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EZPLOT: A COMPUTER PROGRAM WHICH ALLOWS EASY USE OF A LINE PLOTTER

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ABSTRACT

This technical report describes the use of a computer program (called EZPLOT) which has been written to allow easy use of a computer-driven line plotter. This program has been designed to provide a simple set of commands which have adequate facility to plot a wide range of needs, specifically those associated with the ecological studies of the US/IBP Island Ecosystems Research Program.

In general, the EZPLOT commands allow the description of the physical layout of the intended plot and provide several ways of entering data points and lines. Since this procedure, including the labelling with text information, is all done by the computer and plotter, it is possible to plot data at intermediate stages or modify plots to more effectively display the information without excessive redrafting charges.

The technical descriptions of the EZPLOT commands are given with examples of their use. The format of this technical report deviates from the other numbers in this series as it has been designed primarily to serve as a user's guide.

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Introduction

EZPLOT is a computer program which has been written for the Island Ecosystems Research Project. The name of this computer program is designed to imply its use, that is, the program is supposed to allow for easy plotting of project data. The restriction imposed by the computer of having a maximum-name length of seven characters has precluded the full spelling of easy plot; however, this shortening is not intended to change the pronunciation.

The plotting equipment which is described is available at many computer facilities. The line plotter, manufactured by California Computer Products (CalComp), consists of several functional parts. There is a drum which rotates under a pen and moves the paper along its long axis. The pen can be moved along a track across the short axis of the paper. Also, the pen can be raised and lowered so that it either moves while drawing or not drawing. All of these operation are controlled by a series of sequential instructions from the computer through the communication facility of the plotter. Magnetic tapes are created on the computer which are later read by a separate tape drive connected to the plotter.

The general procedure required to use the plotter is as follows:

1. Instructions to guide the physical operation of the plotter are prepared and punched onto tab cards.

2. The cards are read into the University of Hawaii IBM 360/65 computer to be interpreted by the program EZPLOT.

3. The output of EZPLOT is a magnetic tape on which the plotter instructions have been stored. This tape is mounted on the plotter-tape drive by the computer operator.

4. The plotter is activated by the operator, resulting in the reading of the tape and production of the plot.

It is very easy to use this plotting facility and the resulting plots are of a high quality suitable for photo reproduction.

This technical note is intended as a preliminary presentation of the instructions required to prepare data for the computer program EZPLOT. Prior to the implementation of EZPLOT, special-purpose programs generally had to be written to make use of the University of Hawaii Computing Center's CalComp plotter. This has required a certain familiarity with a computer language, and as such, has probably restricted general use of this facility. Without sufficiently simple access to the plotter, it is questionable whether effort to program many applications is worthwhile. EZPLOT allows the use of input data to create CalComp plots; no programming is required of the user. Hopefully, this will make use of the plotter easy enough so that its advantages may be more generally realized.

This program was written in response to the general needs in the Hawaii IBP program where researchers have to have graphical summaries of their data at intervals during their data collection programs. The advantages of using a computer to prepare most of these graphical summaries are many; foremost is the ability of each investigator to easily specify what presentation he wants with a minimum of concern for the technical problems of drafting. This is especially efficient when multiple graphs (such as from several component studies) are plotted in the same manner. Also, it is possible to prepare high-quality graphs at intermediate stages of the research and not have to repeat the earlier preparation effort as new data are added. Changes in scaling, labels, symbols, and the like are also made with a minimum of effort.

EZPLOT, in its current version, is not designed to extract values from complex data sets to be plotted either as symbols or lines. It is expected that these values will be provided as input data along with the plot commands.

It is suggested that readers interested in using EZPLOT skim the sections describing the specific facilities available using EZPLOT (sections 3 through 15) and then work through the section on hints for plotting graphs (16) with concurrent reference to the example (from the Appendix) which appears to be most pertinent to the reader's immediate application. When questions arise regarding the specific parameters of the commands, back reference may be made to the earlier sections.

Most important, however, is that the reader actually try to use EZPLOT. Since this version of the program and the description of its use are preliminary, any suggestions, especially regarding cumbersome specifications or obscure descriptions will be especially welcome.

CalComp plotter

2. The CalComp Plotter and EZPLOT

The CalComp plotter currently being used for EZPLOT is a model 556 drum plotter. In an elemental sense, the only information that this device will accept directly are control instructions for the servomotors which 1) lift the pen, 2) move the pen along a y-axis track and 3) rotate the drum in the x-axis.

A detailed description of the actual procedures employed can be found in the various technical reference manuals at the Computing Center. For readers of this technical report, it is sufficient to understand that the plotter must ultimately have all movements specified as these three parameters. EZPLOT accepts instructions (called commands) at a higher level (ie, as a more abstract description) and converts these, often in combination with other information which has been assumed or specified by a previous instruction, into a form which can be used by subroutines which produce the detailed instructions for the plotter itself. Therefore, the focus of EZPLOT is on the specification of the desired plot in terms of commands. EZPLOT has been designed to provide some commands which are sufficiently abstract that they save the user from having to provide detailed specifications, but are restricted in what they can do. Other commands are available which operate at a level close to the direct-instructions to the plotter. In all cases, a compromise has been struck such that a 'reasonable' amount of information is associated with each command. EZPLOT can be considered to have a 'memory' in that it allows the establishment of values for some parameters which are required for the actual use of some commands. These parameters, such as that specified with a TEXT_HEIGHT command, are assumed to often remain unchanged during several uses of the TEXT command (which requires the use of the TEXT_HEIGHT parameter.) By separating the TEXT_HEIGHT parameter from the TEXT command, unnecessary repetition of a 'constant' value and unnecessarily long parameter lists for some commands are avoided. Commands, therefore, can be seen to be of several basic types. Some of the commands do not directly cause anything to be plotted (examples are the TEXT_HEIGHT, DATA_AREA, and DATA_COORD commands.) These commands are used to establish parameter values which are referenced when other commands are issued. Some commands produce a complex series of pen movements (such as TEXT or *). Other commands, specifically the 'commandless' movement of the pen to a new coordinate position, are very direct, performing only the simple movement desired. Were all pen movements restricted by their being specified by this direct type of command, the plotting of text and symbols would be complex enough to be beyond the ambition of most users. But for many users, such a direct command is the only way to obtain the desired pen movement. Therefore, commands

exist at many levels of abstraction.

Another characteristic of the CalComp plotter is that it must receive its direct instructions in units of inches corresponding to the physical hardware. There are two aspects of this which are important; it is possible to establish a coordinate reference system at the start of a plotting session and change the origin of this reference system at any time during the session (for successive plots) and it is possible to define an area in which reference may be made with data coordinate values.

For the creation of any plot, a reference point must be established from which all subsequent position references may be made. This point is the reference-origin to the physical area of the plotter paper. New plots are obtained by moving this origin along the length of the paper. Remember that this type of plotter uses a long piece of paper (running the x-axis).

This reference origin is used for two commands; the TEXT command allows the insertion of a text string (such as a plot label or comment) at a specific point, and the DATA_AREA command allows the physical-location of a specific area into which references may be made using data units (rather than the physical units of the paper.)

The data-definition of the data area is provided by the DATA_COORD command. Within this data area, there are several ways in which data points may be plotted; symbols may be placed at specific locations and lines may be drawn either in conjunction with the symbols or independent of them.

Each of these facilities will be described in greater detail in subsequent sections.

commands

3. General remarks on the form of commands.

Each of the commands may be given in a free format, that is, without regard for the placement of text or data on the card. There are only a few rules for the use of this general input scheme.

a. The entire command and its parameters (if any) must occur on the same card and in the order in which they are specified in the command descriptions.

b. There must be one or more spaces (blanks) or a comma (or both) separating each parameter in a command.

c. There should be no spaces imbedded within parameter values.

d. Comments may be placed on any command card after the last parameter if these are separated from the last parameter by at least one space or a comma or both.

e. All position references are made as coordinate pairs, with the x-value preceeding the y-value (ie, x,y).

The following 12 sections describe the details of the EZPLOT commands. They are arranged in the order in which they would 'naturally' be used for making a labelled graph; a basic reference point is established, text information is plotted, a data area is established, data dimensions for this area are defined, and symbols are placed and lines plotted. It is also possible to scale the overall plot, thus modifying all of the dimension information in the other commands by a uniform amount. There are also several commands which assist in making multiple plots and annotating the command listing.

A summary of the commands is included as Appendix I.

4. Locating the reference origin of the physical area.

There must be a point established for the origin of all references to the physical-plot area. The original reference point is established by the computer operator when he places the plotter pen 1/2 inch form the bottom edge of the paper a few inches from the leading edge. This point is (0, 0) for all references to the physical-plot area until a RESET command is given.

The RESET command reestablishes the reference-origin point. The form of this command is:

RESET x, y

where x is the distance along the length of the paper expressed in inches, and y is the distance from the bottom of the paper expressed in inches.

The RESET command is most often issued when a new plot is to be made. For example,

RESET 12, 0

will cause the plotter pen to be moved 12 inches to the right (along the roll) from the current physical-reference origin in the pen-up mode, the physical-reference origin of this new location to be made (0, 0), and the pen to be set in the pen-down mode.

COMMENT

5. Placing comments in the input.

There are two ways comments may be placed in the input; on cards with the COMMENT command or following the last parameter on any command card.

The explicit COMMENT command has the form:

COMMENT comment-text

where the comment-text is any text string that does not contain other commands. This text string need not be enclosed in quotation marks.

The use of comments on other command cards simply requires that the comment-text be separated from the last parameter by a comma, or by one or more blanks, or both.

The use of comments with the COMMENT command and other commands is illustrated in the following example:

```
COMMENT DATA FOR FIGURE 1
SYMBOL 14 A STAR
TICK_MARKS THIS USES STANDARD VALUES
* 2 14 DATUM OBTAINED 3/24/72
```

TEXT
TEXT_ANGLE
TEXT_HEIGHT

6. Placing text information in the plot.

The TEXT command is used to place text into the plot. The form of this command is:

TEXT x, y 'text-string'

where x is the distance along the paper in inches from the physical-reference origin where the text is to start, y is the distance up the paper (in inches) from the physical-reference origin where the text is to start, and text-string is the actual text to be placed in the plot. The text string must be enclosed in single quote marks. The maximum length of this string is 50 characters. The exact positioning of the text-string is made in reference to the lower left corner of the first character of the string.

The direction in which the text-string is plotted is determined by the TEXT_ANGLE command. The value given by this command is retained until a new value is given in a subsequent TEXT_ANGLE command. The form of this command is:

TEXT_ANGLE text-angle

where text-angle is the angle of the text string in degrees. If text-angle is 0, the text will be plotted in the direction of the x-axis. A value of 90 will result in the text being plotted in the direction of the y-axis (ie, pivoted in a counter-clockwise direction with the start of the text-string fixed). The text-angle parameter is initialized to 0 at the start of each plotting session. The use of the TEXT_ANGLE command is illustrated in Figure 2.

The height of the text which will be plotted is controlled by the TEXT_HEIGHT command. The form of this command is:

TEXT_HEIGHT text-height

where text-height is the character height in inches. This must be given in increments of .07 inches. Text-height has the initial value of .28 inches.

The value of text-height is retained until the next TEXT_HEIGHT command is used to specify a different value. The use of several different values with the TEXT_HEIGHT command is illustrated in Figure 3.

Only upper-case letters are available with EZPLOT.

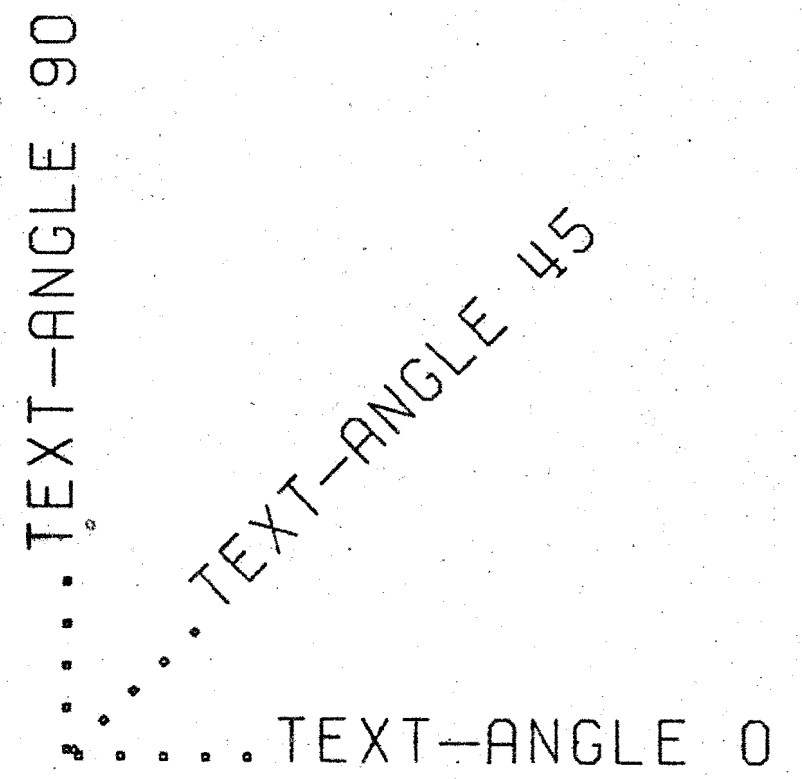


Figure 2.

TEXT_HEIGHT .07

TEXT_HEIGHT .14

TEXT_HEIGHT .21

TEXT_HEIGHT .28

TEXT_HEIGHT .35

Figure 3.

As an example of the use of some of the text-associated commands, assume that the following text were to be placed in a plot:

a. A large-font title at the bottom of the plot,

b. A smaller-font label for the x-axis above the plot title and centered more to the right, and

c. A similar-sized label for the y-axis above the y-delimiting axis line.

The following commands would be one way to satisfy the above requirements.

```
TEXT_HEIGHT .21
TEXT 2 .5 'RAINFALL, 1973'
TEXT_HEIGHT .14
TEXT 4 1.75 'WEEK'
TEXT 1.75 6.25 'MM'
```

DATA_AREA
DATA_COORD

7. Specification of the physical location of the data area.

The DATA_AREA command is used to specify the physical location of the data area. The nature of this data area will be discussed later. The DATA_AREA command has the form:

DATA_AREA xll, yll xur, yur

where xll is the x-axis distance (in inches) of the lower left corner of the data area from the physical reference origin, yll is the y-axis distance (in inches) of the lower-left corner of the data area from the physical reference origin, xur is the x-axis distance (in inches) of the upper right corner of the data area from the physical reference origin, and yur is the y-axis distance (in inches) of the upper right corner of the data area from the physical reference origin.

The use of the DATA_AREA command is illustrated in the following example:

DATA_AREA 2, 2 10, 10

which defines an 8 by 8 inch area located 2 inches up and 2 inches over from the physical reference origin. This area has then been established as the physical area to which corresponding reference will be made in the DATA_COORD command.

The physical area which has been defined by the use of the DATA_AREA command is given data dimensions with the DATA_COORD command. This command is given as:

DATA_COORD xll, yll xur, yur

where xll is the x-data coordinate value for the lower left corner, yll is the y-data coordinate value for the lower left corner, xur is the x-data coordinate value for the upper right corner, and yur is the y-data coordinate value for the upper right corner.

With this definition, all data points may be referenced by the data-unit values. It is the user's responsibility to be sure that all data values given are within the range of the data coordinate values; while this is not an absolute requirement, it is a good practice to use only the data area so as to avoid going off the paper.

The units for the x and y data axes need not be the same. For example,

DATA_COORD 0, 0 1000,1

specifies that the data area is to have x-data values ranging from 0 to 1000 and y-data values ranging from 0 to 1.

When the plotting session begins (ie, before the first use of the DATA_AREA and DATA_COORD commands) the data units are assumed to be inches with the data area originating at the physical reference point. This means that the use of the commands which make reference to data units (such as symbol placement, pen movement for lines, etc) require parameters expressed as inches. This is convenient, in some cases, such as for the

placement of the lines delimiting the axes of graphs. To purposefully revert to this physical reference base, the following commands would be issued:

```
DATA_AREA 0, 0 10, 10
DATA_COORD 0, 0 10, 10
```

Note that the characteristic of this pair of commands is that they have the same value for the pairs of parameters when the physical reference base is desired. The values themselves, for this use, are not important.

TICK_MARKS
X_TICK_NUMBER
Y_TICK_NUMBER
TICK_LENGTH

8. Placement of axis lines and tick marks for data graphs.

A common feature of data graphs are lines delimiting the axes and tick marks dividing these lines into segments. Tick marks serve to locate the values on the axes. The axis lines and tick marks may be placed in the plot by using a combination of the UP and DOWN and line position commands, although it is a tedious procedure. For convenience, the TICKS_MARK command my be used for this same purpose. This command draws lines along the x and y axes (ie, along the lower and left margins of the data area) and short lines dividing these axis lines into equal increments. The tick-mark lines extend outward from the axis-delimiting lines. The form of this command is:

TICK_MARKS

with no parameters issued with the command.

Several parameters are used with the TICK_MARKS command to control the number of intervals on each axis and the length of each tick mark. The tick-mark intervals are specified by the X_TICK_NUMBER and Y_TICK_NUMBER commands. The form of these commands is:

X_TICK_NUMBER number

Y_TICK_NUMBER number

where number is the number of intervals on the axis. This number is the same as the number of tick marks which are drawn because there is no tick mark drawn at the graph origin. The default value is 10 intervals for each axis. Each axis may have a different value for the number of tick marks.

The length of each tick mark is specified by the TICK_LENGTH command whose form is:

TICK_LENGTH length

where length is a decimal fraction specifying the length in inches. The default value is .1 inches.

The plotting of twelve tick marks on the x-axis, tem tick marks on the y-axis, and the x and y axis delimiting lines (along the edges of the data area) is accomplished in the following example: X_TICK_NUMBER 12

TICK_MARKS

Note that ten intervals for each axis is the default number of tick marks, making the command

Y_TICK_NUMBER 10

unnecessary unless the value of Y_TICK_NUMBER previously had been changed in this plotting session.

SYMBOL
SYMBOL_HEIGHT
SYMBOL_ANGLE
*

9. Placement of symbols at data points.

There are eight plotting symbols available to be placed at data points. These are shown in Figure 4 with their symbol identification numbers. The use of these symbols requires the selection of the symbols by using the SYMBOL command, and then placement of the symbol by using the * command.

The SYMBOL command is given in the form:

SYMBOL symbol-identification-number

where symbol-identification-number is the number obtained from Figure 4. This symbol will be used until it is changed by a subsequent use of the SYMBOL command. The default symbol is the number 3, the plus sign.

Each symbol has a height which is specified by the SYMBOL_HEIGHT command. The form of this command is:

SYMBOL_HEIGHT symbol-height

where symbol-height is the size of the symbol (in inches) in multiples of .04 inches. The default value for the height is .16 inches. Several different symbol heights are also illustrated in Figure 4.

The symbols may be rotated. The angle of rotation is specified by the SYMBOL_ANGLE command. This command is given as:

SYMBOL_ANGLE symbol-angle

where symbol-angle is the angle of rotation in degrees. If the value is 0, the symbol will be given as in Figure 4. If the value is 90 they will be rotated (counter-clockwise) 90 degrees. The default symbol-angle is 0.

The actual placement of the symbols is specified by the * command. This command has the form:

* x, y

where x is the x location within the data area (given in data units) and y is the y location within the data area (given in data units).

The symbol actually plotted is the last one specified by the SYMBOL command. Each symbol is plotted centered on the data point.

The movement to the location specified by the * command is made in either the pen-up or pen-down modes, depending on whether SYMBOL_ONLY or SYMBOL_LINE was used last. These commands are discussed later (in section 11).

The placement of several different symbols in the plot is illustrated with the following commands:

SYMBOL-NUMBER	GRAPHIC, BY SYMBOL-HEIGHT			
	.08	.12	.16	.20
0				
1				
2				
3				
4				
5				
11				
14				

Figure 4.

```
SYMBOL_HEIGHT .12
SYMBOL 14 a star
* 2, 10
* 3, 14
* 4, 18
SYMBOL 4 an x
* 2, 8
* 3, 6
* 4, 9
```

UP
DOWN
LINE
pen movement

10. Plotting lines.

Plotting lines is accomplished by the movement of the plotter pen when it is in the pen-down mode. There are two ways the pen movement off the paper can be established; by the direct pen movement commands (UP and DOWN) or by using the LINE command. Movement of the pen across the page to a new data point (whether the pen is up or down) is specified with a data card containing no explicit command, only the final (x,y) location.

To draw a several-segmented line, the following procedure is required: raise the pen from the paper, move the pen to the starting position of the first segment, lower the pen, and move to the next location (ie, the end of the line segment). This procedure is continued for each line segment in an abbreviated fashion. Since the pen is already down on the paper and at the start of the next line segment, the only specification required is the end location of the segment.

To use the line-drawing procedure with the EZPLOT commands, there are two approaches which may be taken. The most direct is the use of the UP and DOWN commands. These commands would be issued in the following order: UP, move to the start of the first segment, DOWN, move to the end of the segment, move to the end of the segment, etc. The UP and DOWN commands which have been illustrated here have no parameters; they occur separately on cards as either:

UP

or

DOWN

The actual pen movement command has the form:

x, y

where x is the x location of the end of the desired movement (in x-data units) and y is the y location (in y-data units). Note that there is no 'explicit' command required.

The LINE command simplifies the specifications required for a line. Since the first data point following the LINE command is the start of the first segment, the pen is automatically raised before going to this point. The pen is then lowered and moved to all subsequent points.

SYMBOL_LINE
SYMBOL_ONLY

11. Combining lines and symbols.

The previous commands have treated symbols and lines independently. Although it would be possible to use the * and line commands to plot lines and symbols (such as at data points on the lines), this procedure requires double specification of each data point.

This may be done more easily by using the SYMBOL_LINE command. This command is issued at the start of a list of data coordinates, each of which is preceeded by the symbol plotting command, *. In use, the symbol at the first data coordinates is plotted with the pen kept in the pen-down mode. Subsequent symbols will then have a line connecting them. This procedure is ended by use of the SYMBOL_ONLY command or another use of the SYMBOL_LINE command. These two commands have the form:

SYMBOL_LINE

and

SYMBOL_ONLY

with no parameters.

The following example will illustrate how to plot two lines, each with different symbols at the ends of each segment:

```
SYMBOL 0 a square
SYMBOL_LINE
* 2, 10
* 3, 12
* 4, 18
SYMBOL 2 a triangle
SYMBOL_LINE
* 2, 5
* 3, 7
* 4, 10
```

SCALE

12. Scaling the overall plot.

The overall plot may be scaled, either larger or smaller, by the use of the SCALE command. This command is given as

SCALE scale-factor

where scale-factor is the percent size of the desired plot with reference to an unscaled plot. For example

SCALE .8

would reduce the entire plot by 20 percent. This command should come at the start of the input for the plot.

This command will be used most commonly when it is most convenient to produce draft-plots of one size and then have them scaled, in toto, for some other purpose. For example, a large plot is made to be examined during data analysis and a reduced plot is made for publication by inserting the SCALE command at the start of the EZPLOT data set.

DEFAULT

13. Reinitializing parameters to their standard values.

If a series of plots is being made, it is sometimes desirable to be able to use
s established for one plot as the values for subsequent plots. For this reason,
ieter values are not modified by EZPLOT between plots. Yet there are times when the
wants to make sure that he can depend on obtaining the standard values for all the
ieters. This can be done explicitly with the use of the DEFAULT command or with
rate commands for all the parameters which have been changed.

The DEFAULT command is issued as:

DEFAULT

with no parameters.

QUIT

14. Terminating a plotting session

The command QUIT (with no parameters) is used to signal the termination of a plotting session. This should not be used at the end of an individual plot if more plots are desired. This command can come only at the end of the entire data deck.

If this command is not included as the last data statement, plotting will terminates normally; its use is, therefore, optional. There is no effective difference between its inclusion or omission. It has been included as a command for purposes which need not concern the user.

To obtain multiple plots, refer to section 4 (the RESET command).

MISC

15. Entering values for other variables

During the program development stages, it may be necessary to modify variables independently of specific commands. This activity need not concern the non-programming user; it is included here for completeness.

The MISC command has the form

MISC PL/I-data statements;

where PL/I-data-statements are regular data-assignment statements, separated by blanks or commas with the last one terminated by a semicolon.

16. Hints for plotting graphs

Organization of the plot into distinct units is important. A 'standard' data plot consists of some set of the following units:

1) a graph title

2) titles for the x- and y-axes (including units and scale)

3) data-area delimitation and data-coordinates values

4) x- and y-axis delimiting lines, 'tick marks' to divide axis-delimiting lines into intervals

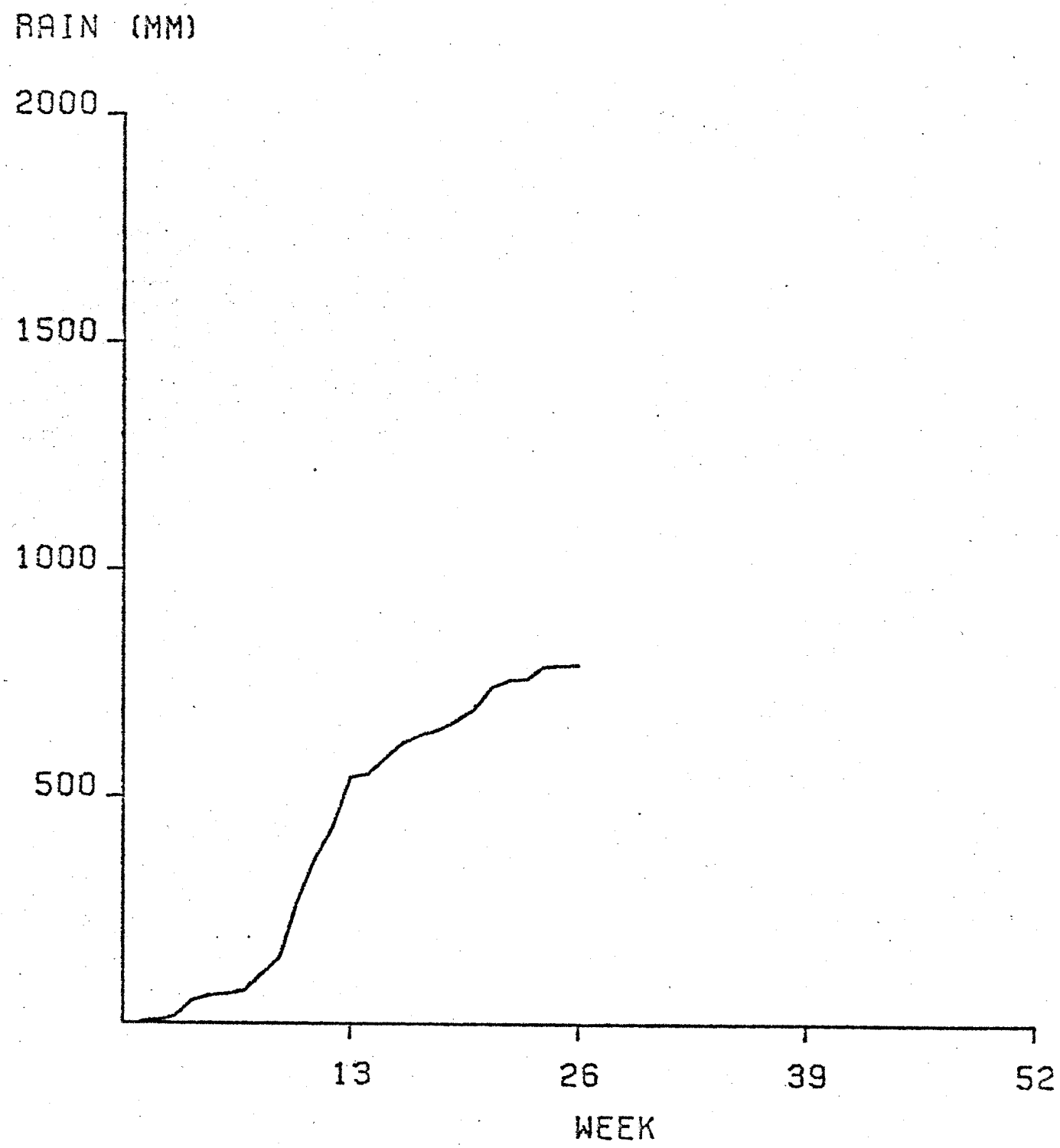
5) value labels for intervals on each axis (or just the end points)

6) legend information, such as symbol identification

7) data-point and/or line-segment specifications

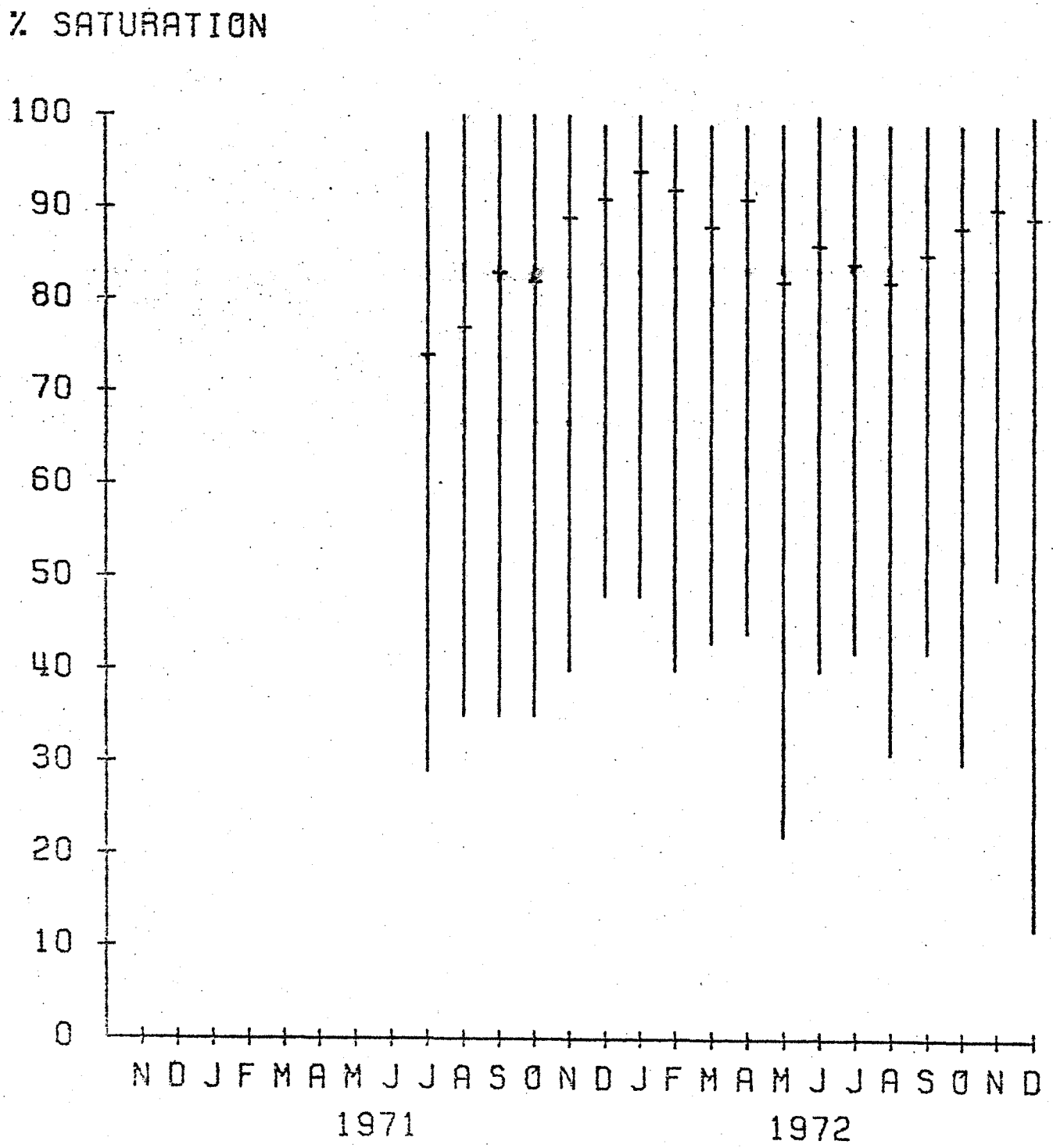
While the plotting program does not recognize such grouping in units, they are useful for the accurate and rapid preparation of data for the plotting program. Each unit can be designed somewhat in isolation of the other units if a few conventions are adopted. This will then allow some standard units to be constructed for families of related graphs. For example, those graphs using the same axis scale and related information can use the same command specifications for the common elements, such as the tick mark identifiers and the data-area specification.

Appendix



CUMULATIVE RAIN, 1973, K54

```
DATA_AREA    2,2    8,8
DATA_COORD    0,0    52, 2000
TEXT_HEIGHT   .21
TEXT  2, .5  'CUMULATIVE RAIN, 1973, K54'
TEXT_HEIGHT    .14
TEXT  5, 1.25  'WEEK'
X_TICK_NUMBER  4
Y_TICK_NUMBER  4
TICK_MARKS
TEXT  3.4  1.6  '13'
TEXT   4.9   1.6   '26'
TEXT   6.4   1.6   '39'
TEXT   7.9   1.6   '52'
TEXT  1.3   3.5   ' 500'
TEXT  1.3   5   '1000'
TEXT  1.3   6.5   '1500'
TEXT  1.3   8   '2000'
TEXT  1.3   8.5   'RAIN (MM)'
LINE
 1      5.3
 2      6.8
 3     15.5
 4     50.0
 5     61.9
 6     65.4
 7     73.1
 8    109.6
 9    145.3
10    269.0
11    361.8
12    432.2
13    543.1
14    550.0
15    587.3
16    620.4
17    636.5
18    647.5
19    668.2
20    695.3
21    744.1
22    759.0
23    760.3
24    738.4
25    789.9
26    792.2
```

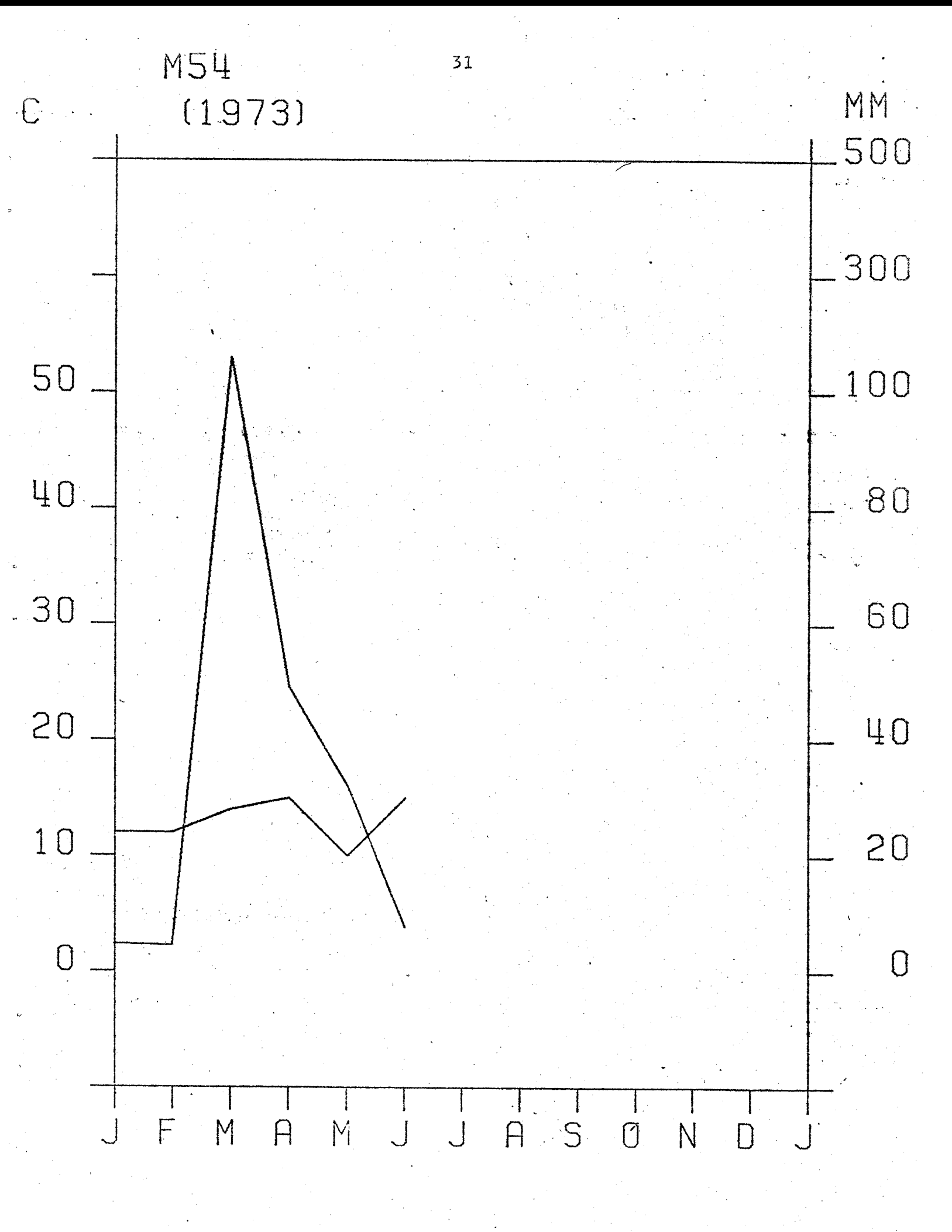


HUMIDITY, M42

```
RESET 12, 0
DATA_AREA 2, 2  8, 8
DATA_COORD 3, 0  29, 100
Y_TICK_NUMBER 10
TICK_LENGTH .1
X_TICK_NUMBER 26
TICK_MARKS
TEXT_HEIGHT .21
TEXT 3, .5  'HUMIDITY, M42'
TEXT_HEIGHT .14
TEXT 1.4 1.94 '  0'
TEXT 1.4 2.54 ' 10'
TEXT 1.4 3.14 ' 20'
TEXT 1.4 3.74 ' 30'
TEXT 1.4 4.34 ' 40'
TEXT 1.4 4.94 ' 50'
TEXT 1.4 5.54 ' 60'
TEXT 1.4 6.14 ' 70'
TEXT 1.4 6.74 ' 80'
TEXT 1.4 7.34 ' 90'
TEXT 1.4 7.94 '100'
TEXT 1.4, 8.5  '% SATURATION'
TEXT 3.5 1.37 '1971'
TEXT 6.3 1.37 '1972'
TEXT 2.18 1.68 'N'
TEXT 2.41 1.68 'D'
TEXT 2.64 1.68 'J'
TEXT 2.87 1.68 'F'
TEXT 3.10 1.68 'M'
TEXT 3.33 1.68 'A'
TEXT 3.56 1.68 'M'
TEXT 3.80 1.68 'J'
TEXT 4.03 1.68 'J'
TEXT 4.26 1.68 'A'
TEXT 4.49 1.68 'S'
TEXT 4.72 1.68 'O'
TEXT 4.95 1.68 'N'
TEXT 5.18 1.68 'D'
TEXT 5.41 1.68 'J'
TEXT 5.64 1.68 'F'
TEXT 5.87 1.68 'M'
TEXT 6.10 1.68 'A'
TEXT 6.33 1.68 'M'
TEXT 6.56 1.68 'J'
TEXT 6.80 1.68 'J'
TEXT 7.03 1.68 'A'
TEXT 7.26 1.68 'S'
TEXT 7.49 1.68 'O'
TEXT 7.72 1.68 'N'
TEXT 7.95 1.68 'D'
SYMBOL_HEIGHT .08
LINE
12  29
12  98
LINE
13  35
13  100
LINE
14  35
```

```
14  100
LINE
15  35
15  100
LINE
16  40
16  100
LINE
17  48
17  99
LINE
18  48
18  100
LINE
19  40
19  99
LINE
20  43
20  99
LINE
21  44
21  99
LINE
22  22
22  99
LINE
23  40
23  100
LINE
24  42
24  99
LINE
25  31
25  99
LINE
26  42
26  99
LINE
27  30
27  99
LINE
28  50
28  99
LINE
29  12
29  100
*  12  74
*  13  77
*  14  83
*  15  82
*  16  89
*  17  91
*  18  94
*  19  92
*  20  88
*  21  91
*  22  82
*  23  86
*  24  84
*  25  82
```

```
*   26   85
*   27   88
*   28   90
*   29   89
```


M54
(1973)
C
MM
500
300
100
80
60
40
20
0
50
40
30
20
10
0
J F M A M J J A S O N D J

```
TEXT_HEIGHT .21
TEXT 1, 9.7   '  M54'
TEXT  1.5, 9.3 '(1973)'
DATA_AREA  1, 1  7,9
DATA_COORD  1, -10  13, 70
LINE      BORDERS
.6, -10
13.4, -10
LINE
13, -12
13, 72
LINE
13.4, 70
.6, 70
LINE
1, 72
1, -12
TEXT    .3    2    ' 0'
TEXT    .3    3    '10'
TEXT    .3    4    '20'
TEXT    .3    5    '30'
TEXT    .3    6    '40'
TEXT    .3    7    '50'
TEXT   .2, 9.3   'C'
TEXT   .9, .5   'J'
TEXT   1.4, .5   'F'
TEXT   1.9, .5   'M'
TEXT   2.4, .5   'A'
TEXT   2.9, .5   'M'
TEXT   3.4, .5   'J'
TEXT   3.9, .5   'J'
TEXT   4.4, .5   'A'
TEXT   4.9, .5   'S'
TEXT   5.4, .5   'O'
TEXT   5.9, .5   'N'
TEXT   6.4, .5   'D'
TEXT   6.9, .5   'J'
TEXT    7.3    2    '  0'
TEXT    7.3    3    ' 20'
TEXT    7.3    4    ' 40'
TEXT    7.3    5    ' 60'
TEXT    7.3    6    ' 80'
TEXT    7.3    7    '100'
TEXT    7.3    8    '300'
TEXT    7.3    9    '500'
TEXT    7.3    9.4    'MM'
LINE
2, -10
2, -12
LINE
3, -10
3, -12
LINE
4, -10
4, -12
LINE
LINE
5, -10
5, -12
```

```
LINE
6, -10
6, -12
LINE
7, -10
7, -12
LINE
8, -10
8, -12
LINE
9, -10
9, -12
LINE
10, -10
10, -12
LINE
11, -10
11, -12
LINE
12, -10
12, -12
LINE
13, 0
13.4, 0
LINE
13, 10
13.4, 10
LINE
13, 20
13.4, 20
LINE
13, 30
13.4, 30
LINE
13, 40
13.4, 40
LINE
13, 50
13.4, 50
LINE
13, 60
13.4, 60
LINE
.6, 0
1, 0
LINE
.6, 10
1, 10
LINE
.6, 20
1, 20
LINE
.6, 30
1, 30
LINE
.6, 40
1, 40
LINE
.6, 50
1, 50
```

```
LINE
.6, 60
1, 60
LINE   TEMPS FOLLOW (MO, TEMP)
1  12
2  12
3  14
4  15
5  10
6  15
DATA_COORD   1, -20   13, 140
LINE   RAIN FOLLOWS (MO, RAIN)
1    4.7
2    4.5
3  106.0
4   49.1
5   32.1
6    7.7
```

COMMAND	PARAMETER	UNITS	PURPOSE
COMMENT			allows the remainder of the card to be used for comments (avoid using commands)
DATA_AREA	xll	inches	to specify the physical area in which the data will be plotted
	vll	inches	
	xur	inches	
	yur	inches	
DATA_COORD	xll	data units	to establish the range of data values to be used in the data-area rectangle
	yll	data units	
	xur	data units	
	yur	data units	
DEFAULT			to reestablish the default values for all parameters
DOWN			to lower the pen
LINE			starts a new line with the next (x, y) pen movement command
MISC	PL/I data statements		allows the specification of values for variables not available through other commands (for debugging only)
QUIT			to terminate a plotting session (not to be used between multiple plots)
RESET	x	inches	to move the physical-reference origin
	y	inches	
SCALE	scale-factor	decimal fraction	to scale the entire plot by the scale factor value
SYMBOL	symbol-id-no	integer number	to specify which symbol is to be plotted (values from figure 4)
SYMBOL_ANGLE	symbol-angle	degrees	to specify the angle at which the symbol is to be plotted (moving counter-clockwise)
SYMBOL_HEIGHT	symbol-height	inches	to specify the height of the plotted symbols (in increments of .04 inches)
SYMBOL_LINE			to place in the line mode so symbols are connected by lines
SYMBOL_ONLY			to remove from the line mode so symbols are not connected by lines
TEXT	x	inches	to plot a text string at the location (x, y)
	y	inches	
	'text-string'		
TEXT_ANGLE	text-angle	degrees	to specify the angle at which the text is to be plotted (moving counter-clockwise)
TEXT_HEIGHT	text-height	inches	to specify the height of the plotted text string (in increments of .07 inches)
TICK_LENGTH	length	inches	to specify the length of each tick mark
TICK_MARKS			to put in the tick-marks and the axis delimiting lines
UP			to lift the pen
X_TICK_NUMBER	number	integer number	to specify the number of intervals to be marked on the x axis
Y_TICK_NUMBER	number	integer number	to specify the number of intervals to be marked on the y axis
	x	data units	to cause the current symbol to be plotted at (x, y)
	y	data units	
(none)	x	data units	to move the pen from its current location to that specified by (x, y)
	y	data units	

Submitting an EZPLOT job.

The previous descriptions have been concerned with the specification of data to be run with the program EZPLOT. To get this to be run on the computer, some Job Control Language (JCL) statements have to be placed with the EZPLOT commands. This information is specific to the implementation of the program at the University of Hawaii Computing Center for use on the IBM 360/65.

The JCL statements for EZPLOT follow the standard conventions. If there is any question, please inquire with one of the consultants.

```
//EZPLOT JOB (jobno,30S,2K1),yourname
// EXEC EZPLOT
//SYSIN DD *
place the EZPLOT commands here
/*
//
```

It is also necessary to hand a 'OS/360 CALCOMP PLOTTER REQUEST SHEET' to the computer operator when you submit your job. An example form is included as the following page. Blank forms are available at the computing center at the job submittal window.

☐ ADR 1
☒ ADR 2

OS/360 CALCOMP PLOTTER REQUEST SHEET
UNIVERSITY OF HAWAII COMPUTING CENTER

JOB NAME EZPLØT ACCT. NO. ——— (FILL IN)

USER'S NAME ——— (FILL IN)

ADDITIONAL INSTRUCTIONS: ———

******NOTES******

1. THIS JOB SHEET IS REUSABLE.
2. IF SYSTEM FAILURE, JOB WILL BE RE-RUN UNLESS OTHERWISE SPECIFIED.
3. IF OS/360 JOB FAILS, PLOT WILL NOT BE RUN UNLESS SPECIFIED.
4. REEL SIZE SHOULD BE SPECIFIED AS F FOR FULL REEL (2400'), H FOR HALF REEL (1200'), M FOR MINI-REEL.
5. CC TAPES WILL NOT BE SAVED UNLESS SAVE IS INDICATED. REEL SIZE IS ASSUMED TO BE HALF REEL.
6. UNLESS OTHERWISE SPECIFIED, PLOTS WILL BE DONE WITH ANY PEN, STARTING 1/2" FROM BOTTOM PERFORATED LINE WITH PEN UP.

OPERATOR USE ONLY

HASP NO.	JOB CLASS	DATE	NO. OF PLOTS	ESTIMATED TIME	ESTIMATED PLOT PAPER
FILL IN	B	FILL IN	FILL IN	FILL IN	FILL IN FT
					FT
					FT
					FT
					FT
					FT
					FT
					FT

360 OPER INIT	360 DATE/TIME	1401 PLOT PAPER	1401 RUN TIME	1401 DATE	1401 OPER INIT
		FT			
		FT			
		FT			
		FT			
		FT			
		FT			
		FT			
		FT			

TAPES

VOL=SER= (ON DD STMT)	TAPE LABEL INFORMATION	REEL SIZE	I	D/I	SAVE	7TRK	9TRK
PLØT	SCRATCH	H		✓	NØ	✓	

DISKS

VOL=SER= (ON DD STMT)

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TECHNICAL REPORTS OF THE US/IBP ISLAND ECOSYSTEMS IRP

(Integrated Research Program)

No. 1 Hawaii Terrestrial Biology Subprogram. First Progress Report and Second-Year Budget. D. Mueller-Dombois, ed. December 1970. 144 p.

No. 2 Island Ecosystems Stability and Evolution Subprogram. Second Progress Report and Third-Year Budget. D. Mueller-Dombois, ed. January 1972. 290 p.

No. 3 The influence of feral goats on koa (Acacia koa Gray) reproduction in Hawaii Volcanoes National Park. G. Spatz and D. Mueller-Dombois. February 1972. 16 p.

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