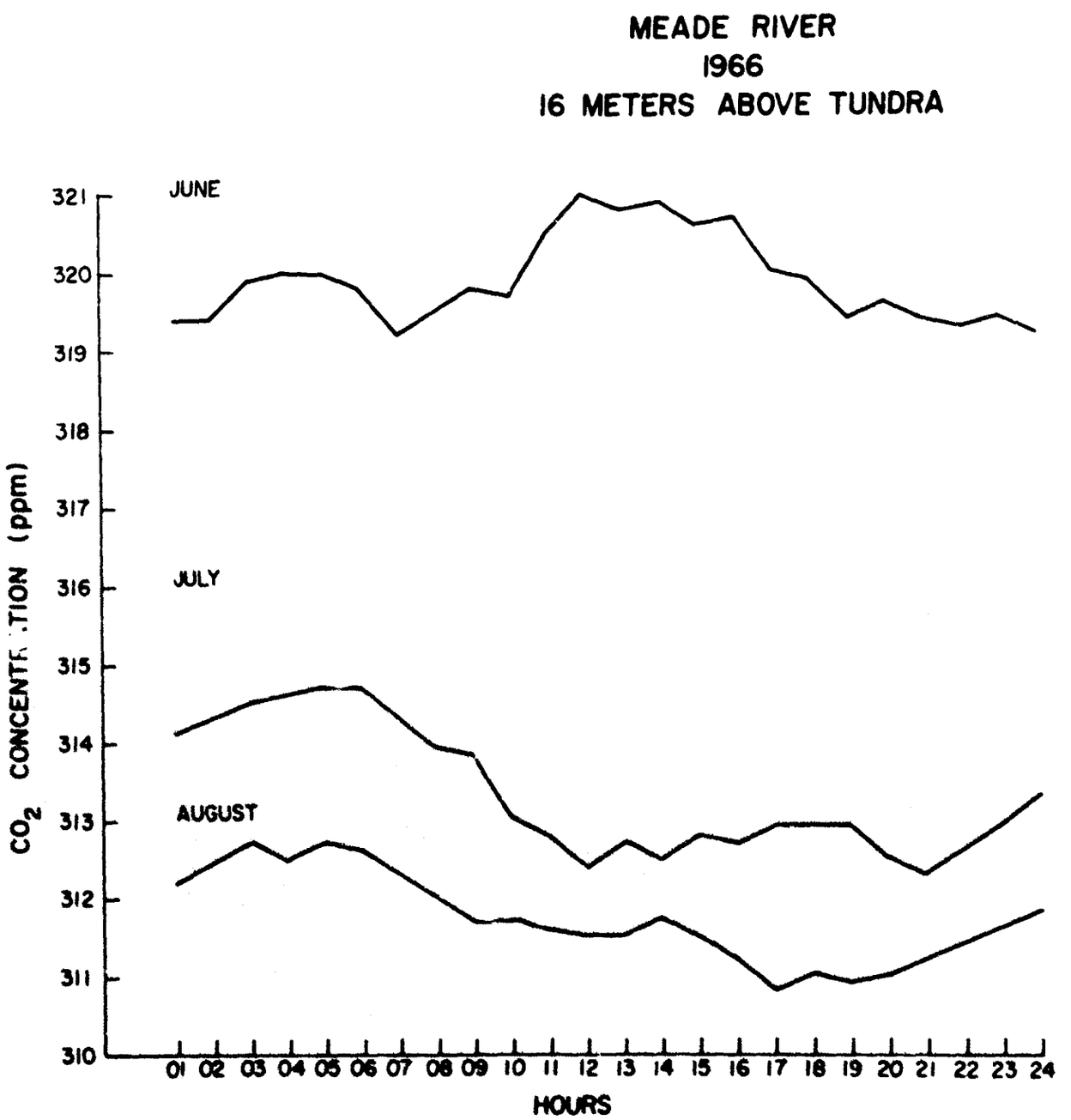

Figure 15. Duirnal Variation of CO_2 at 16 m, Meade River, 1966.

Table 18: Diurnal Course of Carbon Dioxide 16 meters
North Meadow Lake, Alaska

A.S.T.	Index June	Index July	Index August
1966			
00-01	320.2	315.3	311.4
01-02	320.3	315.2	311.5
02-03	320.4	315.0	311.4
03-04	320.2	314.8	311.2
04-05	320.2	314.7	311.1
05-06	320.1	314.6	311.0
06-07	320.1	314.4	310.9
07-08	320.0	314.4	311.0
08-09	320.0	314.3	311.0
09-10	320.0	314.2	311.0
10-11	320.0	314.2	310.8
11-12	320.0	314.2	310.9
12-13	320.0	314.1	310.9
13-14	319.9	314.1	310.9
14-15	319.8	314.1	310.8
15-16	319.9	314.2	310.9
16-17	319.8	314.1	310.8
17-18	319.8	314.3	310.8
18-19	319.8	314.5	310.8
19-20	319.7	314.8	311.0

Table 16: Diurnal Course of Carbon Dioxide
North Meadow Lake, Alaska

16 meters

A.S.T.	Index June	Index July	Index August
1966			
20-21	319.9	314.9	311.1
21-22	320.0	315.1	311.4
22-23	320.3	315.2	311.5
23-24	320.2	315.1	311.5

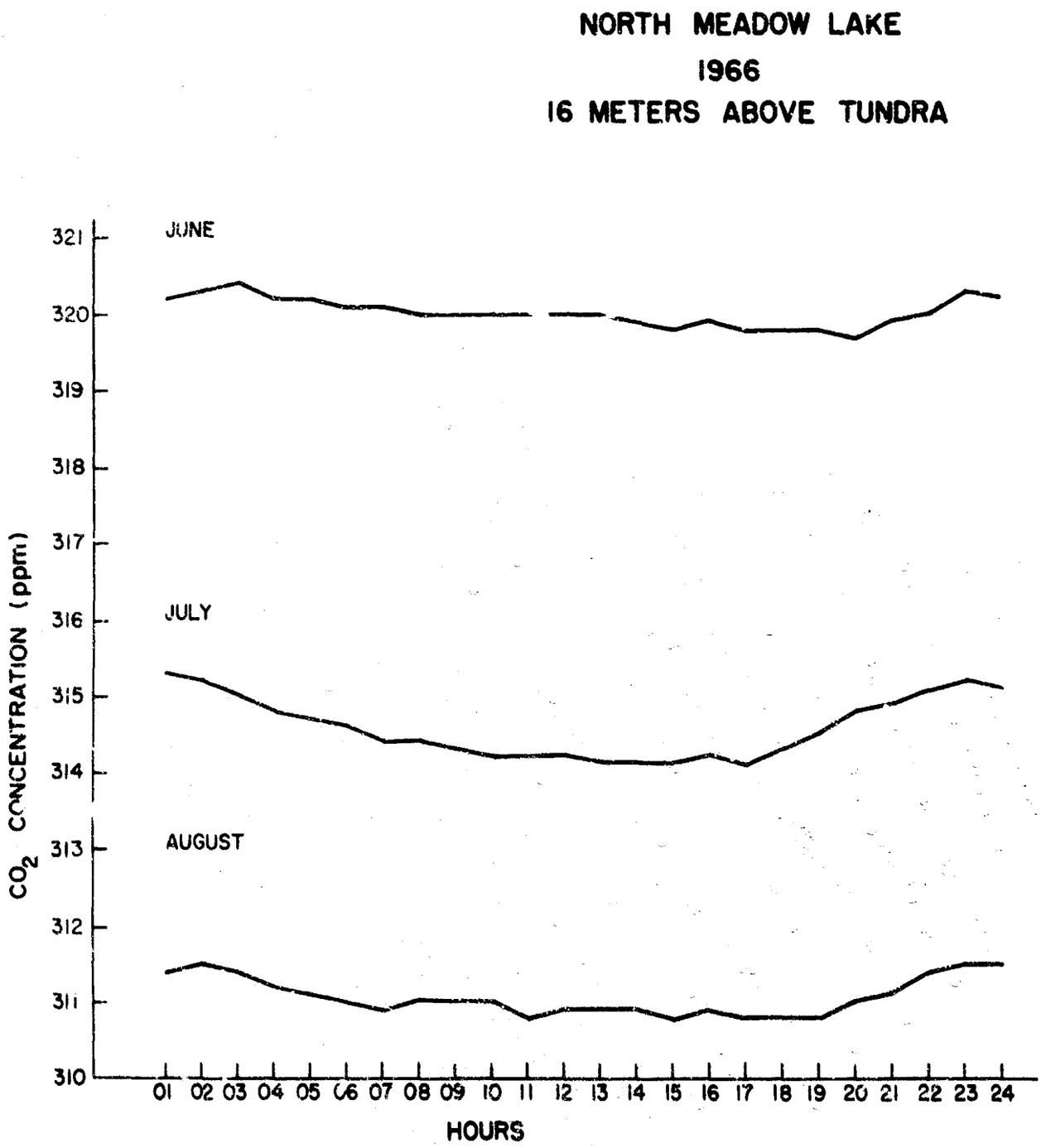

Figure 16. Duirnal Variation of CO_2 at 16 m, North Meadow Lake, 1966.

Table 19: Three Month Average Diurnal Course of Carbon Dioxide for June, July and August, 1966

16 meters

A.S.T.	North Meadow Lake Index	Meade River Index
00-01	315.6	315.2
01-02	315.7	315.4
02-03	315.6	315.7
03-04	315.4	315.7
04-05	315.3	315.8
05-06	315.2	315.7
06-07	315.1	315.3
07-08	315.1	315.1
08-09	315.1	315.1
09-10	315.1	314.8
10-11	315.0	315.0
11-12	315.0	315.0
12-13	315.0	315.0
13-14	315.0	315.0
14-15	314.9	315.0
15-16	315.0	314.9
16-17	314.9	314.6
17-18	315.0	314.6
18-19	315.0	314.4
19-20	315.2	314.4
20-21	315.3	314.3

Table 19: Three Month Average Diurnal Course of Carbon Dioxide for June, July and August, 1966

16 meters

A.S.T.	North Meadow Lake Index	Meade River Index
21-22	315.5	314.4
22-23	315.7	314.6
23-24	315.6	314.8

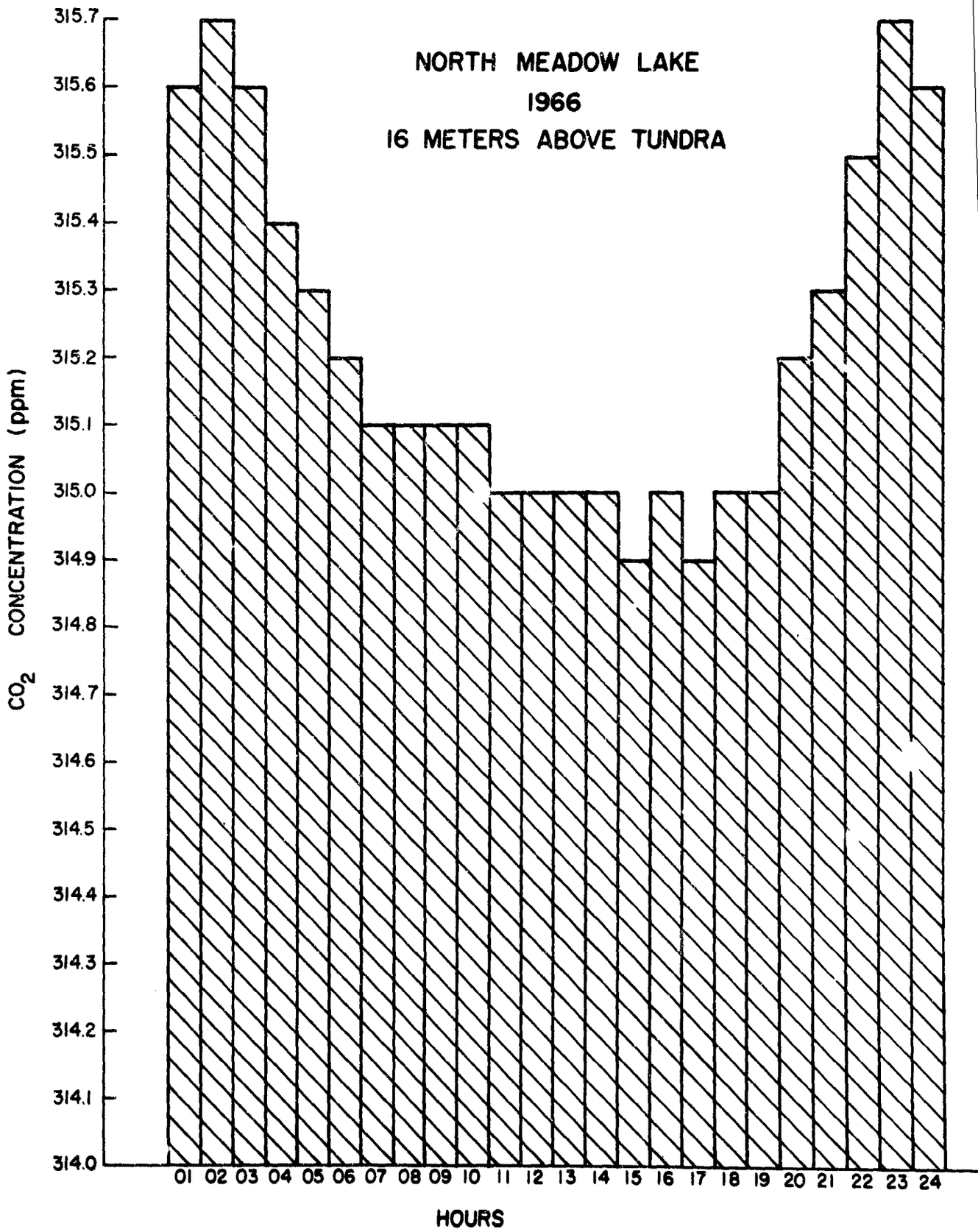

Figure 17. Three Month Duirnal Variation of CO_2, June, July, August, at 16 m, North Meadow Lake, 1966.

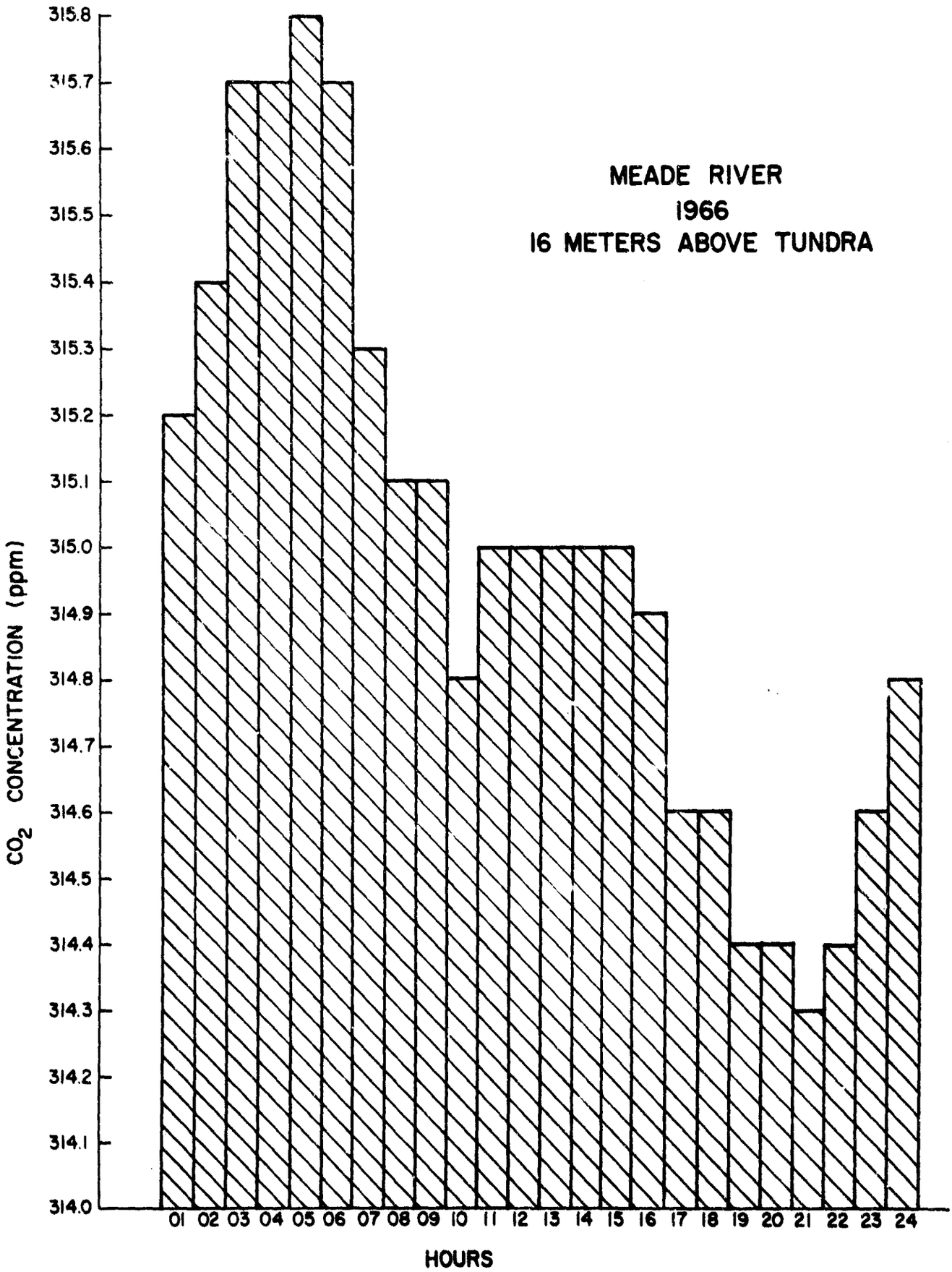

Figure 18. Three Month Duirnal Variation of CO_2, June, July, August, at 16 m, Meade River, 1966

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

Average Daily CO_2 Concentration
Meade River

+ means from ground to air
- means from air to ground

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2
May 24	325.8	325.4	+0.4
25	325.4	325.4	0
26	323.2	323.2	0
27	322.7	321.5	+1.2
28	324.1	323.4	+0.7
29	325.2	325.0	+0.2
30	327.3	325.9	+1.4
31	327.7	327.1	+0.6
June 1	325.8	325.5	+0.3
2	325.0	324.2	+0.8
3	322.2	321.7	+0.5
4	324.5	322.9	+1.6
5	326.0	325.0	+1.0
6	322.7	322.3	+0.4
7	323.6	323.8	-0.2
8	323.0	322.8	+0.2
9	323.4	323.4	0
10	324.4	323.6	+0.8
11	324.5	323.6	+0.9
12	325.2	323.4	+1.8
13	326.5	325.4	+1.1

Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
June 14	324.9	323.2	+1.7
15	-----	-----	----
16	325.5	323.2	+2.3
17	323.9	322.9	+1.0
18	322.5	321.9	+0.6
19	322.7	322.0	+0.7
20	322.5	322.0	+0.5
21	323.4	322.6	+0.8
22	323.3	320.4	+2.9
23	321.1	321.0	+0.1
24	319.9	318.8	+1.1
25	321.5	320.6	+0.9
26	321.3	320.8	+0.5
27	321.3	320.4	+0.9
28	324.3	319.8	+4.5
29	319.2	318.4	+0.8
30	319.5	318.6	+0.9
July 1	317.8	318.0	-0.2
2	318.6	318.2	+0.4
3	318.4	319.0	-0.6
4	318.1	318.1	0

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

+ means from ground to air
- means from air to ground

Average Daily CO_2 Concentration
Meade River

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2	Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
July 5	316.6	316.7	-0.1	July 27	314.3	314.2	+0.1
6	317.2	316.6	+0.6	28	315.0	314.5	+0.5
7	315.0	315.8	-0.8	29	314.3	313.6	+0.7
8	313.5	312.8	+0.7	30	312.4	312.8	-0.4
9	313.3	313.3	0	31	313.2	311.4	+1.8
10	315.3	315.9	-0.6				
11	312.2	312.7	-0.5	August 1	314.1	311.4	+2.7
12	312.6	311.9	+0.7	2	-----	-----	----
13	316.0	315.1	+0.9	3	-----	-----	----
14	311.9	312.1	-0.2	4	-----	-----	----
15	311.6	312.6	-1.0	5	-----	-----	----
16	312.8	312.1	+0.7	6	-----	-----	----
17	310.3	310.5	-0.2	7	-----	-----	----
18	313.3	312.8	+0.5	8	314.2	313.0	+1.2
19	313.1	310.8	+2.3	9	313.0	312.7	+0.3
20	314.7	313.1	+1.6	10	313.3	312.7	+0.6
21	310.8	311.0	-0.2	11	312.8	312.6	+0.2
22	309.6	310.3	-0.7	12	313.1	312.6	+0.5
23	313.0	312.2	+0.8	13	313.5	312.8	+0.7
24	310.2	312.5	-2.3	14	319.4	312.7	+6.7
25	313.6	314.2	-0.6	15	313.2	311.1	+2.1
26	314.3	313.9	+0.4	16	311.7	310.9	+0.8

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

Average Daily CO_2 Concentration
Meade River

+ means from ground to air
- means from air to ground

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2
August 17	312.5	311.4	+1.1
18	312.2	311.0	+1.2
19	311.1	310.3	+0.8
20	312.5	311.0	+1.5
21	315.5	312.0	+3.5
22	319.5	311.2	+8.3
23	320.5	313.9	+6.6
24	312.8	310.8	+2.0
25	315.9	314.1	+1.8
26	314.9	312.7	+2.2
27	321.4	315.4	+6.0
28	311.6	310.4	+1.2
29	310.2	309.5	+0.7
30	310.9	309.9	+1.0
31	310.9	310.2	+0.7
September 1	310.3	309.7	+0.6
2	309.8	309.3	+0.5
3	310.0	309.5	+0.5
4	313.2	309.2	+4.0
5	320.0	311.1	+8.9
6	311.9	310.2	+1.7

Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
September 7	311.1	309.2	+1.9
8	313.3	312.2	+1.1
9	310.5	309.4	+1.1
10	310.6	309.7	+0.9

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

Average Daily CO_2 Concentration
North Meadow Lake

+ means CO_2 from ground to air
- means CO_2 from air to ground

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2
May 24	333.1	323.4	+ 9.7
25	345.7	322.9	+22.8
26	346.6	322.9	+23.7
27	344.3	323.1	+21.2
28	349.1	323.2	+25.9
29	348.8	323.4	+25.4
30	351.6	323.8	+27.8
31	348.1	324.4	+23.7
June 1	339.8	323.4	+16.4
2	338.7	323.3	+15.4
3	374.3	323.3	+15.0
4	423.4	322.8	+100.6
5	-----	-----	------
6	378.9	323.1	+55.8
7	355.8	323.1	+32.7
8	387.2	322.9	+64.3
9	389.0	322.9	+66.1
10	399.7	322.7	+77.0
11	-----	-----	-----
12	-----	-----	-----
13	-----	-----	-----

Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
June 14	323.6	322.0	+ 1.6
15	325.6	322.5	+ 3.1
16	323.2	322.5	+ 0.7
17	322.1	322.1	0
18	-----	-----	-----
19	365.2	321.9	+43.3
20	338.9	321.9	+17.0
21	332.8	322.2	+10.6
22	321.7	320.8	+ 0.9
23	342.9	321.1	+21.8
24	343.7	320.4	+23.3
25	322.2	321.7	+ 0.5
26	320.4	320.4	0
27	321.7	321.0	+ 0.7
28	320.3	319.5	+ 0.8
29	321.2	320.3	+ 0.9
30	319.7	318.8	+ 0.9
July 1	318.6	318.7	- 0.1
2	320.0	320.0	0
3	320.1	320.1	0
4	319.7	319.7	0

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

Average Daily CO_2 Concentration
North Meadow Lake

+ means CO_2 from ground to air
- means CO_2 from air to ground

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2
July 5	320.0	320.0	0
6	321.5	319.8	+1.7
7	321.7	318.3	+3.4
8	317.0	316.6	+0.4
9	314.7	315.1	-0.4
10	317.3	317.3	0
11	315.1	315.0	+0.1
12	314.5	314.8	-0.3
13	314.1	314.3	-0.2
14	313.4	313.8	-0.4
15	311.2	312.1	-0.9
16	312.3	312.6	-0.3
17	313.1	313.7	-0.6
18	314.4	315.1	-0.7
19	315.8	313.9	+1.9
20	314.2	312.7	+1.5
21	310.0	310.8	-0.8
22	314.2	314.7	-0.5
23	314.4	314.3	+0.1
24	312.6	313.7	-1.1
25	310.6	314.5	-3.9
26	313.9	314.7	-0.8

Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
July 27	313.9	314.8	-0.9
28	314.4	314.8	-0.4
29	313.8	313.8	0
30	313.2	313.3	-0.1
31	310.9	310.8	+0.1
August 1	311.5	312.1	-0.6
2	312.2	312.5	-0.3
3	311.7	312.2	-0.5
4	311.2	311.9	-0.7
5	310.6	311.2	-0.6
6	311.0	311.5	-0.5
7	311.4	311.7	-0.3
8	312.1	312.1	0
9	310.6	311.4	-0.8
10	311.2	311.5	-0.3
11	310.9	311.0	-0.1
12	310.9	311.0	-0.1
13	311.1	311.0	+0.1
14	311.1	311.0	+0.1
15	310.0	309.9	+0.1
16	310.2	310.3	-0.1

Table 20: Carbon Dioxide Difference Between Ground and 16 Meter Level

Average Daily CO_2 Concentration
North Meadow Lake

+ means CO_2 from ground to air
- means CO_2 from air to ground

Date 1966	Manometric Scale CO_2 Conc. Ground	16m	ΔCO_2
August 17	310.0	309.9	+0.1
18	309.8	309.9	-0.1
19	310.0	310.0	0
20	311.2	310.5	+0.7
21	313.0	311.2	+1.8
22	311.6	310.8	+0.8
23	311.2	310.8	+0.4
24	311.5	310.6	+0.9
25	314.9	310.8	+4.1
26	313.8	312.0	+1.8
27	311.9	311.1	+0.8
28	310.0	309.8	+0.2
29	310.2	309.8	+0.4
30	310.3	309.9	+0.4
31	310.3	310.0	+0.3
September 1	310.0	310.0	0
2	309.8	309.7	+0.1
3	309.8	309.8	0
4	310.0	309.3	+0.7
5	315.6	310.8	+4.8
6	313.3	311.5	+1.8

Date 1966	CO_2 Conc. Ground	16m	ΔCO_2
September 7	309.9	309.4	+0.5
8	311.7	311.2	+0.5
9	310.4	310.0	+0.4
10	310.9	310.8	+0.1

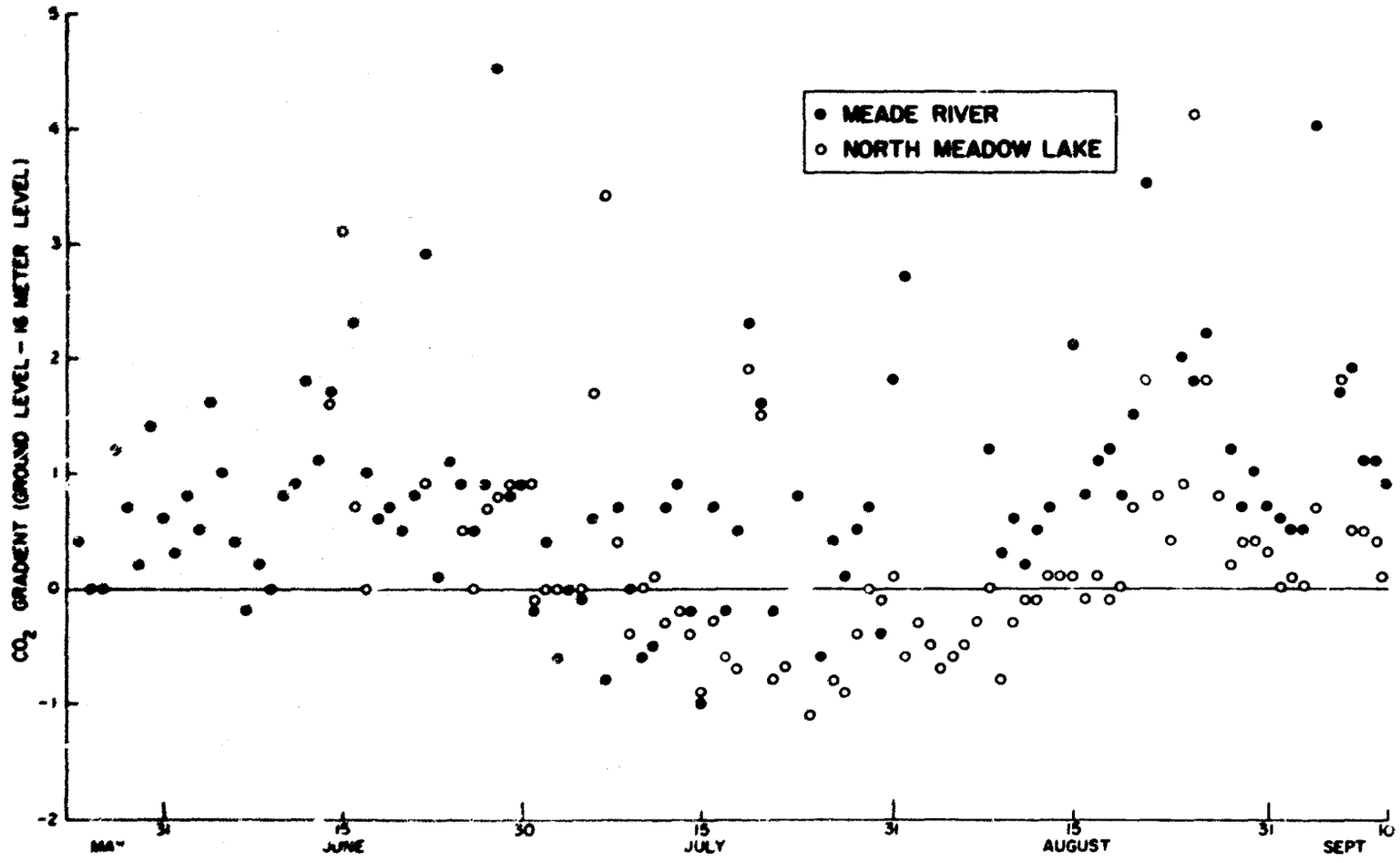

Figure 19. Average Daily CO_2 Gradient Between 16 m and 1 cm at Meade River and North Meadow Lake.

III ECOLOGICAL OBSERVATIONS

Results of measurements of biotic and abiotic parameters are presented in the following section. Discussion of methods of analysis and plant taxonomy has been published in several journal contributions (1, 2, 3, 7) previously listed.

Net primary production above ground was harvested each month from 2 x 5 dm plots in the five predominant communities (Figures 34-39). The litter and non-functional plant materials were separated from the chlorophyllous tissue and both components were oven dried at 70° C and weighed. Growth rates of five common species were determined from weekly measurements of stem and inflorescence length on the same 140 plants throughout the summer. For purposes of comparison the data are expressed as percentages of maximum growth. Six day running means of carbon dioxide concentration were compared with percent maximum growth, measured weekly and are shown in Figure 40. Dry matter production in the Arctic ecosystem at Meade River, Alaska is shown in Figure 30. Histograms of chlorophyll distribution in four communities is given in Figure 41. Tables 25 through 33 tabulate information on growth rate, chlorophyll, and dry weight production.

Hourly carbon dioxide concentrations and air temperatures at Meade River for various periods during the growing season are shown in Figures 21-25. The shaded area between the 16 cm and 1 cm curves represents the time and intensity of a positive flux due to photosynthesis at Meade River.

Results of meteorological observations are given in Tables 21, 22,and 23 and Figures 26, 27, 28, and 29. Some chemical analyses of Meade River water samples are given in Table 24.

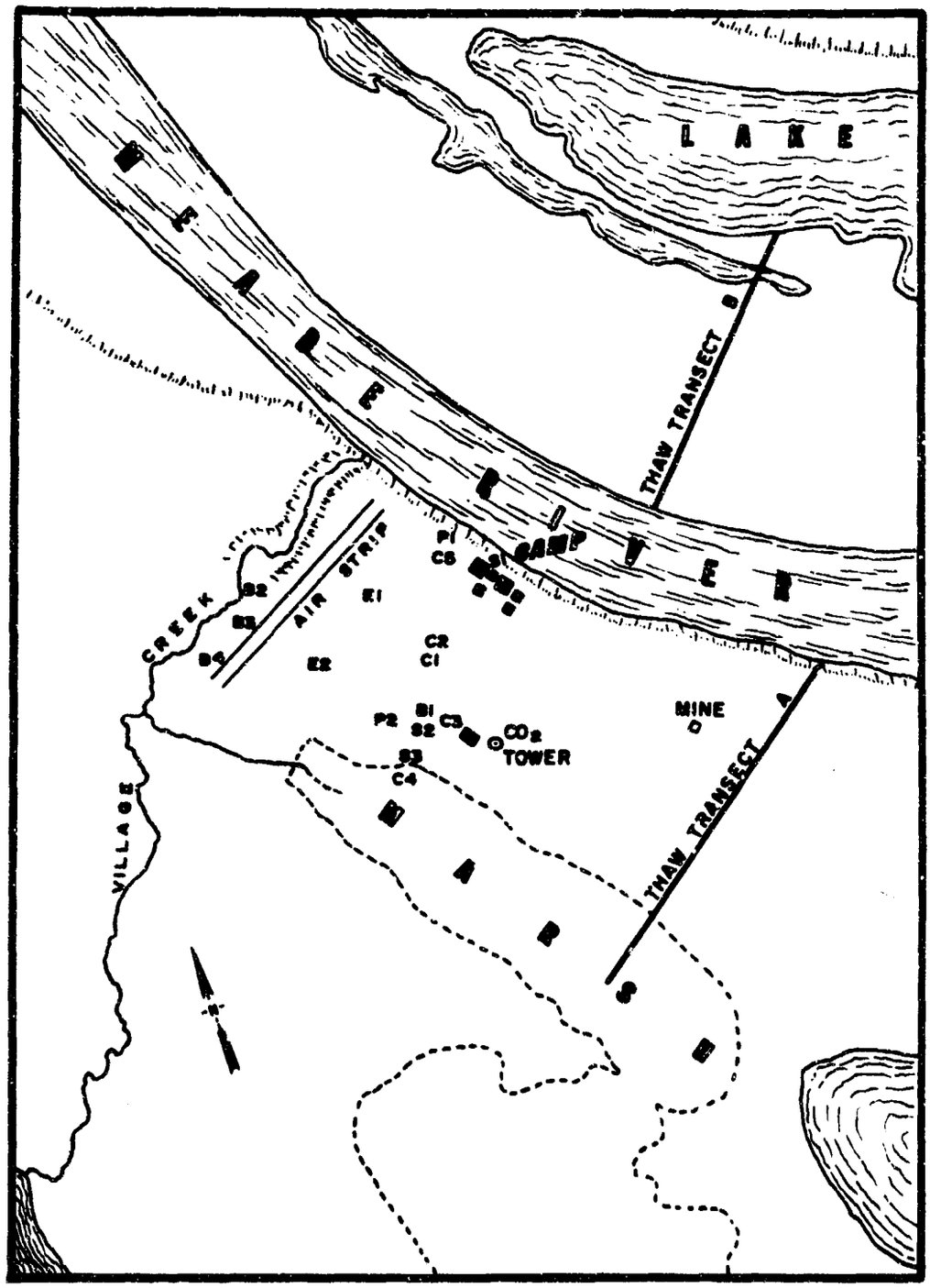

Figure 20. Meade River Study Site Showing Positions of Camp Buildings, Coal Mine, Carbon Dioxide Tower, Transects for Weekly Monitoring of Thaw Depth, and Plant Growth: B = Betula, C = Carex, E = Eriophorum, P = Polygonum and S = Salex.

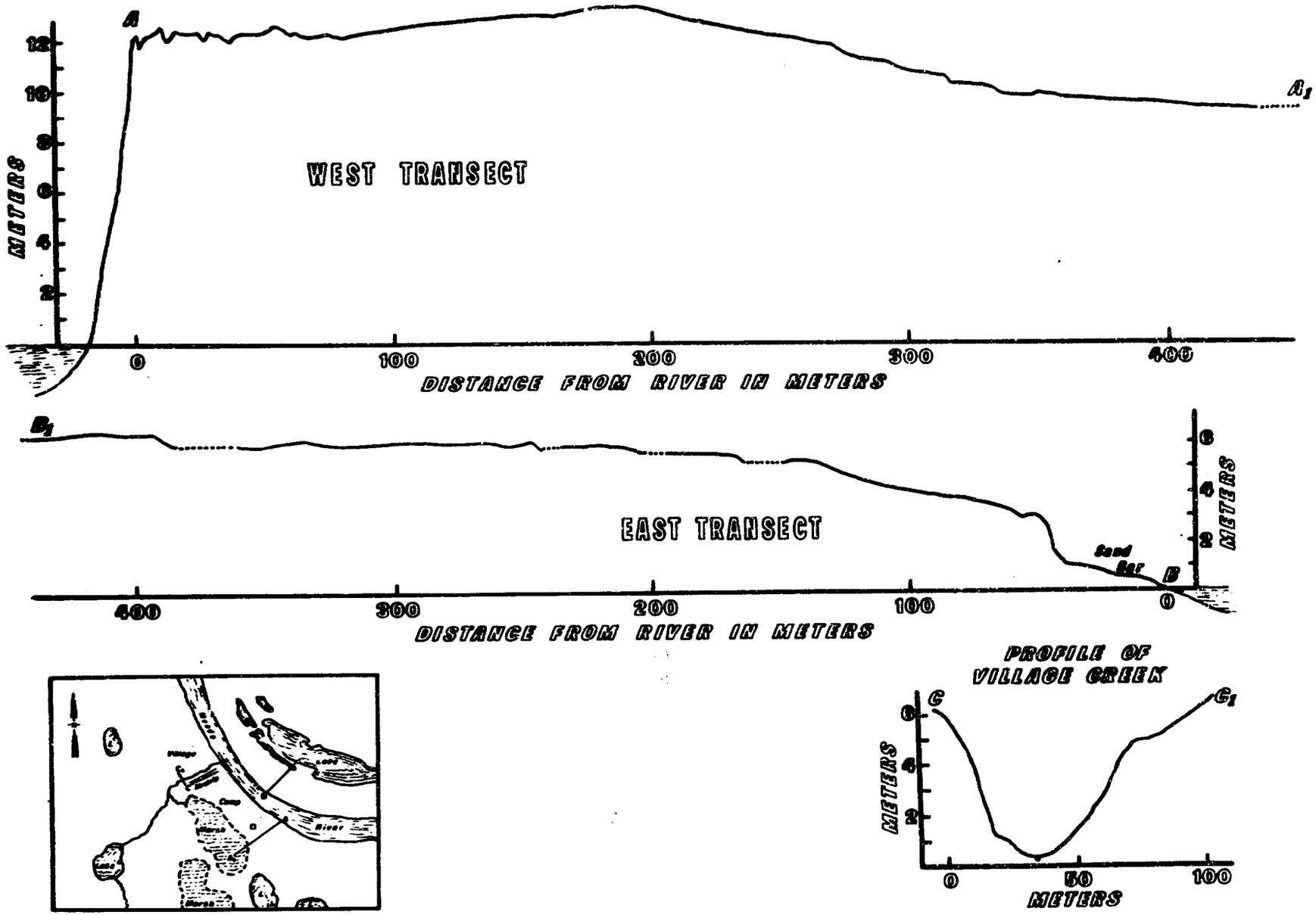

Figure 21. Topographic Profiles of Three Transects at Meade River Camp. Profiles A (upland) and B (river bar) were Probed Weekly for Snow and Thaw Depths.

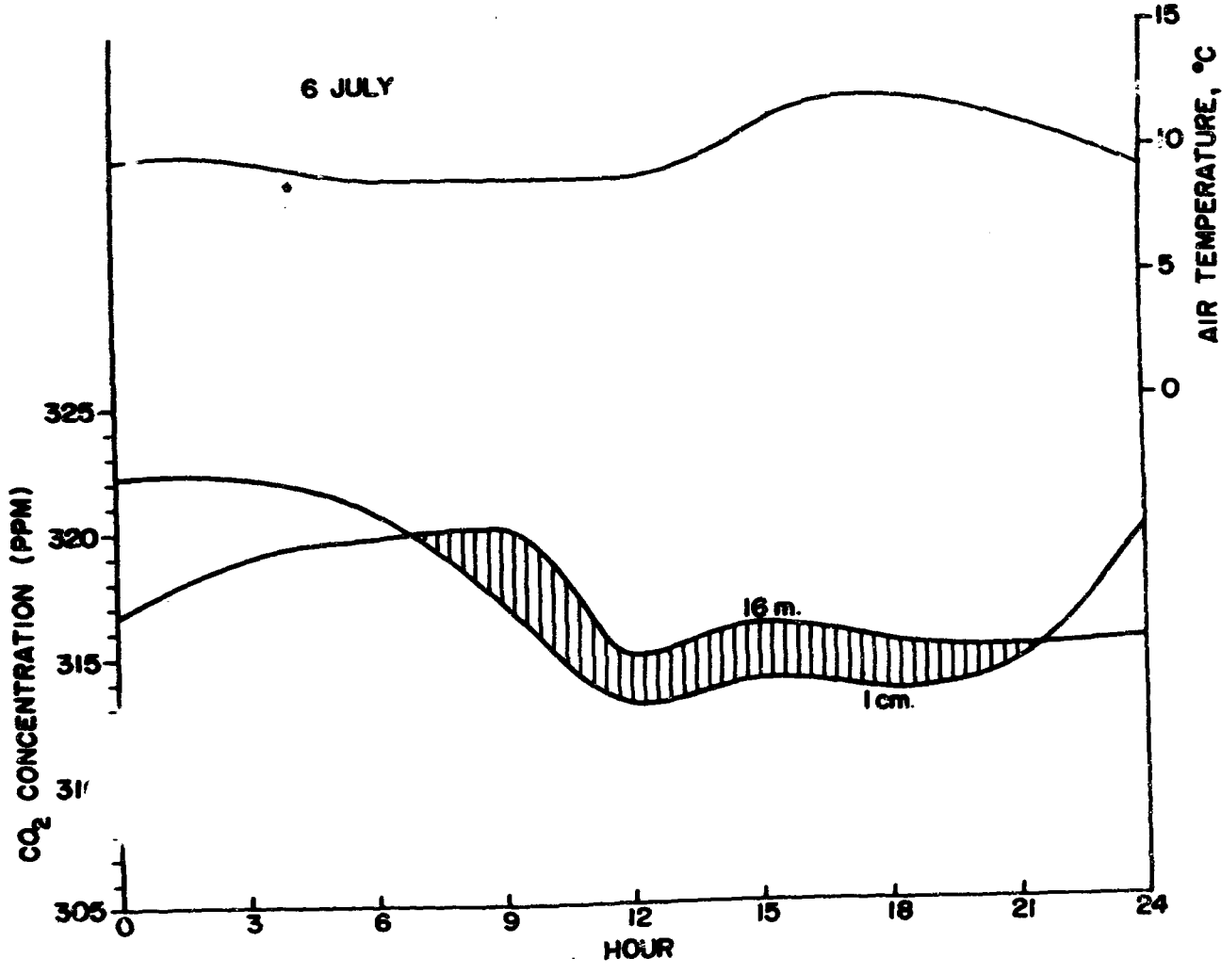

Figure 22. Hourly Carbon Dioxide and Air Temperature at Meade River.

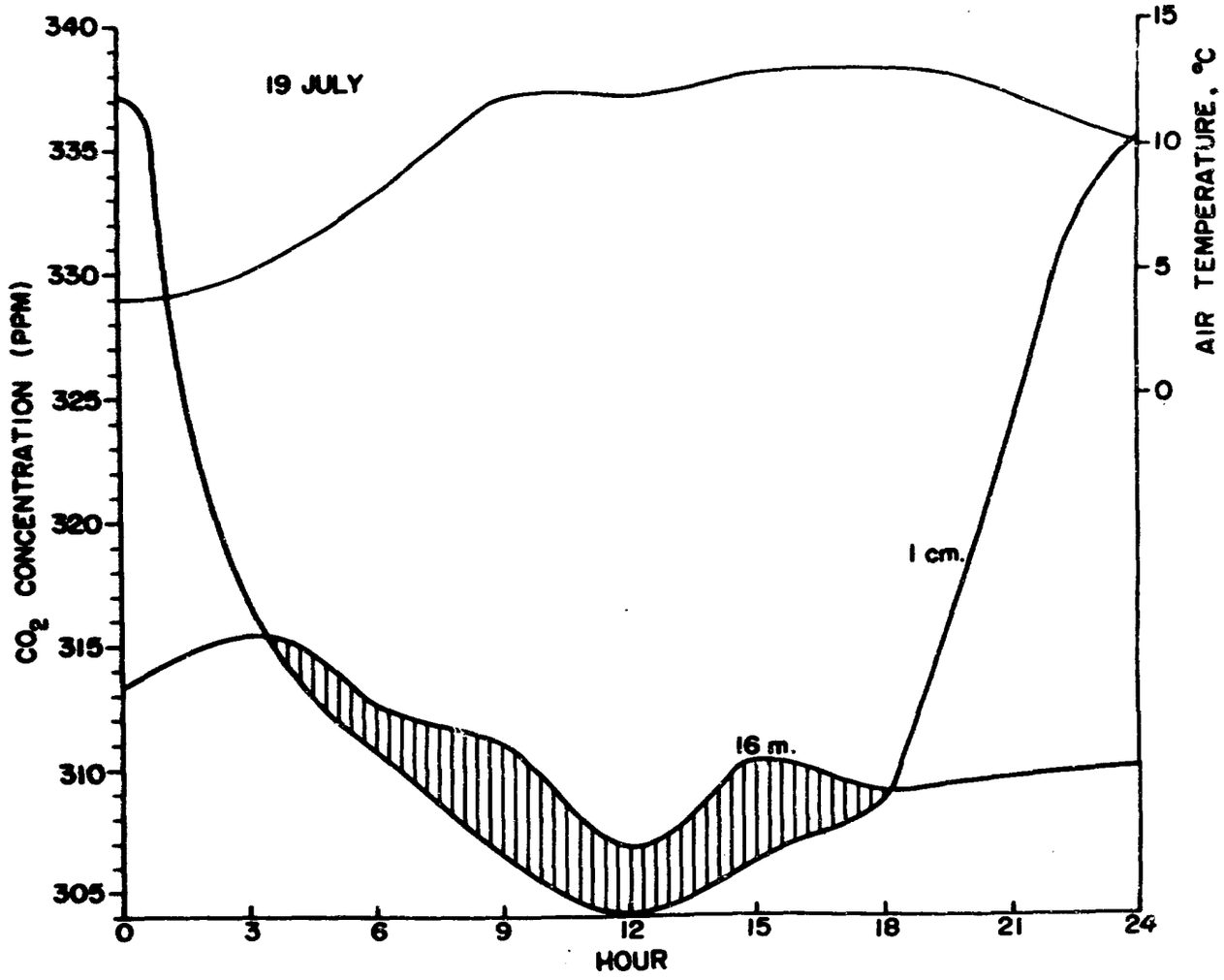

Figure 23. Hourly Carbon Dioxide and Air Temperature at Meade River.

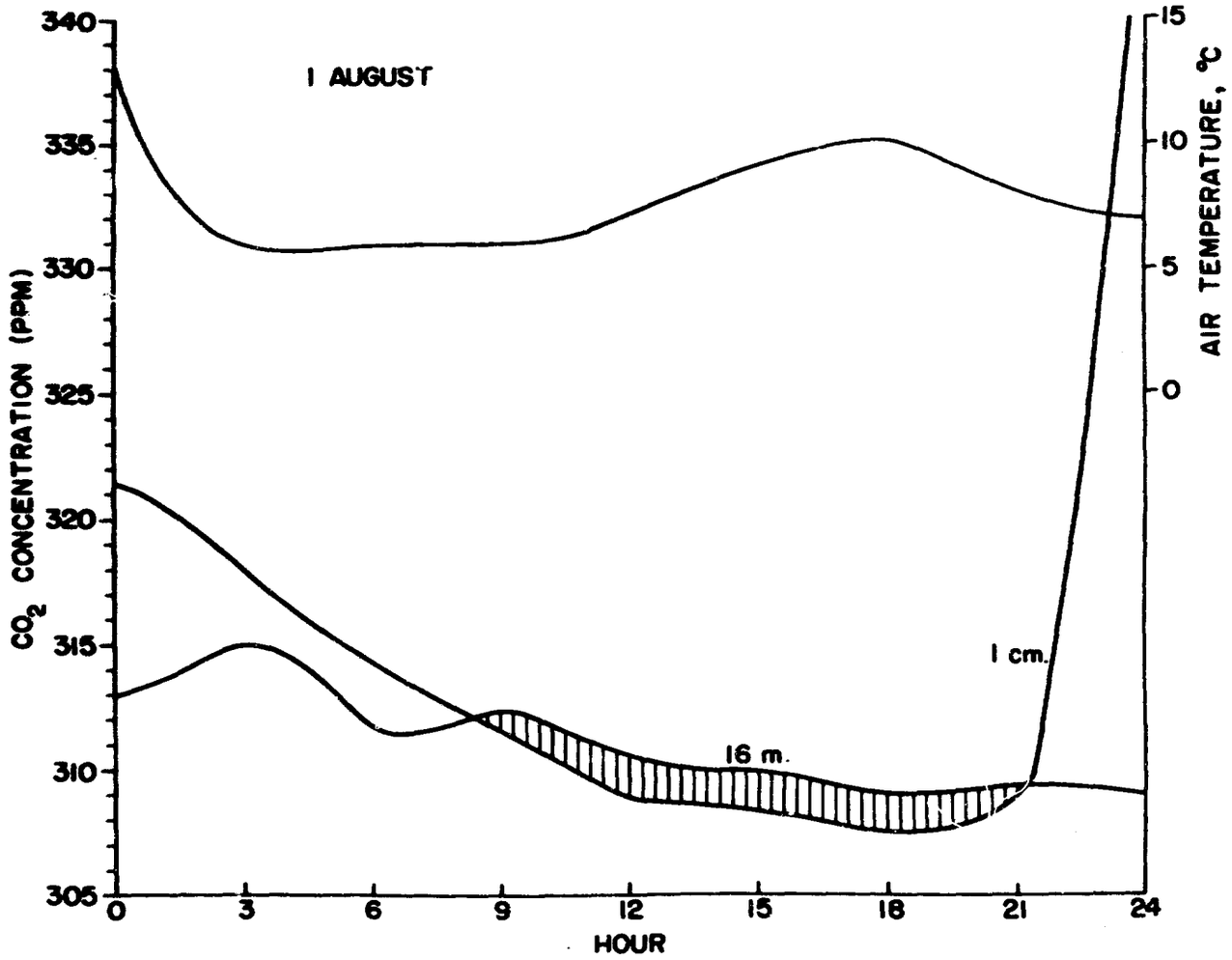

Figure 24. Hourly Carbon Dioxide and Air Temperature at Meade River.

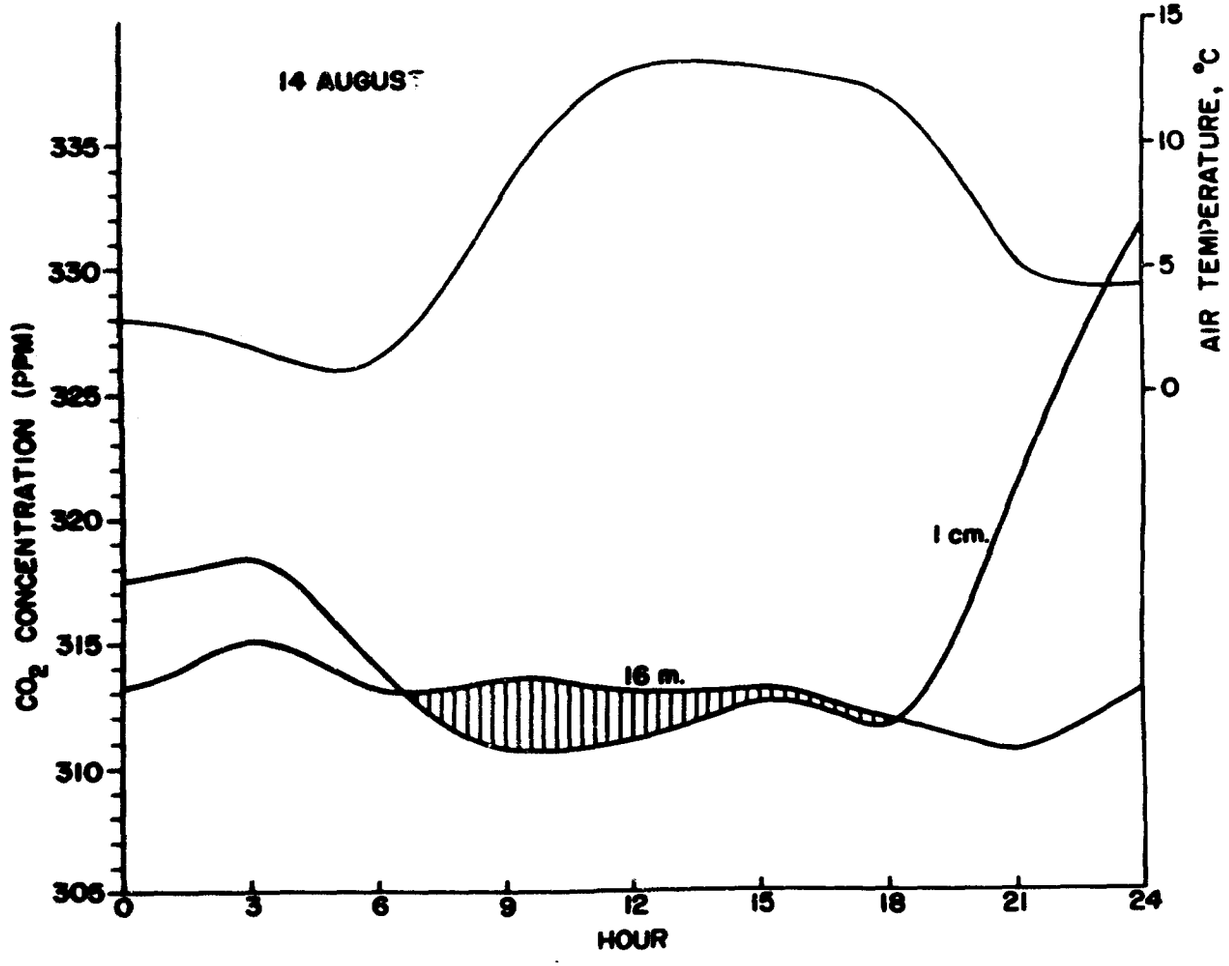

Figure 25. Hourly Carbon Dioxide and Air Temperature at Meade River.

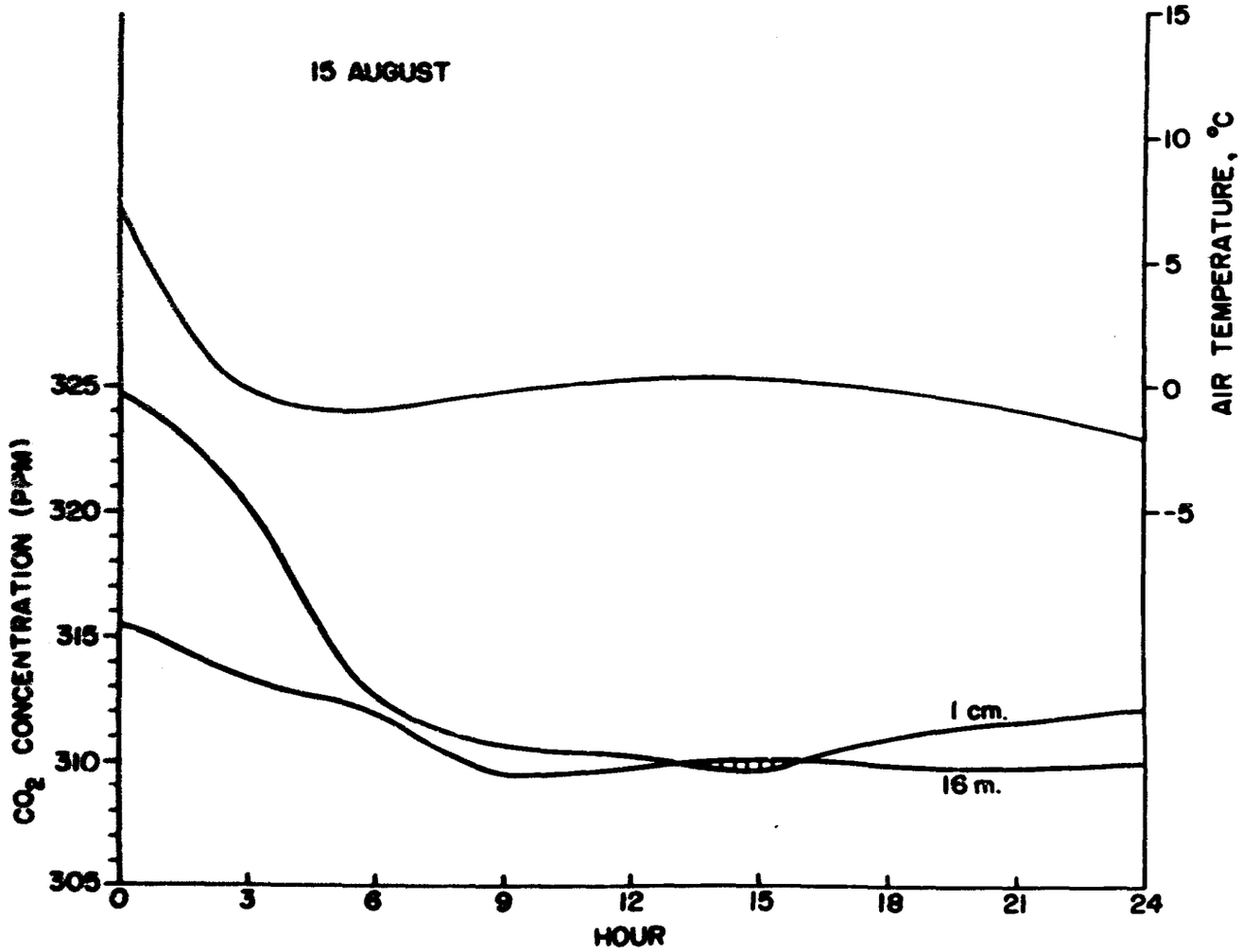

Figure 26. Hourly Carbon Dioxide and Air Temperature at Meade River.

Table 21: Precipitation at Meade River Camp During the Growing Season, 21 May to 10 September 1966 in mm.

Date	4 in.	8 in.	Date	4 in.	8 in.
June 6	.25	T	August 1	4.32	2.78
8	2.79	1.15	2	.51	T
11	2.79	1.89	4	.51	.33
12	5.08	2.78	5	1.52	1.04
15	3.05	1.95	6	.25	T
16	.12	.17	9	T	T
22	T	T	16	.51	.61
24	3.81	(1.23)	17	.51	.38
25	5.59	3.32	18	.76	.56
28	T	T	19	T	
29	4.06	2.54	21	T	T
Mon.	27.54	15.03	22	.25	.24
July 1	.76	.49	24	.25	.14
3	7.62	5.06	25	T	T
4	.25	.14	26	3.05	1.76
6	2.29	1.41	28	4.57	2.90
10	.51	.28	29	22.35	8.90
11	1.02	.80	30	2.03	-
13	7.37	4.28	31	T	T
14	T	T	Mon.	41.40	19.64
16	1.27	.97	Sep. 2	.51	.10
17	.51	.37	3	T	T
18	.51	.37	7	.25	-
20	1.02	.70	8	2.79	-
21	1.27	.76			
22	T	.19			
23	1.02	.19			
26	T	T	Seasonal		
30	.51	.37			
31	.51	.21	Total	98.93	51.85
Mon.	26.44	17.28			

Two gages were used, one 4 inches square receiving area the other a standard 8 inch gage. Values in brackets are unreliably low values.

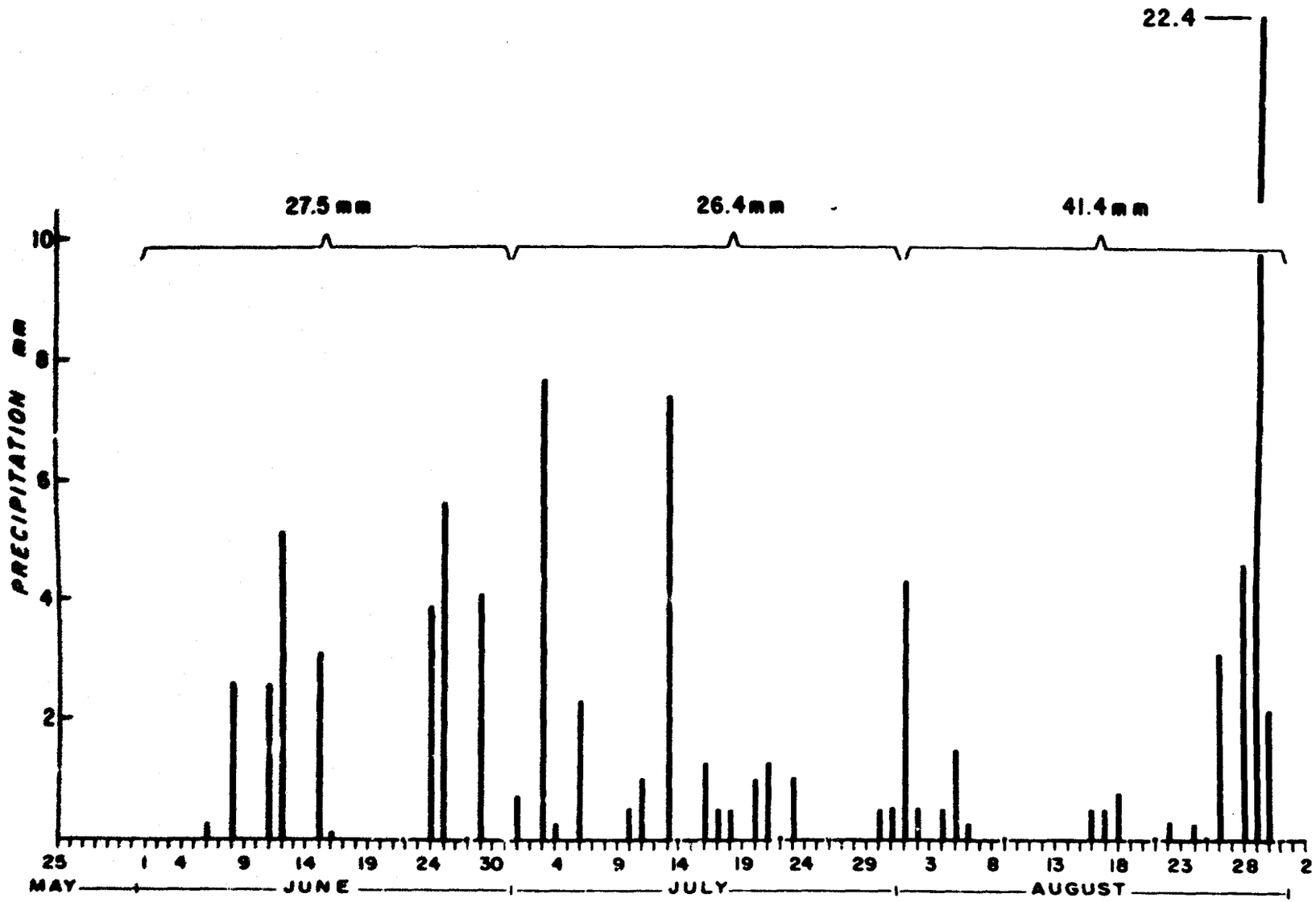

Figure 27. Precipitation Distribution During the 1966 Thaw Season at Meade River.

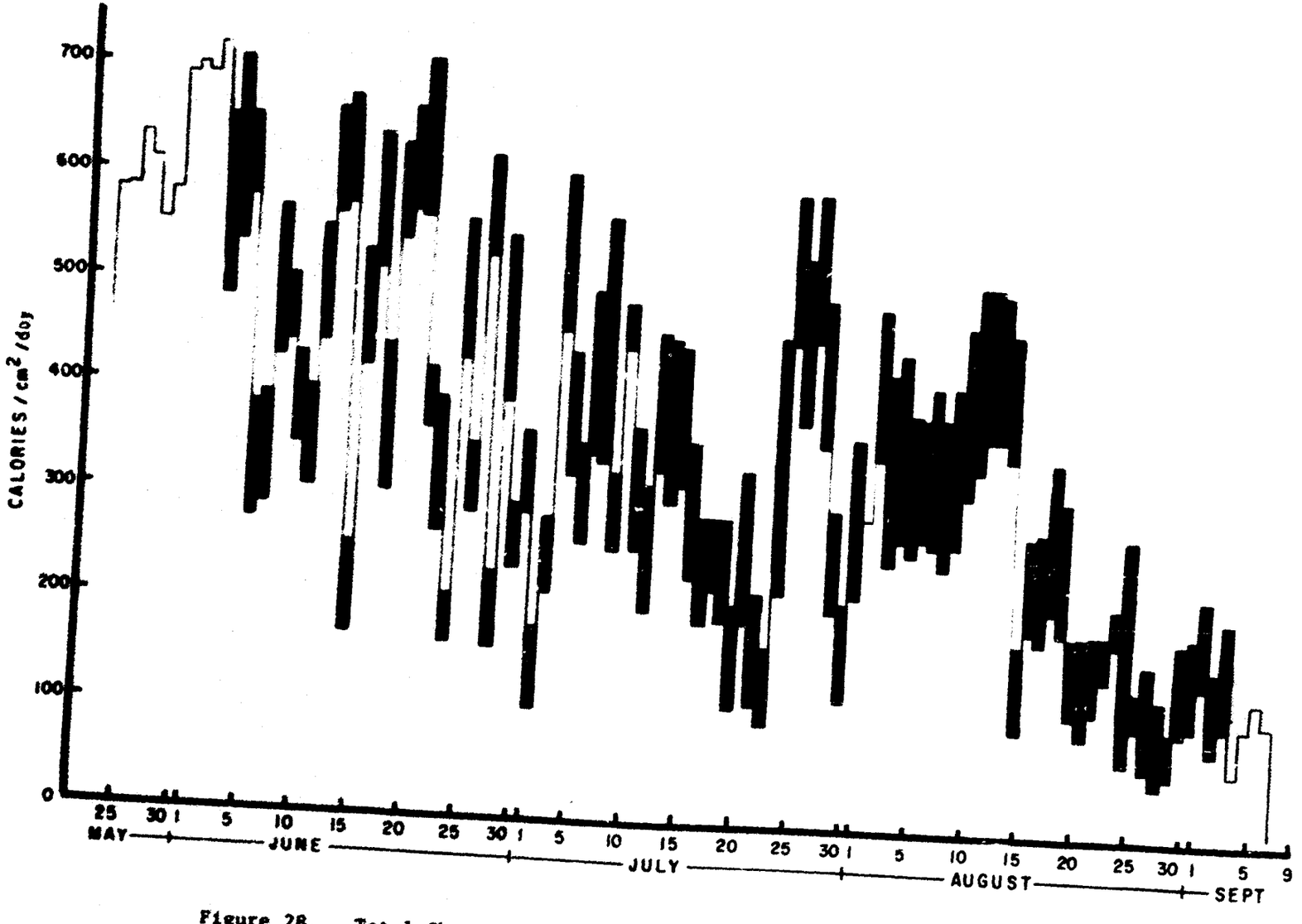

Figure 28. Total Short Wave and Net Solar Radiation During the 1966 Thaw Season at Meade River.

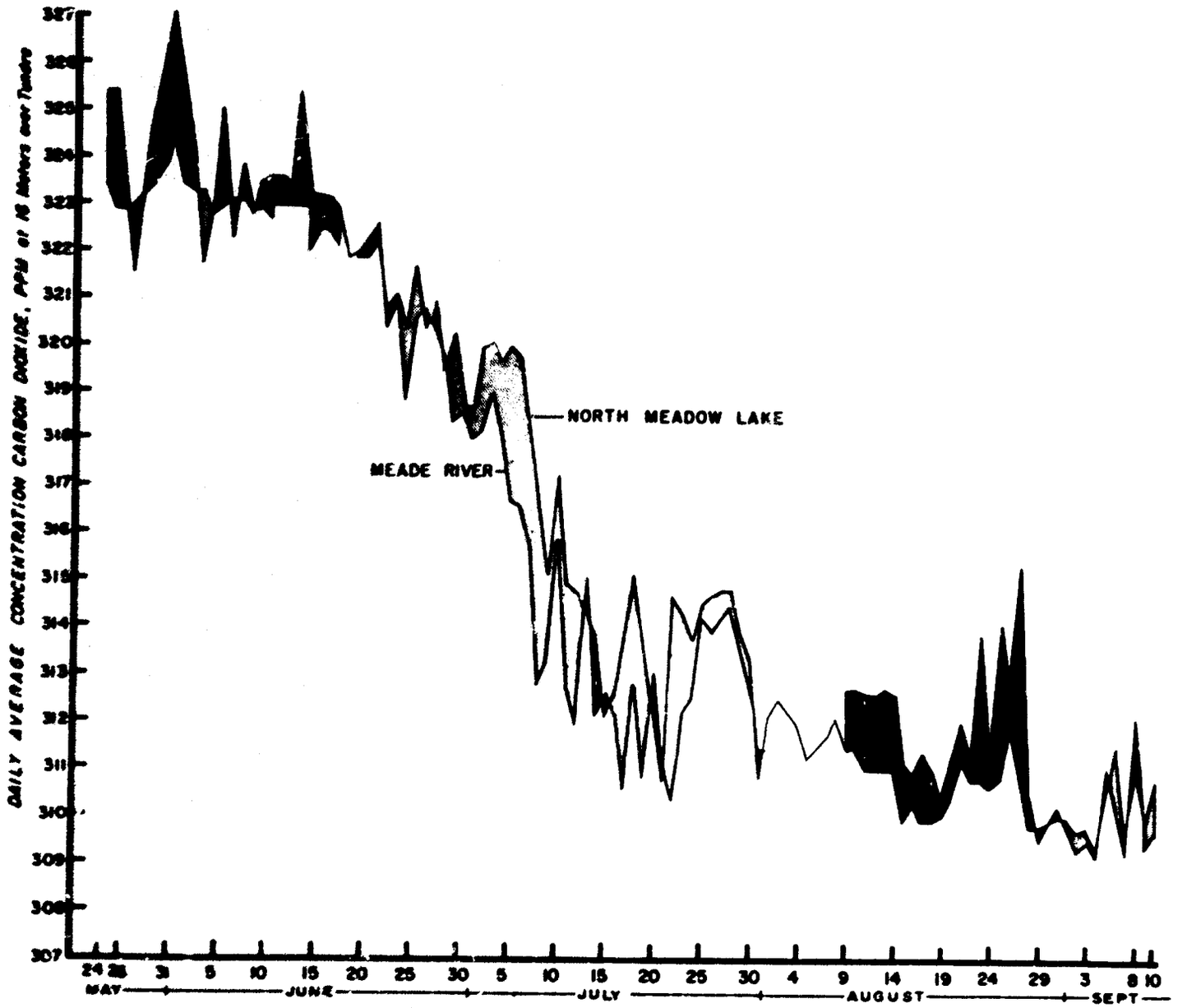

Figure 29. Daily Average Concentration of Carbon Dioxide (ppm) at 16 m Above Tundra at Meade River Camp and North Meadow Lake (Barrow) During the 1966 Thaw Season.

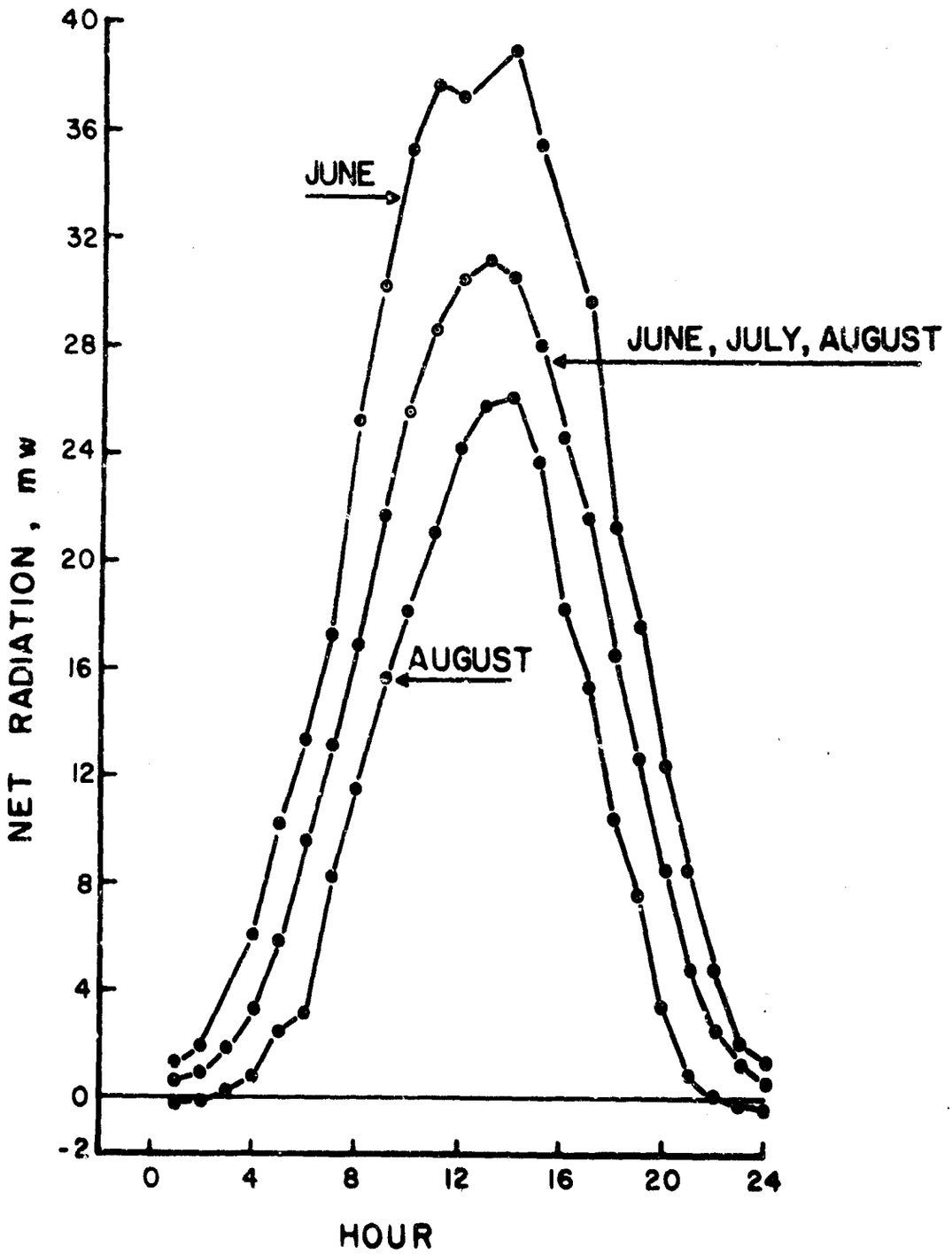

Figure 30. Intensity and Mean Hourly Distribution of Net Radiation at Meade River Camp in June, August, and for Three Summer Months.

Table 22: Open Pan Evaporation Rates, mg/cm^2

Date		Hour	Rate
June	5	1615	-
		1835	20.0
		2125	9.2
	6	0900	2.2
		1100	10.5
		1230	9.8
		1435	-
		1635	9.4
	7	1600	7.1
	10	1430	-
		1730	26.7
		2200	8.5
	11	0800	23.4
		1500	13.2
		1800	16.0
	12	0830	19.5
		1130	23.6
		1430	30.6
		1730	29.3
		2230	5.3
	13	0930	9.3
		1130	36.3
		1330	43.5
		1530	39.1
		1830	27.1
	14	0830	7.2
		1130	41.6
		1430	47.1
		1730	43.8
	15	1130	11.0
	18	1100	-
		1230	32.2
		1600	17.1
		2330	7.4
	19	1145	9.9
		1330	36.1
		1750	50.2
		2345	8.8
	20	0900	8.0
		1100	35.8
		1300	36.6
		1500	46.0
		2030	27.0

Date		Hour	Rate
June	21	0830	-
		1230	43.5
		1420	50.7
		1600	52.6
		2400	16.8
	22	0900	7.7
		1045	19.3
		1345	14.6
	23	1100	8.0
		1515	20.9
	25	1515	-
		2040	16.3
	26	1315	4.4
		1630	17.1
		2025	14.1
	27	0800	2.5
		1030	35.3
		1910	25.4
	29	1140	-
		1900	28.7
	30	1040	4.1
July	1	1010	3.3
	4	0900	-
		1100	26.5
		1630	38.0
		2315	12.7
	6	2145	-
	7	0910	2.0
		2335	14.8
	8	0915	4.3
		1420	25.7
		2130	0
	9	0935	38.2
	13	1400	-
		1600	26.3
		1930	18.6
		2230	13.6
	14	0930	4.9
		1800	27.3
	15	0900	5.3
	16	0830	5.7
		1245	17.5
		1945	62.4

Table 22 continued

Date		Hour	Rate
July	16	2230	-
	17	1210	0.7
	18	1000	3.1
	19	0810	7.5
	20	1035	19.6
	21	0950	6.6
		1312	22.6
		1920	18.9
	22	1000	1.7
		1325	6.3
		1925	1.2
	24	1300	-
		2330	10.3
	25	1030	7.7
		1700	31.9
		1935	15.5
	26	1230	4.8
		1840	25.3
	27	1100	9.2
	28	1010	10.1
		1500	28.3
		1910	13.5
		2030	7.2
August	1	1015	-
	2	0850	6.8
		1245	27.9
		2345	16.5
	3	1010	3.0
		1650	24.4
	4	1300	2.2
		2245	14.8
	7	1015	-
		1430	25.0
	8	1100	7.7
		1400	17.8
		2010	12.8
	9	1015	-
		1320	13.6
		2150	14.1
	10	0900	0.7
		1400	18.8
		2000	7.2
	11	0900	1.7
		1740	25.6
	12	1000	4.3
		1250	32.4
	13	0930	10.6
		1650	28.8
August	14	1045	5.2
		1715	29.5
	17	0950	-
		2300	0.5
	18	1245	1.5
		2000	11.4
	19	0745	0.1
		1245	10.0
		2000	10.6
	20	0840	3.0
		1230	4.1
	21	0830	2.1
	22	0900	26.4
	23	0845	3.2
	24	0930	3.0
		1900	10.5
	25	1010	1.8
	26	0930	19.7
	27	0840	8.4

Note: These values are based on periodic weighing of a shallow polished 9 inch baking tin.

Table 23: Average Daily Wind Velocities
During the Thaw Season
at
Meade River Camp, 1966

Date		mph	Date		mph	Date		mph
May	26	6.8	June	29	3.9	August	2	3.8
	27	4.9		30	4.7		3	7.1
	28	6.3	July	1	4.8		4	6.7
	29	2.5		2	6.2		5	9.4
	30	3.0		3	9.4		6	10.3
	31	3.2		4	8.9		7	13.8
June	1	4.5		5	8.1		8	13.6
	2	5.7		6	4.2		9	11.4
	3	2.5		7	3.4		10	7.1
	4	3.6		8	6.1		11	8.3
	5	1.4		9	6.0		12	7.5
	6	1.8		10	10.2		13	8.0
	7	9.5		11	7.2		14	6.6
	8	10.5		12	6.8		15	4.2
	9	6.7		13	8.5		16	7.2
	10	6.1		14	7.4		17	6.5
	11	3.3		15	4.3		18	5.2
	12	3.8		16	7.7		19	8.2
	13	4.6		17	7.3		20	5.7
	14	3.0		18	10.5		21	2.0
	15	3.5		19	6.6		22	2.7
	16	2.9		20	3.7		23	2.2
	17	4.4		21	6.5		24	4.1
	18	6.5		22	8.6		25	4.1
	19	7.4		23	4.2		26	5.4
	20	4.5		24	4.1		27	4.6
	21	7.5		25	4.8		28	4.6
	22	5.5		26	9.1		29	14.0
	23	6.4		27	9.6		30	12.4
	24	13.7		28	6.1		31	11.6
	25	10.4		29	3.8	Sept.	1	11.6
	26	9.0		30	4.1		2	10.7
	27	-		31	5.2		3	8.1
	28	3.5	August	1	6.2		4	6.6

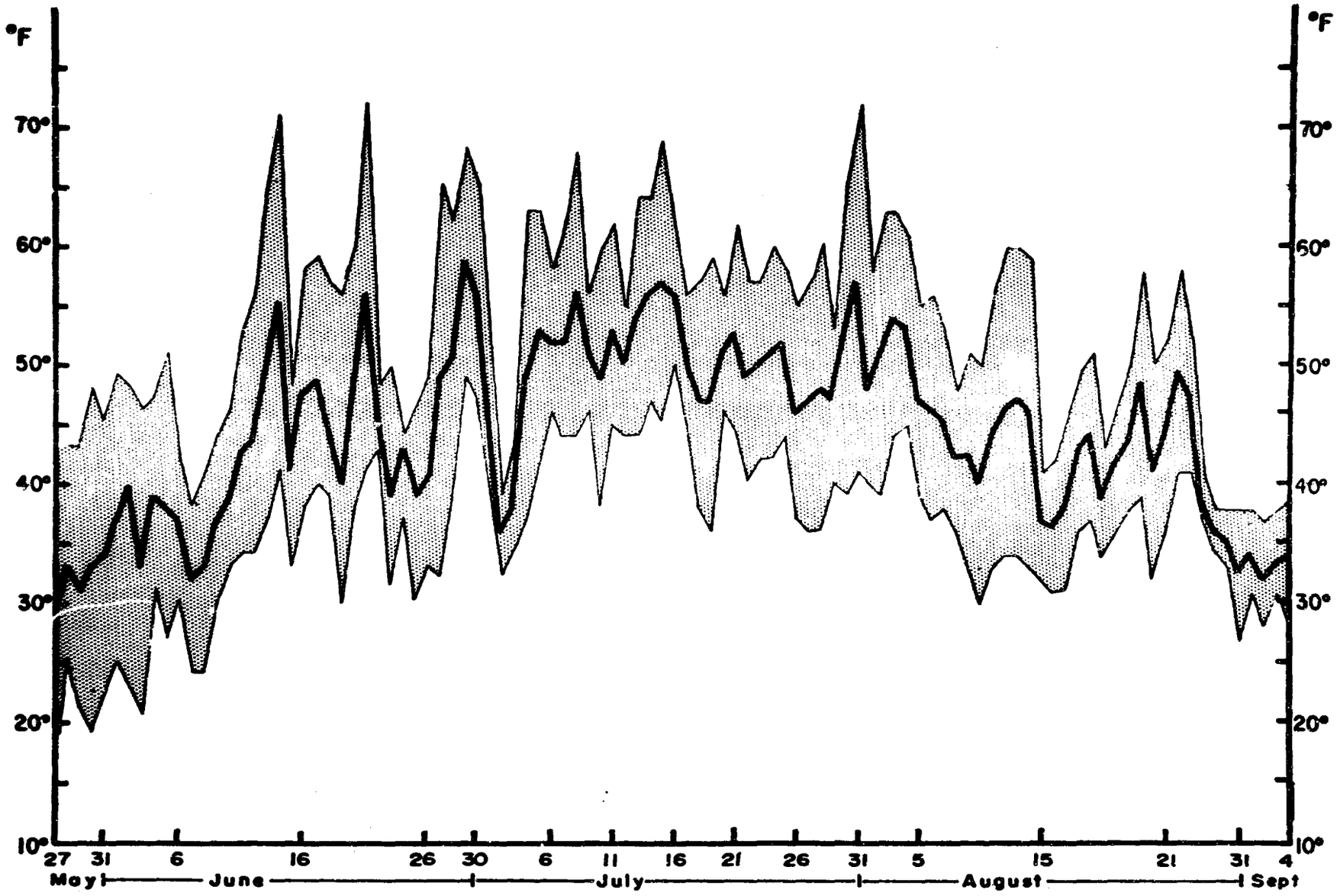

Figure 31. Progression of Daily Mean, Maximum and Minimum Temperatures Based on Five Six's-Type Mercury Thermometers at 5 cm Height in a Screen.

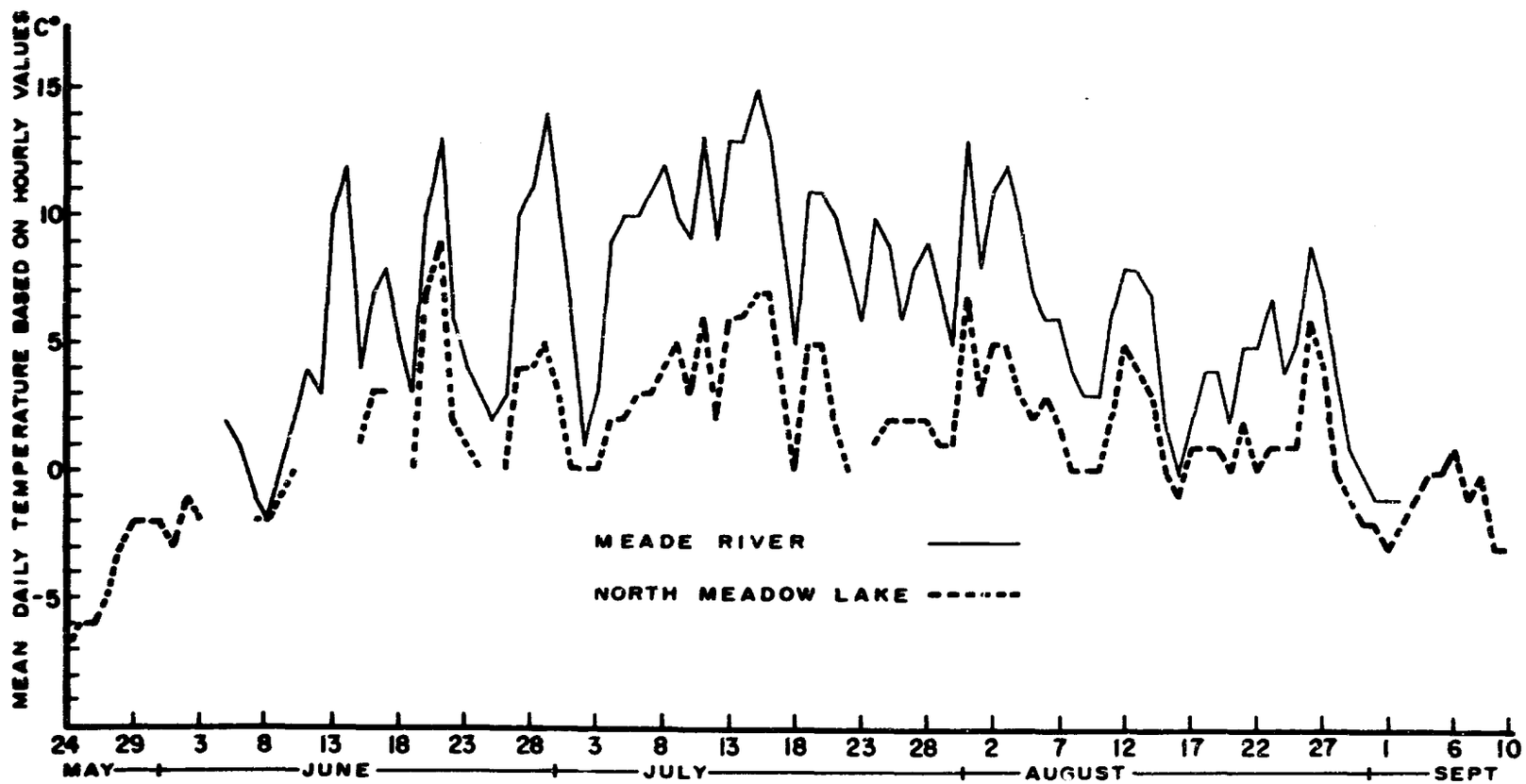

Figure 32. Comparison of Mean Daily Temperatures Based on Hourly Thermograph Values at 5 cm Height at Barrow and Meade River.

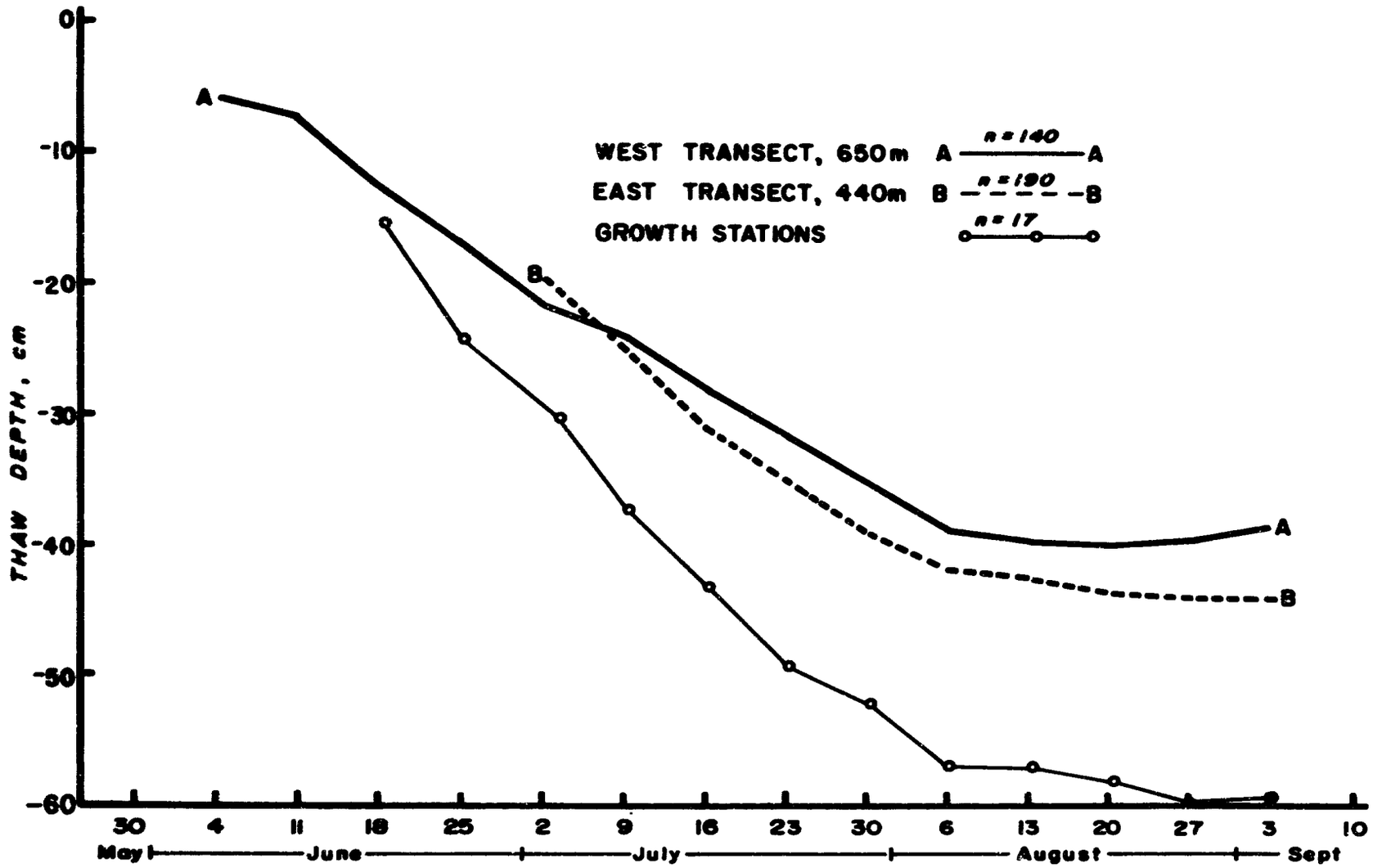

Figure 33. Progression of Thaw in 1966 as an Average 190 Points on Transect A, 140 Points on Transect B, and at 17 Plant Growth Stations.

Table 24: Survey Chemistry of Meade River Water, 1966

Date	Turbidity JTU	Conductance Micrombos	Total Alkalinity	Total Hardness	$CaCo_3$	$MgCo_2$	Fe ppm	Cl	NaCl	SO_4 ppm	Si
June 26	27	73	45	65	20	6	0.25	5	8.3	-	-
July 3	30	82	40	70	30	8	0.28	5	8.3	-	-
July 11	80	91	40	90	35	6	0.32	2.5	4.1	-	-
July 17	40	92	50	80	40	6	0.33	2.5	4.1	7	2.3
Aug. 7	32	107	65	90	40	12	0.26	10	16.5	-	-
Aug. 14	70	-	60	70	40	10	0.32	5	8.3	-	-
Aug. 21	25	130	70	85	45	10	0.20	5	8.3	5	1.7
Aug. 27	-	135	-	-	-	-	-	-	-	-	-
Sept. 4	50	119	70	80	40	12	0.50	5	8.3	-	-

Note: Test performed with Hach Chemical Kit Model DR-EL. Tests for nitrate, nitrite Mn and PO_4 were negative.

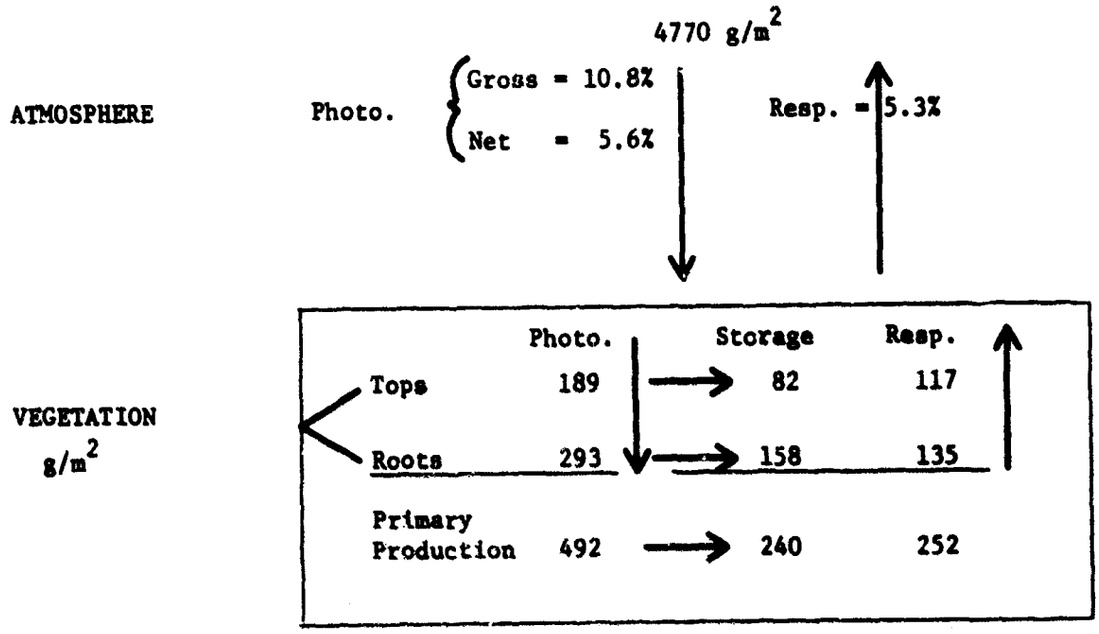

Figure 34. Dry Matter Production in an Arctic Tundra Ecosystem at Meade River, 1966.

TABLE 25: Harvested Biomass at Meade River, 1966

Vegetation Type		Standing Crop, g/m^2		
		30 June	30 July	30 August
Dwarf Willow	Foliage	54	76	94
(Salix pulchra)	Litter	566	199	387
Cottongrass Tussock	Foliage	83	86	57
(Eriophorum vaginatum)	Litter	651	375	400
Dry Sedge Meadow	Foliage	42	45	35
(Carex consimilis)	Litter	256	165	229
Wet Sedge Meadow	Foliage	21	79	72
(Carex aquatilis)	Litter	--	159	158
Sedge Pond	Foliage			67
(Carex aquatilis)	Litter			132

Table 26: Standing Crop of Eight Photosynthesis Sites

Site	Vegetation Type	Dry Weight Live, g/m^2	Chamber Litter, g/m^2	Ratio Live/Dead
1.	Carex aquatilis (wet tundra)	62.1	62.6	0.99
2.	Carex aquatilis (snowbed)	42.4	61.2	0.70
3.	Salix phlebophylla (ridge)	85.5	213.6	0.40
4.	Salix Phlebophylla (ridge)	62.2	180.9	0.34
5.	Eriophorum vaginatum (polygon trough)	260.0	1221.8	0.21
6.	Eriophorum vaginatum (upland tundra)	95.8	1072.1	0.09
7.	Carex aquatilis (pond)	42.6	150.3	0.29
8.	Carex aquatilis (pond)	44.1	150.3	0.29

TABLE 27: Growth Increment of Six Species at Meade River in 1966

Species	Units Measured	Standing crop/unit, dry mg
Betula glandulosa (birch)	40 twigs	46
Salix pulchra (willow)	30 twigs	121
Carex aquatilis (sedge)	30 ramet	151
Carex consimilis (sedge)	20 ramet	120
Eriophorum vaginatum (cotton grass)	4 tussocks	11020
Polygonum bistorta (bistort)	20 tops 20 roots and corm	620 1500

TABLE 28: WEEKLY PLANT GROWTH AT MEADE RIVER, ALASKA

(Mean of 10 Plants, mm)

Species	Site	16 June	25 June	2 July	9 July	16 July	23 July	30 July	6 August	13 August	20 August
Salix pulchra	1	12	21	32	42	55	59	60	61	59	59
	2	11	21	30	41	47	48	49	49	49	49
	3	7	16	25	34	37	38	38	38	39	38
Betula glandulosa	1	3	5	9	13	18	22	25	27	28	26
	2	3	3	5	15	25	28	30	31	33	32
	3	6	7	18	24	29	32	34	35	36	35
	4	12	17	22	27	32	33	34	34	35	34
Carex aquatilis	1	91	104	133	152	179	199	222	227	227	211
	2	56	85	110	139	165	178	188	188	176	164
	3	75	94	125	159	195	222	226	233	231	222
Carex consimilis	1	43	72	110	140	161	17[illegible]	187	186	184	180
	2	38	59	70	85	104	114	123	126	127	120
Eriophorum vaginatum (leaves)	1	51	60	79	85	92	97	98	103	107	100
	2	73	82	105	109	125	134	133	115	105	106
(inflorescence)	1	82	106	132	149	160	160	162	154	161	161
	2	85	99	117	130	137	135	138	133	142	152
Polygonum bistorta (leaves)	1		146	184	223	203	193	190	43	44	41
	2		126	165	185	186	181	145	64	67	79
(inflorescence)	1		34	40	56	97	126	159	131	142	139
	2		28	34	65	123	140	142	139	148	139

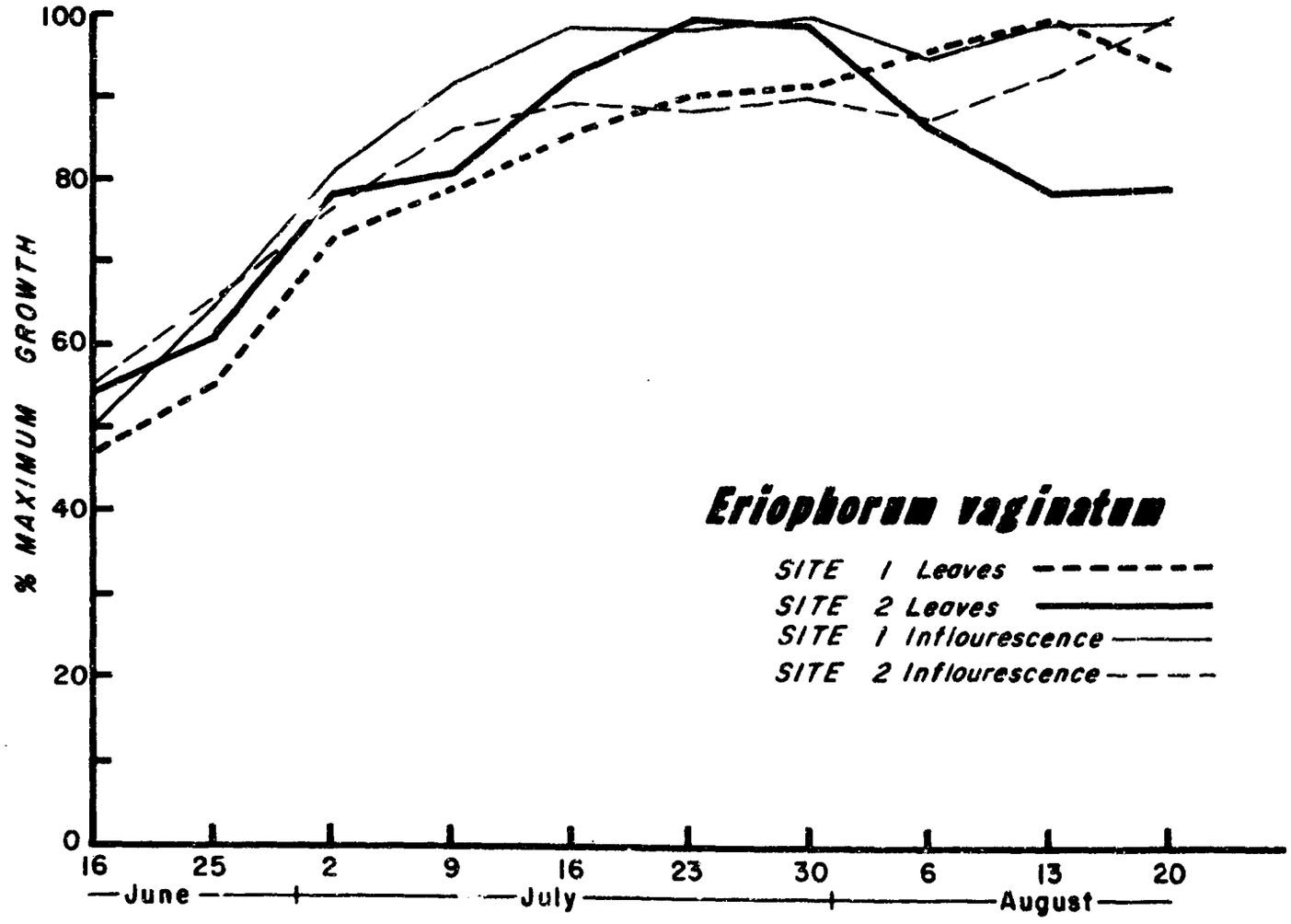

Figure 35. Growth Rates of Six Species at Meade River.

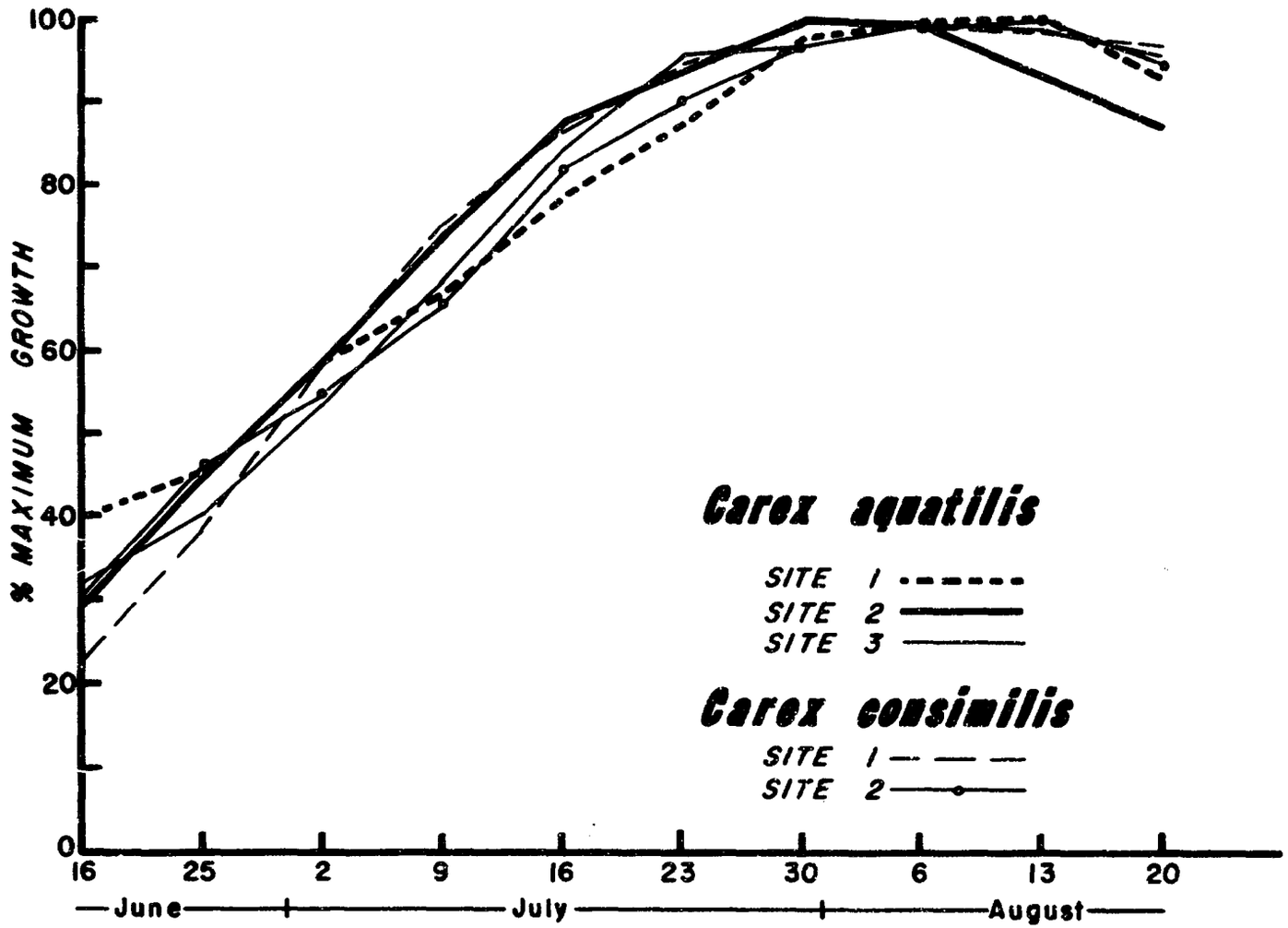

Figure 36. Growth Rates of Six Species at Meade River.

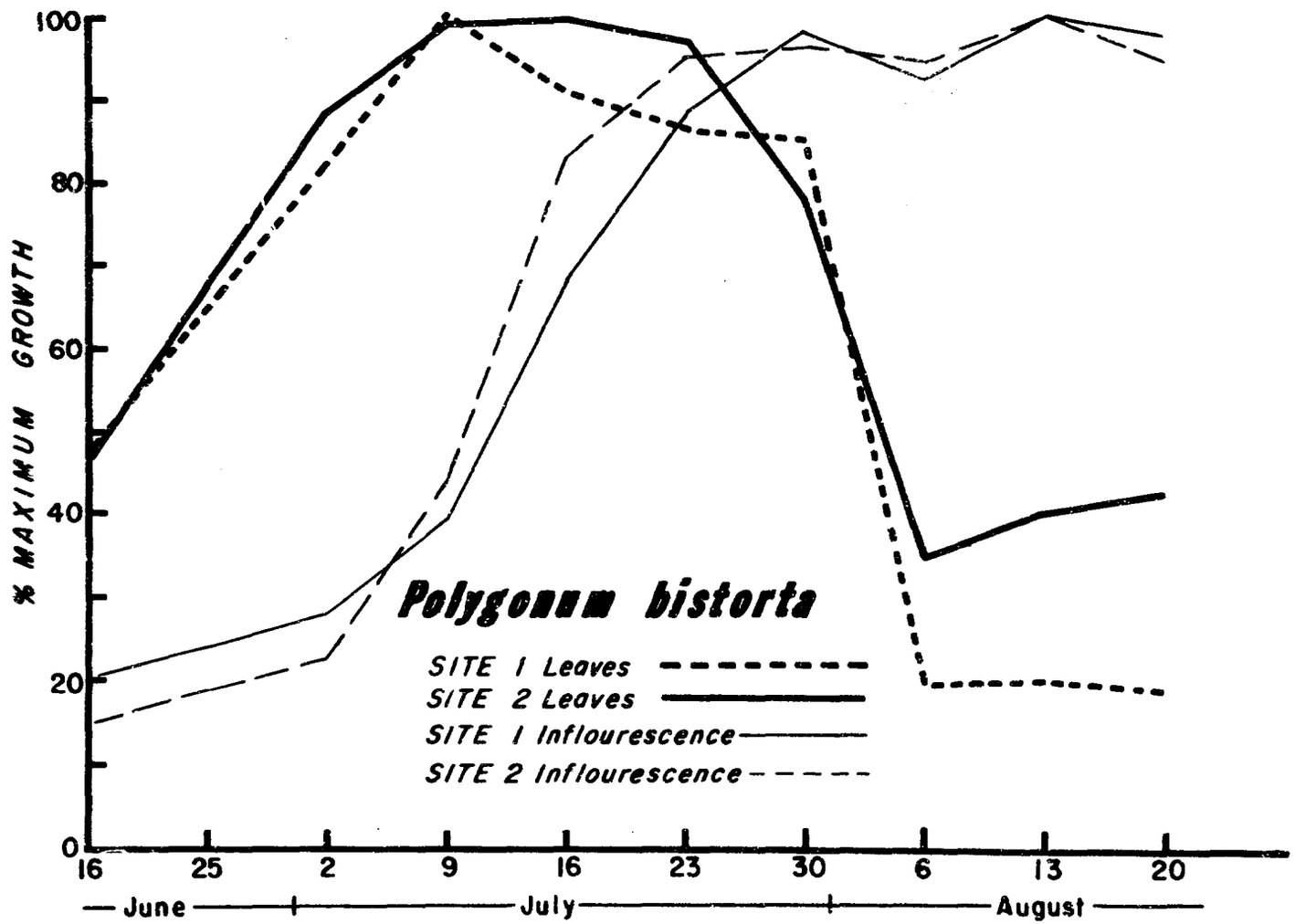

Figure 37. Growth Rates of Six Species at Meade River.

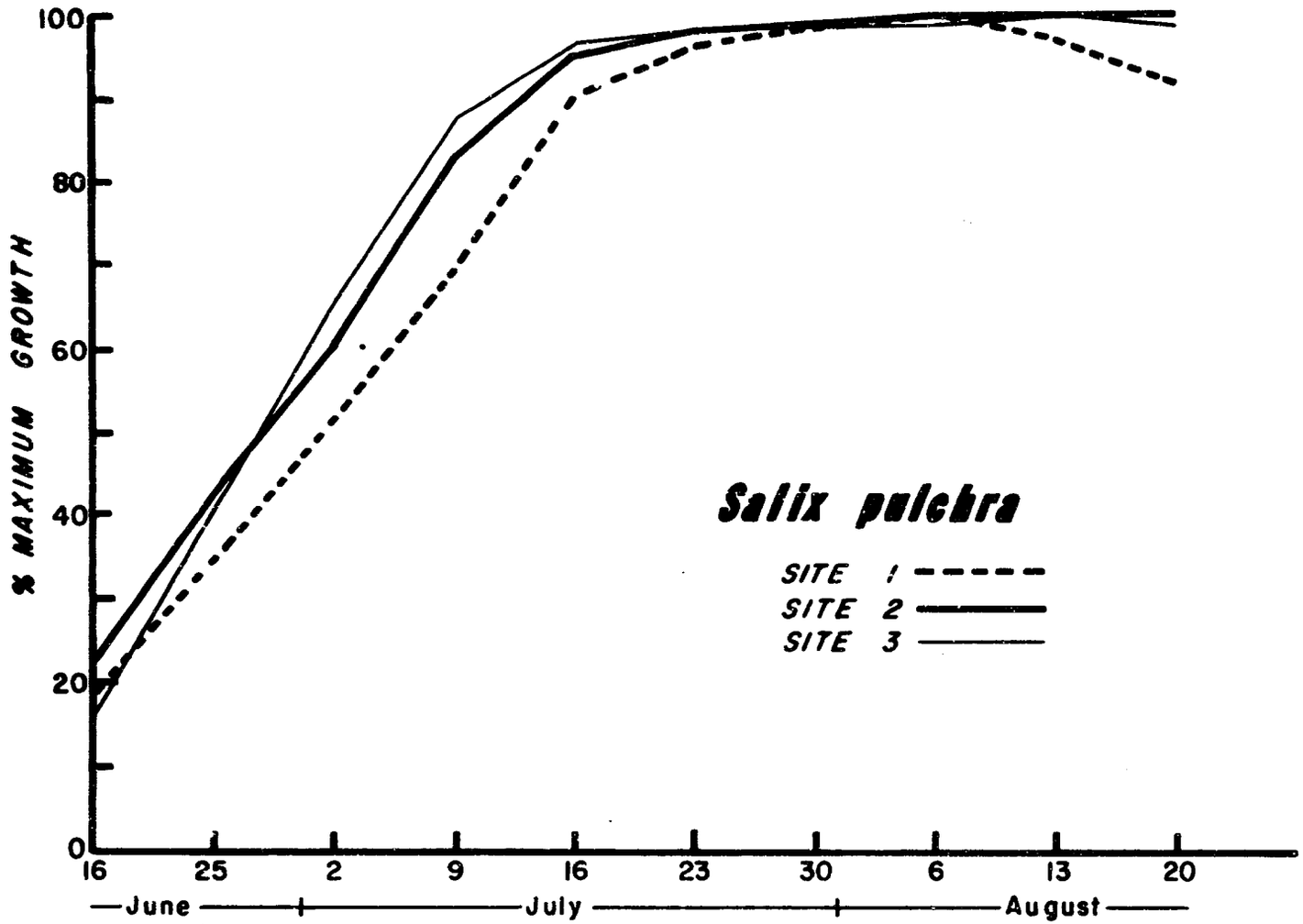

Figure 38. Growth Rates of Six Species at Meade River.

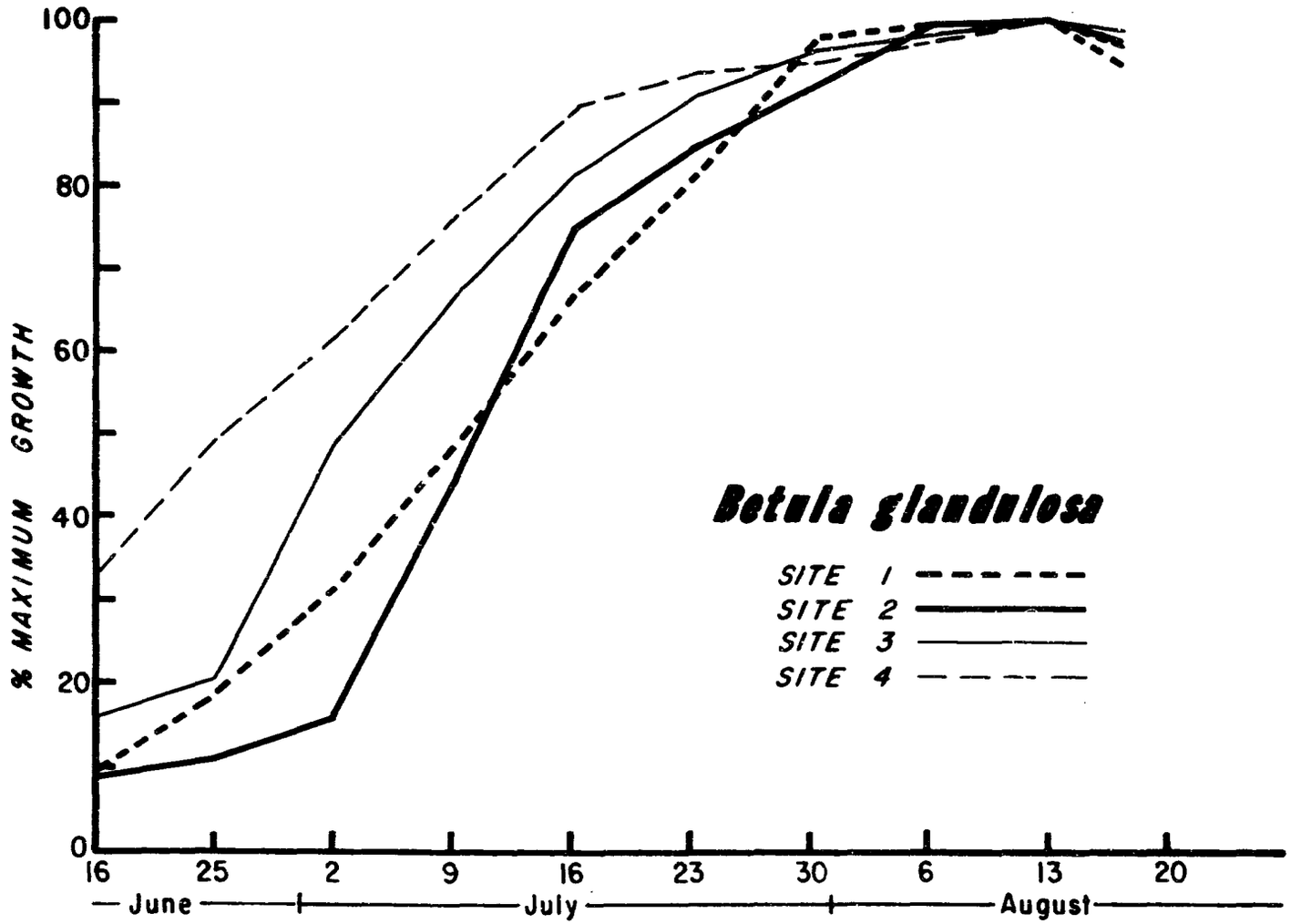

Figure 39. Growth Rates of Six Species at Meade River.

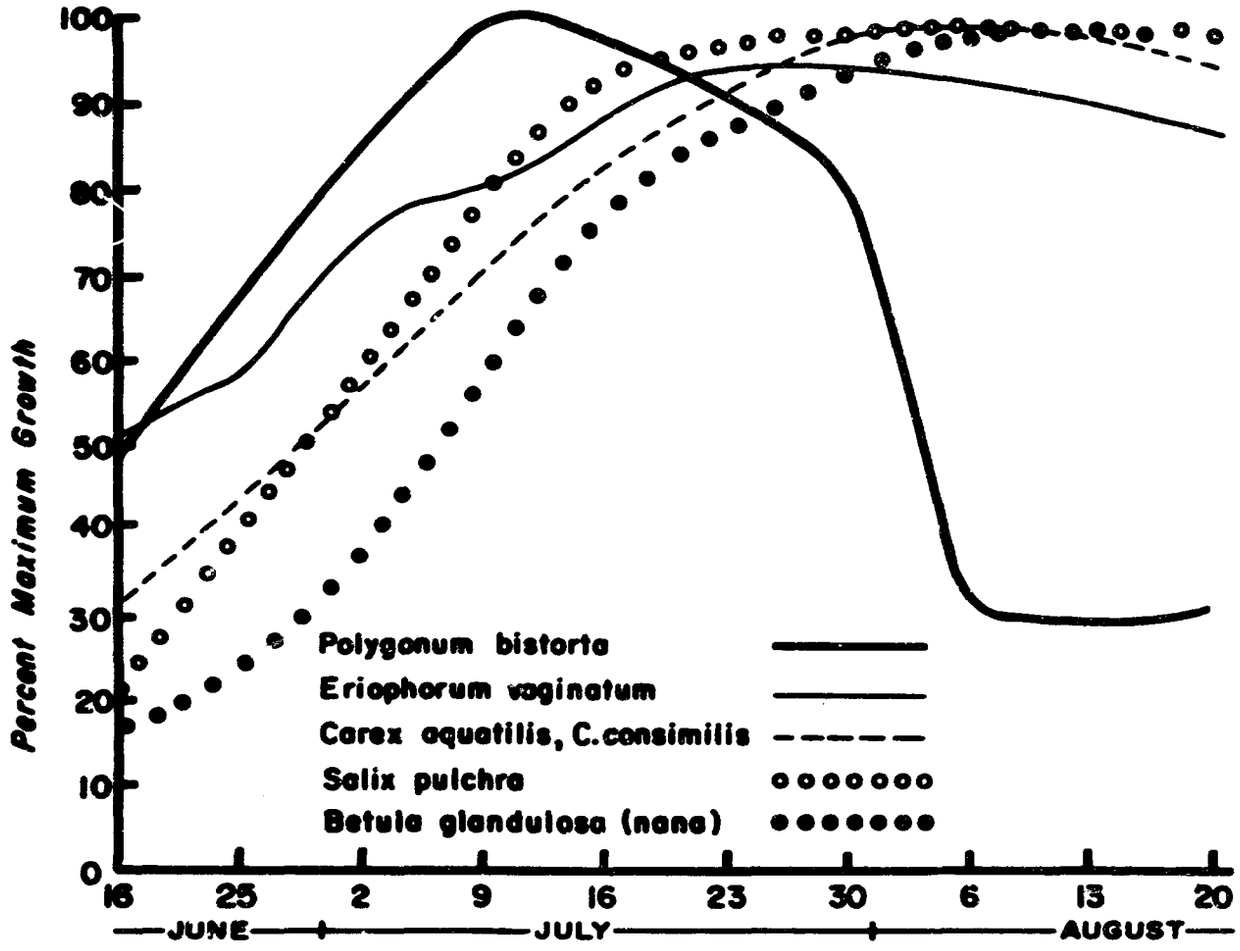

Figure 40. Growth Rates of Six Species at Meade River.

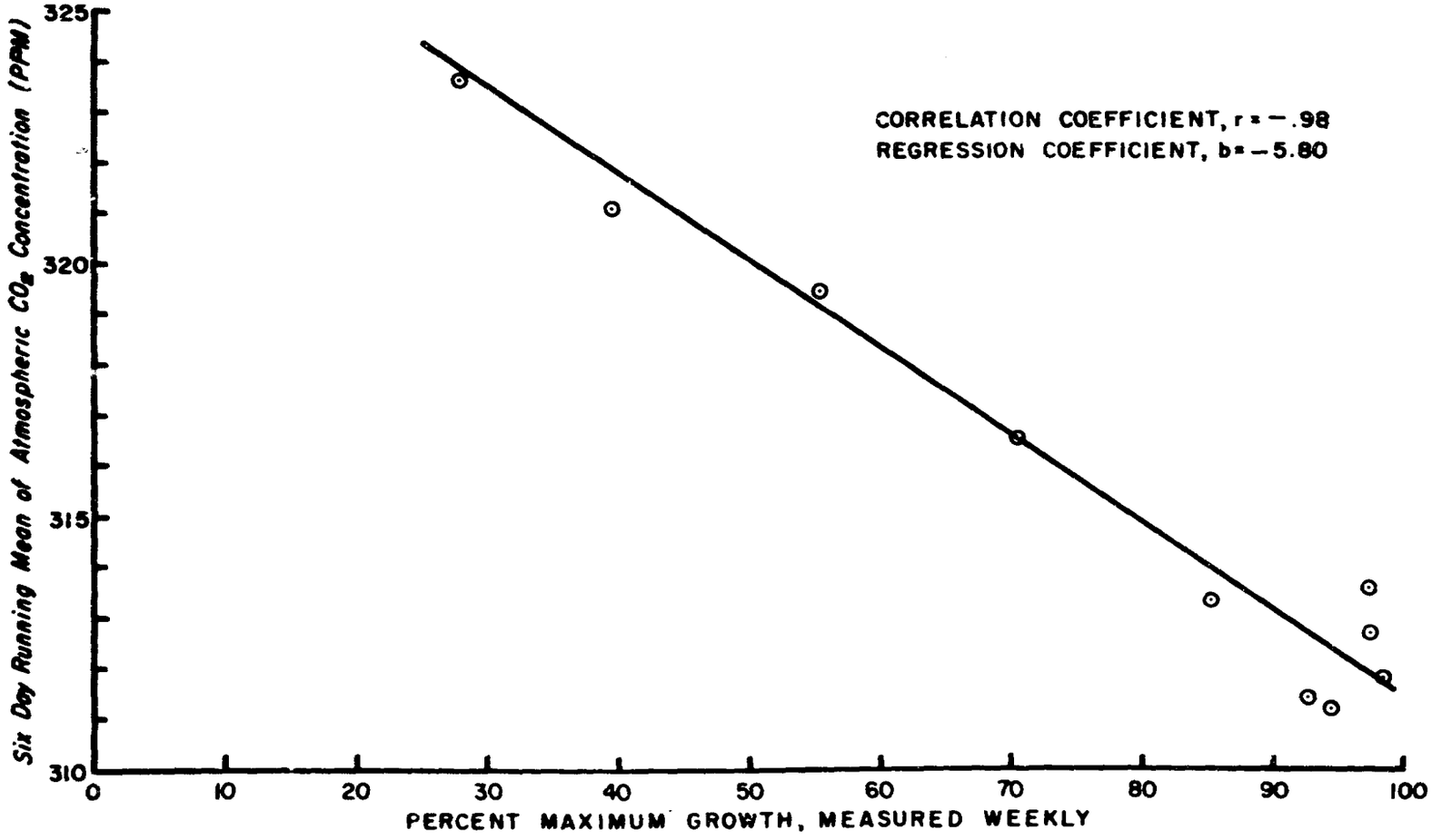

Figure 41. Regression of Six-Day Carbon Dioxide Concentration at 16 m on Percentage of Maximum Plant Growth at Meade River.

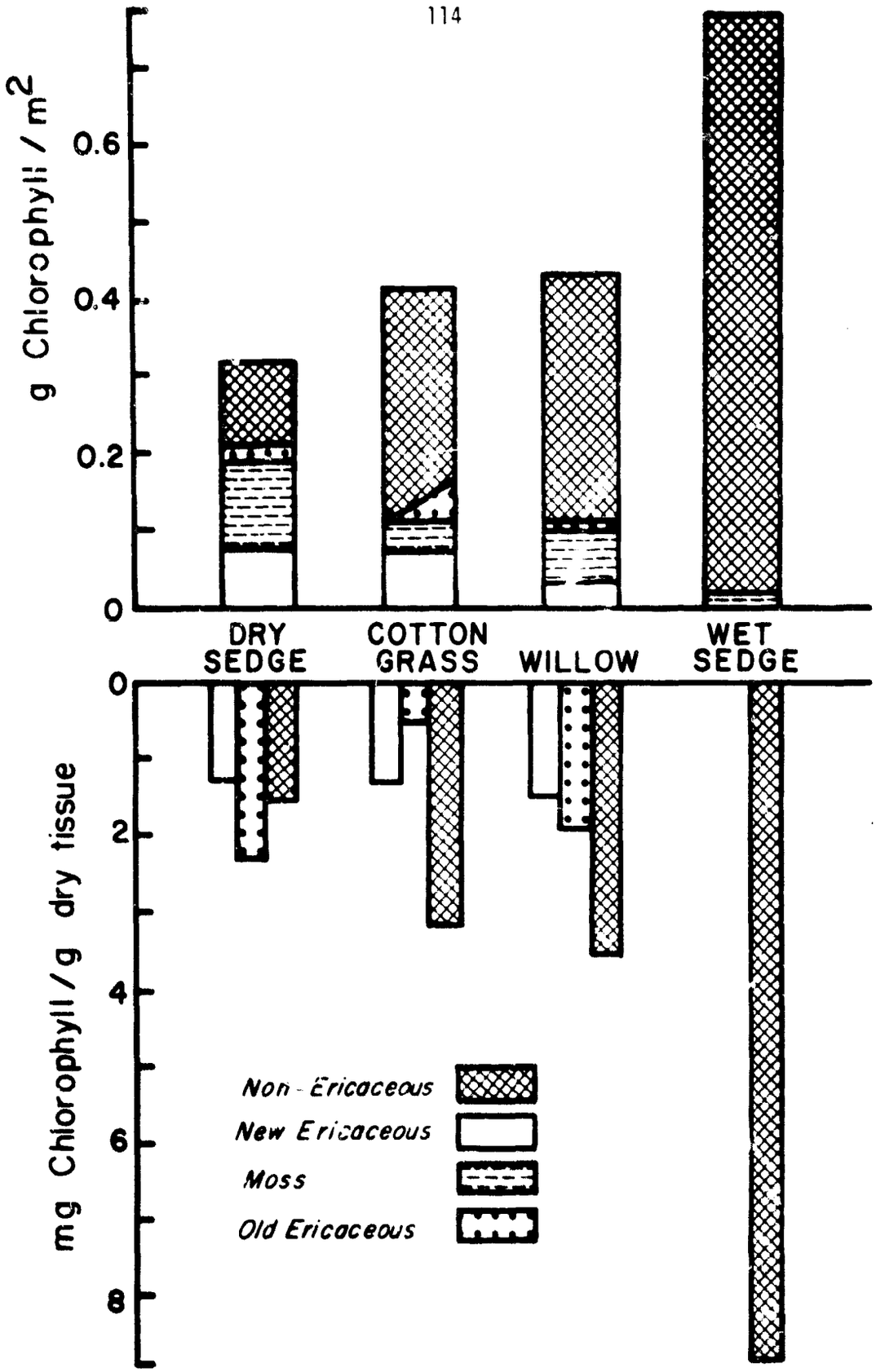

Figure 42. Histograms of Chlorophyll Distribution in Four Components of Four Plant Communities. Note that Bryophytes Accounted for 1/3 of the Pigment in Upland Dry Sedge Stands.

Table 29: Amount of Chlorophyll Per Unit Land Area (g/m^2) and its Distribution in Four Arctic Tundra Communities.

Community	Old Ericad	Current Production Ericad	Non-Ericad	Total	Moss	Old Chloro.	Moss Chloro.	Total Standing Crop
Dry Sedge	.081	.021	.107	.128±13%	.111	25	35	.320
Cotton Grass	.078	----	----	.303±17%	.037	19	9	.418
Willow	.038	.014	.318	.332±8%	.063	9	15	.433
Wet Sedge	.000	.000	.756	.756±12%	.015	0	2	.771

Table 30: Amount of Chlorophyll Per Unit Dry Tissue (mg/g) in Four Arctic Tundra Communities

Community	Ericadeous	Current Ericad	Production Non-Ericad	Correlation, ratio, mg:g
Dry Sedge	1.26	2.28	1.50	.97
Cotton Grass	1.30	---	3.15*	.99
Willow	1.50	1.86	3.53	.92
Wet Sedge	0.00	0.00	8.78	.90

* Value represents total current production.

Table 31: Chlorophyll a:b Ratio and Carotenoid Ratio (OD 5[illegible]4: OD 652) in Four Arctic Tundra Communities

	Chlorophyll a:b				Carotenoid Ratio			
Community	Non Ericad	Current Ericad	Old Ericad	Moss	Non Ericad	Current Ericad	Old Ericad	Moss
Dry Sedge	2.43	1.94	1.83	1.67	1.69	2.08	2.43	2.38
Cotton Grass	1.77	----	1.90	1.52	1.68	----	2.28	2.88
Willow	2.59	1.99	1.96	1.89	1.70	1.94	2.26	2.45
Wet Sedge	2.01	----	----	0.99	1.59	----	----	1.79

Table 32: Current amount of chlorophyll and dry weight production in each sample of each community.

Community and Sample Number	mg Chl/10 dm^2	g dry wt/10 dm^2
Carex dry tundra		
1	8.16	4.27
2		3.28
3	13.76	6.84
4	7.22	4.70
5	11.91	5.81
6		3.87
7	15.62	6.84
8	21.35	10.30
9	15.67	8.56
10	8.70	4.79
	127.99/m^2 ± 16.93	59.26/m^2 ± 7.03
Eriophorum vaginatum		
1	22.41	6.60
2	39.58	11.95
3	39.93	12.83
4	34.94	11.44
5	14.43	5.01
	302.58/m^2 ± 50.72	191.32/m^2 ± 15.7
Salix pulchra		
1	32.02	9.09
2	28.85	7.05
3	20.72	7.78
4	36.74	10.05
5	51.77	13.86
6	36.86	9.87
7	30.11	7.82
8	26.49	8.47
9	27.23	8.72
10	40.47	10.55
	331.26/m^2 ± 27.7	93.26/m^2 ± 6.13
Carex wet tundra		
1	68.37	8.66
2	67.21	9.51
3	76.36	9.18
4	139.54	11.95
5	97.98	10.34
6	53.14	5.49
7	92.87	9.60
8	60.08	8.19
9	44.58	5.85
10	55.51	7.39
	756.34/m^2 ± 88.91	86.16/m^2 ± 6.26

TABLE 33: Weight Loss From Litter Bags Exposed at Barrow
24 August 1965 to 12 September 1966

Sample	Oven Dry	Loss	%	Sample	Oven Dry	Loss	%
1	33.7	4.0	18.4	15	56.5	6.7	23.8
2	31.5	3.9	17.7	16	45.6	6.0	21.4
3	51.6	8.9	22.7	17	65.0	13.3	25.5
4	42.1	6.8	20.5	18	53.1	7.2	23.0
5	37.1	5.2	19.3	19	60.3	6.4	24.6
6	38.4	6.8	19.6	20	54.1	8.7	23.3
7	34.7	5.8	18.6	21	48.8	5.5	22.1
8	37.3	4.4	19.3	22	50.3	5.2	22.4
9	49.9	5.8	22.3	23	53.0	10.3	23.0
10	35.2	3.8	18.8	24			
11	48.4	7.9	22.0	25			
12	41.0	6.8	20.2	26	$\bar{x}$ =		21.3
13	41.5	4.6	20.4	27			
14	44.9	6.1	21.2	28			

Site	Plot	%Loss
1	2	19.7
2	17	20.1
3	21	23.1
4	31	23.7
5	46	20.2

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13. ABSTRACT

This report presents the results of analyses of atmospheric carbon dioxide and ecological factors at Meade River Camp and at North Meadow Lake (Barrow), Alaska. The data summarize reference gas calibrations used in the CO_2 program, with a discussion of methods used to obtain the data for CO_2 concentrations in air at both stations. Variations of CO_2 in the air, at the ground level, and at 16 m above the ground are given for both the Meade River Station and North Meadow Lake. Meteorological observations are presented for the period of observations. The percent rate of growth of five species of tundra plants is shown, and the correlation between CO_2 concentration in the atmosphere and the percent of maximum ground is given. The data for the amounts of chlorophyll and dry weight production in each of four types of communities are presented. A list of publications resulting from the interpretation of these data is included.

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