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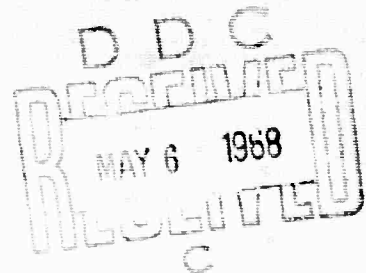
MONTHLY  
MICROCLIMATIC SUMMARY

JUNE 1967

ENVIRONMENTAL DATA BASE  
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY  
TROPIC TEST CENTER  
Fort Clayton, Canal Zone



Sponsored by

Advanced Research Projects Agency, ARPA Order No. 740  
Army Research Office, OCRD, Project No. 2M025001A724 01

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FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY  
MICROCLIMATIC SUMMARY

JUNE 1967

Prepared by

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and  
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USATECOM Project No. 9-4-0013-C1

This research was supported by the Advanced  
Research Projects Agency of the Department  
of Defense and by the Army Research Office,  
OCRD, Department of Army

Conducted by

US Army  
Tropic Test Center  
Fort Clayton, Canal Zone  
with contractual services provided by  
Weather Engineers of Panama Corp.

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## MONTHLY MICROCLIMATIC SUMMARY

### Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N,	79° 33'W
Chiva Chiva	09° 01'N	79° 35'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46 meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground. All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

The relative humidity data contained in this report required some adjustment due to the difficult problems in maintaining hair hygrometers in the humid tropics. The hygrometers show saturation at a time when the psychrometer shows a relative humidity well below 100%. For this reason the hourly measurements made by means of a hair hygrometer have been modified on the basis of simultaneous psychrometer readings of other levels. Details will be given in the fourth Semiannual Report. It can be assumed that the means of relative humidity presented in this volume are very close to the true means.

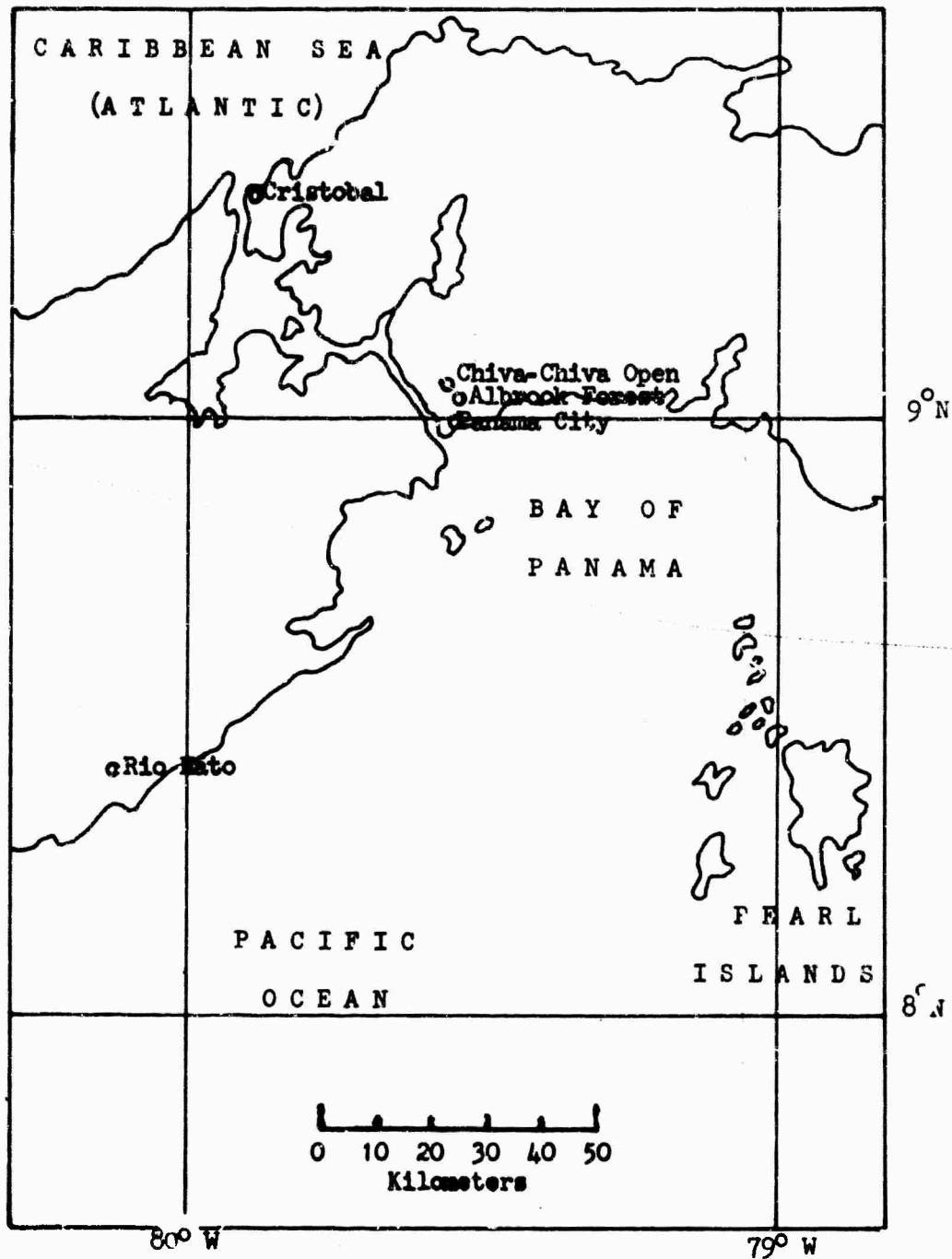


FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Height (meters)										Frequency	
	Sfc	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0		
Temperature:												
Dry Bulb	-	1	1	1	1	2	1	1	-	-	1	Hourly*/Continuously
Wet Bulb	-	1	-	1	1	-	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	1	1	1	-	1	1	-	-	1	Hourly*/Continuously
Barometric Pressure	-	-	1	-	-	-	-	-	-	-	-	Continuously
Evaporation	-	1	-	-	-	-	2	2	-	-	2	Once Daily
Precipitation:												
Recording Gage	-	-	1	-	-	-	-	-	-	-	2	Continuously
Manual Gage	-	-	2	-	-	-	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	-	2	-	-	-	-	-	-	-	4 Times Daily
Wind:												
Direction	-	-	-	-	1	-	-	1	-	-	1	Continuously
Speed	-	-	-	3**	1	-	3**	1**	-	-	1	Hourly**/Continuously

\* Observations made with sling psychrometer when recorders are inoperative.

\*\* Hourly

# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

1. Albrook and Chiva Chiva
2. Albrook only
3. Chiva Chiva only

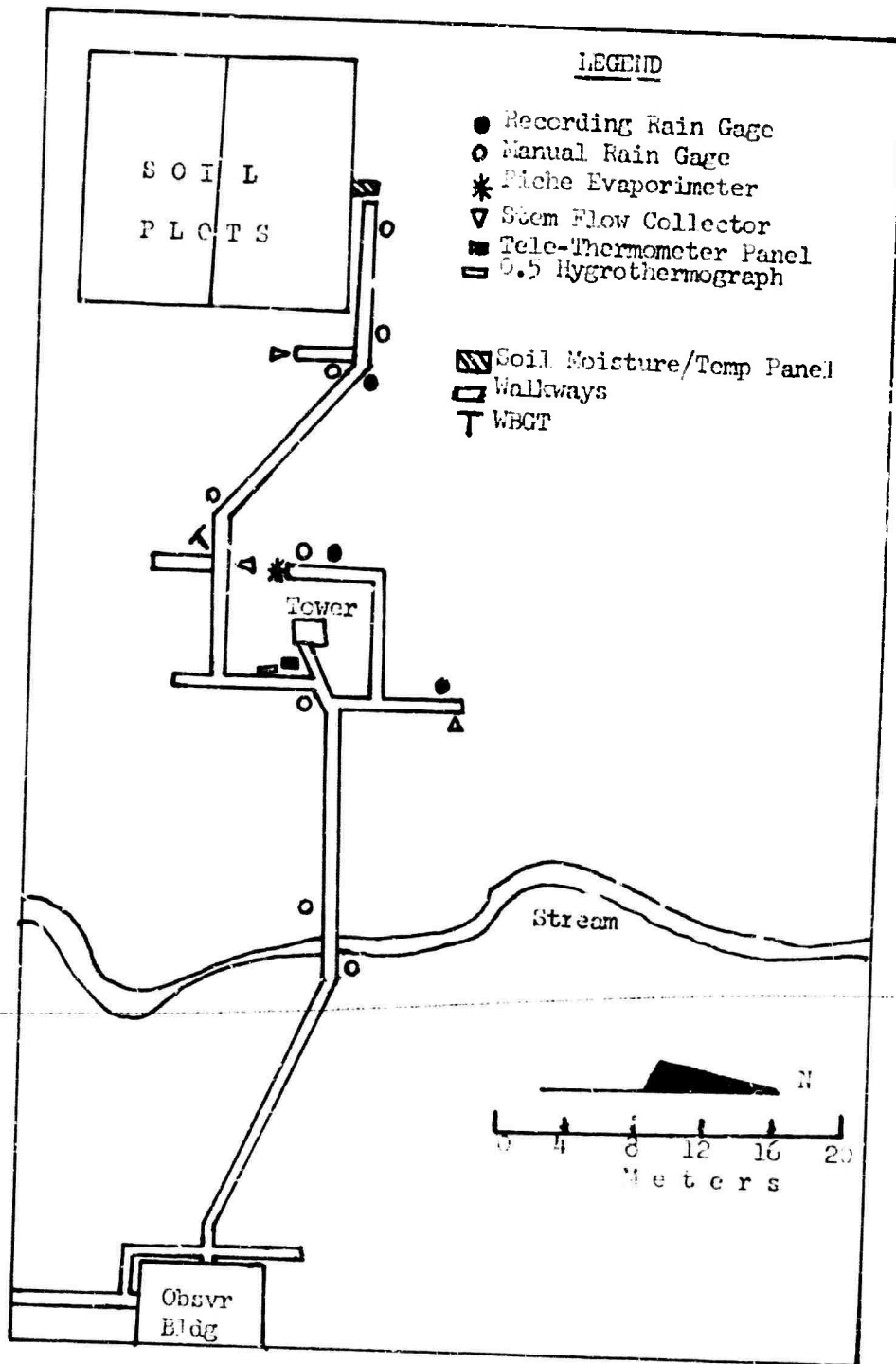


FIGURE 3. ALBECK FOREST SITE, GENERALIZED PLOT

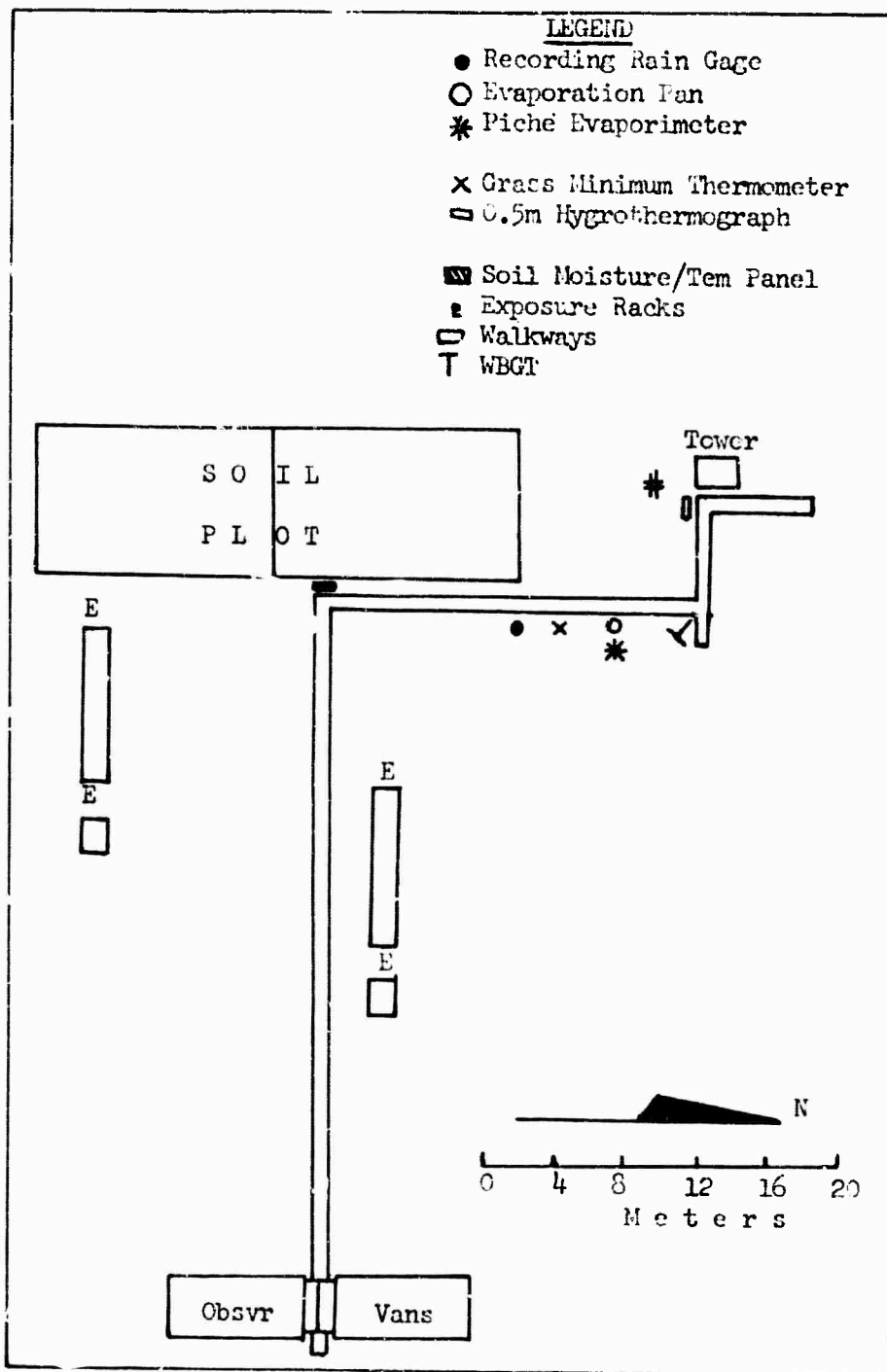


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

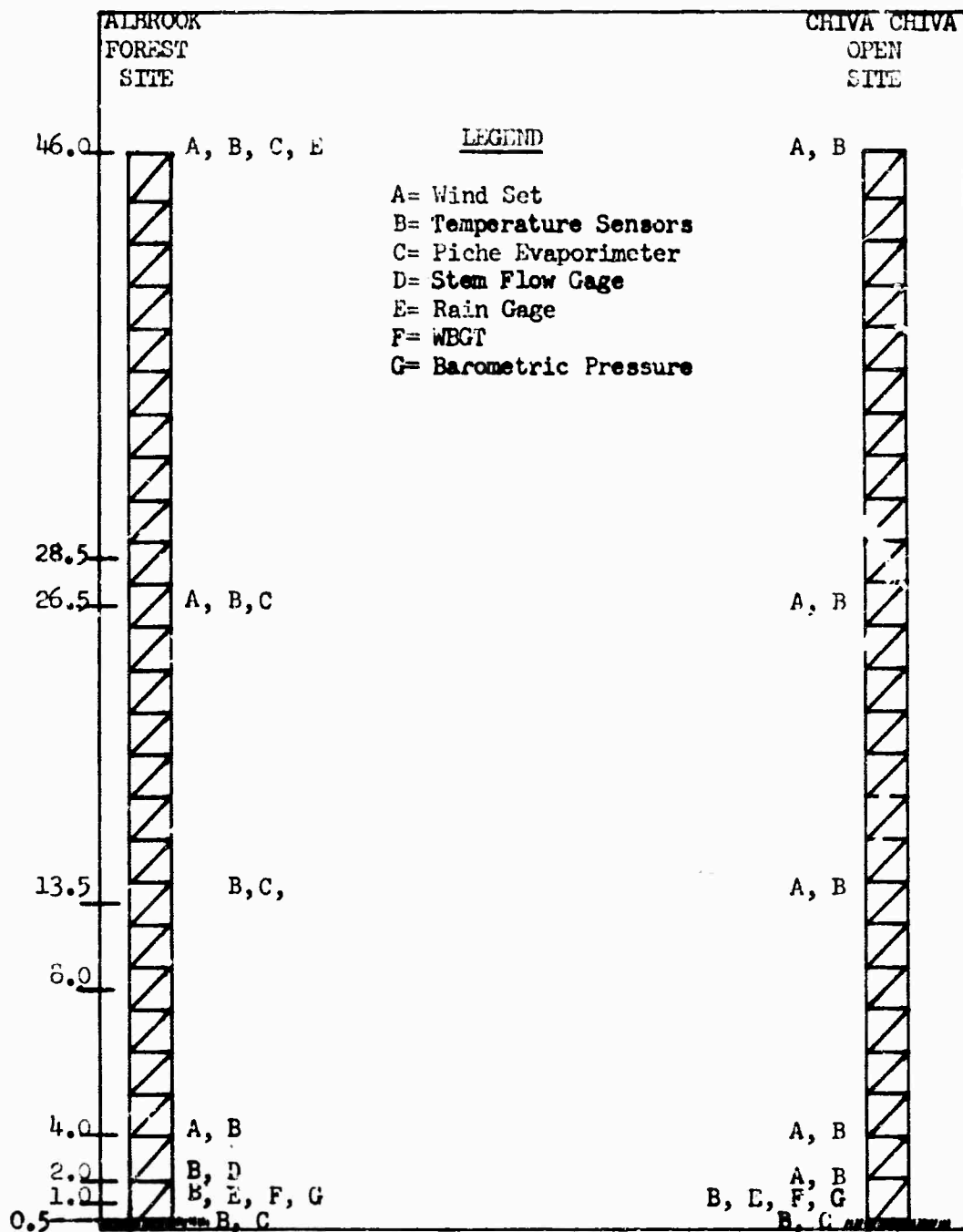


FIGURE 5. INSTRUMENT LOCATION ON TOWERS



**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
JUNE 1967

Exposure	Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*				
	Site	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
46.0 m	4.9	4.5	4.5	4.5	4.1	4.3	5.5	7.7	8.9	10.8	11.0	10.9	15.6	14.3	16.9	13.4	10.2	9.0	8.2	7.0	7.0	7.6	7.0	6.5	5.7				
28.5 m	3.9	3.5	3.9	4.1	3.6	3.2	3.7	8.3	8.3	8.8	10.3	9.3	12.8	15.3	15.6	12.7	12.7	9.3	6.7	6.1	5.3	4.7	4.6	4.8					
26.5 m	5.4	5.4	5.1	5.3	5.3	5.2	4.7	5.8	5.8	7.9	7.7	10.0	9.7	12.3	13.1	10.7	10.0	8.9	8.1	6.9	5.9	5.9	5.9	5.9					
13.5 m	5.7	6.1	6.7	6.2	6.4	6.2	5.0	5.5	6.7	9.5	10.0	10.2	9.4	12.0	12.7	10.9	9.0	8.0	6.7	6.7	5.8	6.1	5.4	5.5					
8.0 m	5.5	5.9	6.6	6.3	6.0	6.3	5.3	5.8	6.5	9.2	9.7	10.0	8.9	11.5	12.0	10.8	7.7	7.4	6.0	6.3	5.5	6.0	5.0	5.5					
Albrook (Forest site)	6.0	6.6	6.9	6.4	5.9	6.4	5.2	5.8	6.3	9.0	9.8	10.2	8.5	11.5	10.5	10.5	8.0	7.3	6.2	6.0	5.5	6.2	5.0	5.3					
4.0 m	5.7	5.1	5.9	5.2	5.5	5.5	4.8	6.0	5.4	6.8	7.7	7.8	7.4	8.8	9.6	9.1	8.0	7.3	6.6	5.7	5.5	5.8	5.3	5.8					
2.0 m																													
1.0 m																													
0.5 m																													

\* No monthly summary was computed for the ranges.

46.0 m	4.2	4.2	4.2	4.2	4.1	3.9	5.2	10.8	14.8	13.3	13.6	12.5	10.4	15.7	15.9	11.7	9.4	8.7	7.4	6.9	6.5	6.0	4.6	4.3				
28.5 m	4.7	4.5	5.0	4.8	4.5	4.5	7.4	11.5	13.4	13.4	13.0	12.1	10.3	15.6	16.5	11.0	9.2	8.8	7.8	7.2	6.4	5.9	4.4	4.3				
26.5 m	4.5	4.2	4.8	4.8	4.5	4.5	6.5	11.9	12.7	13.3	11.6	11.8	9.2	13.6	16.9	11.5	9.2	8.4	7.1	5.9	5.5	4.9	4.4	4.4				
13.5 m	5.6	6.6	7.1	6.3	5.9	6.1	7.4	10.4	12.6	13.2	13.1	10.5	10.9	15.8	16.9	12.1	10.9	9.6	8.1	6.9	6.3	6.2	5.5	6.6				
8.0 m	5.5	6.2	5.9	5.7	5.7	5.5	6.6	10.5	12.6	12.5	13.2	10.3	10.8	15.9	15.9	13.0	11.2	9.1	7.6	6.8	6.1	5.6	5.7	5.9				
4.0 m	5.8	6.3	6.5	6.2	6.5	5.8	6.5	12.3	11.6	11.2	13.2	12.5	11.2	17.7	16.3	14.3	12.2	9.3	8.3	7.0	6.3	5.7	5.4	5.7				
2.0 m	5.8	7.2	7.0	6.1	6.1	5.8	6.3	12.8	10.5	11.9	13.3	13.7	10.5	17.6	16.0	14.3	13.4	9.3	8.0	7.6	6.2	5.7	5.2	5.3				
1.0 m																												
0.5 m																												

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
 JUNE 1967

Exposure	Site	Monthly Means of Relative Humidity by Hour (%)																								Monthly Summary			
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Max.	
Albrook (Forest site)	46.0 m	95	95	95	95	95	95	93	88	82	80	78	79	80	82	85	88	90	93	93	94	94	95	95	95	623	62	90	97
	28.5 m	This level was not instrumented for relative humidity at this time																								622	63	91	98
	26.5 m	97	96	97	97	97	96	93	88	83	81	79	79	81	83	87	90	93	96	96	96	96	96	97	96	689	70	93	99
	13.5 m	97	97	97	97	97	97	96	94	90	87	84	83	85	86	89	91	93	95	95	96	96	97	97	97	719	70	94	100
	8.0 m	This level was not instrumented for relative humidity at this time																								719	73	95	100
4.0 m	98	98	98	98	98	98	97	96	94	90	88	86	85	87	89	90	93	95	96	97	98	97	97	98	719	74	95	100	
2.0 m	98	98	98	98	98	98	97	97	95	91	90	88	86	87	89	91	94	96	96	97	97	97	98	98	713	78	96	100	
1.0 m	98	98	98	98	98	98	98	97	96	93	91	90	88	89	90	93	94	96	96	97	98	97	97	98	713	78	96	100	
0.5 m	98	98	98	98	98	98	98	97	97	95	94	93	91	91	92	93	94	96	97	97	98	97	97	98	713	78	96	100	

Chiva Chiva (Open site)	46.0 m	95	94	94	94	94	93	87	84	79	77	76	75	78	81	85	87	90	92	93	93	94	94	94	717	57	88	97	
	28.5 m	This level was not instrumented for relative humidity at this time																								716	53	89	98
	26.5 m	96	96	96	96	96	94	87	83	79	76	75	75	77	81	85	88	91	94	94	95	95	95	96	96	717	52	90	99
	13.5 m	97	97	97	97	97	97	95	88	84	79	77	76	76	78	82	86	89	92	95	96	96	96	97	97	717	56	90	99
	8.0 m	This level was not instrumented for relative humidity at this time																								717	58	89	100
4.0 m	97	97	97	97	97	97	94	88	84	78	77	75	75	77	80	84	87	90	93	94	95	95	96	96	717	59	89	100	
2.0 m	97	97	97	97	97	97	94	87	84	78	77	75	75	77	80	84	87	90	93	94	95	96	96	97	712	56	90	99	
1.0 m	97	97	97	97	97	97	94	87	84	80	77	77	76	78	81	86	89	92	95	95	96	96	96	97	717	61	90	100	
0.5 m	98	98	98	98	98	98	95	89	84	79	77	76	76	78	81	85	87	91	94	95	97	97	97	717	61	90	100		

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
 JUNE 1967

Exposure	Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*	
	Site	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		24
46.0 m	4	9	8	8	6	3	5	11	24	27	30	29	30	32	35	27	23	22	10	9	7	6	4	5		
28.5 m		This level was not instrumented for relative humidity at this time																								
26.5 m	3	5	6	6	3	2	10	12	23	26	28	29	32	32	35	30	30	23	8	5	3	4	3	3		
13.5 m	4	4	4	4	4	4	4	9	15	21	26	27	27	29	27	26	24	17	11	13	8	8	6	5		
8.0 m		This level was not instrumented for relative humidity at this time																								
4.0 m	5	6	6	9	8	5	7	16	15	26	27	29	29	30	26	26	19	16	12	10	8	8	11	7		
2.0 m	6	5	7	8	8	5	7	14	15	24	26	27	24	27	26	22	17	14	9	8	7	8	9	6		
1.0 m	6	5	7	8	8	6	8	14	10	23	22	25	23	26	21	19	15	14	9	8	8	8	10	6		
0.5 m	7	5	4	5	4	6	6	6	8	14	15	21	16	19	21	19	18	7	8	6	6	5	6	8		

\* No monthly summary was computed for the ranges.

46.0 m	5	9	10	9	9	5	12	20	27	30	29	30	30	35	40	28	27	20	10	7	8	8	12	12		
28.5 m		This level was not instrumented for relative humidity at this time																								
26.5 m	5	11	11	11	9	5	12	25	30	29	34	34	33	41	45	30	28	21	10	8	8	8	13	8		
13.5 m	5	8	7	6	6	5	12	24	32	33	34	35	30	38	41	29	29	19	10	8	8	7	8	6		
8.0 m		This level was not instrumented for relative humidity at this time																								
4.0 m	8	14	15	12	10	6	15	21	27	32	30	30	26	38	42	31	27	23	15	12	14	11	10	10		
2.0 m	5	12	14	11	7	5	12	22	27	33	31	30	23	38	39	31	26	20	14	10	9	9	9	6		
1.0 m	4	8	8	6	6	5	10	26	37	35	34	32	27	39	42	29	27	20	8	9	7	7	7	5		
0.5 m	6	11	10	8	9	5	13	25	25	31	34	37	27	38	35	31	30	21	13	12	9	8	7	6		

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
JUNE 1967

Exposure	Site	Code <sup>1</sup>	Monthly Means <sup>2</sup> of other Elements by Hour																								Monthly Summary			
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
Albrook (Forest site)	WB	(4.0 m)	73.4	73.4	73.3	73.3	73.2	73.1	73.7	75.2	76.3	76.7	77.2	77.5	77.3	77.0	76.4	75.6	75.3	75.0	74.7	74.5	74.2	74.0	73.9	73.7	719	65.6	74.9	79.7
			73.4	73.4	73.4	73.3	73.2	73.1	73.7	75.3	76.3	76.8	77.4	77.6	77.5	77.2	76.4	75.7	75.5	75.1	74.7	74.5	74.2	74.0	73.9	73.7	719	69.8	75.0	79.9
			74.1	74.0	73.9	73.9	73.8	73.7	73.8	75.0	76.4	77.1	77.9	78.2	78.2	77.9	77.3	76.6	76.3	75.9	75.5	75.2	74.9	74.7	74.5	74.3	713	70.7	75.5	80.7
			.748	.736	.726	.722	.723	.729	.742	.756	.768	.772	.770	.758	.741	.724	.707	.700	.699	.708	.720	.737	.745	.758	.764	.761	720	.640	.738	.825
Albrook (Forest site)	P1		0.05	0.09	0.01	0.00	0.50	0.00	0.16	0.01	0.16	0.08	0.04	0.03	0.17	0.43	0.13	0.11	0.05	0.12	0.16	0.02	0.03	0.01	0.01	71	0.01	6.99	0.85	
			0.04	0.04	0.01	0.00	0.13	0.01	0.02	0.02	0.17	0.06	0.08	0.02	0.08	0.22	0.09	0.06	0.02	0.11	0.11	0.02	0.02	0.00	0.03	0.00	49	0.01	3.56	0.41
			0.05	0.05	0.03	0.00	0.40	0.00	0.00	0.00	0.25	0.12	0.05	0.01	0.05	0.45	0.22	0.07	0.02	0.08	0.22	0.02	0.02	0.00	0.00	0.00	36	0.01	4.05	0.80
			0.05	0.15	0.03	0.01	0.18	0.05	0.30	0.05	0.32	0.11	0.03	0.02	0.11	0.75	0.28	0.14	0.02	0.08	0.06	0.01	0.01	0.00	0.00	0.00	46	0.01	5.31	0.75

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Chiva Chiva (Open site)	WB	(4.0 m)	73.4	73.3	73.1	73.1	73.2	74.7	76.0	76.9	77.4	77.7	77.5	77.5	76.6	75.9	75.4	75.1	75.0	74.4	74.2	74.1	73.8	73.9	73.6	717	70.2	75.0	79.8	
			73.4	73.3	73.1	73.1	73.0	73.1	74.8	76.0	77.0	77.4	77.8	77.7	77.6	76.8	76.1	75.4	75.1	74.9	74.4	74.2	74.1	73.8	73.8	73.6	717	69.8	75.0	79.4
			73.2	73.3	73.1	73.2	73.0	73.0	74.4	76.1	77.0	77.8	78.1	78.4	78.0	77.3	76.9	76.0	75.6	75.1	74.7	74.4	74.2	74.0	73.9	73.5	717	69.5	75.2	82.0
Chiva Chiva (Open site)	BP		.840	.826	.815	.813	.813	.820	.835	.850	.862	.866	.861	.850	.832	.815	.796	.792	.793	.801	.815	.828	.840	.856	.851	720	.730	.830	.920	
			0.05	0.10	0.02	0.01	0.25	0.14	0.12	0.03	0.05	0.09	0.06	0.02	0.23	0.50	0.15	0.11	0.05	0.08	0.09	0.08	0.04	0.03	0.01	0.00	69	0.01	6.21	0.65

WB - Wet bulb temperature (°F)  
BP - Barometric pressure (in. of Hg minus 29.0)

P1 - Precipitation at 1.0 m. in open area (in.)  
P2 - Precipitation at 46.0 m. above canopy (in.)  
P3 - Precipitation under drip canopy (in.)  
P4 - Precipitation under open canopy (in.)

<sup>2</sup> Monthly means of precipitation are computed for precipitation days. Precipitation totals are substituted for the mean in the monthly summary.

# SUMMARY OF METEOROLOGICAL OBSERVATIONS

## HOURLY DATA

JUNE 1967

Exposure	Monthly Ranges <sup>2</sup> of other Elements by Hour																								Monthly Summary*	
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrock (Forest site)	WB (4.0 m)	4.9	5.4	5.7	5.5	5.3	5.5	4.1	6.1	4.2	4.7	4.5	4.2	7.2	7.7	8.0	7.2	5.1	6.0	5.0	5.5	4.6	5.0	4.8	4.7	
	WB (2.0 m)	4.9	5.2	5.6	5.3	5.3	5.6	4.3	6.3	4.4	5.0	4.6	4.3	6.3	7.4	8.0	6.8	5.8	5.8	5.0	5.5	4.6	5.0	4.8	4.5	
	WB (0.5 m)	4.9	4.9	5.1	5.0	5.1	5.0	4.4	5.6	4.7	4.0	5.6	5.0	4.2	6.1	6.4	6.6	6.2	6.2	5.8	5.4	5.3	5.0	4.7	4.8	
	BP	.120	.095	.100	.100	.100	.100	.085	.095	.103	.115	.130	.130	.095	.090	.100	.120	.135	.140	.105	.105	.105	.110	.110	.095	
	P1	0.07	0.05	0.01	0.00	0.00	0.00	0.29	0.00	0.51	0.30	0.05	0.04	0.25	0.84	0.14	0.26	0.06	0.28	0.80	0.05	0.04	0.01	0.00	0.00	
	P2	0.00	0.04	0.00	0.00	0.23	0.00	0.00	0.00	0.27	0.08	0.11	0.00	0.13	0.39	0.13	0.15	0.02	0.29	0.34	0.02	0.01	0.00	0.00	0.00	
	P3	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.41	0.22	0.00	0.00	0.00	0.00	0.43	0.07	0.03	0.14	0.79	0.03	0.01	0.00	0.00	0.00	
	P4	0.00	0.00	0.02	0.00	0.51	0.00	0.50	0.00	0.56	0.27	0.07	0.01	0.19	0.00	0.45	0.21	0.01	0.19	0.06	0.00	0.00	0.00	0.00	0.00	

\* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	WB (4.0 m)	4.6	5.1	4.9	5.1	4.9	5.3	4.7	5.1	5.3	5.4	4.4	4.0	5.4	9.0	8.6	6.6	4.8	5.5	4.9	5.5	4.8	4.4	4.7	5.0	
	WB (2.0 m)	4.8	5.0	5.3	4.6	4.6	4.5	4.8	5.2	5.1	4.8	4.3	3.5	5.9	7.8	7.8	6.5	5.0	5.2	4.5	5.0	4.5	4.1	4.4	4.8	
	WB (0.5 m)	4.8	5.9	5.7	5.3	5.5	5.3	4.8	6.2	4.8	5.2	4.9	5.2	8.7	9.7	10.1	7.7	5.5	5.2	5.2	5.5	5.4	4.9	5.0	4.3	
	BP	.110	.095	.090	.100	.100	.095	.080	.090	.100	.120	.120	.100	.090	.085	.105	.105	.130	.140	.120	.110	.100	.100	.090	.095	
	PS	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.09	0.12	0.09	0.01	0.64	0.00	0.25	0.35	0.07	0.19	0.54	0.13	0.06	0.03	0.00	0.00	

WB - Wet bulb temperature (°F)

BP - Barometric pressure (in. of Hg minus 29.0)

PS - Precipitation at 1.0 m. in open area (in.)

P1 - Precipitation at 46.0 m. above canopy (in.)

P2 - Precipitation under full canopy (in.)

P3 - Precipitation under drip canopy (in.)

P4 - Precipitation under open canopy (in.)

<sup>2</sup> Monthly ranges of precipitation are computed for precipitation days.

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
 JUNE 1967

Exposure	Site	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary						
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.			
46.0 m		3	3	3	3	3	4	4	5	6	6	7	8	9	8	6	6	5	6	5	5	5	4	4	689	0	5	20				
28.5 m									This level was not instrumented for wind speed at this time																							
26.5 m		1	1	1	1	1	1	2	2	3	3	3	4	3	3	3	3	2	2	2	2	2	1	1	667	0	2	13				
13.5 m									This level was not instrumented for wind speed at this time																							
8.0 m									This level was not instrumented for wind speed at this time																							
4.0 m		0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	692	0	0	3				
2.0 m									This level was not instrumented for wind speed at this time																							
1.0 m									This level was not instrumented for wind speed at this time																							
0.5 m									This level was not instrumented for wind speed at this time																							

46.0 m		4	4	4	4	4	4	4	4	5	6	6	7	7	9	9	7	6	5	6	5	5	4	4	675	0	5	18				
28.5 m									This level was not instrumented for wind speed at this time																							
26.5 m		2	2	2	2	2	3	3	3	4	4	5	6	6	7	6	6	5	4	4	3	3	2	2	632	0	4	17				
13.5 m		1	1	1	1	1	2	2	2	3	4	4	5	5	6	3	3	2	1	1	1	1	1	1	720	0	2	16				
8.0 m									This level was not instrumented for wind speed at this time																							
4.0 m		1	2	2	2	2	2	3	3	4	4	5	5	6	5	4	4	3	3	3	2	2	2	2	708	0	3	13				
2.0 m		0	1	0	0	0	1	1	1	2	2	3	3	4	2	1	1	0	0	1	0	0	0	0	720	0	1	10				
1.0 m									This level was not instrumented for wind speed at this time																							
0.5 m									This level was not instrumented for wind speed at this time																							

**SUMMARY OF METEOROLOGICAL OBSERVATIONS**  
**HOURLY DATA**  
 JUNE 1967

Exposure	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*	
	Site	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		24
46.0 m	8	10	11	12	8	12	12	12	14	17	17	14	20	17	20	18	13	13	14	16	15	10	13	10	9	
28.5 m																										
26.5 m	6	9	5	8	5	9	7	7	9	8	12	8	11	10	10	10	9	9	11	13	11	7	8	8	8	
12.5 m																										
8.0 m																										
4.0 m	0	1	1	1	1	1	1	1	1	2	2	2	3	2	2	2	2	1	1	2	1	1	1	1	1	
2.0 m																										
1.0 m																										
0.5 m																										

\* No monthly summary was computed for the ranges.

46.0 m	7	13	10	10	10	9	13	11	12	10	10	17	11	16	10	14	13	10	8	11	12	13	10	10	8	
28.5 m																										
26.5 m	6	7	8	7	7	10	10	10	9	8	13	10	15	12	15	13	10	7	8	9	9	8	7	5	5	
13.5 m	4	7	7	6	7	6	9	6	9	10	13	10	16	11	10	9	6	5	6	10	5	8	6	4	4	
8.0 m																										
4.0 m	4	7	7	5	6	5	8	7	8	8	12	8	12	8	12	10	7	7	6	6	7	7	5	4	4	
2.0 m	2	3	4	3	4	2	5	5	5	6	8	6	10	7	6	4	3	3	3	3	5	3	4	3	2	
1.0 m																										
0.5 m																										

ALBROOK (Forest site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 46.0 m.  
(%)

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	6.9					3.4	3.5	3.5	3.5	3.4	3.4	3.7				3.4	3.4	3.4	3.4	3.4	6.9	13.7		6.9	
NNE					10.3	6.9	3.5				3.4	7.4				6.9			3.4		3.4				
NI	3.4	3.4	6.9	3.4	13.7	6.9	7.2	3.5	3.5		3.4		3.7	3.4					3.4	3.4	6.9		3.4	6.9	
ENE	6.9	3.4		6.9		10.3		7.2	10.7	6.9		3.7	3.7		3.4	3.4					6.9	3.4	6.9	6.9	
E	3.4		10.3	3.4		3.4	7.2	7.2		3.4	3.4		3.7	3.4	3.4										3.4
ESE		3.4	6.9	3.4					3.5				3.7						3.4			3.4	3.4	3.4	
SE									7.2	6.9	6.9	7.4		10.3	6.9		6.9	6.9					3.4	3.4	
SSE									10.7	3.4	3.4		7.4	3.4				3.4	3.4					6.9	
S								10.7	17.9	20.6	41.2	55.5	51.8	41.2	27.5	27.5	20.6	6.9	3.4	6.9	3.4				
SSW			3.4		3.4							3.7	3.7			3.4		3.4		3.4	3.4	6.9			
SW													3.7		10.3		3.4	3.4				3.4			
WSW			3.4	3.4							3.4			3.4				13.7	3.4						
W	6.9	20.6	13.7	13.7	13.7	10.3				3.4	3.4	7.4		10.3	17.2	6.9	13.7	10.3	10.3		10.3	3.4	3.4	3.4	10.3
WNW	20.6	3.4	17.2	20.6	10.3	17.2	3.5	21.4	10.7	24.0	6.9	3.7		3.4	10.3	13.7	10.3	13.7	6.9	24.0	10.3	20.6	27.5	20.6	20.6
NW	17.2	17.2	10.3		20.6	20.6	17.9	7.2	17.9	6.9	6.9	3.7	7.4	6.9	6.9	13.7	24.0	13.7	27.5	17.2	24.0	10.3	27.5	13.7	13.7
NNW	6.9	6.9		3.4			14.2	3.5			3.4		3.7	3.4	3.4		3.4		6.9	17.2		3.4		6.9	6.9
CALM	27.5	41.2	27.5	37.8	27.5	20.6	42.8	35.6	14.2	20.6	10.3	3.7	7.4	10.3	10.3	20.6	13.7	20.6	24.0	24.0	24.0	27.5	20.5	20.5	24.0

\* Note: Due to rounding, percentage totals do not equal 100%.

ALBROOK (Forest site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 26.5 m.  
(%)

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	3.5	3.5	3.5	7.2												3.5	3.5		7.2	3.5	3.5	3.5	3.5	3.5	
NNE					3.5										3.5	7.2									
NE					3.5			3.7	3.5	7.2	3.7	3.7				3.5									
ENE									3.5																
E		3.5						7.4		3.5	11.1	7.4			10.7	3.5			3.5	3.5		3.5	3.5	3.5	
ESE									3.5	10.7			10.7	3.5	7.2	3.5			3.5		3.5				
SE								3.7	3.5				3.7		3.5						3.5				
SSE				3.5								3.7				3.5	3.5		3.5						
S		7.2	3.5	3.5				18.5	29.6	28.6	39.3	59.2	51.8	39.3	17.9	14.2	14.2	14.2	3.5	3.5	3.5	3.5	3.5	3.5	
SSW																		3.5	3.5						
SW											3.5		3.7		14.2	3.5		3.5					3.5	3.5	
WSW										3.5	3.5	3.7		3.5	3.5	3.5	3.5	3.5						3.5	
W	7.2	7.2		3.5	3.5					3.5				10.7		7.2	3.5	7.2	7.2	7.2	3.5				
WNW																									
NW	14.2	7.2	7.2	10.7	17.9	10.7	14.8		18.5	7.2	7.2	3.7	7.4	3.5	17.9	10.7	14.2	14.2	14.2	14.2	10.7	14.2	17.9	14.2	14.2
NNW	10.7	21.4	14.2	3.5	7.2	7.2	11.1	11.1	3.7	3.5				3.5		7.2	10.7	7.2	3.5	10.7	17.9	7.2	7.2	21.4	
CALM	64.2	50.0	64.2	64.2	53.5	57.0	70.3	55.5	29.6	32.1	17.9	11.1	22.2	21.4	21.4	24.9	32.1	35.6	42.8	42.8	50.0	64.2	46.3	60.7	

\* Note: Due to rounding, percentage totals do not equal 100%.

TABLE NO. 8. A. 1967

ALBROOK (Forest site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 4.0 m.

Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		3.4						3.5	3.4		3.4						3.4							
NNE						3.4								3.4		3.4	6.9	3.4						3.4
NE								3.5	3.4	3.4				3.4	3.4		3.4							
ENE															3.4									
E			3.4							3.4	10.7			6.9										
ESE																								
SE														3.4	3.4	6.9	3.4							3.4
SSE													7.2		3.4									
S			3.4	3.4			3.5		17.2	24.0	20.6	35.6	35.6	31.3	10.3	3.4								
SSW								3.5				7.2												
SW						3.4				3.4	3.4			3.4	3.4									3.4
WSW									3.4		3.4		3.5											
W				3.4			3.5		3.4		3.4				3.4									
WNW					3.4			3.5			3.5				3.4		6.9	6.9		3.4	3.4			
NW		3.4											3.5	6.9	3.4		3.4	3.4					3.4	3.4
NNW									3.4							3.4	3.4							
CALM	100.0	92.7	89.3	87.7	96.1	89.3	92.8	85.6	65.2	68.7	61.9	42.8	50.0	37.8	61.9	82.4	79.0	82.4	89.3	96.1	96.1	92.7	92.7	96.1

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 46.0 m.  
(%)

Hr./Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	10.0	10.0	10.0	6.7	3.3			6.7	6.7	6.7	3.5		3.3	6.7	10.0	10.0	6.7	10.0		3.3	10.0	13.3	3.3	3.3
NNE				3.3		6.7	3.3	6.7								3.3					6.7	3.3		3.3
NE		3.3		3.3	10.0	6.7	13.3	3.3		3.3	7.2	10.0	3.3	3.3							3.3		6.7	10.0
ENE	13.3	3.3	10.0	3.3	3.3	6.7	6.7	3.3	5.7			6.7	3.3	3.3	6.7	3.3	3.3		3.3					6.7
E	3.3		3.3	10.0	3.3	3.3	6.7	6.7	6.7	13.3	7.2		3.3	10.0	10.0	6.7			10.0	6.7	3.3	3.3	13.3	6.7
ESE	3.3	6.7				3.3		3.3	6.7		3.5	3.3		6.7	3.3	3.3	6.7	10.0	6.7	3.3	3.3	3.3	3.3	3.3
SE	3.3		3.3			3.3		6.7	5.7	20.0	14.2	20.0	23.3	10.0	16.7	20.0	13.3	10.0	6.7	3.3				
SSE					3.3					6.7	10.7	10.0	6.7	10.0	6.7	3.3	3.3	3.3			3.3	3.3		
S		3.3	6.7		6.7			3.3	6.7	6.7	7.2	20.0	23.3	20.0	10.0	3.3	6.7	6.7	3.3		3.3	3.3		
SSW				3.3	3.3	3.3	3.3				7.2	3.3	3.3				6.7	10.0	3.3					
SW	3.3	3.3	3.3	6.7			3.3			6.7			3.3		6.7		3.3	3.3			3.3	3.3	3.3	
WSW		6.7				3.3	3.3		3.3		3.5	10.0				3.3	3.3					3.3	3.3	
W		6.7	16.7	6.7	10.0	6.7	3.3	13.3	6.7	6.7	7.2	3.3	3.3	6.7	3.3	6.7	3.3	13.3	16.7		10.0	3.3	3.3	10.0
WNW	16.7	6.7	6.7	23.3	20.0	3.3	6.7	6.7	3.3	6.7	10.7	3.3	6.7	6.7	13.3	3.3	10.0	10.0	3.3	16.7	10.0	20.0	13.3	13.3
NW	40.0	36.7	30.0	20.0	26.7	33.3	30.0	30.0	33.3	20.0	14.2	6.7	13.3	13.3	13.3	20.0	26.7	23.3	36.7	23.3	23.3	26.7	40.0	30.0
NNW	6.7	10.0	6.7	10.0	10.0	20.0	20.0	10.0	10.0	3.3	3.5	3.3	5.3	3.3	10.0	13.3	6.7		6.7	30.0	20.0	6.7	10.0	13.3
CALM		3.3	3.3	3.3					3.3										3.3	3.3		3.3		

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 26.5 m.  
(%)

Hr. Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	6.7	10.0	10.0	10.0	16.7	6.7	10.0	6.7		3.3				3.3		13.3	6.7	3.3	6.7	16.7	16.7	13.3	3.3	3.3	
NNE	3.3	3.3		3.3		3.3		6.7	10.0	6.7	3.3			3.3		6.7	3.3	3.3			3.3		3.3	3.3	
NE	10.0	10.0	6.7	6.7	6.7	3.3	10.0	3.3			6.9	6.7				3.3				6.7			6.7	3.3	
ENE	3.3		3.3		6.7	6.7	16.7	3.3	3.3	6.7	6.9	3.3	6.7		3.3				3.3	3.3				6.7	
E	3.3	3.3	5.3	10.0	3.3	3.3		13.3	16.7	10.0		16.7		6.7	10.0	6.7	3.3		6.7	3.3	6.7			3.3	13.3
ESE	3.3	6.7	10.0			3.3			3.3	3.3	6.9		13.3	16.7	10.0	6.7		6.7	6.7		3.3	3.3			3.3
SE			10.0	3.3		3.3	3.3	10.0	3.3	16.7	6.9	16.7	6.7	6.7	10.0	6.7	20.0	10.0	13.2	3.3	3.3			3.3	3.3
SSE	3.3				3.3			3.3	6.7	13.3	17.2	10.0	20.0	10.0	10.0	13.3	6.7	6.7		3.3		6.7			
S					3.3	3.3			3.3	3.3	6.9	10.0	16.7	20.0	13.3	6.7	6.7	13.3		3.3	3.3	3.3			
SSW				3.3			3.3			3.3	6.9	6.7						3.3							
SW		3.3	3.3	6.7		10.0	3.3		2.3	3.3		6.7	6.7		3.3		6.7	3.3	3.3			13.3			10.0
WSW	3.3				3.3	3.3					6.9	3.3	3.3		3.3	3.3		3.3	3.3		3.3			3.3	6.7
W	10.0	10.0		10.0	6.7			6.7	6.7	3.3	13.7	6.7		10.0	10.0	10.0	3.3	13.3	6.7	3.3	13.3	10.0	13.3	3.3	3.3
WNW	16.7	6.7	16.7	16.7	10.0	6.7	13.3	3.3	13.3	13.3	3.4		10.0			3.3	6.7	10.0	20.0	10.0	6.7	13.3	13.3	13.3	20.0
NW	30.0	30.0	20.0	20.0	20.0	26.7	6.7	20.0	30.0	10.0	3.4	10.0	16.7	13.3	16.7	3.3	30.0	13.3	16.7	23.3	20.0	20.0	30.0	30.0	6.7
NNW	6.7	6.7	10.0	6.7	13.3	13.3	20.0	23.3		6.7	6.9	3.3		6.7	10.0	16.7	3.3	10.0	13.3	20.0	16.7	10.0	13.3	13.3	16.7
CALM		10.0	6.7	3.3	6.7	6.7	6.7		3.3		3.4			3.3		3.3	3.3			6.7		6.7	3.3	3.3	3.3

\* Note: Due to rounding, percentage totals do not equal 100%.

UNIVERSITY OF S. A. STATE

CHIVA CHIVA (Open site) JUNE 1967

Relative Frequencies\* of Wind Directions by Hour at 4.0 m.

(%)

Hr/Dir	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
N	13.3	13.3		3.3	10.0	6.7	6.7	13.3	6.7	13.3				3.3	6.7	26.7	3.3	3.3	3.3	16.7	13.3	6.7			
NNE	10.0	3.3	23.3	10.0	10.0		3.3	3.3	3.3		3.4	3.3		3.3		3.3	3.3			6.7	3.3	3.3	3.3	3.3	3.3
NE	6.7	10.0	6.7	6.7	10.0	3.3	16.7	6.7	3.3	3.3	10.3	3.3	6.7			3.3			10.0	6.7	6.7	3.3	3.3	3.3	10.0
ENE		6.7	6.7	3.3	3.3		10.0	13.3	3.3	3.3		10.0			3.3					3.3	3.3	3.3	6.7	13.3	3.3
E	10.0	6.7	3.3			3.3			23.3	6.7	6.9	3.3	10.0	16.7	13.3	3.3	3.3		13.3			6.7			6.7
ESE			3.3	3.3				13.3	3.3			3.3	6.7	3.3	13.3	6.7	10.0	10.0	3.3	3.3	6.7			6.7	3.3
SE			6.7	3.3				3.3		20.0	10.3	13.3	10.0	20.0	13.3	13.3	10.0	6.7	3.3	6.7	3.3	3.3			3.3
SSE			3.3	3.3	3.3	10.0	3.3		3.3	3.3	13.7	13.3	13.3	6.7	10.0	6.7	3.3	10.0	23.3	3.3	3.3	3.3			3.3
S		3.3		3.3	3.3	3.3	6.7		3.3	10.0	13.7	20.0	16.7	16.7	3.3	3.3	10.0	6.7	3.3	3.3	3.3	3.3			3.3
SSW				6.7	3.3		6.7	3.3				3.3	10.0		6.7		3.3								3.3
SW			3.3			6.7			3.3	10.0			3.3		3.3		6.7	3.3	3.3		6.7	3.3	10.0	6.7	
WSW	3.3				10.0	3.3		3.3	6.7	3.3	6.9	10.0		6.7	3.3	6.7	6.7	6.7		3.3	6.7	3.3	3.3	3.3	6.7
W	10.0	10.0		10.0	6.7	10.0	10.0	3.3	10.0	3.3	10.3	3.3	3.3	6.7	6.7	6.7	6.7	10.0	20.0	16.7	10.0	10.0	10.0	10.0	
WNW	16.7	10.0	10.0	13.3	13.3	10.0	10.0	3.3	6.7	6.7		3.3	10.0			13.3	16.7	6.7	6.7	10.0	5.7	20.0	13.3	10.0	
NW	13.3	16.7	23.3	16.7	6.7	23.3	10.0	6.7	20.0	13.3	10.3	10.0		10.0	10.0	10.0	6.7	10.0	6.7	10.0	6.7	16.7	33.3	10.0	
NNW	6.7	6.7	3.3	6.7	13.3	13.3	16.7	26.7			0.3		10.0	6.7	6.7	10.0	13.3		20.0	10.0	13.3	10.0	3.3	13.3	
CALM	10.0	13.3	6.7	10.0	6.7	6.7			3.3	3.3	3.4								6.7	3.3	3.3	3.3	3.3	6.7	

\* Note: Due to rounding, etc., the total do not equal 100%.

# SUMMARY OF NON HOURLY DATA

JUNE 1967

Summary of Elements with Non-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	W&GT Index <sup>1</sup> (at 1.0 meters)	Index value	419	70.1	76.7	82.4
		Dry bulb temp.	419	70.0	77.6	)
		Wet bulb temp.	419	70.0	77.2	81.0
		Black bulb temp.	419	70.4	78.3	86.0
	Evaporation <sup>3</sup> (in. at 4 levels)	Piche (46.0 m)	27	0.024	4.848*	0.409
		Piche (26.5 m)	22	0.030	3.960*	0.317
		Piche (13.5 m)	22	0.006	1.182*	0.110
		Piche ( 0.5 m)	23	0.006	0.660*	0.140
	Precipitation from Rain gauge Network <sup>2</sup> (in. at 1.0 meters)	Gauge # 1	23	0.01	2.36*	0.56
		Gauge # 2	28	0.01	4.16*	0.98
		Gauge # 3	30	0.01	5.33*	1.07
		Gauge # 4	28	0.01	7.30*	2.05
		Gauge # 5	30	0.01	4.29*	1.00
		Gauge # 6	31	0.01	5.32*	1.07
		Gauge # 7	29	0.01	4.20*	1.00
		Gauge # 8	28	0.01	4.44*	0.94
Stem Flow <sup>2</sup> (in. at 2.0 meters)	Small tree	24	0.01	4.42*	1.05	
	Medium tree	21	0.01	3.67*	1.33	
	Large tree	14	0.01	98.72*	45.38	
Chiva Chiva (Open site)	W&GT Index <sup>1</sup> (at 1.0 meters)	Index value	421	70.1	79.6	93.1
		Dry bulb temp.	421	70.2	80.4	92.0
		Wet bulb temp.	421	70.2	76.8	83.0
		Black bulb temp.	421	69.7	89.0	122.0
	Evaporation <sup>3</sup> (in. at 0.5 meters)	Piche	30	0.006	3.810*	0.451
		Pan	27	0.004	5.596*	1.091
	Minimum Grass temp <sup>3</sup> (°F at grass tips)	None	22	69.3	72.2	75.0

- 1 - Hourly observations between 0600 and 1900 hours inclusive
- 2 - Six hourly observations
- 3 - Daily observations

\* Total Values

## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)		2a. REPORT SECURITY CLASSIFICATION	
US Army Tropic Test Center Fort Clayton, Canal Zone		UNCLASSIFIED	
		2b. GROUP	
3. REPORT TITLE			
Monthly Microclimatic Summary, June 1967: Environmental Data Base for Regional Studies in the Humid Tropics			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
Data Summary, June 1967			
5. AUTHOR(S) (First name, middle initial, last name)			
6. REPORT DATE		7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
April 1968		28	
8a. CONTRACT OR GRANT NO.		8b. ORIGINATOR'S REPORT NUMBER(S)	
a. PROJECT NO. 2M025001A724-01			
c. USATECOM No. 9-4-0013-01			
d. Work Unit: USATTC # 001		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
10. DISTRIBUTION STATEMENT			
Distribution of this document is unlimited.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
		Advanced Research Projects Agency Army Research Projects Office, OCRD	
13. ABSTRACT			
This report contains detailed microclimatic data for June 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Climate Microclimatology Tropic Environment Humid Tropics Panama Canal Zone Microclimatology Data Base						