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THE UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING

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Final Report

RAIN SCAVENGING STUDIES--DATA COLLECTION AND SYNTHESIS

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ABSTRACT

During the month of May, 1964, field data on rain-producing weather systems, and samples of rain suitable for radiochemical and palynological analyses were collected by University of Michigan personnel at Chickasha, Oklahoma. Raindrop-size data were recorded at ground level by means of the photoelectric raindrop-size spectrometer. In addition a tipping-bucket raingauge was used to obtain detailed information on the rainfall intensity variations, and a weighing raingauge of 10 times standard collecting area was used to obtain total rainfall records. Samples of rain were collected by means of 3 fiberglass funnels specially fabricated for the experiment, each having a collecting area of 2.5 m^2. Wind data and measurements of the amount of airborne pollens were also taken. In all, 106 samples of rain were collected for analysis.

Collation, synthesis and interpretation of the data will include complementary records from several other groups, and will be done under a subsequent contract.

INTRODUCTION

Comprehensive field data on rains which occurred at Chickasha, Oklahoma, during May, 1964, were collected, and sequential samples of the rain were collected at a field station, erected for the purpose and operated by University of Michigan personnel on farm land owned by C. W. Neville, 2 miles NW of the town of Chickasha. The sampling and data-recording effort was coordinated with parallel operation of the U. S. Weather Bureau Severe Storms Laboratory Beta Network and Radars; the U. S. Department of Agriculture, Agricultural Research Service Washita River Watershed raingauge network; the University of Oklahoma network of automatic rain sampling stations; the U. S. Air Force Radar at Tinker AFB; and the U. S. Weather Bureau Radar at Will Rogers Airport, Oklahoma City. Additional coordination with USAF Air Weather Service airsampling flights, and with data-collection by the USAF flying laboratory, was attempted, but not successful.

The data and samples were returned, with the special field instrumentation supplied by The University of Michigan, to the laboratories of the Department of Meteorology and Oceanography, Ann Arbor, for reduction and analysis. Data assembled by the other coordinating groups are being procured as they become available, and complete interpretations will be developed under a subsequent contract.

SAMPLING STATION

Following the formal approval of the effort and availability of funds about mid-March, 1964, the design of the field station, procurement of necessary instrumentation and preliminary calibrations were undertaken immediately. A visit to Norman and Chickasha, Oklahoma, in the first week of April produced most of the basic arrangements for construction of The University of Michigan sampling station in a wheat field owned by C. W. Neville, within one-quarter mile of the USWB Beta Network station designated as WB-11 (see map, Figure 1). The installation was completed and ready for operation on 1 May, 1964.

A special feature of the installation is the 8 short power - line poles used to support the 3 rain-sampling cones, and simultaneously to anchor the field shelter hut against the anticipated severe storms (Figure 2). The poles were set to a depth of 5 ft. The sampling cones were designed to have a collecting area 2.5 m^2 (diameter 5 ft 10.2 in.) each, and were fabricated of fiber-glass to resist hail damage.

Instruments were distributed about the hut according to the station plan shown in Figure 3. The complement of instruments included

(1) photoelectric raindrop-size spectrometer
(2) tipping-bucket raingauge (operation recording each 0.01 in.)
(3) weighing raingauge with ten-fold increased collecting funnel (continuous recording)
(4) anemometer (1/60 mi. contacts)
(5) wind vane (continuous recording)
(6) 3 rotobar samplers (for pollen in low-level air)

Most of these appear in Figures 4 and 5.

Recording instruments, auxiliary equipment, and sample containers were housed in the hut and in the spectrometer tent. These include the following:

(1) an Esterline-Angus combination operations and analog recorder on which
   (a) wind speed used four operations channels
   (b) the tipping-bucket raingauge used one operations channel
   (c) beginning and end of rain sample collections used one operations channel
   (d) miscellaneous time and remark checks used one operations channel
   (e) wind direction used the continuous recording section to record these data synchronously.

(2) a portable dictating machine to record remarks during the operating periods

(3) accessory and recording equipment for the raindrop spectrometer:
   (a) a Tektronix 532 oscilloscope
   (b) a CEC 5-124 oscillograph
   (c) an air compressor
   (d) power supplies and controls

Most of these items appear in Figures 6, 7, and 8.

OBSERVATIONS

The season was drier than anticipated. Two periods supplied most of the data and samples that were obtained: 9 and 10 May, and 28 and 29 May. During these periods all of The University of Michigan instruments except the rotobar samplers were in continuous operation. The rotobars are inherently intermittent in operation and require manual changing. Unfortunately, one cup of the anemometer loosened and shifted from its correct position during the operation of the station. This was not determined until the end of the operating period, so the wind speed data are of questionable value.

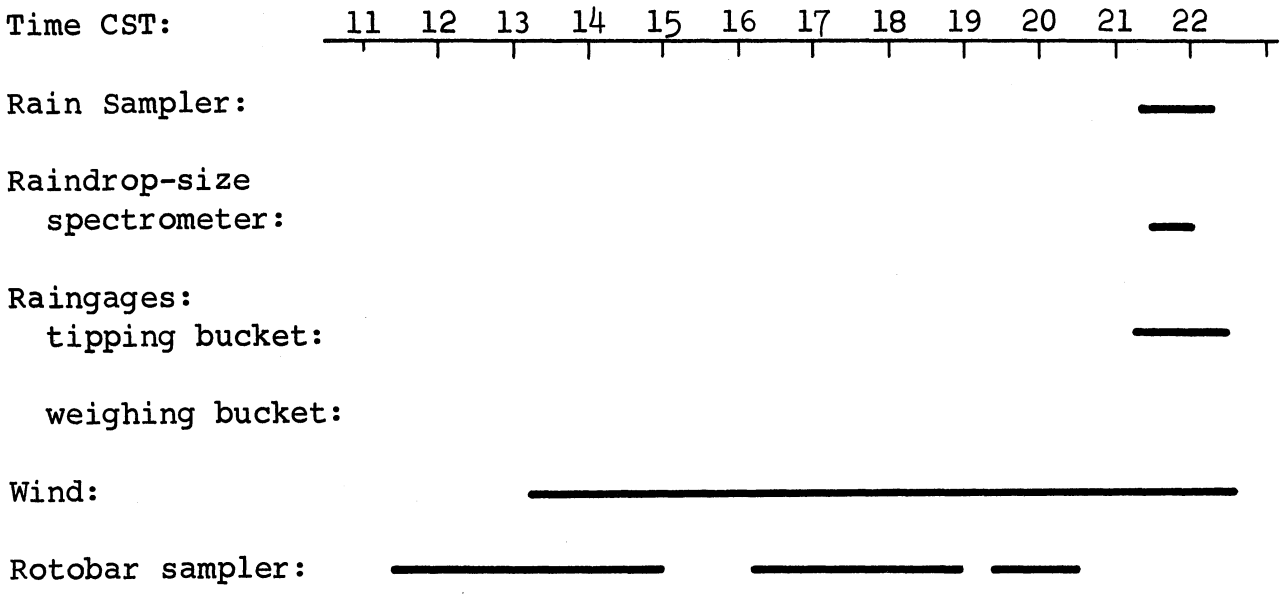
A total of 12 2-gallon samples, 48 1-gallon samples, and 46 1/2-gallon samples were collected. Rain intensities up to 400 mm hr^{-1} were computed from the tipping-bucket raingauge data for the order of 1-min. duration during the storms of 10 May.

There being no good prospect of rain in early June, the station was shut down and personnel, equipment, samples and records were returned to Michigan on 1 June.

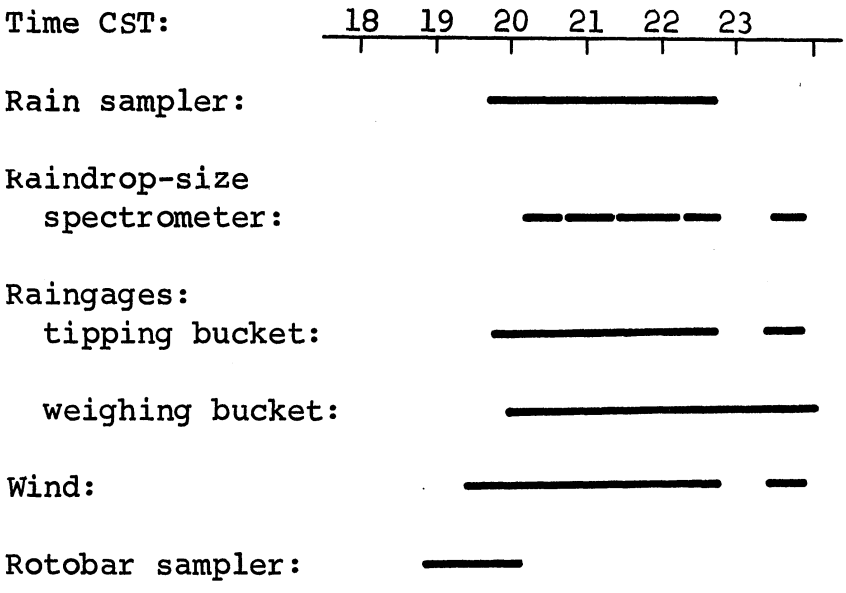
OPERATIONAL LOG

Periods of data collection by the instruments at the field site are presented below. Only those five days are included on which rain samples were collected, although occasional data were taken on other days in anticipation of rain which failed to materialize. No data were collected during hours excluded from the time scales on the respective days.

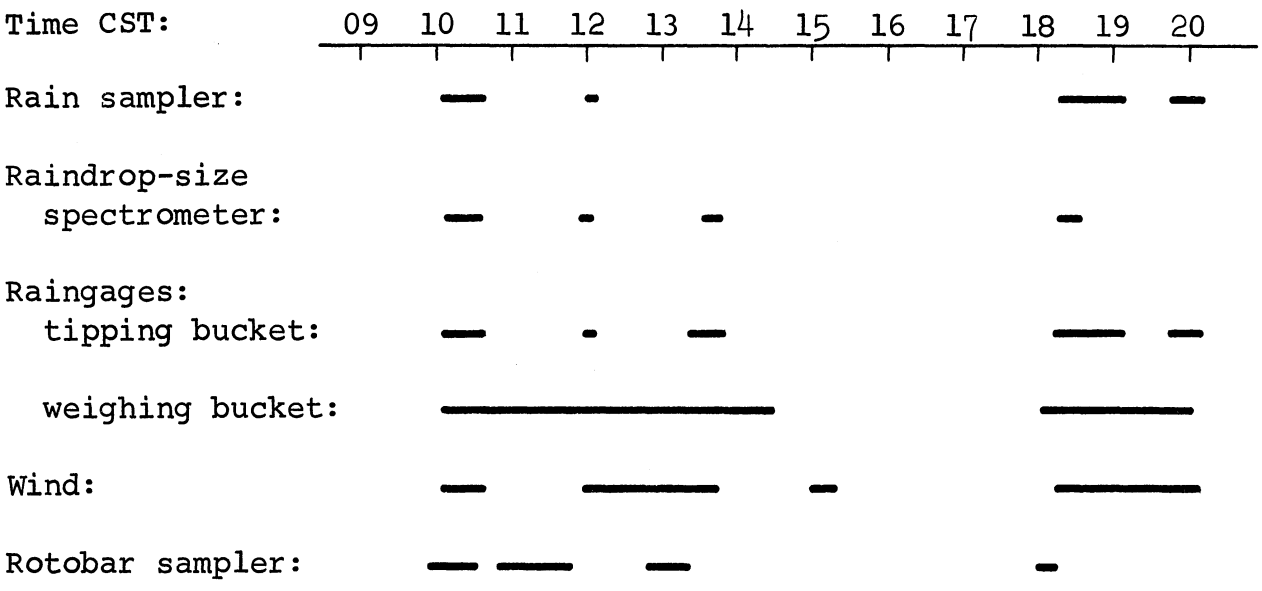
May 7, 1964



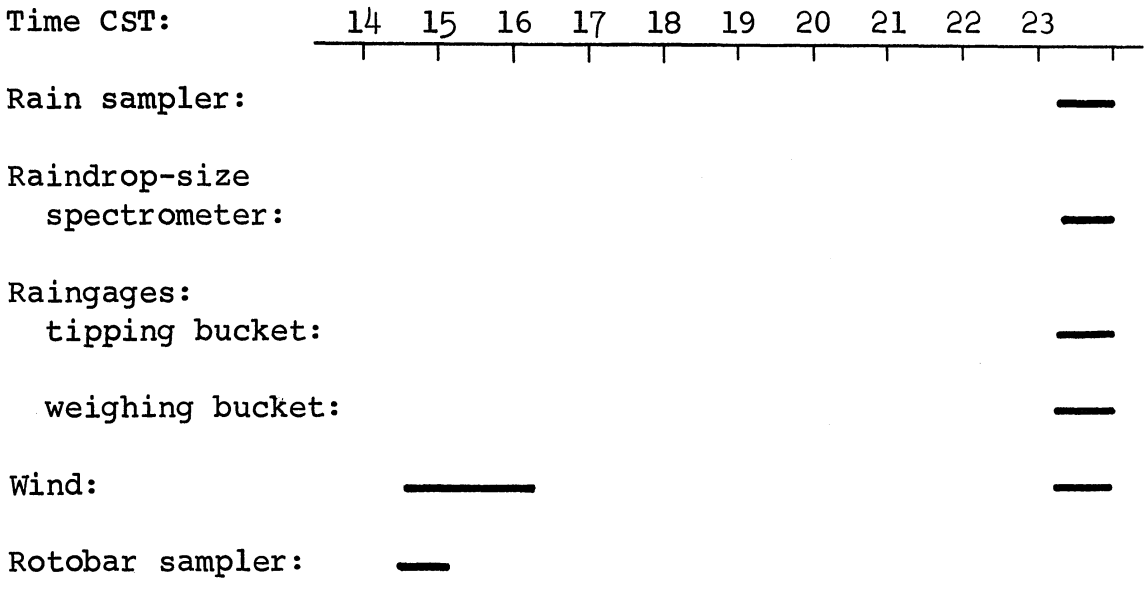
May 9, 1964



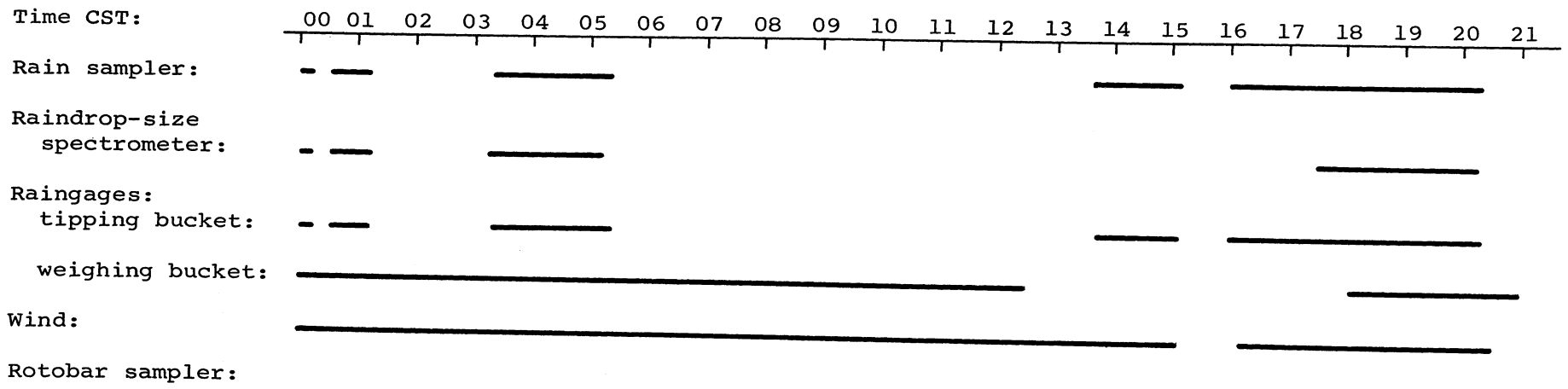
May 10, 1964



May 28, 1964



May 29, 1964


Time CST:
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21
Rain sampler:
Raindrop-size spectrometer:
Raingages:
tipping bucket:
weighing bucket:
Wind:
Rotobar sampler:

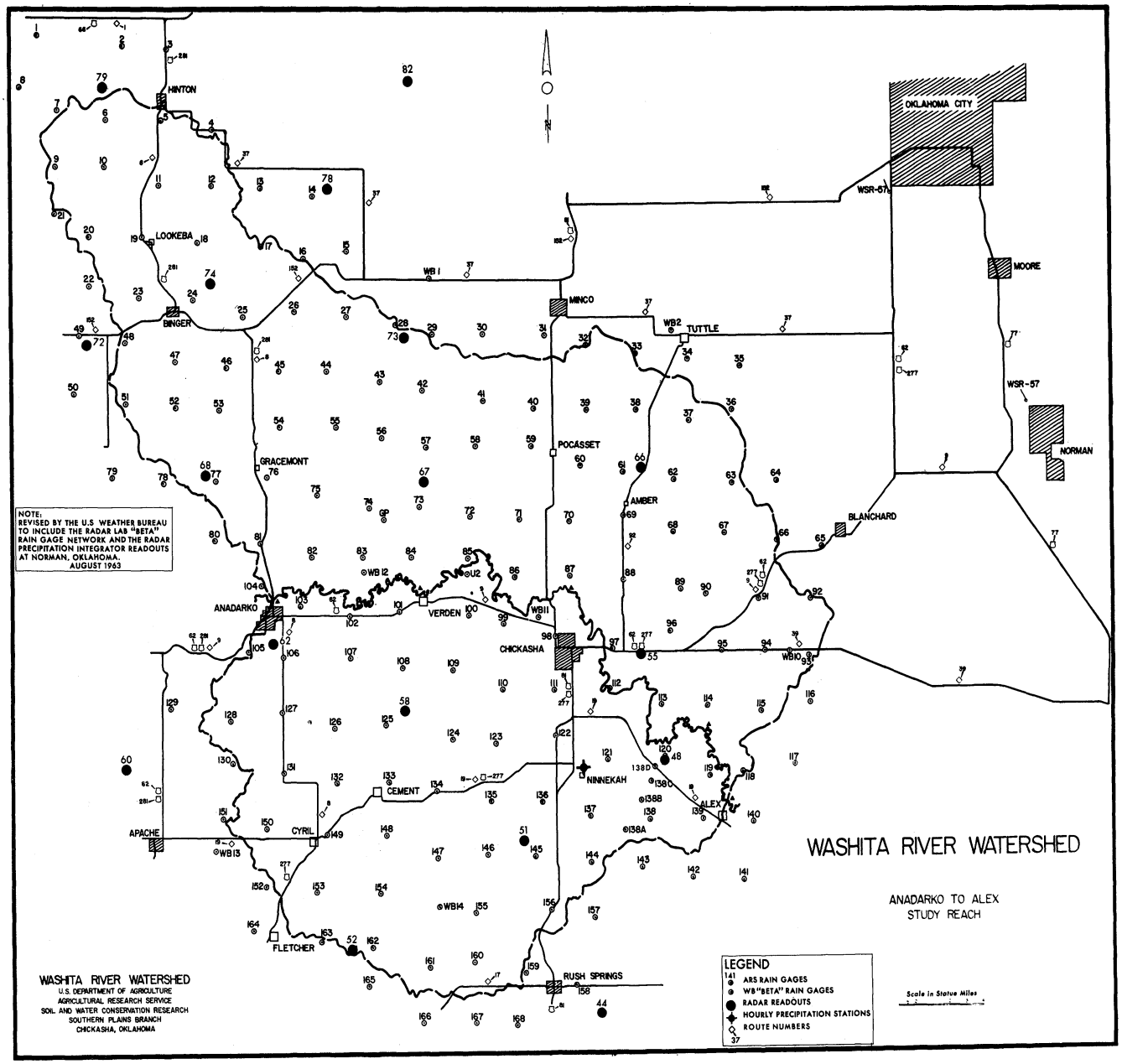


Figure 1. Map of Chickasha, Oklahoma, area showing location of Michigan rain sampling station at WB-11. (This map was obtained through the courtesy of the U. S. Department of Agriculture, Agricultural Research Service office in Chickasha, Oklahoma.)

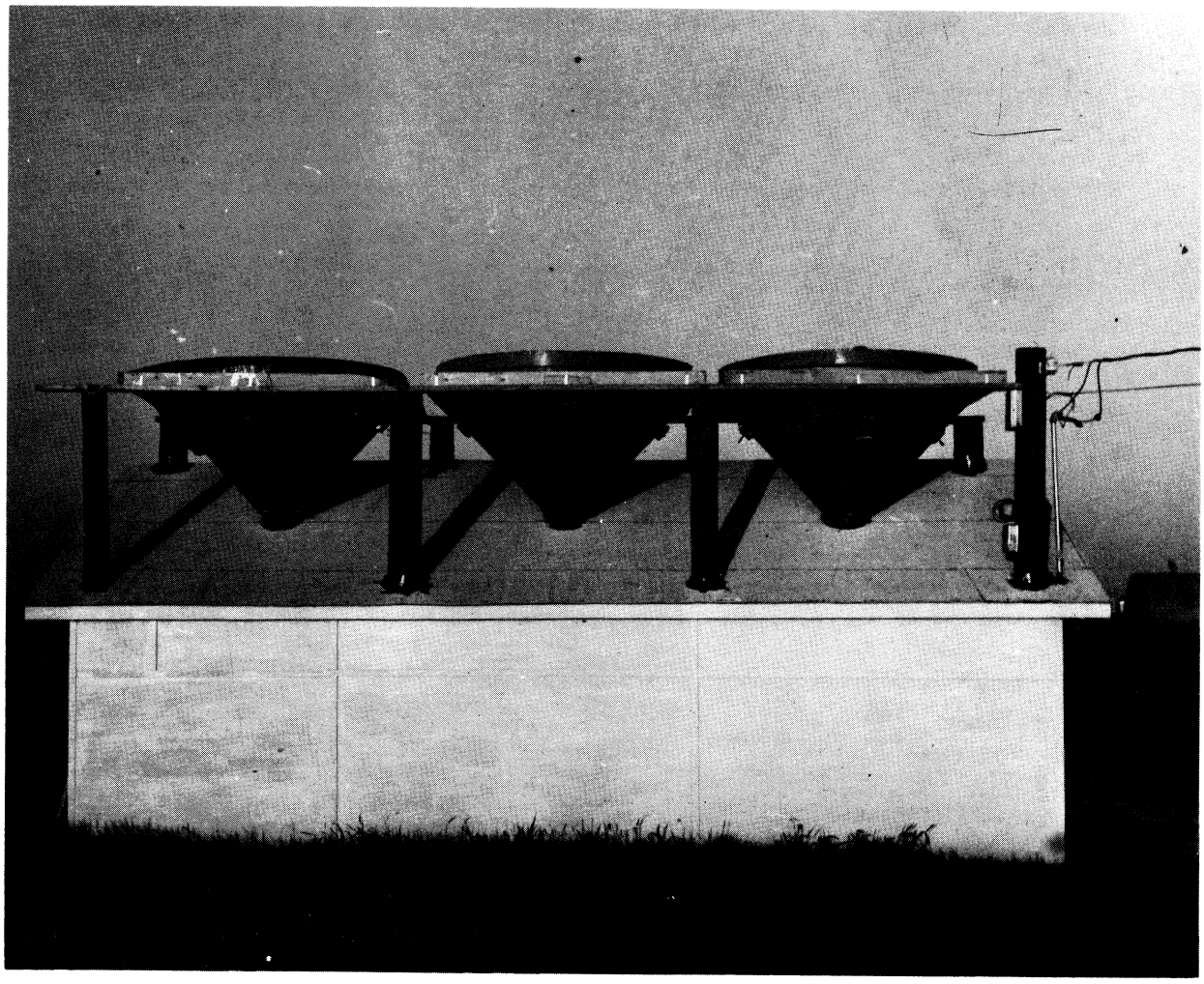
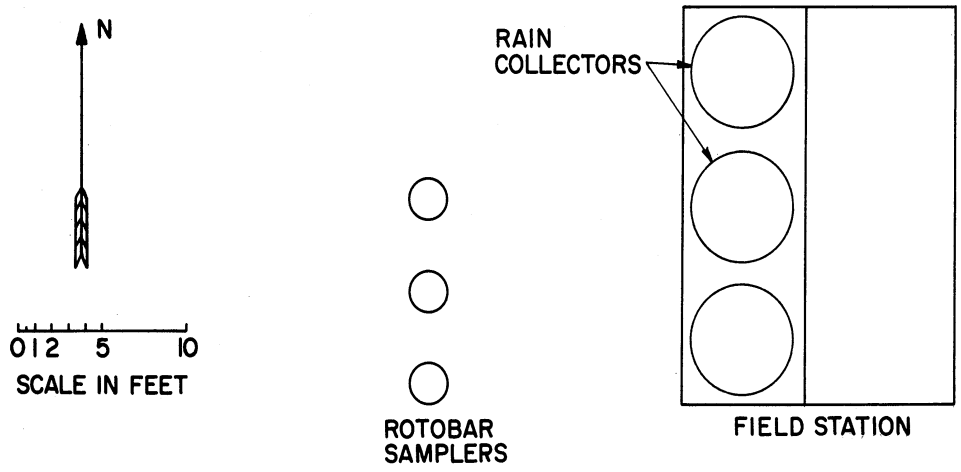


Figure 2. West elevation of the field shelter hut showing the 3 rain-sampling cones and the 8 power-line poles which served both to support the sampling cones and to anchor the hut under severe storm conditions.



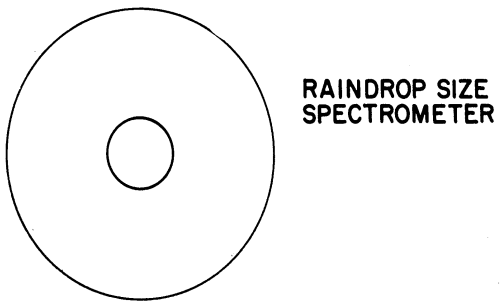


Figure 3. Station plan showing distribution of instruments about the shelter hut. Location was chosen so that the SW corner of the hut was 200 ft. from the roadway to the west and an equal distance from the railroad right-of-way to the south.

Figure 4. View looking SW. The black tent houses the raindrop spectrometer. The tipping bucket (right) and weighing (center) raingauges, and the anemometer-wind vane assembly (left) are shown.

Figure 5. Looking N from the spectrometer site. The three rotobar pollen samplers are shown at left center. Low structure at extreme left background is adjacent to Beta station WB-11.

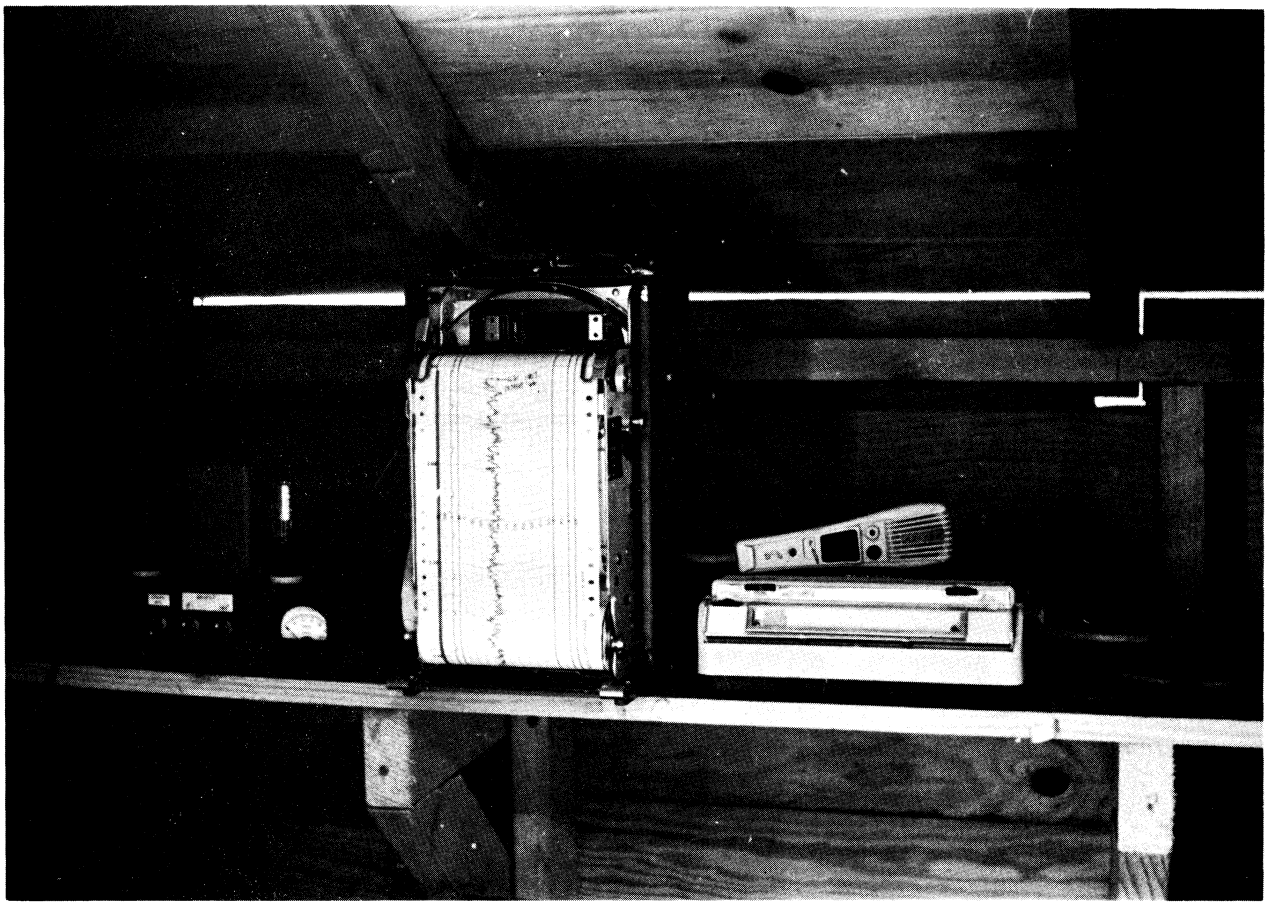


Figure 6. Hut interior showing power supply for wind system, E-A combination recorder, and small dictating machine.

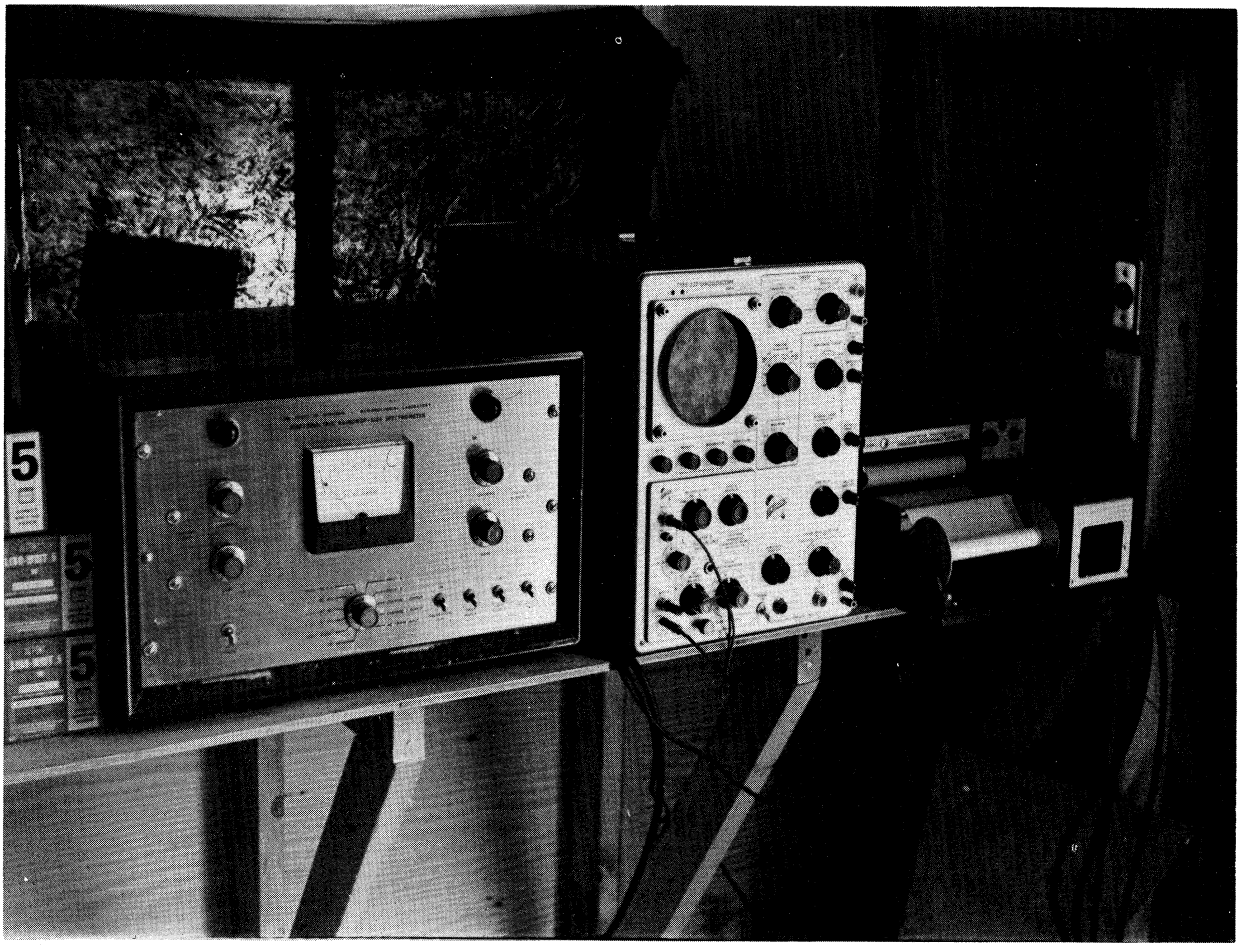


Figure 7. Hut interior showing the electronic control box for the raindrop spectrometer, the Tektronix oscilloscope, and the CEC oscillograph.

Figure 8. The raindrop-size spectrometer and associated equipment with the tent folded back.