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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<sub>2</sub> program, with a discussion of methods used to obtain the data for CO<sub>2</sub> concentrations in air at both stations. Variations of CO<sub>2</sub> 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<sub>2</sub> concentration in the atmosphere and the percent of maximum growth 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

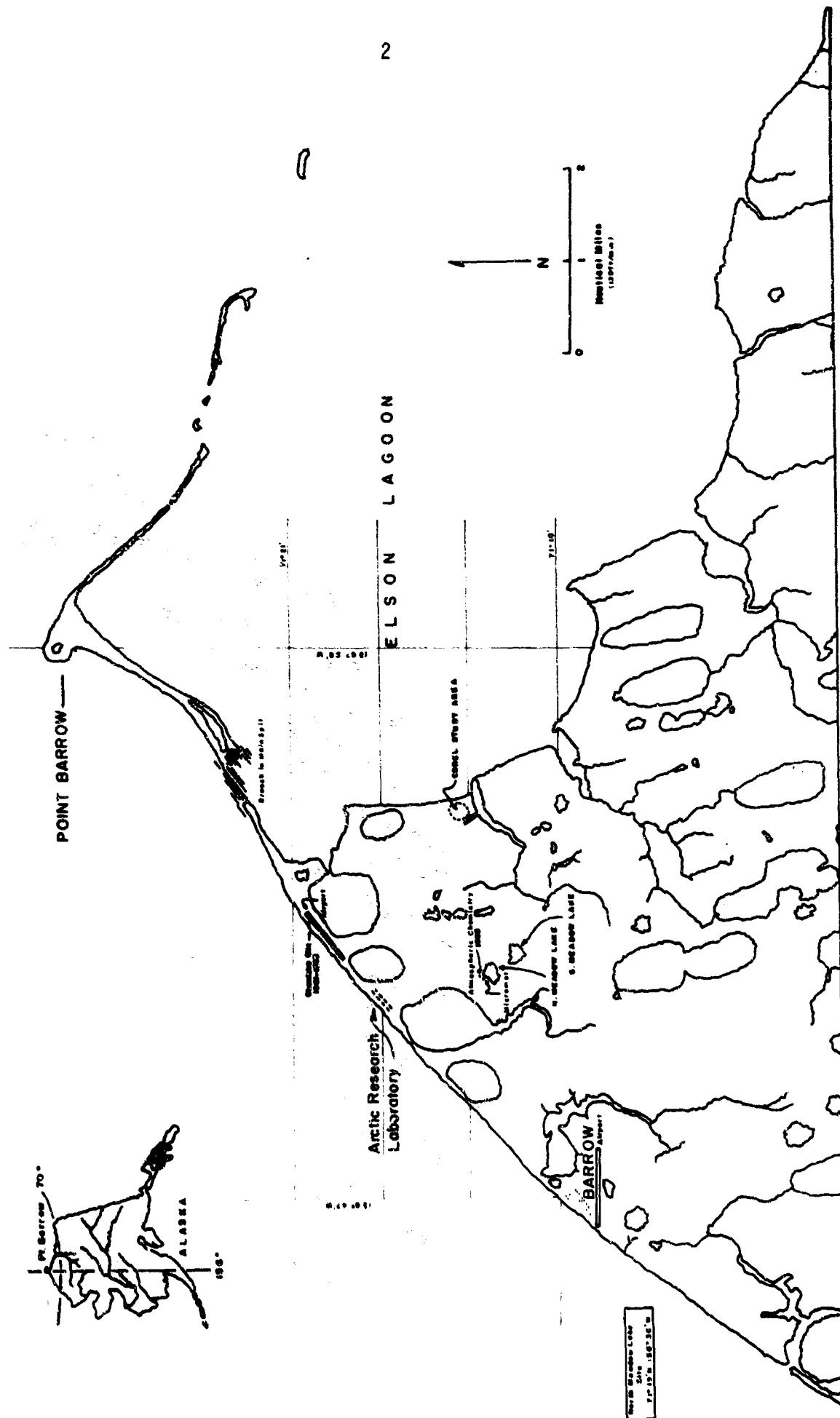
This report is a record of the data for measurements of carbon dioxide in the atmosphere near the ground and ecological observations during the summer of 1966 at two field stations separated by approximately  $1^{\circ}$  of latitude. Observations were made throughout the growing season on the Arctic coastal plain of Alaska. The North Meadow Lake Station at an elevation of 6 m ( $71^{\circ}18'N$ ,  $159^{\circ}39'W$ ) 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 ( $70^{\circ}28'N$ ,  $157^{\circ}26'W$ ) 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.

# ARCTIC OCEAN



COORDINATES REPRESENT THE APPARENT FIX OF:  
 1) BARROW AND PUBLISHED POSITION  
 2) WORLD GEOGRAPHICAL MAPS, SHOWS NAME  
 3) BARROW AND ASSUMES POSITION STATED  
 IS FOR THAT LOCATION

Figure 1. Location of North Meadow Lake Station ( $71^{\circ}18'N, 159^{\circ}39'W$ ).

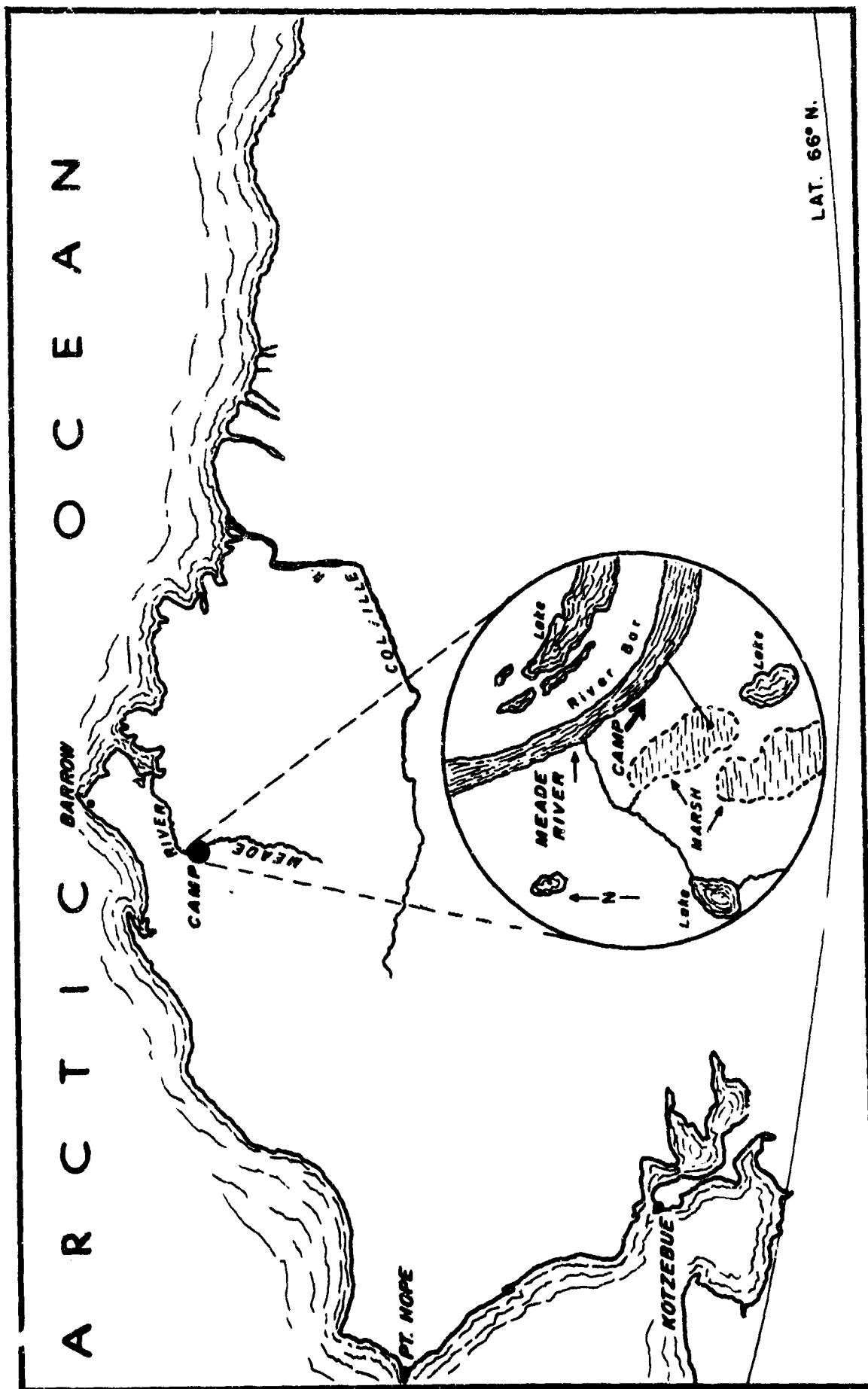


Figure 2. Location of NARL Camp on the Meade River 65 Miles SSW of Barrow (70°28'N, 157°26'W).

## 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<sub>2</sub> concentrations. This report does not include hourly values of CO<sub>2</sub> for Meade River Camp or for Barrow. These values are too numerous to tabulate and are documented fully on computer output sheets.<sup>1</sup> 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:

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

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<sub>2</sub> Report, 1966. For example, reference to the manometric equation is given in the CO<sub>2</sub> 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<sub>2</sub> Report, 1966.

<sup>1</sup>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<sub>2</sub> Report, 1966 TABLE 4.

#### TABLE 4

Final values for all CRREL<sup>2</sup> reference cylinders are tabulated and are similar to CO<sub>2</sub> 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

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<sup>2</sup>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<sub>2</sub> Report, 1966 TABLE 5. All values were corrected to 30" Hg (10.16 centibars). The procedure for reducing these data is given in CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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  $\text{CO}_2$  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  $\text{CO}_2$  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  $\text{CO}_2$  and initial  $\text{CO}_2$  utilization by the early tundra vegetation. During May and June the Barrow area was still snow covered.

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

#### TABLE 10

Monthly values for  $\text{CO}_2$  at Meade River and Barrow are presented.

The following mean monthly differences in  $\text{CO}_2$  measured at 16 m above the ground between the two stations was noted:

| <u>Month</u> | <u>MR - NML</u> |
|--------------|-----------------|
| June         | +0.3 ppm        |
| July         | -1.8            |
| August       | +1.0            |

These data indicate a net flux of  $\text{CO}_2$  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  $\text{CO}_2$  near the ground. It is difficult to obtain a preferred wind orientation at both Meade River and Barrow simultaneously; however, a selection of  $\text{CO}_2$  data for winds of  $15^\circ$  and  $195^\circ$  with indicated tolerances are presented in TABLE 11.

The long term average shows almost no horizontal changes along the NML-MR  $\text{CO}_2$  transect with wind orientation by our techniques. The greatest detectable differences occurred in early July.

#### TABLE 12

The distribution of  $\text{CO}_2$  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  $\text{CO}_2$  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  $\text{CO}_2$  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  $\text{CO}_2$  by tundra.

#### TABLE 13

Weekly average concentrations of  $\text{CO}_2$  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  $\text{CO}_2$  entrained under the snow cover. At Meade River ambient  $\text{CO}_2$  showed values commensurate with the usual spring rise in  $\text{CO}_2$  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  $\text{CO}_2$  from the atmosphere near the ground than Meade River; thus, the higher Meade River  $\text{CO}_2$  levels.

#### TABLE 14

This Table gives the monthly averages for  $\text{CO}_2$  near the ground at Meade River and Barrow. Note that the June average is not used because of the anomalously high values at Barrow caused by  $\text{CO}_2$  measurements underneath the snow.

TABLE 15

Three-day running means of  $\text{CO}_2$  at Meade River and North Meadow Lake at 16 m are represented in Figures 11 and 12.

The major variations in atmospheric  $\text{CO}_2$  at 16 m between Meade River and Barrow were:

| <u>Date</u> | <u>MR-NML</u> |
|-------------|---------------|
| 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  $\text{CO}_2$  concentration at 16 m are given.

TABLE 17 and 18

Diurnal variations of  $\text{CO}_2$  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  $\text{CO}_2$  concentration during the night and lower  $\text{CO}_2$  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  $\text{CO}_2$  for June, July and August 1966 for Meade River and Barrow are tabulated and shown in Figures 15, 16.

Figure 15 shows that minimum  $\text{CO}_2$  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  
Heade River, Alaska

| Standard<br>Tank No. | Compared<br>Tank No. | Observed<br>Scale<br>Diff. | Number<br>of<br>Comparisons | Index<br>Diff. | Recorder<br>Single<br>Set | Scale<br>Factor<br>Wgt'd Avg. | Date of<br>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<br>Single Set Bar. Press(mb) | Adjusted Recorder Scale Factor | Date of Analysis |
|-------------------|---------------------|----------------------|-----------------------|----------------------------------------------------|--------------------------------|------------------|
| 2015              | 5752                | 4.23                 | 1                     | 4.75                                               | 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                                               | 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                                               | 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                                               | 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                                               | 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<br>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                                                | 6.19                           | 9 June 1966      |
| 7055              | 3732              | 2.80                 | 7                     | 6.10                                                | 6.19                           | 10 June 1966     |
| 7055              | 3732              | 2.90                 | 5                     | 5.89                                                | 5.95                           | 11 June 1966     |
| 7055              | 3732              | 2.78                 | 11                    | 6.14                                                | 6.17                           | 12 June 1966     |
| 7055              | 3732              | 2.71                 | 13                    | 6.30                                                | 6.32                           | 13 June 1966     |
| 7055              | 3732              | 2.79                 | 6                     | 6.12                                                | 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 <sub>2</sub> | W <sub>3</sub> | *      | II     | II†    | I      | W <sub>1</sub> | IHS    | W <sub>4</sub> |
| 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 Cases Used to Determine Recorder Scale Factors - Meade River, Alaska

| <u>Standard Tank</u> | <u>Compared Tank</u> | <u>Index Differences</u> |
|----------------------|----------------------|--------------------------|
| 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

| <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> |
|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|
| 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

| <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> |
|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|
| 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<sub>2</sub> Analyzer  
Barrow, Alaska (North Meadow Lake)

| <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> |
|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|
| 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<sub>2</sub> Analyzer  
Barrow, Alaska (North Meadow Lake)

| <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> | <u>Date</u><br><u>1966</u> | <u>Recorder</u><br><u>Scale</u><br><u>Factor</u> |
|----------------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|
| 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 <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Meade River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| May 24, 1966 |                               |                 |                   |                 |
| 25           | 322.9                         | 325.4           | 321.3             | 323.4           |
| 26           | 322.9                         | 325.4           | 320.9             | 322.9           |
| 27           | 321.1                         | 323.2           | 320.9             | 322.9           |
| 28           | 319.7                         | 321.5           | 321.0             | 323.1           |
| 29           | 321.3                         | 323.4           | 321.1             | 323.2           |
| 30           | 322.6                         | 325.0           | 321.2             | 323.4           |
| 31           | 323.3                         | 325.9           | 321.6             | 323.8           |
|              | 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           | -----             | -----           |

16 meters

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

| Date          | Meade River |                 | CO <sub>2</sub> Concentration |                 | North Meadow Lake |                 |
|---------------|-------------|-----------------|-------------------------------|-----------------|-------------------|-----------------|
|               | Index       | Manometric(ppm) | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| June 12, 1966 | 321.3       | 323             | -----                         | -----           | -----             | -----           |
| 13            | 322.9       | 325.4           | -----                         | -----           | -----             | -----           |
| 14            | 321.1       | 323.2           | 320.1                         | 322.0           | 320.1             | 322.0           |
| 15            | -----       | -----           | 320.5                         | 322.5           | 320.5             | 322.5           |
| 16            | 321.1       | 323.2           | 320.5                         | 322.5           | 320.5             | 322.5           |
| 17            | 320.9       | 322.9           | 320.2                         | 322.1           | 320.2             | 322.1           |
| 18            | 320.0       | 321.9           | -----                         | -----           | -----             | -----           |
| 19            | 320.1       | 322.0           | 320.0                         | 321.9           | 320.0             | 321.9           |
| 20            | 320.3       | 322.2           | 320.0                         | 321.9           | 320.0             | 321.9           |
| 21            | 320.6       | 322.6           | 320.3                         | 322.2           | 320.3             | 322.2           |
| 22            | 318.8       | 320.4           | 319.1                         | 320.8           | 319.1             | 320.8           |
| 23            | 319.3       | 321.0           | 319.4                         | 321.1           | 319.4             | 321.1           |
| 24            | 317.5       | 318.8           | 318.8                         | 320.4           | 318.8             | 320.4           |
| 25            | 319.0       | 320.6           | 319.9                         | 321.7           | 319.9             | 321.7           |
| 26            | 319.1       | 320.8           | 318.8                         | 320.4           | 318.8             | 320.4           |
| 27            | 318.8       | 320.4           | 319.3                         | 321.0           | 319.3             | 321.0           |
| 28            | 318.3       | 319.8           | 318.1                         | 319.5           | 318.1             | 319.5           |
| 29            | 317.2       | 318.4           | 318.7                         | 320.3           | 318.7             | 320.3           |
| 30            | 317.3       | 318.6           | 317.5                         | 318.8           | 317.5             | 318.8           |

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

16 meters

| Date         | CO <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Meade River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | 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 <sub>2</sub> Concentration |                 |                   |                 |
|----------------|-------------------------------|-----------------|-------------------|-----------------|
|                | Meade River                   |                 | North Meadow Lake |                 |
|                | Index                         | Manometric(ppm) | Index             | 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)  
Manometric Concentration Scale

16 meters

| Date           | CO <sub>2</sub> Concentration |                 |                   |                 |
|----------------|-------------------------------|-----------------|-------------------|-----------------|
|                | Meade River                   |                 | North Meadow Lake |                 |
|                | Index                         | Manometric(ppm) | Index             | 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             | 309.6           |

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

| Date              | CO <sub>2</sub> Concentration |                 |                   |                 |
|-------------------|-------------------------------|-----------------|-------------------|-----------------|
|                   | Meade River                   |                 | North Meadow Lake |                 |
|                   | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| August 29, 1966   | 309.9                         | 309.5           | 310.1             | 309.8           |
|                   | 310.2                         | 309.9           | 310.2             | 309.9           |
|                   | 310.4                         | 310.2           | 310.3             | 310.0           |
| September 1, 1966 | 310.0                         | 309.7           | 310.3             | 310.0           |
|                   | 309.7                         | 309.3           | 310.0             | 309.7           |
|                   | 309.9                         | 309.5           | 310.1             | 309.8           |
|                   | 309.6                         | 309.2           | 309.7             | 309.3           |
|                   | 311.2                         | 311.1           | 310.9             | 310.8           |
|                   | 310.4                         | 310.2           | 311.5             | 311.5           |
|                   | 309.6                         | 309.2           | 309.8             | 309.4           |
|                   | 312.1                         | 312.2           | 311.3             | 311.2           |
|                   | 309.8                         | 309.4           | 310.3             | 310.0           |
|                   | 310.0                         | 309.7           | 310.9             | 310.8           |

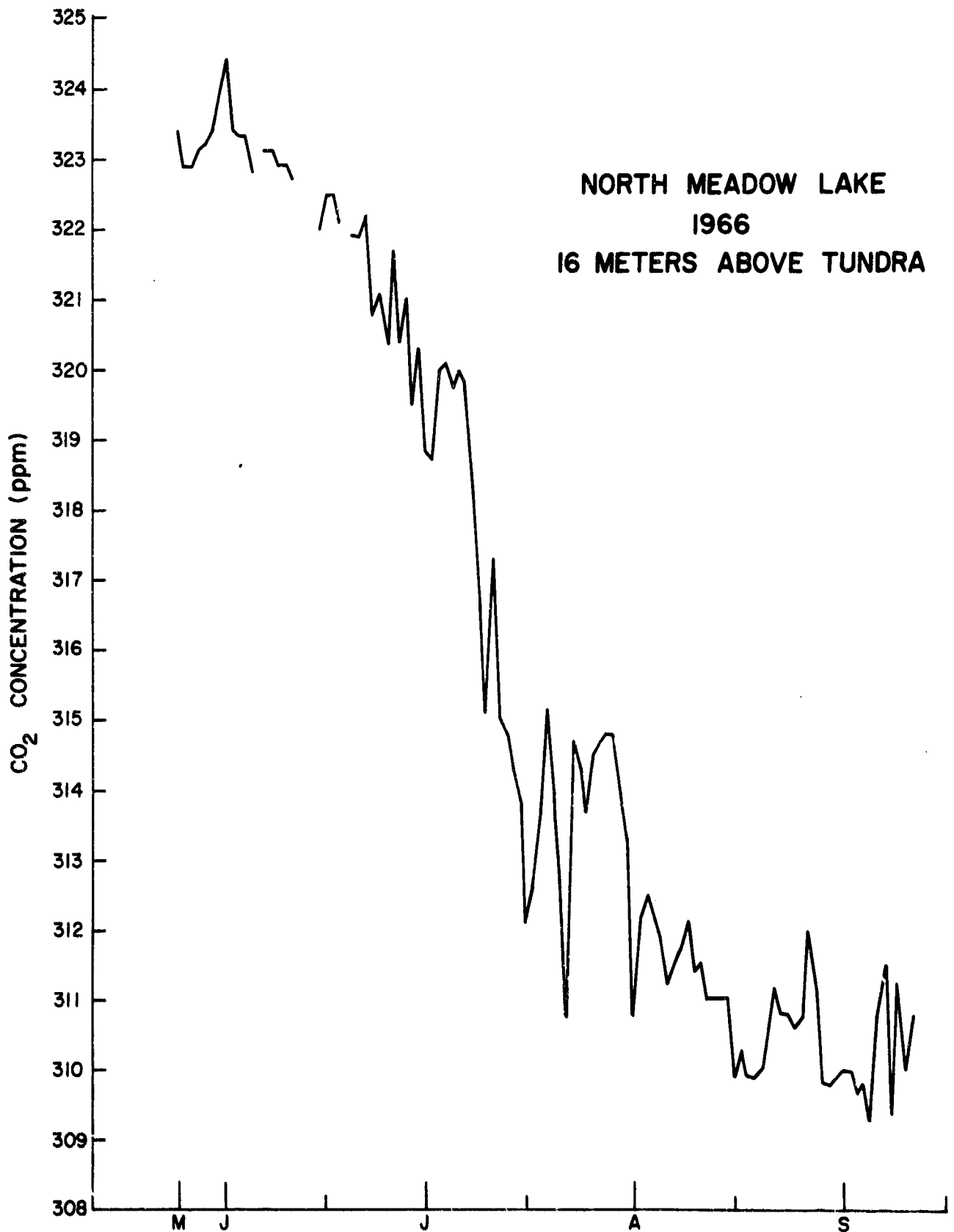


Figure 3. Daily Average CO<sub>2</sub> Concentration (ppm) at 16 m, North Meadow Lake, 1966.

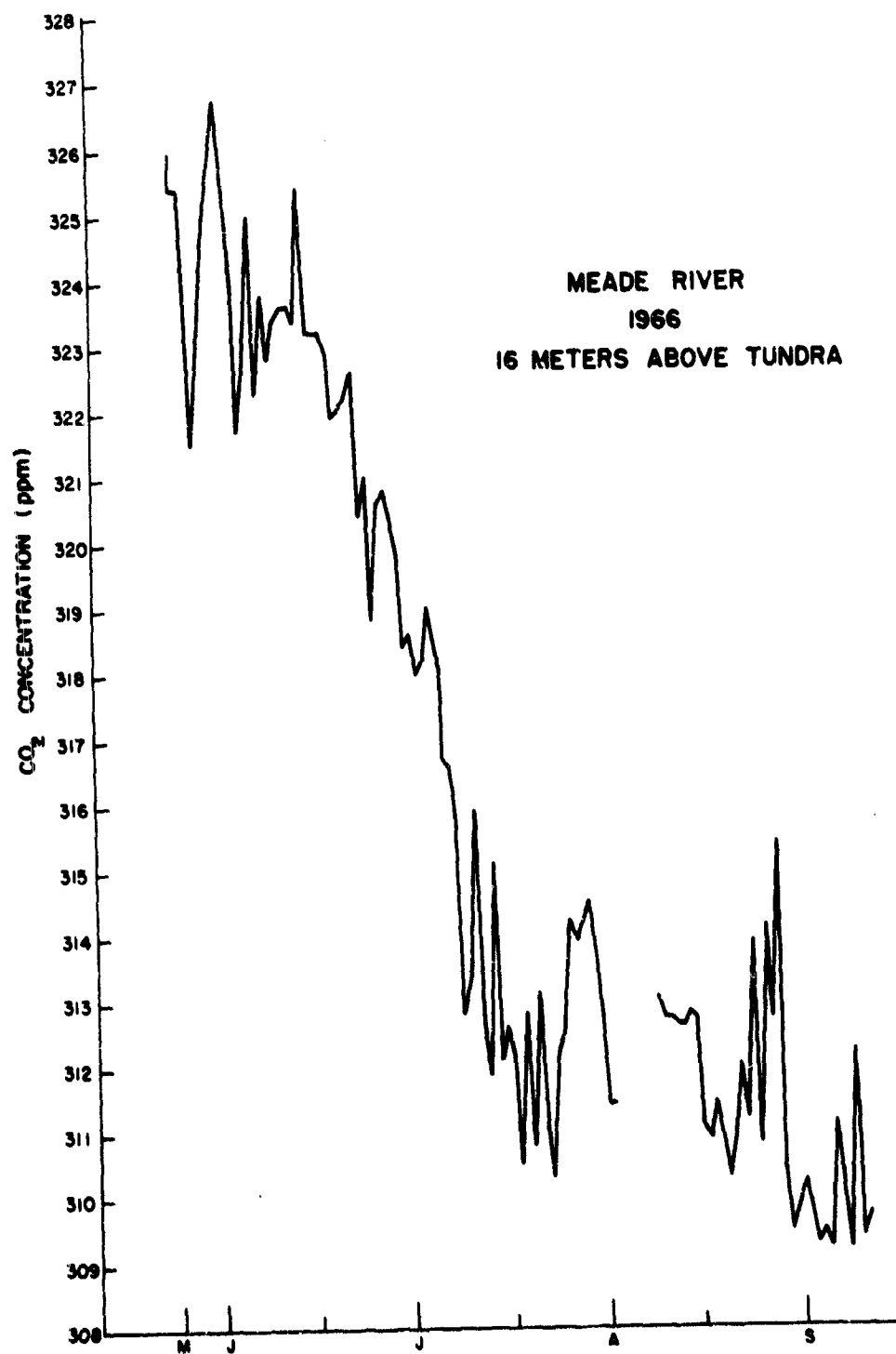


Figure 4. Daily Average CO<sub>2</sub> Concentration (ppm) at 16 m, North Meade River, 1966.

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

16 meters

| Date              | CO <sub>2</sub> 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           |

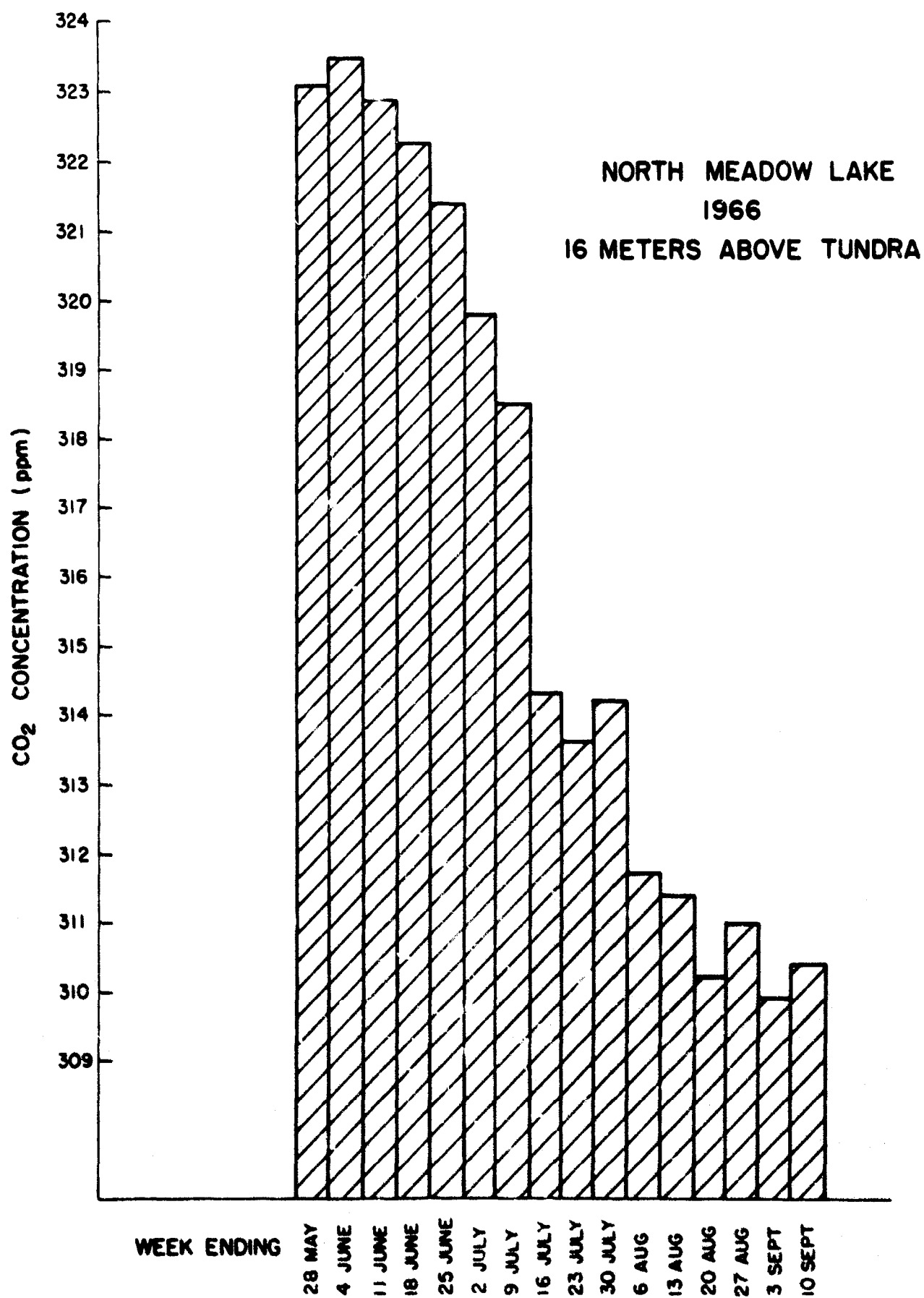


Figure 5. Weekly Average CO<sub>2</sub> Concentration (ppm) at 16 m, North Meadow Lake, 1966.

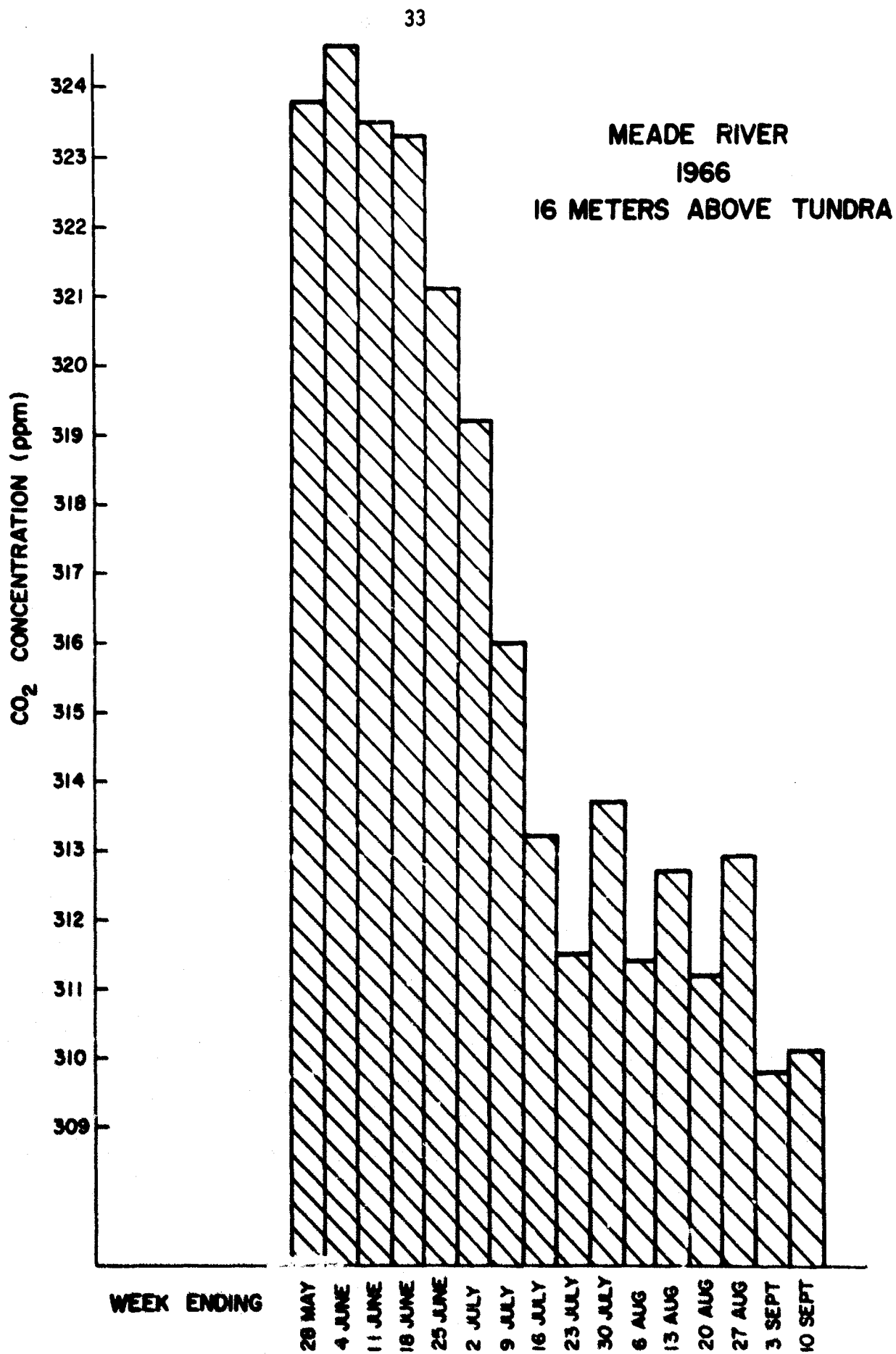


Figure 6. Weekly Average CO<sub>2</sub> Concentration (ppm) at 16 m, Meade River, 1966.

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

| <u>Date</u> | 16 meters                                                                  |                          |
|-------------|----------------------------------------------------------------------------|--------------------------|
|             | <u>CO<sub>2</sub> Concentration Manometric (ppm)</u><br><u>Weade River</u> | <u>North Meadow Lake</u> |
| 1966        |                                                                            |                          |
| June        |                                                                            |                          |
| July        | 322.2                                                                      | 321.9                    |
| August      | 313.8                                                                      | 315.3                    |
|             | 311.9                                                                      | 310.9                    |
| Average     | 316.0                                                                      | 316.0                    |

Table 11: Concentration of CO<sub>2</sub> with Wind Direction  
Yeade River and North Meadow Lake, Alaska

| Date         | 15° (360 to 70)               |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | CO <sub>2</sub> Concentration |                 | North Meadow Lake |                 |
|              | Yeade River<br>Index          | Manometric(ppm) | Index             | 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           | 310.5             | 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<sub>2</sub> with Wind Direction  
Meade River and North Meadow Lake, Alaska

1950 (140 to 210)

| Date          | CO <sub>2</sub> Concentration |                            |
|---------------|-------------------------------|----------------------------|
|               | Meade River<br>Index          | North Meadow Lake<br>Index |
| June 20, 1966 | 319.9                         | 320.3                      |
|               | 320.3                         | 320.6                      |
|               | 318.6                         | 317.2                      |
| July 9        | 314.5                         | 313.0                      |
|               | 313.5                         | 310.9                      |
|               | 310.9                         | 313.6                      |
| August 25     | 311.9                         | 312.6                      |
|               | 315.7                         | 315.5                      |
|               | 316.6                         | 316.3                      |
| Average       |                               | 312.8                      |

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

| Date         | CO <sub>2</sub> Concentration |                 | CO <sub>2</sub> Concentration |                 |
|--------------|-------------------------------|-----------------|-------------------------------|-----------------|
|              | Meade River<br>Index          | Manometric(ppm) | North Meadow Lake<br>Index    | 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)  
Manometric Concentration Scale

| Date          | CO <sub>2</sub> Concentration |                 |                           | Ground Level    |  |
|---------------|-------------------------------|-----------------|---------------------------|-----------------|--|
|               | Meade River<br>Index          | Manometric(ppm) | North Meade Lake<br>Index | 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)  
Manometric Concentration Scale

| Date         | CO <sub>2</sub> Concentration |                 |                            | Ground Level    |
|--------------|-------------------------------|-----------------|----------------------------|-----------------|
|              | Meade River<br>Index          | Manometric(ppm) | North Meadow Lake<br>Index | 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) Ground Level  
 Manometric Concentration Scale

| Date          | Meade River |                 | CO <sub>2</sub> Concentration |                 | North Meadow Lake |                 |
|---------------|-------------|-----------------|-------------------------------|-----------------|-------------------|-----------------|
|               | Index       | Manometric(ppm) | Index                         | Manometric(ppm) | Index             | 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           |                   |                 |

\*lot used.

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

| Date           | CO <sub>2</sub> Concentration |                 |                   |                 | Ground Level |  |
|----------------|-------------------------------|-----------------|-------------------|-----------------|--------------|--|
|                | Meade River                   |                 | North Meadow Lake |                 |              |  |
|                | Index                         | Manometric(ppm) | Index             | 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)  
Manometric Concentration Scale

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

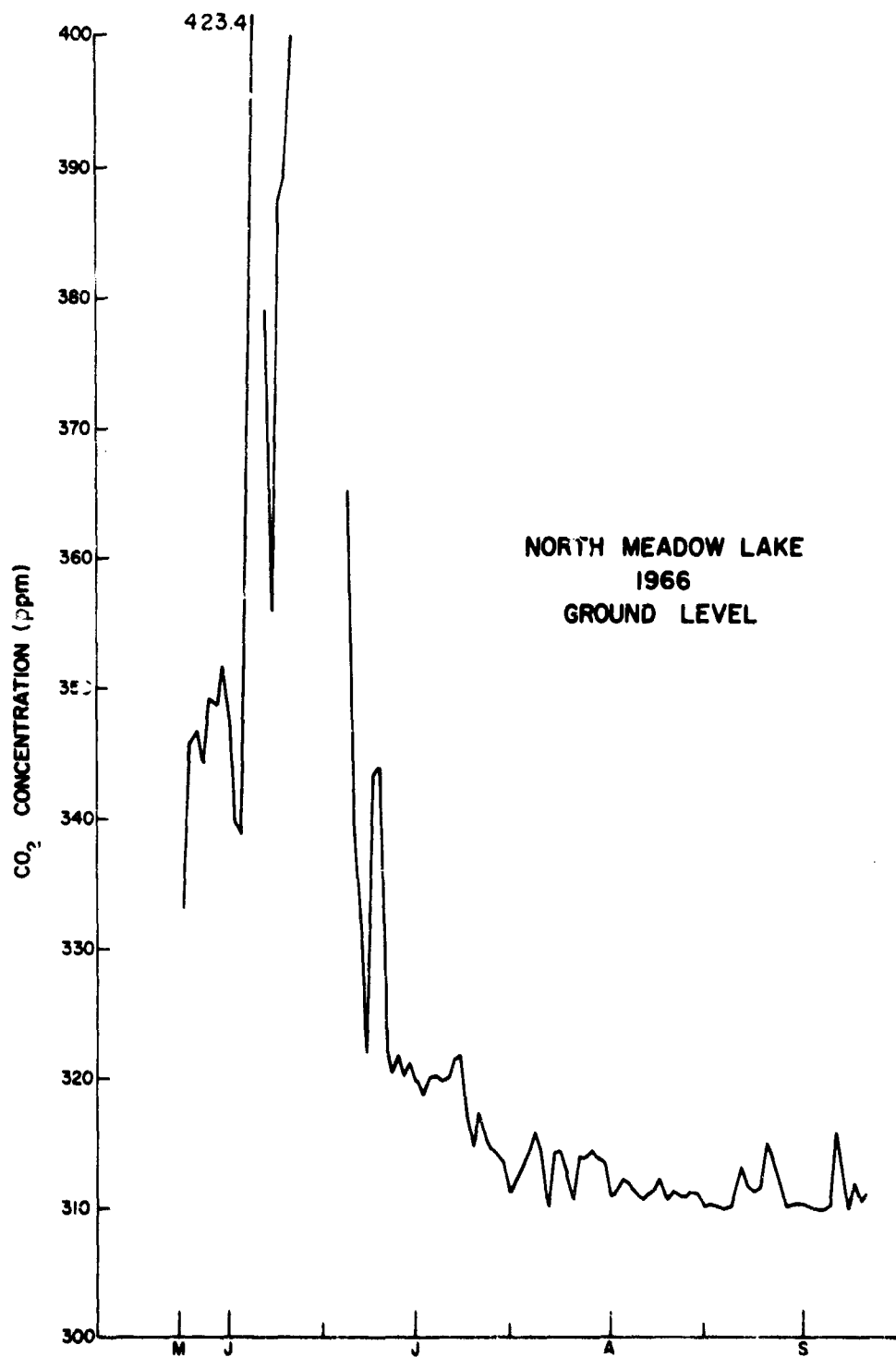


Figure 7. Daily Average CO<sub>2</sub> Concentration (ppm) at Ground Level, North Meadow Lake, 1966.

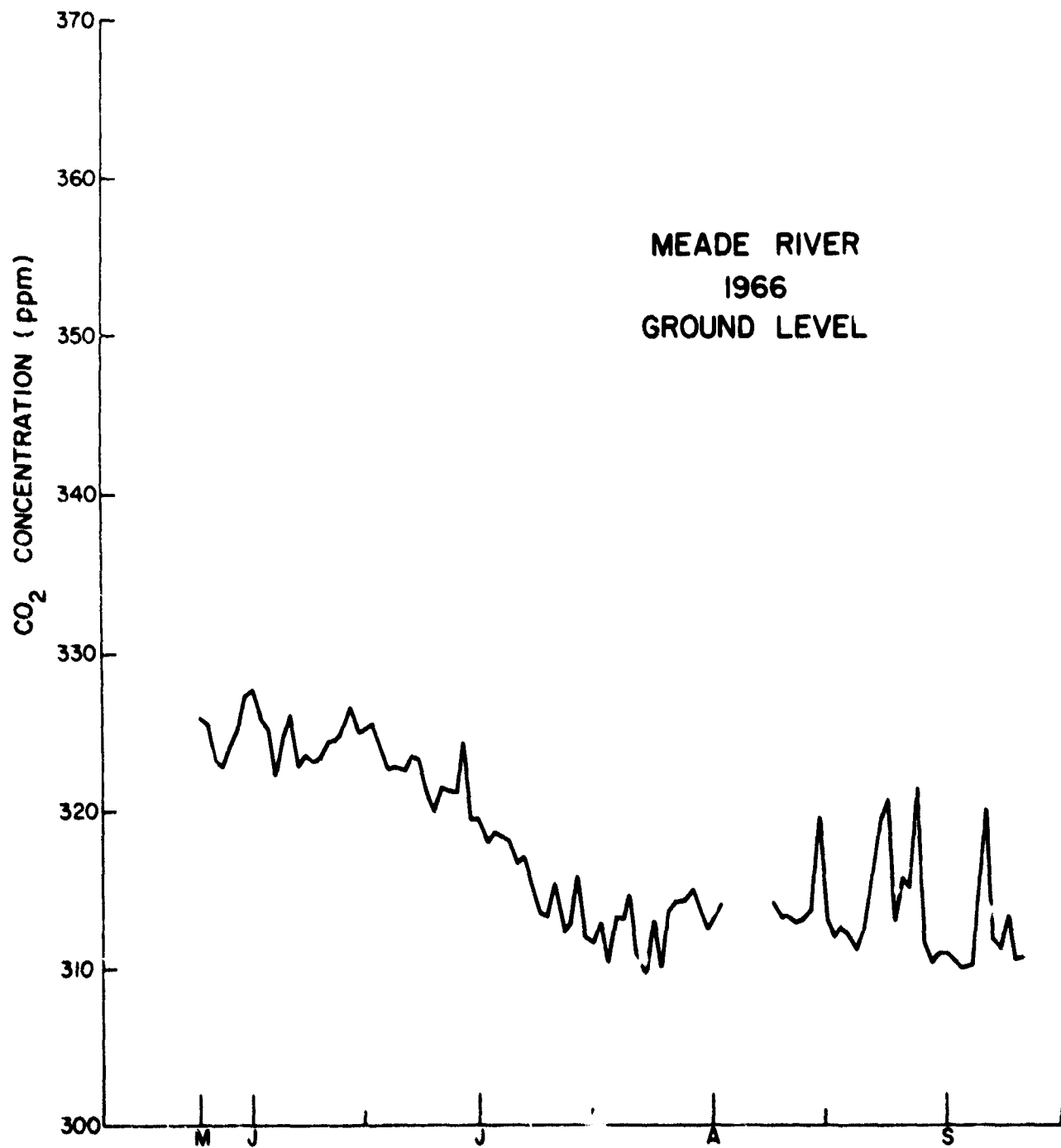


Figure 8. Daily Average CO<sub>2</sub> Concentration (ppm) at Ground Level, Meade River, Alaska, 1966.

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

| Date      | CO <sub>2</sub> Concentration |                 |                            | Ground Level    |
|-----------|-------------------------------|-----------------|----------------------------|-----------------|
|           | Meade River<br>Index          | Manometric(ppm) | North Meadow Lake<br>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           |

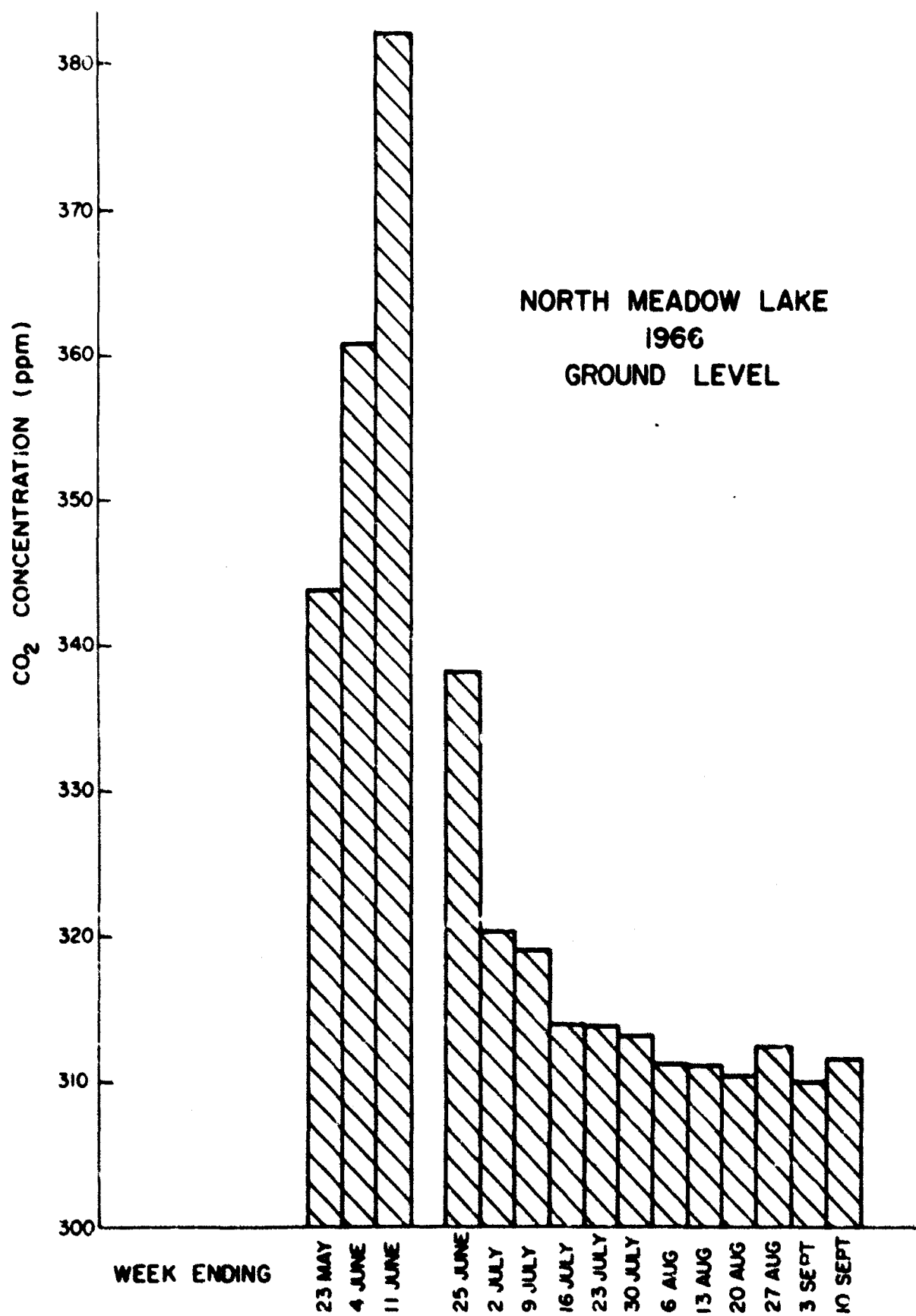


Figure 9. Weekly Average Concentration (ppm) at Ground Level, North Meadow Lake, 1966.

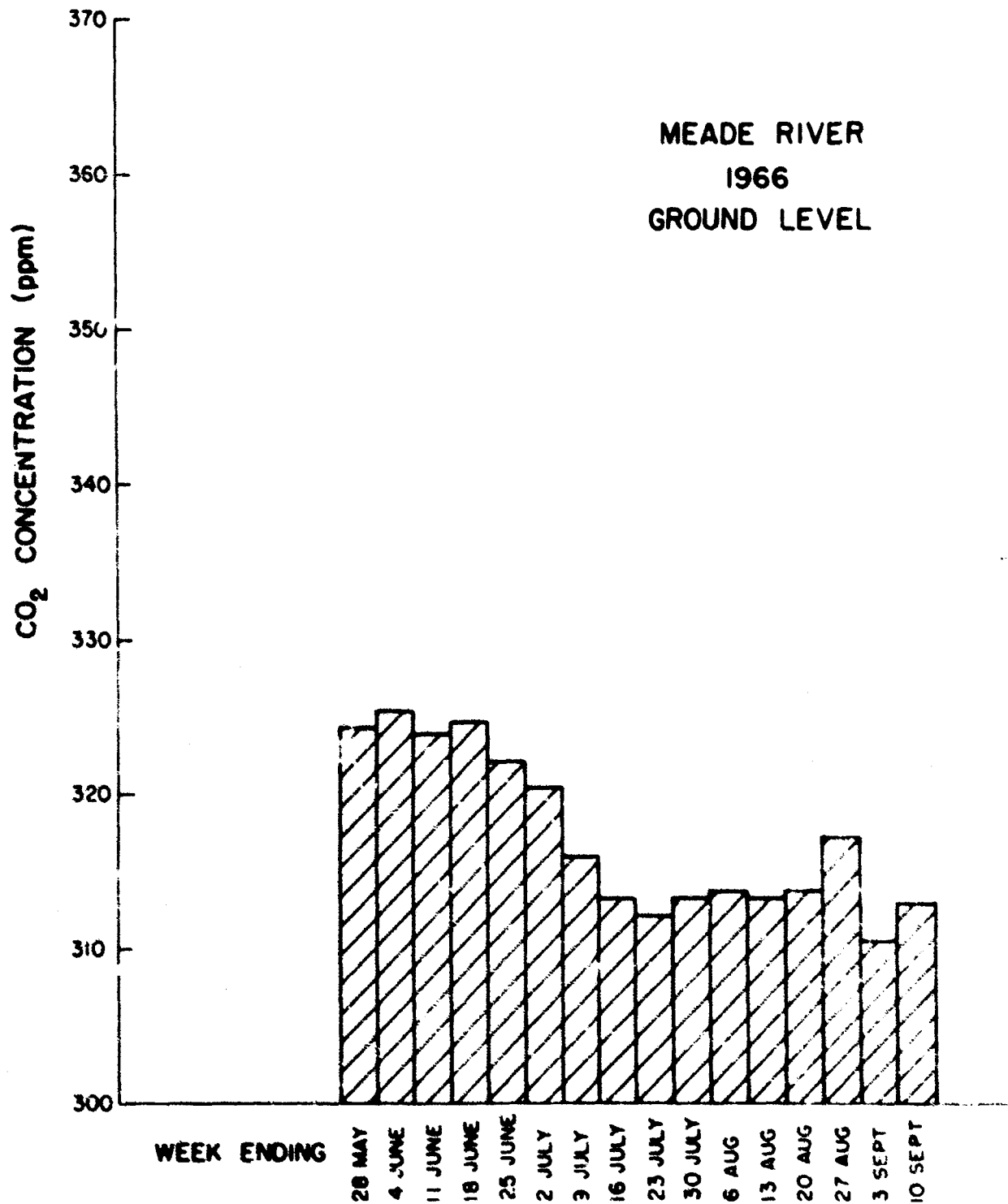


Figure 10. Weekly Average Concentration (ppm) at Ground Level, Meade River, 1966.

Table 14: Monthly Average Index of Carbon Dioxide (ppm)  
 Manometric Concentration Scale

| <u>Date</u>              | <u>CO<sub>2</sub> Concentration</u> |                        | <u>Ground Level</u>                      |                        |
|--------------------------|-------------------------------------|------------------------|------------------------------------------|------------------------|
|                          | <u>Meade River</u><br><u>Index</u>  | <u>Manometric(ppm)</u> | <u>North Meadow Lake</u><br><u>Index</u> | <u>Manometric(ppm)</u> |
| 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<sub>2</sub> in air sampled under a snow cover.

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

16 meters

| Date         | CO <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Meade River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | 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           |
| 49           |                               |                 |                   |                 |
| 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 <sub>2</sub> Concentration |                 |                   |                 |
|---------------|-------------------------------|-----------------|-------------------|-----------------|
|               | Meade River                   |                 | North Meadow Lake |                 |
|               | Index                         | Manometric(ppm) | Index             | 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 Lay Running Mean Concentration of  
Atmospheric Carbon Dioxide

16 meters

| Date         | CO <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Meade River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | 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           | <b>318.0</b>      | 315.4           |
| 8            | 314.4                         | 315.0           | 317.0             | <b>318.2</b>    |
| 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             | 315.3           |
| 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           | 312.0             | 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           | CO2 Concentration |                 |                   |                 | 52 |
|----------------|-------------------|-----------------|-------------------|-----------------|----|
|                | Meade River       |                 | North Meadow Lake |                 |    |
|                | Index             | Manometric(ppm) | Index             | 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 <sub>2</sub> Concentration |                 |                   |                 |
|-----------------|-------------------------------|-----------------|-------------------|-----------------|
|                 | Meade River                   |                 | North Meadow Lake |                 |
|                 | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| August 13, 1966 |                               |                 |                   |                 |
| 14              | 312.5                         | 312.7           | 311.1             | 311.0           |
| 15              | 312.5                         | 312.7           | 311.1             | 311.0           |
| 16              | 312.1                         | 312.2           | 310.8             | 310.6           |
| 17              | 311.6                         | 311.6           | 310.6             | 310.4           |
| 18              | 311.2                         | 311.1           | 310.3             | 310.0           |
| 19              | 311.2                         | 311.1           | 310.3             | 310.0           |
| 20              | 311.0                         | 310.9           | 310.2             | 309.9           |
| 21              | 310.9                         | 310.8           | 310.4             | 310.2           |
| 22              | 311.2                         | 311.1           | 310.8             | 310.6           |
| 23              | 311.4                         | 311.4           | 311.0             | 310.9           |
| 24              | 312.2                         | 312.3           | 311.0             | 310.9           |
| 25              | 311.9                         | 312.0           | 310.9             | 310.8           |
| 26              | 312.7                         | 313.0           | 310.9             | 310.8           |
| 27              | 312.3                         | 312.5           | 311.2             | 311.1           |
| 28              | 313.6                         | 314.1           | 311.3             | 311.2           |
| 29              | 312.6                         | 312.8           | 311.1             | 311.0           |
| 30              | 311.7                         | 311.7           | 310.5             | 310.3           |
| 31              | 310.2                         | 309.9           | 310.1             | 309.8           |
|                 | 310.2                         | 309.9           | 310.2             | 309.9           |

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

16 meters

| Date              | CO <sub>2</sub> 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           |

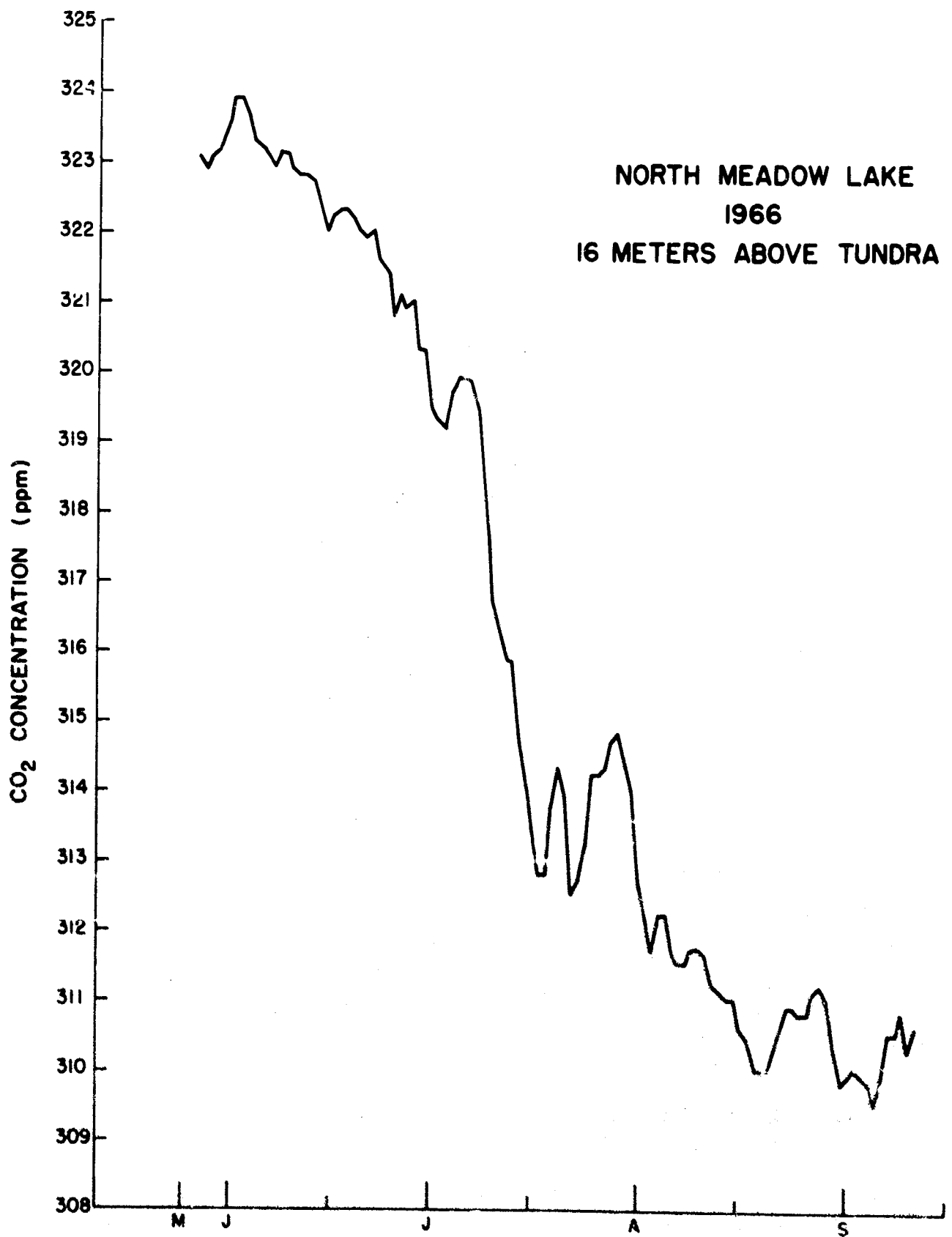


Figure 11. Three Day Running Mean of CO<sub>2</sub> Concentration at 16 m.  
North Meadow Lake, 1966.

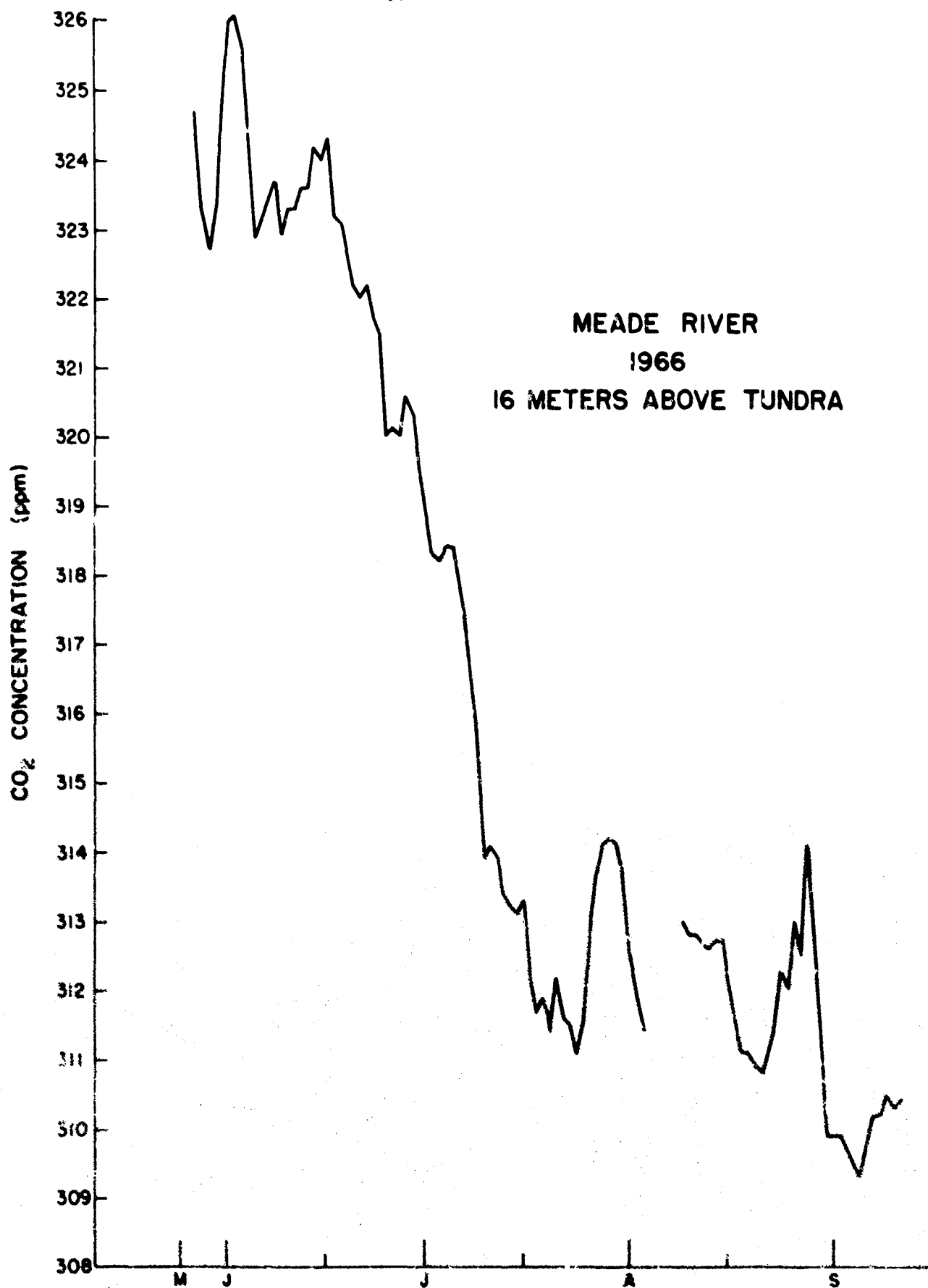


Figure 12. Three Day Running Mean of CO<sub>2</sub> concentrations at 16 m, Meade River, 1966.

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

16 meters

| Date         | CO <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Hedge River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| May 23, 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 <sub>2</sub> Concentration |                 |                   |                 |
|---------------|-------------------------------|-----------------|-------------------|-----------------|
|               | Meade River                   |                 | North Meadow Lake |                 |
|               | Index                         | Manometric(ppm) | Index             | 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           | 320.5             | 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                         | 321.5           | 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 <sub>2</sub> Concentration |                 |                   |                 |
|--------------|-------------------------------|-----------------|-------------------|-----------------|
|              | Meade River                   |                 | North Meadow Lake |                 |
|              | Index                         | Manometric(ppm) | Index             | 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 <sub>2</sub> Concentration |                 |                   |                 |
|----------------|-------------------------------|-----------------|-------------------|-----------------|
|                | Meade River                   |                 | North Meadow Lake |                 |
|                | Index                         | Manometric(ppm) | Index             | 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 <sub>2</sub> Concentration |                 |                   |                 |
|-------------------|-------------------------------|-----------------|-------------------|-----------------|
|                   | Meade River                   |                 | North Meadow Lake |                 |
|                   | Index                         | Manometric(ppm) | Index             | 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 <sub>2</sub> Concentration |                 |                   |                 |
|-------------------|-------------------------------|-----------------|-------------------|-----------------|
|                   | Meade River                   |                 | North Meadow Lake |                 |
|                   | Index                         | Manometric(ppm) | Index             | Manometric(ppm) |
| September 2, 1966 |                               |                 |                   |                 |
| 3                 | 310.1                         | 309.8           | 310.2             | 309.9           |
| 4                 | 310.0                         | 309.7           | 310.2             | 309.9           |
| 5                 | 310.0                         | 309.7           | 310.1             | 309.8           |
| 6                 | 310.1                         | 309.8           | 310.2             | 309.9           |
| 7                 | 310.1                         | 309.8           | 310.4             | 310.2           |
| 8                 | 310.1                         | 309.8           | 310.3             | 310.0           |
| 9                 | 310.5                         | 310.3           | 310.5             | 310.3           |
| 10                | 310.4                         | 310.2           | 310.6             | 310.4           |
|                   | 310.5                         | 310.3           | 310.8             | 310.6           |

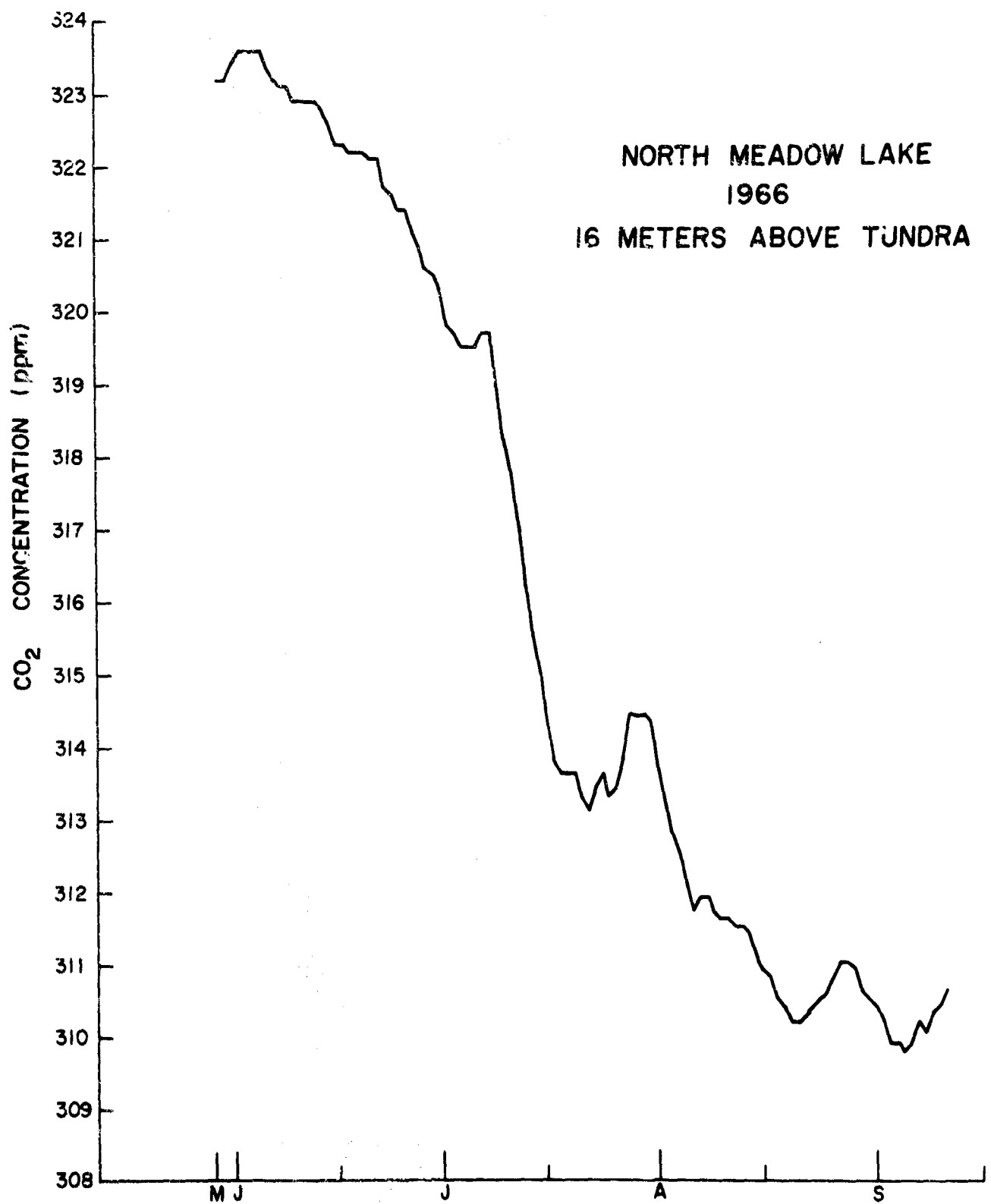


Figure 13. Six Day Running Mean CO<sub>2</sub> Concentration at 16 m, North Meadow Lake, 1966.

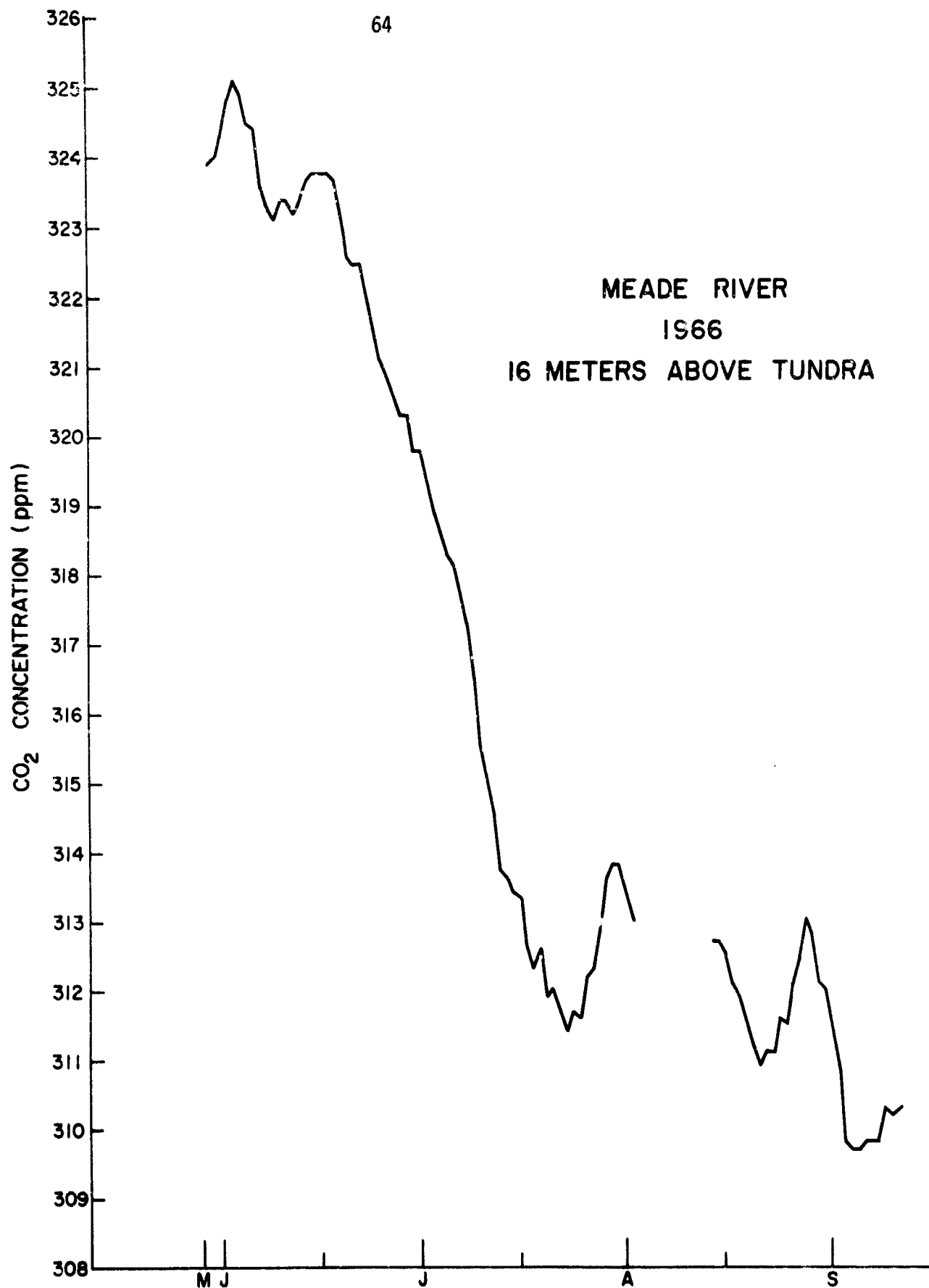


Figure 14. Six Day Running Mean CO<sub>2</sub> Concentration at 16 m, Meade River, 1966.

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

| A.S.T. | Index<br>June | Index<br>July | 16 meters       |  |
|--------|---------------|---------------|-----------------|--|
|        |               |               | Index<br>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  
Heade River, Alaska 16 meters

| <u>A.S.T.</u> | <u>Index<br/>June</u> | <u>Index<br/>July</u> | <u>Index<br/>August</u> |
|---------------|-----------------------|-----------------------|-------------------------|
| 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                   |

MEADE RIVER  
1966  
16 METERS ABOVE TUNDRA

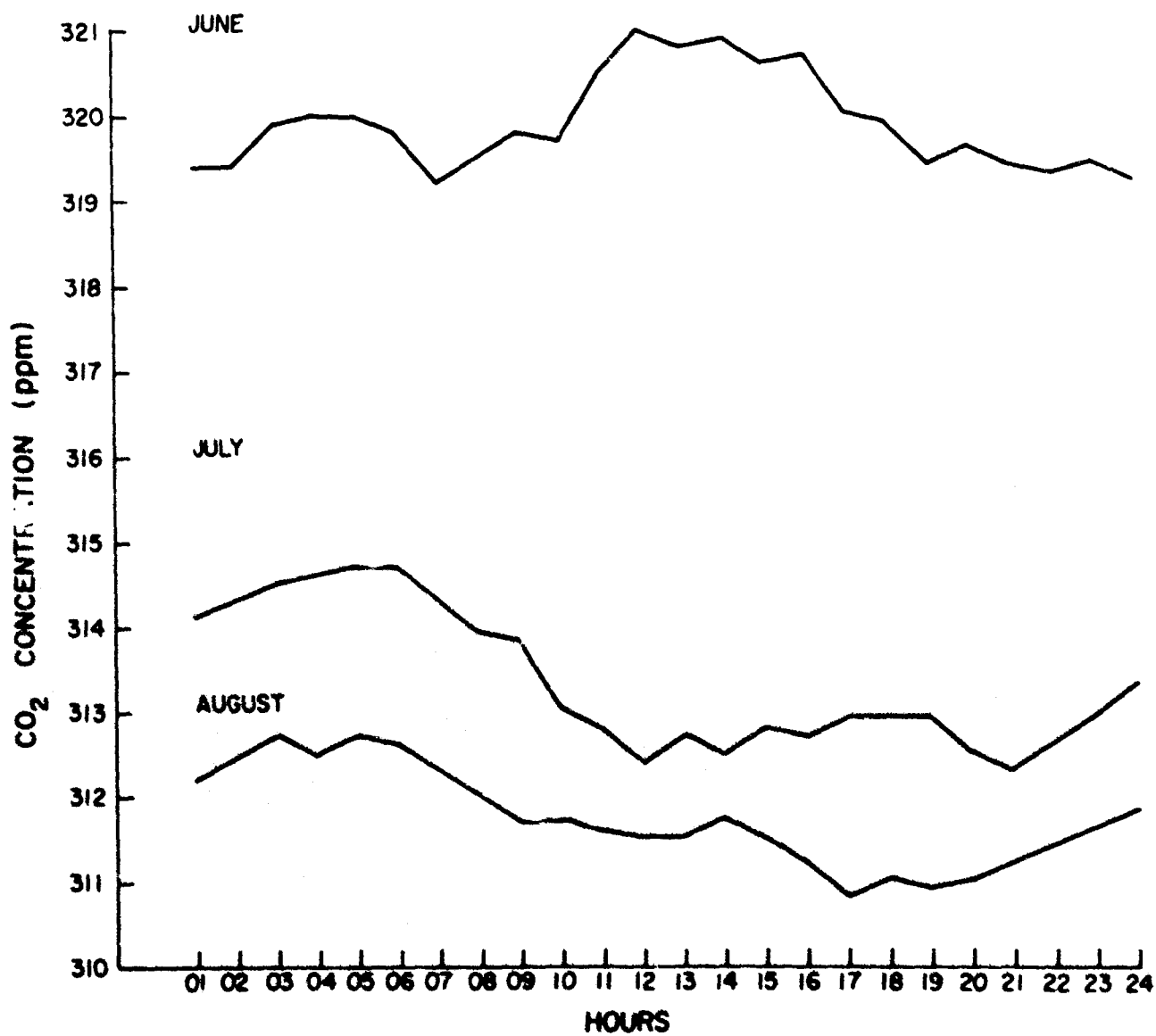


Figure 15. Diurnal Variation of CO<sub>2</sub> at 16 m, Meade River, 1966.

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

| A.S.T. | 16 meters     |                 |
|--------|---------------|-----------------|
|        | Index<br>June | Index<br>August |
| 1966   |               |                 |
| 00-01  | 322.2         | 311.4           |
| 01-02  | 320.3         | 311.5           |
| 02-03  | 320.4         | 311.4           |
| 03-04  | 320.2         | 311.2           |
| 04-05  | 320.2         | 311.1           |
| 05-06  | 320.1         | 311.0           |
| 06-07  | 320.1         | 310.9           |
| 07-08  | 320.0         | 311.0           |
| 08-09  | 320.0         | 311.0           |
| 09-10  | 320.0         | 311.0           |
| 10-11  | 320.0         | 310.8           |
| 11-12  | 320.0         | 310.9           |
| 12-13  | 320.0         | 310.9           |
| 13-14  | 319.9         | 310.9           |
| 14-15  | 319.9         | 310.8           |
| 15-16  | 319.9         | 310.9           |
| 16-17  | 319.8         | 310.8           |
| 17-18  | 319.8         | 310.8           |
| 18-19  | 319.8         | 310.8           |
| 19-20  | 319.7         | 311.0           |

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

16 meters

| <u>A.S.T.</u> | <u>Index<br/>June</u> | <u>Index<br/>July</u> | <u>Index<br/>August</u> |
|---------------|-----------------------|-----------------------|-------------------------|
| 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                   |

NORTH MEADOW LAKE  
1966  
16 METERS ABOVE TUNDRA

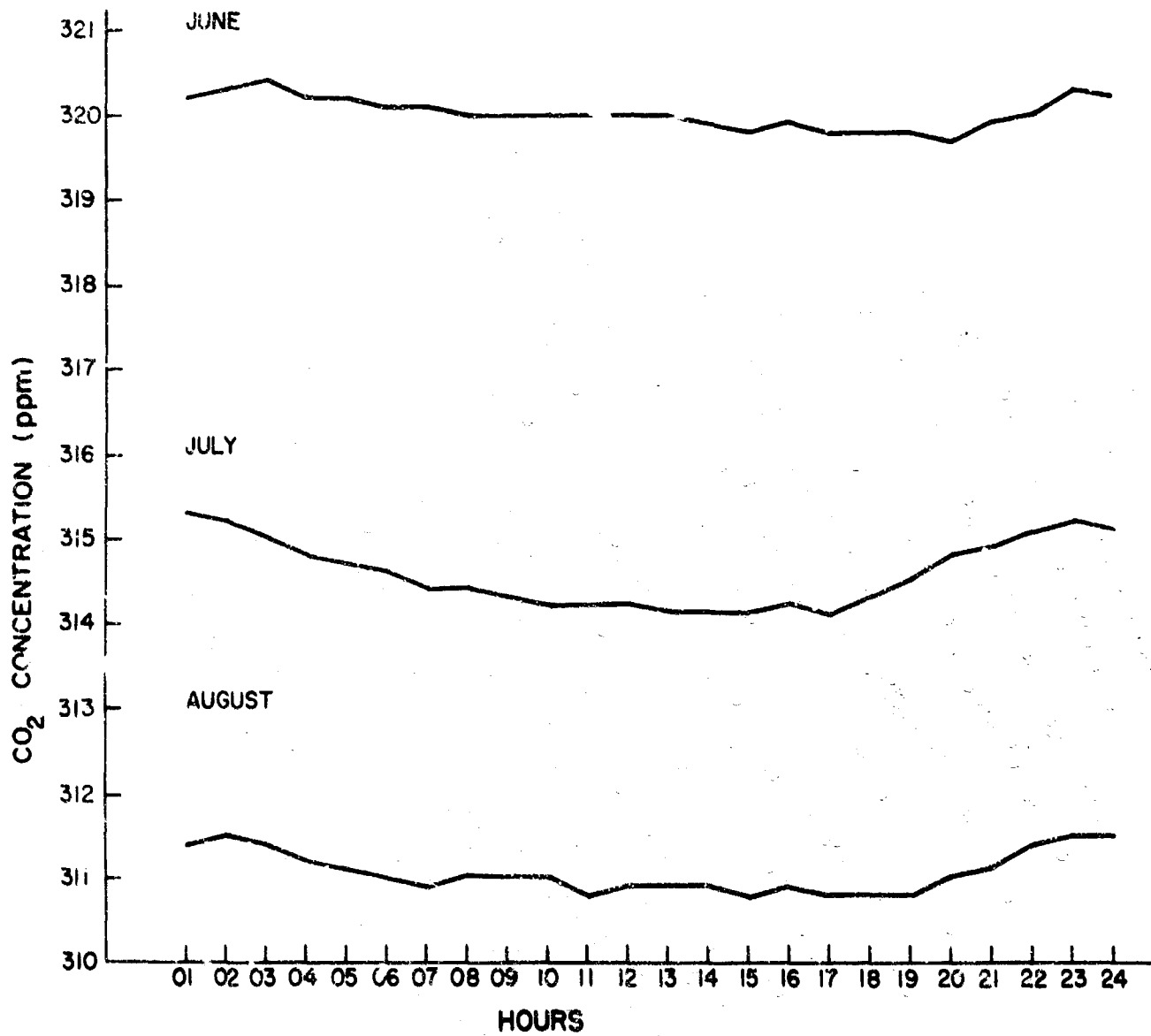


Figure 16. Diurnal Variation of CO<sub>2</sub> at 16 m, North Meadow Lake, 1966.

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

16 meters

| A.S.T. | North Meadow Lake<br>Index | Meade River<br>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                      | 315.0                |
| 16-17  | 314.9                      | 314.9                |
| 17-18  | 315.0                      | 314.6                |
| 18-19  | 315.0                      | 314.6                |
| 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

| <u>A.S.T.</u> | <u>North Meadow Lake<br/>Index</u> | <u>Meade River<br/>Index</u> |
|---------------|------------------------------------|------------------------------|
| 21-22         | 315.5                              | 314.4                        |
| 22-23         | 315.7                              | 314.6                        |
| 23-24         | 315.6                              | 314.8                        |

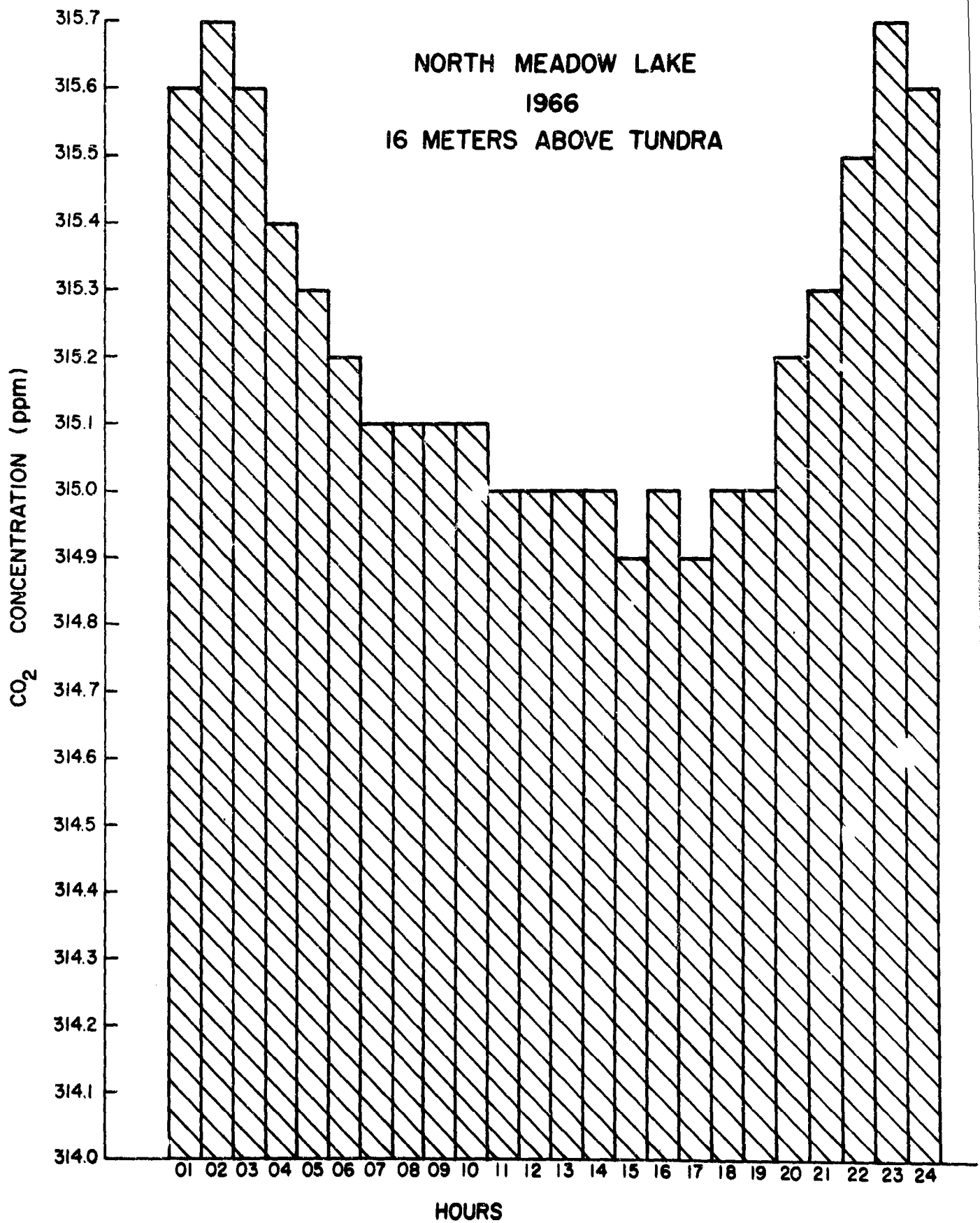


Figure 17. Three Month Duirnal Variation of CO<sub>2</sub>, June, July, August, at 16 m, North Meadow Lake, 1966.

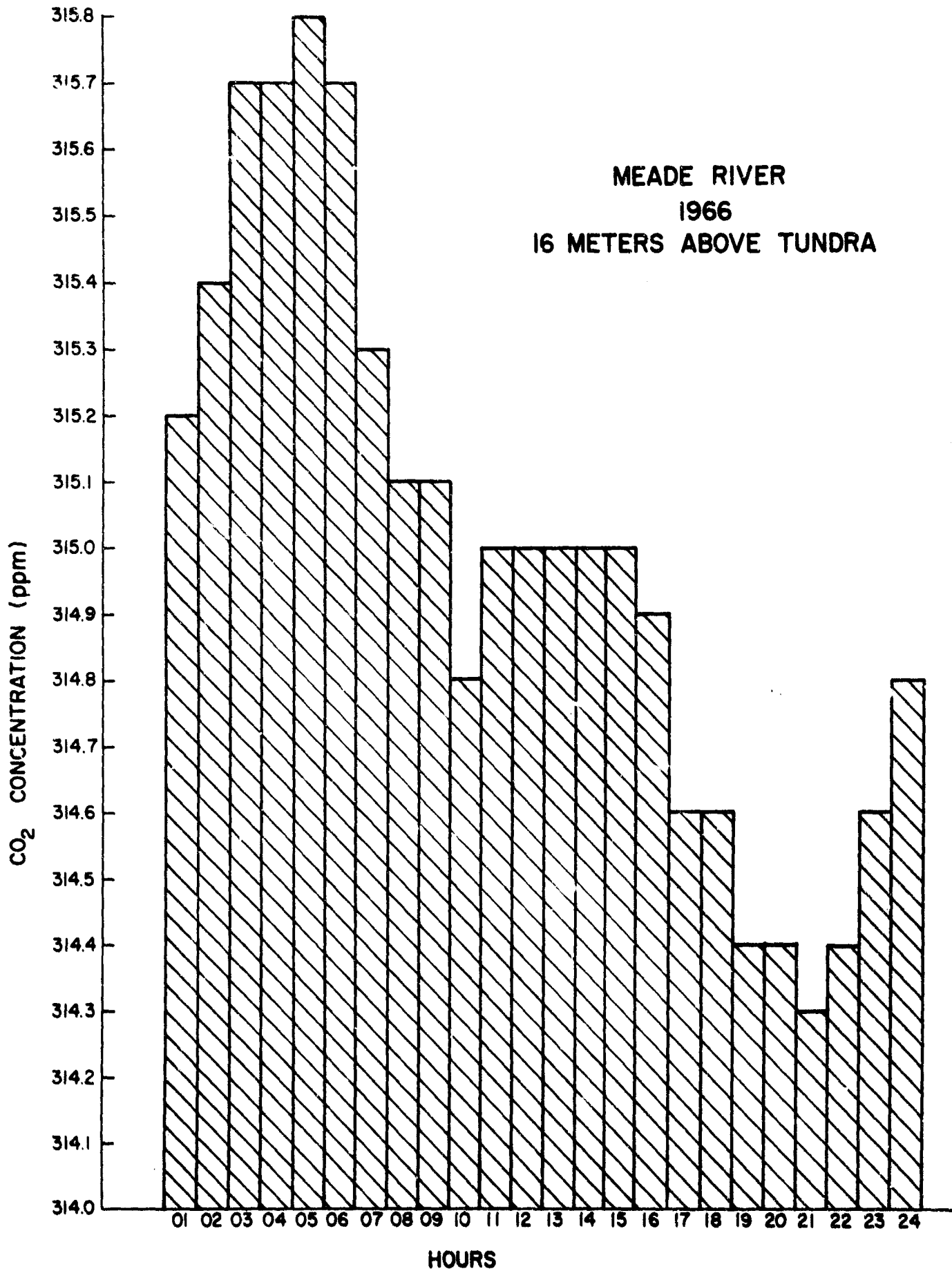


Figure 18. Three Month Diurnal Variation of CO<sub>2</sub>, June, July, August,  
at 16 m, Meade River, 1966

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

Average Daily CO<sub>2</sub> Concentration  
Meade River

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

| Date<br>1966 | Manometric Scale<br>CO <sub>2</sub> Conc. |         | Date<br>1966 | CO <sub>2</sub> Conc. |         | ACO <sub>2</sub> |
|--------------|-------------------------------------------|---------|--------------|-----------------------|---------|------------------|
|              | Ground                                    | 16m     |              | Ground                | 16m     |                  |
| May 24       | 325.8                                     | - 325.4 | June 14      | 324.9                 | - 323.2 | +1.7             |
| 25           | 325.4                                     | - 325.4 | 15           | -----                 | -----   | -----            |
| 26           | 323.2                                     | - 323.2 | 16           | 325.5                 | - 323.2 | +2.3             |
| 27           | 322.7                                     | - 321.5 | 17           | 323.9                 | - 322.9 | +1.0             |
| 28           | 324.1                                     | - 323.4 | 18           | 322.5                 | - 321.9 | +0.6             |
| 29           | 325.2                                     | - 325.0 | 19           | 322.7                 | - 322.0 | +0.7             |
| 30           | 327.3                                     | - 325.9 | 20           | 322.5                 | - 322.0 | +0.5             |
| 31           | 327.7                                     | - 327.1 | 21           | 323.4                 | - 322.6 | +0.8             |
|              |                                           |         | 22           | 323.3                 | - 320.4 | +2.9             |
| June 1       | 325.8                                     | - 325.5 | 23           | 321.1                 | - 321.0 | +0.1             |
| 2            | 325.0                                     | - 324.2 | 24           | 319.9                 | - 318.8 | +1.1             |
| 3            | 322.2                                     | - 321.7 | 25           | 321.5                 | - 320.6 | +0.9             |
| 4            | 324.5                                     | - 322.9 | 26           | 321.3                 | - 320.8 | +0.5             |
| 5            | 326.0                                     | - 325.0 | 27           | 321.3                 | - 320.4 | +0.9             |
| 6            | 322.7                                     | - 322.3 | 28           | 324.3                 | - 319.8 | +4.5             |
| 7            | 323.6                                     | - 323.8 | 29           | 319.2                 | - 318.4 | +0.8             |
| 8            | 323.0                                     | - 322.8 | 30           | 319.5                 | - 318.6 | +0.9             |
| 9            | 323.4                                     | - 323.4 |              |                       |         |                  |
| 10           | 324.4                                     | - 323.6 | July 1       | 317.8                 | - 318.0 | -0.2             |
| 11           | 324.5                                     | - 323.6 | 2            | 318.6                 | - 318.2 | +0.4             |
| 12           | 325.2                                     | - 323.4 | 3            | 318.4                 | - 319.0 | -0.6             |
| 13           | 326.5                                     | - 325.4 | 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<sub>2</sub> Concentration  
 Meade River

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

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

| Average Daily CO <sub>2</sub> Concentration<br>Meade River |        |                       |        | + means from ground to air<br>- means from air to ground |                       |  |                  |
|------------------------------------------------------------|--------|-----------------------|--------|----------------------------------------------------------|-----------------------|--|------------------|
| Manometric Scale                                           |        | CO <sub>2</sub> Conc. |        | Date<br>1966                                             | CO <sub>2</sub> Conc. |  | ΔCO <sub>2</sub> |
| Date<br>1966                                               | Ground | 16m                   | Ground |                                                          | 16m                   |  |                  |
| August                                                     | 17     | 312.5 - 311.4         |        | September 7                                              | 311.1 - 309.2         |  | +1.9             |
|                                                            | 18     | 312.2 - 311.0         |        | 8                                                        | 313.3 - 312.2         |  | +1.1             |
|                                                            | 19     | 311.1 - 310.3         |        | 9                                                        | 310.5 - 309.4         |  | +1.1             |
|                                                            | 20     | 312.5 - 311.0         |        | 10                                                       | 310.6 - 309.7         |  | +0.9             |
|                                                            | 21     | 315.5 - 312.0         |        |                                                          |                       |  |                  |
|                                                            | 22     | 319.5 - 311.2         |        |                                                          |                       |  |                  |
|                                                            | 23     | 320.5 - 313.9         |        |                                                          |                       |  |                  |
|                                                            | 24     | 312.8 - 310.8         |        |                                                          |                       |  |                  |
|                                                            | 25     | 315.9 - 314.1         |        |                                                          |                       |  |                  |
|                                                            | 26     | 314.9 - 312.7         |        |                                                          |                       |  |                  |
| September                                                  | 1      | 310.3 - 309.7         |        |                                                          |                       |  |                  |
|                                                            | 2      | 309.8 - 309.3         |        |                                                          |                       |  |                  |
|                                                            | 3      | 310.0 - 309.5         |        |                                                          |                       |  |                  |
|                                                            | 4      | 313.2 - 309.2         |        |                                                          |                       |  |                  |
|                                                            | 5      | 320.0 - 311.1         |        |                                                          |                       |  |                  |
|                                                            | 6      | 311.9 - 310.2         |        |                                                          |                       |  |                  |
|                                                            |        |                       |        |                                                          |                       |  |                  |
|                                                            |        |                       |        |                                                          |                       |  |                  |
|                                                            |        |                       |        |                                                          |                       |  |                  |
|                                                            |        |                       |        |                                                          |                       |  |                  |

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

Average Daily CO<sub>2</sub> Concentration  
North Meadow Lake

+ means CO<sub>2</sub> from ground to air  
- means CO<sub>2</sub> from air to ground

| Date<br>1966 | Manometric Scale<br>CO <sub>2</sub> Conc. |         | Date<br>1966 | CO <sub>2</sub> Conc. |         | $\Delta$ CO <sub>2</sub> |
|--------------|-------------------------------------------|---------|--------------|-----------------------|---------|--------------------------|
|              | Ground                                    | 16m     |              | Ground                | 16m     |                          |
| May 24       | 333.1                                     | - 323.4 | June 14      | 323.6                 | - 322.0 | + 1.6                    |
| 25           | 345.7                                     | - 322.9 | 15           | 325.6                 | - 322.5 | + 3.1                    |
| 26           | 346.6                                     | - 322.9 | 16           | 323.2                 | - 322.5 | + 0.7                    |
| 27           | 344.3                                     | - 323.1 | 17           | 322.1                 | - 322.1 | 0                        |
| 28           | 349.1                                     | - 323.2 | 18           | -----                 | -----   | -----                    |
| 29           | 348.8                                     | - 323.4 | 19           | 365.2                 | - 321.9 | +43.3                    |
| 30           | 351.6                                     | - 323.8 | 20           | 338.9                 | - 321.9 | +17.0                    |
| 31           | 348.1                                     | - 324.4 | 21           | 332.8                 | - 322.2 | +10.6                    |
| June 1       | 339.8                                     | - 323.4 | 22           | 321.7                 | - 320.8 | + 0.9                    |
| 2            | 338.7                                     | - 323.3 | 23           | 342.9                 | - 321.1 | +21.8                    |
| 3            | 374.3                                     | - 323.3 | 24           | 343.7                 | - 320.4 | +23.3                    |
| 4            | 423.4                                     | - 322.8 | 25           | 322.2                 | - 321.7 | + 0.5                    |
| 5            | -----                                     | -----   | 26           | 320.4                 | - 320.4 | 0                        |
| 6            | 378.9                                     | - 323.1 | 27           | 321.7                 | - 321.0 | + 0.7                    |
| 7            | 355.8                                     | - 323.1 | 28           | 320.3                 | - 319.5 | + 0.8                    |
| 8            | 387.2                                     | - 322.9 | 29           | 321.2                 | - 320.3 | + 0.9                    |
| 9            | 389.0                                     | - 322.9 | 30           | 319.7                 | - 318.8 | + 0.9                    |
| 10           | 399.7                                     | - 322.7 | July 1       | 318.6                 | - 318.7 | - 0.1                    |
| 11           | -----                                     | -----   | 2            | 320.0                 | - 320.0 | 0                        |
| 12           | -----                                     | -----   | 3            | 320.1                 | - 320.1 | 0                        |
| 13           | -----                                     | -----   | 4            | 319.7                 | - 319.7 | 0                        |

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

Average Daily CO<sub>2</sub> Concentration  
North Meadow Lake

+ means CO<sub>2</sub> from ground to air  
- means CO<sub>2</sub> from air to ground

| Date<br>1966 | Manometric Scale<br>CO <sub>2</sub> Conc. |         | Date<br>1966 | CO <sub>2</sub> Conc. |         | $\Delta$ CO <sub>2</sub> |
|--------------|-------------------------------------------|---------|--------------|-----------------------|---------|--------------------------|
|              | Ground                                    | 16m     |              | Ground                | 16m     |                          |
| July 5       | 320.0                                     | - 320.0 | July 27      | 313.9                 | - 314.8 | -0.9                     |
| 6            | 321.5                                     | - 319.8 | 28           | 314.4                 | - 314.8 | -0.4                     |
| 7            | 321.7                                     | - 318.3 | 29           | 313.8                 | - 313.8 | 0                        |
| 8            | 317.0                                     | - 316.6 | 30           | 313.2                 | - 313.3 | -0.1                     |
| 9            | 314.7                                     | - 315.1 | 31           | 310.9                 | - 310.8 | +0.1                     |
| 10           | 317.3                                     | - 317.3 |              |                       |         |                          |
| 11           | 315.1                                     | - 315.0 | August 1     | 311.5                 | - 312.1 | -0.6                     |
| 12           | 314.5                                     | - 314.8 | 2            | 312.2                 | - 312.5 | -0.3                     |
| 13           | 314.1                                     | - 314.3 | 3            | 311.7                 | - 312.2 | -0.5                     |
| 14           | 312.4                                     | - 313.8 | 4            | 311.2                 | - 311.9 | -0.7                     |
| 15           | 311.2                                     | - 312.1 | 5            | 310.6                 | - 311.2 | -0.6                     |
| 16           | 312.3                                     | - 312.6 | 6            | 311.0                 | - 311.5 | -0.5                     |
| 17           | 313.1                                     | - 313.7 | 7            | 311.4                 | - 311.7 | -0.3                     |
| 18           | 314.4                                     | - 315.1 | 8            | 312.1                 | - 312.1 | 0                        |
| 19           | 315.8                                     | - 313.9 | 9            | 310.6                 | - 311.4 | -0.8                     |
| 20           | 314.2                                     | - 312.7 | 10           | 311.2                 | - 311.5 | -0.3                     |
| 21           | 310.0                                     | - 310.8 | 11           | 310.9                 | - 311.0 | -0.1                     |
| 22           | 314.2                                     | - 314.7 | 12           | 310.9                 | - 311.0 | -0.1                     |
| 23           | 314.4                                     | - 314.3 | 13           | 311.1                 | - 311.0 | +0.1                     |
| 24           | 312.6                                     | - 313.7 | 14           | 311.1                 | - 311.0 | +0.1                     |
| 25           | 310.6                                     | - 314.5 | 15           | 310.0                 | - 309.9 | +0.1                     |
| 26           | 313.9                                     | - 314.7 | 16           | 310.2                 | - 310.3 | -0.1                     |

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

+ means CO<sub>2</sub> from ground to air  
- means CO<sub>2</sub> from air to ground

Average Daily CO<sub>2</sub> Concentration  
North Meadow Lake

| Date<br>1966 | Manometric Scale<br>CO <sub>2</sub> Conc. |         | Date<br>1966 | ACO <sub>2</sub> | CO <sub>2</sub> Conc. |         |
|--------------|-------------------------------------------|---------|--------------|------------------|-----------------------|---------|
|              | Ground                                    | 16m     |              |                  | Ground                | 16m     |
| August 17    | 310.0                                     | - 309.9 | September 7  | +0.1             | 309.9                 | - 309.4 |
| 18           | 309.8                                     | - 309.9 | 8            | -0.1             | 311.7                 | - 311.2 |
| 19           | 310.0                                     | - 310.0 | 9            | 0                | 310.4                 | - 310.0 |
| 20           | 311.2                                     | - 310.5 | 10           | +0.7             | 310.9                 | - 310.8 |
| 21           | 313.0                                     | - 311.7 |              | +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             |                       |         |

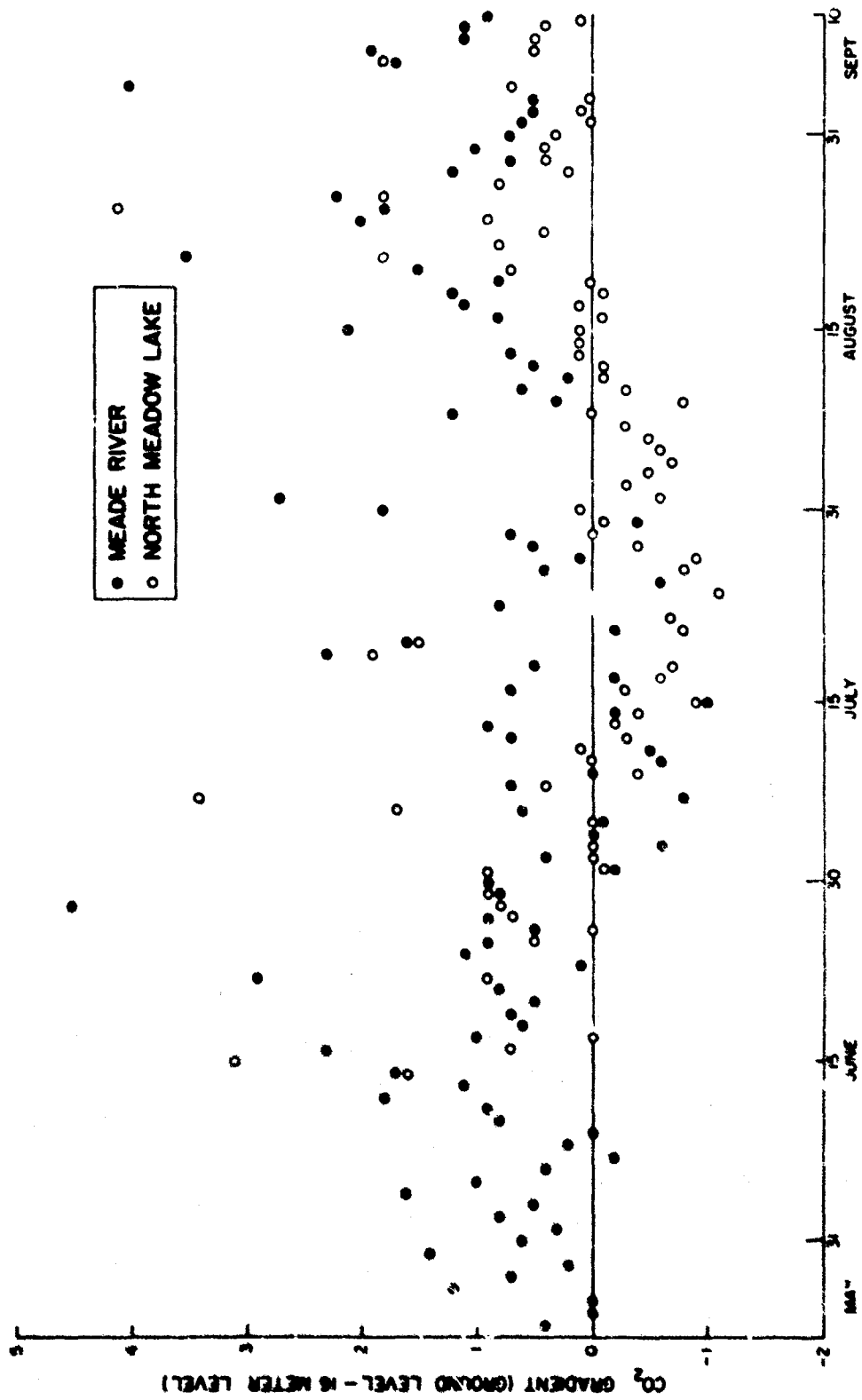


Figure 19. Average Daily CO<sub>2</sub> Gradient Between 16 m and 1 cm at Meade River and North Meadow Lake.

### 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.

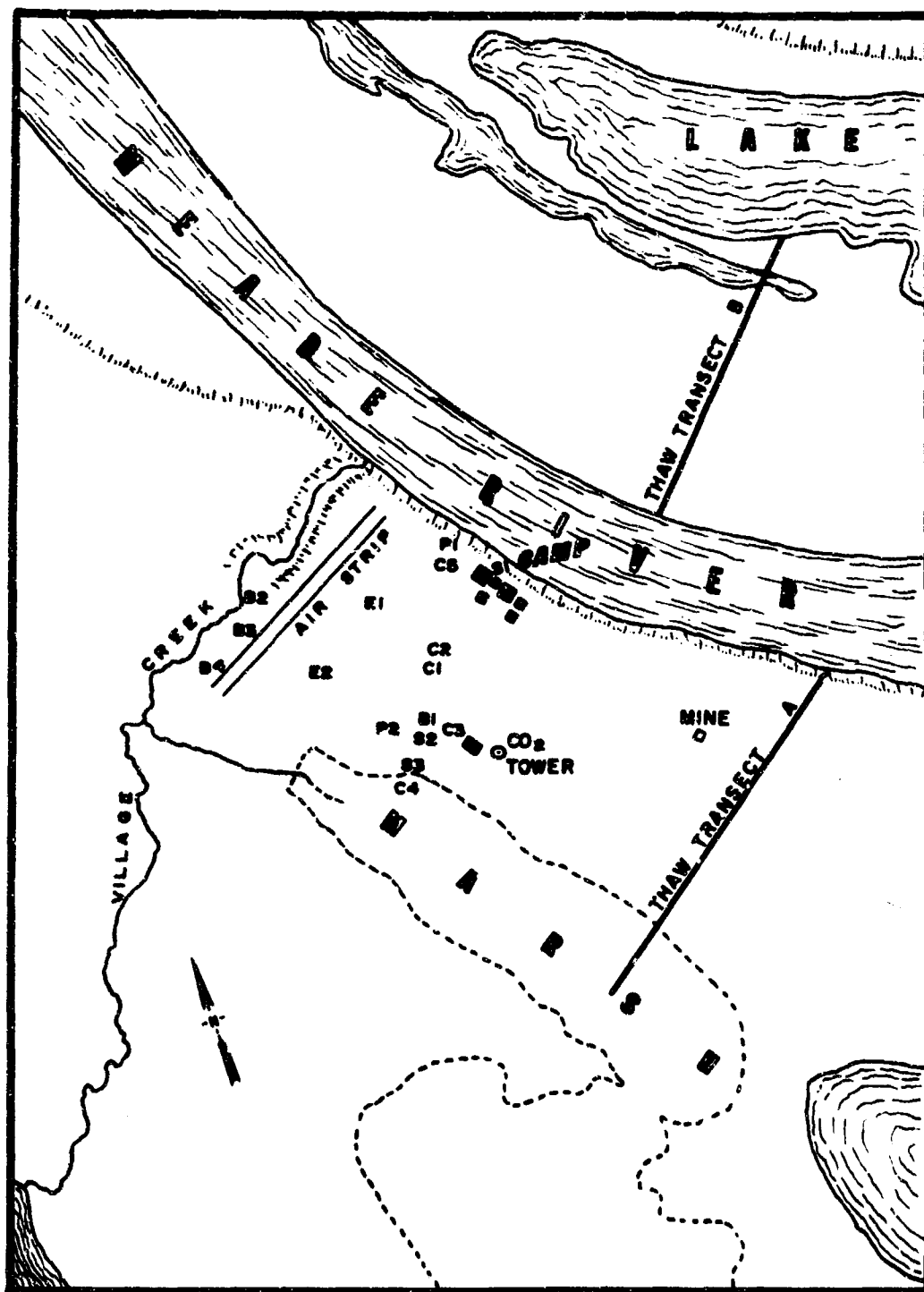


Figure 20. Meade River Study Site Showing Positions of Camp Buildings, Coal Mine, Carbon Dioxide Tower, Transects for Weekly Monitoring of Thaw Depth, and Plant Growth: B = Betula, C = Carex, E = Eriophorum, P = Polygonum and S = Salex.

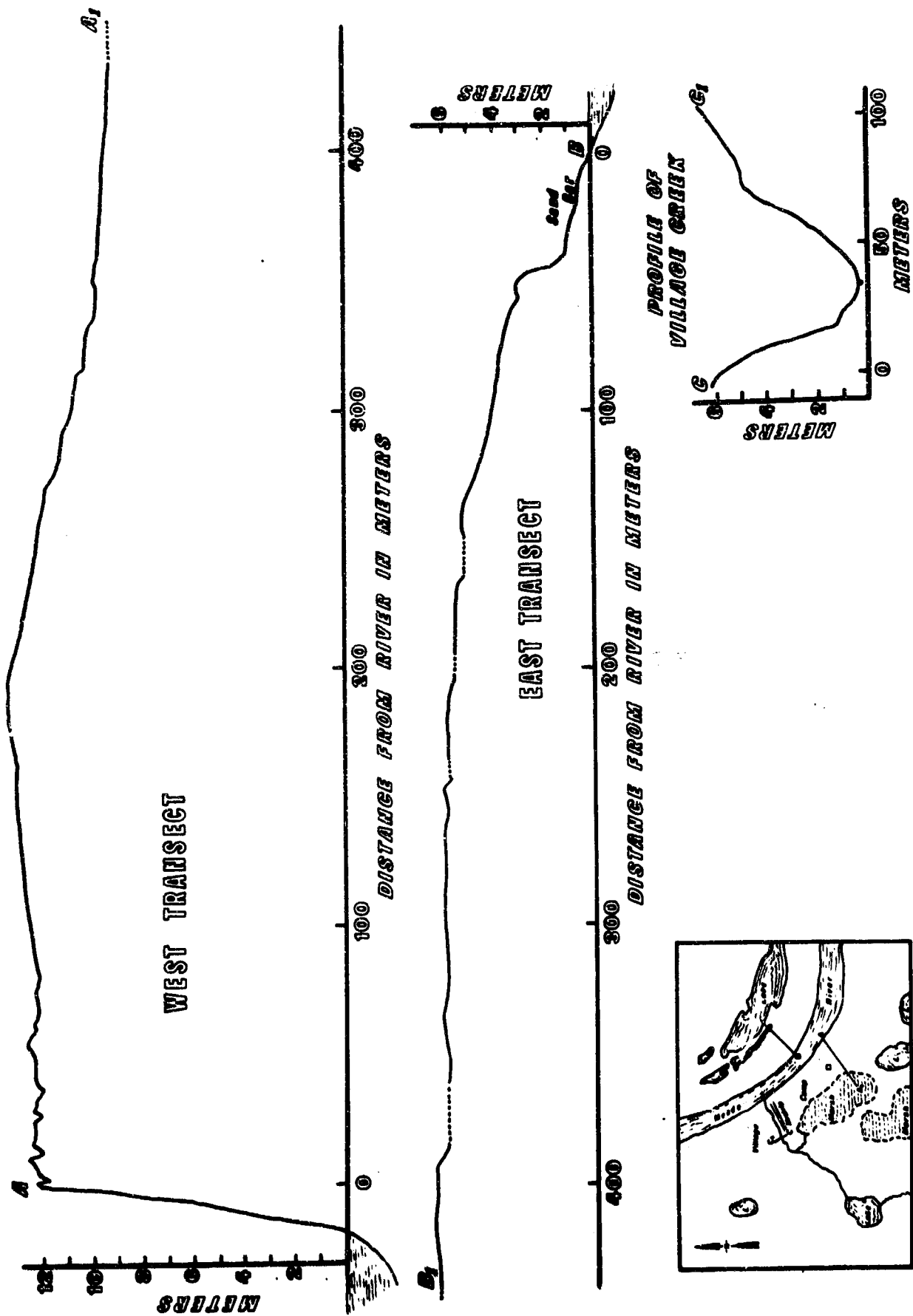


Figure 21. Topographic Profiles of Three Transects at Meade River Camp. Profiles A (upland) and B (river bar) were Probed Weekly for Snow and Thaw Depths.

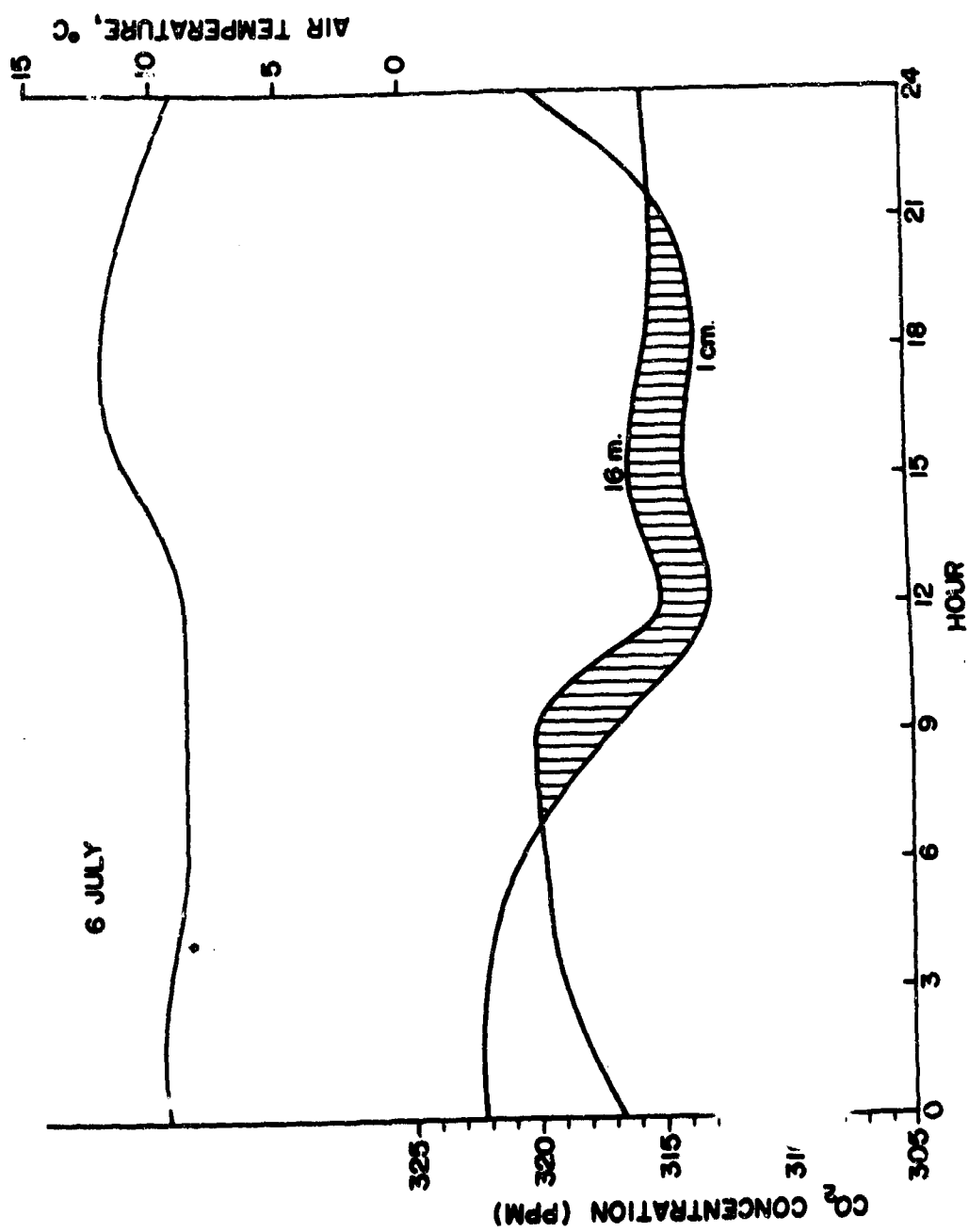


Figure 22. Hourly Carbon Dioxide and Air Temperature at Meade River.

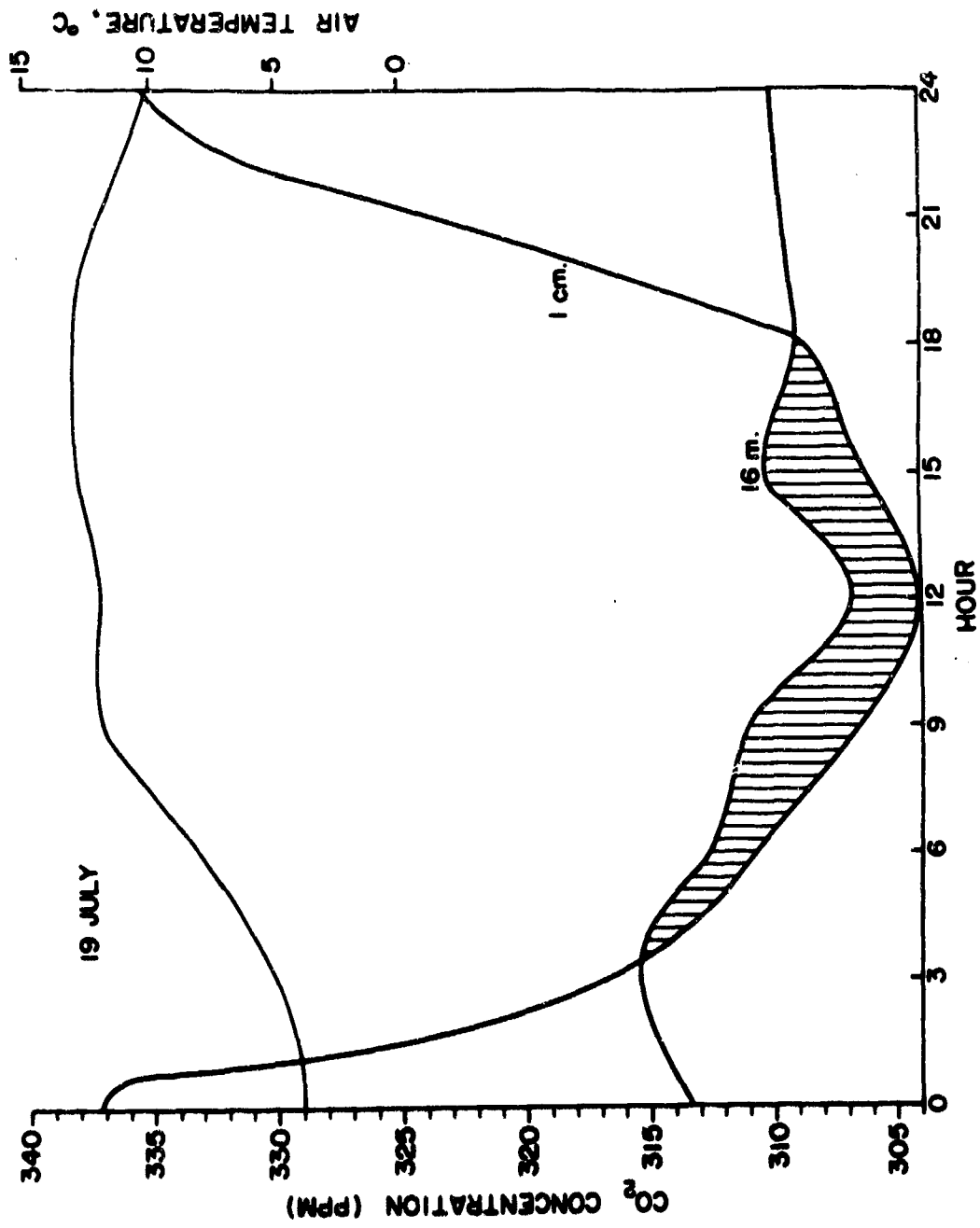


Figure 23. Hourly Carbon Dioxide and Air Temperature at Meade River.

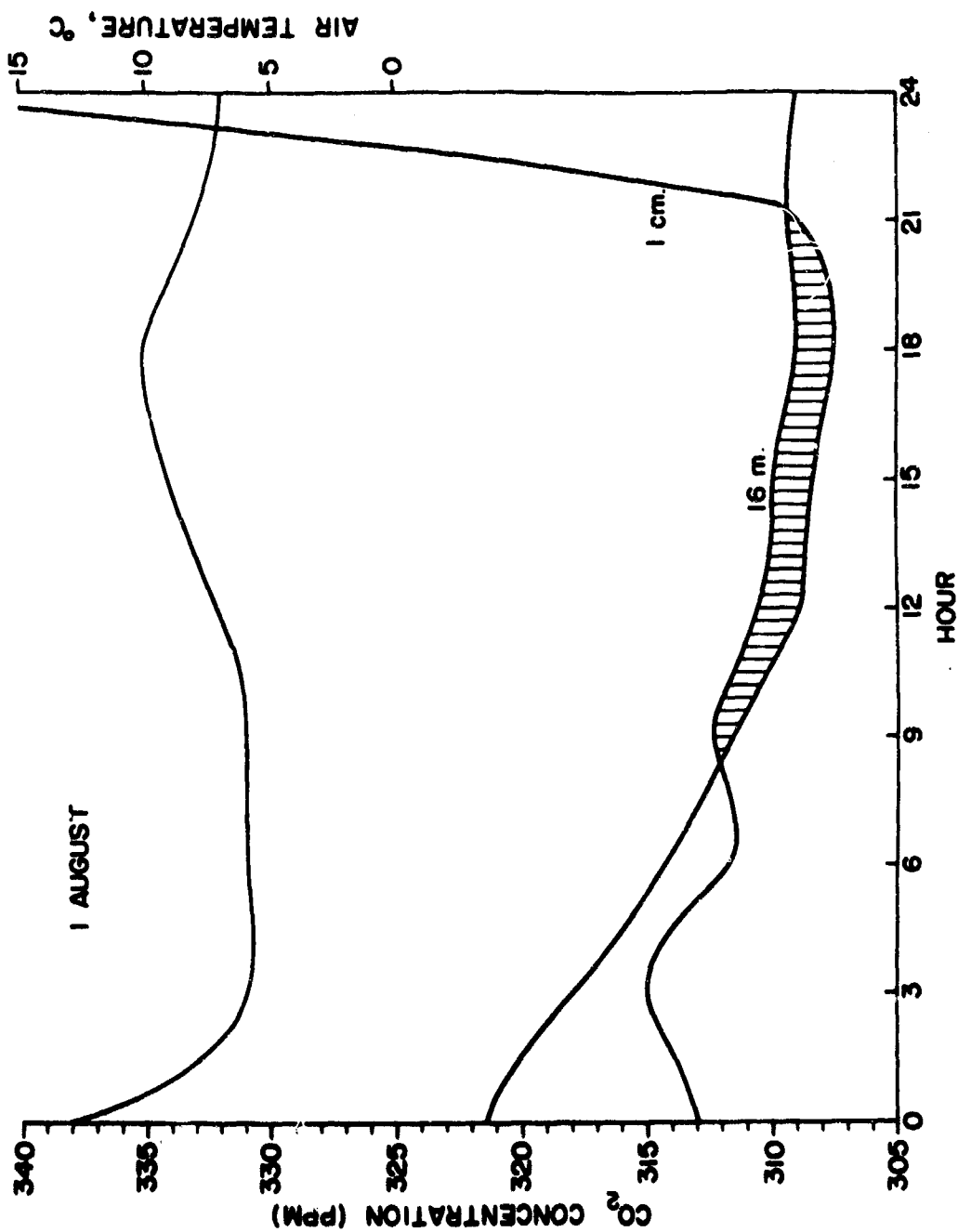


Figure 24. Hourly Carbon Dioxide and Air Temperature at Meade River.

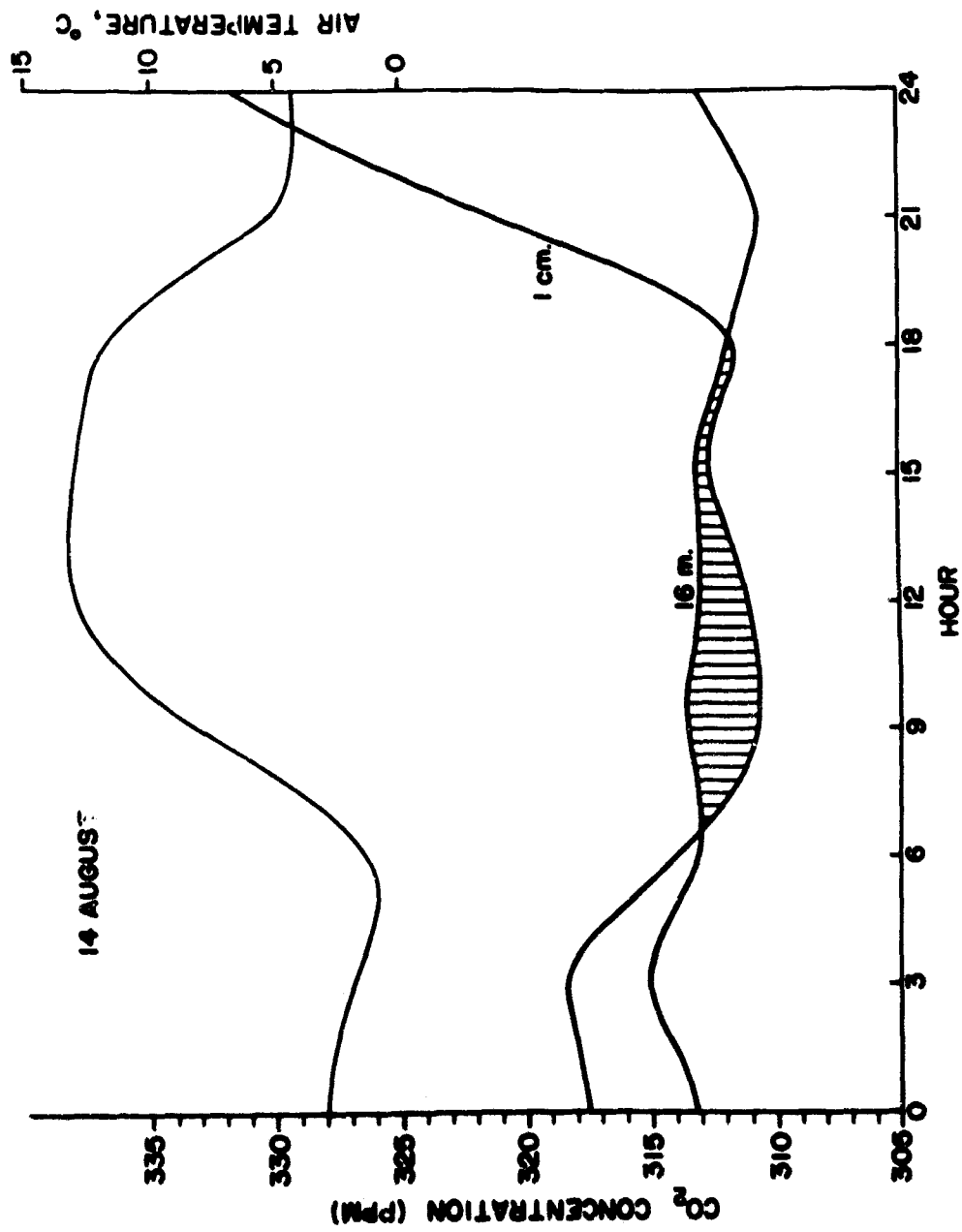


Figure 25. Hourly Carbon Dioxide and Air Temperature at Meade River.

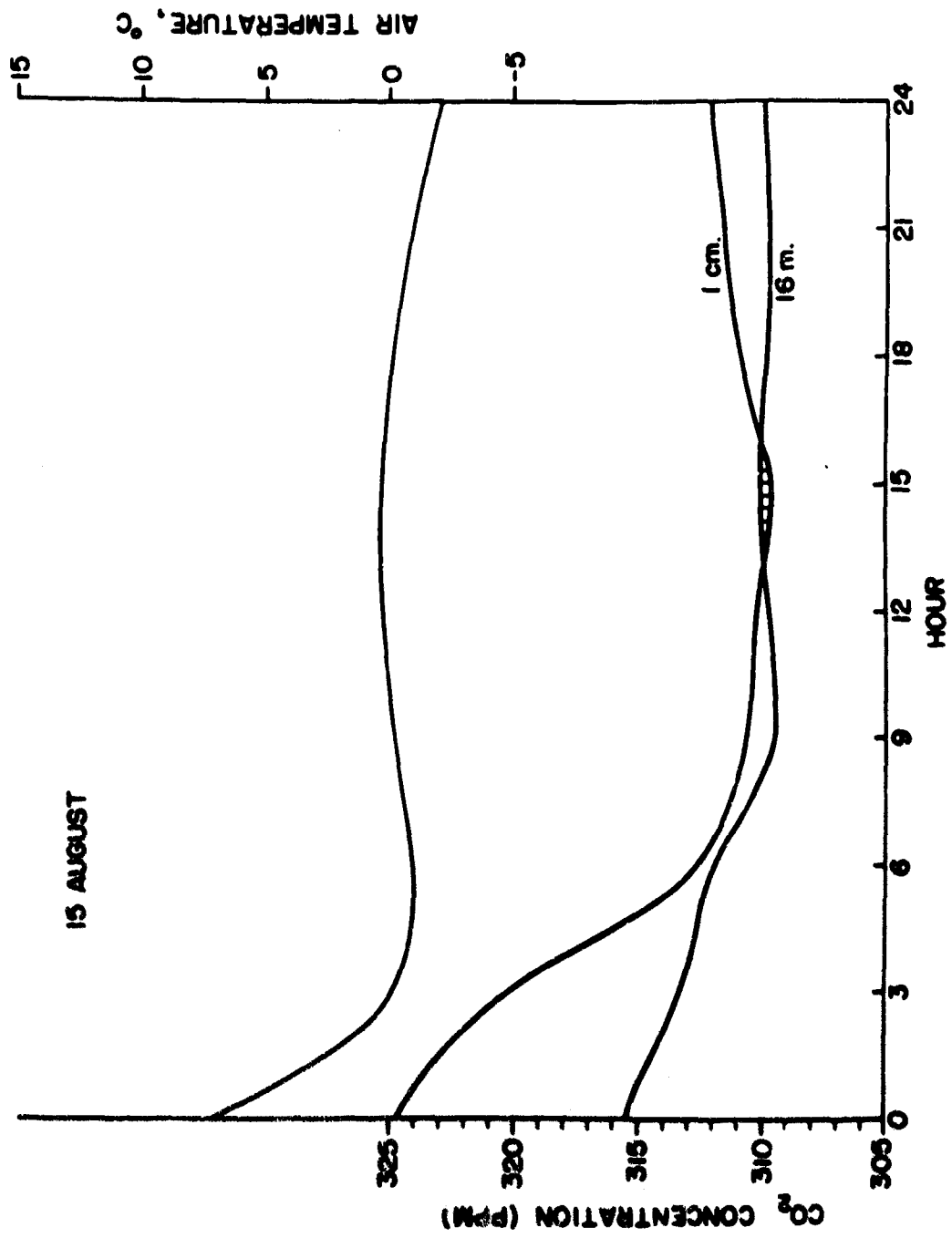


Figure 26. Hourly Carbon Dioxide and Air Temperature at Meade River.

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      |            |       |       |
| 30         | .51   | .37    | Seasonal   |       |       |
| 31         | .51   | .21    | Total      | 98.93 | 51.85 |
| Mon. 26.44 | 17.08 |        |            |       |       |

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

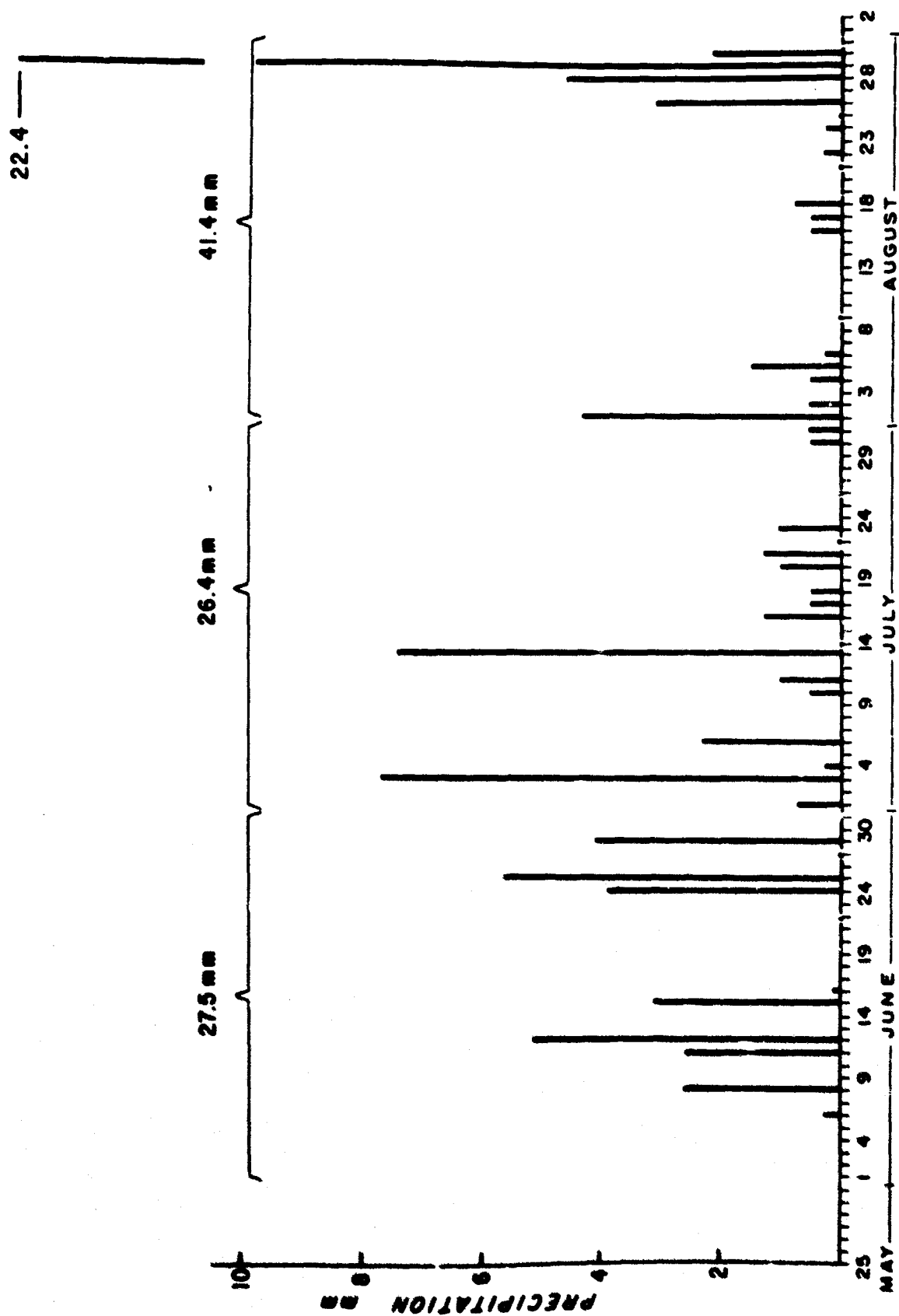


Figure 27. Precipitation Distribution During the 1966 Thaw Season at Meade River.

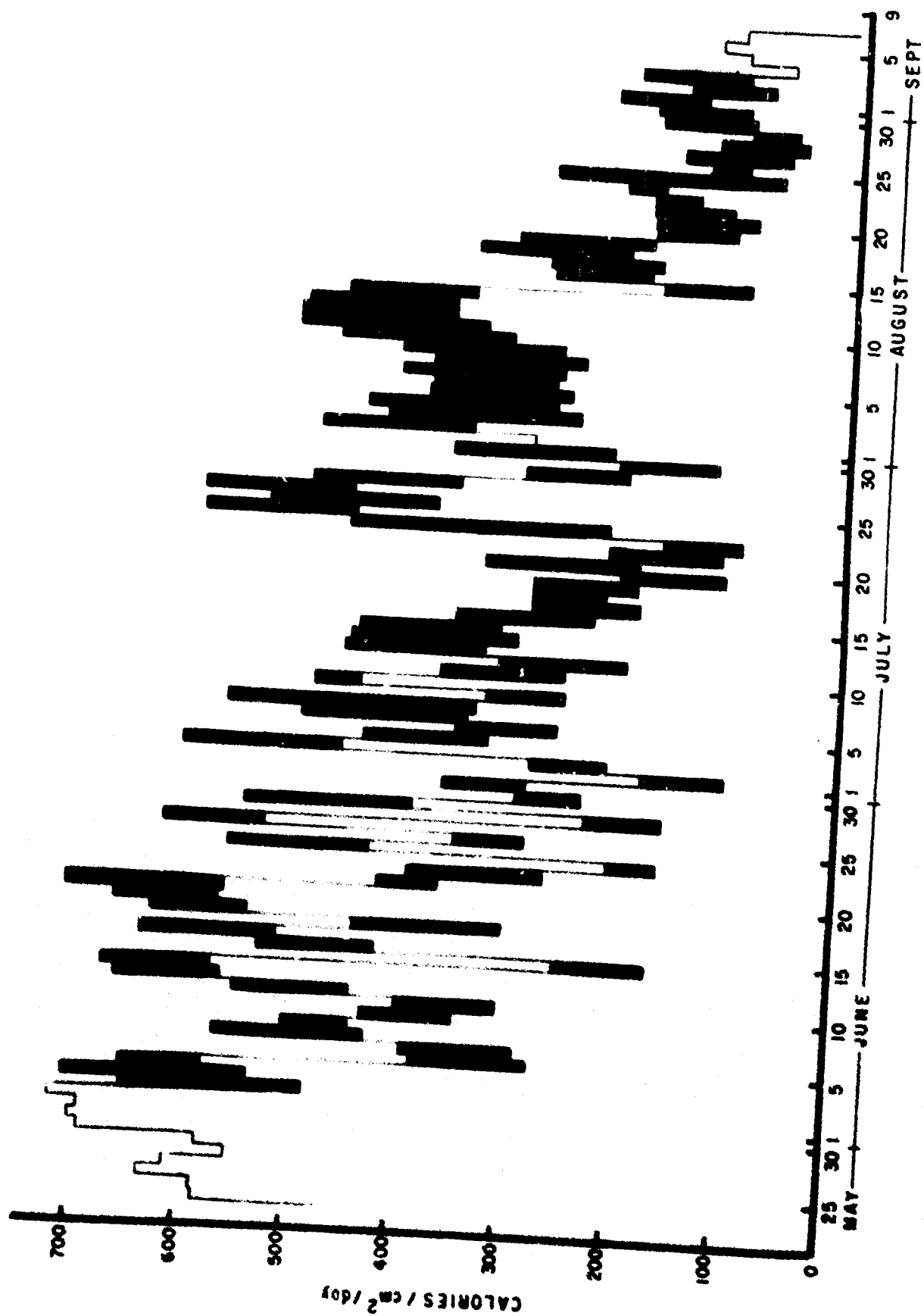


Figure 28. Total Short Wave and Net Solar Radiation During the 1966 Thaw Season at Meade River.

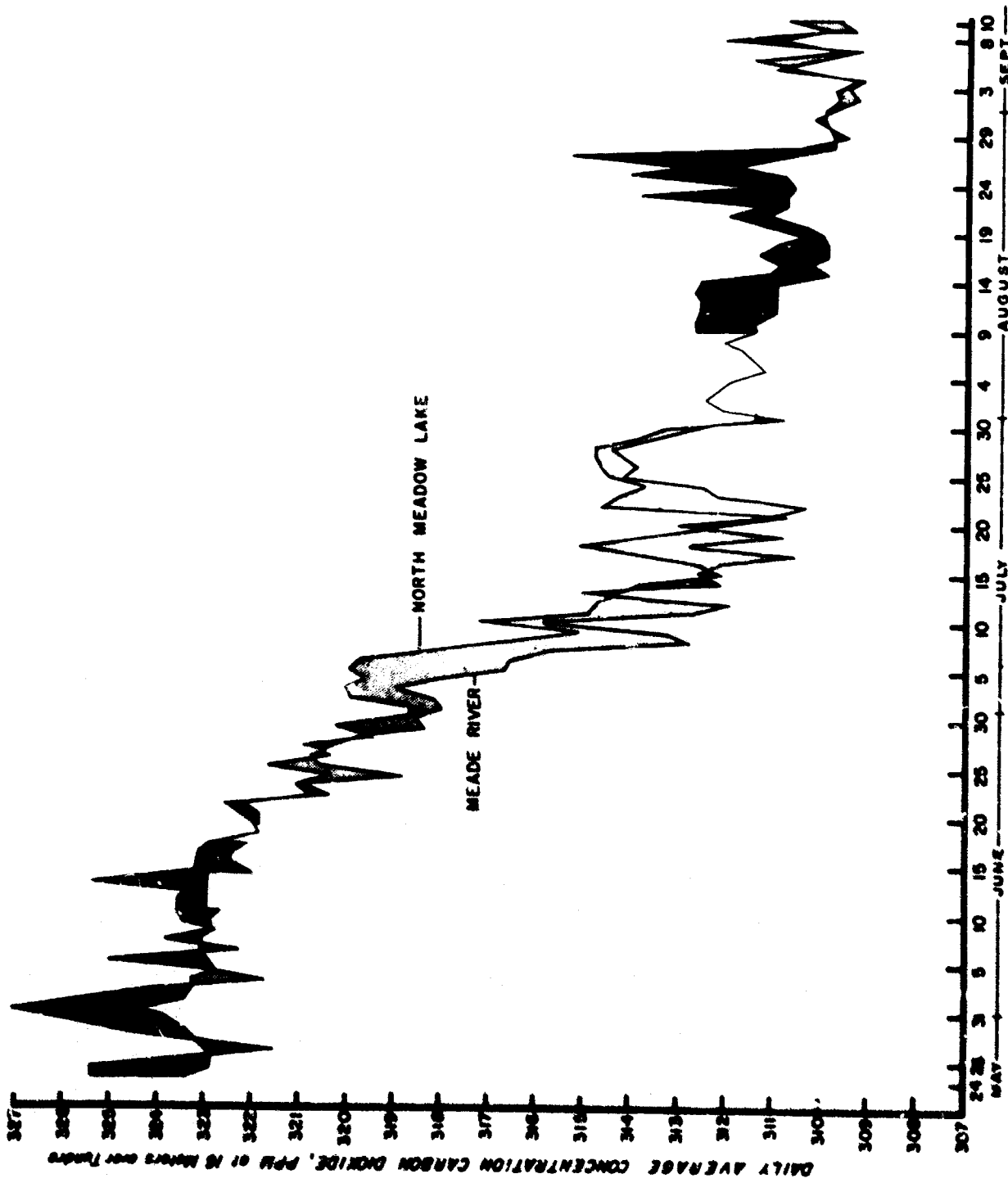


Figure 29. Daily Average Concentration of Carbon Dioxide (ppm) at 16 m Above Tundra at Meade River Camp and North Meadow Lake (Barrow) During the 1966 Thaw Season.

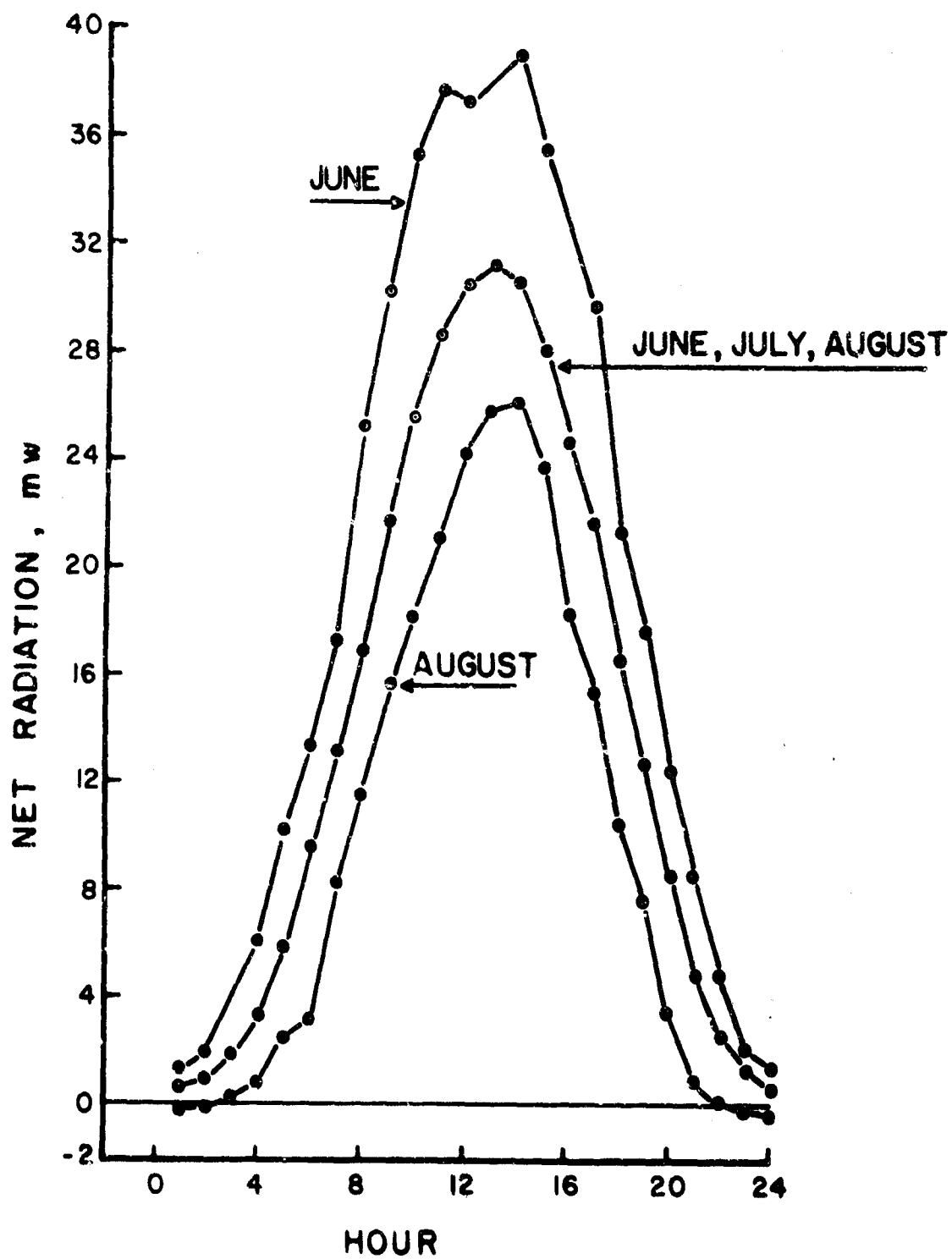


Figure 30. Intensity and Mean Hourly Distribution of Net Radiation at Meade River Camp in June, August, and for Three Summer Months.

Table 22: Open Pan Evaporation Rates, mg/cm<sup>2</sup>

| Date   | Hour | Rate | Date    | Hour | Rate |
|--------|------|------|---------|------|------|
| June 5 | 1615 | -    | June 21 | 0830 | -    |
|        | 1835 | 20.0 |         | 1230 | 43.5 |
|        | 2125 | 9.2  |         | 1420 | 50.7 |
| 6      | 0900 | 2.2  |         | 1600 | 52.6 |
|        | 1100 | 10.5 |         | 2400 | 16.8 |
|        | 1230 | 9.8  | 22      | 0900 | 7.7  |
| 7      | 1435 | -    |         | 1045 | 19.3 |
|        | 1635 | 9.4  |         | 1345 | 14.6 |
| 10     | 1600 | 7.1  | 23      | 1100 | 8.0  |
|        | 1430 | -    |         | 1515 | 20.9 |
|        | 1730 | 26.7 | 25      | 1515 | -    |
| 11     | 2200 | 8.5  |         | 2040 | 16.3 |
|        | 0800 | 23.4 |         | 1315 | 4.4  |
| 12     | 1500 | 13.2 | 26      | 1630 | 17.1 |
|        | 1800 | 16.0 |         | 2025 | 14.1 |
|        | 0830 | 19.5 | 27      | 0800 | 2.5  |
| 13     | 1130 | 23.6 |         | 1030 | 35.3 |
|        | 1430 | 30.6 |         | 1910 | 25.4 |
|        | 1730 | 29.3 | 29      | 1140 | -    |
| 14     | 2230 | 5.3  |         | 1900 | 28.7 |
|        | 0930 | 9.3  |         | 1040 | 4.1  |
| 15     | 1130 | 36.3 | July 1  | 1010 | 3.3  |
|        | 1330 | 43.5 |         | 0900 | -    |
|        | 1530 | 39.1 |         | 1100 | 26.5 |
| 18     | 1830 | 27.1 | 4       | 1630 | 38.0 |
|        | 0830 | 7.2  |         | 2315 | 12.7 |
|        | 1130 | 41.6 | 6       | 2145 | -    |
| 19     | 1430 | 47.1 |         | 0910 | 2.0  |
|        | 1730 | 43.8 |         | 2335 | 14.8 |
| 20     | 1130 | 11.0 | 8       | 0915 | 4.3  |
|        | 1100 | -    |         | 1420 | 25.7 |
|        | 1230 | 32.2 |         | 2130 | 0    |
| 21     | 1600 | 17.1 | 9       | 0935 | 38.2 |
|        | 2330 | 7.4  |         | 1400 | -    |
|        | 1145 | 9.9  | 13      | 1600 | 26.3 |
| 22     | 1330 | 36.1 |         | 1930 | 18.6 |
|        | 1750 | 50.2 |         | 2230 | 13.6 |
| 23     | 2345 | 8.8  | 14      | 0930 | 4.9  |
|        | 0900 | 8.0  |         | 1800 | 27.3 |
|        | 1100 | 35.8 | 15      | 0900 | 5.3  |
| 24     | 1300 | 36.6 |         | 0830 | 5.7  |
|        | 1500 | 46.0 |         | 1245 | 17.5 |
|        | 2030 | 27.0 | 16      | 1945 | 62.4 |

Table 22 continued

| Date   | Hour | Rate | Date   | Hour | Rate |
|--------|------|------|--------|------|------|
| July   | 16   | 2230 | August | 14   | 1045 |
|        | 17   | 1210 |        |      | 1715 |
|        | 18   | 1000 |        | 17   | 0950 |
|        | 19   | 0810 |        |      | 2300 |
|        | 20   | 1035 |        | 18   | 1245 |
|        | 21   | 0950 |        |      | 2000 |
|        |      | 1312 |        | 19   | 0745 |
|        |      | 1920 |        |      | 1245 |
|        | 22   | 1000 |        |      | 2000 |
|        |      | 1325 |        | 20   | 0840 |
|        |      | 1925 |        |      | 1230 |
|        | 24   | 1300 |        | 21   | 0830 |
|        |      | 2330 |        | 22   | 0900 |
|        | 25   | 1030 |        | 23   | 0845 |
|        |      | 1700 |        | 24   | 0930 |
|        |      | 1935 |        |      | 1900 |
|        | 26   | 1230 |        | 25   | 1010 |
|        |      | 1840 |        | 26   | 0930 |
|        | 27   | 1100 |        | 27   | 0840 |
|        | 28   | 1010 |        |      |      |
|        |      | 1500 |        |      |      |
|        |      | 1910 |        |      |      |
|        |      | 2030 |        |      |      |
| August | 1    | 1015 |        |      |      |
|        | 2    | 0850 |        |      |      |
|        |      | 1245 |        |      |      |
|        |      | 2345 |        |      |      |
|        | 3    | 1010 |        |      |      |
|        |      | 1650 |        |      |      |
|        | 4    | 1300 |        |      |      |
|        |      | 2245 |        |      |      |
|        | 7    | 1015 |        |      |      |
|        |      | 1430 |        |      |      |
|        | 8    | 1100 |        |      |      |
|        |      | 1400 |        |      |      |
|        |      | 2010 |        |      |      |
|        | 9    | 1015 |        |      |      |
|        |      | 1320 |        |      |      |
|        |      | 2150 |        |      |      |
|        | 10   | 0900 |        |      |      |
|        |      | 1400 |        |      |      |
|        |      | 2000 |        |      |      |
|        | 11   | 0900 |        |      |      |
|        |      | 1740 |        |      |      |
|        | 12   | 1000 |        |      |      |
|        |      | 1250 |        |      |      |
|        | 13   | 0930 |        |      |      |
|        |      | 1650 |        |      |      |

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  |

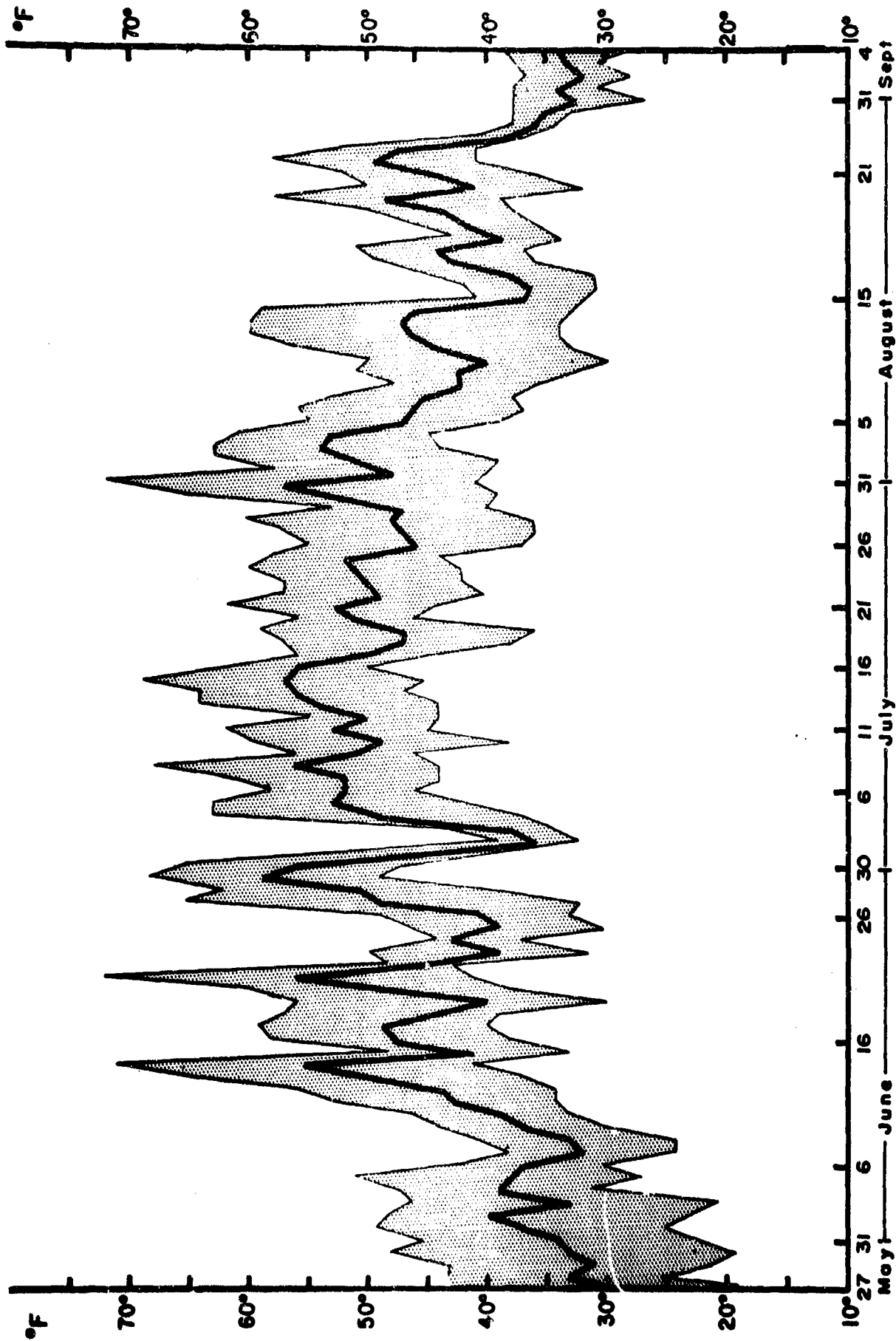


Figure 31. Progression of Daily Mean, Maximum and Minimum Temperatures Based on Five Six's-Type Mercury Thermometers at 5 cm Height in a Screen.

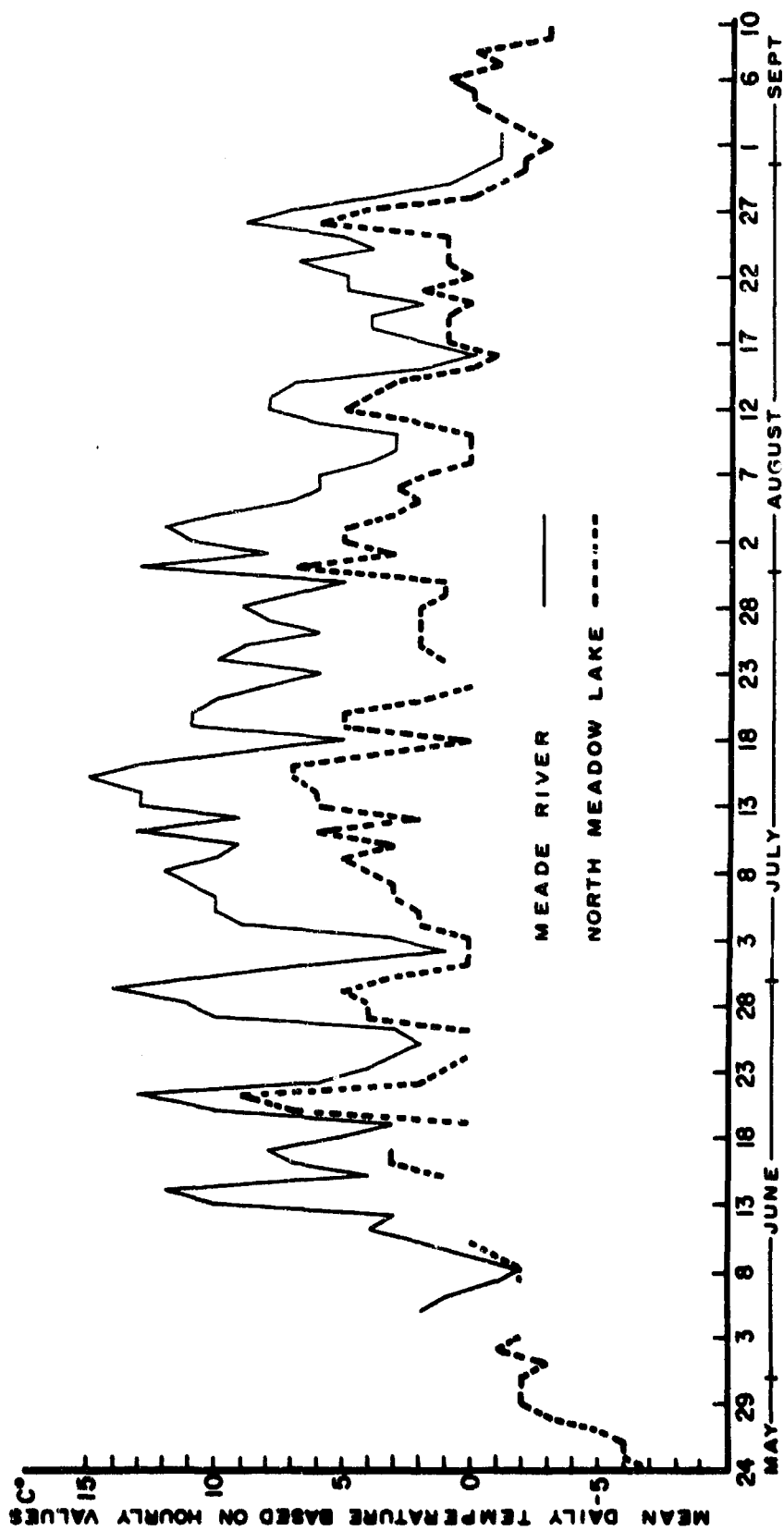


Figure 32. Comparison of Mean Daily Temperatures Based on Hourly Thermograph Values at 5 cm Height at Barrow and Meade River.

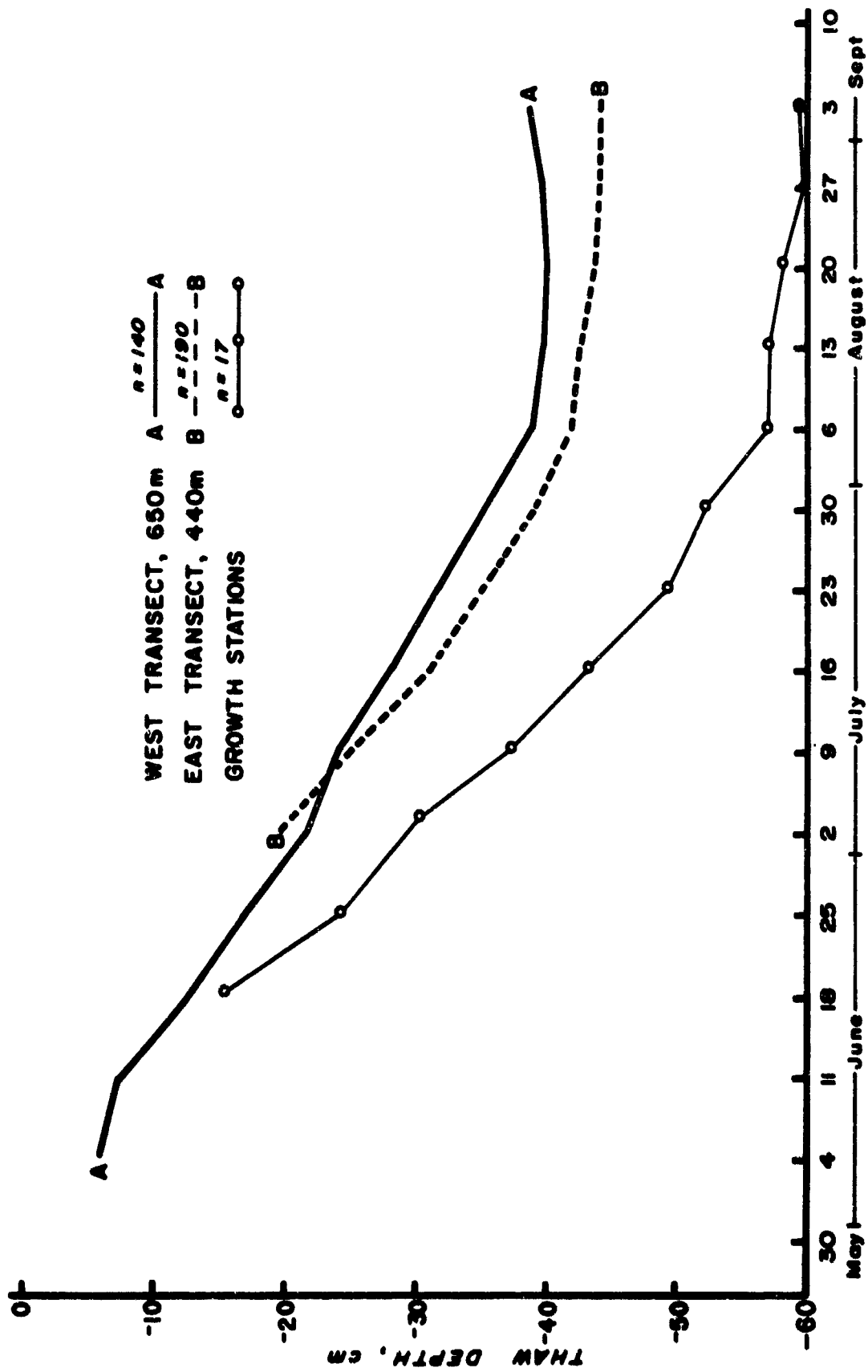


Figure 33. Progression of Thaw in 1966 as an Average 190 Points on Transect A, 140 Points on Transect B, and at 17 Plant Growth Stations.

Table 24: Survey Chemistry of Meade River Water, 1966

| Date    | Turbidity<br>JTU | Conductance<br>Micromhos | Total<br>Alkalinity | Total<br>Hardness | CaCo <sub>3</sub> | MgCo <sub>2</sub> | Fe<br>ppm | Cl  | NaCl | SO <sub>4</sub> | Si<br>ppm |
|---------|------------------|--------------------------|---------------------|-------------------|-------------------|-------------------|-----------|-----|------|-----------------|-----------|
| 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<sub>4</sub> were negative.

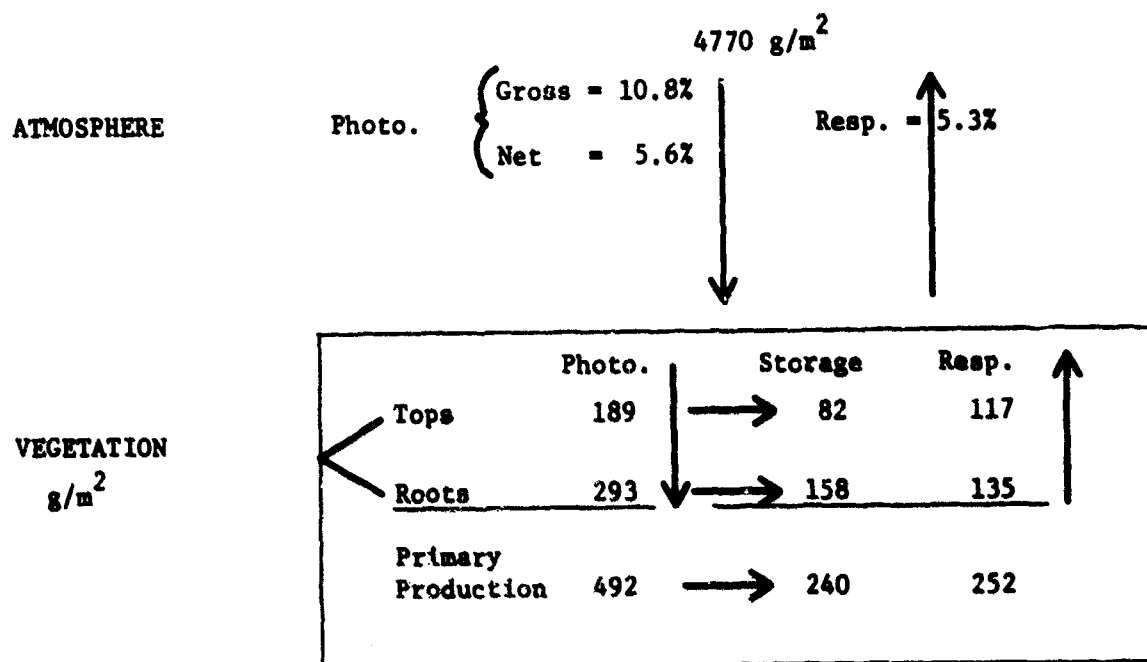


Figure 34. Dry Matter Production in an Arctic Tundra Ecosystem at Meade River, 1966.

TABLE 25: Harvested Biomass at Meade River, 1966

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

Table 26: Standing Crop of Eight Photosynthesis Sites

| Site | Vegetation Type                          | Dry Weight<br>Live, g/m <sup>2</sup> | Chamber<br>Litter, g/m <sup>2</sup> | Ratio<br>Live/Dead |
|------|------------------------------------------|--------------------------------------|-------------------------------------|--------------------|
| 1.   | Carex aquatilis<br>(wet tundra)          | 62.1                                 | 62.6                                | 0.99               |
| 2.   | Carex aquatilis<br>(snowbed)             | 42.4                                 | 61.2                                | 0.70               |
| 3.   | Salix phlebophylla<br>(ridge)            | 85.5                                 | 213.6                               | 0.40               |
| 4.   | Salix Phlebophylla<br>(ridge)            | 62.2                                 | 180.9                               | 0.34               |
| 5.   | Eriophorum vaginatum<br>(polygon trough) | 260.0                                | 1221.8                              | 0.21               |
| 6.   | Eriophorum vaginatum<br>(upland tundra)  | 95.8                                 | 1072.1                              | 0.09               |
| 7.   | Carex aquatilis<br>(pond)                | 42.6                                 | 150.3                               | 0.29               |
| 8.   | Carex aquatilis<br>(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 |
|-----------------------------------------------|-------------------|----------------------------|
| <i>Betula glandulosa</i><br>(birch)           | 40 twigs          | 46                         |
| <i>Salix pulchra</i><br>(willow)              | 30 twigs          | 121                        |
| <i>Carex aquatilis</i><br>(sedge)             | 30 ramet          | 151                        |
| <i>Carex consimilis</i><br>(sedge)            | 20 ramet          | 120                        |
| <i>Eriophorum vaginatum</i><br>(cotton grass) | 4 tussocks        | 11020                      |
| <i>Polygonum bistorta</i><br>(bistort)        | 20 tops           | 620                        |
|                                               | 20 roots and corm | 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     | 171     | 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     | 139     | 131      | 142       | 139       |
|                               | 2    |         | 28      | 34     | 65     | 123     | 140     | 142     | 139      | 148       | 139       |

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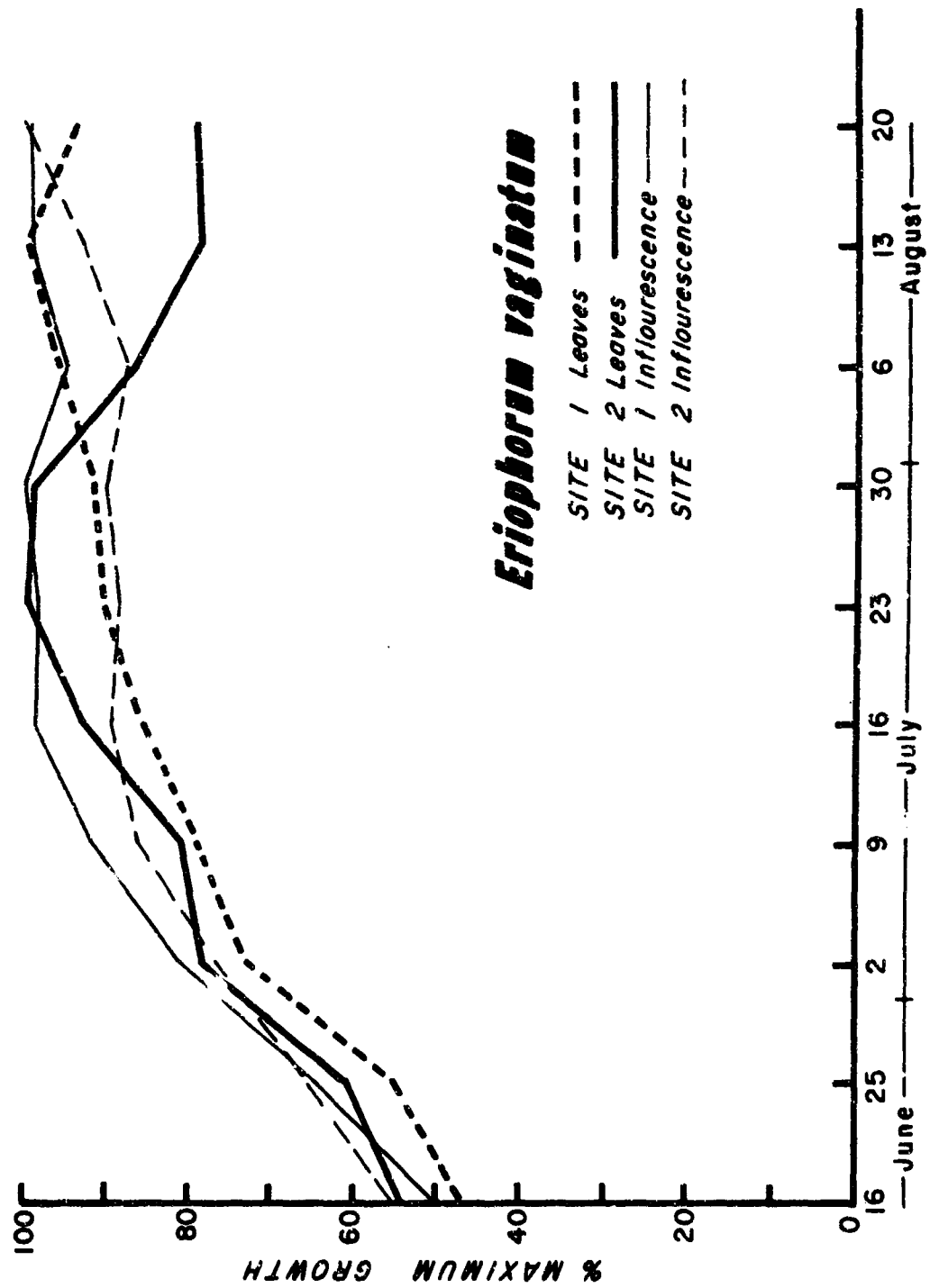


Figure 35. Growth Rates of Six Species at Meade River.

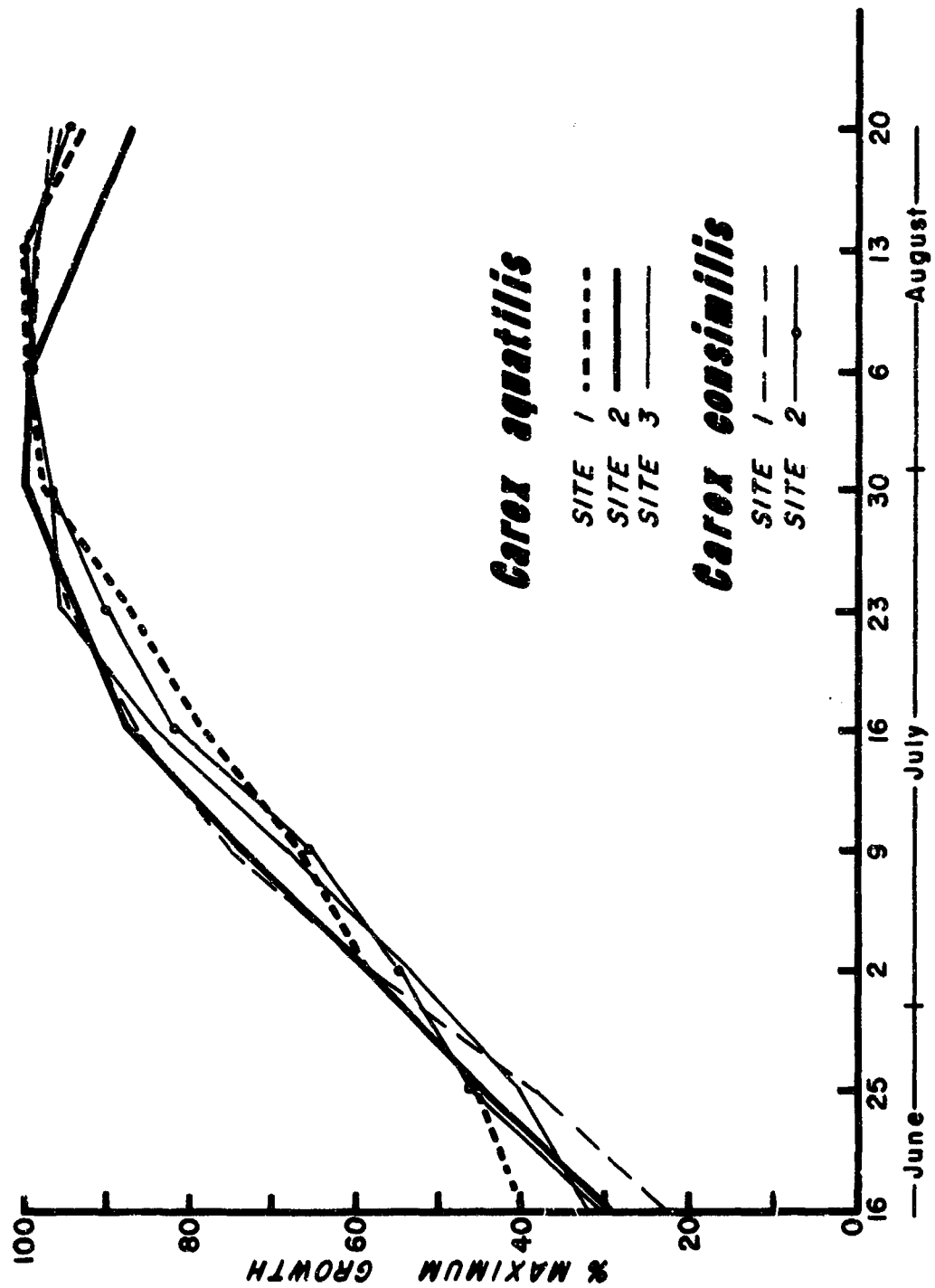


Figure 36. Growth Rates of Six Species at Meade River.

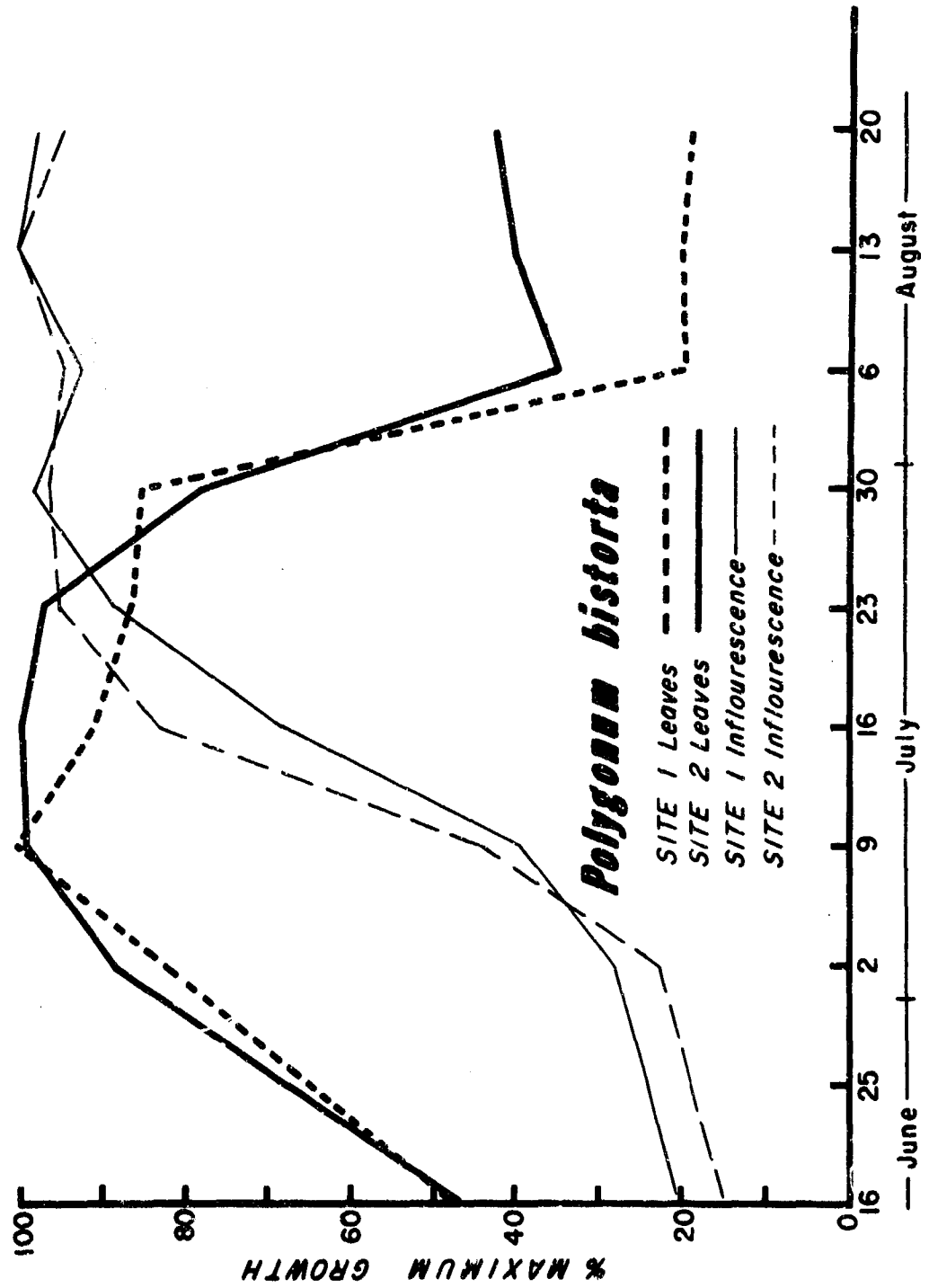


Figure 37. Growth Rates of Six Species at Meade River.

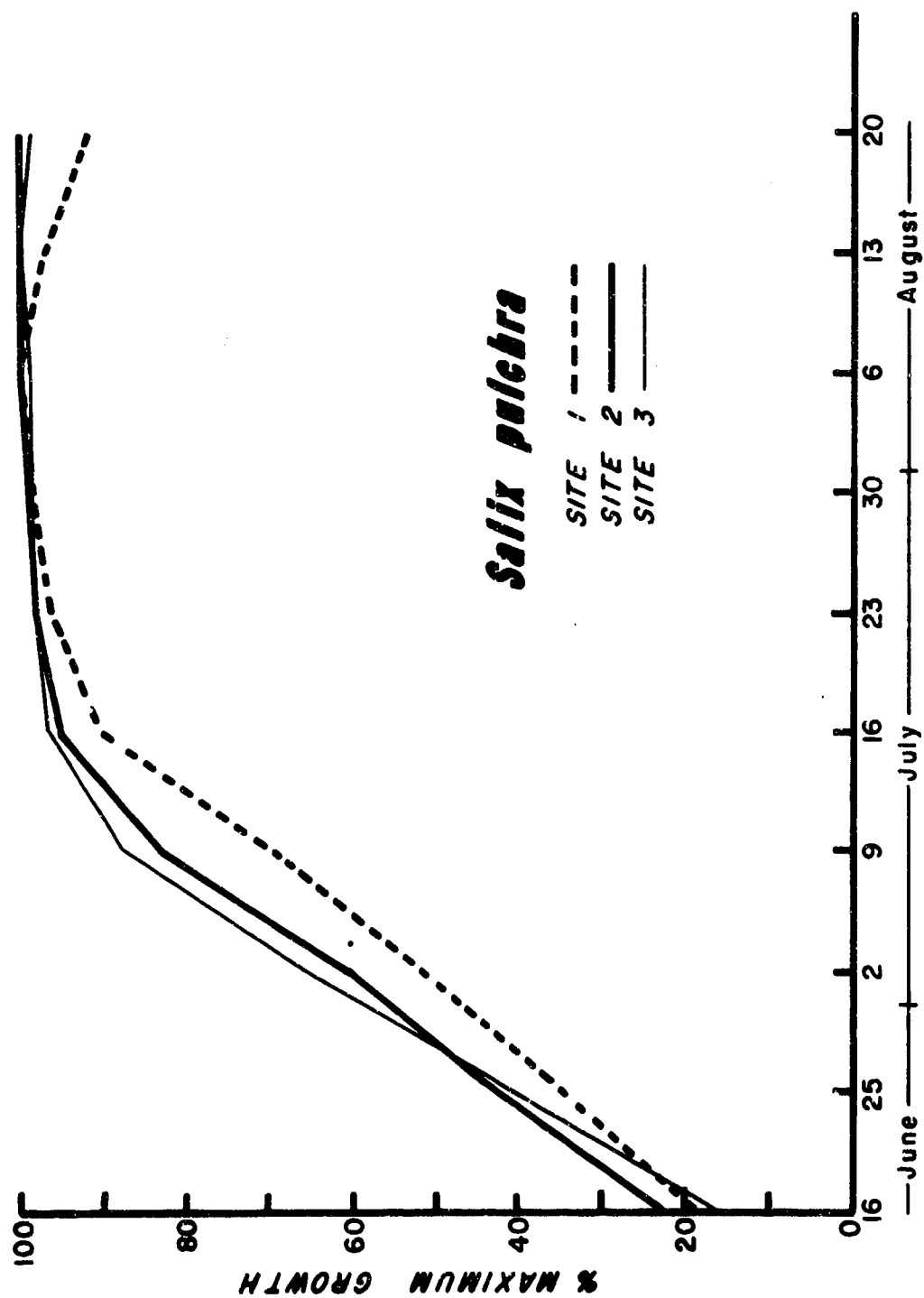


Figure 38. Growth Rates of Six Species at Meade River.

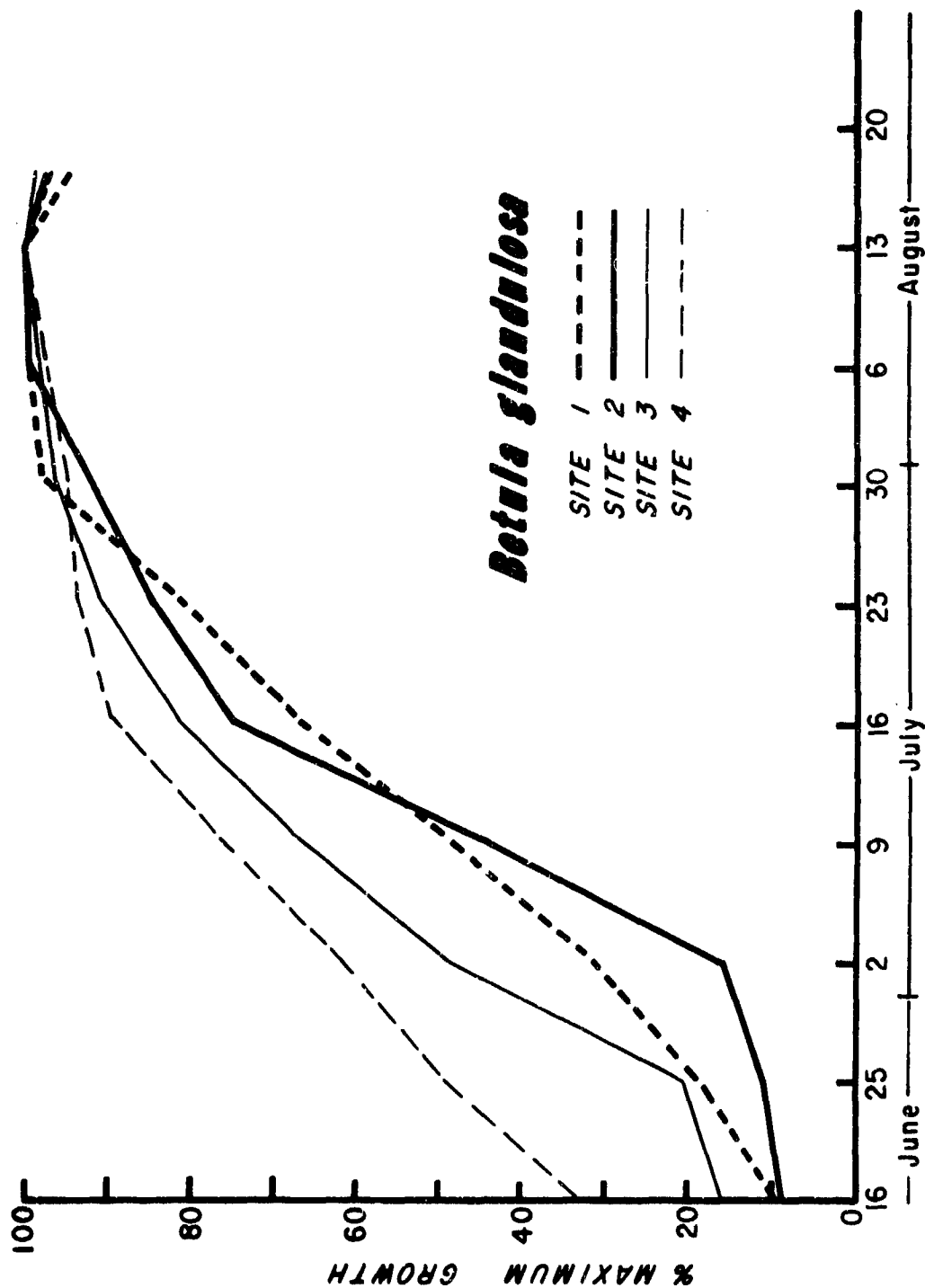


Figure 39. Growth Rates of Six Species at Meade River.

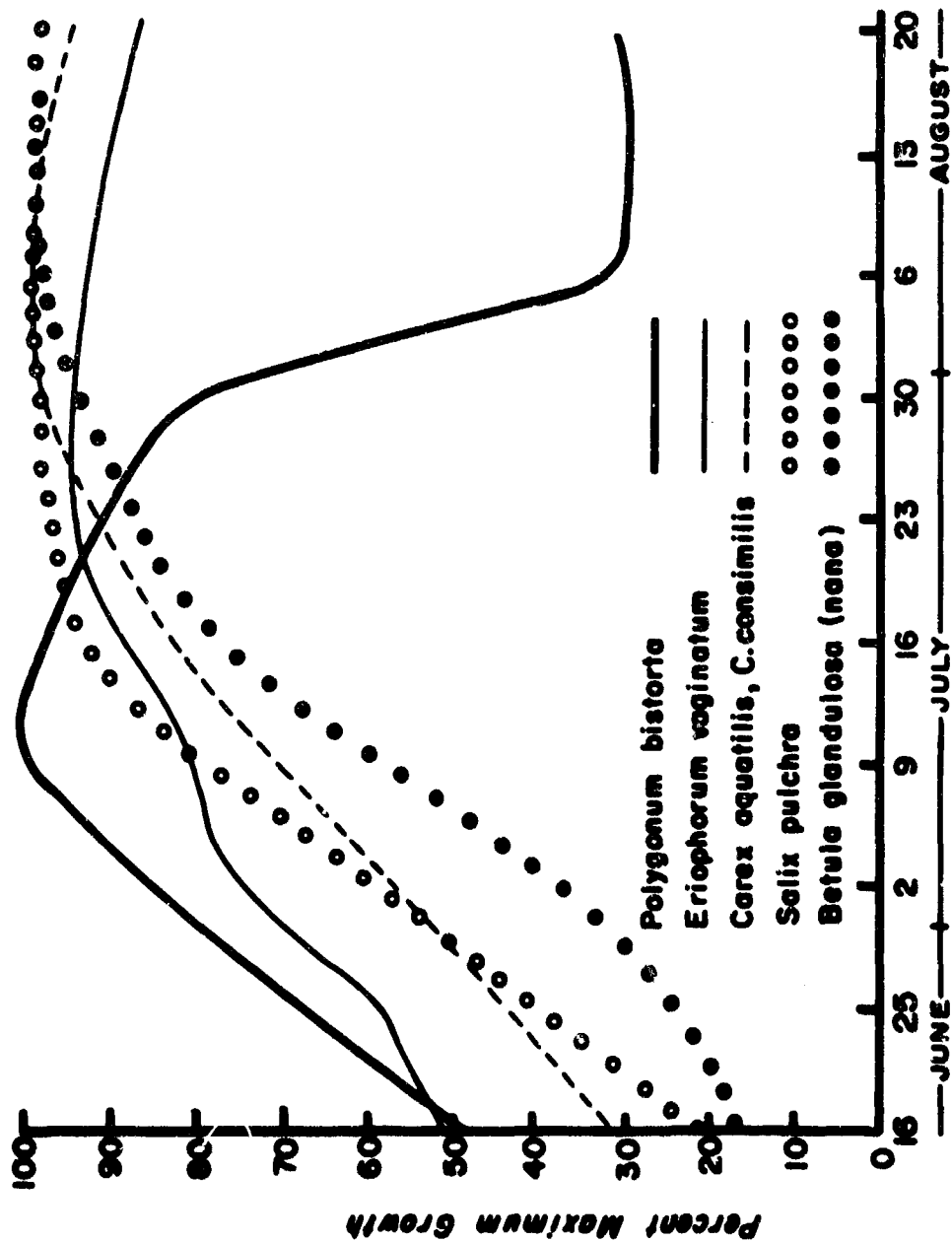


Figure 40. Growth Rates of Six Species at Meade River.

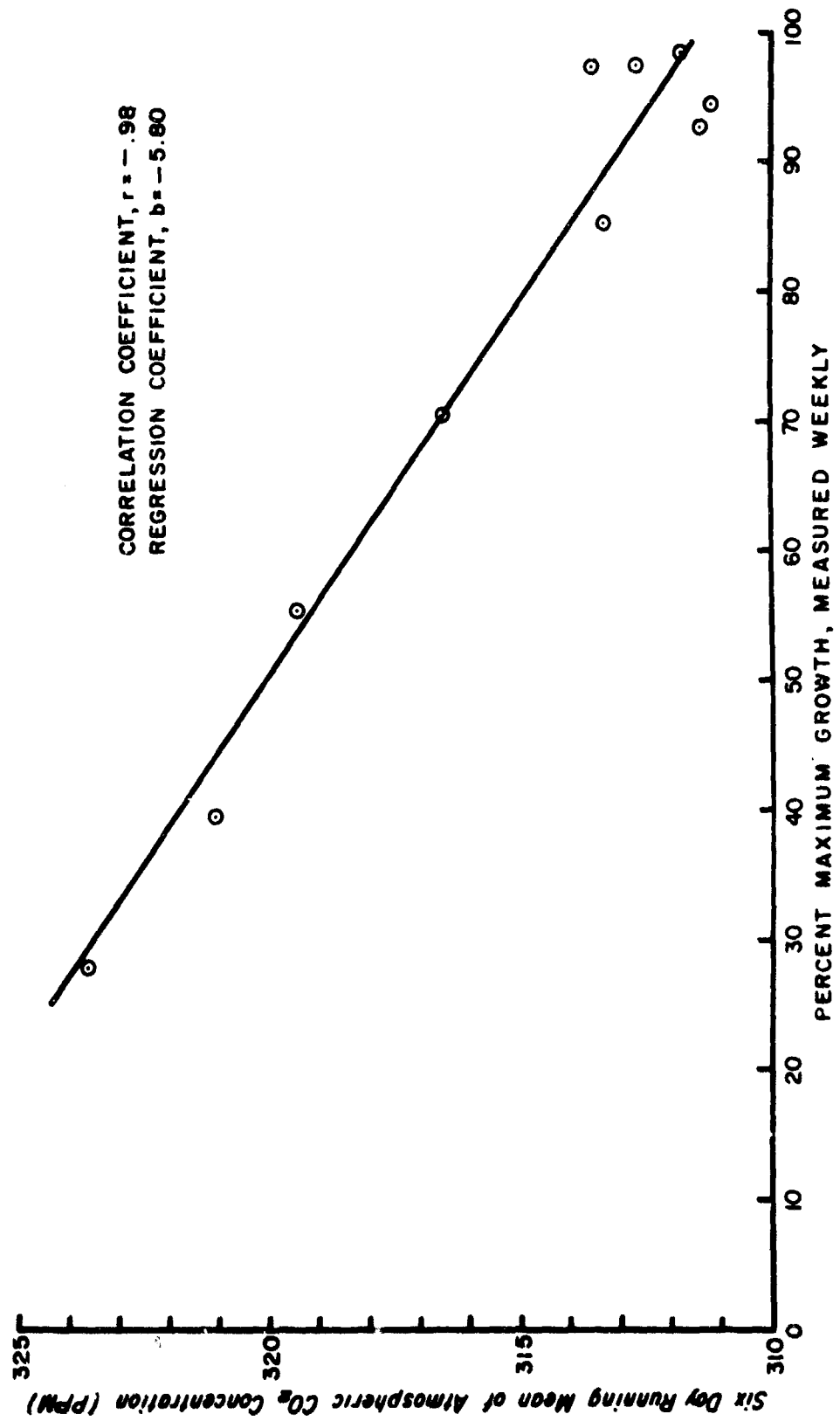


Figure 41. Regression of Six-Day Carbon Dioxide Concentration at 16 m on Percentage of Maximum Plant Growth at Heade River.

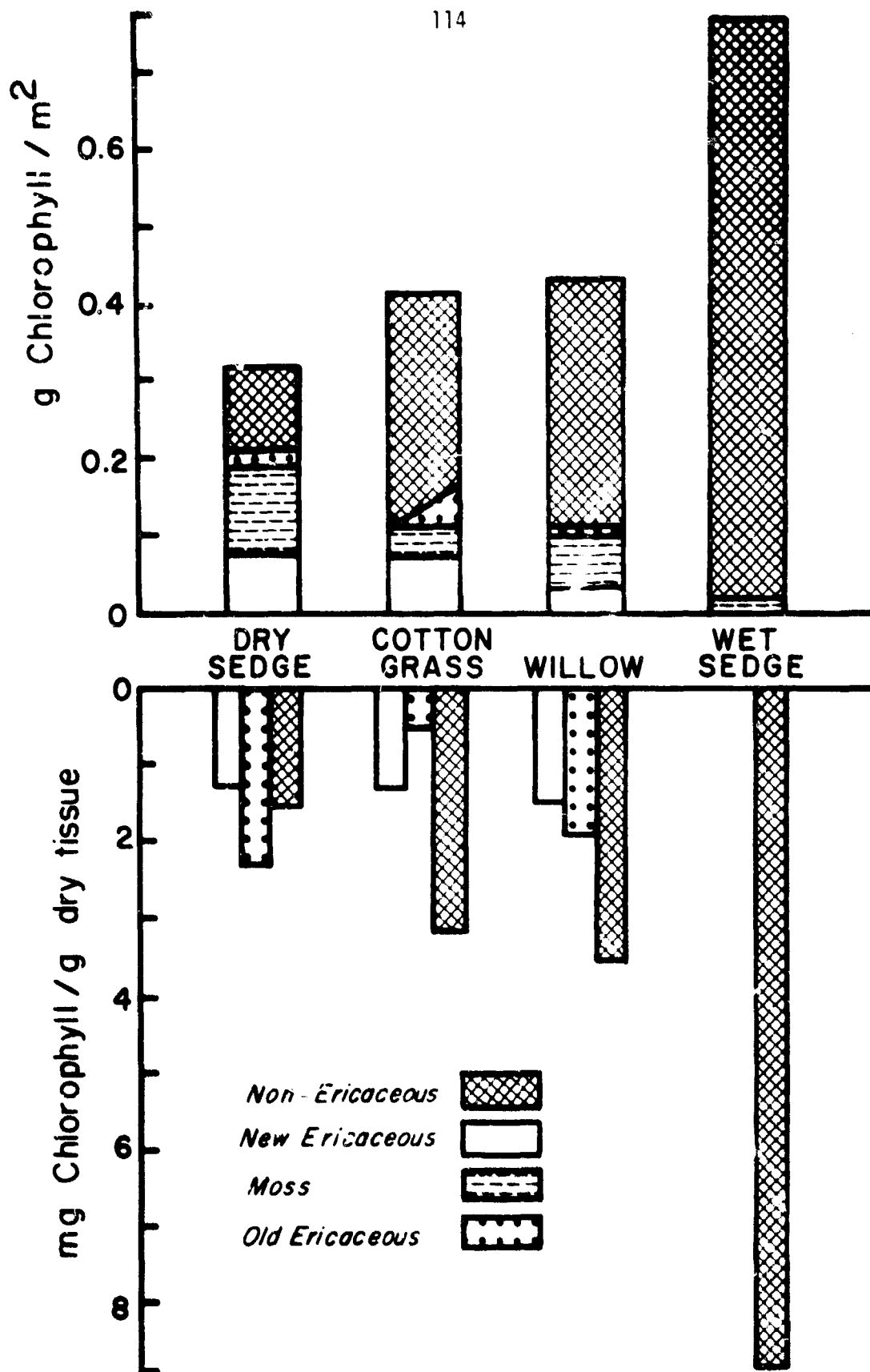


Figure 42. Histograms of Chlorophyll Distribution in Four Components of Four Plant Communities. Note that Bryophytes Accounted for 1/3 of the Pigment in Upland Dry Sedge Stands.

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

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

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

| Community    | Ericadeous |        | Current |            | Production |            | Correlation,<br>ratio, mg:g |
|--------------|------------|--------|---------|------------|------------|------------|-----------------------------|
|              | Ericadeous | Ericad | Ericad  | Non-Ericad | Non-Ericad | Non-Ericad |                             |
| 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 574: OD 652)  
in Four Arctic Tundra Communities

| Community    | Chlorophyll a:b |                   |               |      | Carotenoid Ratio |                   |               |      |
|--------------|-----------------|-------------------|---------------|------|------------------|-------------------|---------------|------|
|              | Non<br>Ericad   | Current<br>Ericad | Old<br>Ericad | Moss | Non<br>Ericad    | Current<br>Ericad | Old<br>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<br>Sample Number | mg Chl/10 dm <sup>2</sup>     | g dry wt/10 dm <sup>2</sup>  |
|--------------------------------|-------------------------------|------------------------------|
| <b>Carex dry tundra</b>        |                               |                              |
| 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 <sup>2</sup> ± 16.93 | 59.26/m <sup>2</sup> ± 7.03  |
| <b>Eriophorum vaginatum</b>    |                               |                              |
| 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                         |
|                                | 202.58/m <sup>2</sup> ± 50.72 | 191.32/m <sup>2</sup> ± 15.7 |
| <b>Salix pulchra</b>           |                               |                              |
| 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 <sup>2</sup> ± 27.7  | 93.26/m <sup>2</sup> ± 6.13  |
| <b>Carex wet tundra</b>        |                               |                              |
| 1                              | 68.97                         | 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                         |
|                                | 756.14/m <sup>2</sup> ± 88.91 | 86.16/m <sup>2</sup> ± 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     | 6.6  | 20.2 | 26     | 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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| <p>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<sub>2</sub> program, with a discussion of methods used to obtain the data for CO<sub>2</sub> concentrations in air at both stations. Variations of CO<sub>2</sub> 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<sub>2</sub> 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.</p> |                                                                                    |                                                              |  |

| 14<br>KEY WORDS                                                            | LINK A |    | LINK B |    | LINK C |    |
|----------------------------------------------------------------------------|--------|----|--------|----|--------|----|
|                                                                            | ROLE   | WT | ROLE   | WT | ROLE   | WT |
| Arctic Ecology<br>Arctic Tundra<br>Atmospheric Chemistry<br>Carbon Dioxide |        |    |        |    |        |    |
|                                                                            |        |    |        |    |        |    |
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