

APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND

Research Program No. 54
EXPOSURE TESTING (STUDY OF MATERIAL DETERIORATION)

Sponsored by
ADVANCED RESEARCH PROJECTS AGENCY (ARPA)
U. S. DEPARTMENT OF DEFENCE

Conducted by
ENVIRONMENTAL AND ECOLOGICAL RESEARCH INSTITUTE
of
APPLIED SCIENTIFIC RESEARCH CORPORATION OF THAILAND
UNDER ARPA CONTRACT DAJB 29-70-C-0086
TASK 3-1

With the co-operation of
MILITARY RESEARCH AND DEVELOPMENT CENTER (MRDC)

Interim Report Nos. 1, 2, and 3 Combined

TEXTILES

by

Kaew Nualchawee

William Prewett

ASRCT, BANGKOK, 1972



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SUMMARY

Samples of six varieties of military cloth were subjected to exposure, above the ground, on racks in evergreen forest and in a forest clearing in North-East Thailand with the purpose of assessing their deterioration under such conditions. Similar samples were also stored in buildings near the exposure sites to assess their shelf life.

Samples were withdrawn from exposure for testing at intervals of three months, the tests made being, measurement of tensile strength and elongation at break in the directions of warp and of filling, total mold count and assessment of colour change.

Results of the tests show that, so far, the samples stored under cover have deteriorated little if at all and, more surprisingly, the samples exposed in the forest, after nine months in that environment, have also deteriorated very little. Samples exposed in the clearing deteriorated seriously over nine months both in tensile strength and in colour. Samples exposed at both sites rapidly became densely populated by mold. However, the endurance of the strength and colour of the samples at the forest site seems to indicate that the species of mold present did not have any destructive action on the cloth. (It is possible that some destructive species might have been active at the clearing but not in the forest.) It seems that actinic destruction by direct sunlight was the most significant cause of colour fading and loss of strength.

FOREWORD

The work reported herein is part of a research program called "Exposure Testing" or "Study of Material Degradation". This program is sponsored by the Advanced Projects Research Agency ("ARPA"), which is an agency of the Government of the United States of America, under ARPA contract No. DAJB 29-7-C-0086 and modification number DAJB 29-70-C-0086-P00003. The establishment of exposure testing facilities and performing of the program by the Applied Scientific Research Corporation of Thailand is done in cooperation with Military Research and Development Center (MRDC). MRDC acts as the medium in determining the Royal Thai Armed Services requirements and establishing test priorities in consonance with ARPA to develop MRDC R & D management capability. Under this cooperation, the Royal Thai Government Agencies will supply ASRCT with test materials along with their test requirements. According to priorities, ASRCT then performs the exposure tests on the selected materials with in its own capability. This will open a valuable link to the knowledge of material degradation in Southeast Asian tropics.

INTRODUCTION

This report concerns exposure and testing, under the terms set out in the "Foreword" of samples of military cloth. Six varieties of cloth for test have been provided by the Clothing Organisation of Thailand.

It was originally proposed that interim reports should be written on each occasion of the withdrawal of cloth samples from test exposure. It was not possible to write any report before the completion of tests on samples of the third withdrawal, so, in the interests of conciseness, this is a combined report covering the material of the first, second and third withdrawals.

MATERIALS, METHODS OF EXPOSURE, TESTS,

METEOROLOGY AND IDENTIFICATION

MATERIALS

Six varieties of cloth are being tested. These varieties have been produced as military clothing materials. They are as follows:

<u>Sample</u>	<u>Projects Identification Code</u>
(1) Pure cotton, olive drab twill	1-1-1
(2) Pure cotton, khaki twill	1-1-2
(3) Pure cotton, plain weave, khaki cloth	1-2-1
(4) Pure cotton, plain weave, white cloth	1-2-2
(5) 65 % polyester, 35 % cotton, plain weave, blue cloth	1-2-3
(6) 65 % polyester, 35 % cotton, plain weave, olive drab cloth	2-1-1

These samples have all been given "finishing treatments" but none of them has been intentionally treated to give it biocidal properties, (which latter would have been done with the purpose of protecting it from decay or attack by vermin).

METHODS OF EXPOSURE

At the outset of the exposure period, samples of each of the six varieties of cloth provided were emplaced for storage (for studying their shelf life) or exposure at each of five locations at the Sakaerat Experiment Station. The five locations and the conditions of exposure or storage are as follows:

- (1) Air conditioned room; Control samples were stored, loosely folded, in open polythene bags in an air conditioned room where humidity and temperature were prevented from reaching values as high as the ambient values.
- (2) Cleared site depot; Storage test samples were placed (also loosely folded in open polythene bags) on a shelf in a well ventilated, wooden hut (hereafter referred to as the "cleared site depot") in a jungle

Tests of the following qualities were made:-

- (1) Tensile strength and elongation at break in the directions of warp and of filling,
- (2) Mold infestation (counted),
- (3) Colour (as assessed by Lovibond "tintometer").

Unexposed samples were tested at the outset of the exposure period and samples from each of the five locations were tested after exposure (or storage). Rain fell on the nights previous to the first and second withdrawals. On both occasions, samples from the racks were hung out to dry within a few hours of withdrawal.

- (1) Tensile strength and elongation at break tests; An "Instron" tensile strength tester was employed for making tests.

Sample preparation Five strips were cut from each sample, for testing strength in the direction of warp and five more were cut (in the appropriate direction) for testing in the direction of the filling. The sides of each strip were unravelled until a one inch wide band of unbroken treads remained. Prior to testing on the "Instron" these strips were preconditioned for at least 48 hours to a relative humidity of 65 % to 66 % and a temperature as near 27°C as possible. The average results, for each set of five pieces, of breaking strain and extension at break, are presented in Table 1 to 6 inclusive.

- (2) Mold count; Twenty, one-centimetre squares were cut from each sample and ten of the cut squares were placed on nutrient again each of two Petri dishes.^{*} After the elapse of several days, the cloth squares were examined for mold growth. The number of squares showing any infection was recorded. Results are presented in the top halves of tables 7 to 12 inclusive.

* Tests made before exposure were apparently not made as outlined above. Table 13 shows the results reported for the unexposed samples. These results have been used to calculate the most probable values for the results which would have been obtained had the samples been measured in the same manner as subsequent batches. The estimates obtained are also presented in Table 13. Estimates have been made of the population densities most probably represented by the reported results. These estimates are shown in the bottom halves of Tables 7 to 12.

- (3) Colour assessment; The colour of both sides of each sample was assessed using a Lovibond "Tintometer" in the manner prescribed by the manufacturer. All samples were measured against magnesium carbonate blocks provided by the manufacturer as a white reference material. The magnesium carbonate was found to be measurably dull and yellowish in comparison with the white cloth specimen (1-2-2). For this reason, samples of specimen 1-2-2 were also measured against unexposed portions of itself and very much faded samples of the other specimens were also measured against unexposed 1-2-2. Results are presented in Tables 15 to 45.

METEOROLOGY

Concurrently with the exposure and storage of test samples, meteorological observations are being made at the exposure sites, those reported covering the period September, 1971 to June, 1972, this being the interval between the outset of exposure and the third withdrawal. The following observations are reported under "results and discussion".

- (1) Daily maximum and minimum temperature and relative humidity as recorded by Lambrecht "Thermohygrograph". Values recorded inside and outside the depots at the cleared site and the jungle site are reported graphically as degrees Fahrenheit and as percent.
- (2) Daily rainfall as recorded by Belfort recording rain gauge. Values recorded at the cleared site and the jungle site are reported in millimetres.
- (3) Daily sunshine duration as recorded by Campbell-Stokes sunshine recorder. Values recorded at the cleared site are reported graphically in hours.

IDENTIFICATION OF SAMPLES

The samples are labelled with a code consisting of a succession of figures and letters occupying nine positions. Reading from the left, these are as follows:

Positions 1, 2, 3, 4, 5 and 6

These positions are occupied successively by an Arabic figure, a dash, a second Arabic figure, another dash, a third Arabic figure and another

dash. Together, the three Arabic figures indicate the nature of the sample as already described under "Materials and Testing" on page.

Position 7

A Roman figure indicating the position of the sample during exposure or storage as follows:

<u>Figure occupying position 7 in the code</u>	<u>Location of exposure or storage indicated</u>
0	at the air conditioned room
I	at the cleared site
II	at the jungle site
-	not stored or exposed but tested when first received.

Position 8

A lower case letter indicating whether the sample was exposed on the racks or housed during the exposure period.

<u>Letter occupying position 8 in the code</u>	<u>Condition of exposure</u>
a	housed
b	exposed on the racks
-	not housed or exposed but tested when first received.

Position 9

Upper case letter indicating the time of withdrawal.

<u>Letter occupying position 9 in the code</u>	<u>Withdrawal No.</u>	<u>Date of withdrawal</u>	<u>period of exposure or storage</u>
0	inapplicable	inapplicable	none
A	first	27 Dec. 1971	3 months
B	second	27 March 1972	6 months
C	third	27 June 1972	9 months

RESULTS

Results of observations, tests and measurements are presented below in the following order:-

- First - Results of tensile strength tests,
- Second - Mold counts,
- Third - Colour assessments,
- Fourth - Meteorological data.

In the second, third and fourth categories, the tables or graphs are preceded by an explanation.

The following is a list showing the order in which results are presented.

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Results of Tensile Strength Tests

Table 1

Olive drab twill (1-1-1)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
Olive drab twill "	Air- cond. room "	Outset, (--0)	64.6	35.8	12.7	15.8
		First, (OaA)	65.9	35.3	12.2	15.7
		Second, (OaB)	64.4	35.5	13.0	15.0
		Third, (OaC)	64.2	32.1	12.8	15.0
Olive drab twill "	Cleared site depot "	Outset, (--0)	64.6	35.8	12.7	15.8
		First, (IaA)	66.8	35.3	13.1	15.6
		Second, (IaB)	64.8	35.9	13.0	15.5
		Third, (IaC)	65.1	36.0	13.2	15.6
Olive drab twill "	Cleared site racks "	Outset, (--0)	64.6	35.8	12.7	15.8
		First, (IoA)	49.1	30.3	16.5	12.1
		Second, (IoB)	27.0	13.5	13.9	10.0
		Third, (IoC)	22.0	11.5	13.8	8.8
Olive drab twill "	Jungle site depot "	Outset, (--0)	64.6	35.8	12.7	15.8
		First, (IIaA)	66.0	35.5	12.7	15.1
		Second, (IIaB)	64.8	33.2	12.6	16.2
		Third, (IIaC)	62.7	35.2	13.6	14.7
Olive drab twill "	Jungle site racks "	Outset, (--0)	64.6	35.8	12.7	15.8
		First, (IIoA)	52.1	36.5	14.9	14.2
		Second, (IIoB)	63.9	37.5	17.1	15.3
		Third, (IIoC)	61.2	36.3	17.5	14.1

Table 2

Khaki twill (1-1-2)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
Khaki twill	Air- cond.	Outset, (--0)	58.5	37.5	11.4	12.8
"	room	First, (OaA)	60.3	38.7	11.7	12.3
"	"	Second, (OaB)	59.3	38.3	11.8	12.8
"	"	Third, (OaC)	58.9	37.7	11.8	13.0
Khaki twill	Cleared site	Outset, (--0)	58.5	37.5	11.4	12.8
"	depot	First, (IaA)	60.8	41.6	12.0	13.8
"	"	Second, (IaB)	60.6	36.9	11.8	12.4
"	"	Third, (IaC)	56.8	37.5	11.4	12.9
Khaki twill	Cleared site	Outset, (--0)	58.5	37.5	11.4	12.8
"	racks	First, (IoA)	47.3	32.8	13.8	11.0
"	"	Second, (IoB)	28.5	25.9	12.6	9.8
"	"	Third, (IoC)	15.8	11.1	10.8	7.3
Khaki twill	Jungle site	Outset, (--0)	58.5	37.5	11.4	12.8
"	depot	First, (IIaA)	61.3	40.9	11.8	13.4
"	"	Second, (IIaB)	60.4	39.7	12.3	13.0
"	"	Third, (IIaC)	59.8	33.8	12.1	12.4
Khaki twill	Jungle site	Outset, (--0)	58.5	37.5	11.4	12.8
"	racks	First, (IIoA)	62.3	42.0	14.2	13.5
"	"	Second, (IIoB)	60.2	37.9	14.5	13.1
"	"	Third, (IIoC)	52.0	35.8	13.9	12.3

Table 3

Khaki Cloth (1-2-1)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
Khaki cloth	Air- cond.	Outset, (--0)	49.9	20.6	13.6	7.4
"	room	First, (OaA)	49.1	21.0	13.4	7.3
"	"	Second, (OaB)	49.0	22.1	13.0	7.6
"	"	Third, (OaC)	47.6	20.8	13.8	7.7
Khaki cloth	Cleared site	Outset, (--0)	49.9	20.6	13.6	7.4
"	depot	First, (IaA)	47.2	21.8	13.4	7.9
"	"	Second, (IaB)	49.0	23.7	14.0	7.8
"	"	Third, (IaC)	49.3	19.3	13.9	7.9
Khaki cloth	Cleared site	Outset, (--0)	49.9	20.6	13.6	7.4
"	racks	First, (IoA)	36.5	10.7	15.8	6.4
"	"	Second, (IoB)	17.5	5.2	15.0	6.0
"	"	Third, (IoC)	13.5	3.3	14.4	4.3
Khaki cloth	Jungle site	Outset, (--0)	49.9	20.6	13.6	7.4
"	depot	First, (IIaA)	48.9	21.8	13.6	7.4
"	"	Second, (IIaB)	50.8	21.9	13.8	7.7
"	"	Third, (IIaC)	49.9	20.7	14.0	8.0
Khaki cloth	Jungle site	Outset, (--0)	49.9	20.6	13.6	7.4
"	racks	First, (IIoA)	45.4	22.8	16.9	7.2
"	"	Second, (IIoB)	46.8	24.0	17.2	7.9
"	"	Third, (IIoC)	49.8	24.6	17.9	7.9

Table 4

White Cloth (1-2-2)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
White cloth	Air- cond.	Outset, (--O)	49.5	20.7	12.6	6.1
"	room	First, (0aA)	46.1	20.4	12.0	6.1
"	"	Second, (0aB)	48.0	18.5	12.9	5.6
"	"	Third, (0aC)	47.6	17.5	12.6	5.8
White cloth	Cleared site	Outset, (--O)	49.5	20.7	12.6	6.1
"	depot	First, (IaA)	47.7	20.5	13.1	6.2
"	"	Second, (IaB)	46.6	18.8	12.6	6.0
"	"	Third, (IaC)	47.1	18.6	12.6	6.0
White cloth	Cleared site	Outset, (--O)	49.5	20.7	12.6	6.1
"	racks	First, (IoA)	42.0	11.0	17.8	6.2
"	"	Second, (IoB)	37.8	10.0	18.0	6.0
"	"	Third, (IoC)	32.5	9.2	17.1	5.4
White cloth	Jungle site	Outset, (--O)	49.5	20.7	12.6	6.1
"	depot	First, (IIaA)	48.0	20.3	13.0	6.2
"	"	Second, (IIaB)	48.6	18.3	12.3	6.0
"	"	Third, (IIaC)	47.2	18.5	12.8	6.1
White cloth	Jungle site	Outset, (--O)	49.5	20.7	12.6	6.1
"	racks	First, (IIoA)	50.7	21.4	16.2	6.4
"	"	Second, (IIoB)	50.6	22.1	18.2	6.4
"	"	Third, (IIoC)	49.3	21.9	18.4	7.1

Table 5

Blue Cloth (1-2-3)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
Blue cloth	ir- cond.	Outset, (--0)	63.5	25.3	25.3	22.9
"	room	First, (0aA)	61.6	24.0	25.9	23.8
"	"	Second, (0aB)	60.8	24.1	24.8	23.9
"	"	Third, (0aC)	60.3	23.5	25.3	23.0
Blue cloth	Cleared site	Outset, (--0)	63.5	25.3	25.3	22.9
"	depot	First, (IaA)	50.4	19.1	21.5	22.7
"	"	Second, (IaB)	51.1	18.7	21.8	22.7
"	"	Third, (IaC)	50.3	19.8	21.5	20.9
Blue cloth	Cleared site	Outset, (--0)	63.5	25.3	25.3	22.9
"	racks	First, (IoA)	41.1	16.1	14.1	13.2
"	"	Second, (IoA)	31.9	12.8	12.2	11.3
"	"	Third, (IoC)	22.5	8.6	10.8	7.4
Blue cloth	Jungle site	Outset, (--0)	63.5	25.3	25.3	22.9
"	depot	First, (IIaA)	52.7	21.2	22.8	23.8
"	"	Second, (IIaB)	52.2	21.5	22.1	23.8
"	"	Third, (IIaC)	57.3	19.5	24.1	21.8
Blue cloth	Jungle site	Outset, (--0)	63.5	25.3	25.3	22.9
"	rack	First, (IIoA)	49.2	19.0	21.0	18.8
"	"	Second, (IIoB)	49.8	20.2	21.5	16.8
"	"	Third, (IIoC)	50.4	20.6	21.2	17.3

Table 6

Olive drab Cloth (2-1-1)

Sample	Site	Withdrawal and code	Average Breaking load (Kg. per in.)		Average Elongation at break (%)	
			Warp	Filling	Warp	Filling
Olive drab cloth "	Air- cond. room "	Outset, (--0)	64.0	26.2	30.6	21.6
		First, (OaA)	66.1	26.3	30.8	20.9
		Second, (OaB)	65.2	26.8	30.9	22.3
		Third, (OaC)	64.6	28.3	31.1	23.1
Olive drab cloth "	Cleared site. depot "	Outset, (—0)	64.0	26.2	30.6	21.6
		First, (IaA)	65.7	28.2	30.4	22.2
		Second, (IaB)	64.6	29.7	31.4	23.2
		Third, (IaC)	63.2	28.8	31.4	22.1
Olive drab cloth "	Cleared site racks "	Outset, (--0)	64.0	26.2	30.6	21.6
		First, (IoA)	37.5	16.0	17.8	12.2
		Second, (IoB)	24.1	10.4	13.9	8.1
		Third, (IoC)	14.3	6.3	10.5	6.4
Olive drab cloth "	Junglo site, depote "	Outset, (—0)	64.0	26.2	30.6	21.6
		First, (IIaA)	66.1	27.2	31.9	21.7
		Second, (IIaB)	65.3	29.0	31.4	23.1
		Third, (IIaC)	64.4	28.0	31.4	23.1
Olive drab cloth "	Jungle site racks "	Outset, (—0)	64.0	26.2	30.6	21.6
		First, (IIoA)	63.8	28.5	31.0	22.1
		Second, (IIoB)	62.5	28.3	29.7	21.8
		Third, (IIoC)	59.8	27.3	28.6	20.8

Results of Mold Tests

Table 7,8,9,10,11,12,13 & 14

Results for each of the six specimens are presented in six separate tables.

When the specimens were tested before exposure, counts were, apparently, made in terms of density (reported as "colonies per 100 inch²"). Subsequent tests were made by counting how many, out of twenty pieces of cloth, showed any infection, each piece being one square centimetre in area.

On the assumption that, on average, the frequency of non-infection varies as the inverse exponential of population density, an attempt has been made to correlate these two modes of counting, as follows:

$$1 - \frac{P}{100} = e^{-d}$$

where, "P" is the percentage frequency occurrence of mold in one centimetre squares of sample,

and "d" is the density of population expressed as colonies per square centimetre,

and "e" is the natural base of logarithms.

The third column of each table is headed firstly "Expressed as:-" followed by "& "m" or "e" ". Under this heading, the entry "frequency" means percentage frequency occurrence of mold in one centimetre square of sample and the entry "density" means density of population expressed as colonies per 100 square centimetres of sample. "m" indicates mmeasurements, "e" indicates estimates made from measurements using the exponential formula shown above. Estimates of frequency are rounded off to the nearest 5%. Estimates of density are rounded off to show precision not finer than $\frac{1}{16}$. This precision is still unrealistically fine.

"inf." entered as an estimated density corresponds to 100% measured frequency and indicates a density probably in excess of 350 colonies per 100 cm².

The second column of table 13 shows mold counts made before exposure as they were originally reported in "colonies per 100 in²".

Table 14 shows numbers of visible mold spots observed on samples withdrawn from the depots and control room on 27, June, 1972 (third withdrawal).

Results of Mold Counts

Table 7

Sample:- Pure Cotton, Olive drab Twill, Code No. (1-1-1)

Withdrawal and Code	Storage or Exposure Period	Expressed as:- & "m" or "e"		Control Room (0)	Cleared Site		Jungle Site	
					Depot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	30	30	30	30	30
First, A	3 months	"	m	0	0	100	0	100
Second, B	6 months	"	m	10	0	100	10	100
Third, C	9 months	"	m	10	10	100	5	100
Outset, O	None	density	m	37	37	37	37	37
First, A	3 months	"	e	0	0	inf.	0	inf.
Second, B	6 months	"	e	11	0	inf.	11	inf.
Third, C	9 months	"	e	11	11	inf.	5	inf.

Table 8

Sample:- Pure Cotton, Khaki Twill, Code No. (1-1-2)

Withdrawal and Code	Storage or Exposure Period	Expressed as:- & "m" or "e"		Control Room (0)	Cleared Site		Jungel Site	
					Depot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	35	35	35	35	35
First, A	3 months	"	m	0	40	100	5	80
Second, B	6 months	"	m	10	0	100	0	100
Third, C	9 months	"	m	0	0	100	0	100
Outset, O	None	density	m	46	46	46	46	46
First, A	3 months	"	e	0	50	inf.	5	160
Second, B	6 months	"	e	11	0	inf.	0	inf.
Third, C	9 months	"	e	0	0	inf.	0	inf.

Results of Mold Tests

Table 9

Sample:- Pure Cotton, Plain Weave, Khaki Cloth, Code No. (1-2-1)

Withdrawal and Code	Storage or Exposure Period	Expressed as:- & "m" or "e"		Control Room (O)	Cleared Site		Jungle Site	
					Depot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	10	10	10	10	10
First, A	3 months	"	m	0	0	100	5	10
Second, B	6 months	"	m	10	0	100	0	100
Third, C	9 months	"	m	30	5	100	5	100
Outset, O	None	density	m	9	9	9	9	9
First, A	3 months	"	e	0	0	inf.	5	11
Second, B	6 months	"	e	11	0	inf.	0	inf.
Third, C	9 months	"	e	35	5	inf.	5	inf.

Table 10

Sample:- Pure Cotton, Plain Weave, White Cloth, Code No. (1-2-2)

Withdrawal and Code	Storage or Exposure Period	Expressed as:- & "m" or "e"		Control Room (O)	Cleared Site		Jungle Site	
					Depot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	5	5	5	5	5
First, A	3 months	"	m	0	0	100	0	15
Second, B	6 months	"	m	5	0	100	0	100
Third, C	9 months	"	m	0	5	100	20	100
Outset, O	None	density	m	6	6	6	6	6
First, A	3 months	"	e	0	0	inf.	0	16
Second, B	6 months	"	e	5	5	inf.	0	inf.
Third, C	9 months	"	e	0	5	inf.	22	inf.

Results of Mold Tests

Table 11

Sample:- Polyester & Cotton, Plain Weave, Blue Cloth, Code No. (1-2-3)

Withdrawal and Code	Storage or Exposure Period	Expressed as:- & "m" or "e"		Control Room (0)	Cleared Site		Jungle Site	
					Dépot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	20	20	20	20	20
First, A	3 months	"	m	0	0	100	0	100
Second, B	6 months	"	m	15	0	100	20	100
Third, C	9 months	"	m	15	10	100	0	100
Outset, O	None	density	m	22	22	22	22	22
First, A	3 months	"	e	0	0	inf.	0	inf.
Second, B	6 months	"	e	16	0	inf.	22	inf.
Third, C	9 months	"	e	16	11	inf.	0	inf.

Table 12

Sample:- Polyester & Cotton, Plain Weave, Olive drab, Cloth, Code No. (2-1-1)

Withdrawal and Code	Storage or Exposure Peirod	Expressed as:- & "m" or "e"		Control Room (0)	Cleared Site		Jungle Site	
					Depot (Ia)	Racks (Io)	Depot (IIa)	Racks (IIo)
Outset, O	None	frequency	e	55	55	55	55	55
First, A	3 months	"	m	15	0	100	0	100
Second, B	6 months	"	n	20	0	100	0	100
Third, C	9 months	"	m	10	0	100	0	100
Outset, O	None	density	m	74	74	74	74	74
First, A	3 months	"	e	16	0	inf.	0	inf.
Second, B	6 months	"	e	22	0	inf.	0	inf.
Third, C	9 months	"	e	11	0	inf.	0	inf.

Results of Mold Counts

Table 13

Tests Made Before Exposure

Specimen and Code	Mold count reported (colonies ₂ per 100 in ²)	Mold count recalculated as colonies ₂ per 100 cm ²	Rounded off recalculated in tables Nos.	Estimated frequency (% is cm ²)
Olive drab twill (1-1-1)	240	37.2	37	30
Khaki twill (1-1-2)	300	46.5	46	35
Plain weave, khaki cloth (1-2-1)	60	9.3	9	10
Plain weave, white cloth (1-2-2)	40	6.2	6	5
Plain weave, blue cloth (1-1-3)	140	21.7	22	20
Plain weave, olive drab cloth (2-1-1)	480	74.4	74	55

Table 14

Direct Observation of Mold Spots on Samples of the Third Withdrawal from it
Depots and Control Room

Sample and Code	Site of Exposure or Storage	Mold Count Expressed as Spots per Square Foot
Plain weave, khaki cloth,	Air-conditioned control room	50
"	Cleared site depot	20
"	Jungle site depot	20

RESULTS OF ASSESSMENT OF COLOUR CHANGES

Explanation of the terms used in the tables

"Measured against"

The entry "Magnesium carbonate" or " MgCO_3 " means that the colour was assessed by comparison with the magnesium carbonate blocks supplied for the purpose by the manufacturer.

The entry "control" or "(1-2-2)" indicates a measurement made using an unexposed portion of white cloth sample, code No. 1-2-2, as reference material.

"Side of cloth"

The entry "twill" means the side of the cloth showing the diagonal lination characteristic of twill cloth.

The entry "in" means the other side of twill cloth which is usually worn on the inside.

The entry "top" means the side that was exposed uppermost on the racks at the cleared site.

The entry "under" means the side of the cloth which was underneath during exposure on the racks at the cleared site.

"Matching slides"

The entries, in the three or four columns under this heading, show the numerical values of the combination of coloured glass slides assembled to make a colour match. The values might, roughly, be proportional to the "reflective optical densities" with respect to each of the three colours matched.

The letters "R", "Y" & "B" stand for red, yellow and blue respectively. The entry "-ve grey" indicates neutral grey slides placed in the beam from the test sample. (The coloured slides are placed in the beam from the white reference material.)

"Lovibond colour"

This term is used to represent the quasi-quantitative description of the appearance of the sample which was derived, in the manner indicated by

the manufacturer, from figures shown under "Matching slides". The procedure is as follows:-

(a) If any neutral grey slides were used in making a match, record their total value as "brightness".

(b) If neutral grey slides were not used and the values of the coloured slides were greater than zero in all three cases, record the value of the lowest coloured slides' combination as "dullness".

(c) The difference between the lowest colour slide value and the intermediate one is expressed as one of three complementary colours. The identity of the complementary colour is determined by which slides give the lowest value (the "dullness" value) thus:-

<u>Colour of slides</u> <u>giving lowest value</u> <u>(dullness)</u>	<u>Colour name for the difference</u> <u>between the lowest and the</u> <u>intermediate colour slide values</u>	<u>Code</u> <u>letter</u> <u>in the</u> <u>tables</u>
red ("R")	green	"G"
yellow ("Y")	violet	"V"
blue ("B")	orange	"O"

(d) The difference between the intermediate colour slide value and the highest one is recorded under the name of the highest one.

Thus the "Lovibond colour" consists of three terms. The first term is the "brightness" or the "dullness". The second and third terms are two colours. One of these colours is the colour of the slides which gave the highest value and the other is one of its neighboring complementary colours.

"Colour description"

The "Colour description" is a non numerical presentation of the figures constituting the "Lovibond colour". The colour description obtained is sometimes misleading as, for instance, in the case of the blue cloth No. (1-2-3), which is frequently described as "dull blue-violet" and twice as "dull blue-green" whereas, in fact, except in the case of samples exposed on the cleared site racks, the contribution from violet or green is so small that the appearance is simply "dull blue".

Table 45

Table 45 shows rates of fading of samples exposed on the cleared site racks. The figures shown are the natural logarithms, (multiplied by 100), of the ratios of pairs of matching colour slides values obtained at consecutive withdrawals. They represent gradients (multiplied by 100) for plots of the natural logarithm of matching slides value against time (withdrawal number). Each of the figures presented is nearly equal to the difference between a pair of consecutive matching slides values expressed as a percentage of the geometric mean of those values.

Results of Assessment of Colour Changes

Table 15

Sample and site:- Olive drab twill, (1-1-1), at the air-conditioned room
 Measured against:- Magnesium carbonate

Withdrawal and Code	Side Cloth	Matching slides			Lovibond colour						
		R	Y	B	Dullness	R	O	Y	G	B	V
Outset, (--0)	?	4.2	8.5	6.4	4.2			2.1	2.2		
First, (OaA)	twill	4.1	8.1	6.3	4.1			1.8	2.2		
Second, (OaB)	"	4.0	9.1	6.2	4.0			2.9	2.2		
Third, (OaC)	"	3.7	8.0	6.1	3.7			1.9	2.4		
First, (OaA)	in	4.3	8.7	6.8	4.3			1.9	2.5		
Second, (OaB)	"	4.1	9.7	6.6	4.1			3.1	2.5		
Third, (OaC)	"	4.0	9.7	6.6	4.0			3.1	2.6		
Colour description:- "dull yellow-green" throughout											

Table 16

Sample and site:- Khaki twill, (1-1-2), at the air-condition room

Measured against:- Magnesium carbonate

Withdrawal and Code	Side Cloth	Matching slides			Lovibond colour						
		R	Y	B	dullness	R	O	Y	G	B	V
Outset, (--0)	?	3.7	5.4	3.4	3.4		0.3	1.7			
First, (OaA)	twill	3.3	4.2	2.6	2.6		0.7	0.9			
Second, (OaB)	"	3.1	4.0	2.5	2.5		0.6	0.9			
Third, (OaC)	"	3.1	4.1	2.5	2.5		0.6	1.0			
First, (OaA)	in	3.4	4.5	2.8	2.8		0.6	1.1			
Second, (OaB)	"	3.1	4.1	2.5	2.5		0.6	1.0			
Third, (OaC)	"	3.5	4.8	2.8	2.8		0.7	1.3			
Colour description:- "dull yellow-orange" throughout											

Results of assessment of Colour Changes

Table 17

Sample and Site:- Plain weave, khaki cloth, (1-2-1), at the air-cond. room

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			dull ness	Lovibond colour					
	R	Y	B		R	O	Y	G	B	V
Outset, (--0)	3.7	5.4	3.2	3.2		0.5	1.7			
First, (0aA)	3.2	4.2	2.6	2.6		0.6	1.0			
	3.2	4.3	2.7	2.7		0.5	1.1			
Second, (0aB)	3.1	4.1	2.5	3.5		0.6	1.1			
	3.0	4.1	2.6	2.6		0.4	1.1			
Third, (0aC)	3.1	4.5	2.6	2.6		0.5	1.3			
	3.1	4.5	2.5	2.5		0.6	1.4			

Colour description:- "dull yellow-orange" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 18

Sample and Site:- Plain weave, white cloth, (1-2-2), at the air-cond. room

Withdrawal and Code	Measured against	Matching slides				Lovibond colour								
		R	Y	B	-ve green	dullness	brightness	R	O	Y	G	B	V	
Outset, (--0)	MgCO ₃	0.2	0.1	0.4	-	0.1	-						0.2	0.1
First, (0aA)	"	0.1	0.0	0.2	0.1	-	0.1						0.1	0.1
		0.1	0.0	0.2	0.1	-	0.1						0.1	0.1
Second, (0aB)	"	0.1	0.0	0.1	0.2	-	0.2							0.1
		0.1	0.0	0.2	0.2	-	0.2						0.1	0.1
Third, (0aC)	"	0.1	0.0	0.1	0.1	-	0.1							0.1
First, (0aA)	(1-2-2) control	0.0	0.0	0.0	0.0	-	-							
		0.0	0.0	0.0	0.0	-	-							
Second, (0aB)	"	"	"	"	"									
Third, (0aC)	"	"	"	"	"									

Colour description:- outset v MgCO₃, "dull blue-violet"

other samples v MgCO₃, "bright blue-violet" or "bright violet"

all samples v control, neutral white

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Changes

Table 19

Sample and Site:- Plain weave, blue cloth, (1-2-3), at the air-cond. room

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	6.0	5.3	9.7	5.3					3.7	0.7
First, (OaA)	6.3	6.1	10.0	6.1					3.7	0.2
	6.3	6.1	10.0	6.1					3.7	0.2
Second, (OaB)	5.3	5.2	9.5	5.2					4.2	0.1
	5.4	5.1	9.6	5.1					4.2	0.3
Third, (OaC)	6.1	5.8	10.1	5.8					4.0	0.3
	6.0	6.1	10.1	6.0				0.1	4.0	

Colour description:- Withdrawals O, A & B, "dull blue-violet"
 Withdrawal C, "dull blue-violet" or "dull blue green"
 (Very close to being simply "dull blue" in all cases.)

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 20

Sample and Site:- Plain weave, olive drab cloth, (2-1-1), at the air-cond. room
 Measured against:- Magnesium carbonate.

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	4.7	8.8	6.6	4.7			2.2	1.9		
First, (OaA)	4.6	10.3	7.2	4.6			3.1	2.6		
	4.7	10.3	7.2	4.7			3.1	2.5		
Second, (OaB)	4.1	9.4	6.6	4.1			2.8	2.5		
	4.2	9.5	6.5	4.2			3.0	2.3		
Third, (OaC)	4.5	10.6	7.1	4.5			3.5	2.6		
	4.5	10.5	7.1	4.5			3.4	2.6		

Colour description:- "dull yellow-green" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Changes

Table 21

Sample and Site:- Olive drab twill, (1-1-1), at the cleared site depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Side of cloth	Matching slides			Lovibond colour						
		R	Y	B	dullness	R	O	Y	G	B	V
Outset, (--0)	?	4.2	8.5	6.4	4.2			2.1	2.2		
First, (IaA)	twill	4.0	8.4	6.2	4.0			2.2	2.2		
Second, (IaB)	"	4.0	9.1	6.1	4.0			3.0	2.1		
Third, (IaC)	"	4.0	8.5	6.5	4.0			2.0	2.5		
First, (IaA)	in	4.2	8.8	6.6	4.2			2.2	2.4		
Second, (IaB)	"	4.1	9.6	6.6	4.1			3.0	2.5		
Third, (IaC)	"	4.0	8.9	6.6	4.0			2.3	2.6		

Colour description:- "dull yellow-green" throughout

Table 22

Sample and Site:- Khaki twill, (1-1-2), at the cleared depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Side of cloth	Matching slides			dull ness	Lovibond colour						
		R	Y	B		R	O	Y	G	B	V	
Outset, (--0)	?	3.7	5.4	5.4	3.4		0.3	1.7				
First, (IaA)	twill	3.2	4.4	2.8	2.8		0.4	1.2				
Second, (IaB)	"	3.1	4.0	2.5	2.5		0.6	0.9				
Third, (IaC)	"	3.1	4.2	2.5	2.5		0.6	1.1				
First, (IaA)	in	3.3	4.3	2.7	2.7		0.6	1.0				
Second, (IaB)	"	3.2	4.2	2.5	2.5		0.7	1.0				
Third, (IaC)	"	3.3	4.4	2.7	2.7		0.6	1.1				

Colour description:- "dull yellow-orange" throughout

Results of Assessment of Colour Changes

Table 23

Sample and Site:- Plain weave, khaki cloth, (1-2-1), at the cleared site depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			dull ness	Lovibond colour					
	R	Y	B		R	O	Y	G	B	V
Outset, (--0)	3.7	5.4	3.2	3.2		0.5	1.7			
First, (IaA)	3.2	4.3	2.7	2.7		0.5	0.9			
	3.2	4.3	2.8	2.8		0.4	0.9			
Second, (IaB)	3.0	4.1	2.4	2.4		0.6	1.1			
	3.0	4.1	2.5	2.5		0.5	1.1			
Third, (IaC)	3.1	4.3	2.6	2.6		0.5	1.2			
	3.1	4.1	2.5	2.5		0.6	1.0			

Colour description:- "dull yellow-orange" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 24

Sample and Site:- Plain weave, white cloth, (1-2-2), at the cleared site depot

Withdrawal and Code	Measured against	Matching slides				Lovibond colour							
		R	Y	B	-ve grey	dullness	brightness	R	O	Y	G	B	V
Outset, (—0)	MgCO ₃	0.2	0.1	0.4	-	0.1	-					0.2	0.1
First, (IaA)	"	0.1	0.0	0.2	0.1	-	0.1					0.1	0.1
		0.1	0.0	0.2	0.1	-	0.1					0.1	0.1
Second, (IaB)	"	0.1	0.0	0.2	0.2	-	0.2					0.1	0.1
		0.1	0.0	0.1	0.2	-	0.2						0.1
Third, (IaC)	"	0.2	0.0	0.2	0.2	-	0.2						0.2
Ist., 2nd. & 3rd., (IaA, IaB & IaC)	(1-2-2) control	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-

Colour descriptions:- at the outset v MgCO₃, "dull blue-violet"

at other times v MgCO₃, "bright blue-violet" or "bright violet"

at all times v control, neutral white

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Changes

Table 25

Sample and Site:- Plain weave, blue cloth, (1-2-3), at the cleared site depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	6.0	5.3	9.7	5.3					3.7	0.7
First, (IaA)	6.4	6.1	10.0	6.1					3.6	0.3
	6.2	6.3	10.1	6.3			0.1		3.8	
Second, (IaB)	5.7	5.6	9.9	5.6					4.2	0.1
	5.8	5.8	9.9	5.8					4.1	
Third, (IaC)	6.2	6.1	10.2	6.1					4.0	0.1
	6.1	6.1	10.2	6.1					4.1	

Colour description:- "dull blue-violet" or dull blue-green"

(very close being simply "dull blue" in all cases.)

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 26

Sample and Site:- Plain weave, olive drab cloth, (2-1-1), at the cleared site depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			dull ness	Lovibond colour					
	R	Y	B		R	O	Y	G	B	V
Outset, (—0)	4.7	8,8	6.6	4.7			2.2	1.9		
First, (IaA)	4.6	10.1	7.1	4.6			3.0	2.5		
	4.7	10.2	7.1	4.7			3.1	2.4		
Second, (IaB)	4.4	9.9	6.8	4.4			3.1	2.4		
	4.4	9.8	6.6	4.4			3.2	2.2		
Third, (IaC)	4.5	10.7	7.1	4.5			3.6	2.6		
	4.5	10.7	7.1	4.5			3.6	2.6		

Colour description:- "dull yellow-green" throughout

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Changes

Table 27

Sample and Site:- Olive drab twill, (1-1-1), on the cleared site racks

Withdrawal and Code	Measured against	Side of cloth	Matching slides			Lovibond colour						Colour description	
			R	Y	B	dull ness	R	O	Y	G	B		V
Outset, (--0)	MgCO ₃	?	4.2	8.5	6.4	4.2			2.1	2.2			dull yellow-green
First, (IoA)	"	twill	3.3	6.0	4.9	3.3			1.1	1.6			dull yellow-green
Second, (IoB)	"	(top)	1.5	2.0	2.4	1.5				0.5	0.4		dull blue-green
Third, (IoC)	"	"	0.8	0.9	1.6	0.8				0.1	0.7		dull blue-green
Second, (IoB)	control	"	1.5	2.3	2.0	1.5			0.3	0.5			dull yellow-green
Third, (IoC)	(1-2-2)	"	0.7	1.0	1.1	0.7			0.3	0.1			dull yellow-green
First, (IoA)	MgCO ₃	in	4.2	8.3	6.4	4.2			1.9	2.2			dull yellow-green
Second, (IoB)	"	(under)	4.0	7.9	6.0	4.0			1.9	2.0			dull yellow-green
Third, (IoC)	"	"	3.2	6.3	5.1	3.2			1.2	1.9			dull yellow-green

Results of Assessment of Colour Changes

Table 28

Sample and Site:- Khaki twill, (1-1-2), on the cleared site racks

Withdrawal and Code	Measured against	Side of cloth	Matching slides			Lovibond colour							Colour description	
			R	Y	B	dull ness	R	O	Y	G	B	V		
Outset, (—0)	MgCO ₃	?	3.7	5.4	3.4	3.4		0.3	1.7					dull yellow-orange
First, (IoA)	"	twill (top)	1.1	1.1	0.9	0.9		0.2						dull orange
Second, (IoB)	"	"	0.6	0.5	0.8	0.5					0.2	0.1	dull blue-violet	
Third, (IoC)	"	"	0.5	0.5	0.8	0.5					0.3		dull blue	
Second, (IoB)	control (1-2-2)	"	0.3	0.2	0.1	0.1	0.1	0.2					dull red-orange	
Third, (IoC)	"	"	0.4	0.4	0.4	0.4							grey	
First, (IoA)	MgCO ₃	in (under)	3.3	4.0	2.1	2.1		1.2	0.7				dull yellow-orange	
Second, (IoB)	"	"	2.0	2.2	1.1	1.1		0.9	0.2				dull yellow-orange	
Third, (IoC)	"	"	1.5	1.6	1.1	1.1		0.4	0.1				dull yellow-orange	

Results of Assessment of Colour Changes

Table 29

Sample and Site:- Plain weave, khaki cloth, (1-2-1), on the cleared site racks

Withdrawal and Code	Measured against	Side of cloth	Matching slides			Lovibond colour							colour description	
			R	Y	B	dull ness	R	O	Y	G	B	V		
Outset, (—0)	?	-	3.7	5.4	3.2	3.2		0.5	1.7					dull yellow-orange
First, (IoA)	MgCO ₃	top	1.3	1.3	0.9	0.9		0.4						dull orange
Second, (IoB)	"	"	0.7	0.6	0.8	0.6					0.1	0.1		dull blue-violet
Third, (IoC)	"	"	0.6	0.6	0.8	0.6					0.2			dull blue
Second, (IoB)	control (1-2-2)	"	0.5	0.6	0.3	0.3		0.2	0.1					dull yellow-orange
Third, (IoC)	"	"	0.5	0.7	0.4	0.4		0.1	0.2					dull yellow-orange
First, (IoA)	MgCO ₃	under	3.1	3.6	1.8	1.8		1.3	0.5					dull yellow-orange
Second, (IoB)	"	"	2.0	2.5	1.1	1.1		0.9	0.5					dull yellow-orange
Third, (IoC)	"	"	1.3	1.5	1.0	1.0		0.3	0.2					dull yellow-orange

Results of Assessment of Colour Change

Table 30

Sample and Site:- Plain weave, white cloth, (1-2-2), on the cleared site racks

Withdrawal and Code	Measured against	Matching slides				Lovibond colour							Colour description	
		R	Y	B	-ve. grey	dull ness	bright ness	R	O	Y	G	B		V
Outset, (--0)	MgCO ₃	0.2	0.1	0.4	-	0.1	-					0.2	0.1	dull blue-violet
First, (IoA)	"	0.2	0.2	0.2	-	0.2	-					0.1		grey
		0.2	0.2	0.3		0.2	-							dull blue
Second, (IoB)	"	0.3	0.2	0.5	-	0.2	-					0.2	0.1	dull blue-violet
		0.3	0.2	0.5	-	0.2	-					0.2	0.1	dull blue-violet
Third, (IoC)	"	0.7	0.5	0.9	-	0.5	-					0.2	0.2	dull blue-violet
		0.7	0.9	1.0	-	0.7	-				0.2	0.1		dull blue-green
First, (IoA)	control sample	0.2	0.3	0.0	0.0	0.0	0.0		0.2	0.1				yellow-orange
		0.1	0.3	0.1	-	0.1	-			0.2				dull yellow
Second, (IoB)	"	0.2	0.4	0.1	-	0.1	-		0.1	0.2				dull yellow-orange
		0.2	0.4	0.2	-	0.2	-			0.2				dull yellow
Third, (IoC)	"	0.6	0.7	0.6	-	0.6	-			0.1				dull yellow
		0.6	0.9	0.7	-	0.6	-			0.2	0.1			dull yellow-green

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Change

Table 31

Sample and Site:- Plain weave, blue cloth, (1-2-3), on the cleared site racks

Withdrawal and Code	Measured against	Side of cloth	Matching slides			Lovibond colour						
			R	Y	B	dullness	R	O	Y	G	B	V
Outset, (--0)	MgCO ₃	-	6.0	5.3	9.7	5.3					3.7	0.7
First, (IoA)	"	top	5.5	5.0	8.0	5.0					2.5	0.5
Second, (IoB)	"	"	4.1	3.1	5.5	3.1					1.4	1.0
Third, (IoC)	"	"	2.4	1.6	3.4	1.6					1.0	0.8
Third, (IoC)	(1-2-2)	"	2.1	1.5	2.8	1.5					0.7	0.6
First, (IoA)	MgCO ₃	under	6.0	5.4	9.6	5.4					3.6	0.6
Second, (IoB)	"	"	5.6	5.2	9.2	5.2					3.6	0.4
Third, (IoC)	"	"	5.4	5.3	9.1	5.3					3.7	0.1

Colour description:- "dull blue-violet" throughout.

Table 32

Sample and Site:- Plain weave, olive drab cloth, (2-1-1),
on the cleared site racks

Withdrawal and Code	Measured against	Side of cloth	Matching slides			Lovibond colour						Colour description	
			R	Y	B	dullness	R	O	Y	G	B		V
Outset, (—0)	MgCO ₃	-	4.7	8.8	6.6	4.7			2.2	1.9			dull yellow-green
First, (IoA)	"	top	3.8	5.6	4.8	3.8			0.8	1.0			dull yellow-green
Second, (IoB)	"	"	2.3	3.0	3.1	2.3				0.7	0.1		dull blue-green
Third, (IoC)	"	"	1.5	1.6	1.9	1.5				0.1	0.3		dull blue-green
Second, (IoB)	(1-2-2)	"	2.1	2.8	2.5	2.1			0.3	0.4			dull yellow-green
Third, (IoC)	"	"	1.3	1.6	1.5	1.3			0.1	0.2			dull yellow-green
First, (IoA)	MgCO ₃	under	4.7	9.9	6.2	4.7			3.7	1.5			dull yellow-green
Second, (IoB)	"	"	4.5	9.1	5.8	4.5			3.3	1.3			dull yellow-green
Third, (IoC)	"	"	4.1	7.4	3.5	4.1	0.6		3.3				dull yellow-orange

Results of Assessment of Colour Changes

Table 33

Sample and Site:- Olive drab twill, (1-1-1), at the jungle site depot.

Measured against:- Magnesium carbonate.

Withdrawal and Code	Side of cloth	Matching slides			Lovibond colour						
		R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (—0)	?	4.2	8.5	6.4	4.2			2.1	2.2		
First, (IIaA)	twill	4.0	8.6	6.4	4.0			2.2	2.4		
Second, (IIaB)	"	4.0	9.3	6.4	4.0			2.9	2.4		
Third, (IIaC)	"	3.7	8.2	6.0	3.7			2.2	2.3		
First, (IIaA)	in	4.1	8.8	6.6	4.1			2.2	2.5		
Second, (IIaB)	"	4.1	9.6	6.5	4.1			3.1	2.4		
Third, (IIaC)	"	4.1	9.7	6.5	4.1			3.2	2.4		

Colour description:- "dull yellow-green" throughout.

Table 34

Sample and Site:- Khaki twill, (1-1-2), at the jungle site depot

Measured against:- Magnesium carbonate

With drawal and Code	Side of cloth	Matching slides			Lovibond colour						
		R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (—0)	?	3.7	5.4	3.4	3.4		0.3	1.7			
First, (IIaA)	twill	3.1	3.8	2.4	2.4		0.7	0.7			
Second, (IIaB)	"	3.1	4.0	2.6	2.6		0.5	0.9			
Third, (IIaC)	"	3.1	4.1	2.5	2.5		0.6	1.0			
First, (IIaA)	in	3.3	4.4	2.8	2.8		0.5	1.1			
Second, (IIaB)	"	3.2	4.3	2.7	2.7		0.5	1.1			
Third, (IIaC)	"	3.2	4.6	2.7	2.7		0.5	1.4			

Colour description:- "dull yellow-orange" throughout.

Results of Assessment of Colour Changes

Table 35

Sample and Site:- Plain weave, Khaki cloth, (1-2-1), at the jungle site depot

Measured against:- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	3.7	5.4	3.2	3.2		0.5	1.7			
First, (IIaA)	3.0	4.1	2.5	2.5		0.5	1.1			
	3.1	4.3	2.5	2.5		0.6	1.2			
Second, (IIaB)	3.1	4.1	2.5	2.5		0.6	1.0			
	3.0	4.1	2.5	2.5		0.5	1.1			
Third, (IIaC)	3.1	4.3	2.5	2.5		0.6	1.2			
	3.1	4.2	2.5	2.5		0.6	1.1			

Colour description:- "dull yellow-orange" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 36

Sample and Site:- Plain weave, white cloth, (1-2-2),
at the jungle site depot.

Withdrawal and Code	Side of cloth	Matching slides				Lovibond colour								Colour description	
		R	Y	B	-ve grey	dull ness	bright ness	R	O	Y	G	B	V		
utset, (--0)	MgCO ₃	0.2	0.1	0.4	-	0.1	-						0.2	0.1	dull blue-violet
irst, (IIaA)		0.1	0.0	0.2	0.1	-	0.1						0.1	0.1	bright blue-violet
		0.1	0.0	0.2	0.1	-	0.1						0.1	0.1	bright blue-violet
econd, (IIaB)		0.1	0.0	0.2	0.2	-	0.2						0.1	0.1	bright blue-violet
		0.1	0.0	0.2	0.2	-	0.2						0.1	0.1	bright blue-violet
hird, (IIaC)	"	0.1	0.0	0.1	0.1	-	0.1							0.1	bright violet
st., 2nd., & 3rd., (IIaA, IIaB & IIaC)	(1-2-2) control	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	neutral white

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Change

Table 37

Sample and Site :- Plain weave, blue cloth, (1-2-3), at the jungle site depot.

Measured against :- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						Colour description	
	R	Y	B	dull ness	R	O	Y	G	B		V
Outset, (--0)	6.0	5.3	9.7	5.3					3.7	0.7	dull blue-violet (near dull blue)
First, (IIaA)	6.1	6.0	10.1	6.0					4.0	0.1	" " " " " "
	6.2	6.0	10.1	6.0					3.9	0.2	" " " " " "
Second, (IIaB)	5.4	5.3	9.6	5.3					4.2	0.1	" " " " " "
	5.4	5.4	9.7	5.4					4.3		dull blue
Third, (IIaC)	6.1	6.1	10.2	6.1					4.1		dull blue
	6.3	6.0	10.1	6.0					3.8	0.3	dull blue-violet (near dull blue)

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 38

Sample and Site :- Plain weave, olive drab cloth, (2-1-1), at the jungle site depot.

Measured against :- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (—0)	4.7	8.8	6.6	4.7			2.2	1.9		
First, (IIaA)	4.6	10.1	6.8	4.6			3.3	2.2		
	4.8	10.2	7.2	4.8			3.0	2.4		
Second, (IIaB)	4.3	9.5	6.7	4.3			2.8	2.4		
	4.3	9.5	6.6	4.3			2.9	2.3		
Third, (IIaC)	4.6	10.8	7.1	4.6			3.7	2.5		
	4.5	10.7	7.1	4.5			3.6	2.6		

Colour description :- "dull yellow-green" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Change

Table 39

Sample and Site :- Olive drab twill, (1-1-1), on the jungle site racks.

Measured against :- Magnesium carbonate

Withdrawal and Code	Side of cloth	Matching slides			Lovibond colour						
		R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	?	4.2	8.5	6.4	4.2			2.1	2.2		
First, (IIoA)	twill	4.0	8.5	6.3	4.0			2.2	2.3		
Second, (IIoB)	"	3.7	8.0	5.8	3.7			2.2	2.1		
Third, (IIoC)	"	3.1	7.4	5.3	3.1			2.1	2.2		
First, (IIoA)	in	4.0	8.8	6.6	4.0			2.2	2.6		
Second, (IIoB)	"	3.8	9.2	6.1	3.8			3.1	2.3		
Third, (IIoC)	"	3.3	7.4	5.4	3.3			2.0	2.1		

Colour description :- "dull yellow-green" throughout.

Table 40

Sample and Site :- Khaki twill, (1-1-2-), on the jungle site racks.

Measured against :- Magnesium carbonate

Withdrawal and Code	Side of cloth	Matching slides			dull ness	Lovibond colour						
		R	Y	B		R	O	Y	G	B	V	
Outset, (—0)	?	3.7	5.4	3.4	3.4		0.3	1.7				
First, (IIoA)	twill	3.1	3.8	2.4	2.4		0.7	0.7				
Second, (IIoB)	"	3.1	4.0	2.4	2.4		0.7	0.9				
Third, (IIoC)	"	3.0	4.0	2.3	2.3		0.7	1.0				
First, (IIoA)	in	3.3	4.2	2.5	2.5		0.8	0.9				
Second, (IIoB)	"	3.1	4.0	2.5	2.5		0.6	0.9				
Third, (IIoC)	"	3.3	4.5	2.5	2.5		0.8	1.2				

Colour description :- "dull yellow-orange" throughout.

Results of Assessment of Colour Change

Table 41

Sample and Site :- Plain weave, Khaki cloth, (1-2-1), on the jungle site racks.

Measured against :- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	3.7	5.4	3.2	3.2		0.5	1.7			
First, (IIoA)	3.1	4.0	2.5	2.5		0.6	0.9			
	3.2	4.2	2.5	2.5		0.7	1.0			
Second, (IIoB)	3.0	4.1	2.4	2.4		0.6	1.1			
	3.0	4.1	2.3	2.3		0.7	1.1			
Third, (IIoC)	3.1	4.4	2.2	2.2		0.9	1.3			
	3.0	4.3	2.1	2.1		0.9	1.3			

Colour description :- "dull yellow-orange" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 42

Sample and Site :- Plain weave, white cloth, (1-2-2), on the jungle site racks.

Withdrawal and Code	Measured against	Matching slides			Lovibond colour						Colour description	
		R	Y	B	dull ness	R	O	Y	G	B		V
Outset, (—0)	MgCO ₃	0.2	0.1	0.4	0.1					0.2	0.1	dull blue-violet
First, (IIoA)	"	0.1	0.0	0.2	0.0					0.1	0.1	blue-violet
	"	0.1	0.0	0.2	0.0					0.1	0.1	blue-violet
Second, (IIoB)	"	0.1	0.1	0.0	0.0		0.1					orange
	"	0.1	0.1	0.0	0.0		0.1					orange
Third, (IIoC)	"	0.1	0.1	0.0	0.0		0.1					orange
	"	0.2	0.1	0.0	0.0	0.1	0.1					red-orange
First, (IIoA)	control	0.0	0.1	0.0	0.0			0.1				yellow
	sample	0.1	0.1	0.0	0.0			0.1				orange
Second, (IIoB)	"	0.1	0.1	0.0	0.0			0.1				orange
	"	0.1	0.1	0.0	0.0			0.1				orange
Third, (IIoC)	"	0.2	0.3	0.0	0.0			0.2	0.1			yellow-orange
	"	0.2	0.4	0.0	0.0			0.2	0.2			yellow-orange

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Change

Table 43

Sample and Site :- Plain weave, blue cloth, (1-2-3), on the jungle racks.

Measured against :- Magnesium carbonate

Withdrawal and Code	Matching slides			Lovibond colour						
	R	Y	B	dull ness	R	O	Y	G	B	V
Outset, (--0)	6.0	5.3	9.7	5.3					3.7	0.7
First, (IIoA)	6.4	5.6	10.0	5.6					3.6	0.8
	6.2	5.7	10.0	5.7					3.8	0.5
Second, (IIoB)	6.1	5.7	9.8	5.7					3.7	0.4
	6.2	5.6	9.8	5.6					3.6	0.6
Third, (IIoC)	6.4	6.0	10.1	6.0					3.7	0.4
	6.2	6.1	10.0	6.1					3.8	0.1

Colour description :- "dull blue-violet" throughout.

(very close to being simply "dull blue".

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Table 44

Sample and Site :- Plain weave, olive drab cloth, (2-1-1), on the jungle racks.

Measured against :- Magnesium carbonate

Withdrawal and Code	Matching slides			dull ness	Lovibond colour					
	R	Y	B		R	O	Y	G	B	V
Outset, (—0)	4.7	8.8	6.6	4.7			2.2	1.9		
First, (IIoA)	4.5	10.0	6.5	4.5			3.5	2.0		
	4.5	10.4	6.4	4.5			4.0	1.9		
Second, (IIoB)	4.1	9.6	5.9	4.1			3.7	1.8		
	4.1	9.6	6.1	4.1			3.5	2.0		
Third, (IIoC)	4.3	10.1	6.2	4.3			3.9	1.9		
	4.4	10.4	6.3	4.4			4.1	1.9		

Colour description :- "dull yellow-green" throughout.

Paired figures indicate that measurements were made on both sides of the cloth and both results are reported.

Results of Assessment of Colour Change

Table 45

Rate of fading of colour expressed as $100 \times \left(\log_e \frac{C_n}{C_{(n+1)}} \right)$

where " C_n " is the matching slides value at the "n"th withdrawal

and " $C_{(n+1)}$ " is that at the next consecutive withdrawal.

Code	Sample	Time Interval	Proportional Rate of loss of colour over 3 months		
			Red	Yellow	Blue
1-1-1-Io	Olive drab twill, top (twill) side	(1) (27, Sept., -71) (27, Dec., -71)	22	30	25
"	"	(2) (27, Dec., -71) (27, March, -72)	79	110	71
"	"	(3) (27, March, -72) (27, June, -72)	76	83	60
"	Olive drab twill, under ("in") side	(1) (27, Sept., -71) (27, Dec., -71)	2	5	6
"	"	(2) (27, Dec., -71) (27, March, -72)	5	5	6
"	"	(3) (27, March, -72) (27, June, -72)	22	23	16
1-1-2-Io	Khaki twill, top (twill) side	(1) (27, Sept., -71) (27, Dec., -71)	110	134	106
"	"	(2) (27, Dec., -71) (27, March, -72)	61	79	12
"	"	(3) (27, March, -72) (27, June, -72)	nc*	nc*	nc*

* nc :- "not calculable"

Results of Assessment of Colour Changes

Table 45 continued

Code	Sample	Time Interval	Proportional rate of loss of colour over 3 months		
			Red	Yellow	Blue
1-1-2-Io	Khaki twill, under ("in") side	(1) (27, Sept., -71) (27, Dec., -71)	3	12	29
"	"	(2) (27, Dec., -71) (27, March, -72)	50	60	65
"	"	(3) (27, March, -72) (27, June, -72)	29	32	nc*
1-2-1-Io	Plain weave, Khaki cloth, top side	(1) (27, Sept., -71) (27, Dec., -71)	90	118	108
"	"	(2) (27, Dec., -71) (27, March, -72)	62	72	12
"	"	(3) (27, March, -72) (27, June, -72)	nc*	nc*	nc*
"	Plain weave, khaki cloth, under ("in") side	(1) (27, Sept., -71) (27, Dec., -71)	3	17	39
"	"	(2) (27, Dec., -71) (27, March, -72)	44	36	49
"	"	(3) (27, March, -72) (27, June, -72)	43	51	10
1-2-3-Io	Plain weave, blue cloth top side	(1) (27, Sept., -71) (27, Dec., -71)	14	20	22
"	"	(2) (27, Dec., -71) (27, March, -72)	29	28	37
"	"	(3) (27, March, -72) (27, June, -72)	54	66	48
"	Plain weave, blue cloth under ("in") side	(1) (27, Sept., -71) (27, Dec., -71)	5	12	4

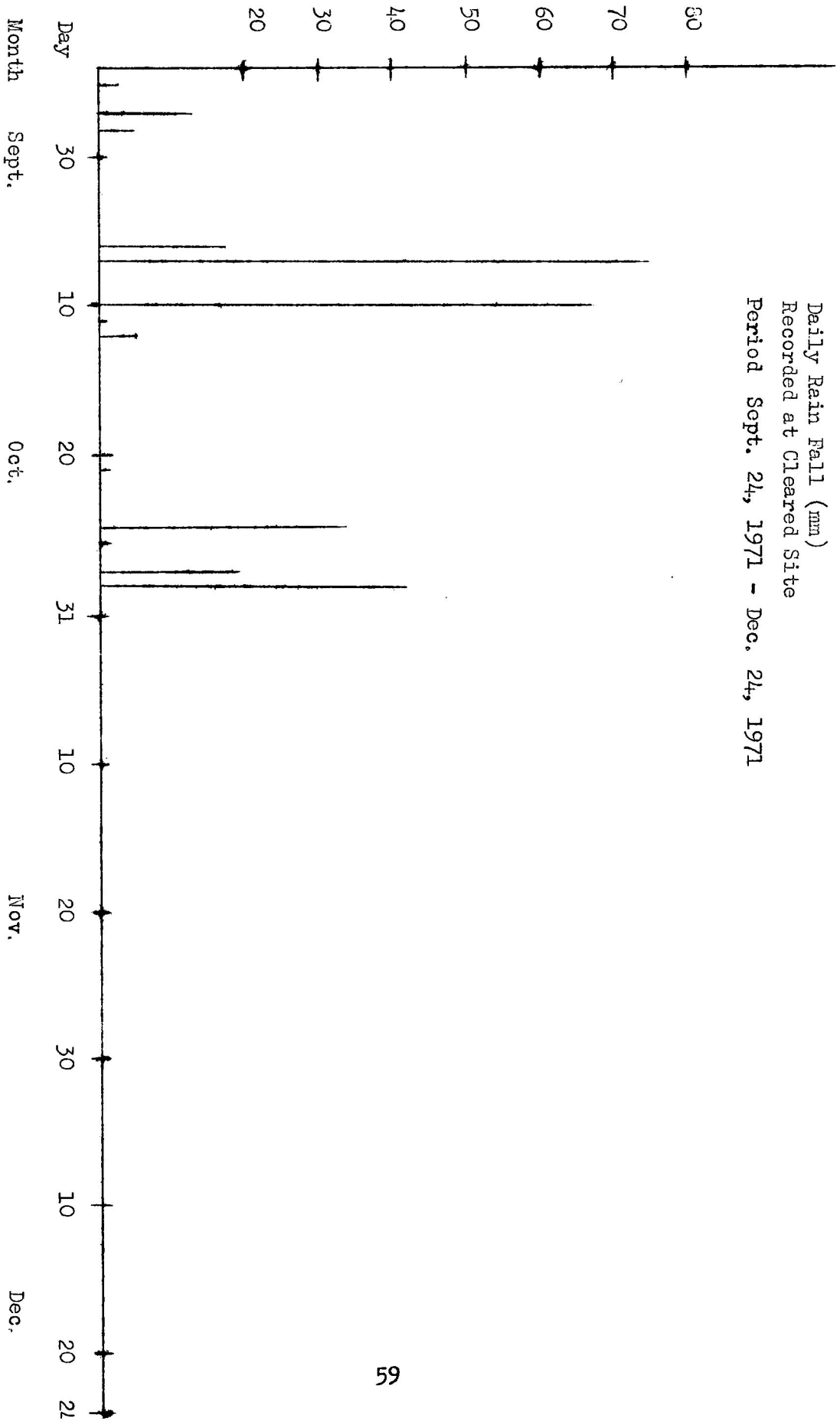
*nc :- "not calculable"

Results of Assessment of Colour Changes

Table 45 continued

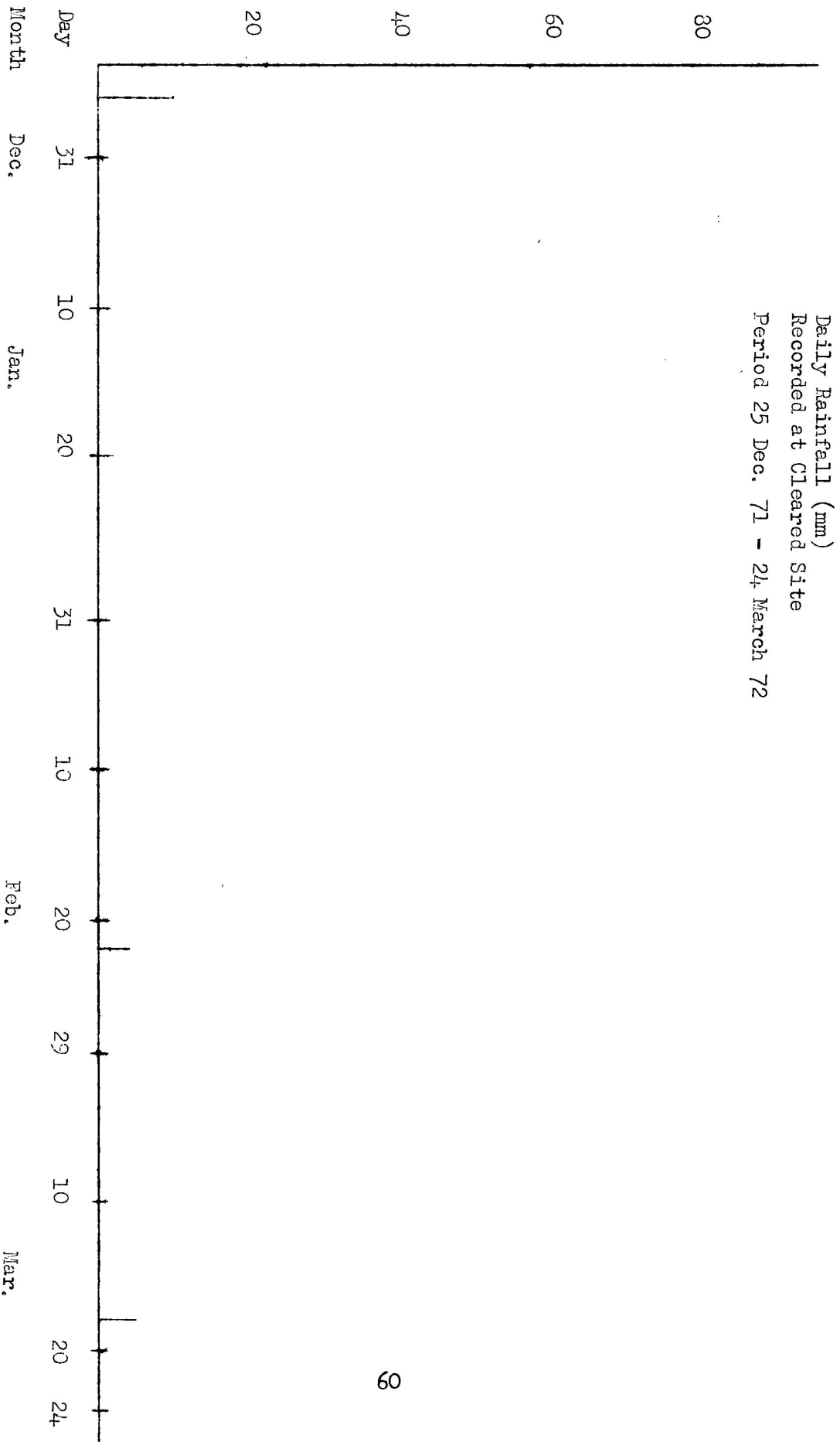
Code	Sample	Time Interval	Proportional rate of loss of colour over 3 months		
			Red	Yellow	Blue
1-2-3-Io	Plain weave, blue cloth under("in) side	(2) (27, Dec., -71) (27, March, -72)	7	4	4
"	"	(3) (27, March, -72) (27, June, -72)	4	2	1
2-1-1-Io	Plain weave, olive drab cloth, top side	(1) (27, Sept., -71) (27, Dec., -71)	20	61	41
"	"	(2) (27, Dec., -71) (27, March, -72)	50	62	43
"	"	(3) (27, March, -72) (27, June, -72)	48	56	51
"	Plain weave, olive drab cloth, under side	(1) (27, Sept., -71) (27, Dec., -71)	-1	4	15
"	"	(2) (27, Dec., -71) (27, March, -72)	4	8	7
"	"	(3) (27, March, -72) (27, June, -72)	9	21	51

Rainfall (mm)

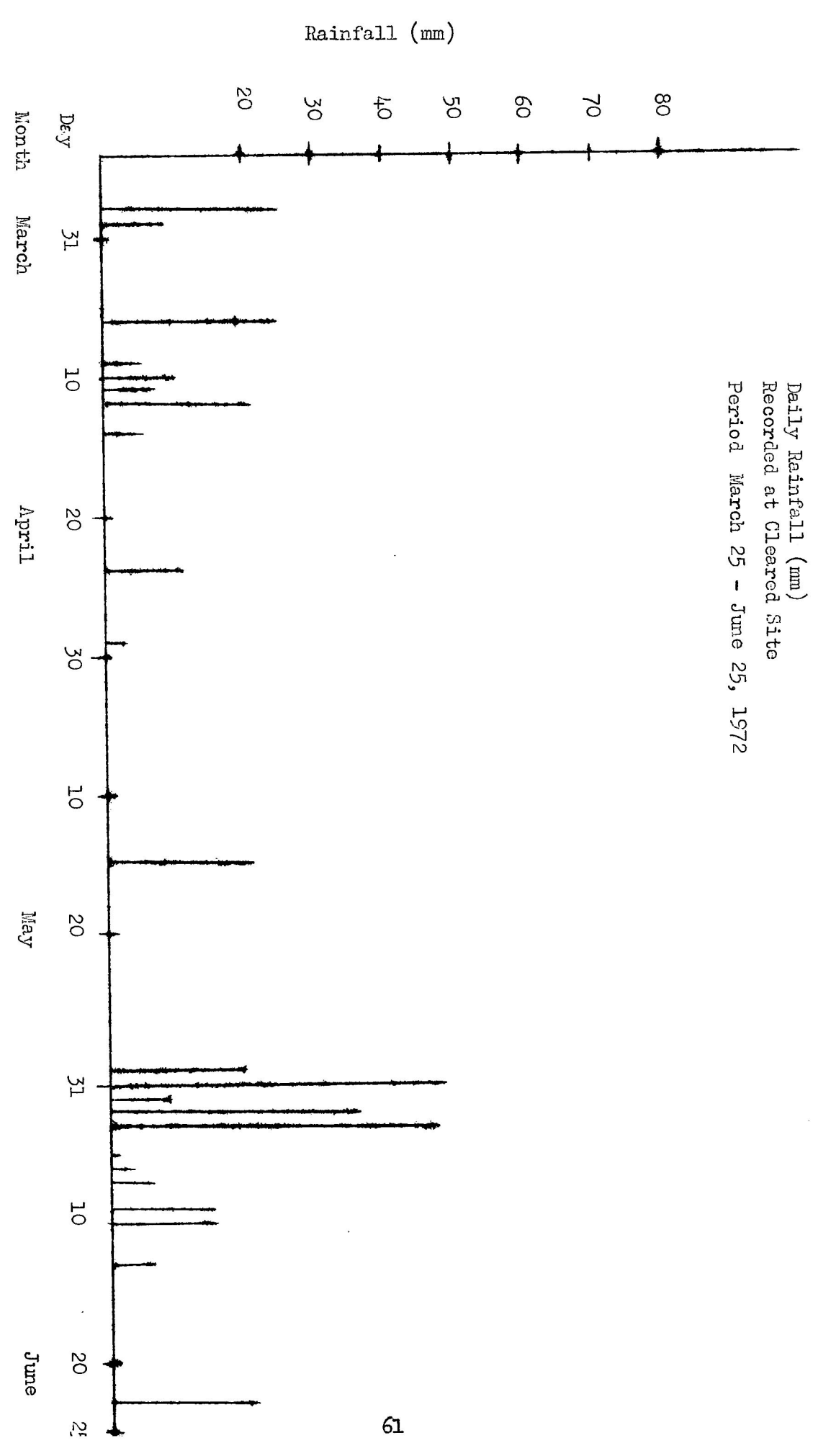


Daily Rain Fall (mm)
Recorded at Cleared Site
Period Sept. 24, 1971 - Dec. 24, 1971

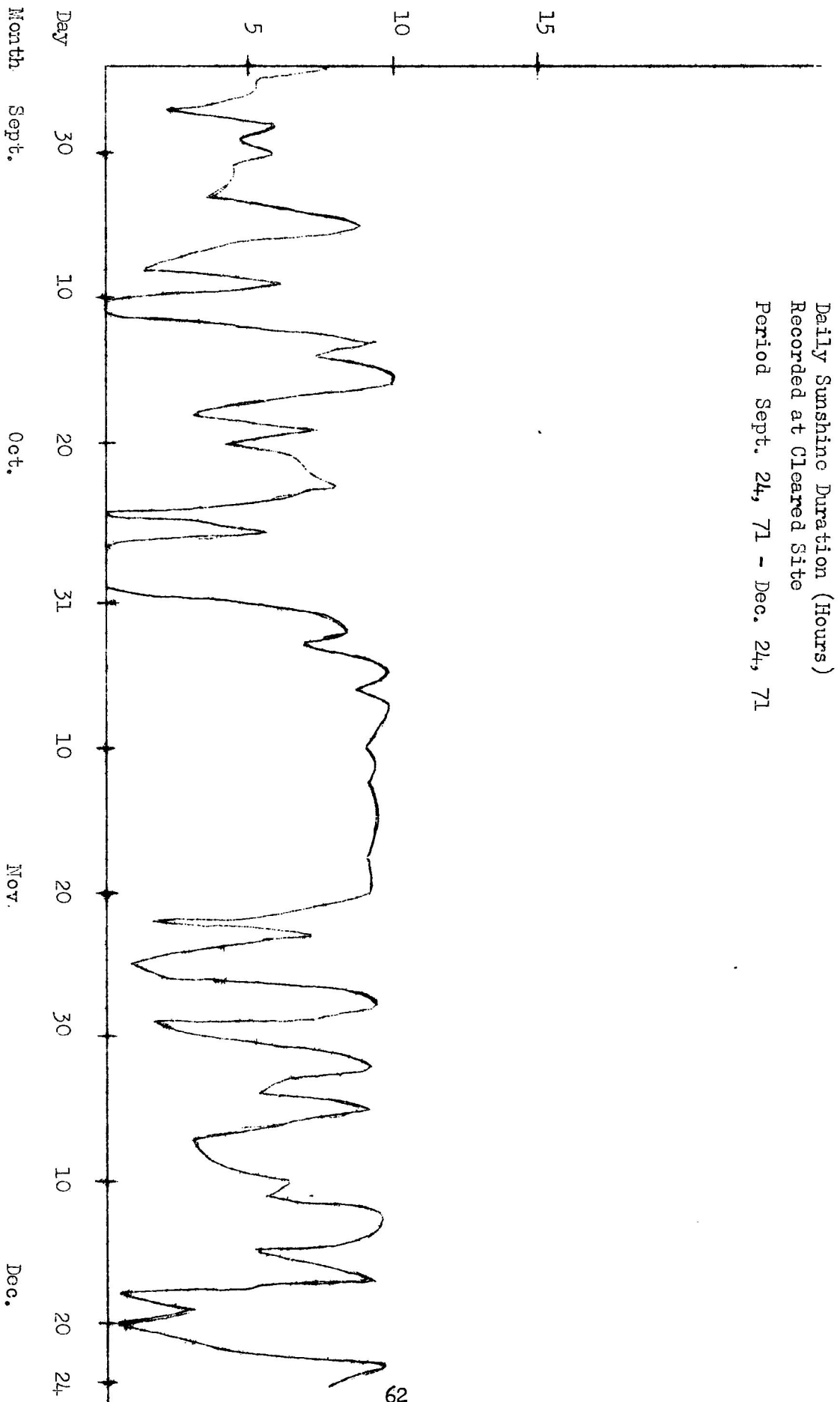
Rainfall (mm)



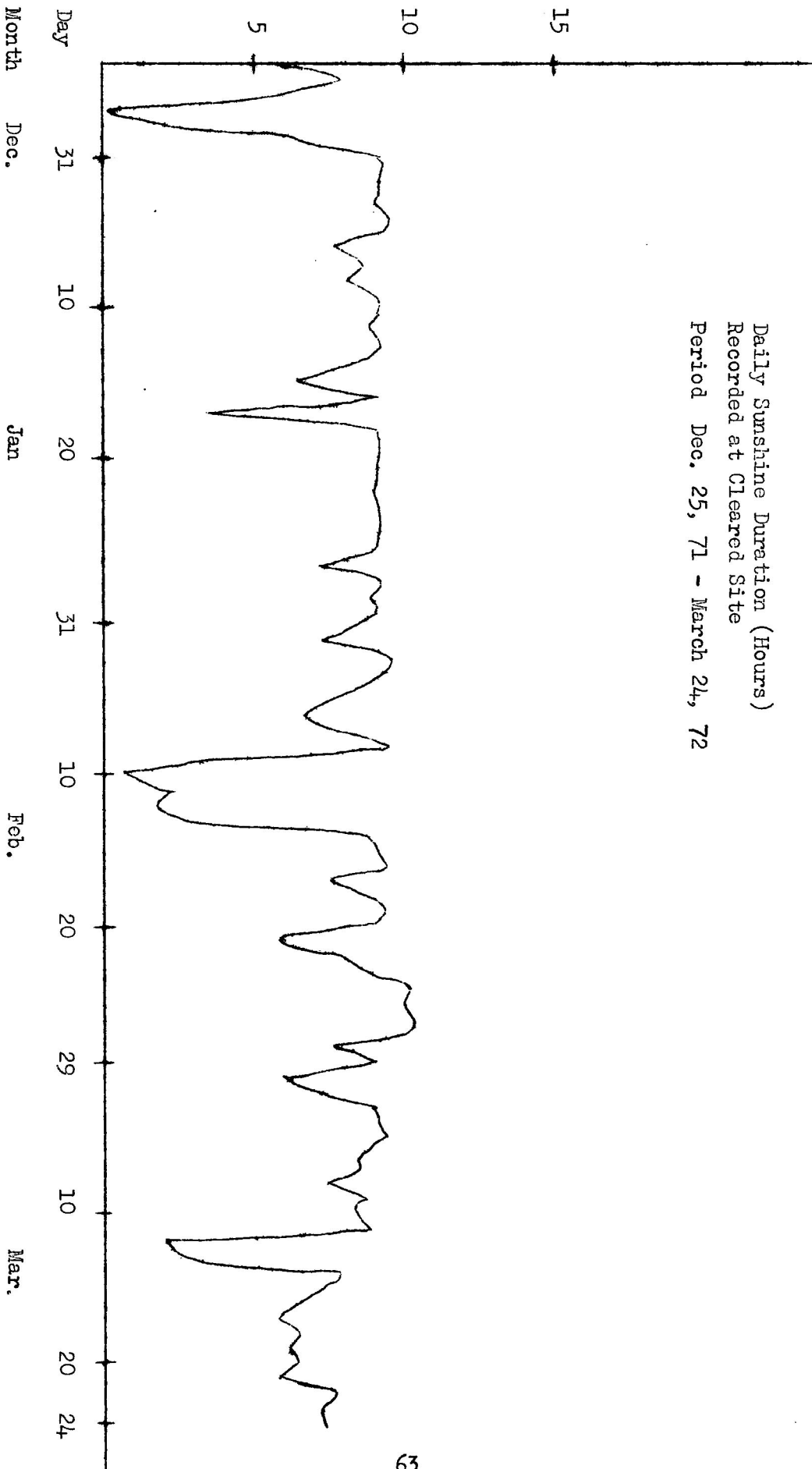
Daily Rainfall (mm)
 Recorded at Cleared Site
 Period March 25 - June 25, 1972



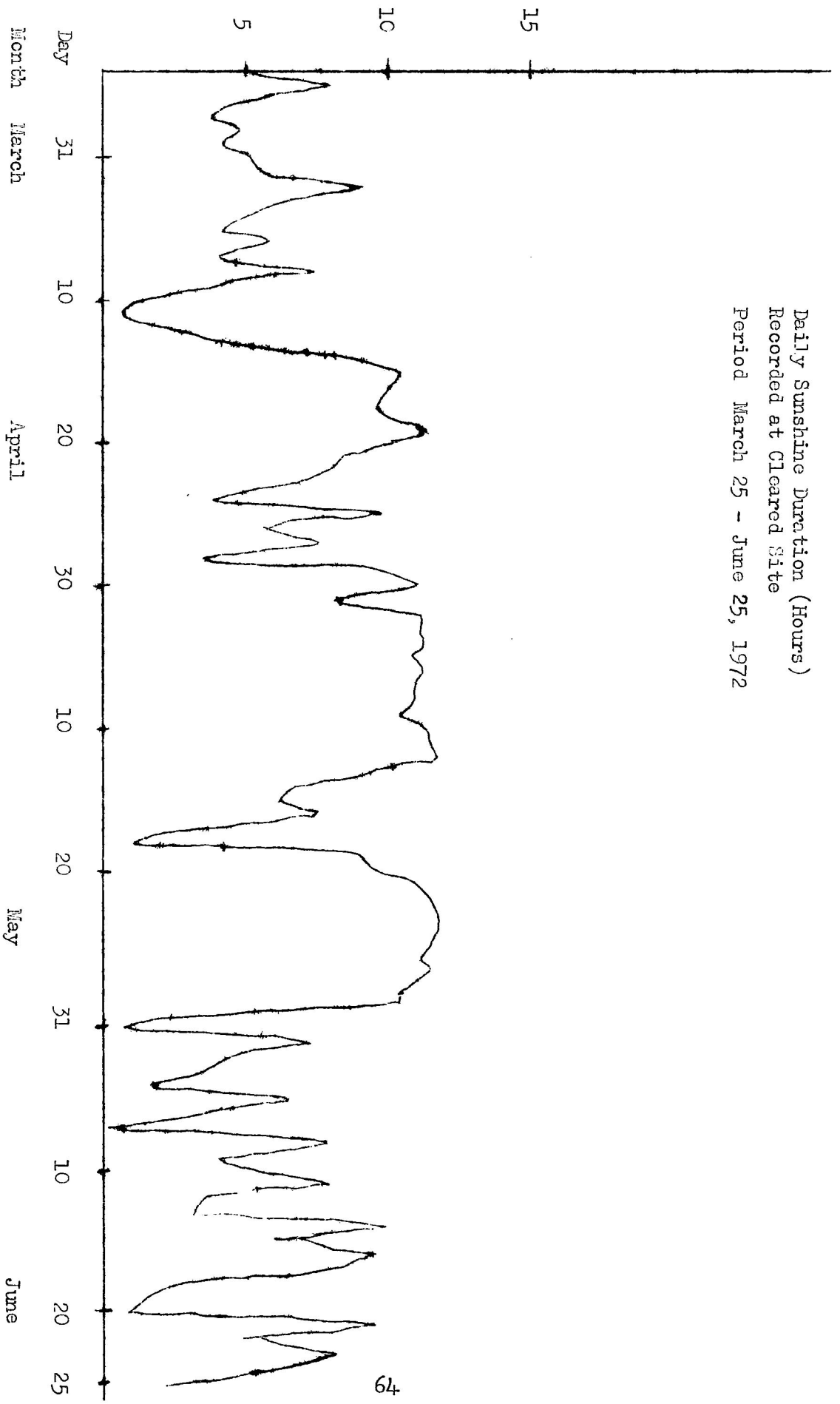
Sunshine Duration, (hrs.)



Sunshine Duration (Hours)

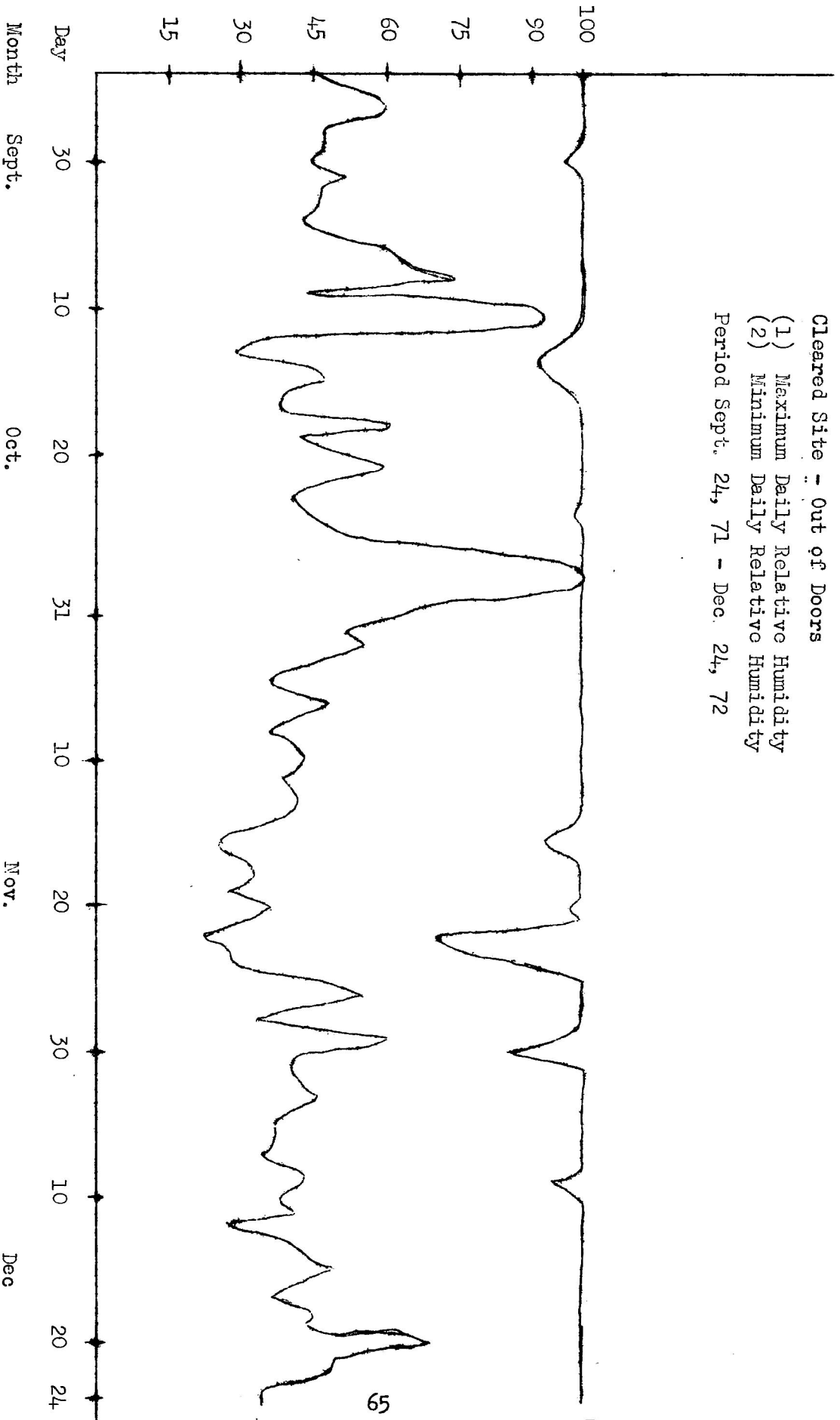


Sunshine Duration (Hours)

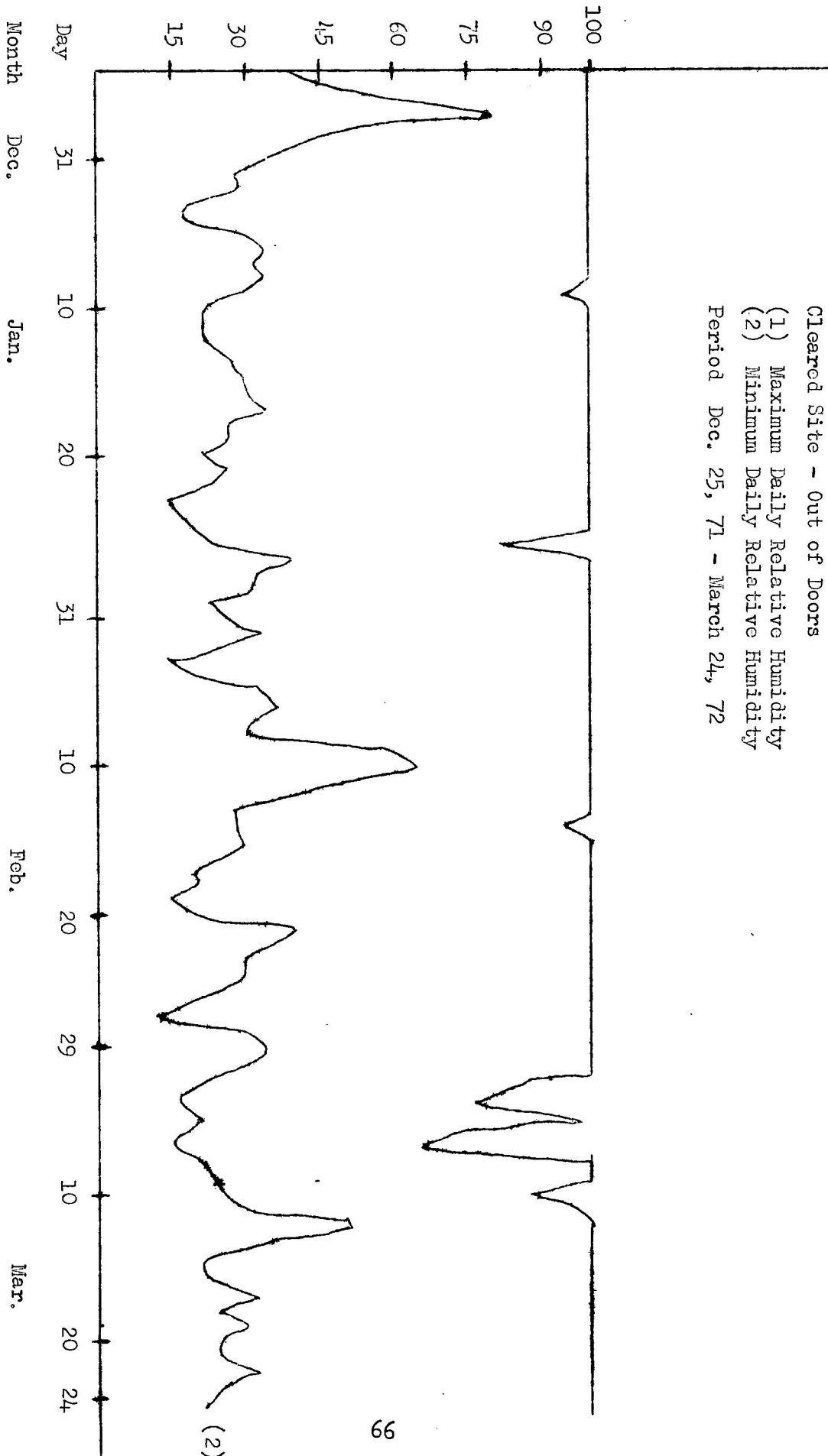


Daily Sunshine Duration (Hours)
Recorded at Cleared Site
Period March 25 - June 25, 1972

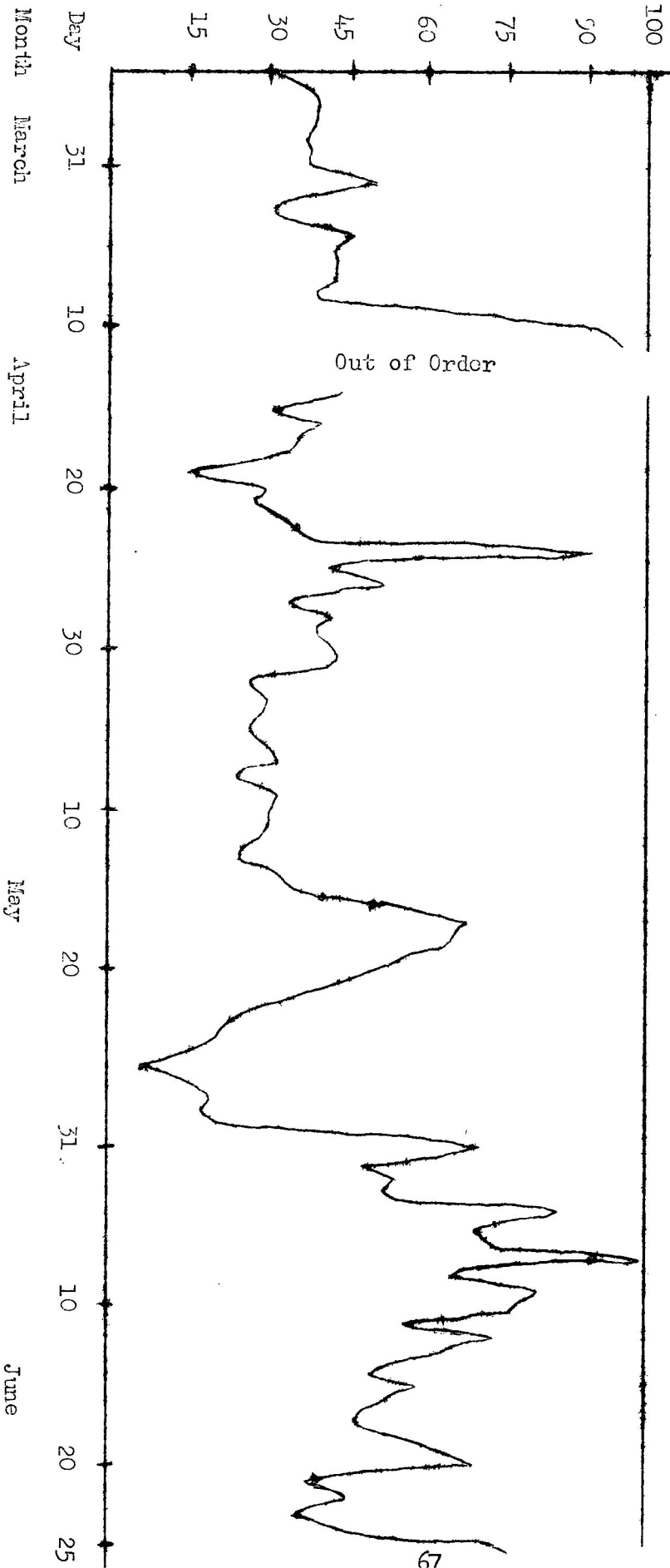
Percent Relative Humidity



Percent Relative Humidity

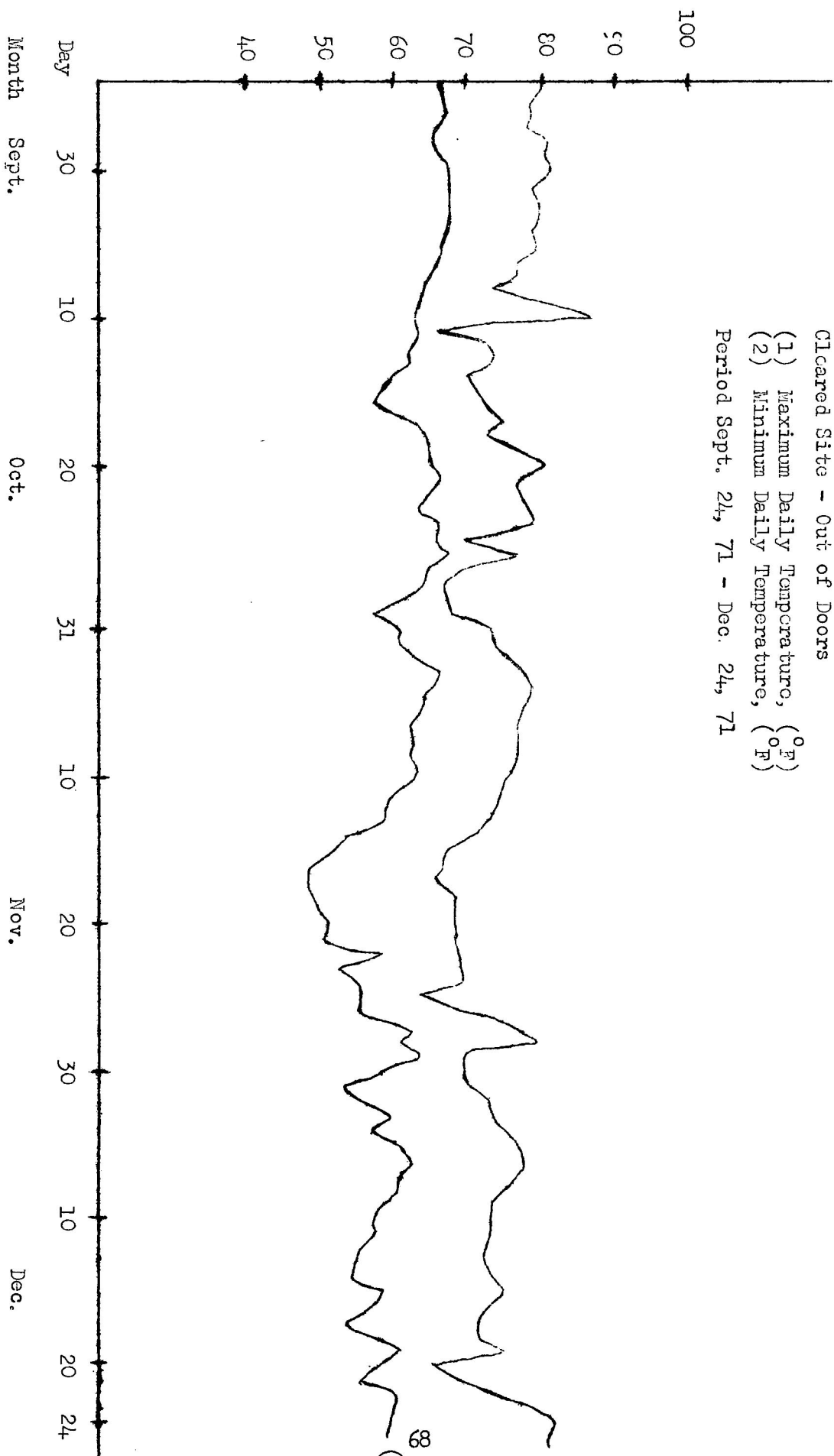


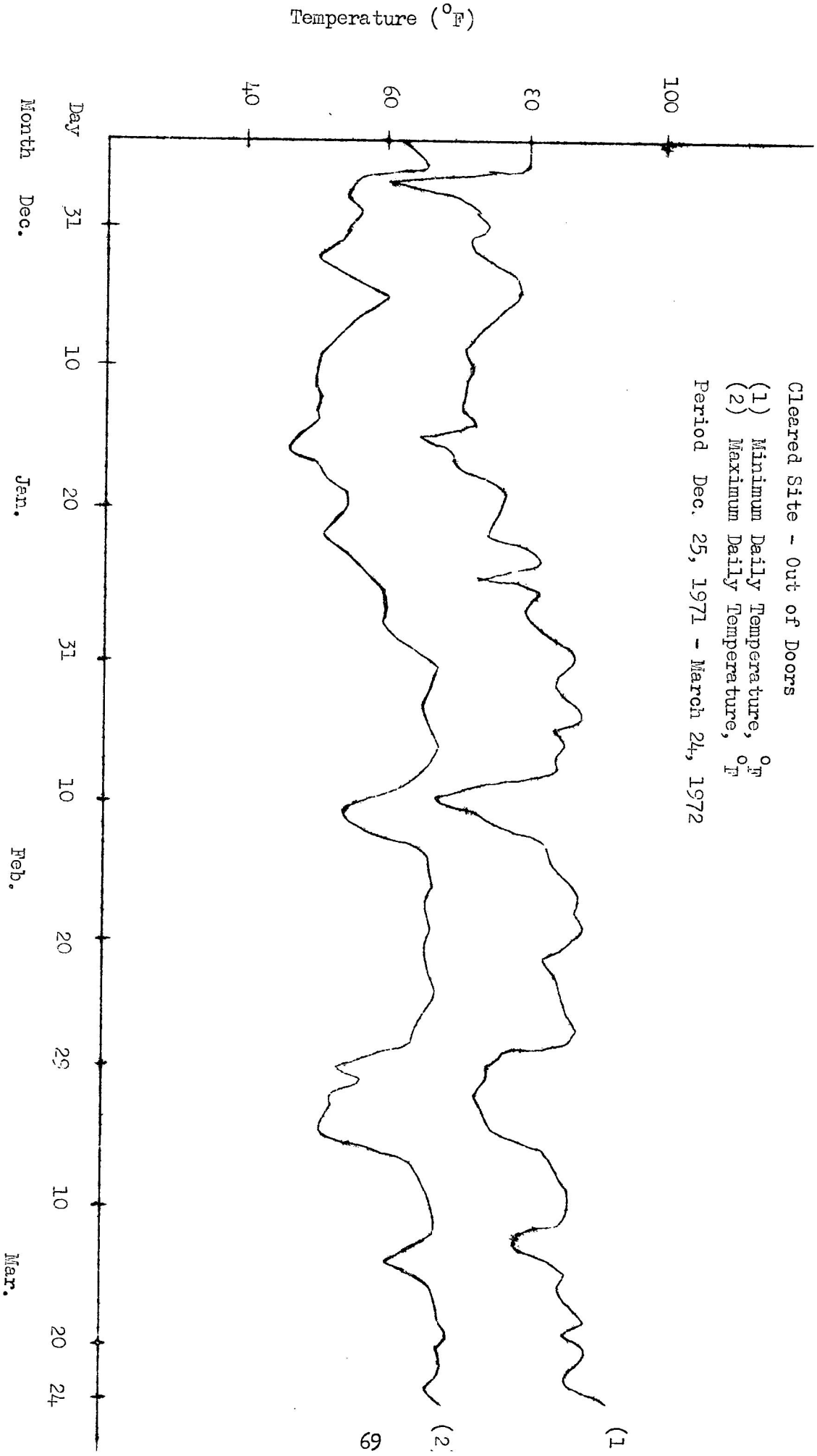
Percent Relative Humidity



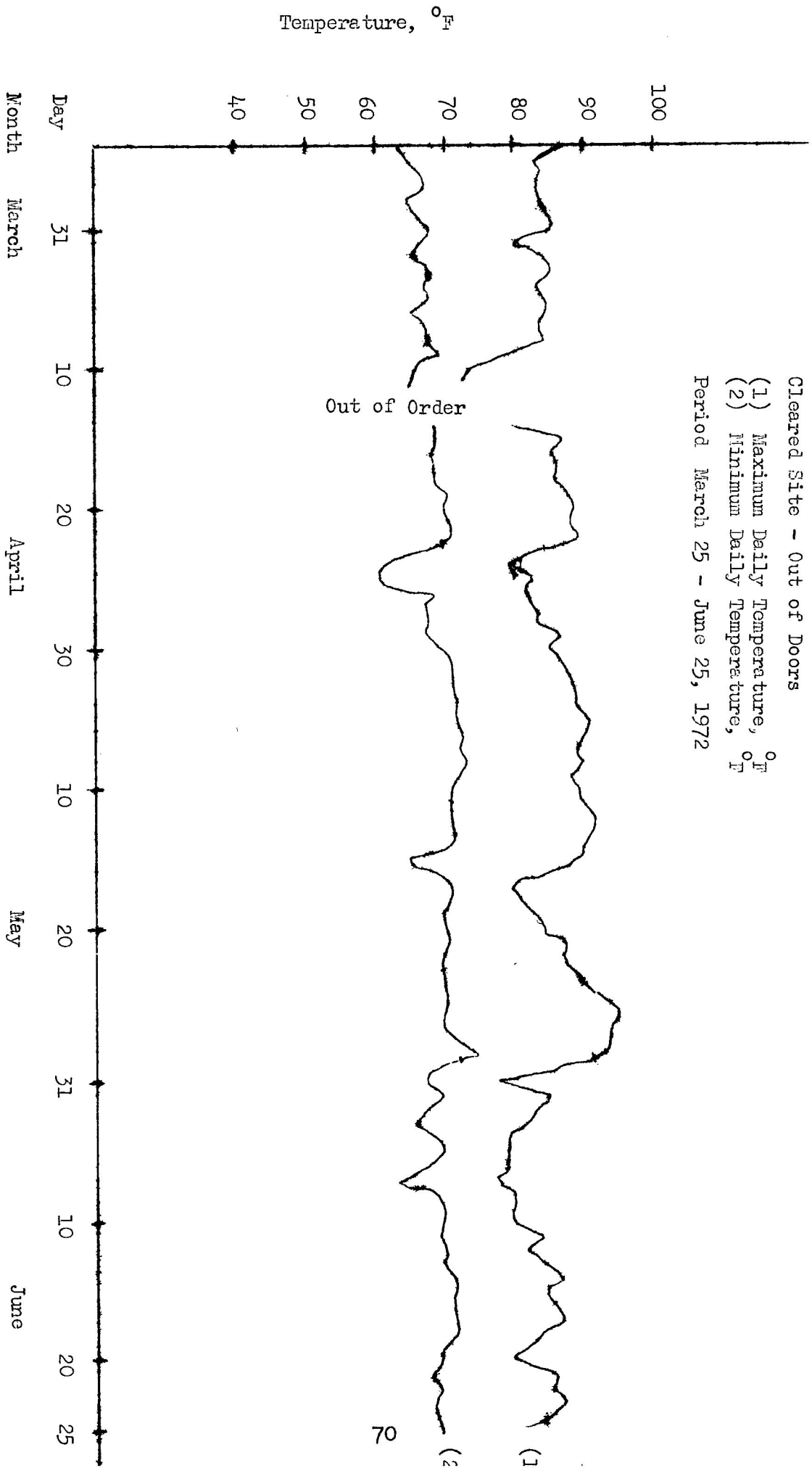
Cleared Site - Out of Doors
(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity
Period March 25 - June 25, 1972

Temperature ($^{\circ}\text{F}$)

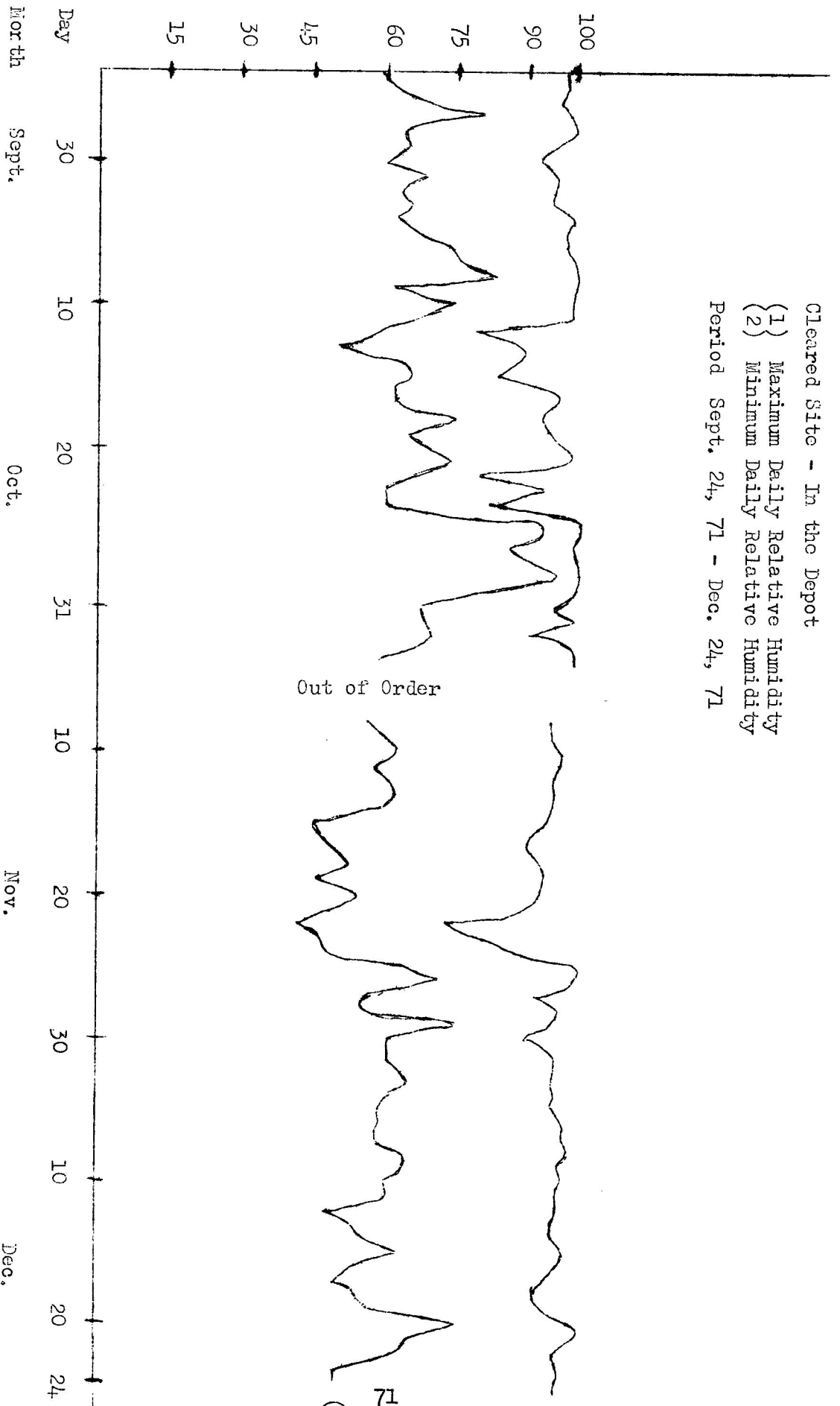




(1)
(2)
69



Percent Relative Humidity



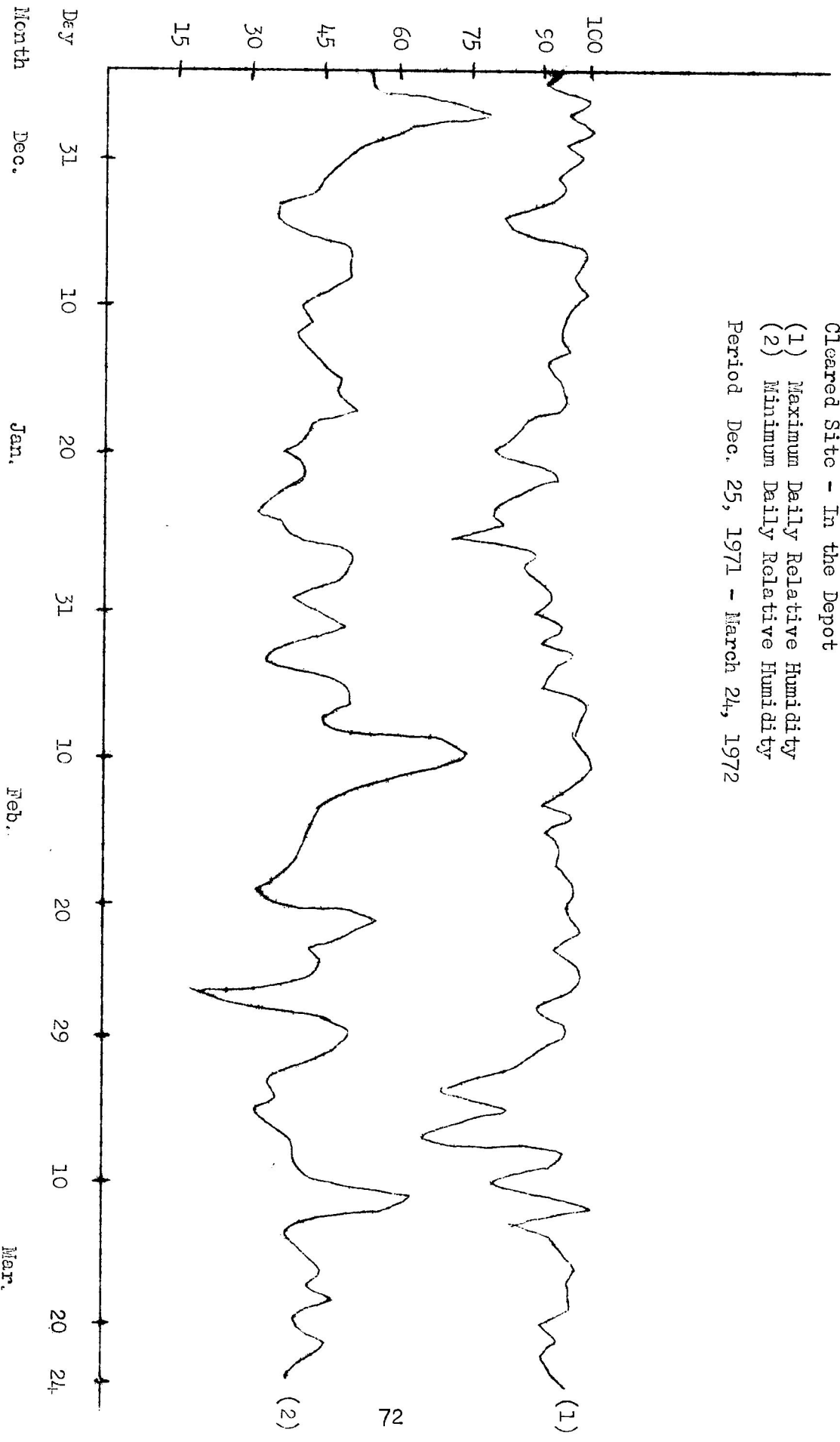
Cleared Site - In the Depot

(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity
Period Sept. 24, 71 - Dec. 24, 71

Out of Order

17

Percent Relative Humidity

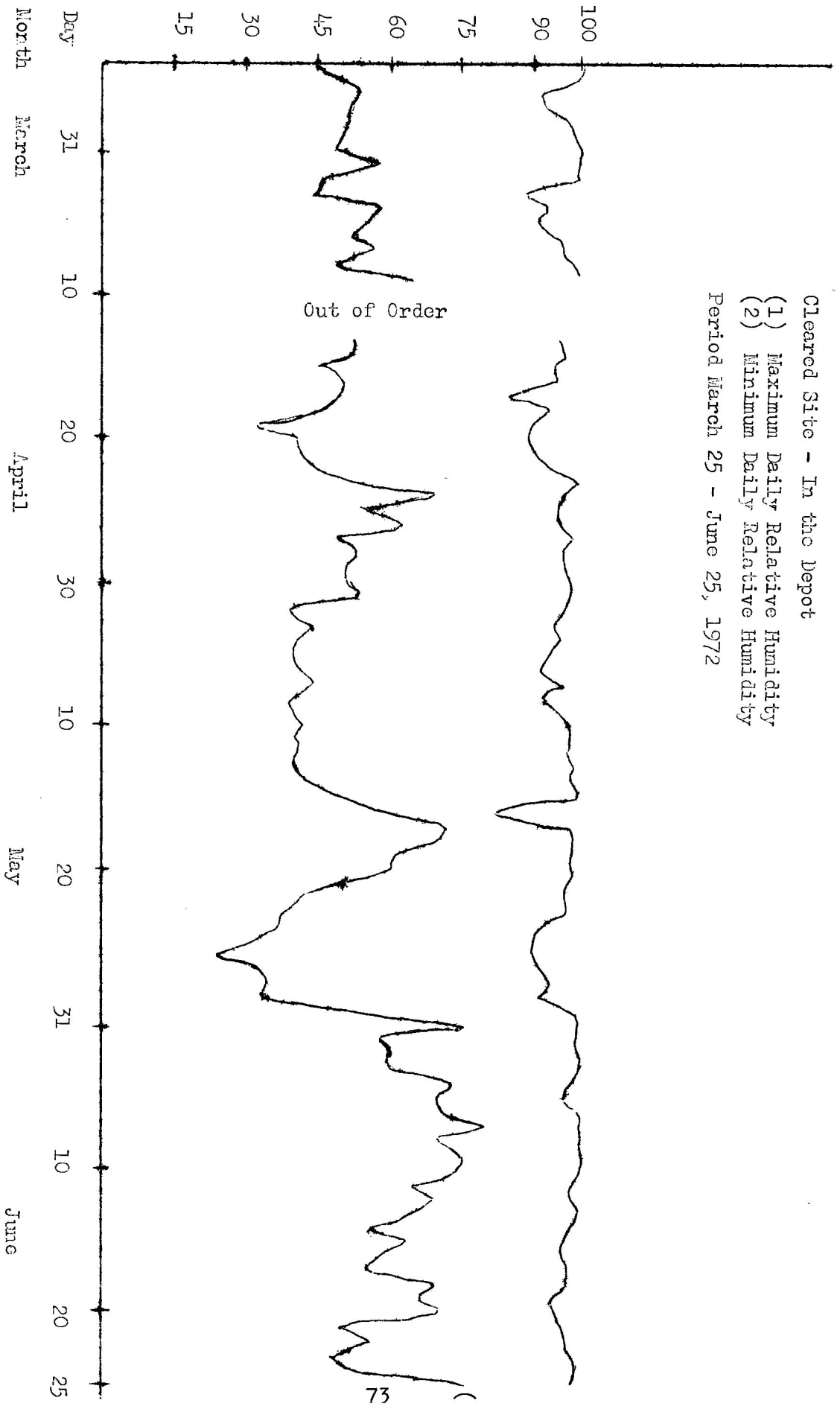


Cleared Site - In the Depot

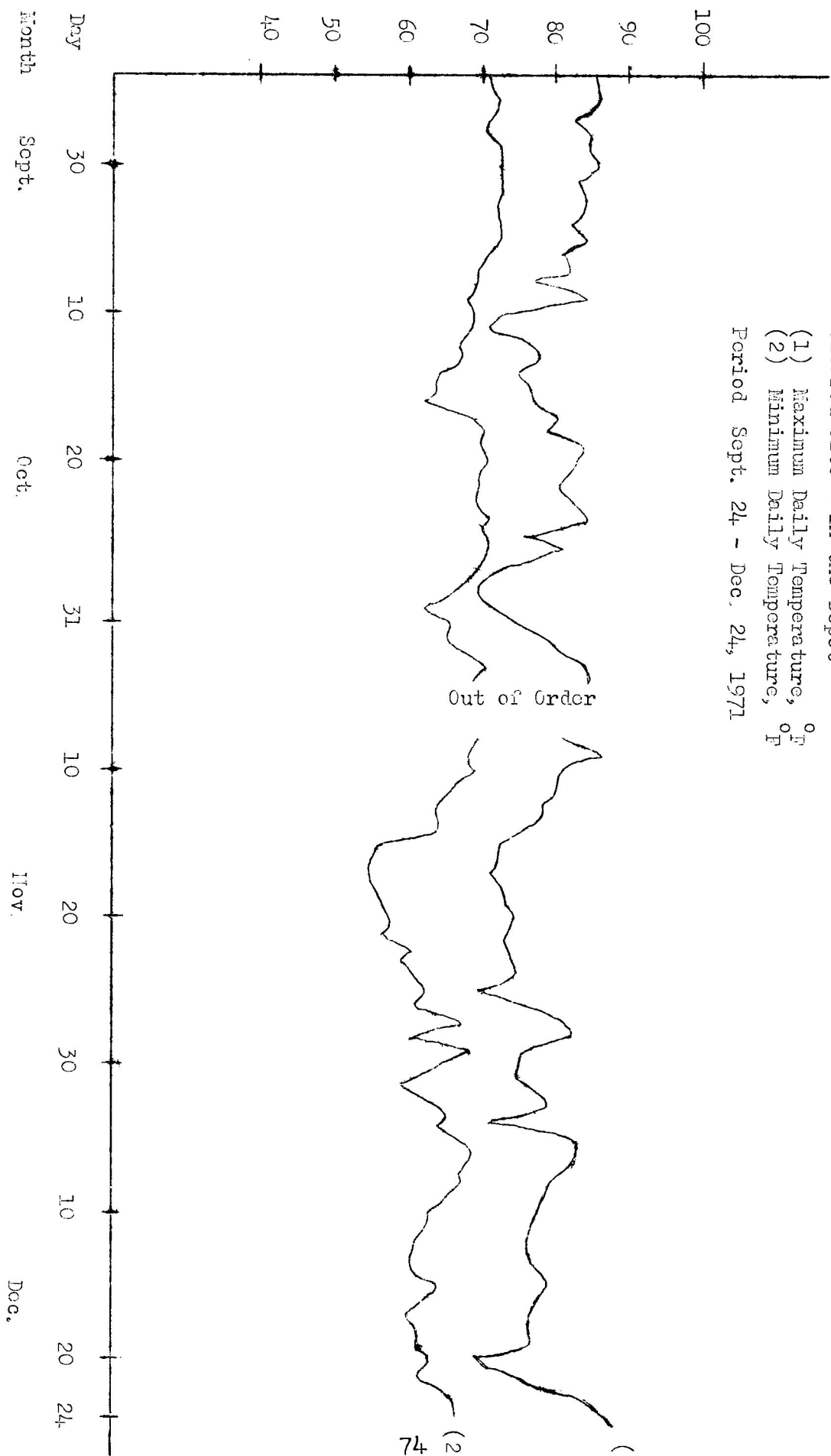
- (1) Maximum Daily Relative Humidity
- (2) Minimum Daily Relative Humidity

Period Dec. 25, 1971 - March 24, 1972

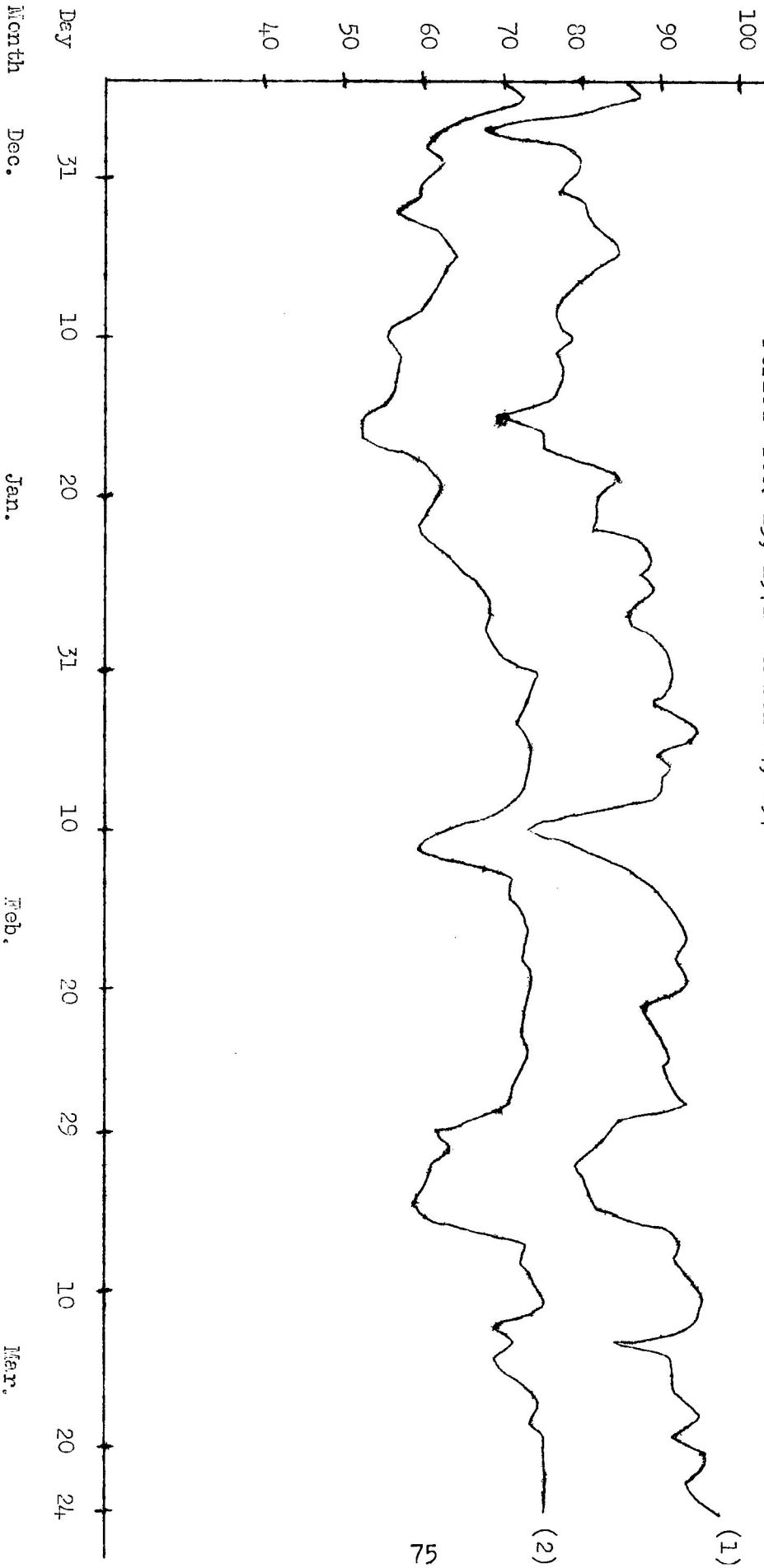
Percent Relative Humidity



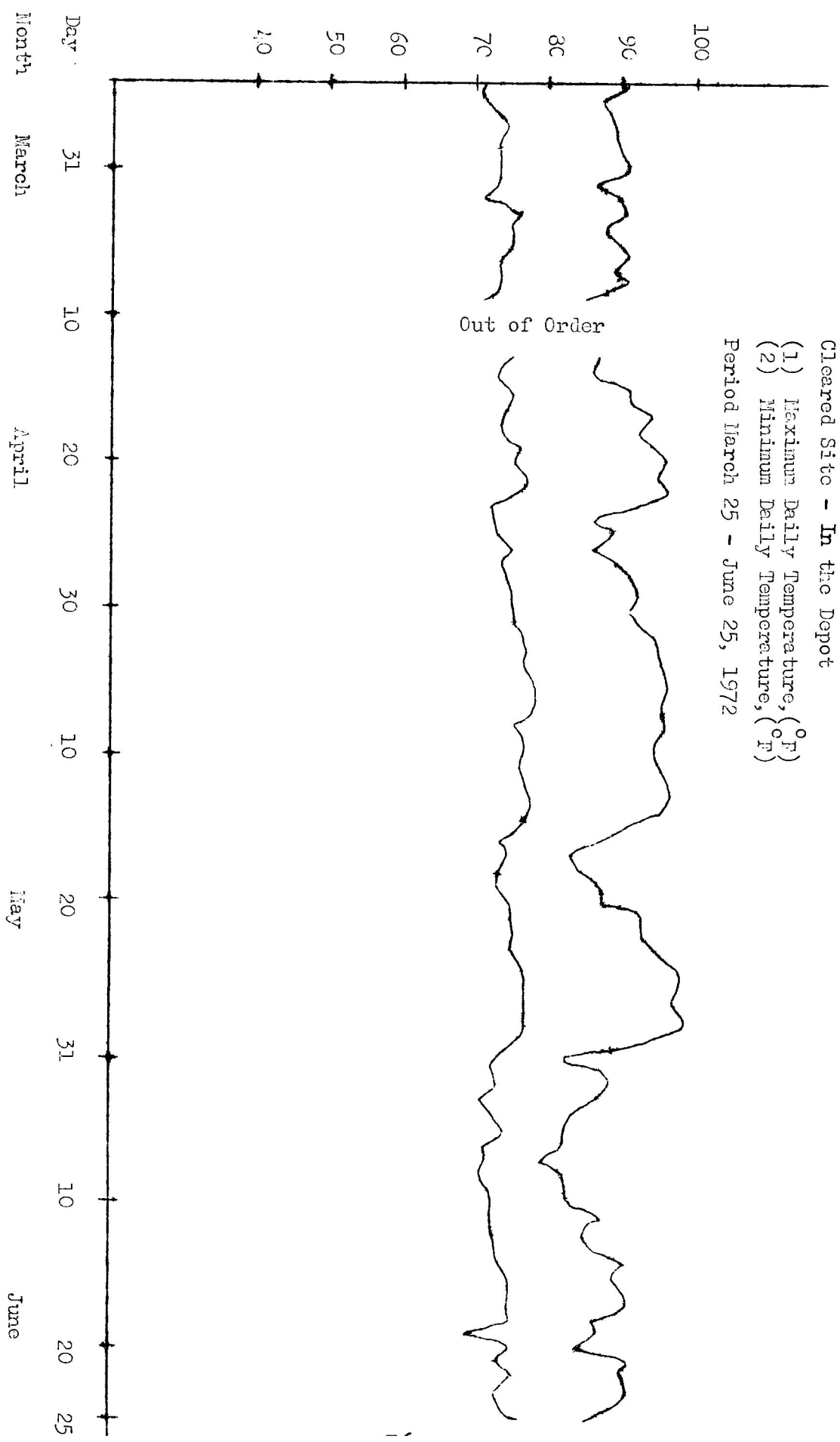
Temperature, (^oF)



Temperature ($^{\circ}$ F)



Temperature ($^{\circ}$ F)

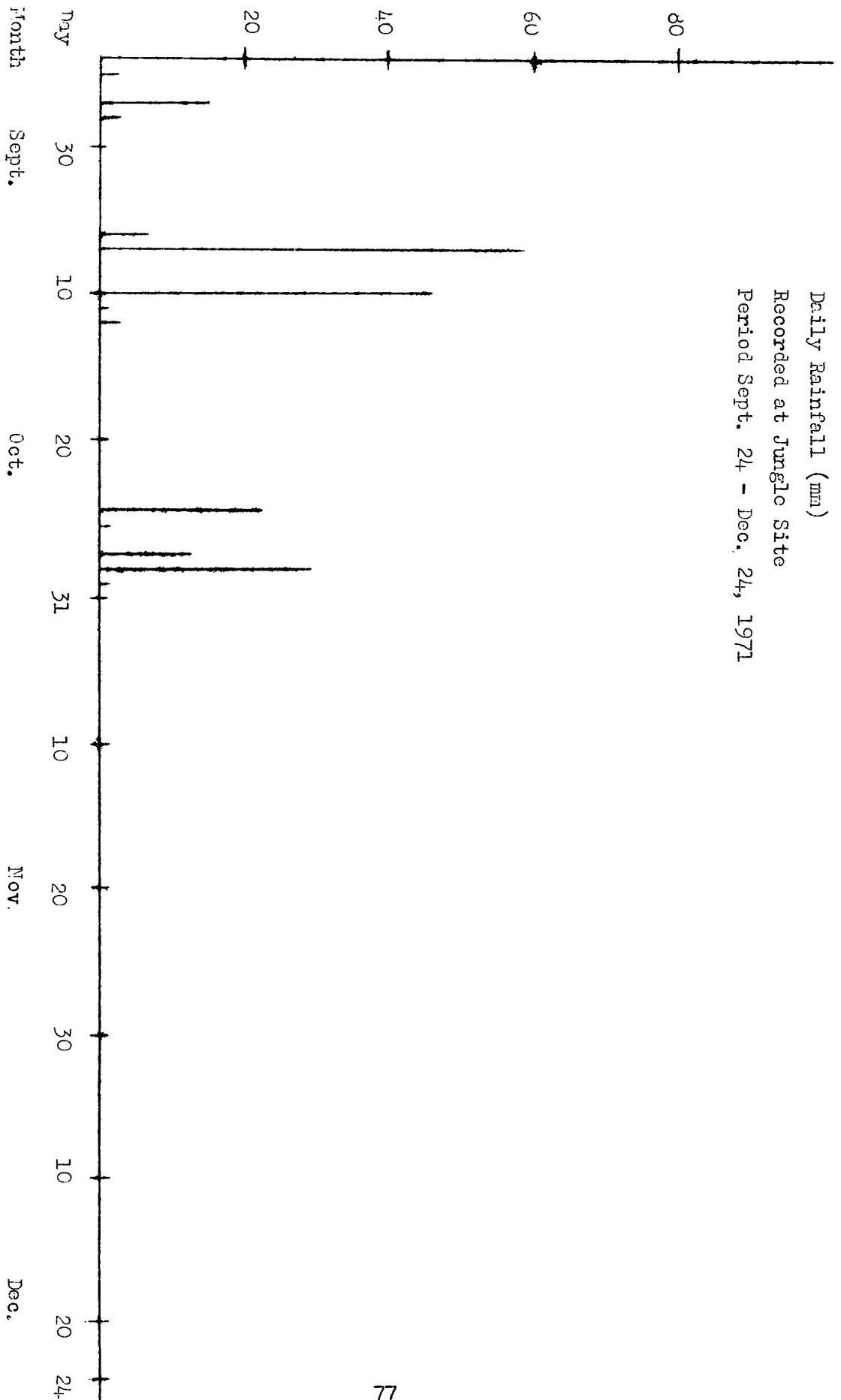


Cleared Site - In the Depot

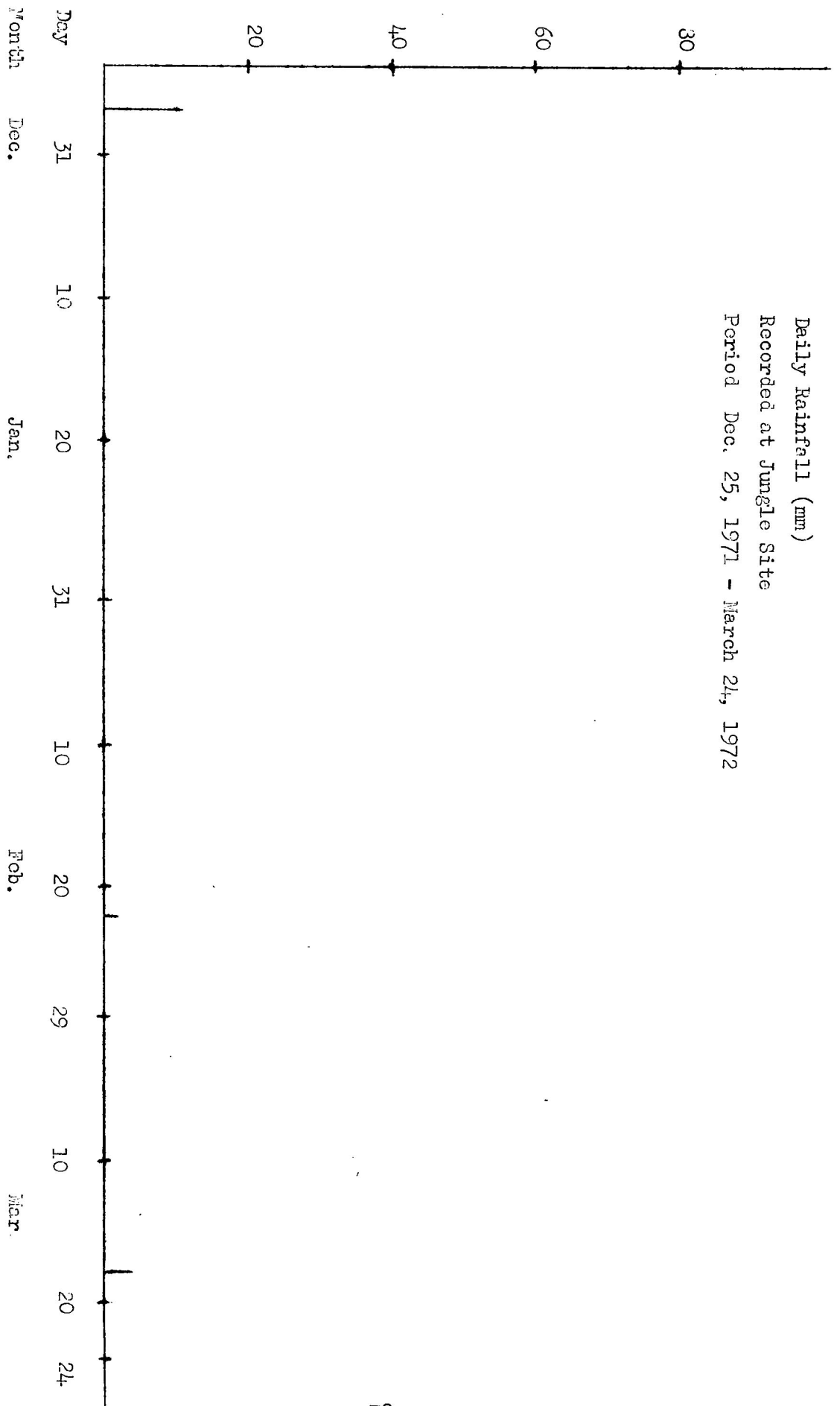
- (1) Maximum Daily Temperature, ($^{\circ}$ F)
- (2) Minimum Daily Temperature, ($^{\circ}$ F)

Period March 25 - June 25, 1972

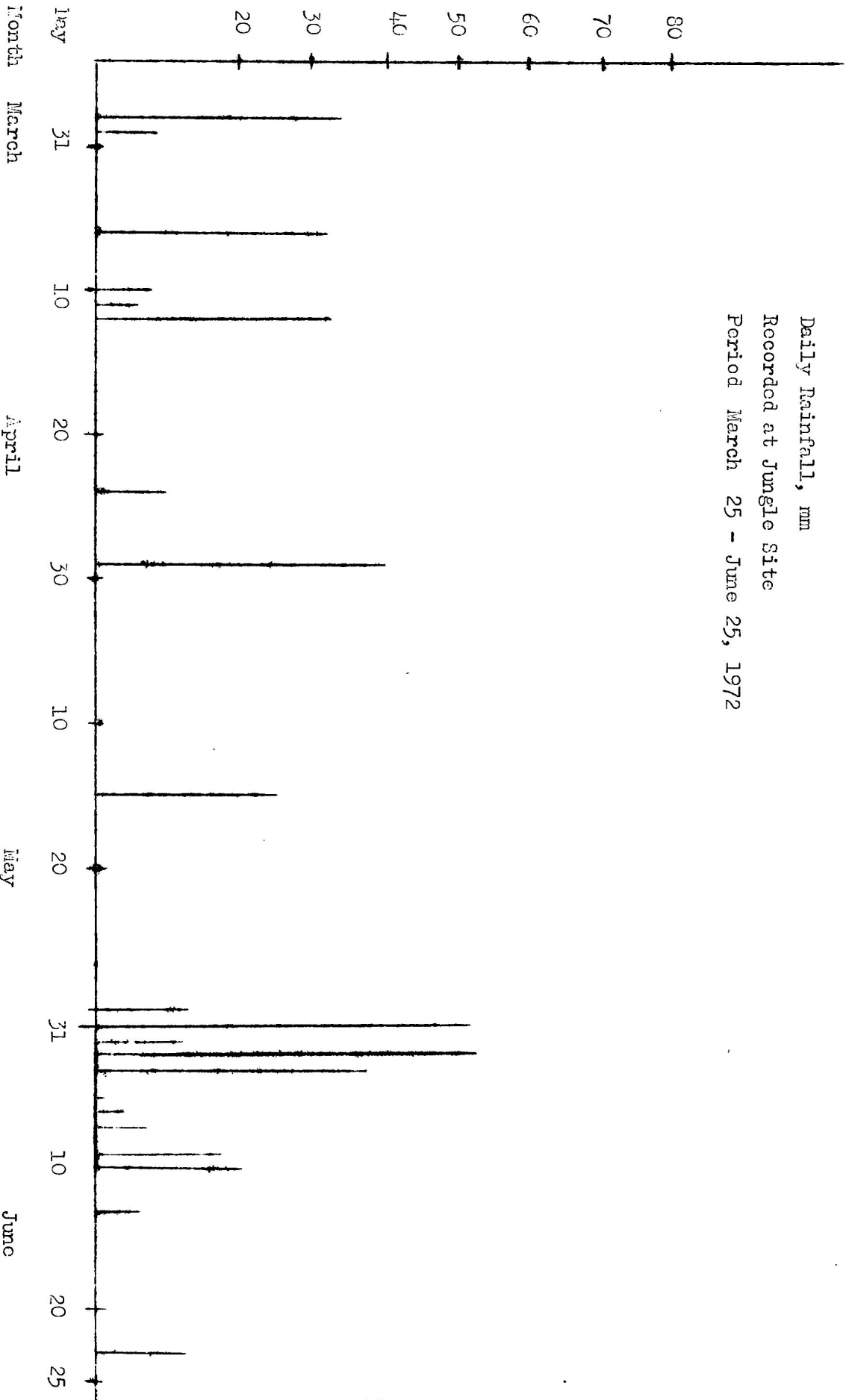
Rainfall (mm)



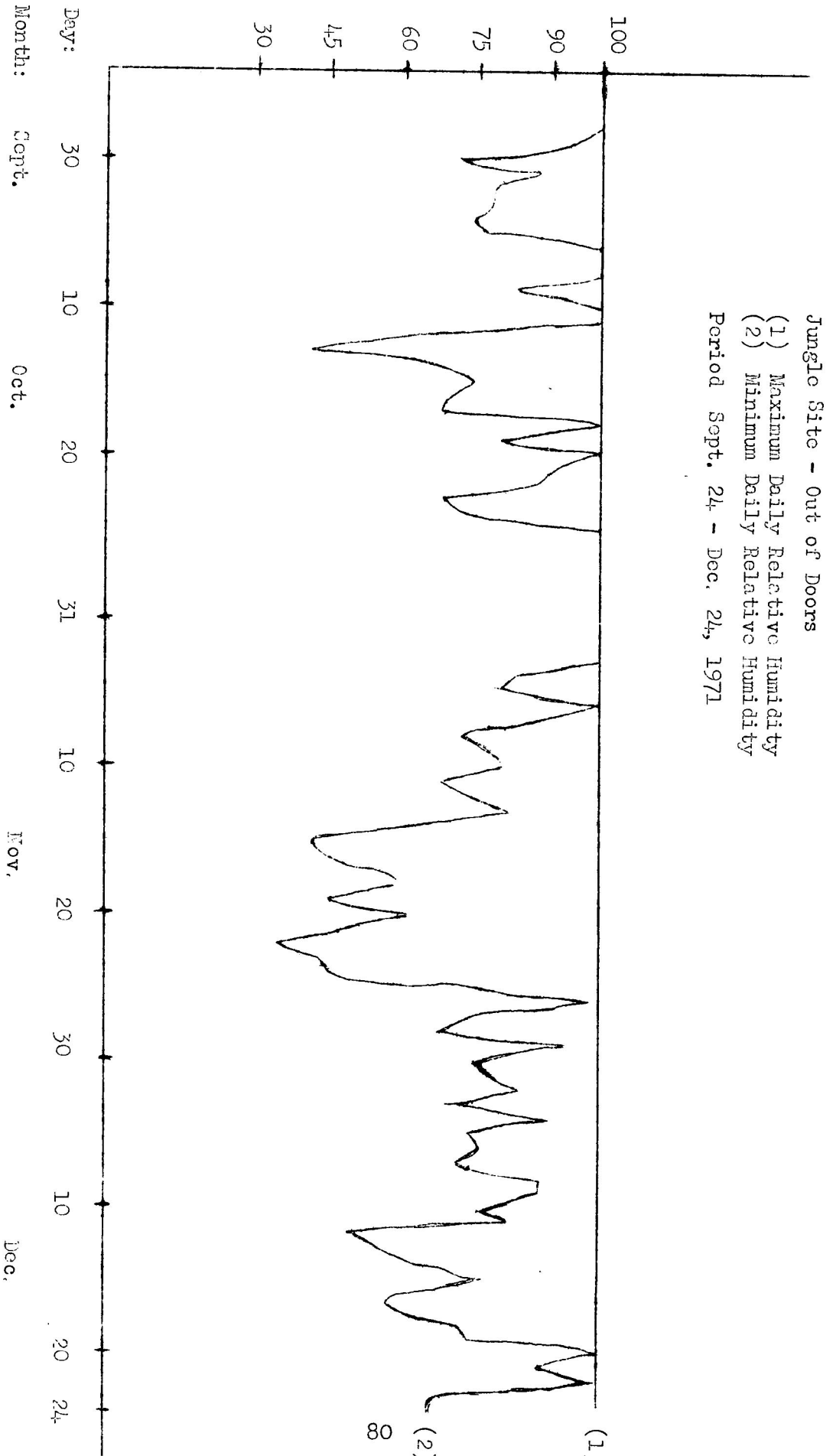
Daily Rainfall (mm)



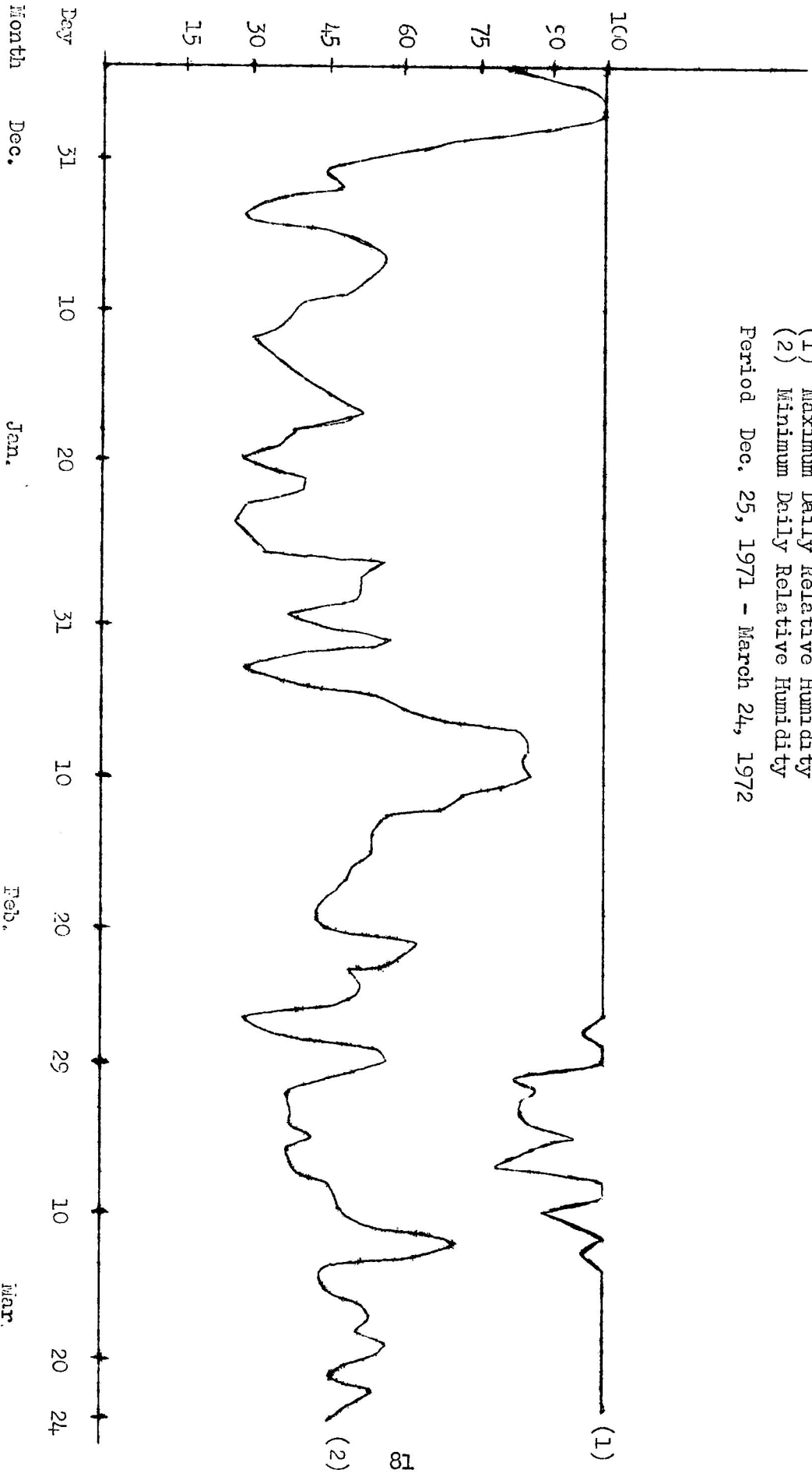
Rainfall (mm)



Percent Relative Humidity



Percent Relative Humidity



Jungle Site - Out of Doors

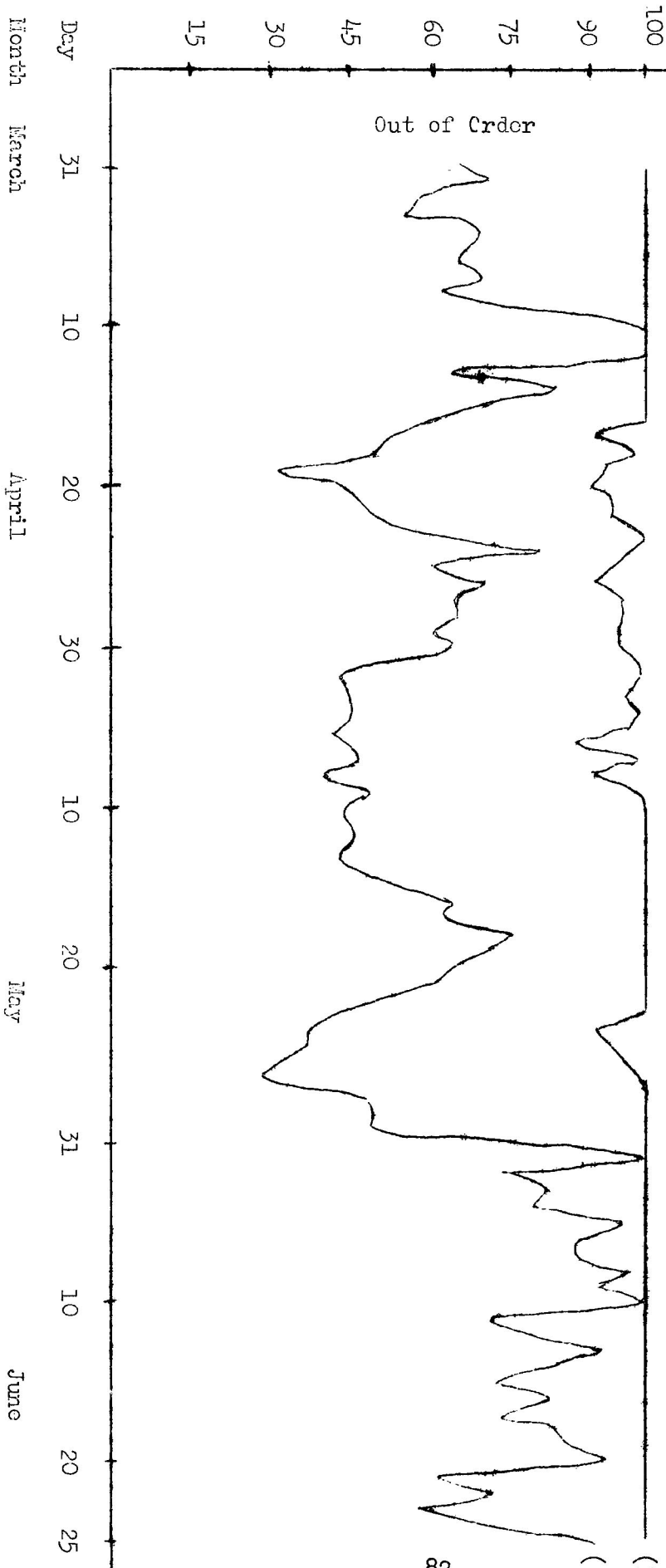
(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity

Period Dec. 25, 1971 - March 24, 1972

(1)

(2)

Percent Relative Humidity



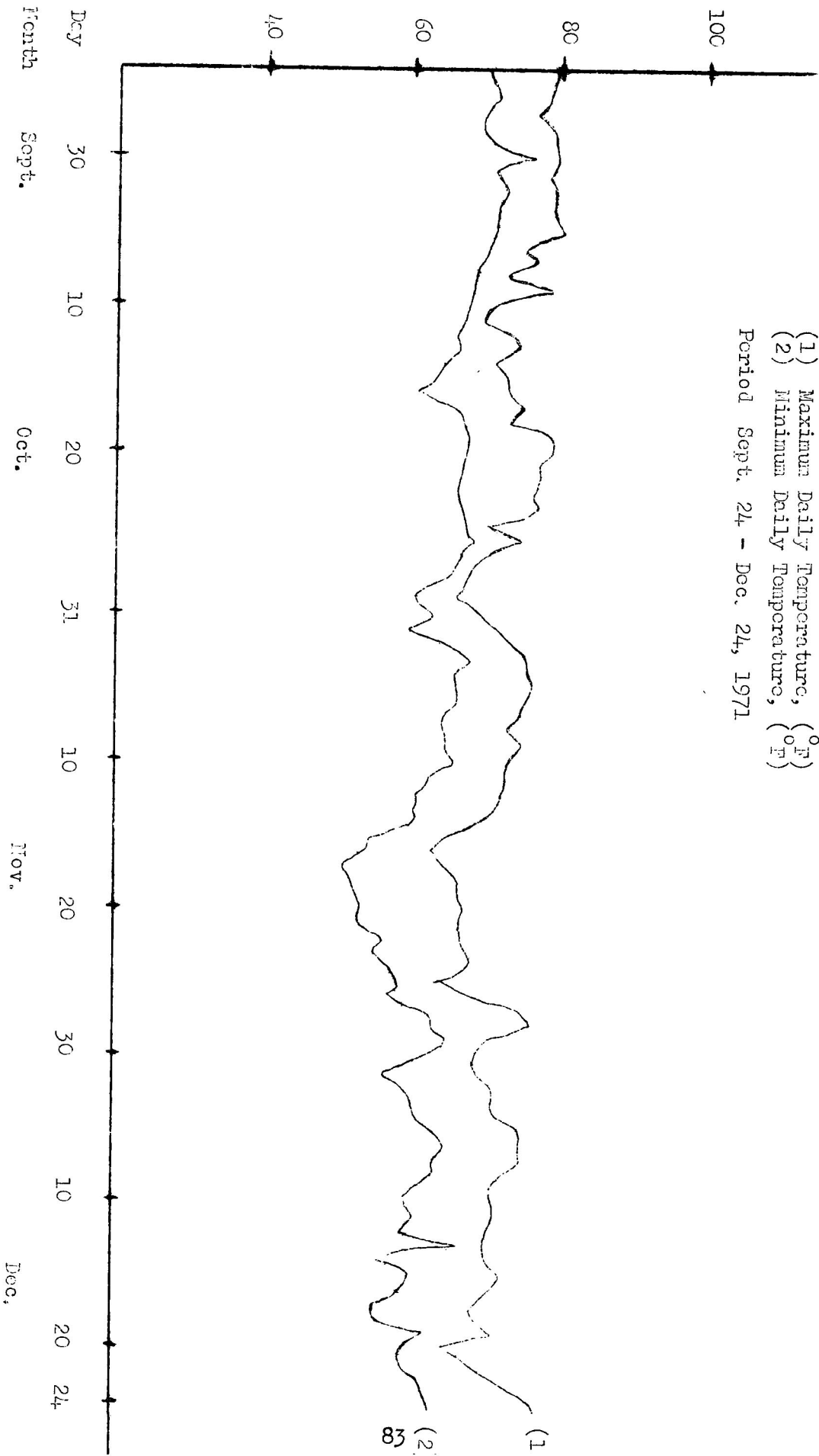
Jungle Site - Out of Doors

(1) Maximum Daily Relative Humidity

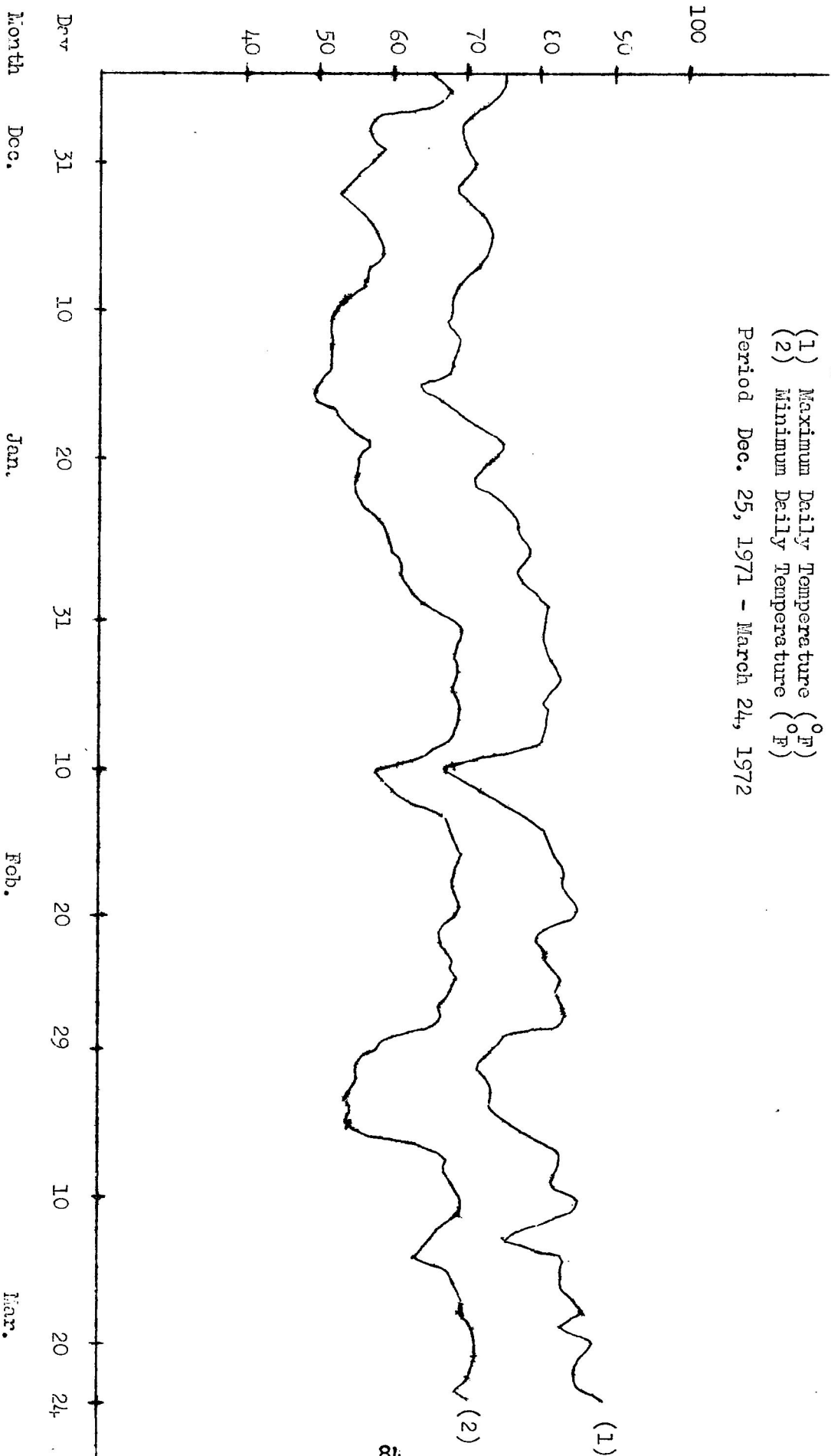
(2) Minimum Daily Relative Humidity

Period March 25 - June 25, 1972

Temperature ($^{\circ}$ F)



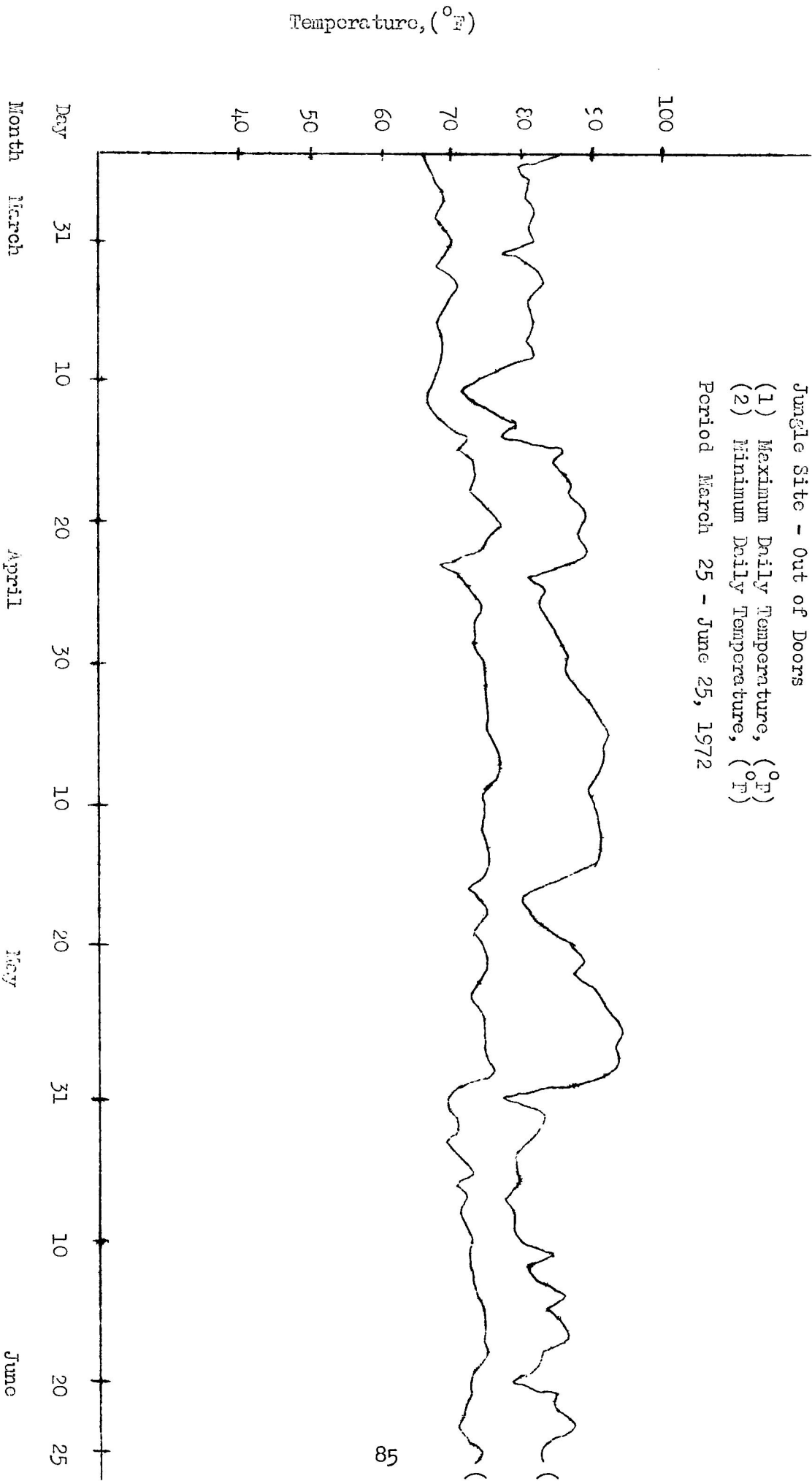
Temperature, ($^{\circ}\text{F}$)



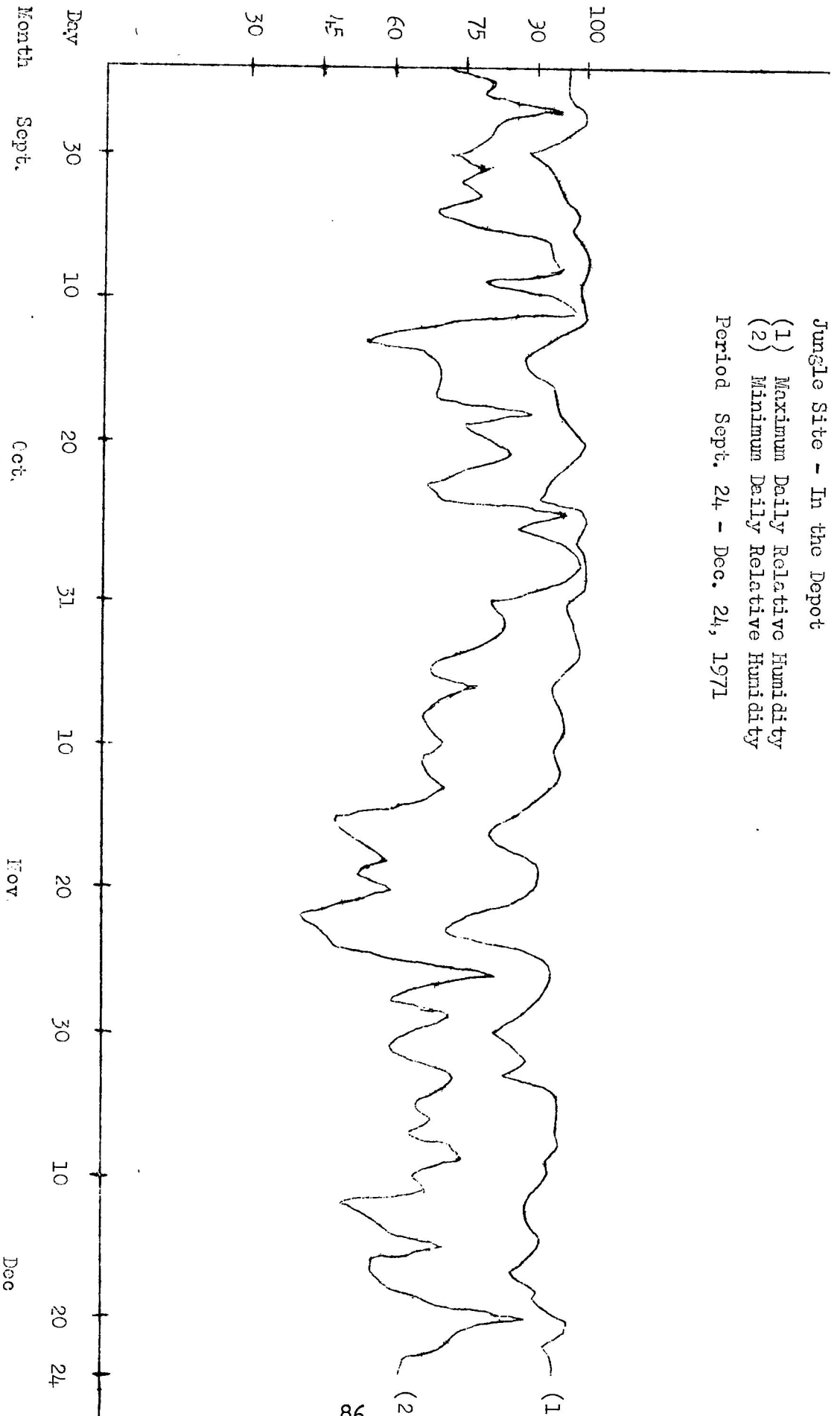
Jungle Site - Out of Doors

(1) Maximum Daily Temperature ($^{\circ}\text{F}$)
(2) Minimum Daily Temperature ($^{\circ}\text{F}$)

Period Dec. 25, 1971 - March 24, 1972



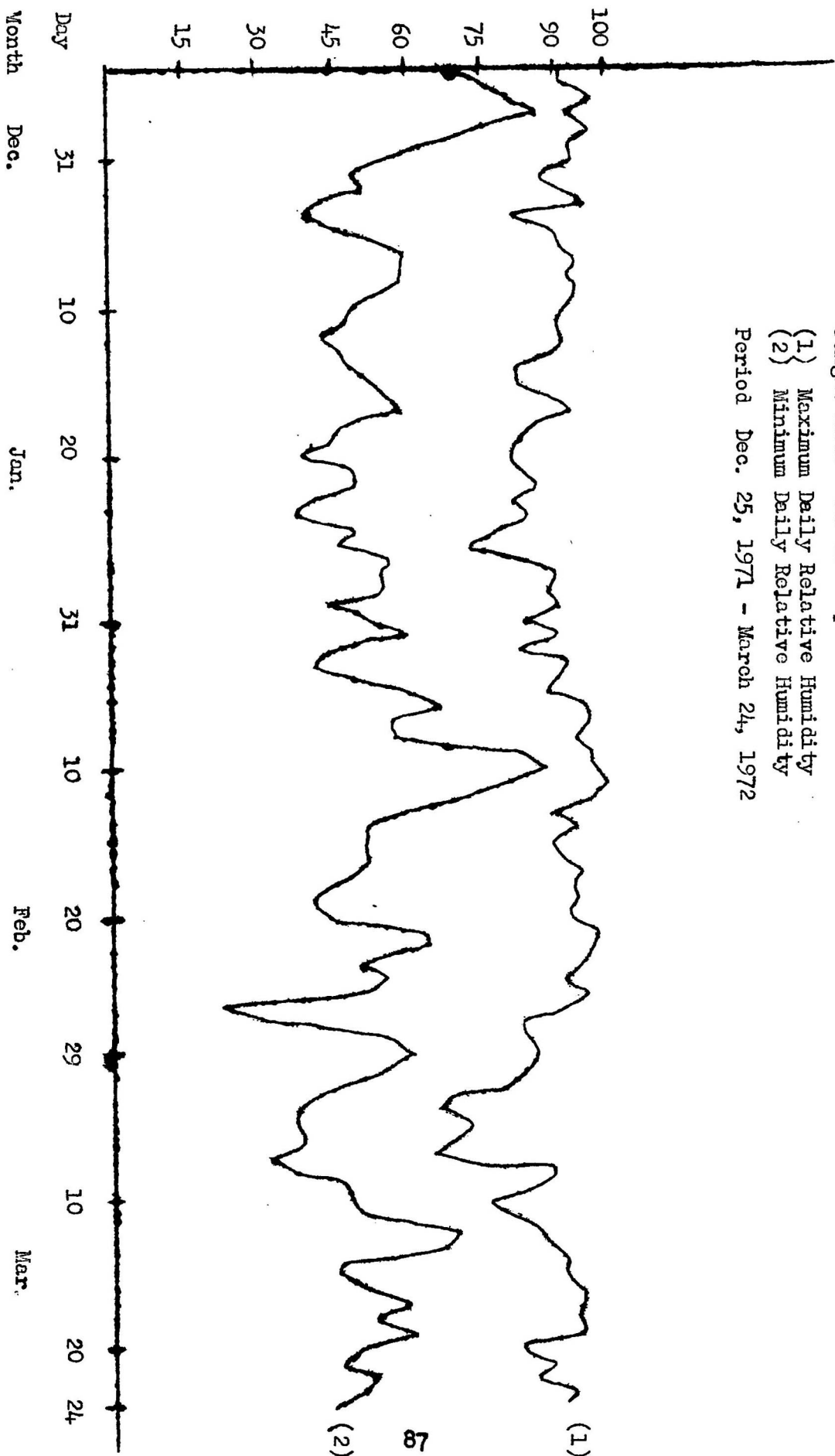
Percent Relative Humidity



Jungle Site - In the Depot
(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity
Period Sept. 24 - Dec. 24, 1971

(1)
(2)
86

Percent Relative Humidity



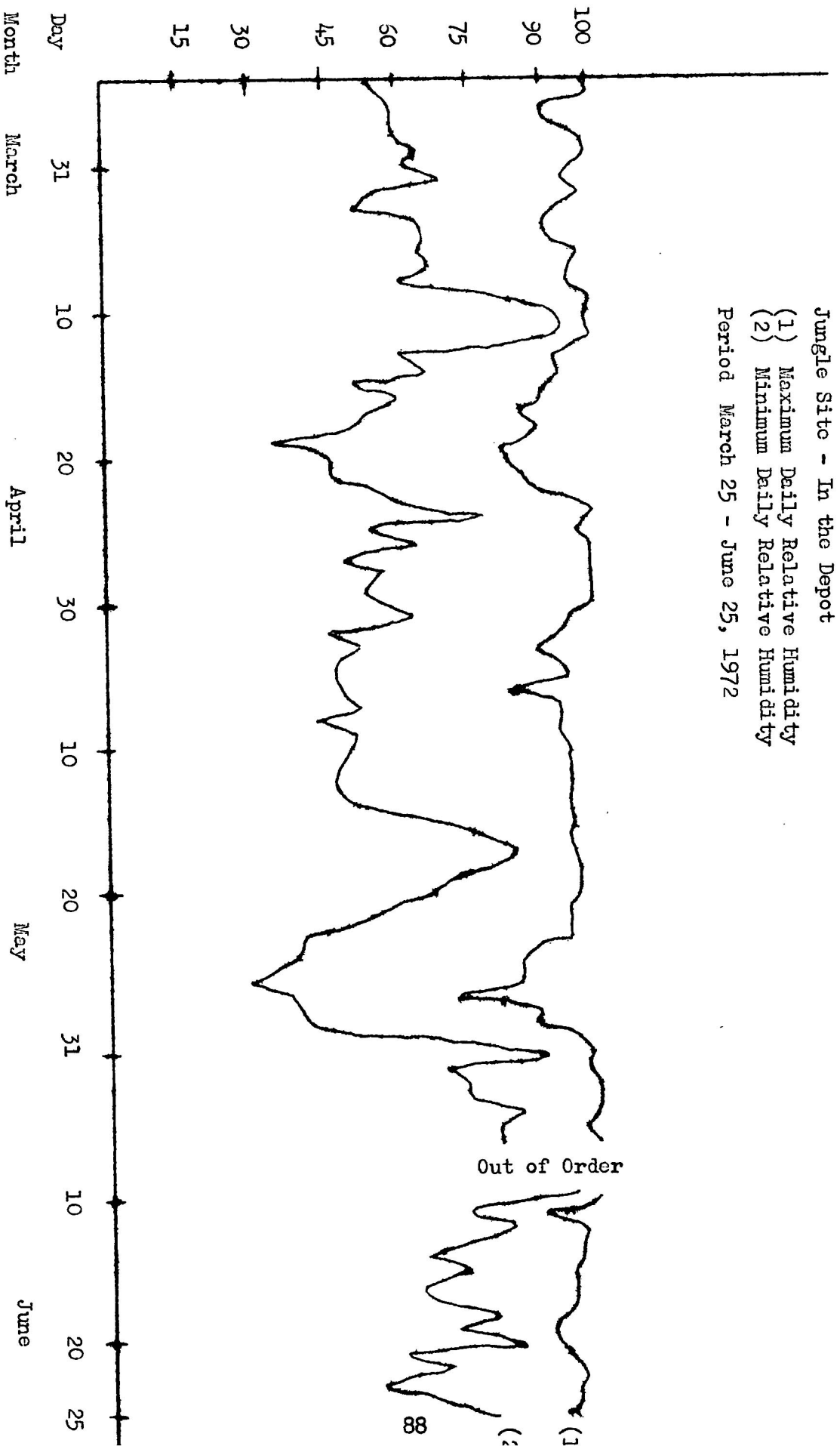
Jungle Site - In the Depot

(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity

Period Dec. 25, 1971 - March 24, 1972

(1)
87
(2)

Percent Relative Humidity



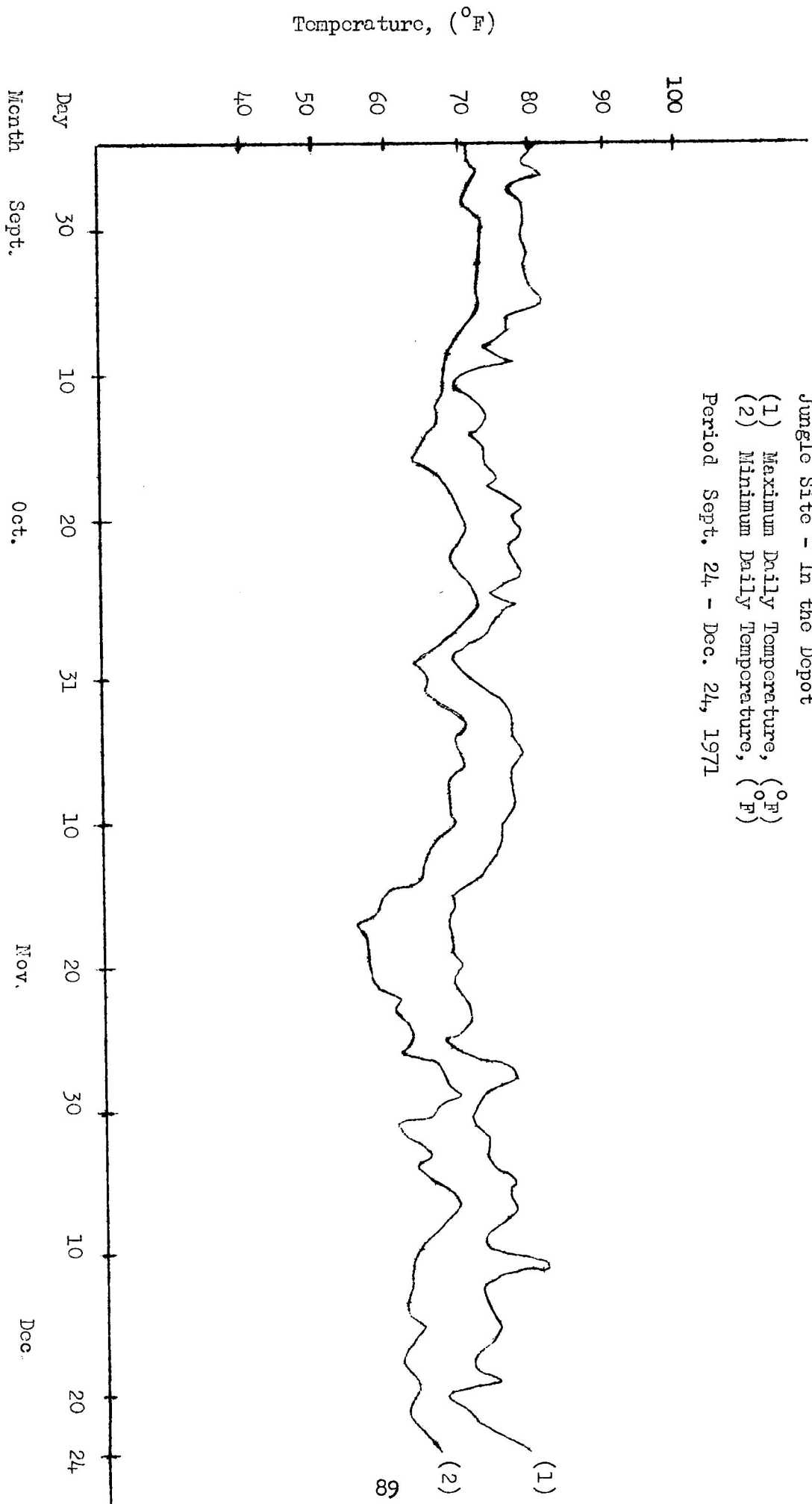
Jungle Site - In the Depot

(1) Maximum Daily Relative Humidity
(2) Minimum Daily Relative Humidity

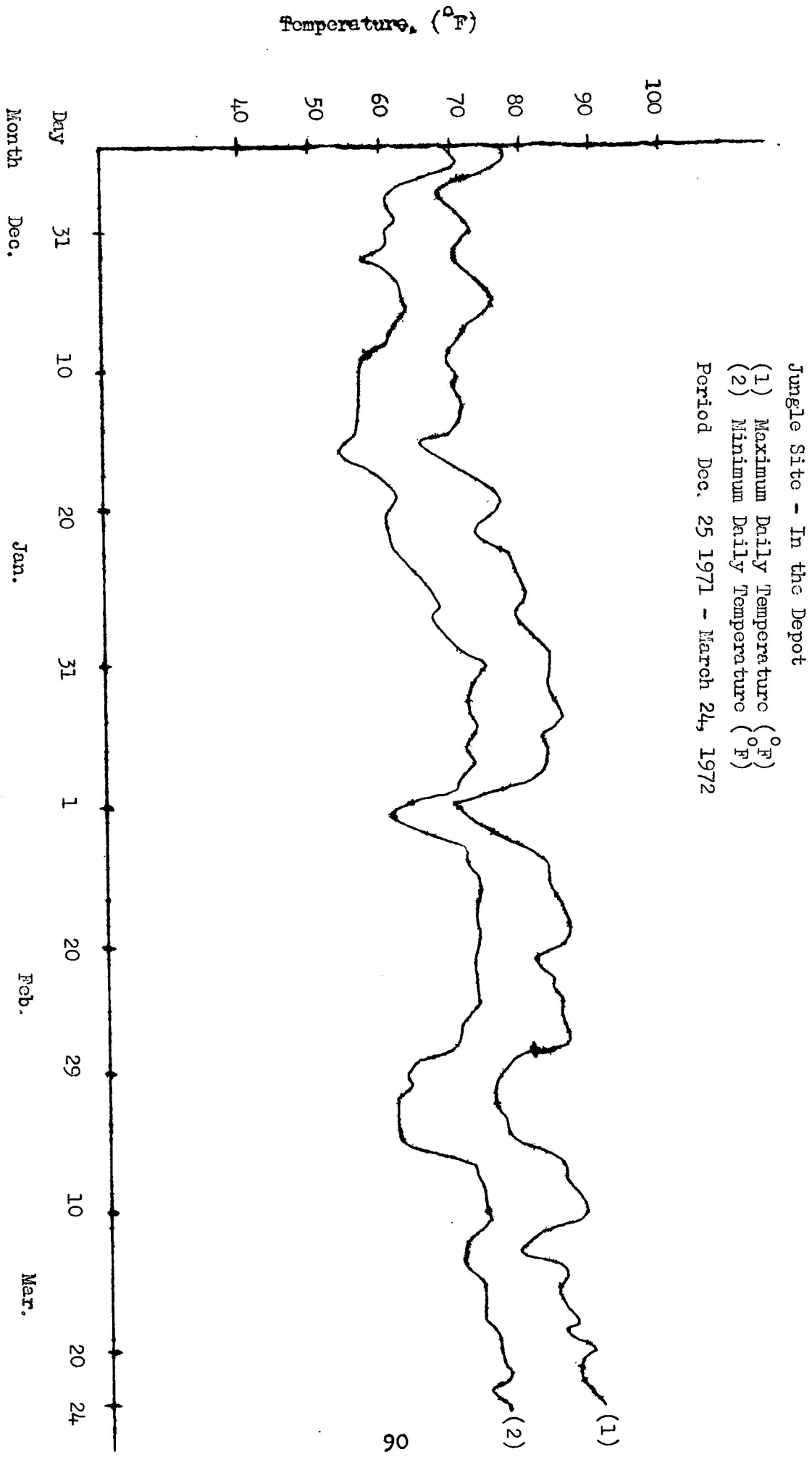
Period March 25 - June 25, 1972

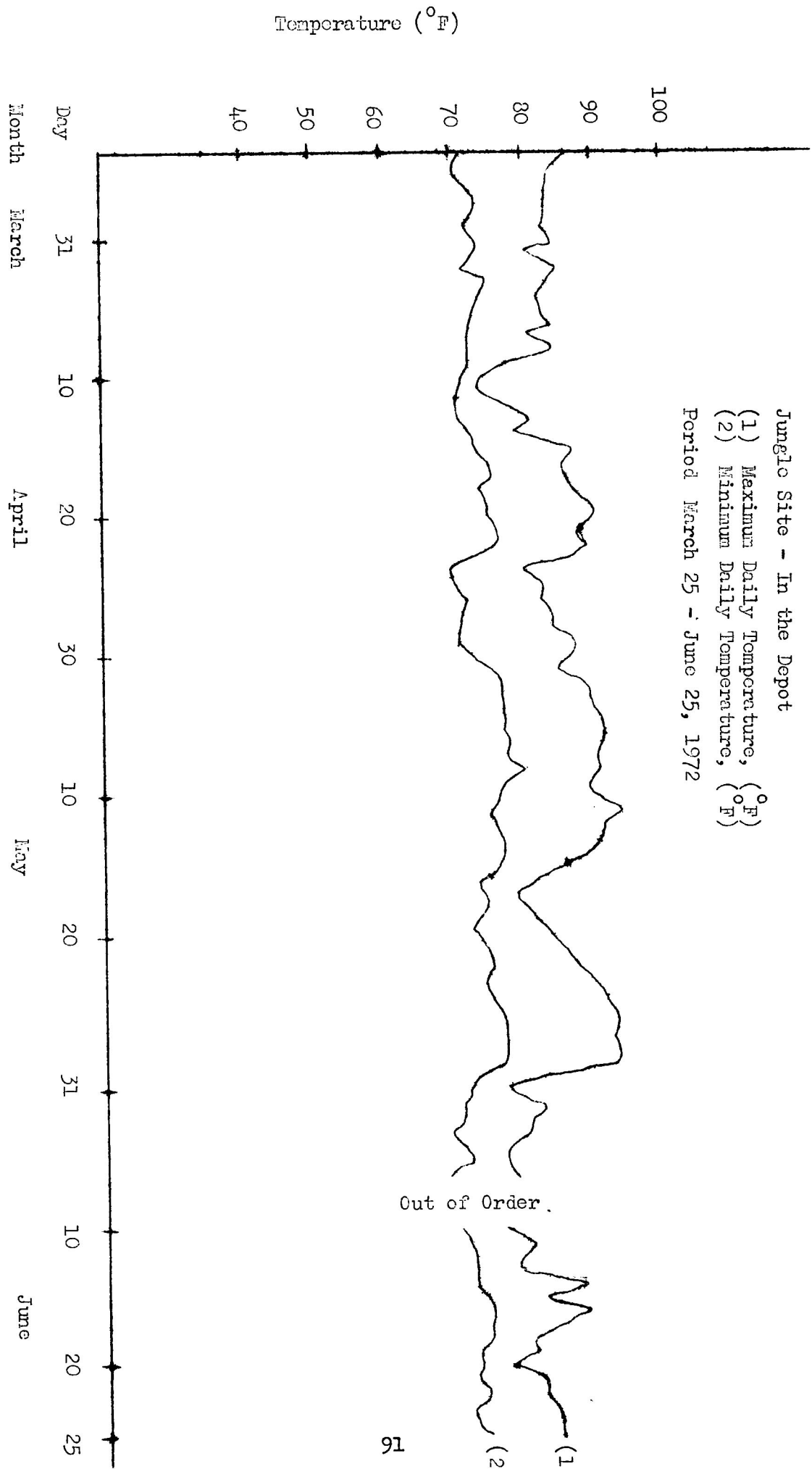
Out of Order

(1)
(2)
88



(1)
(2)
89





DISCUSSION

Tensile Strength Tests

Exceþt in the case of one sample, little or no change is perceptible in the measured tensile properties of samples stored in the air-conditioned room and the depots. The variation shown in the tables can probably be accounted for in terms of the variation, from one part to another, of the cloth and variation in sample preparation. However, the blue sample distinctly lost strength when stored in the cleared site depot and also appears to have deteriorated a little in the jungle site depot and air-conditioned room. It is notable that this sample also feels slightly damp or tacky to the touch.

Each sample lost strength rapidly when exposed on the cleared site racks. However, the same did not hold for the jungle site racks where the samples did not appear to lose strength enough to measure. In fact, they seemed to withstand the conditions there as well as they did those of the depots and control room.

Mold Counts

Samples exposed on the racks at both sites rapidly became populated by mold. These samples became discoloured and spotted and some of the spots could be visually identified as mold. A few samples of the third withdrawal from depots and control room were seen to be marked by sporadic mold spots, as shown in table 4. The frequency counts do not reveal any tendency for the mold population to increase in the samples stored in the control room and depots.

After withdrawal, it was found that small red ants were in the process of colonising the samples withdrawn from the jungle site depot on 27 June 1972. It appeared that, up to that time, they had done no damage.

Colour Tests

Measurements were made at the outset of exposure by an operative different from the one who made all subsequent measurements. There is appreciable subjective variation between measurements made by the two different operatives and also between measurements made by the same operative on different occasions. For the sake of uniformity in the subjective aspects of measurement, it would be best, where feasible, to compare results for outdoor

exposure samples with results obtained on the same occasion on samples stored in the depots or air-conditioned room rather than to compare results obtained on different occasions or by different operatives. .

Obvious fading and change of tint only occurred in samples exposed on the cleared site racks. Only the khaki samples, (1-1-2) and (1-2-1) showed fading, evident in the measurements, when exposed on the jungle site racks, where little or no direct sunlight reaches the samples. All samples exposed on racks at both sites became unevenly discoloured. The discolouration is most easily observed on the white sample, (1-2-2). In some cases it is visibly identifiable as mold growth. The green component in the measurements obtained at the third withdrawal for sample (1-2-2), taken from the cleared site racks, is due to visible algae.

On the cleared site racks, the rate of loss of colour, relative to the amount of colour present, does not vary with time in the same manner for each sample. The khaki samples, (1-1-2) and (1-2-1), showed a rapid loss on their upper sides up to the time of the first withdrawal and the rate then decreased. For the olive drab samples (Nos. (1-1-1) and (2-1-1)) the rate was somewhat slower during the period up to the first withdrawal than it was subsequently. In the case of the blue sample, (1-2-3), the rate of fading on the top side was slow up to the first withdrawal and then increased through the second and third withdrawals. These results are presented in table No. 45 . The samples on the cleared site racks also changed visibly in hue and this change is brought out in the measured variations between the rates of fading of the separate colour components. The authors suggest two alternative explanations for the accelerating rate of fading shown by the top surfaces of most of the samples. Firstly, it could be due to some protective mechanism in the finished cloth which inhibited fading until its protective capacity was exhausted. The second explanation is a particular case of the first. If the optical density of the dyed fibres was initially high enough, the dye in the surface layer of each fibre would, at first, protect the dye underneath. An analogous effect is evident in the accelerating fading of the undersides of samples which were initially protected by the dye in the cloth above.

CONCLUSION

Please see the last paragraph of the summary which contains the conclusions drawn from the results reported above.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to the Microbiology Unit, ASRCT for their generous co-operation in providing space and facilities in the laboratory and to Mr. Paitoon Kittichaichananon, Mr. Suchart Sun-tornpan and Mr. Pakorn Prakarnseree who made the mold counts. Similarly, Mr. Sathit Kashemsanta is to be thanked for performing the tensile strength tests and Mr. Chunnong Hayakitkosol for making colour measurements. Thanks are also due to Dr. L.E. Wood of RDC-T for providing valuable guidance in the prosecution of the project and for having made many arrangements for bringing it into being.

TEST PLAN

Sakraat Experiment Station

Applied Scientific Research Corporation of Thailand

Subject

Textiles

(Natural and Synthetic Fibres)

1. Sponsor: Clothing Organisation
Manufacturer: Clothing Organisation
2. Purpose: To determine shelf life and toleration of outdoor exposure which are to be assessed from the rate of deterioration, the growth of mold, changes in colour and changes in tensile strength.
3. Scope of Trial:
Number of types: 6
Number of withdrawals: 4
Number of sites: 5
4. Exposure:
Cleared site - Indoors
 - On racks

Jungle site - Indoors
 - On racks

Control room - On shelves
5. Assessment:
Visual on site
Colour changes
Microbiological growth
Loss of strength
6. Withdrawal
Program: One year with withdrawal at three monthly intervals.
7. Meteorological
Data: Routine
8. Reports: At each withdrawal

