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MONTHLY
MICROCLIMATIC SUMMARY

SEPTEMBER 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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ENVIRONMENTAL DATA BASE
FOR REGIONAL STUDIES IN THE N.M.I.D TROPICS

MONTHLY
MICROCLIMATIC SUMMARY

SEPTEMBER 1967

Prepared by

Michael A. Fradel, Project Officer
and
Dr. Wilfried H. Portig, Meteorologist

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.

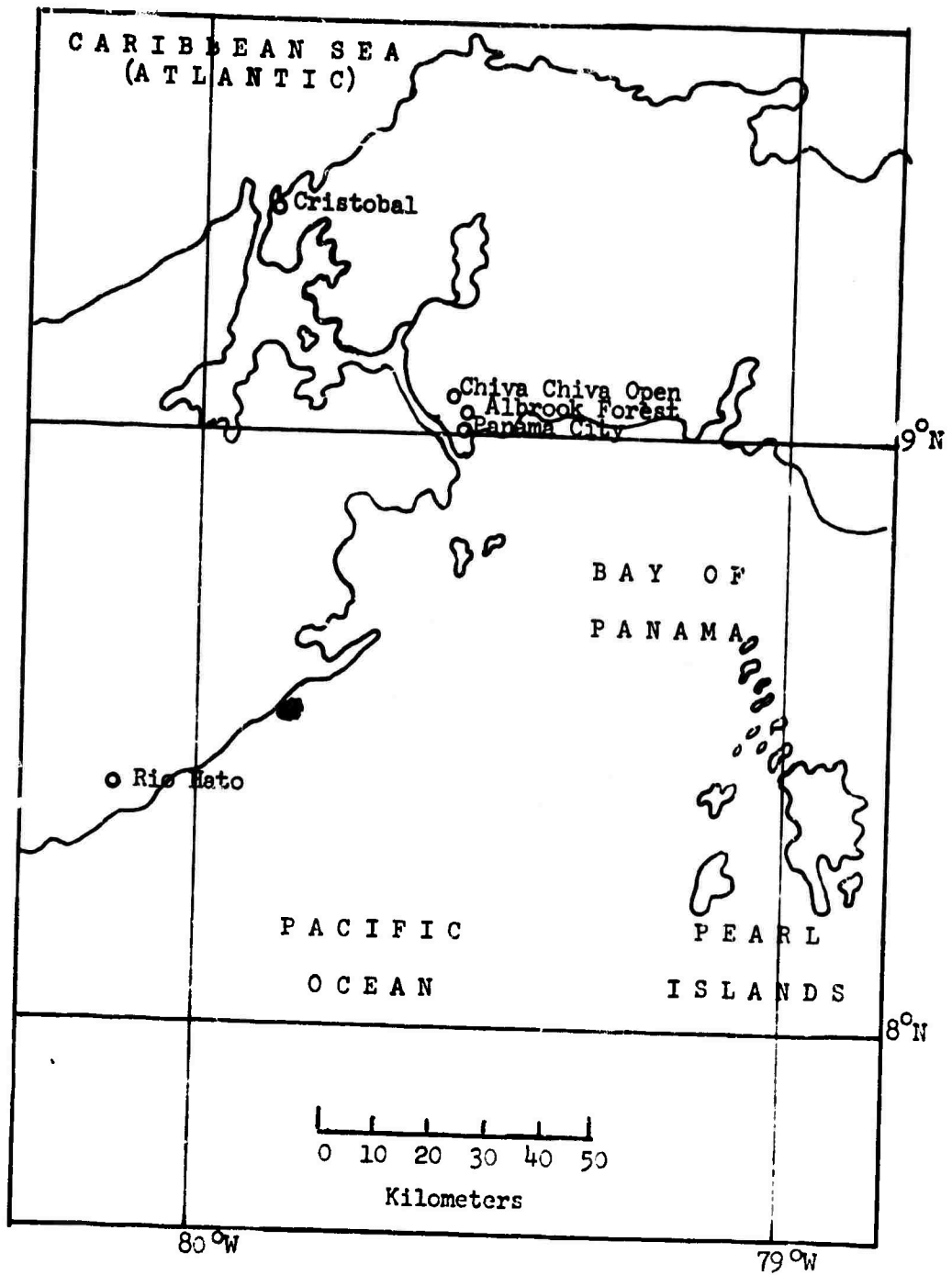


FIGURE 1. LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element:	0.5	1.0	2.0	4.0	8.0	13.5	26.5	28.5	46.0	Frequency
Temperature:										
Dry Bulb	-	1	1	1	-	1	1	-	1	Hourly*/Continuously
Wet Bulb	-	-	1	1	-	-	-	-	-	Hourly*/Continuously
Grass Minimum	3	-	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	1	-	-	-	-	-	-	Hourly (0600-1900 EST)
Relative Humidity	-	1	3	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	-	2	Continuously
Speed	-	-	3**	1	-	3**	1**	-	2	Hourly**/Continuously

1. Albrook and Chiva Chiva.
2. Albrook 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.

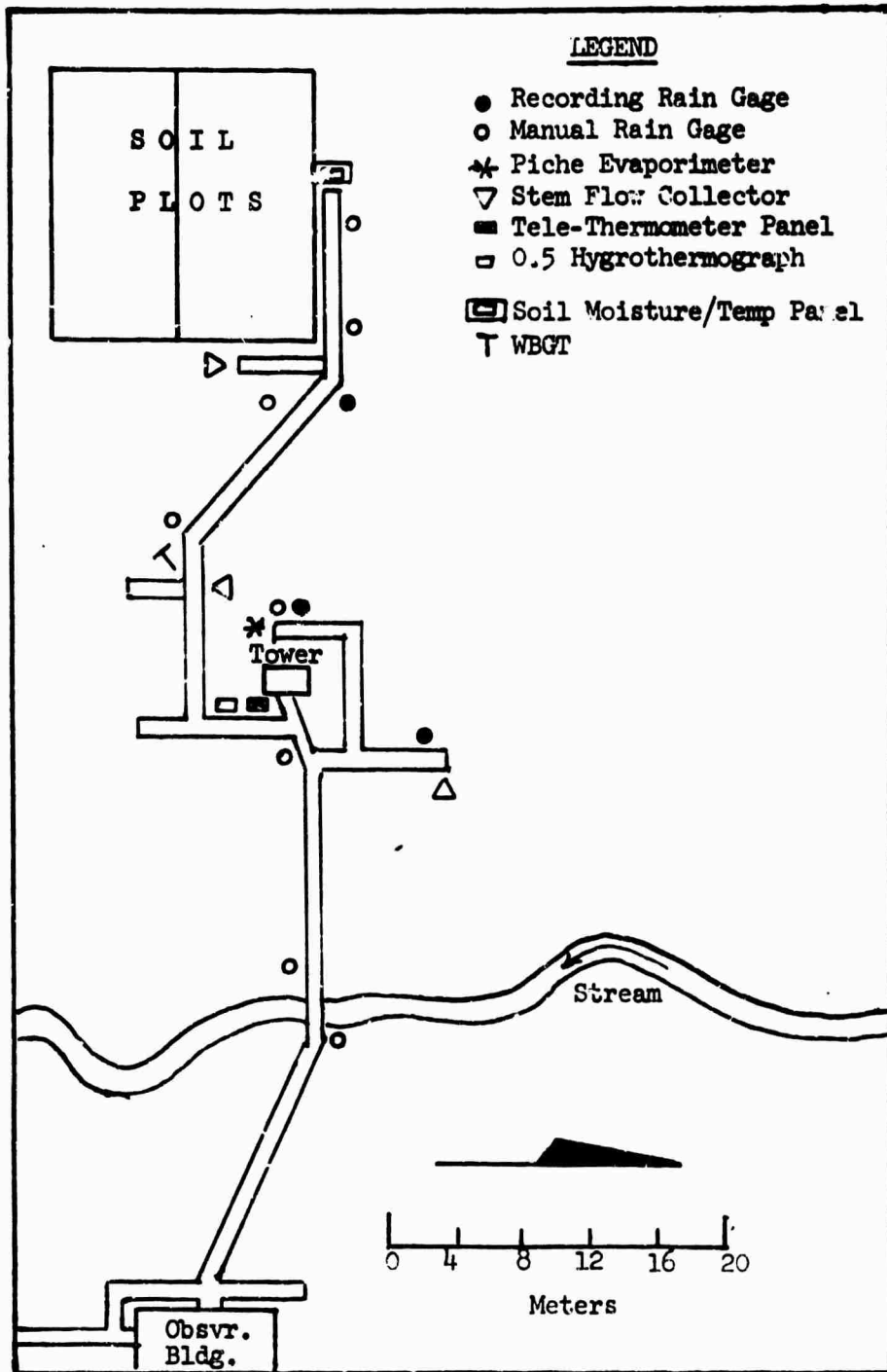


FIGURE 3. ALBROOK FOREST SITE, GENERALIZED PLOT

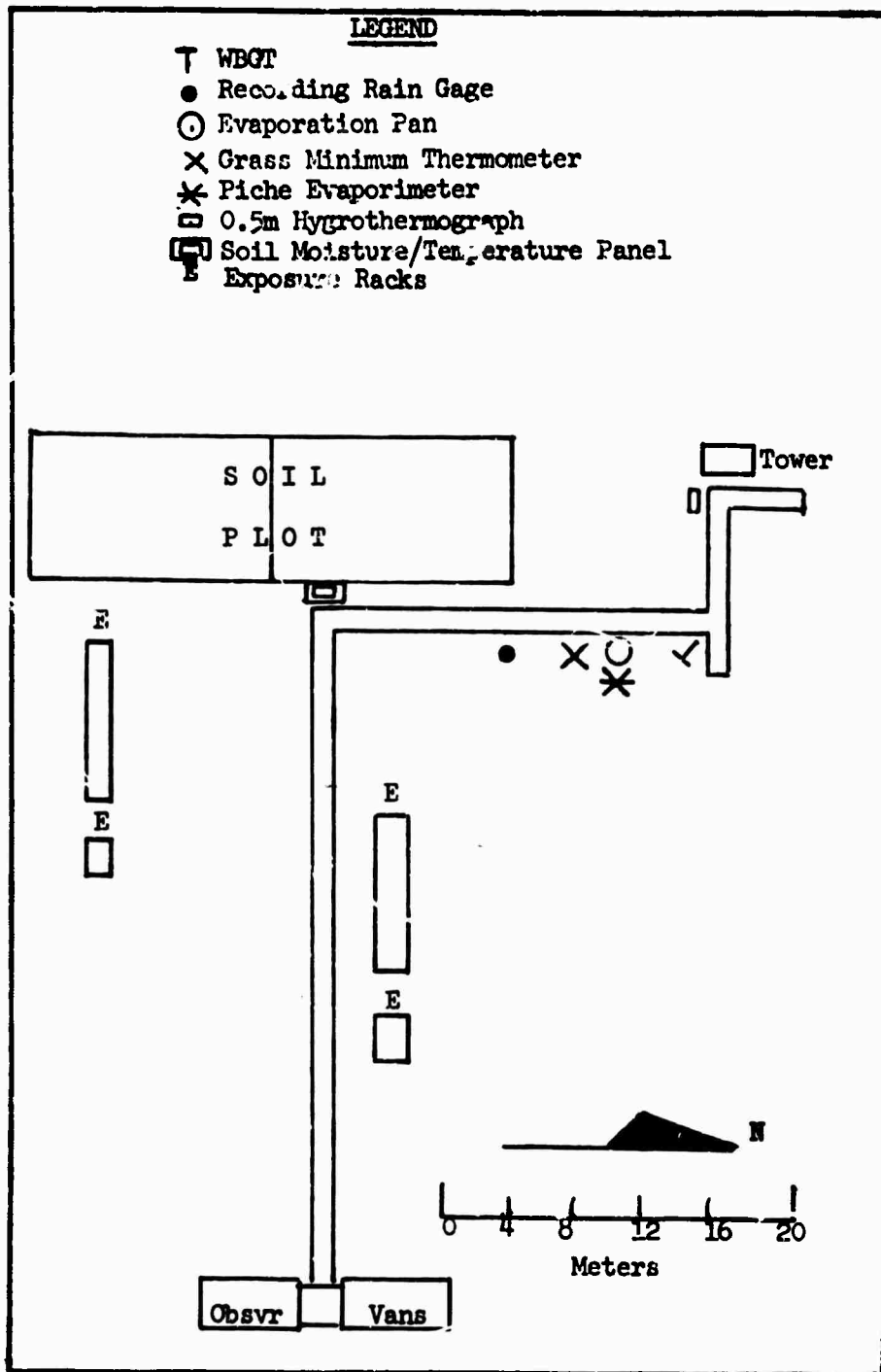


FIGURE 4. CHIVA CHIVA OPEN, GENERALIZED PLOT

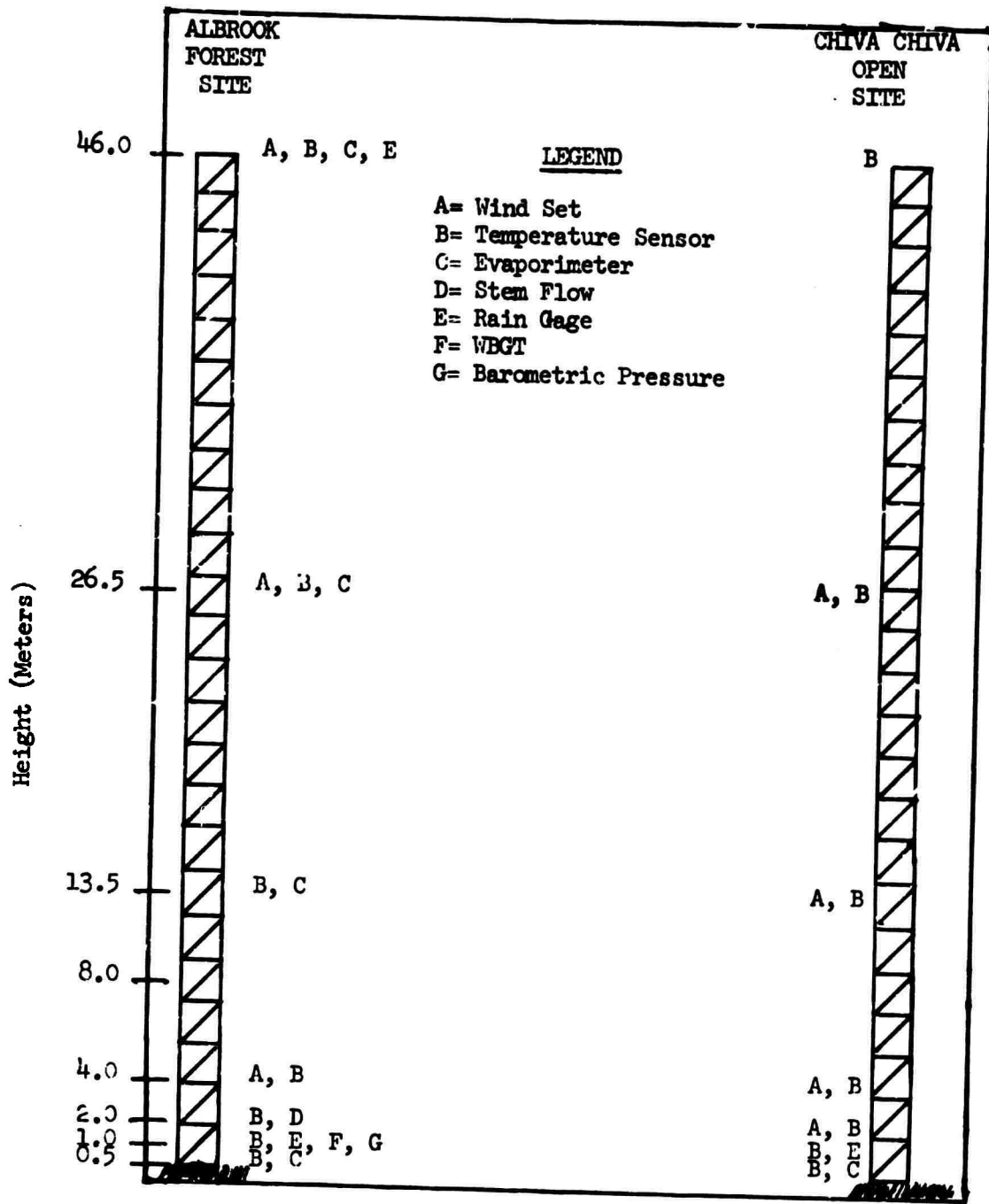


FIGURE 5. INSTRUMENT LOCATION ON TOWERS

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
SEPTEMBER 1967

Exposure	Monthly Means 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.
Albrook (Forest site)	46.0 m	74.2	74.0	73.6	73.5	73.4	73.4	73.9	75.9	78.7	80.3	81.8	82.3	82.4	80.6	79.6	78.6	77.6	76.6	75.5	75.2	74.9	74.7	74.5	74.3	720	70.0	76.6	87.0
	28.5 m																												
	26.5 m	73.4	73.3	73.0	72.9	72.8	73.7	76.4	79.3	81.2	83.1	83.8	83.7	82.1	80.7	79.5	78.2	76.7	75.0	74.5	74.2	74.1	73.8	73.6	720	69.1	76.7	88.6	
	13.5 m	73.7	73.5	73.4	73.2	73.0	73.1	73.5	75.3	77.5	79.2	81.0	82.1	82.4	81.4	79.9	78.8	78.1	77.1	75.9	75.3	75.0	74.6	74.3	74.0	713	70.0	76.5	82.0
	8.0 m																												
Albrook (Forest site)	4.0 m	73.6	73.4	73.3	73.0	72.7	72.9	73.6	75.6	77.6	79.9	80.1	81.0	80.9	79.3	78.7	78.0	77.1	76.1	75.3	75.0	74.8	74.5	74.2	73.8	594	69.5	76.1	84.9
	2.0 m	73.6	73.5	73.3	73.0	72.8	72.9	73.5	75.5	77.3	78.7	79.8	80.6	80.7	79.2	78.6	77.9	77.1	76.1	75.4	75.0	74.8	74.5	74.2	73.8	594	69.3	76.0	84.7
	1.0 m	73.7	73.5	73.4	73.0	72.9	72.9	73.5	75.3	77.0	78.3	79.5	80.3	80.4	79.1	78.4	78.0	77.1	76.2	75.6	75.1	74.9	74.7	74.3	74.0	594	69.0	76.0	84.8
	0.5 m	74.3	74.1	73.9	73.7	73.6	73.4	73.6	75.2	76.8	78.2	79.3	80.2	80.4	79.4	78.7	77.9	77.4	76.7	75.9	75.5	75.3	75.0	74.8	74.5	657	69.4	76.1	83.7

Chiva Chiva (Open site)	46.0 m	74.0	73.9	73.7	73.5	73.3	73.8	75.4	77.8	79.4	80.9	81.8	81.8	80.1	79.5	78.1	77.5	76.7	76.0	75.4	75.1	74.9	74.5	74.3	714	67.7	76.4	86.9
	28.5 m																											
	26.5 m	73.6	73.4	73.2	73.1	72.8	73.5	75.5	77.9	79.6	80.8	81.8	82.0	80.3	79.7	78.2	77.5	76.8	75.7	75.2	74.8	74.6	74.1	73.8	711	68.2	76.3	87.2
	13.5 m	73.3	73.0	72.8	72.9	72.8	73.5	75.6	78.0	79.8	81.2	82.0	81.9	80.2	79.7	78.4	77.4	76.6	75.5	75.0	74.7	74.2	73.8	73.5	712	67.5	76.2	87.7
	8.0 m																											
Chiva Chiva (Open site)	4.0 m	73.5	73.3	73.0	72.9	73.0	72.8	75.0	78.5	80.3	82.4	83.8	84.1	82.1	81.3	79.7	78.6	77.3	75.7	75.2	74.9	74.5	74.2	73.8	681	68.1	77.0	90.1
	2.0 m	73.4	73.2	72.9	72.7	72.8	72.6	75.3	78.9	80.8	82.9	84.4	84.7	82.6	81.7	79.9	78.8	77.3	75.8	75.2	74.8	74.3	74.1	73.7	681	67.8	77.1	90.6
	1.0 m	73.3	73.0	72.7	72.5	72.4	72.3	75.0	78.7	81.5	83.8	85.1	85.4	83.2	81.5	79.8	78.8	77.2	75.6	75.2	74.8	74.3	73.9	73.5	714	67.0	77.4	91.2
	0.5 m	73.2	73.0	72.6	72.4	72.3	72.2	75.2	79.5	82.1	84.6	86.4	86.0	83.9	81.9	80.0	78.8	77.2	75.1	74.7	74.2	73.8	73.5	720	67.0	77.7	93.2	

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
 SEPTEMBER 1967

Exposure	Monthly Means 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	No. of Obs.	Min.	Mean	Max.
46.0 m	94	94	94	94	95	95	94	91	86	86	76	76	76	79	81	83	85	88	88	92	93	93	94	94	94	649	62	88	98
28.5 m	This level was not instrumented for relative humidity at this time																												
26.5 m	96	96	96	96	97	96	96	92	86	81	75	74	74	77	81	84	87	90	94	95	95	95	95	96	96	646	54	89	100
13.5 m	97	97	97	97	98	97	97	96	91	87	81	79	77	80	84	86	89	91	94	95	95	95	96	97	97	642	56	91	100
8.0 m	This level was not instrumented for relative humidity at this time																												
4.0 m	98	98	98	98	99	98	98	97	93	89	87	84	84	88	90	92	93	96	97	97	97	97	98	98	98	594	68	94	100
2.0 m	98	98	98	98	98	98	98	97	94	91	89	86	86	89	91	93	95	96	97	97	97	97	98	98	98	594	68	95	100
1.0 m	98	98	98	98	98	98	98	98	96	94	91	89	88	91	93	94	95	97	97	97	97	98	98	98	98	594	68	96	100
0.5 m	96	97	96	97	96	97	97	96	95	94	92	91	90	90	91	94	94	95	95	96	96	96	96	96	96	680	75	95	100

46.0 m	95	95	95	95	96	96	95	92	86	81	77	75	75	80	82	84	86	87	89	91	91	91	92	94	94	693	55	89	100
28.5 m	This level was not instrumented for relative humidity at this time																												
26.5 m	96	95	96	96	97	96	96	93	86	81	78	74	74	79	81	84	85	88	91	92	93	93	93	95	95	710	56	89	100
13.5 m	97	97	97	97	97	97	96	92	86	81	76	74	74	78	81	83	86	89	92	93	94	94	94	96	96	712	56	89	100
8.0 m	This level was not instrumented for relative humidity at this time																												
4.0 m	97	97	97	97	97	97	94	87	83	78	75	72	74	79	80	83	86	90	94	94	95	95	96	97	97	682	57	90	100
2.0 m	97	97	97	97	97	97	92	87	83	77	73	72	74	78	79	82	86	90	94	95	95	95	96	97	97	681	56	89	100
1.0 m	This level was not instrumented for relative humidity at this time																												
0.5 m	97	98	98	98	98	98	94	87	82	78	75	74	74	79	81	85	88	92	95	96	97	97	98	98	97	719	57	90	100

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
 SEPTEMBER 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	10	10	10	9	7	6	6	15	25	31	32	34	27	32	29	24	22	23	17	16	12	12	11	10			
	28.5 m								This level was not instrumented for relative humidity at this time																			
	26.5 m	11	12	12	5	5	5	8	16	27	35	39	41	39	43	33	29	29	29	13	13	12	12	7	8			
	13.5 m	4	6	5	4	4	4	4	12	19	29	36	36	39	42	30	27	21	15	14	13	11	9	8	5			
	8.0 m								This level was not instrumented for relative humidity at this time																			
4.0 m	5	7	4	4	4	4	4	7	10	18	22	27	29	32	26	24	21	16	10	8	9	7	6	14	14			
2.0 m	5	5	4	4	4	4	4	7	8	18	19	25	24	32	24	23	11	14	17	8	8	5	6	14	14			
1.0 m	4	4	5	4	4	4	4	6	5	12	14	23	19	32	22	17	11	8	9	8	8	4	6	15	14			
0.5 m	14	15	16	17	17	16	6	6	6	8	12	20	19	19	23	22	20	18	14	18	17	17	17	16	16			

* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	46.0 m	15	9	12	8	12	9	7	14	22	27	37	44	38	37	36	30	26	19	22	16	16	13	12	16			
	28.5 m								This level was not instrumented for relative humidity at this time																			
	26.5 m	14	15	14	13	12	10	10	20	22	22	32	40	31	33	34	27	24	17	16	17	15	14	11	14			
	13.5 m	13	14	12	13	9	9	12	22	21	27	34	40	32	34	37	28	26	20	20	17	18	14	9	15			
	8.0 m								This level was not instrumented for relative humidity at this time																			
4.0 m	8	12	11	8	8	8	8	27	26	26	30	34	37	33	37	36	31	25	19	17	15	13	10	8	8			
2.0 m	8	12	10	8	5	4	4	31	23	27	35	37	36	30	35	29	25	19	16	14	12	6	6	7				
1.0 m								This level was not instrumented for relative humidity at this time																				
0.5 m	8	10	10	14	8	11	15	35	42	32	36	32	37	39	36	28	25	19	16	12	12	7	8	8				

SUMMARY OF METEOROLOGICAL OBSERVATIONS

HOURLY DATA

SEPTEMBER 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)	73.1	72.9	72.7	72.5	72.3	72.4	73.2	75.0	75.9	76.5	77.0	77.0	77.0	76.5	76.3	76.0	75.6	75.1	74.6	74.2	74.2	73.9	73.6	73.3	717	68.0	74.6	80.0
	WB	(2.0 m)	73.1	73.0	72.7	72.5	72.3	72.5	73.1	74.9	76.1	76.8	77.1	77.3	77.3	76.7	76.5	76.2	75.8	75.2	74.7	74.3	74.2	74.0	73.7	73.4	717	68.0	74.7	80.0
	WB	(0.5 m)	73.6	73.4	73.2	73.0	72.9	72.8	72.9	74.4	76.0	76.8	77.5	78.2	78.3	77.3	76.8	76.5	76.2	75.7	75.0	74.7	74.5	74.3	74.1	73.9	711	68.7	75.1	80.9
	BP		.766	.752	.741	.735	.738	.746	.766	.787	.801	.806	.801	.782	.754	.729	.715	.708	.705	.717	.732	.747	.767	.780	.784	.778	720	.620	.756	.875
	P1		0.20	0.13	0.18	0.10	0.01	0.01	0.39	0.15	0.02	0.06	0.12	0.08	0.03	0.57	0.33	0.23	0.15	0.07	0.18	0.37	0.51	0.20	0.11	0.05	70	0.01	15.23	2.55
	P2		0.14	0.04	0.08	0.14	0.01	0.00	0.23	0.07	0.01	0.05	0.07	0.03	0.05	0.52	0.15	0.11	0.04	0.13	0.20	0.31	0.47	0.20	0.04	0.04	57	0.01	9.29	2.20
	P3		0.07	0.11	0.05	0.02	0.01	0.00	0.36	0.12	0.02	0.06	0.10	0.07	0.09	0.75	0.36	0.16	0.02	0.10	0.04	0.26	1.26	0.21	0.06	0.04	63	0.01	17.62	2.50
	P4		0.27	0.12	0.13	0.01	0.00	0.01	0.24	0.10	0.02	0.02	0.07	0.07	0.01	0.79	0.42	0.17	0.07	0.19	0.03	0.43	1.13	0.70	0.13	0.07	57	0.01	12.83	2.80

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Chiva Chiva (Open site)	WB	(4.0 m)	73.0	72.8	72.6	72.4	72.5	72.3	73.7	75.8	76.5	77.0	77.4	77.3	77.6	76.9	76.5	75.6	75.4	75.1	74.5	74.1	73.9	73.6	73.6	73.2	705	67.8	74.7	80.5
	WB	(2.0 m)	72.8	72.6	72.3	72.1	72.2	72.0	73.6	76.0	76.8	77.3	77.6	77.7	78.0	77.0	76.8	75.7	75.5	75.1	74.5	74.1	73.9	73.5	73.4	73.0	704	67.2	74.7	81.2
	WB	(0.5 m)	72.7	72.6	72.3	72.1	72.0	71.9	74.0	76.4	77.4	78.7	79.5	78.9	79.0	78.2	77.2	76.3	75.9	75.5	74.7	74.2	74.0	73.7	73.4	72.9	719	67.0	75.1	85.0
	BP		.855	.840	.831	.829	.836	.845	.863	.882	.898	.903	.899	.878	.845	.827	.813	.804	.800	.811	.827	.841	.860	.875	.878	.871	720	.720	.850	.980
	PS		0.01	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.09	0.09	0.16	0.06	0.08	0.36	0.03	0.07	0.07	0.13	0.26	0.03	0.02	0.00	0.00	0.01	47	0.01	4.72	0.90

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.)

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
SEPTEMBER 1967

Exposure	Site	Monthly Ranges ² 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	
Albrook (Forest site)	WB (4.0 m)	5.6	6.2	6.7	6.3	6.7	7.0	6.1	4.3	5.1	4.9	5.4	5.1	4.6	7.0	7.0	7.0	6.2	5.2	4.2	3.9	6.0	5.4	5.1	5.4	
	WB (2.0 m)	5.7	6.2	6.4	6.0	6.5	7.0	6.0	4.4	4.7	5.2	5.4	5.8	4.7	7.0	6.9	6.8	6.0	5.3	4.1	4.0	5.6	5.2	5.0	5.4	
	WB (0.5 m)	5.2	5.4	6.2	6.5	6.5	6.8	6.6	5.1	4.6	5.5	6.3	6.6	6.8	6.5	7.0	6.8	5.9	5.6	4.6	4.4	5.2	5.2	5.9	5.2	
	BP	.110	.115	.115	.120	.125	.120	.120	.105	.120	.115	.130	.120	.130	.115	.130	.140	.150	.145	.145	.130	.120	.115	.115	.120	
Albrook (Open site)	P1	0.00	0.00	0.26	0.18	0.00	0.00	0.17	0.14	0.02	0.09	0.19	0.06	0.03	2.54	0.84	0.46	0.26	0.25	0.97	1.74	1.97	0.56	0.00	0.07	
	P2	0.00	0.05	0.21	0.00	0.00	0.00	0.05	0.02	0.00	0.08	0.12	0.03	0.03	2.19	0.52	0.37	0.02	0.29	0.36	1.19	1.39	0.00	0.00	0.00	
	P3	0.00	0.19	0.13	0.00	0.00	0.00	0.32	0.20	0.01	0.00	0.24	0.00	0.15	2.49	0.82	0.39	0.04	0.41	0.11	0.99	2.49	0.59	0.00	0.00	
	P4	0.00	0.03	0.15	0.00	0.00	0.00	0.37	0.02	0.03	0.00	0.24	0.06	0.00	2.79	1.04	0.54	0.20	0.43	0.03	1.24	2.24	0.00	0.00	0.00	

* No monthly summary was computed for the ranges.

China Chiva (Open site)	WB (4.0 m)	5.3	5.8	5.9	5.6	6.8	7.0	6.6	4.5	6.2	4.7	5.5	7.9	7.1	9.3	7.0	7.2	6.8	4.8	4.4	4.4	4.7	5.6	5.5	5.0
	WB (2.0 m)	6.0	7.0	6.6	6.5	7.5	7.5	6.7	5.0	6.7	5.2	5.6	8.5	7.0	10.0	7.0	7.5	6.5	5.0	4.5	5.0	5.0	6.0	5.8	5.4
	WB (0.5 m)	5.9	6.6	6.2	6.8	7.5	7.7	6.5	5.4	7.2	8.4	8.7	10.8	7.3	11.0	9.9	7.7	7.0	4.7	5.4	5.2	5.1	5.5	5.7	5.3
	BP	.135	.105	.125	.120	.115	.110	.110	.125	.125	.110	.140	.130	.115	.135	.125	.135	.135	.140	.120	.120	.125	.120	.115	.125
PS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.08	0.13	0.84	0.05	0.14	0.15	0.49	0.74	0.01	0.00	0.00	0.00	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.)

² Monthly ranges of precipitation are computed for precipitation days.

SUMMARY OF METEOROLOGICAL OBSERVATIONS
HOURLY DATA
 SEPTEMBER 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	2	3	4	3	3	3	2	4	4	4	4	5	6	6	6	5	5	4	4	4	4	4	4	3	3	485	0	4	15
	28.5 m	This level was not instrumented for wind speed at this time																												
	26.5 m	1	1	1	1	1	1	1	2	2	2	3	4	4	4	4	3	3	2	2	1	2	2	1	1	1	700	0	2	8
	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	712	0	0	1
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	This level was not instrumented for wind speed at this time																												
28.5 m	This level was not instrumented for wind speed at this time																												
26.5 m	2	2	3	3	3	3	2	4	5	5	5	6	6	8	7	6	6	5	4	3	3	3	3	3	2	551	0	4	18
13.5 m	0	0	1	0	0	1	1	2	2	3	3	4	5	4	4	4	2	2	1	1	1	1	1	1	0	719	0	2	10
8.0 m	This level was not instrumented for wind speed at this time																												
4.0 m	1	1	1	1	2	1	0	2	3	3	4	4	4	3	4	4	2	1	1	1	1	2	1	1	190	0	2	10	
2.0 m	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2	2	2	1	1	1	1	1	1	0	584	0	1	8	
.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
 SEPTEMBER 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	5	9	8	7	8	6	5	5	9	10	9	9	13	13	10	11	11	10	9	10	14	9	9	8	10							
	28.5 m									This level was not instrumented for wind speed at this time																							
	26.0 m	5	5	3	3	3	3	4	4	5	6	6	4	5	7	7	6	6	5	6	4	8	7	5	3	5							
	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	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0					
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																							

* No monthly summary was computed for the ranges.

46.0 m	This level was not instrumented for wind speed at this time																										
28.5 m	This level was not instrumented for wind speed at this time																										
26.0 m	4	7	8	8	7	6	6	6	9	12	8	10	10	18	13	9	12	7	7	6	7	6	7	8	7	7	5
13.5 m	2	6	7	5	3	2	4	4	6	10	6	7	10	9	10	10	10	7	6	4	5	6	6	6	6	4	
8.0 m	This level was not instrumented for wind speed at this time																										
4.0 m	2	3	3	3	4	3	1	1	5	0	6	7	8	6	7	7	8	5	4	5	4	4	4	2	3	3	
2.0 m	0	3	4	3	1	1	2	2	2	2	3	2	3	7	8	5	6	4	3	3	3	3	4	3	4	1	
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) SEPTEMBER 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				3.3	3.3		3.3		3.3	6.7				3.3		10.0	3.3		3.3	3.3	6.7	3.3	3.3	
NNE	3.3	6.7	3.3			10.0							3.4	3.3	3.3			3.3	3.3	3.3				
NE	3.3		3.3	3.3	13.3						6.7	3.3				3.3		3.3	6.7		3.3	3.3	10.0	6.7
ENE				6.7	6.7	3.3	10.0	3.3	3.3		3.3			3.3	3.3					3.3				
E		3.3	3.3	6.7		13.3	3.3	3.3							3.3								3.3	3.3
ESE	3.3								3.3		3.3	6.7		3.3										
SE	10.0		6.7	6.7	3.3			13.3	6.7	6.7	10.0	10.0		3.3		3.3		3.3		3.3		3.3		
SSE		3.3					3.3		6.7	6.7		6.7	13.7	3.3	13.3		3.3	6.7						
S	6.7	13.5	10.0	3.3	10.0	6.7	6.7	6.7	23.3	30.0	30.0	56.7	51.5	43.3	36.7	33.3	26.7	13.3	10.0	10.0	13.3	10.0	6.7	6.7
SSW		3.3	3.3		3.3		6.7	6.7	6.7	6.7	10.0		6.9	6.7		3.3	6.7	10.0				3.3	6.7	
SW	3.3	3.3		6.7		10.0		6.7	6.7	10.0		3.3	6.9		3.3	13.3	3.3	10.0	10.0	10.0	20.0	10.0		6.7
WSW	10.0	6.7	3.3			10.0	3.3	16.7	3.3	10.0	10.0	3.3	6.9	3.3		10.0	10.0	13.3	3.3	3.3	6.7		10.0	10.0
W	10.0	20.0	23.3	13.3	3.3		10.0	6.7	6.7	10.0	16.7		3.4	13.3	6.7	10.0	10.0	10.0	26.7	10.0	13.3	16.7	20.0	13.3
WNW	13.3	10.0	10.0	16.7	16.7	16.7	13.3	16.7	10.0	6.7	3.3		3.4	3.3	16.7		20.0	6.7	3.3	20.0	10.0	10.0	10.0	13.3
NW	10.0	13.3	6.7	3.3	20.0	10.0	6.7	6.7	13.3	3.3		10.0		6.7	6.7	3.3	6.7		6.7	6.7	6.7	13.3	6.7	10.0
NNW	3.3	3.3	6.7	3.3			3.3		3.3		3.3					3.3		3.3						
CALM	23.3	13.3	13.3	26.7	16.7	23.3	26.7	13.3	3.3	3.3	3.3		3.4	3.3	6.7	6.7	10.0	16.7	26.7	20.0	16.7	16.7	23.3	30.0

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

ALBROOK (Forest site) SEPTEMBER 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		10.3	6.9		6.9	3.4	10.3			10.0	6.7			10.0	10.0	6.9				6.7	6.7	6.9	6.9	3.4	
NNE	3.4	6.9	3.4	3.4															3.3	3.3	3.3	6.9			
NE							3.4		6.9	3.3	6.7	3.3			6.7									3.4	
ENE									3.4		3.3														3.4
E			3.4	6.9							3.3			3.3	3.3		3.3								
ESE										10.0		3.3			3.3	3.4									
SE	3.4		3.4		3.4		3.4	3.4	6.9		6.7	3.3	6.9	10.0	3.3	6.9		3.3	3.3				3.4		
SSE				3.4					3.4	3.3	10.0	10.0	24.0	3.3	3.3	3.4	10.0								
S	3.4	3.4	6.9		3.4	3.4	10.3	10.3	20.6	26.7	23.3	50.0	44.6	40.0	26.7	24.0	16.7	20.0	3.3	6.7	6.7	3.4	3.4	3.4	
SSW					3.4					3.3	6.7	3.3		3.3	6.7	6.9	3.3	3.3							
SW								24.0		3.3	6.7	6.7			6.7	3.4	6.7			3.3	3.3			3.4	
WSW					3.4				6.9	3.3		3.3			3.3	3.4		6.7			3.3	3.4			
W			3.4		3.4	3.4		3.4	6.9	6.7	3.3			6.7	3.3	3.4	3.3	10.0	6.7	6.7	3.3			6.9	3.4
WNW	10.3	3.4		10.3		10.3	10.3	13.7	3.4	3.3	6.7	6.7	13.7	6.7		3.4	3.3	6.7	10.0	6.7	6.7	10.3			6.9
NW	3.4	17.2	10.3	10.3	20.6	13.7	10.3	3.4	6.9	13.3	16.7			10.0	16.7	13.7	26.7	20.0	30.0	16.7	20.0	17.2	13.7	10.3	
NNW	10.3	3.4	13.7	13.7	6.9	17.2	6.9	17.2	17.2	3.3		10.0	6.9	3.3	3.3	13.7	20.0	10.0	3.3	10.0	10.0	10.3	13.7	13.7	
CALM	65.2	54.9	48.1	51.5	48.1	48.1	44.6	20.6	17.2	10.0			3.4	3.3	3.3	6.9	6.7	20.0	40.0	40.0	43.3	34.1	51.5	61.9	

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

ALBROOK (Forest site) SEPTEMBER 1967

Relative Frequency* of Wind Directions by Hour at 4.0 m.

(%)

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											
NNE																									
NE																									
ENE												6.7													
E																									
ESE								3.3																	
SE																									
SSE																									
S																									
SSW									3.3			3.3													
SW							3.3																		
WSW																									
W										3.3															
WNW											3.3		3.3												
NW																									
NNW										3.3															
CALM	100.0	100.0	100.0	100.0	100.0	100.0	96.7	96.7	96.7	93.3	96.7	96.3	90.0	96.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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

CHIVA CHIVA (Open site) SEPTEMBER 1967

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

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	14.8	3.7	14.8	7.4	25.9	7.4	14.8	14.8	22.2	22.2	11.1	7.4	3.7	14.8	7.2	14.2	7.2	7.2	7.4	18.5	18.5	14.8	25.0	3.7
NNE		14.8	11.1	3.7	7.4	7.4	3.7	7.4	11.1			3.7	3.7		10.7	3.5	14.2	3.5	11.1	11.1		14.8	7.4	
NE	3.7	3.7	3.7	7.4		7.4	7.4			7.4	7.4	3.7		3.7		7.2	7.2	3.5	3.7		3.7	3.7	3.7	3.7
ENE		3.7		3.7		7.4			3.7						3.5				3.7	7.4		3.7	7.4	
E		3.7	7.4		3.7		3.7		3.7		3.7		3.7					3.5			11.1	3.7		
ESE	3.7		7.4	11.1	7.4		3.7	3.7					3.7	7.4	7.2		3.5				3.7	3.7		11.1
SE			3.7		3.7			11.1	7.4	11.1	3.7	7.4		7.4	7.2	3.5	7.2	3.5			3.7	7.4		
SSE		7.4				3.7			3.7	3.7	11.1	3.7		7.4	7.2	7.2	3.5	7.2	7.4	3.7			3.7	3.7
S	7.4	7.4	7.4			7.4	11.1	14.8	33.3	37.0	37.0	44.4	59.2	48.1	24.9	24.9	17.9	17.9	22.2	7.4				
SSW								3.7				3.7	3.7			7.2	7.2				3.7			
SW						3.7										7.2		7.2	3.7			3.7	3.7	3.7
WSW		7.4				7.4		3.7						3.7					3.7	3.7	3.7	3.7	3.7	3.7
W	7.4	3.7				7.4	7.4	3.7	11.1		7.4	3.7			3.5			10.7			7.4	3.7	7.4	7.4
WNW	25.9	7.4	14.8	14.8	14.8	11.1			3.7		3.7	11.1	7.4		14.2	7.2	7.9		7.4	7.4			7.4	11.1
NW	18.5	11.1	18.5	11.1	11.1	18.5	11.1	14.8	3.7	7.4	7.4		7.4	3.7	14.2	7.2	10.7	18.6	18.5	11.1	29.6	29.6	14.8	25.9
NNW	7.4	11.1	3.7	7.4		7.4		3.7		7.4		7.4	3.7	7.4		10.7	3.5	7.2	11.1	14.8	7.4	3.7	7.4	18.5
CALM	11.1	14.8	7.4	11.1	11.1	3.7	40.7	11.1	7.4	3.7	7.4	3.7	3.7								3.7	7.4	7.4	7.4

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

CHIVA CHIVA (Open site) SEPTEMBER 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	3.3	10.0	6.7	10.0	10.0	10.0	3.3	10.3	6.9	3.4	10.3	10.3	3.4	12.3	13.3	3.3	3.3	13.3	10.0		10.0	6.7	10.0	
NNE	3.3		10.0	13.3	6.7	6.7							3.4	3.4	3.3	6.7	10.0			10.0	6.7	3.3	3.3	6.7	
NE	20.0	6.7	13.3	13.3	6.7	6.7	3.3	3.3	3.4				3.4	3.4				3.3	6.7	16.7	10.0	13.3	3.3	13.3	
ENE	6.7	10.0	10.0	3.3		6.7		6.7					3.4		3.3	3.3		3.3	3.3	6.7	3.3		10.0	6.7	
E	6.7	6.7		3.3	3.3			3.3	10.3	10.3	13.7			6.9	3.3	3.3		3.3			3.3	3.3	3.3	6.7	3.3
ESE				3.3	6.7			3.3	3.4	6.9		6.9			3.3		6.7		6.7	6.7	6.7	3.3			3.3
SE	3.3	3.3	6.7			6.7			6.9		13.7	10.3	3.4	13.7	10.0	6.7	13.3	6.7				3.3	3.3	3.3	
SSE	3.3	3.3	3.3		3.3	3.3			3.4	6.9	3.4			3.4	13.3	16.7	3.3	10.0	10.0		3.3				
S		6.7		6.7	3.3	3.3	13.3	16.7	24.0	41.2	27.5	41.2	54.9	44.6	16.7	20.0	13.3	6.7	10.0	6.7	3.3		10.0		
SSW								3.3				3.4			3.3			6.7						3.3	
SW	3.3	6.7			6.7	3.3					3.4				3.3		3.3				6.7	6.7	10.0	10.0	
WSW			3.3	3.3		10.0	3.3	6.7	3.4			3.4	3.4		6.7	6.7	6.7	6.7	6.7	3.3	3.3		3.3	6.7	
W	10.0	6.7	3.3		6.7	6.7	13.3			3.4		3.4	10.3	6.9	13.3	3.3	3.3	10.0	6.7	6.7	10.0	13.3		10.0	
WNW	13.3	6.7		6.7	6.7	10.0		6.7	3.4	3.4	6.9	10.3		3.4	3.3	16.7	13.3	16.7	10.0	6.7	10.0	13.3	13.3	3.3	
NW	16.7	6.7	26.7	13.3	10.0	10.0	6.7	20.0	13.7	10.3	10.3	6.9	3.4	10.3	6.7		6.7	16.7	13.3	10.0	23.3	16.7	16.7	16.7	
NNW	6.7	16.7	10.0	13.3	10.0	10.0	3.3	10.0	6.9		10.3					3.3	6.7		6.7	10.0		3.3	6.7	3.3	
CALM	6.7	6.7	10.0	10.0	13.3	6.7	46.7	16.7	10.3	10.3	6.9	3.4	3.4				6.7	6.7	6.7	6.7	10.0	10.0	6.7	3.3	

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

SEPTEMBER 1967

SUMMARY OF NON HOURLY DATA

SEPTEMBER 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)	WBGT Index ¹ (at 1.0 meters)	Index value	419	68.2	76.7	81.5
		Dry bulb temp.	419	58.0	77.5	86.2
		Wet bulb temp.	419	68.0	76.2	80.8
		Black bulb temp.	419	68.8	78.0	88.2
	Evaporation ³ (in. at 4 levels)	Piche (46.0)	30	0.024	5.573*	0.360
		Piche (26.5)	29	0.024	3.879*	0.244
		Piche (13.5)	28	0.006	1.177*	0.104
		Piche (0.5)	23	0.006	0.611*	0.104
	Precipitation from Raingauge Network ² (in. at 1.0 meters)	Gauge # 1	31	0.01	12.62*	3.15
		Gauge # 2	31	0.01	17.98*	4.72
Gauge # 3		31	0.01	16.88*	3.95	
Gauge # 4		31	0.01	14.49*	3.87	
Gauge # 5		30	0.01	13.79*	3.25	
Gauge # 6		33	0.01	14.00*	3.48	
Gauge # 7		33	0.01	12.75*	3.15	
Gauge # 8		29	0.01	14.14*	3.51	
Stem Flow ² (in. at 2.0 meters)	Small tree	24	0.01	5.07*	0.99	
	Medium tree	25	0.01	4.75*	0.93	
	Large tree	21	0.01	33.54*	11.00	
Chiva Chiva (Open site)	WBGT Index ¹ (at 1.0 meters)	Index value	420	66.9	79.8	90.9
		Dry bulb temp.	420	67.0	80.3	99.0
		Wet bulb temp.	420	67.0	77.9	86.5
		Black bulb temp.	420	66.5	90.0	120.6
	Evaporation ³ (in. at 0.5 meters)	Piche	26	0.012	3.525*	0.281
		Pan	20	0.046	4.471*	1.893
Minimum Grass temp ³ (°F at grass tips)	None	25	62.5	69.8	78.0	

1 - Hourly observations between 0600 and 1900 hours inclusive

2 - Six hourly observations

3 - Daily observations

*Total Values

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13. ABSTRACT			
<p>This report contains detailed microclimatic data for September 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.</p>			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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