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MONTHLY
MICROCLIMATIC SUMMARY

JANUARY 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

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JANUARY 1967

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USATECOM Project No. 9-4-0013-01

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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.

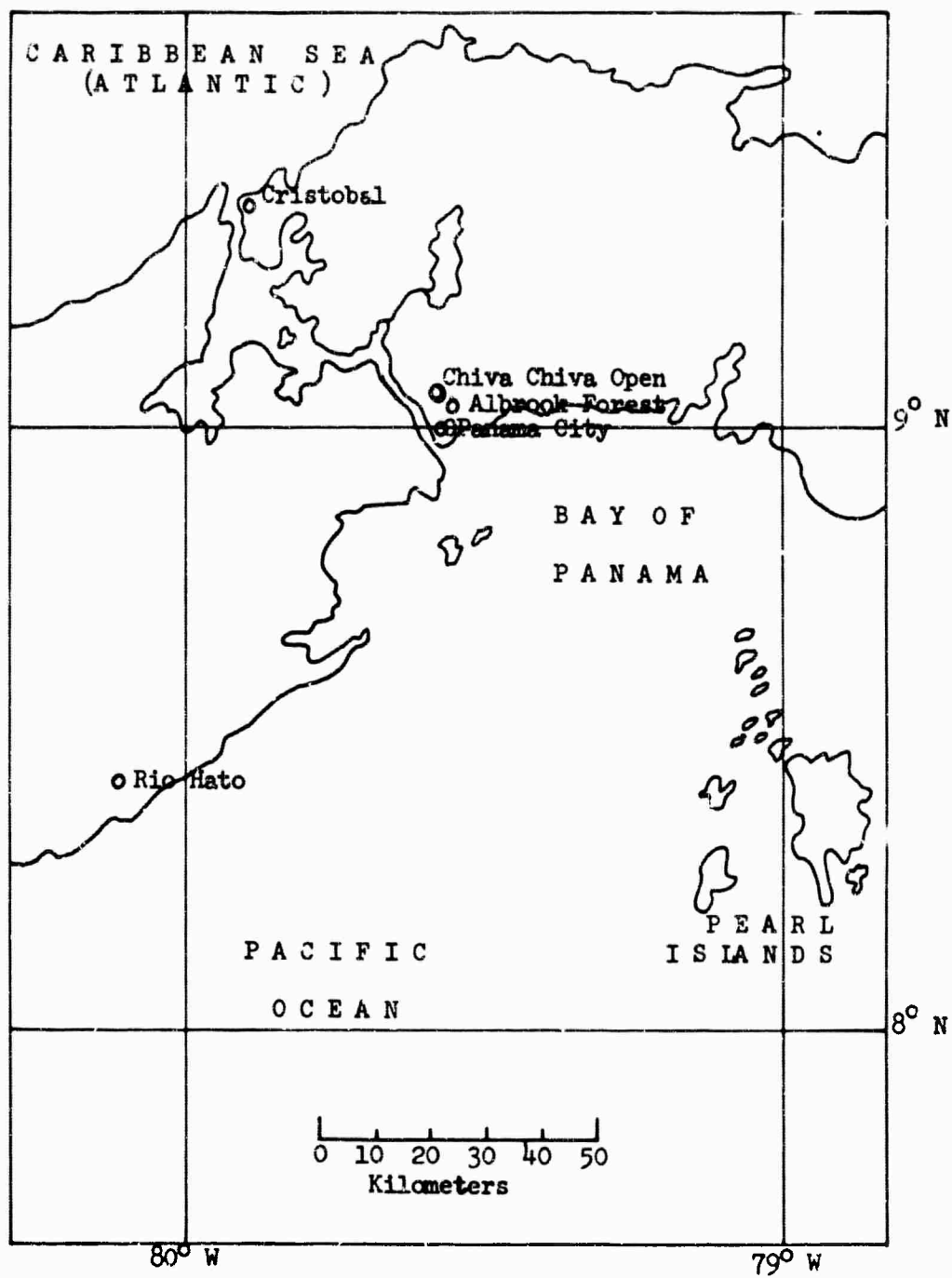


FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

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

* Observations made with sling psychrometer when recorders are inoperative.

** Hourly

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

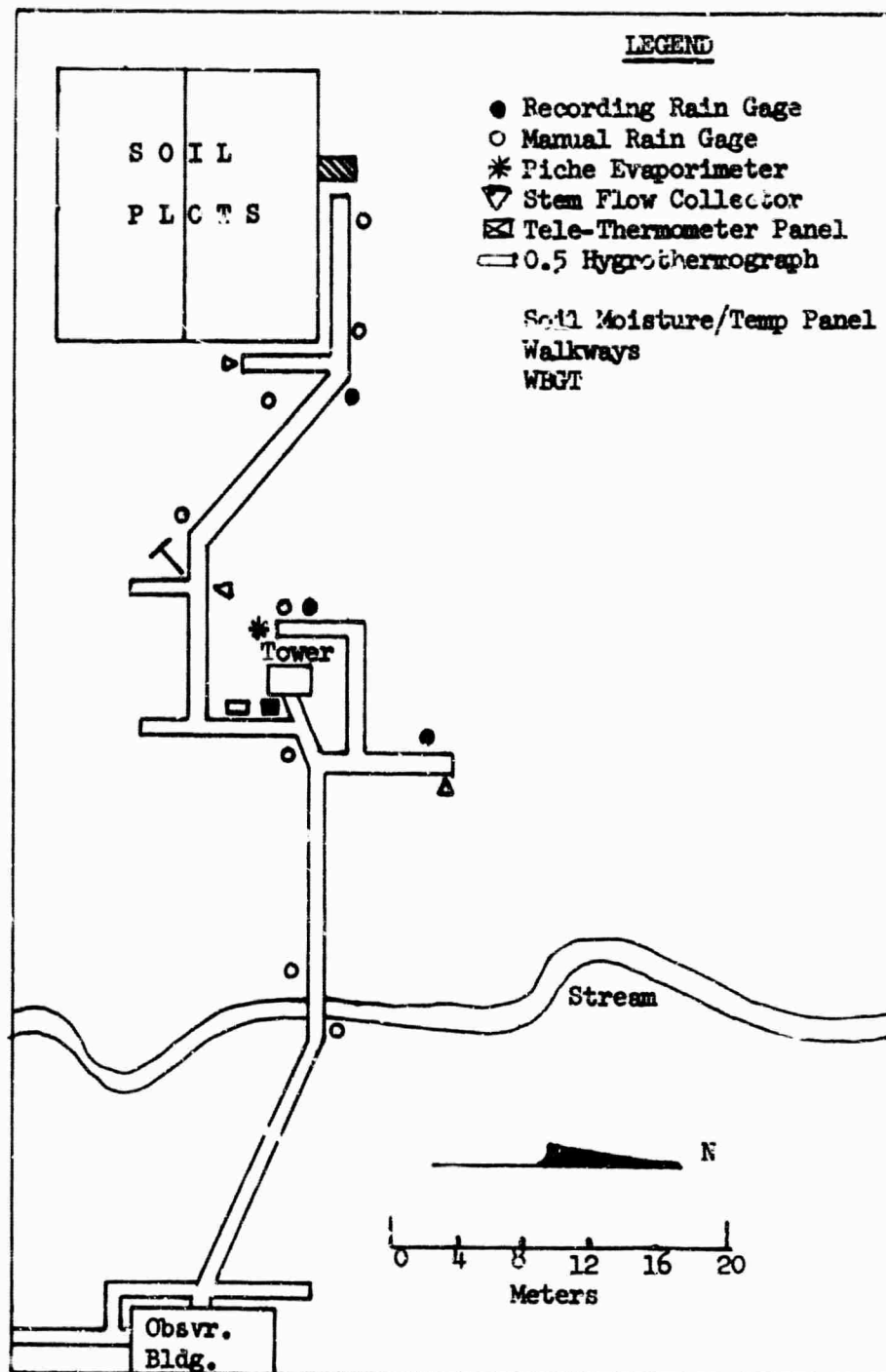


FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

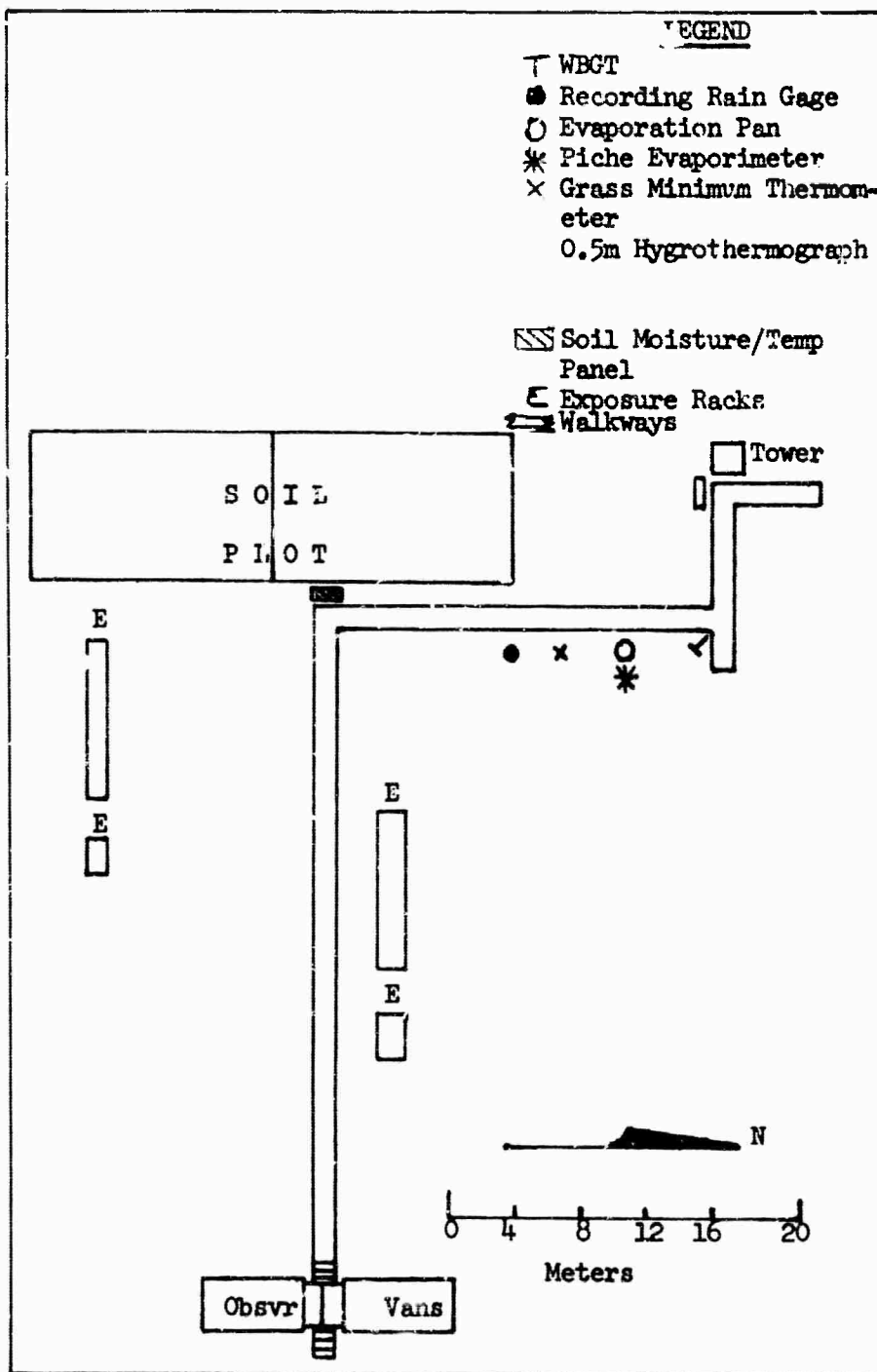


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

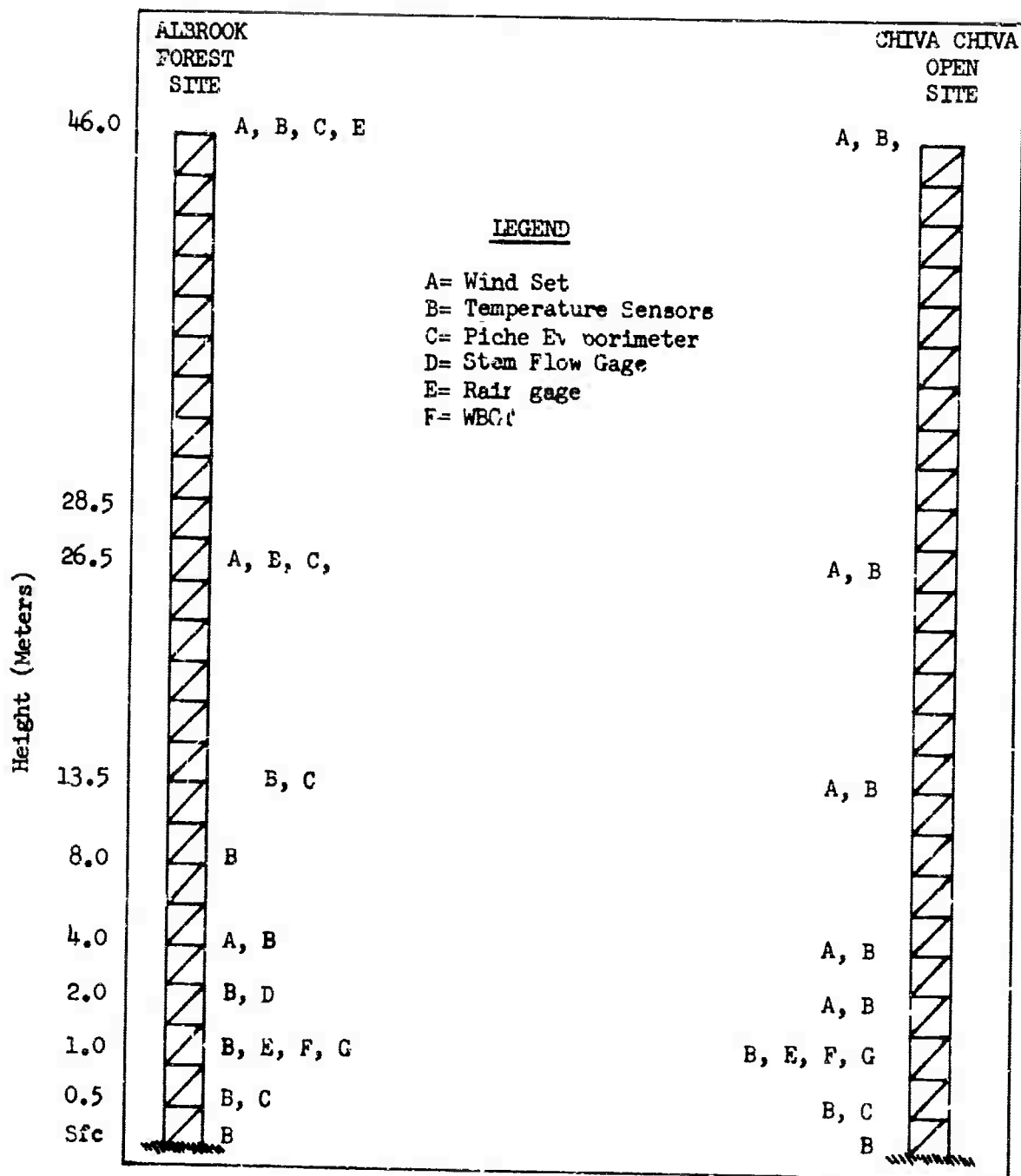


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS:

HOURLY DATA

JANUARY 1967

Exposure		Monthly Means of Air Temperature by Hour (°F)																								Monthly Summary				
		Site	Level	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
Albrook (Forest site)	46.0 m		74.9	74.7	74.5	74.4	74.2	74.2	74.7	76.8	80.6	82.7	84.0	84.9	85.6	85.3	85.0	83.7	82.3	90.1	77.8	76.7	76.0	75.5	75.0	74.9	744	71.7	78.7	89.2
	28.5 m								This level was not instrumented for air temperature at this time																					
	26.5 m		74.5	74.3	74.0	73.9	73.6	73.5	73.8	76.3	80.8	83.3	84.8	85.6	86.1	86.2	86.0	84.7	83.6	81.0	77.9	76.6	75.7	75.3	74.9	74.6	744	69.1	78.8	89.1
	13.5 m		74.1	73.9	73.6	73.4	73.3	73.0	72.9	74.9	78.5	81.2	83.2	84.5	85.0	85.3	84.6	83.5	82.5	80.1	77.8	76.5	75.6	74.9	74.5	74.2	744	69.3	78.0	88.2
	8.0 m		73.5	73.2	73.1	72.6	72.6	72.5	72.4	74.8	78.6	81.2	82.9	83.9	84.6	84.5	83.8	82.9	81.5	78.9	76.5	75.5	74.7	74.3	73.8	73.5	743	69.1	77.3	87.9
	4.0 m		73.1	72.8	72.5	72.2	72.3	72.0	72.1	74.7	78.6	81.1	82.7	83.6	84.6	84.3	84.0	82.8	81.0	78.1	76.2	75.0	74.2	73.9	73.4	73.1	744	69.0	77.0	87.8
	2.0 m		73.0	72.7	72.4	72.2	72.2	72.0	72.0	74.5	78.2	80.5	82.3	83.3	84.3	84.1	84.0	82.7	80.8	78.1	76.2	74.9	74.1	73.3	72.3	73.1	744	69.0	76.9	87.7
	1.0 m		73.2	73.0	72.8	72.5	72.4	72.1	72.2	74.5	78.2	80.7	82.4	83.6	84.5	84.9	83.9	82.8	81.1	78.4	76.2	75.5	74.7	74.1	73.8	73.4	744	69.2	77.1	91.0
	0.5 m		73.5	73.2	73.0	72.7	72.6	72.4	72.3	74.0	77.3	79.7	81.6	83.0	83.7	83.8	83.8	82.8	81.3	79.0	76.9	75.7	74.9	74.3	73.9	73.5	742	70.0	77.0	86.7

on

Chiva Chiva (Open site)	46.0 m	75.1	75.0	74.9	74.8	74.7	74.6	74.9	76.2	79.3	81.4	83.0	84.0	84.5	84.5	84.2	83.3	82.1	80.2	77.9	76.9	76.2	75.9	75.5	75.3	743	72.3	78.5	86.7
	28.5 m							This level was not instrumented for air temperature at this time																					
	26.5 m	75.1	74.9	74.8	74.7	74.5	74.3	74.4	76.5	79.6	81.8	83.4	84.5	84.9	85.0	84.6	83.9	82.7	80.6	78.3	77.3	76.4	76.0	75.6	75.4	744	71.4	78.7	86.9
	13.5 m	74.9	74.7	74.6	74.5	74.3	74.1	74.2	76.4	80.1	82.2	83.7	84.7	85.2	85.3	84.9	84.0	82.7	80.6	78.2	77.1	76.3	75.9	75.5	75.2	744	70.2	76.7	87.6
	8.0 m							This level was not instrumented for air temperature at this time																					
	4.0 m	74.3	74.0	74.1	74.0	73.7	73.2	73.9	78.4	81.3	84.1	85.2	86.3	86.7	86.6	85.9	84.7	82.9	79.7	77.3	76.2	75.4	75.0	74.8	74.6	744	69.5	78.8	89.9
	2.0 m	73.8	73.6	73.7	73.7	73.2	72.5	73.6	78.8	82.0	84.8	86.3	87.5	87.8	87.7	86.7	85.4	83.6	79.7	77.2	76.0	75.2	74.8	74.4	74.1	744	68.8	79.0	90.4
	1.0 m	72.8	73.5	73.5	73.3	73.0	72.3	73.5	79.2	82.7	85.6	87.0	88.6	88.8	88.6	87.4	85.5	83.5	79.6	76.9	76.5	75.5	74.9	74.4	74.1	744	68.5	79.2	93.0
	0.5 m	73.4	73.3	73.1	73.1	72.8	72.4	73.2	80.0	84.6	87.4	88.8	90.3	90.0	90.1	88.5	86.5	84.2	79.5	77.0	75.8	75.0	74.5	74.1	73.7	744	68.9	79.6	94.9

SUMMARY OF METEOROLOGICAL OBSERVATIONS HOURLY DATA JANUARY 1967

Exposure		Monthly Ranges of Air Temperature by Hour (°F)																								Monthly Summary*		
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
Albrook (Forest site)	46.0 m	3.8	3.3	3.0	3.7	5.0	5.4	3.6	5.9	6.9	4.9	4.9	6.5	7.6	7.1	8.1	10.0	8.4	7.4	6.2	2.9	3.6	3.3	4.6	4.8			
	28.5 m								This level was not instrumented for air temperature at this time																			
	26.5 m	3.7	3.9	5.1	7.0	7.5	8.0	6.3	7.4	6.9	5.5	5.4	7.1	6.1	7.5	8.6	10.9	10.8	10.0	6.2	4.2	3.8	3.0	4.2	4.3			
	13.5 m	5.6	5.9	6.4	5.8	6.4	6.9	5.6	6.3	5.0	5.2	6.2	8.8	7.8	7.2	8.6	9.0	8.3	7.0	5.1	4.5	4.3	4.8	4.9	4.7			
	8.0 m	4.9	5.6	5.6	5.6	5.4	5.6	6.1	5.5	5.3	6.6	7.4	10.8	7.0	7.9	9.1	8.9	8.3	10.2	5.1	4.9	5.1	4.9	5.2	4.7			
	4.0 m	5.7	5.0	5.1	5.8	5.3	5.4	5.1	6.1	5.5	5.5	6.7	9.3	7.8	7.5	7.9	8.6	6.8	6.5	4.9	4.5	5.1	5.5	5.6	5.5			
	2.0 m	5.9	5.5	5.0	5.2	5.8	5.5	5.4	5.8	5.2	5.5	7.0	9.7	8.3	7.2	7.5	8.7	6.6	5.7	5.0	4.5	5.0	5.2	5.3	5.7			
	1.0 m	4.7	4.1	4.1	4.5	4.8	4.3	4.9	5.0	5.0	6.1	7.5	9.4	9.5	10.2	9.3	9.0	6.5	6.2	4.2	4.3	4.5	4.9	5.1	4.9			
0.5 m	6.2	5.2	5.0	4.2	4.2	5.0	5.3	5.4	3.8	4.0	7.4	7.0	7.2	6.6	6.6	7.8	7.2	5.8	4.8	3.7	3.8	4.8	5.4	5.6				

* No monthly summary was computed for the ranges.

46.0 m	2.6	3.4	3.7	3.8	4.1	3.6	3.3	3.8	5.1	3.7	3.8	4.4	6.0	4.9	8.3	7.7	7.4	6.8	4.7	3.3	3.3	3.8	3.8	3.7
28.5 m	This level was not instrumented for air temperature at this time																							
26.5 m	3.9	3.4	3.6	5.1	5.1	5.0	4.7	5.8	4.9	4.6	3.8	4.9	5.9	5.0	8.1	8.2	8.3	8.1	5.1	3.9	3.4	3.9	4.3	4.1
13.5 m	3.5	4.0	5.0	5.4	6.7	6.3	6.4	5.4	4.6	4.0	4.2	4.5	6.6	5.9	8.1	7.6	7.2	6.6	6.2	4.0	3.4	3.2	3.5	3.4
8.0 m	This level was not instrumented for air temperature at this time																							
4.0 m	5.7	5.7	6.6	6.6	6.5	5.8	5.8	6.6	7.6	5.9	5.3	7.0	7.8	8.1	10.9	10.7	9.1	6.5	4.2	4.5	4.7	4.3	4.9	6.2
2.0 m	5.6	5.7	6.3	6.2	7.6	7.4	6.0	7.2	7.8	6.0	6.3	7.5	8.1	8.0	11.1	9.1	9.1	6.3	4.4	4.4	5.5	4.9	5.8	5.6
1.0 m	4.8	4.8	5.5	5.7	6.5	7.5	6.5	8.7	10.6	9.2	8.3	10.0	9.0	10.0	13.2	10.3	8.9	6.2	6.4	3.8	4.6	4.0	4.6	4.8
0.5 m	6.0	6.4	6.7	6.1	7.1	7.3	6.2	7.5	10.8	9.7	10.8	13.9	15.4	10.6	10.1	10.5	9.0	6.4	4.0	3.6	5.1	4.6	4.8	5.6

SUMMARY OF METEOROLOGICAL OBSERVATIONS
 HOURLY DATA
 JANUARY 1967

Exposure		Monthly Means of Relative Humidity by Hour (%)																								Mont' Summary			
Site	Level	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.	Mean	Max.	
Albrook (Forest site)	46.0 m	85	86	86	86	86	85	80	72	67	62	60	55	59	61	63	67	72	77	81	83	84	85	85	85	740	46	76	96
	28.5 m								This level was not instrumented for relative humidity at this time																				
	26.5 m	88	89	89	89	90	88	83	72	67	63	60	55	60	61	63	66	73	79	82	85	86	87	88	744	50	77	97	
	13.5 m	92	92	93	93	94	94	92	81	74	69	65	63	63	66	67	69	74	79	84	87	90	91	91	744	51	61	97	
	8.0 m								This level was not instrumented for relative humi... at this time																				
	4.0 m	94	95	96	96	96	96	93	83	75	71	67	64	66	69	70	74	80	84	88	91	91	93	94	744	50	84	100	
	2.0 m	95	95	96	96	96	97	94	86	78	73	70	66	67	69	72	76	81	85	89	91	92	94	94	744	52	85	100	
	1.0 m	94	94	94	95	95	96	95	87	79	74	70	68	68	70	72	77	81	86	88	91	92	92	93	744	57	85	98	
	0.5 m	94	94	94	95	95	96	95	91	84	78	74	71	71	72	75	79	82	86	88	90	92	93	93	730	56	87	100	

46.0 m	86	87	87	88	87	88	87	88	87	88	87	83	76	70	64	61	59	59	60	63	66	72	77	81	84	85	85	86	744	49	77	98
28.5 m											This level was not instrumented for relative humidity at this time																					
26.5 m	87	88	88	88	88	88	88	88	89	88	83	74	68	63	60	59	58	59	62	65	71	77	82	84	85	86	87	744	47	77	97	
13.5 m	88	88	87	88	88	88	88	88	89	88	82	74	68	62	59	58	58	59	62	66	72	78	82	84	85	86	87	744	47	77	99	
8.0 m										This level was not instrumented for relative humidity at this time																						
4.0 m	90	91	90	91	91	91	90	91	91	92	82	74	67	62	59	59	59	60	63	68	73	80	83	86	88	89	89	744	48	78	100	
2.0 m	91	91	90	91	91	91	90	91	91	93	92	81	72	65	62	58	58	57	59	62	66	73	80	84	86	86	89	90	743	46	78	99
1.0 m	91	91	91	91	91	91	91	92	93	92	83	74	66	60	57	56	56	57	60	65	74	82	85	87	88	89	90	742	46	78	99	
0.5 m	92	92	92	92	93	92	92	93	94	93	79	69	63	59	56	56	55	58	62	65	75	81	84	87	89	90	90	744	42	78	100	

Chiva Chiva (C) site

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JANUARY 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*	
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0 m	12	9	10	13	7	20	15	18	27	27	29	32	34	30	35	35	34	26	20	17	9	11	12	13		
	28.5 m							This level was not instrumented for relative humidity at this time																			
	26.5 m	12	13	9	14	17	16	13	18	30	22	22	28	32	31	31	40	31	25	26	16	11	12	11	12		
	13.5 m	9	12	10	8	11	11	7	11	24	25	30	38	35	32	42	38	40	28	25	20	15	10	9	9		
	8.0 m							This level was not instrumented for relative humidity at this time																			
	4.0 m	12	13	10	9	8	9	11	13	24	28	37	47	39	40	41	44	37	26	24	19	15	13	14	12		
Albrook (Forest site)	2.0 m	10	12	9	8	8	9	10	11	23	29	35	46	39	37	39	43	32	29	22	19	14	13	13	9		
	1.0 m	7	9	8	8	6	6	6	9	22	30	31	36	32	29	37	37	27	22	16	12	10	8	7	8		
	0.5 m	13	11	11	10	10	6	8	8	17	25	53	38	36	36	37	38	34	26	21	18	12	15	12	12		

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	16	16	12	16	14	20	20	12	18	17	16	27	29	29	33	35	31	27	20	14	14	16	16	18		
	28.5 m							This level was not instrumented for relative humidity at this time																			
	26.5 m	17	16	10	14	14	18	14	13	19	18	20	26	32	30	34	35	32	26	22	15	15	18	17	18		
	13.5 m	16	13	13	17	14	17	16	14	19	17	20	27	32	31	34	35	32	25	20	16	16	18	19	20		
	8.0 m							This level was not instrumented for relative humidity at this time																			
	4.0 m	18	15	13	16	17	15	17	20	28	18	19	29	33	31	22	34	35	27	23	19	18	14	16	19		
Chiva Chiva (Open site)	2.0 m	16	11	12	13	14	12	13	20	29	23	21	27	34	33	33	34	37	25	25	20	19	20	19	20		
	1.0 m	13	11	13	14	14	12	13	23	28	22	22	32	38	33	34	36	33	26	17	13	11	14	18	16		
	0.5 m	11	12	13	11	13	14	12	23	33	22	25	40	43	31	27	40	33	24	22	16	12	14	18	19		

SUMMARY OF METEOROLOGICAL OBSERVATIONS HOURLY DATA JANUARY 1967

Exposure		Monthly Means ² of other Elements by Hour																								Monthly Summary			
Site	Code ¹	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)	71.9	71.8	71.6	71.5	71.5	71.3	71.4	73.3	74.8	75.0	75.3	75.0	74.9	75.2	75.6	75.1	74.6	73.5	72.8	72.4	72.3	72.1	72.0	71.9	744	68.0	73.2	80.0
	W8 (2.0 m)	72.0	71.7	71.6	71.5	71.5	71.3	71.4	73.3	75.0	75.4	75.5	75.4	75.3	75.4	75.9	75.5	75.0	73.9	73.0	72.5	72.3	72.2	72.1	71.9	744	68.0	73.4	79.5
	W8 (0.5 m)	72.2	72.0	71.8	71.7	71.6	71.5	71.4	73.0	75.2	75.9	76.2	76.3	76.2	76.2	76.4	76.2	75.8	74.9	73.7	73.1	72.7	72.5	72.3	72.1	730	68.8	73.8	80.6
	RP	.728	.714	.700	.695	.700	.711	.733	.755	.770	.773	.762	.739	.712	.688	.666	.662	.667	.678	.700	.715	.735	.746	.747	.743	744	.620	.718	.820
Albrook	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.03	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5	0.01	0.51	0.38
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.26	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.33	0.26
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.30	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.17	0.30
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.31	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4	0.01	0.41	0.31

Chiva Chiva (Open site)	WB	(4.0 m)	72.2	72.0	72.0	72.0	71.7	71.5	72.1	74.2	74.8	75.1	75.1	75.0	75.2	75.1	75.0	74.7	74.5	73.3	72.8	72.6	72.5	72.4	72.4	72.3	744	69.2	73.4	79.9
	W8	(2.0 m)	71.9	71.7	71.7	71.8	71.5	71.1	71.9	74.4	75.1	75.5	75.7	75.6	75.6	75.5	75.3	75.0	74.5	73.3	72.7	72.5	72.3	72.2	72.0	71.9	743	68.2	73.4	78.5
	W8	(0.5 m)	71.7	71.6	71.6	71.5	71.3	71.1	71.8	74.9	76.3	76.8	77.0	77.2	76.9	76.8	76.4	75.8	75.1	73.5	72.7	72.5	72.3	72.2	72.0	71.8	744	68.7	73.8	79.3
	RP		.813	.799	.785	.782	.786	.800	.818	.841	.860	.863	.854	.831	.808	.777	.756	.753	.757	.768	.788	.804	.825	.835	.834	.829	744	.705	.807	.915
Chiva Chiva (Open site)	PS		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	0.02	0.11	0.09

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

P5 - 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.)

² 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 JANUARY 1967

Exposure		Monthly Ranges ² of other Elements by Hour																								Monthly Summary*	
Site	Code ¹	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	WB (4.0 m)	4.5	4.3	4.0	4.0	5.0	5.5	4.9	3.3	4.0	3.8	4.9	5.8	5.7	6.2	7.2	8.2	7.1	5.7	4.9	4.2	3.8	4.0	4.7	4.5		
	WR (2.0 m)	4.1	4.5	4.3	4.5	5.0	5.5	5.1	3.5	3.3	4.0	5.3	6.0	5.2	5.7	6.1	7.8	6.0	5.1	4.5	4.2	4.1	4.1	4.4	4.2		
	WB (0.5 m)	4.4	4.5	4.9	5.1	5.3	5.5	5.8	4.9	3.0	3.7	4.9	8.2	5.4	5.7	6.2	6.0	6.0	4.8	4.5	4.3	4.2	3.8	4.4			
	BP	.090	.095	.095	.100	.110	.105	.110	.100	.095	.090	.115	.105	.105	.120	.085	.090	.100	.115	.115	.110	.120	.115	.110	.095		
	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	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)	3.7	3.7	4.0	3.0	4.2	3.7	4.4	3.1	2.8	4.2	4.2	5.1	5.2	5.9	8.0	7.4	8.2	5.2	5.0	5.1	4.2	3.8	4.1	4.4		
	WR (2.0 m)	4.2	3.8	4.0	3.5	5.5	5.0	4.2	2.8	2.7	4.5	4.5	4.5	5.0	6.3	6.0	4.8	6.5	5.5	5.0	5.1	4.5	4.1	4.5	4.5		
	WB (0.5 m)	3.5	3.9	4.4	3.7	4.6	4.6	3.6	3.5	3.0	3.3	3.8	3.4	3.2	3.4	3.0	3.5	4.6	4.0	3.9	3.9	3.5	3.4	4.1	4.3		
	BP	.100	.090	.090	.090	.110	.110	.105	.100	.100	.095	.100	.100	.095	.100	.090	.095	.115	.120	.140	.130	.115	.110	.105	.100		
	FS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

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

²Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JANUARY 1967

Exposure	Monthly Means of Wind Speed by Hour (miles/hr.)																								Monthly Summary					
	Site	Level	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)		46.0 m	6	5	5	5	6	6	6	5	6	8	10	9	9	10	8	9	7	6	6	6	5	5	6	6	712	0	7	22
		28.5 m								This level was not instrumented for wind speed at this time																				
		26.5 m	1	1	1	1	1	2	2	2	3	3	3	3	4	2	3	2	2	2	2	1	2	2	2	2	710	0	2	17
		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	1	1	0	1	1	1	0	0	0	0	1	1	709	0	0	6
	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																				

[illegible]

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

JANUARY 1967

Exposure	Monthly Ranges of Wind Speed by Hour (miles/hr.)																								Monthly Summary*		
	Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22		23	24
Albrook (Forest site)		46.0 m	11	12	11	10	13	10	11	11	16	16	19	13	20	22	17	16	11	9	8	10	10	9	11	11	
		28.5 m	This level was not instrumented for wind speed at this time																								
		26.5 m	5	5	5	5	4	5	6	5	11	8	14	10	10	17	5	7	10	9	4	4	5	5	5	7	
		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	3	3	3	3	1	3	1	1	2	2	3	4	4	4	3	2	2	4	1	1	2	1	6	4	
		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																								

ALBROOK (Forest site) JANUARY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m. (%)																									
Dir	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				3.3			3.4			10.4	27.4	37.8	39.9	13.3	26.6	27.5	20.0	13.3	3.3	6.6			6.6	3.3	3.4
NNE		3.3						3.4			10.4	6.8	10.0	6.6	3.3	3.4	3.3	3.3		3.3					
NE										3.4		6.8	3.3				6.6								
ENE											3.4		3.3												
E																									
ESE																									
SE																									
SSE										3.4			3.3		3.3										
S						3.3																			
SSW			3.3							3.4	3.4														
SW			6.6							3.4						3.4	3.3						3.3		
WSW		3.3	3.3	6.6	3.3	3.3			6.8			3.4		3.3	6.6			6.6		3.3		3.3		3.4	3.3
W		56.4	49.8	49.8	49.8	59.8	61.9	65.4	55.0	20.7		13.8	3.3	16.6	10.0	17.2	26.6	20.0	20.0	16.6	53.1	49.8	59.8	65.4	73.1
WNW		20.0	16.6	23.3	26.6	13.4	20.9	17.3	10.4	10.4	17.2	3.4	3.3	10.0	10.0	3.4	13.3	10.0	20.0	23.3	13.3	23.3	16.6	3.4	6.6
NW		10.0	10.0	6.6	10.0	10.0	3.4	6.8	17.2	17.2	20.8	6.8	20.0	33.2	20.0	13.8	16.6	29.9	33.2	29.9	23.3	13.3	10.0	10.4	13.3
NNW		3.3	3.3	3.3	6.6		3.4			17.2	10.4	20.8	13.3	13.3	16.6	24.2	10.0	16.6	23.3	16.6	6.6			10.4	
CALM		3.3	6.6	6.6	3.3	10.0	6.8	6.8	10.4	10.4	6.8			3.3	3.3	6.8					3.3	3.3	6.6	3.4	3.3

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

ALBROOK (Forest site) JANUARY 1967

Relative Frequencies* of Wind Directions by Hour at 20.5 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							3.4		10.4	3.5	17.9	10.0	10.0	16.6	10.4	6.6	10.0	6.6	3.3	3.3				3.4
NNE									3.4	3.5	3.5	16.6		6.6	6.8	6.6	3.3	6.6	3.3					
NE										21.4	17.9	3.3	10.0	6.6	3.4	10.0	3.3	6.6				2.3		
ENE													3.3		10.4	6.6	3.3		3.3					
E										3.5					3.4		3.3							
ESE											3.5			3.3										
SE												3.3												
SSE														3.3										
S												3.3	3.3	3.3										
SSW										3.5														
SW											3.5	3.3				3.3								
WSW			3.3						3.4				3.3		3.4	3.3				3.3	3.3			3.4
W	10.0	10.0	3.3	6.6	10.0	20.8	17.2	13.8	6.8				10.0	3.3	6.8		10.0	10.0	6.6	6.6	13.2	10.0	3.4	10.0
WNW	23.3	23.3	26.6	13.3	16.6	10.4	17.2	10.4	6.8	3.5	3.5	6.6	3.3	13.3	3.4	20.0	10.0	3.3	10.0	10.0	13.3	26.6	31.0	23.3
NW	3.3	3.3	6.6	6.6	10.0	6.6	10.4	17.2	13.8	17.9	17.9	16.6	20.0	13.3	13.8	23.3	26.6	13.3	20.0	33.2	23.3	10.0	10.4	6.6
NNW	3.3			3.3			6.8	6.8	3.4	10.8	3.5	6.6	10.0	6.6	10.4	3.3		6.6	13.3	6.6		3.3		6.6
CALM	59.8	63.1	59.8	69.7	63.1	61.8	44.7	48.2	48.2	32.1	28.7	26.6	26.6	23.3	27.5	16.6	29.9	46.6	39.9	35.6	46.6	46.6	48.3	53.1

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

ALBROOK (Forest site) JANUARY 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	3.3		3.3		3.3		3.4	6.9	6.9	6.9	3.4	10.0	6.6	3.3	3.4	6.6	13.3	10.0	3.3		10.0	6.6	3.4	
NNE				3.3							6.9	6.6			3.4			6.6	6.6	3.3				
NE												3.3	6.6	10.0	3.4			3.3	3.3	3.3				
ENE									3.4	6.9				6.6			3.3							
E										6.9	3.4		10.0	6.6	6.9	6.6								
ESE												3.3	3.3		6.9									
SE										3.4	6.9	6.6	3.3	6.6		6.6								
SSE											3.4				3.4									
S											3.4	10.0	3.3	3.3		3.3		3.3						3.3
SSW				3.3					3.4		10.4	3.3	6.6	6.6	3.4		6.6				3.3			
SW				3.3					3.4		3.4	3.3	3.3	3.3	3.4	3.3	3.3	3.3	3.3			3.3		
WSW									3.4				3.3	3.3			3.3							3.3
W	3.3	6.6	3.3	3.3	3.3	3.4	3.4			6.9	3.4	3.3	3.3	3.3	2.4	3.3	3.3	10.0	3.3	10.0	3.3		10.4	10.0
WNW	10.0	3.3	6.6	3.3		6.9			3.4	10.4		3.3	3.3			6.6	3.3			6.6	6.6	6.6	6.9	3.3
NW	13.3	10.0	13.3	20.0	26.6	17.2	13.8	6.9	6.9			3.3			3.4	6.6	3.3		10.0	6.6	3.3	16.6	3.4	10.0
NNW	3.3		6.6			10.4		3.4			3.4			10.0							3.3	3.3	13.8	10.0
CALM	66.4	79.7	66.4	63.1	66.4	61.9	79.0	82.4	68.8	58.4	51.6	43.2	46.6	46.6	58.6	56.6	59.8	59.8	69.7	69.7	63.1	61.9	59.8	59.8

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

CHIVA CHIVA (Open site) JANUARY 1967

Relative Frequencies* of Wind Directions by Hour at 46.0 m. (%)																									
Dir	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		25.8	22.6	25.8	19.4	22.6	19.4	9.7	19.4	38.7	32.2	35.5	29.0	25.8	26.6	38.7	45.2	32.2	29.0	38.7	16.1	16.6	23.3	25.8	16.1
NNE		3.2	3.2				6.4	6.4			22.6	19.4	19.4	16.1	13.3	16.1	9.7	12.9	5.2	3.2	3.2				3.2
NE											12.9	6.4	9.7	12.9		3.2	3.2		3.2						
ENE											3.2											3.3			3.2
E																									
ESE		3.2																							
SE												3.2	3.2												
SSE																									
S														3.2											6.4
SSW				3.2																					
SW			3.2			3.2																			
WSW					3.2		3.2																		
W							3.2		9.7				3.2								3.3	3.3	3.2		
WNW			6.4	3.2	6.4	9.7	3.2	6.4	3.2		3.2			3.2	3.3	3.2	3.2	12.9					3.3	3.2	3.2
NW		19.4	12.9	16.1	32.2	38.7	29.0	45.2	25.8	12.9		12.9		9.7	20.0	9.7	12.9	9.7	22.6	22.6	35.5	26.6	33.2	29.0	29.0
NNW		48.4	51.6	48.4	38.7	25.8	35.5	29.0	41.9	48.4	25.8	22.6	35.5	29.0	36.6	29.0	25.8	32.2	41.9	25.5	45.2	49.8	55.6	38.7	38.7
CALM				3.2				3.2																	

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

IMPRESORA B A 10111

CHIVA CHIVA (Open site) JANUARY 1967

Relative Frequencies* of Wind Directions by Hour at 26.5 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
Dir																								
N	36.6	29.9	49.8	43.2	29.9	33.2	23.3	25.6	66.4	35.5	25.8	22.6	25.8	49.8	45.2	48.4	46.6	43.2	53.2	59.8	55.0	58.4	49.8	39.9
NNE	13.3	20.0	6.6	3.3	13.3	6.6	6.6	6.6	13.3	19.4	25.8	32.2	29.0	16.6	22.6	19.4	16.6	20.0	20.0	3.3	6.8	3.4	3.3	10.0
NE							10.0	3.3	3.3	29.0	25.8	29.0	19.4	16.6	19.4	12.9	6.6	3.3	6.6	6.6	3.4			3.3
ENE										3.2			6.4		3.2	3.2		3.3						3.3
E	3.3			3.3						3.2		3.2									3.4			3.3
ESE																								
SE	3.3	3.3				3.3					3.2											3.3		3.3
SSE																								
S												3.2												
SSW							3.3																	
SW	3.3			3.3	3.3				3.3															
WSW																								
W		3.3		3.3		6.6															3.4			
WNW				3.3	3.3			3.3									3.3				3.4	3.4	3.3	
NW	10.0	3.3	16.6	13.3	6.6	10.0	23.3	3.3	3.3	6.4		3.2	9.7	6.6	6.4	6.4	13.3	6.6	3.3	13.2		17.2	10.0	10.0
NNW	29.9	36.6	20.0	26.6	39.9	36.6	29.9	49.8	10.0	3.2	11.4	6.4	9.7	10.0	3.2	9.7	13.3	23.3	16.6	16.6	24.2	17.2	23.3	23.3
CALM		3.3	6.6		3.3	3.3	3.3	3.3														6.6	3.3	3.3

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

IMPRESORA: B. A. 41111

CHIVA CHIVA (Open site) JANUARY 1967

		Relative Frequencies* of Wind Directions by Hour at 4.0 m. (%)																							
Dir	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		6.4	19.4	19.4	12.9	6.4	6.4	3.2	12.9	29.0	48.4	45.2	29.0	22.6	36.6	29.0	32.2	45.2	29.0	32.2	16.1	10.0	20.0	16.1	19.4
NNE		3.2		6.4	9.7	12.9		9.7	3.2	12.9	3.2	16.1	22.6	12.9	13.3	3.2	12.9	3.2	6.4	3.2	3.2				9.7
NE			3.2	3.2		6.4		9.7	3.2		16.1	12.9	16.1	19.4	3.3	16.1		6.4			13.3	2.3			6.4
ENE							16.1															3.3			9.7
E					3.2							3.2											3.2	3.2	
ESE		3.2	3.2			3.2																			
SE		3.2	3.2																						
SSE																									
S				3.2					3.2				3.2												
SSW							3.2																		
SW			3.2														3.2					3.3	3.2		
WSW			3.2			3.2												3.2							
W		3.2	3.2		3.2	3.2	3.2	3.2	6.4		3.2		3.2					3.2			3.2	3.3	6.6	3.2	
WNW		9.7	9.7	3.2	3.2			16.1	6.4	3.2	3.2			6.4		9.7	3.2	3.2	9.7					3.2	9.7
NW		22.6	22.6	32.2	35.5	29.0	32.2	35.5	35.5	25.8	3.2	12.9	9.7	19.4	23.3	9.7	12.9	12.9	19.4	32.2	38.7	20.0	39.9	32.2	9.7
NNW		41.9	19.4	25.8	25.8	29.0	29.0	12.9	25.8	29.0	22.6	9.7	16.1	19.4	23.3	32.2	35.5	22.6	35.5	32.2	38.7	49.8	26.6	32.2	32.2
CALM		6.4	9.7	6.4	6.4	6.4	9.7	9.7	3.2															6.4	

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

IMPRESORA S. A. 1967

SUMMARY OF NON HOURLY DATA

JANUARY 1967

Summary of Elements with 1-hourly Frequencies of Observation						
Site	Element, Units and Exposure	Description	Nu of obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBGT Index ¹ (at 1.0 meters)	Index value	434	63.8	76.6	82.5
		Dry bulb temp.	434	69.2	79.7	91.0
		Wet bulb temp.	434	68.5	75.1	91.0
		Black bulb temp.	434	69.8	80.3	96.8
	Evaporation ³ (in. at 4 levels)	Piche (46.0 m)	31	0.189	15.971*	0.762
		Piche (26.5 m)	31	0.129	11.092*	0.500
		Piche (13.5 m)	31	0.355	5.147*	0.250
		Piche (0.5 m)	31	0.030	3.019*	0.135
	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1	4	0.01	0.41*	0.33
		Gauge # 2	5	0.01	0.41*	0.34
		Gauge # 3	5	0.01	0.52*	0.41
		Gauge # 4	3	0.01	0.36*	0.32
		Gauge # 5	4	0.01	0.41*	0.33
		Gauge # 6	4	0.01	0.37*	0.30
		Gauge # 7	4	0.01	0.46*	0.35
		Gauge # 8	3	0.01	0.30*	0.25
	Stem Flow ² (in. at 2.0 meters)	Small tree	2	0.02	0.36*	0.34
		Medium tree	2	0.01	0.49*	0.48
		Large tree	1	0.14	0.14*	0.14
Chiva Chiva (Open site)	WBGT Index (at 1.0 meters)	Index value	434	68.0	79.5	86.9
		Dry bulb temp.	434	68.5	82.8	93.0
		Wet bulb temp.	434	68.0	75.3	93.0
		Black bulb temp.	428	67.9	92.4	112.8
	Evaporation ³ (in. at 0.5 meters)	Piche	24	0.116	8.869*	0.512
		Pan	38	0.054	9.366*	0.531
	Minimum Grass temp ³ (°F at grass tips)	None	30	63.5	67.2	70.0

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

*Total Values

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13. ABSTRACT

This report contains detailed microclimatic data for January 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.

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14.

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